

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA23LA195

WRECKAGE AND ENGINE EXAMINATION

May 16, 2023

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A. ACCIDENT

Location: Fallston, MD
Date: April 13, 2023
Time: 1515 EDT
1915 UTC
Airplane: N412RS; RV-14A

B. WRECKAGE AND ENGINE EXAMINATION

Investigator	Joshua Young National Transportation Safety Board Washington, DC
Party Coordinator	Ryan Enders Lycoming Engines Williamsport, PA

C. SUMMARY

On April 13, 2023, about 1515 eastern daylight time, an experimental, amateur-built RV-14A airplane, N412RS, was substantially damaged when it was involved in an accident near Fallston, Maryland. The private pilot was seriously injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 personal flight.

According to local law enforcement personnel, the pilot departed from runway 22 at Fallston Airport (W42), Fallston, Maryland. The airplane crashed in a corn field, about 50 ft past the departure end of the 2,200-ft-long runway.

The wreckage came to rest upright, and there was no fire. The right wing separated during the impact sequence and was located adjacent to the main wreckage. The forward fuselage was twisted and buckled. The engine remained attached to the fuselage, and the propeller remained attached to the engine. The empennage exhibited minor damage. The landing gear were buckled under the fuselage.

First responders asked the pilot if he recalled the event, and he reported that he did not.

D. DETAILS OF THE EXAMINATION

1.0 Airframe Examination

The airplane as it sat at the recovery facility was in four main pieces consisting of the fuselage, empennage and both wings. There was no evidence of a fire.



Photo 1: The airplane laid out at the recovery facility.



Photo 2: The airplane laid out at the recovery facility.

1.1 Fuselage

The fuselage remained intact with the canopy cut for recovery. The bottom of the fuselage, beneath the instrument panel, was crushed upwards and aft into the footwell of the cockpit. There was buckling on the left side of the fuselage at the bulkhead aft of the wing root. The right side of the fuselage was impact crushed inwards and buckled. The right side of the fuselage from the canopy rail to the floorboard was cut and separated from the back of the left seat forward to the firewall.



Photo 3: View of the forward fuselage crushed up and aft.



Photo 4: Buckling of the left side of the fuselage.



Photo 5: View of the right side of the fuselage.



Photo 6: View of the right side of the fuselage.

1.2 Empennage

The empennage was cut away from the fuselage to facilitate recovery. Continuity of the elevator was confirmed from the flight control in the cockpit to the flight control surface through one cut made for recovery. Continuity of the rudder was confirmed from the cockpit flight control to the flight control surface through one cut made to facilitate recovery. The left horizontal stabilizer remained attached to the empennage and the left elevator remained attached to the left horizontal stabilizer at all attachment points. The left elevator counterweight remained in place. The trim tab remained attached to the left elevator at all attach points and was in line with the elevator. The left elevator trailing edge tip was deformed slightly down. The right horizontal stabilizer remained attached to the empennage. The right elevator remained attached to the right horizontal stabilizer at all attachment points and the counterweight remained in place. The vertical stabilizer exhibited slight leading-edge abrasion. The rudder remained attached to the vertical stabilizer at all attachment points. The ELT was removed from the empennage and its bracket was still in place with no damage.



Photo 7: View of the empennage, cut for recovery.



Photo 8: View of the right horizontal stabilizer, elevator, and trim tab.



Photo 9: View of the right elevator and trim tab.



Photo 10: View of the left horizontal stabilizer and elevator.



Photo 11: View of the leading edge of the vertical stabilizer.



Photo 12: View of the rudder.



Photo 13: View of the ELT cradle.

1.3 Aircraft Wings

The left wing was cut from the airplane to facilitate recovery. Continuity of the left aileron was confirmed from the flight control in the cockpit to the control surface through one cut made by recover personnel at the wing root. The left aileron remained attached to the wing at all attachment points. The flap remained attached to the wing at all attachment points and moved freely when moved by hand. The left-wing fuel cap was seated in place and opened by hand. The left fuel tank was punctured and the smell of 100LL aviation fuel was observed when the fuel cap was removed. The leading edge and upper surface of the wing were dented and impact damaged. The wing tip remained attached and a light cover just inboard of the wingtip was fragmented.



Photo 14: Left fuel cap seated in place.



Photo 15: View of the left-wing leading-edge damage.



Photo 16: View of the buckling on the top of the left wing.



Photo 17: View of the left wing tip damage.



Photo 18: View of the left aileron.

The right wing was impact separated from the airplane and the fracture at the wing spar exhibited overload failure. The leading edge exhibited denting throughout its length. The outboard leading edge was crushed up and aft and the wing tip was impact separated. The aileron was impact separated from the wing. Continuity was confirmed from the cockpit flight control to the control surface through multiple overload fractures. The flap remained attached to the wing at all attachment points and moved freely by hand. The right fuel cap was seated in place and was opened by hand. The right fuel tank was punctured and the smell of 100LL aviation fuel was noted when the fuel cap was removed.



Photo 19: Overview of the right wing as found at the recovery facility.



Photo 20: Overview of the right wing with aileron and wingtip laid out.



Photo 21: View of the right wing spar that remained attached to the fuselage.

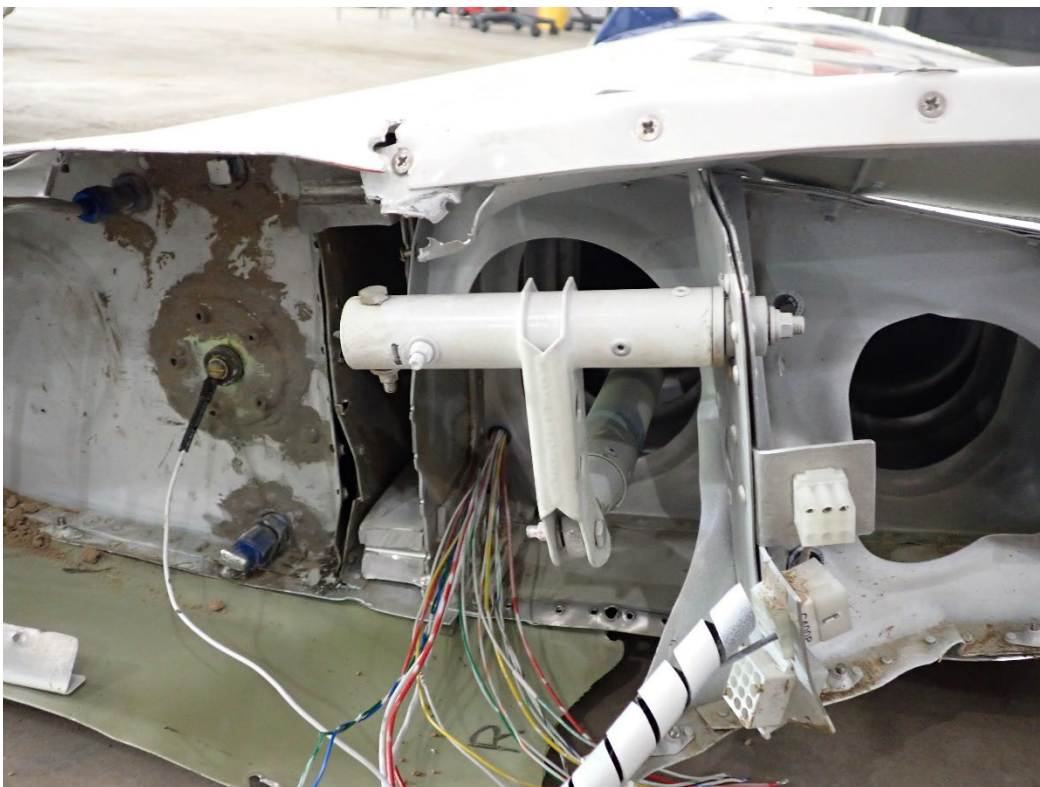


Photo 22: View of the right wing root.

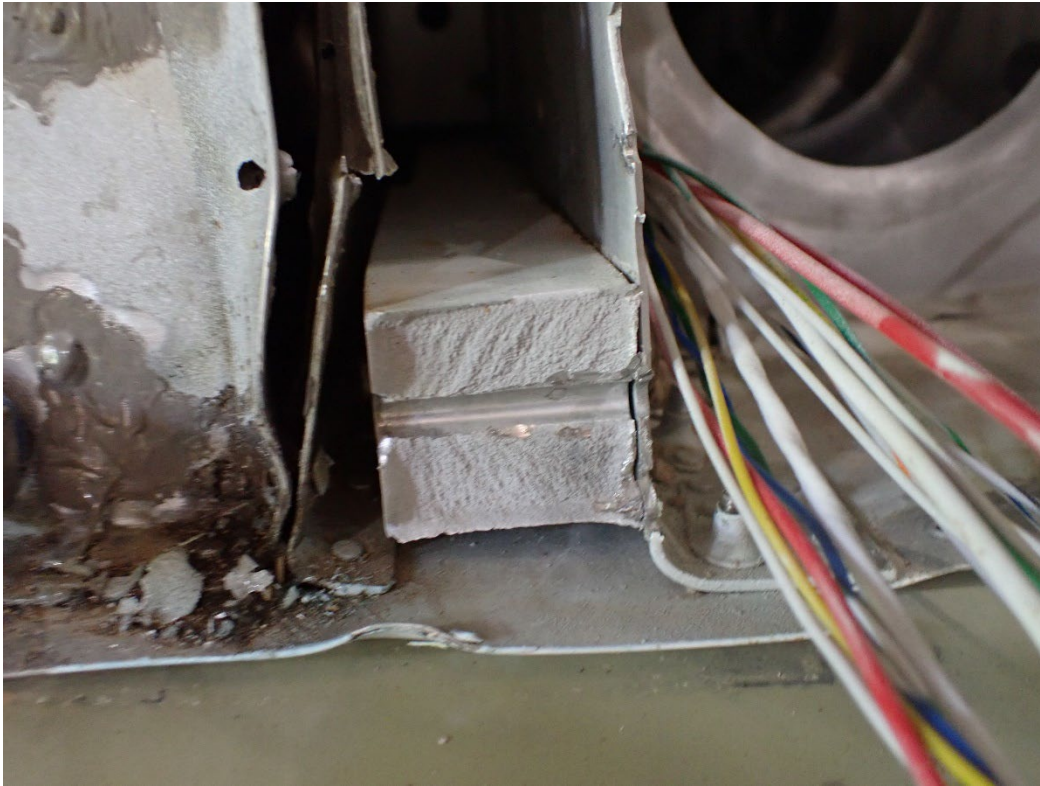


Photo 23: Right wing lower spar fracture.



Photo 24: Right wing upper spar fracture.



Photo 25: Right wing fuel cap seated.



Photo 26: Damage to the right wing outboard leading edge.



Photo 27: View of the right aileron laid out with the right wing.



Photo 28: View of impact fractured right aileron pushrod head.

1.4 Landing Gear

The nose and main landing gear were separated from the airplane at the recovery facility. The nose landing gear was impact separated from its attachment point. The right main landing gear was impact separated from its attachment point. The left main landing gear was impact separated from its attachment point with the attachment bolt remaining in place.



Photo 29: View of the landing gear laid out.

1.5 Cockpit

The cockpit was intact and contained no conventional instrumentation. The throttle and mixture knobs were slightly less than full forward and the propeller control was full forward. The cabin heat knob was pulled out slightly. The circuit breakers were examined with only the autopilot breaker having been tripped. The following switches in the cockpit were noted:

Ignition: OFF
BATT: OFF

ALT: OFF
FUEL PUMP: OFF
AVIONICS: OFF
NAV LIGHTS: OFF
STROBES: OFF
TAXI LIGHT: OFF
LANDING LIGHTS: OFF
DEFROST: OFF
PITOT HEAT: OFF
EMERG BATT: OFF



Photo 30: View of the cockpit as found at the recovery facility.

1.6 Survivability

The left seat back remained attached by one of the 2 hinges with the other hinge having the rivets pulled from the airframe. The left seat was equipped with a five point harness which operated normally. The harness remained attached at all attachment points. The right seat back remained attached at

both hinges. The right seat was also equipped with a five point harness which remained attached at all attachment points.



Photo 31: View of the cockpit seats.



Photo 32: View of the left seat back hinges.



Photo 33: View of the left seat harness.

1.7 Fuel/Fuel System

Both wing fuel tanks were punctured. The fuel selector was in the off position. An inline fuel filter was found downstream of the fuel selector but prior to the electric fuel pump. The inline fuel filter was removed and contained debris both in the cup and on the filter pleats. The inline fuel filter contained fuel that appeared to be 100LL aviation fuel, the fuel was tested with water finding paste and no water was noted.

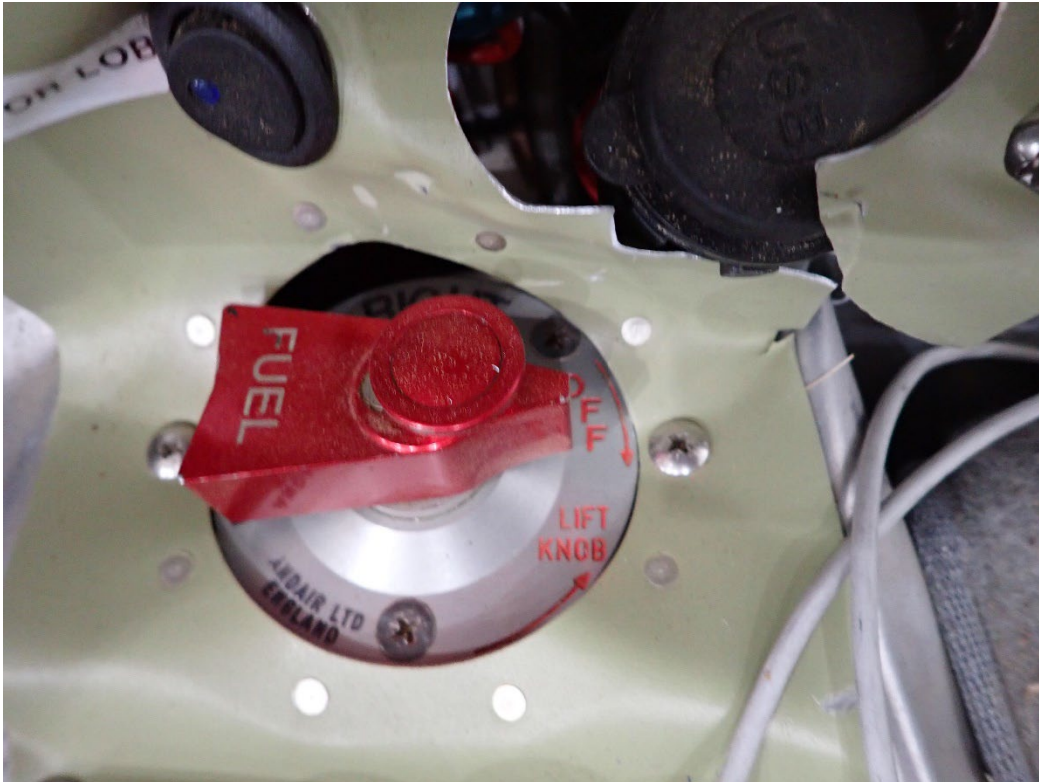


Photo 34: Fuel selector as found.



Photo 35: View of the inline fuel filter.



Photo 36: View of debris found in the inline fuel filter.

2.0 Engine Examination

The airplane was equipped with a Lycoming Y1O-390-EXP98. It remained attached to the fuselage by all engine mounts. The engine mounts were cut to facilitate examination of the engine. The propeller was removed to facilitate examination. Suction and compression were confirmed on all cylinders using the thumb method when the engine was rotated by hand. The rocker covers were removed, and valve train continuity was confirmed when the engine was rotated by hand through 720° of rotation.



Photo 37: The engine as found at the recovery facility. (Lycoming Photo)



Photo 38: The engine as found at the recovery facility. (Lycoming Photo)



Photo 39: Engine suspended for examination with rocker covers removed. (Lycoming Photo)

2.1 Induction and Exhaust System

The induction air filter remained secure in the engine baffling and was removed with minimal debris noted. The intake and exhaust pipes exhibited impact damage. The airplane was equipped with exhaust gas temperature sensors. All intake and exhaust valves operated normally when the engine was rotated by hand.



Photo 40: View of the air intake filter.

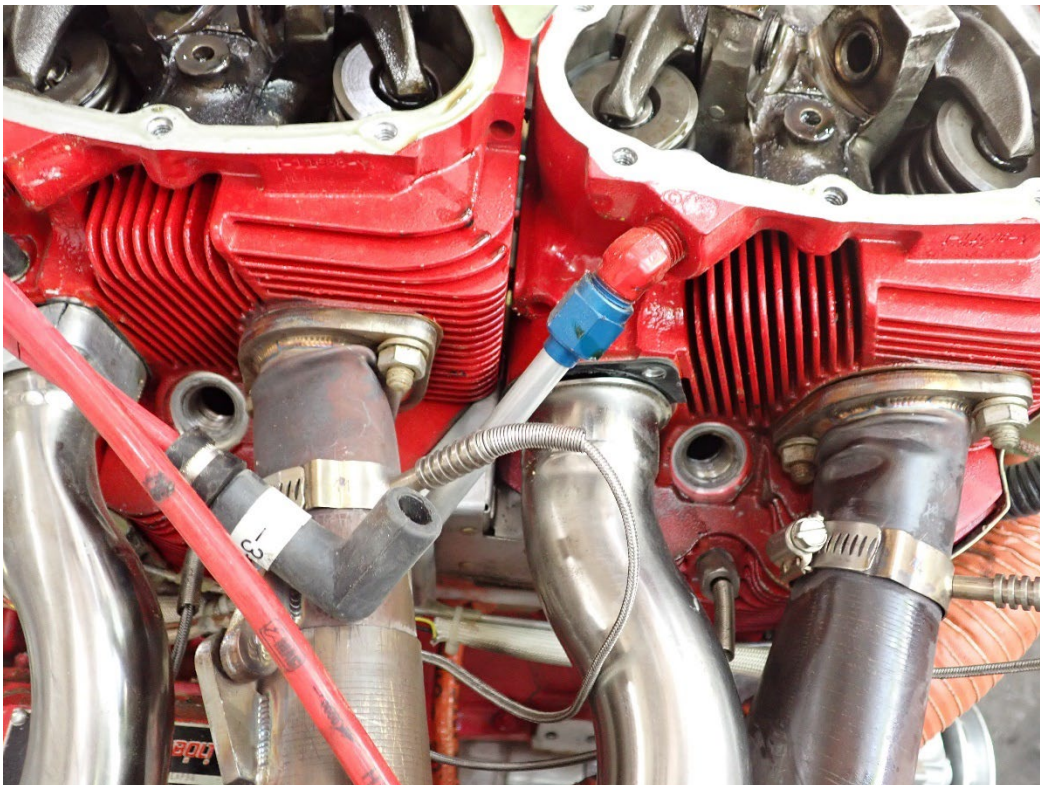


Photo 41: View of impact damage to the intake and exhaust pipes.

2.2 Magnetos

The engine was equipped with two electronic magnetos which remained attached to the engine at all attachment points and were undamaged. The timing of both magnetos was checked and was between 2° and 4° after top dead center which is within the range noted in the E-mag Electronic Ignition installation and operating guide (LC114.28).

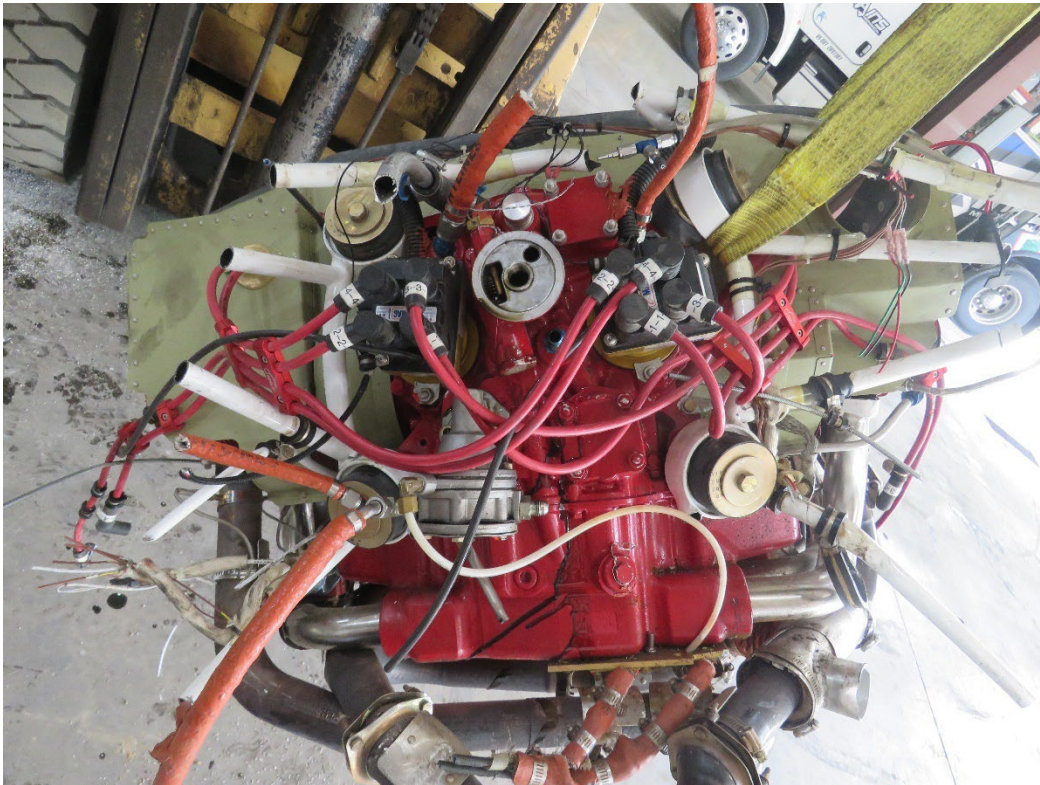


Photo 42: View of the engine accessory case with magnetos attached. (Lycoming Photo)



Photo 43: View of the magneto which powered the top sparkplugs.



Photo 44: View of the magneto that powered the bottom sparkplugs. (Lycoming Photo)

2.3 Ignition System

The starter motor remained attached to the engine at all attachment points and was undamaged. The starter flywheel was impact damaged and fractured and was removed to facilitate rotation of the engine. The ignition harness was undamaged and was not tested. The sparkplugs for the top and bottom were an automotive style sparkplug which were removed and examined. The Nos. 2 and 4 bottom sparkplugs were oil soaked due to the engine position after recovery, all other showed normal wear.



Photo 45: Overview of all sparkplugs. (Lycoming Photo)

2.4 Fuel System

The engine driven diaphragm fuel pump was secured to the accessory housing of the engine and was undamaged. The unit was removed for further investigation and the diaphragms were undamaged.

The fuel injector unit remained attached to the bottom of the engine. Organic matter was pushed into the inlet side of the unit from the impact sequence. The throttle and mixture control cables were attached, and continuity of the cables was confirmed to the cockpit controls. The unit was removed for further investigation. The fuel inlet screen had minor contamination. The diaphragms of the injector were intact and undamaged.

The fuel flow divider remained installed on the top of the engine and was undamaged. The unit was opened for further analysis. Liquid fuel was found in the unit and the diaphragm was undamaged.

The fuel nozzles were secured into their respective cylinder heads. They were removed for further investigation and all four nozzles were unobstructed.

Liquid fuel was found in the engine driven fuel pump, fuel inject unit, fuel manifold, and at the #2-cylinder nozzle. Fuel was collected from the fuel

injector unit and tested with a water finding paste, no evidence of water was found.



Photo 46: Engine driven fuel pump disassembled for examination. (Lycoming Photo)

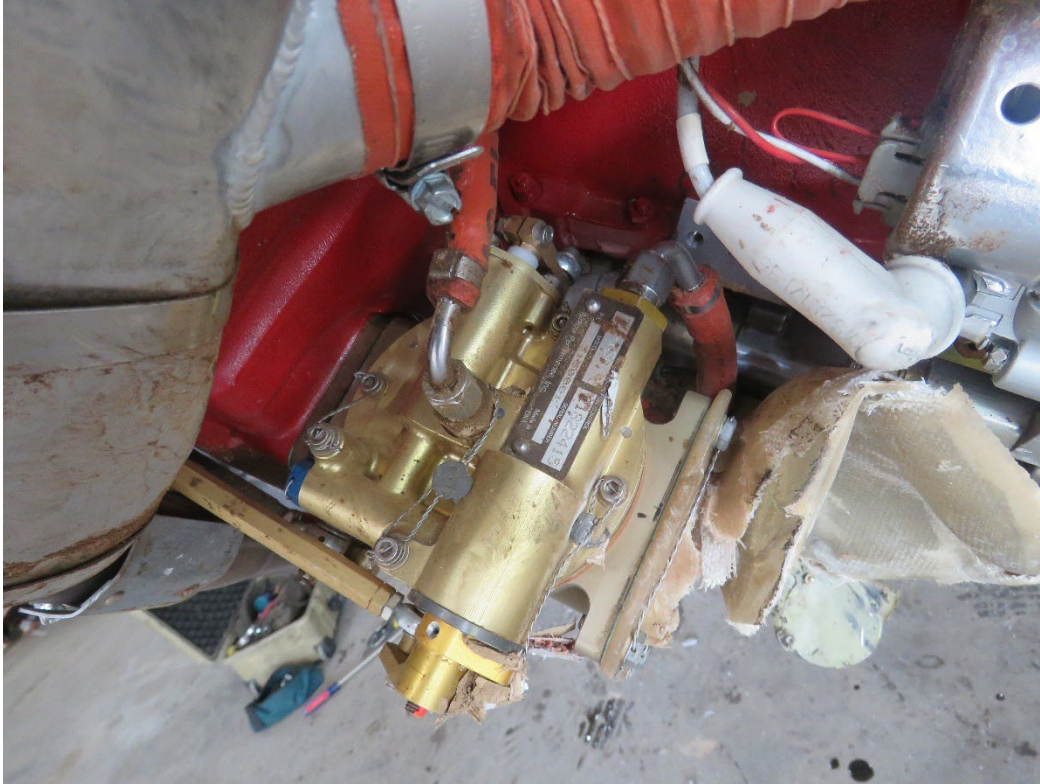


Photo 47: Fuel injector unit attached to the engine. (Lycoming Photo)

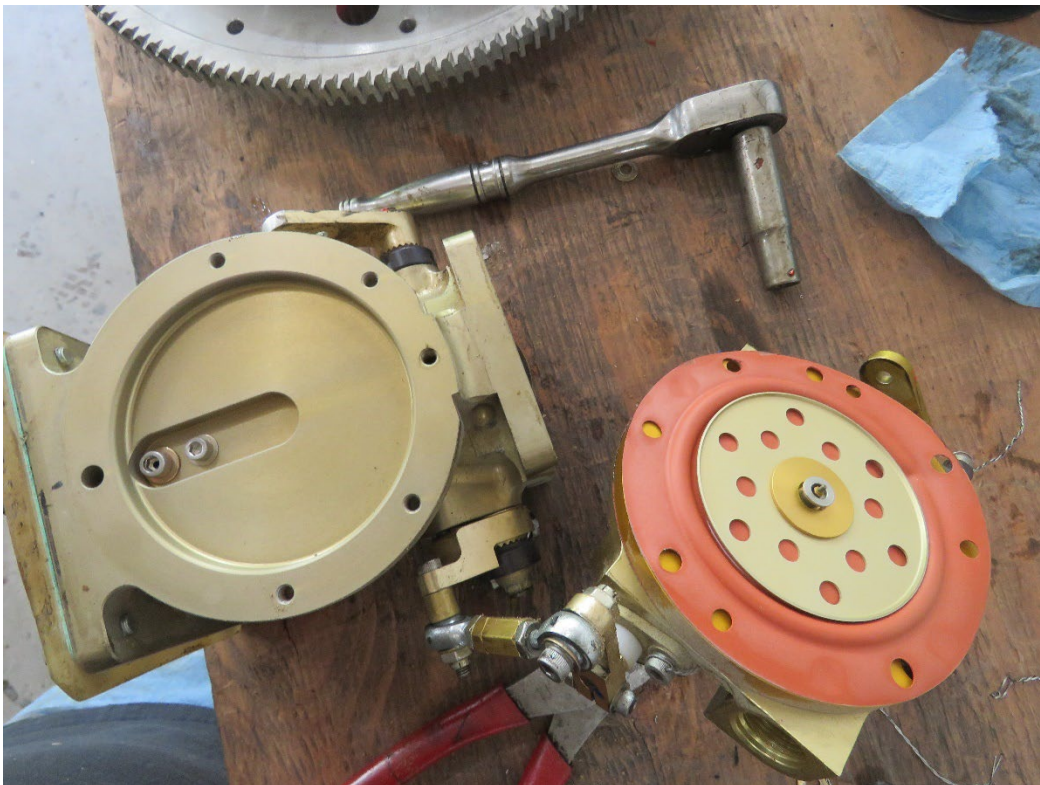


Photo 48: Fuel injector unit disassembled for examination. (Lycoming Photo)



Photo 49: Fuel inlet screen with minor contamination.



Photo 50: Fuel flow divider removed and disassembled for examination. (Lycoming Photo)



Photo 51: Fuel injector nozzles removed for examination.



Photo 52: Fuel from the fuel injector unit with water test paste. (Lycoming Photo)

2.5 Lubrication System

The oil sump remained intact, and the oil drain plug was in place. The engine had oil throughout. The oil suction screen remained safety wired in place and was removed for examination and was free of debris. The oil filter remained safety wired in place and was removed and cut open for examination with no debris noted between the pleats. The oil filter had a date of 11/3/22 written on the side. The oil cooler remained attached to the engine and oil drained out of it when the lines were removed.



Photo 53: Oil suction screen free of debris.



Photo 54: Oil filter pleats free of debris. (Lycoming Photo)

3.0 Propeller Examination

The airplane was equipped with a Hartzell controllable pitch propeller, HC-C2YR-1BFP. The spinner was impact crushed aft and fractured. The propeller remained attached to the crankshaft flange at all attachment points and was removed to facilitate examination of the engine. The propeller governor was removed from the engine and the governor gasket screen was clear of debris, the governor pumped oil when operated by hand.



Photo 55: Propeller spinner and hub.



Photo 56: Propeller governor gasket screen free of debris.

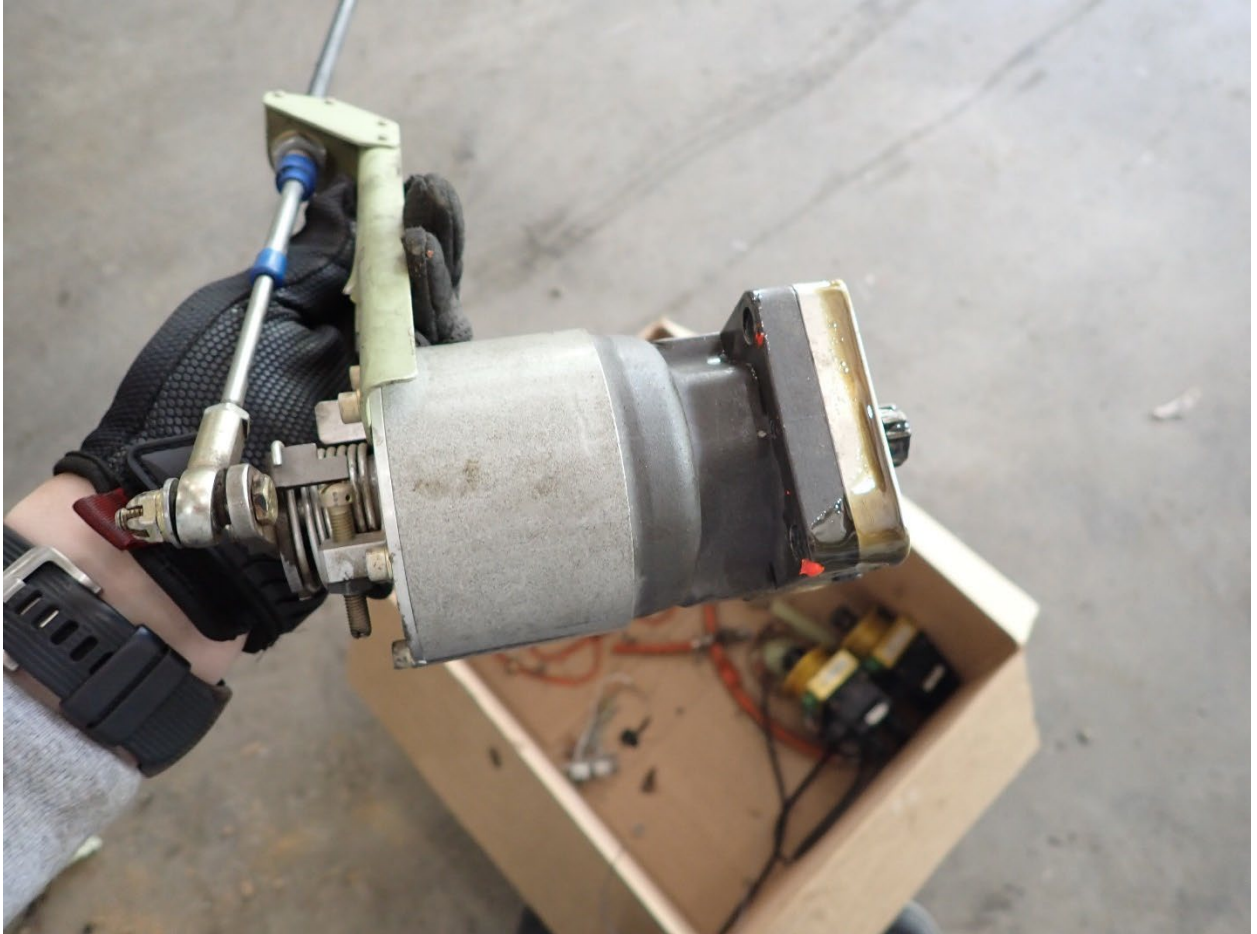


Photo 57: Propeller governor removed for examination.

The blades of the propeller were marked arbitrarily with an A and B for identification throughout the examination and will be referred to as such. Blade A remained straight and could be rotated in the hub by hand. It exhibited leading edge gouging and polishing near the tip. Blade A also exhibited chordwise and longitudinal scratching. Blade B was able to be rotated by hand in the hub and was bent aft about 45° at the midspan. Blade B exhibited leading edge gouging and polishing. It also exhibited chordwise and longitudinal scratching.



Photo 58: Overview of the propeller.



Photo 59: Overview of blade A.



Photo 60: Blade A leading edge gouging, polishing and chordwise scratching.



Photo 61: Overview of blade B.



Photo 62: View of the bend in blade B.



Photo 63: Blade B leading edge polishing, gouging and chordwise scratching.

Submitted by:

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