

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA21FA317

WRECKAGE EXAMINATION

August 10, 2001

A. ACCIDENT

Location: Argyle, New York
Date: August 7, 2021
Time: 1800 eastern daylight time

Helicopter: Rotorway Exec 162F, Registration N162KJ

B. WRECKAGE EXAMINATION

Investigator Doug Brazy
National Transportation Safety Board
Ashburn, Virginia

Investigator Michael Bush
Federal Aviation Administration
Albany, New York

C. SUMMARY

On August 7, 2021, at 1800 eastern daylight time, an experimental amateur-built Rotorway Exec 162F, N162KJ, was destroyed when it was involved in an accident in Argyle, New York. The pilot and passenger were fatally injured. The helicopter was operated as a Title 14 Code of Federal Regulations Part 91 personal flight.

D. DETAILS OF THE EXAMINATION

1.0 Accident Site

The wreckage path was about 400 ft long and oriented on a heading of 210° magnetic. It began in an open field of 4 ft tall grass, with a 4-inch by 4-inch fractured piece of aluminum skin from the right side of the tailboom, just forward of the tail rotor arc. A portion of the helicopter's registration number was visible on the piece. The path transitioned through a line of trees, and continued into a wooded area, down a steep hill about 200 ft long and ended in flat/low area at the bottom of the incline. The right horizontal stabilizer was located 156 ft along the wreckage path, 70 ft left of the path centerline. The left horizontal stabilizer was located 165 ft along, and 205 ft left, of the path centerline. A section of tail boom, about 4 ft long, including the vertical stabilizer, tail rotor gearbox with 1 tail rotor blade attached was located just downrange of the tree line, about 200 ft along, 10 ft left of the wreckage path. path centerline. Pieces of plastic clear canopy were found on the left and right side of the wreckage path in the wooded area, all along the path and at widely varying distances left and right of the path.

No tree/vegetation damage was found along the wreckage path through the wooded area, except for minor damage to branches immediately surrounding and directly above the main wreckage. There were no grounds cars or tree damage found leading to the main wreckage. The helicopter was destroyed, and largely consumed by a post-crash fire.



Figure 1 - Accident Site

2.0 Airframe Examination

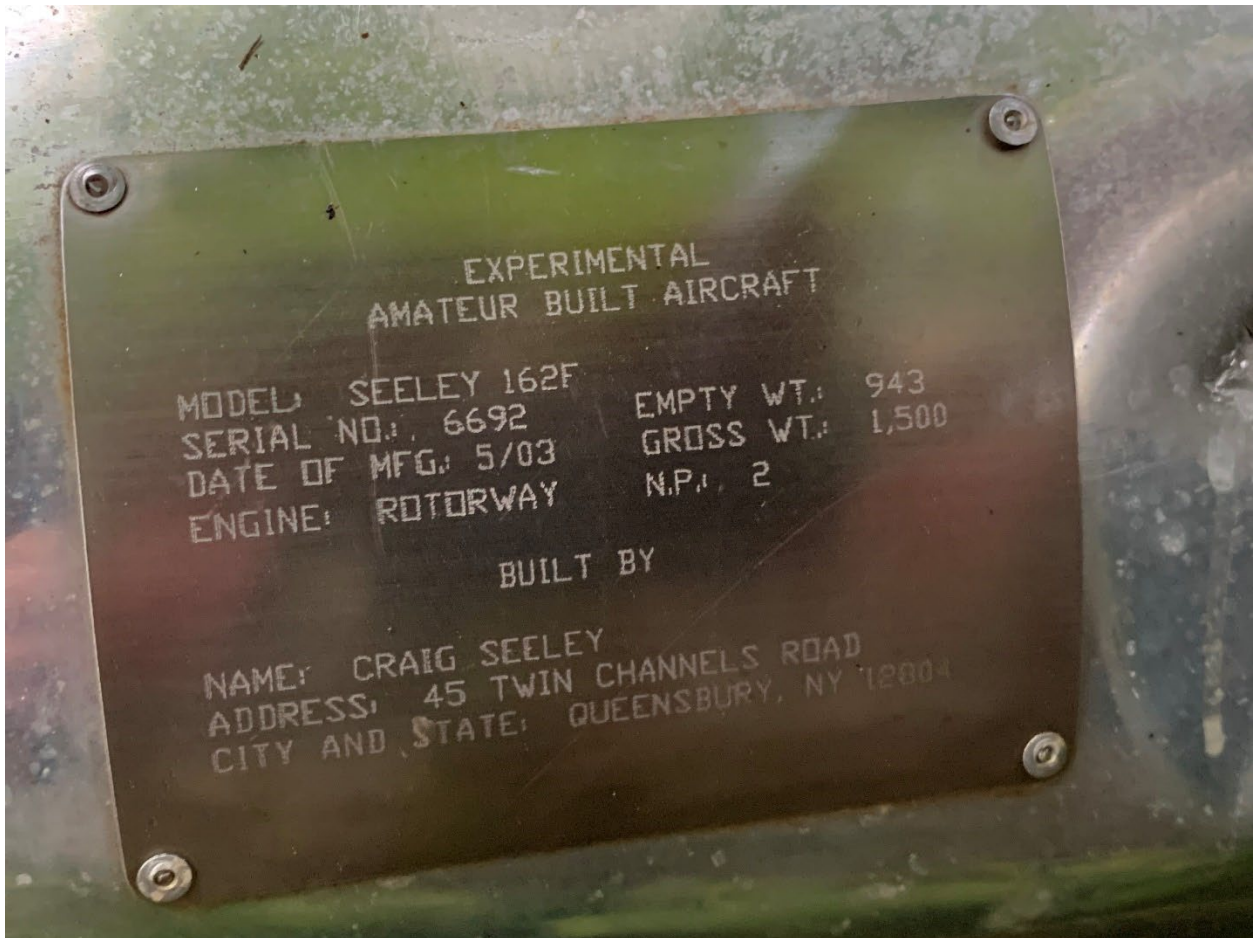


Figure 2 - Dataplate

2.1 Fuselage

The fuselage was largely consumed by fire, many aluminum components were melted. Significant Fiberglass melted/fabric remains. Steel frame tubes mostly intact but impact displaced/damage. Tubes/plates of fuselage impinging on engine crankshaft sheave. Left landing skid melted away near mid span.



Figure 3 - Fuselage View from Bottom

About ½ of the tail boom (about 4 ft long) remained attached to fuselage. It was impact damaged and torn open at its aft end. Remnants of 2-3 circular ring shaped cast aluminum stiffeners were found fractured, ½ of 1 of those remained in tail boom section attached to fuselage. The ballast weight was in place on its centerline mount below the forward tail boom.



Figure 4 - Tail boom Section - Attached to Fuselage

The aft section (about 4 ft long) of the tail boom was found about halfway along the debris path, 200 ft from the main wreckage. The forward end of the section was fractured and torn open. The tail rotor gear box remained attached, along with 1 of the 2 tail rotor blades. The 2nd tail rotor blade was not located. The vertical stabilizer and tail rotor guard remained intact.



Figure 5 - Aft Tail Boom Section

The pitch change links remained intact, rotated freely, and the pitch change mechanism moved freely. The drive pulley remained attached inside.



Figure 6 - Tail Rotor Pitch Change Links

Impact marks and paint transfer were found on the right side of the tail boom consistent with the arc and color of the tail rotor blade tips (last 3-4 inches).



Figure 7 - Impact Marks and Paint Transfer - Tail Rotor Blade

Impact marks at the forward (fractured) end of the tail boom section were shaped similar to the main rotor blade and contained some black marks consistent with main rotor blade paint.



Figure 8 Impact Marks at Forward End of Tail Boom Section



Figure 9 - Impact Marks at Forward End of Tail Boom Section (enlarged)



Figure 10 - Main Rotor Blade Shown at Impact Marks

The left and right horizontal stabilizers were separated from the tail boom and found separately in field along wreckage path (they were mounted at or forward of the fracture/damage area at the front of the separated tail boom section), along with small piece of tail boom skin, with partial N number, from Right side of tail boom, in the fractured/damaged area.

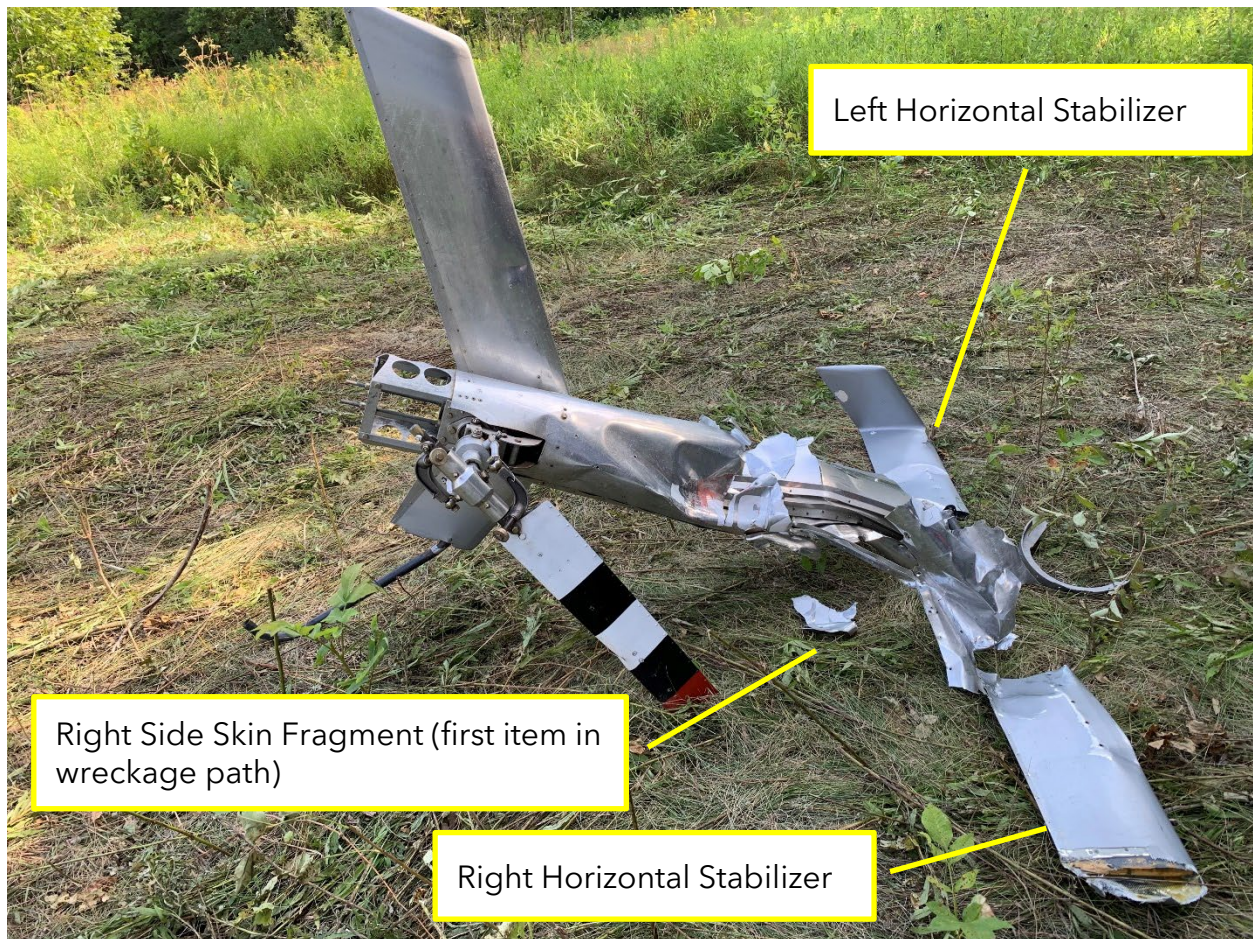


Figure 11 - Aft Section of Tail Boom

Both main rotor blades remained attached to blade grips at the rotor head. The bolt head of the blade grip to hub attachment bolt on blade "B" was fracture separated. The remainder of the bolt was in place (in the elastomeric bearing and through the opposite side of the grip).

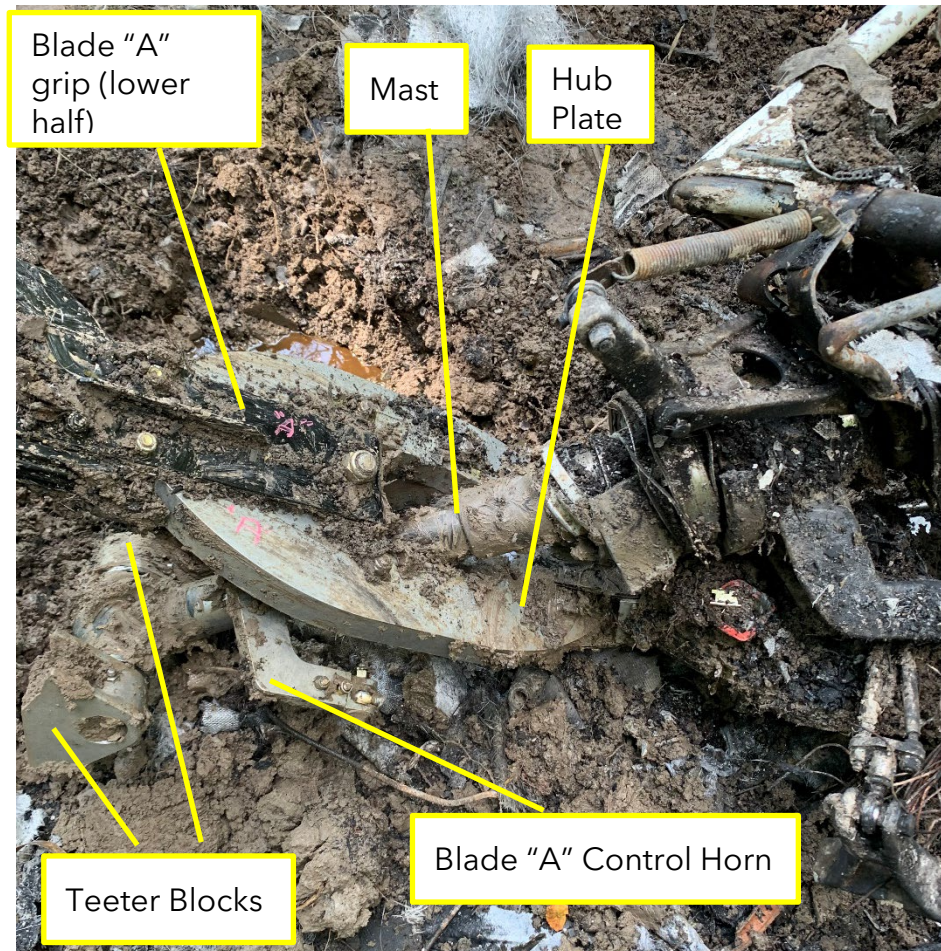


Figure 12 - Main Rotor Hub (view of bottom side)

The inboard end (hub side) of both the A and B blade grips (the bottom halves of each grip) were damaged, with round indentations, consistent with the diameter of the mast.

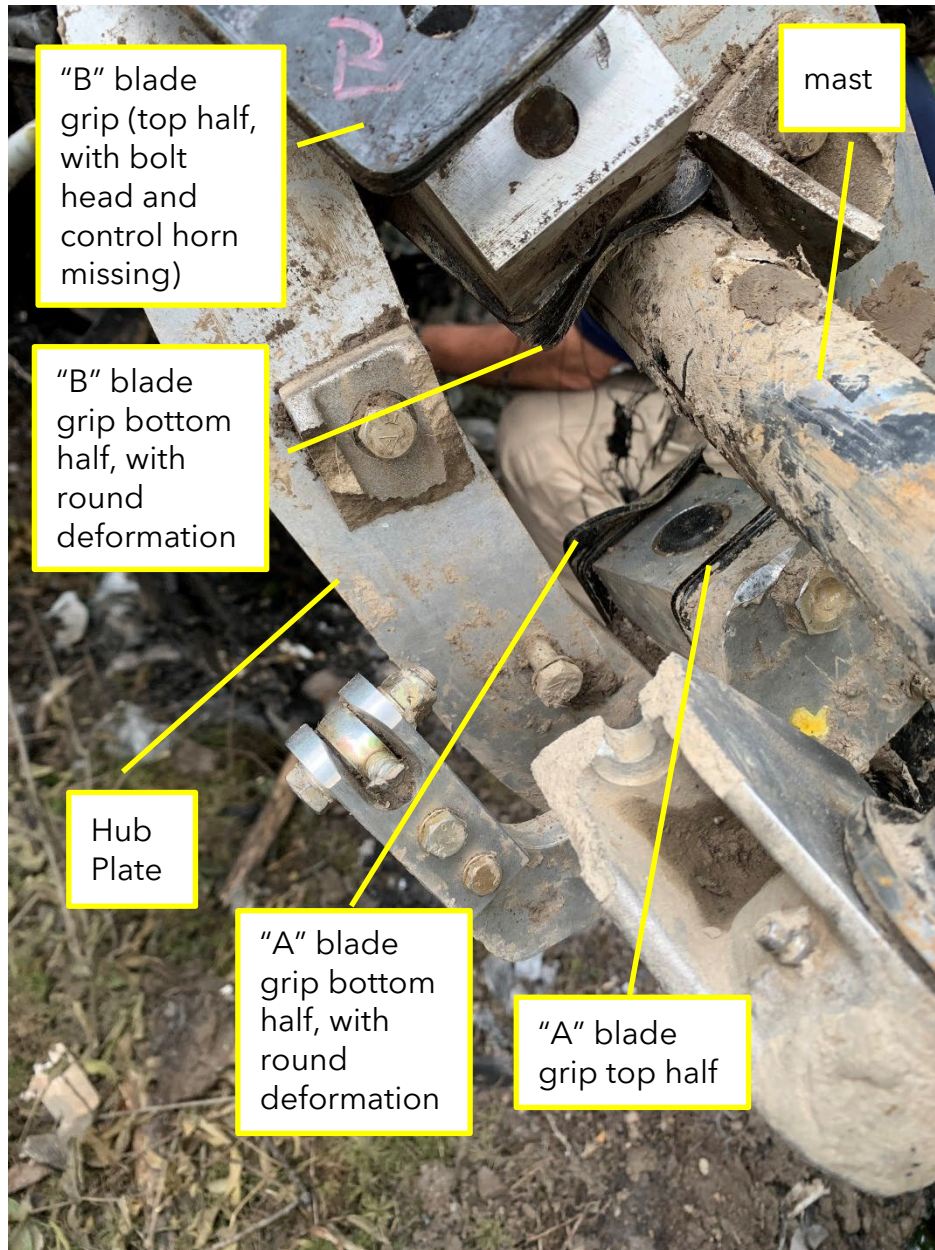


Figure 13 - Main Rotor Hub - (view from top side)



Figure 14 - Blade "B" Lower Half Grip (enlarged, view from bottom)

The blade "A" control horn had an impact mark just above the upper half of the blade grip.

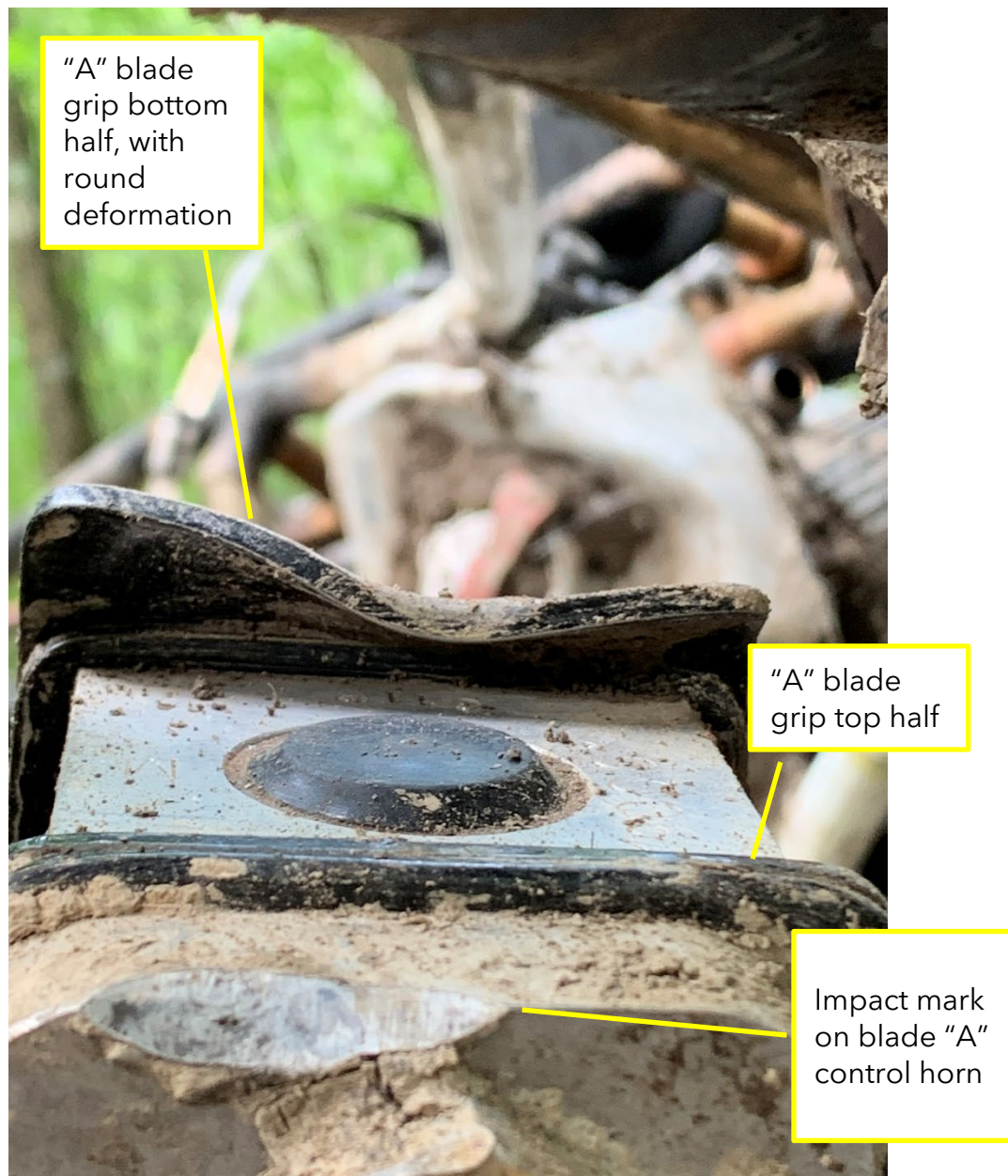


Figure 15 - Blade "A" Lower and Upper Grips and Damage to Control Horn

Blade "A" was largely intact. The bottom side was dented throughout the span, and it was bent downward slightly at mid-span and again about 2 ft from the tip. The top of the blade had some mud/scrape marks extending aft from the leading edge, with no remarkable leading edge damage.

Blade "B" was found mostly underneath helicopter, the inboard half of the span was impact and fire damaged. Some leading-edge gouging was present about 1-3 feet from outboard edge.

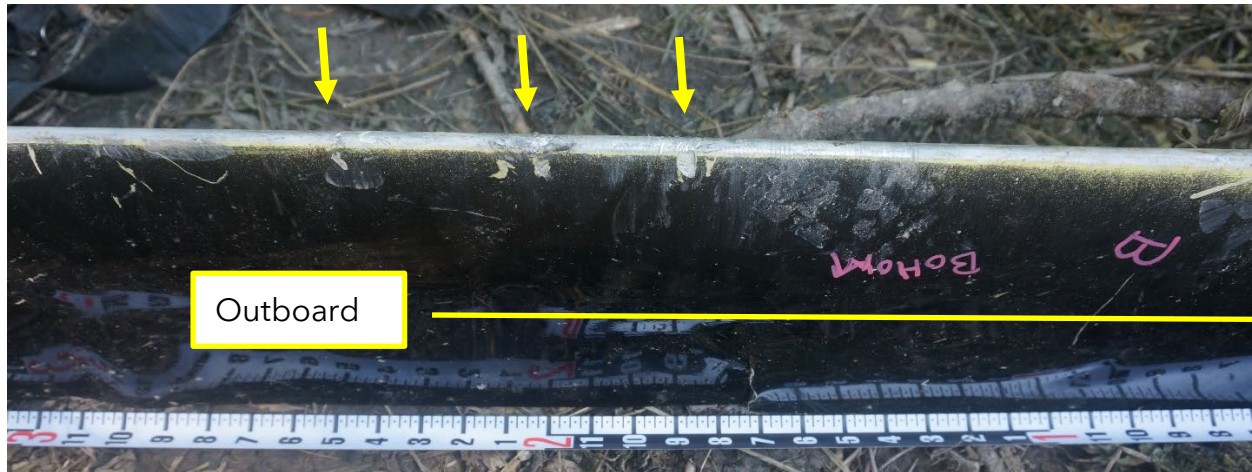
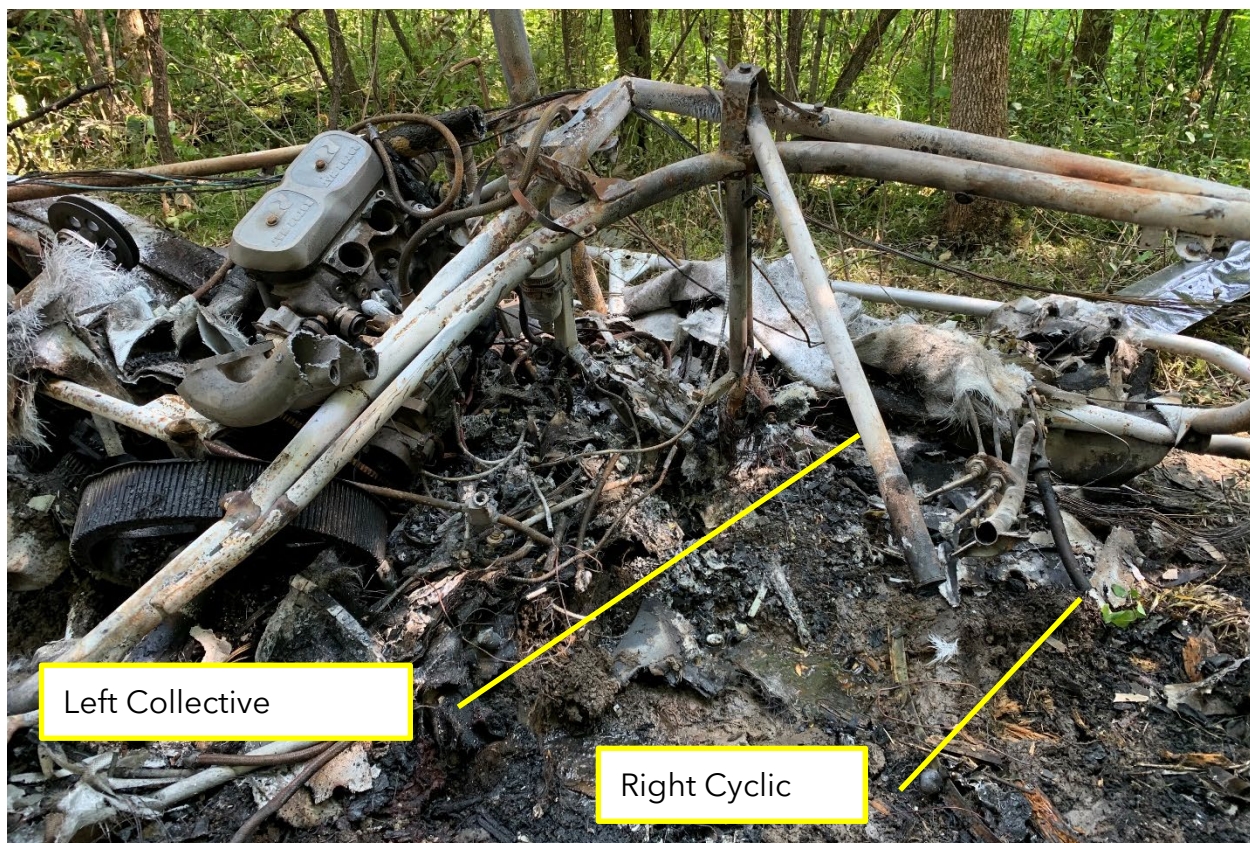


Figure 16 Blade "B" Leading Edge Damage

The right seat collective control tube and left seat cyclic control stick were not found in the wreckage.

The left collective tube remained attached. The throttle control rod was continued from the grip to the base of the collective tube. The lateral throttle control rod was found separated from its attach points. No control cables or rods were found attached to the collective control.



Left Collective

Right Cyclic

Figure 17 - Controls

The right cyclic control stick remained attached to its torque tube. It was not connected to the (missing) left cyclic control stick or any other control cables.

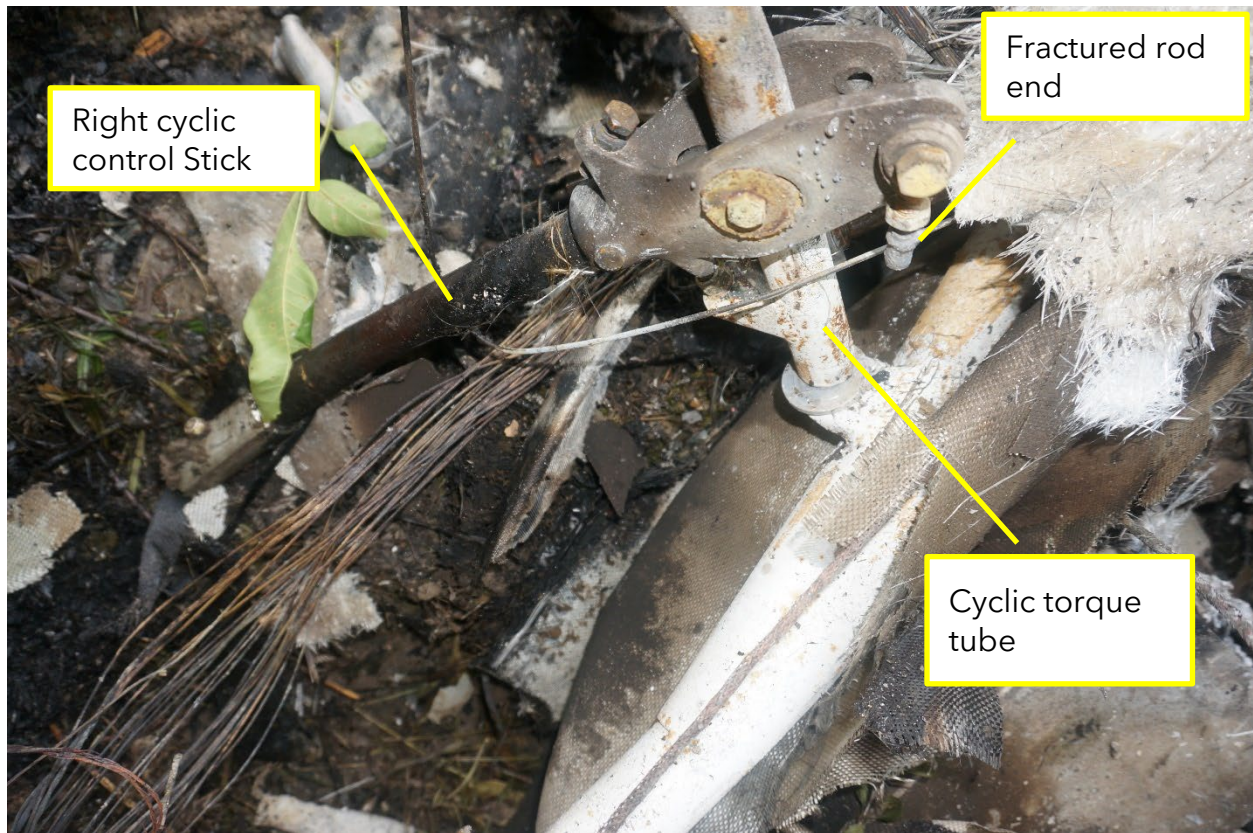


Figure 18 - Right Cyclic Control Stick

The left-right teleflex (push-pull) cable set, mounted to a weldment on the cyclic torque tube, was found disconnected. The ends of both cables were melted and the terminating block (where the two cables attach to a single "rod end" was missing. The cable ends remained near the mount for the (missing) left cyclic control stick.



Figure 19 - Cyclic Torque Tube

This cable set was continuous to one of the (fractured) lugs on the non-rotating swashplate.

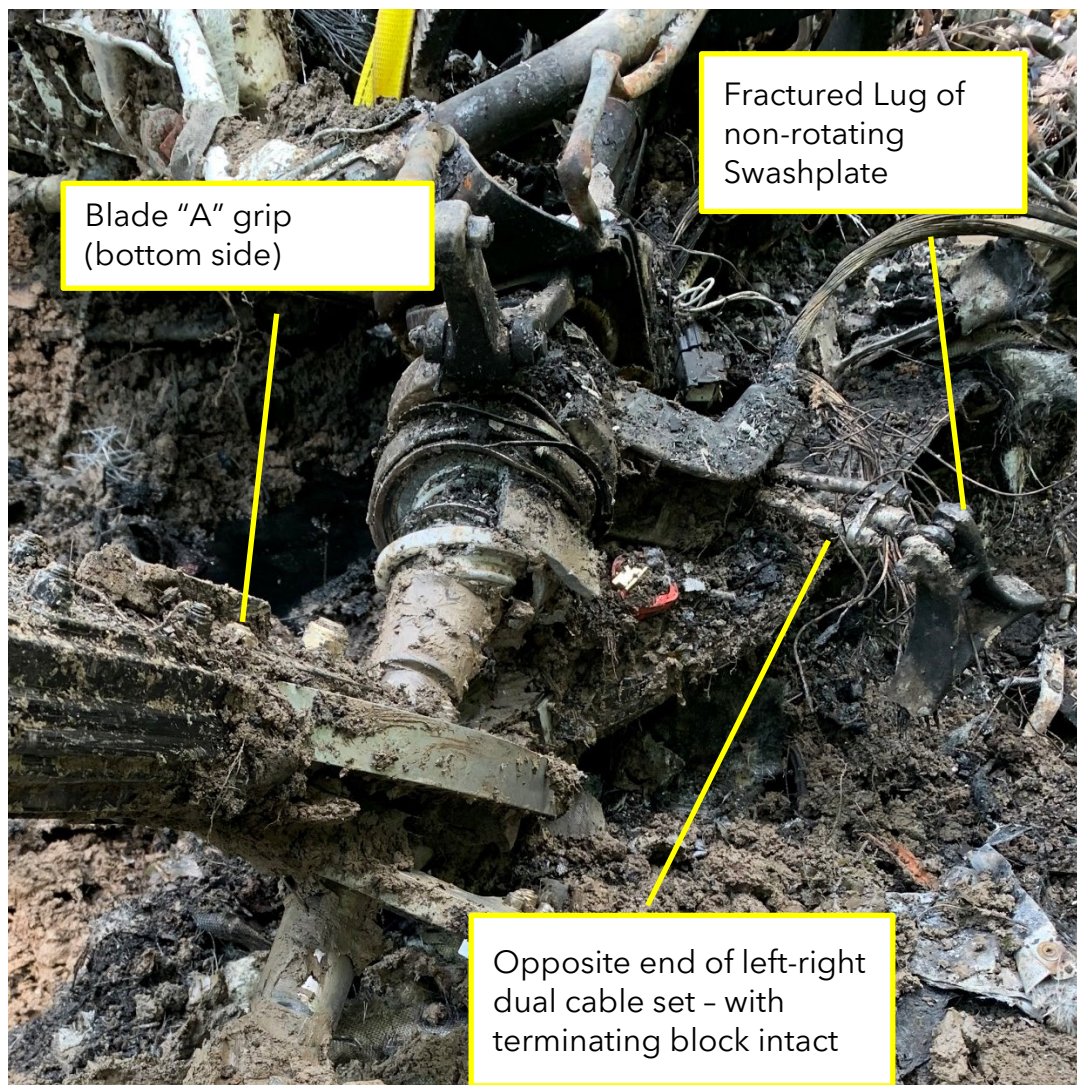


Figure 20 - Left-Right Cable Set End

The fore-aft teleflex cable set remained attached to the control horn on the cyclic torque tube. The opposite end of this cable was not located.

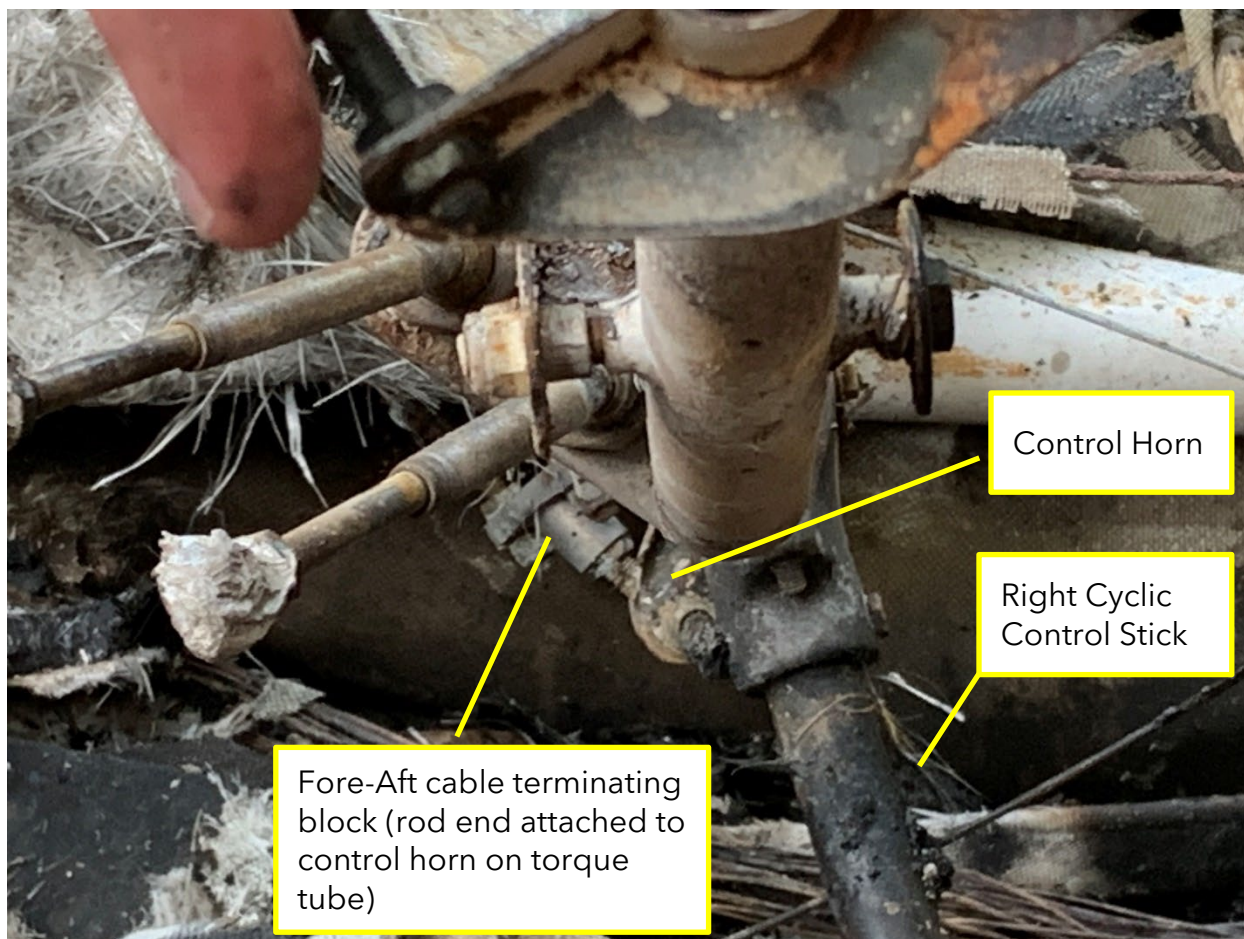


Figure 21 - Fore-Aft Cable Connected at Cyclic Torque Tube

Several damaged components were found buried beneath the rotor head. Both pitch change links remained attached to fragments of their lower control horns, one of which separated from the fragment when the helicopter was lifted.



Figure 22 - Fragmented Rotor Head Components

The single teleflex control cable between the left seat anti-torque pedal set and the tail rotor, was continuous from the pedal set to a fracture near the tail boom separation location. All the small diameter wires in the cable were separated at the pedal end fitting, the large diameter core wire remained attached. The left seat and right seat pedal sets remained attached to the fuselage tube and linked to each other. No wires remained attached at the teleflex fitting in the rear of the tail boom.

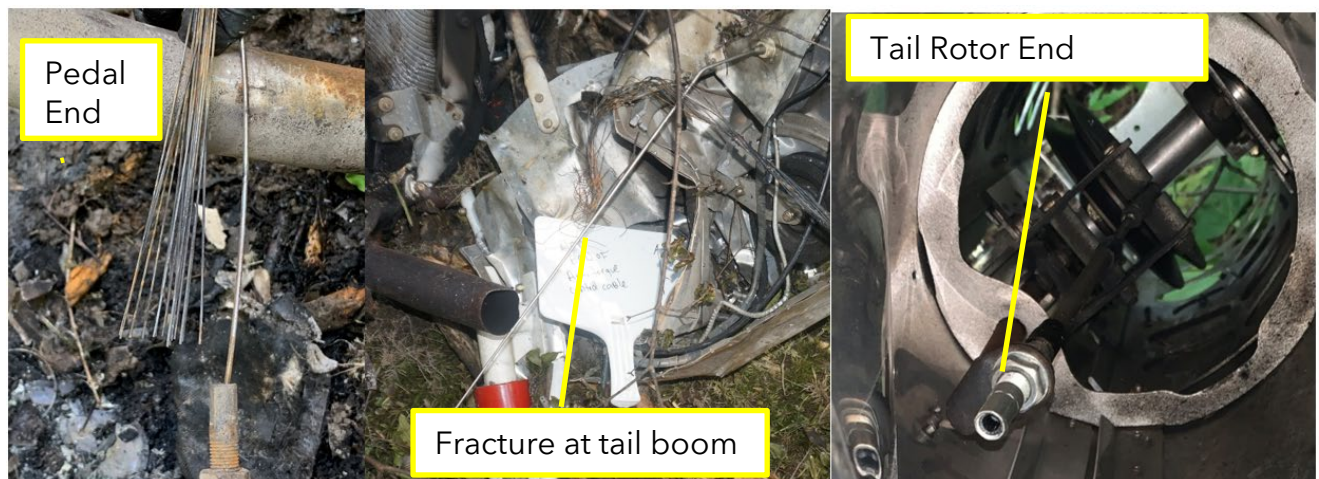


Figure 23 - Tail Rotor Control Cable

3.0 Engine/Drive System Examination

No data plate was found on the engine. According to FAA records the engine was manufactured by Rotorway, model RI 162F, S/N 6459. It was a four stroke, four cylinder, 2659 cubic centimeter, liquid cooled, fuel injected, 150 horsepower engine.

The engine sustained thermal damage, some components were found melted.



Figure 24 - Engine

A section of fuselage was found impinged on the crankshaft sheave, which left the sheave damaged. No rotational scoring marks were found on the sheave. The crankshaft could not be rotated using hand tools. After cutting away the impinging fuselage structure, the crankshaft still would not rotate.

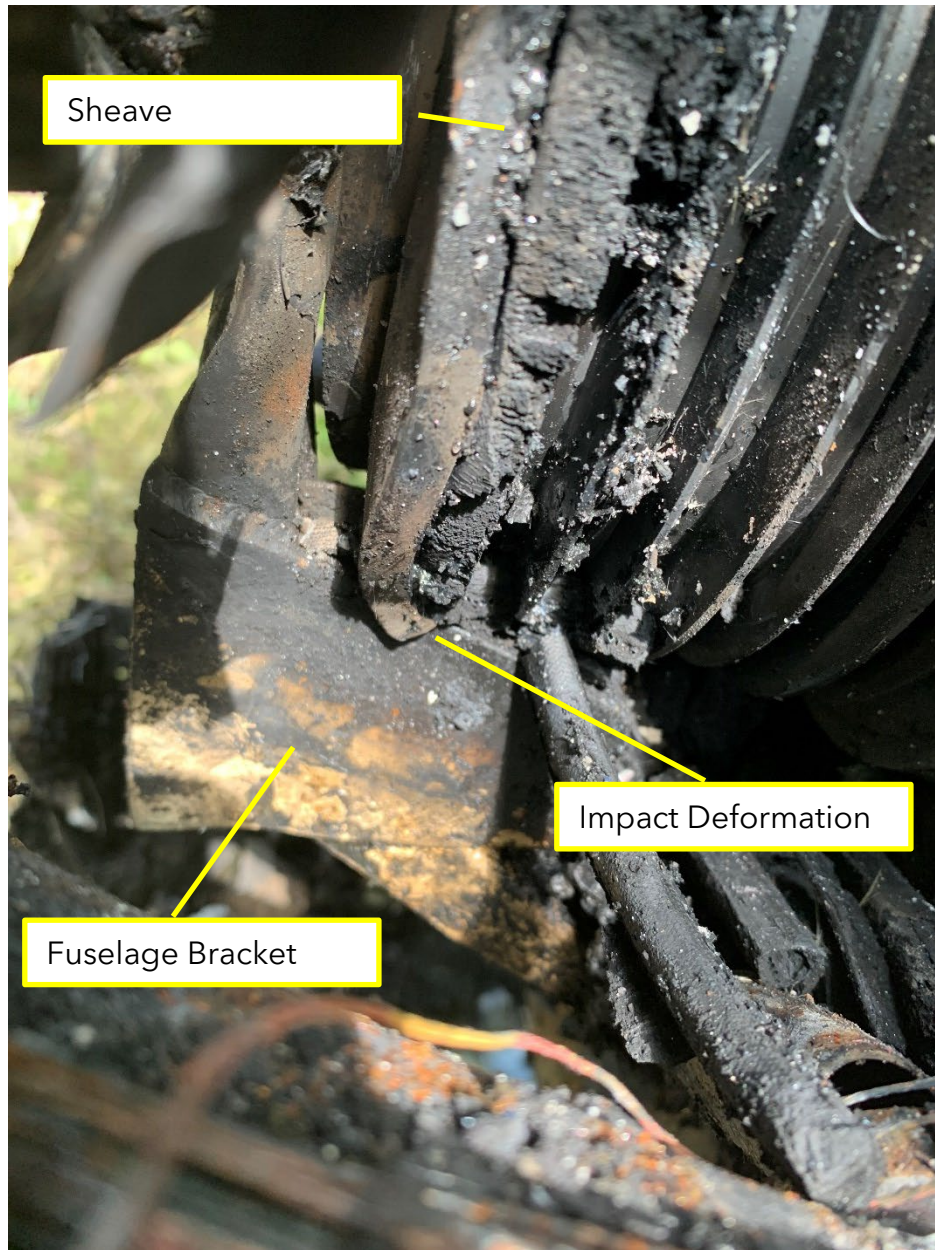


Figure 25 - Crankshaft Sheave

A borescope examination of all four cylinders revealed no anomalies with the cylinder walls, position tops or valves. The Nos. 1 and 2 valve rocker arms, springs and pushrods were in place and undamaged, with some discoloration and consistent with heat from the post crash fire.

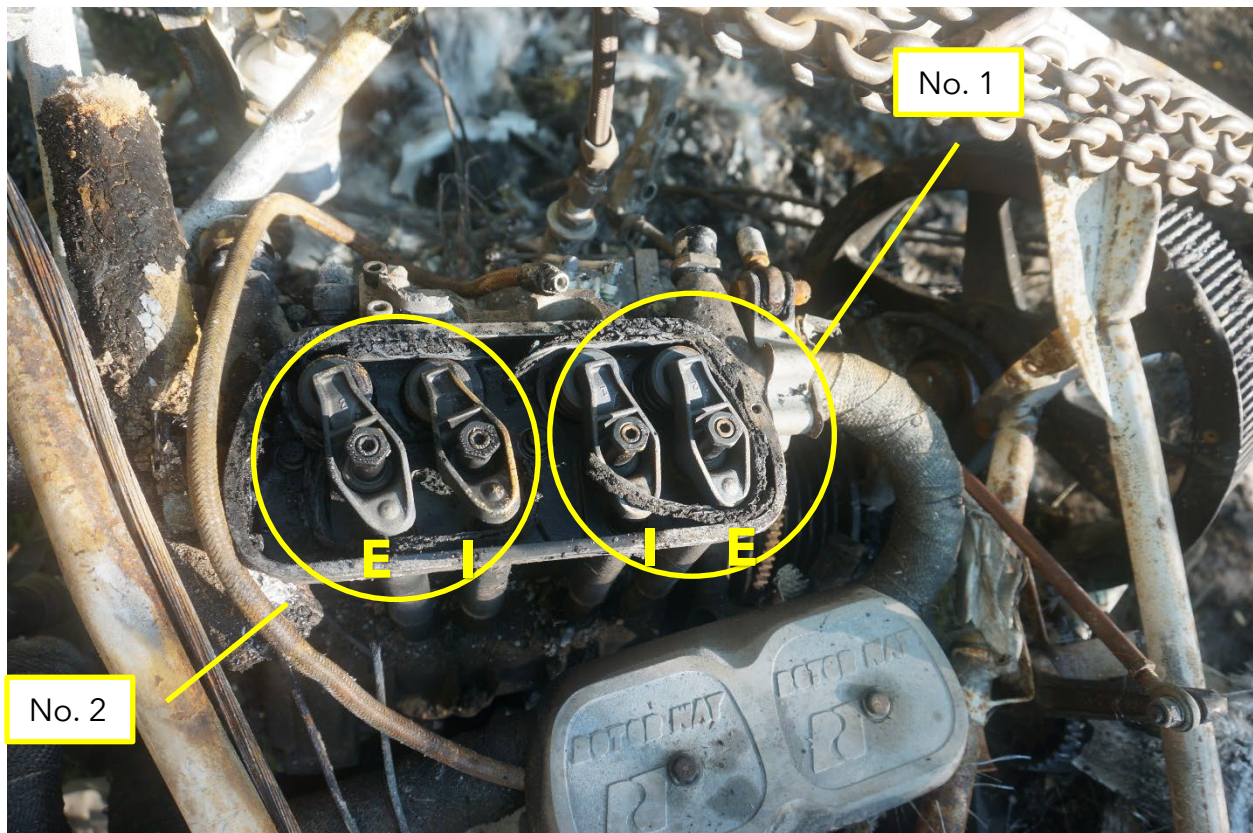


Figure 26 Valvetrain - Cylinders Nos. 1 and 2 ("Right" Engine bank, Left Side of Helicopter)

The rocker cover for the Nos. 3 and 4 cylinders was inaccessible due to the helicopter orientation and could not be removed.

The spin-on type oil filter element was absent of debris.



Figure 27 - Oil Filter

The ignitions leads to all 4 cylinders were thermally damaged and partially or completely melted at the spark plug ends. Only 1 spark plug from each cylinder could be removed due to impact damage. Each was generally clean with tan colored electrodes and white insulators. The No. 3 plug was slightly oil soaked.

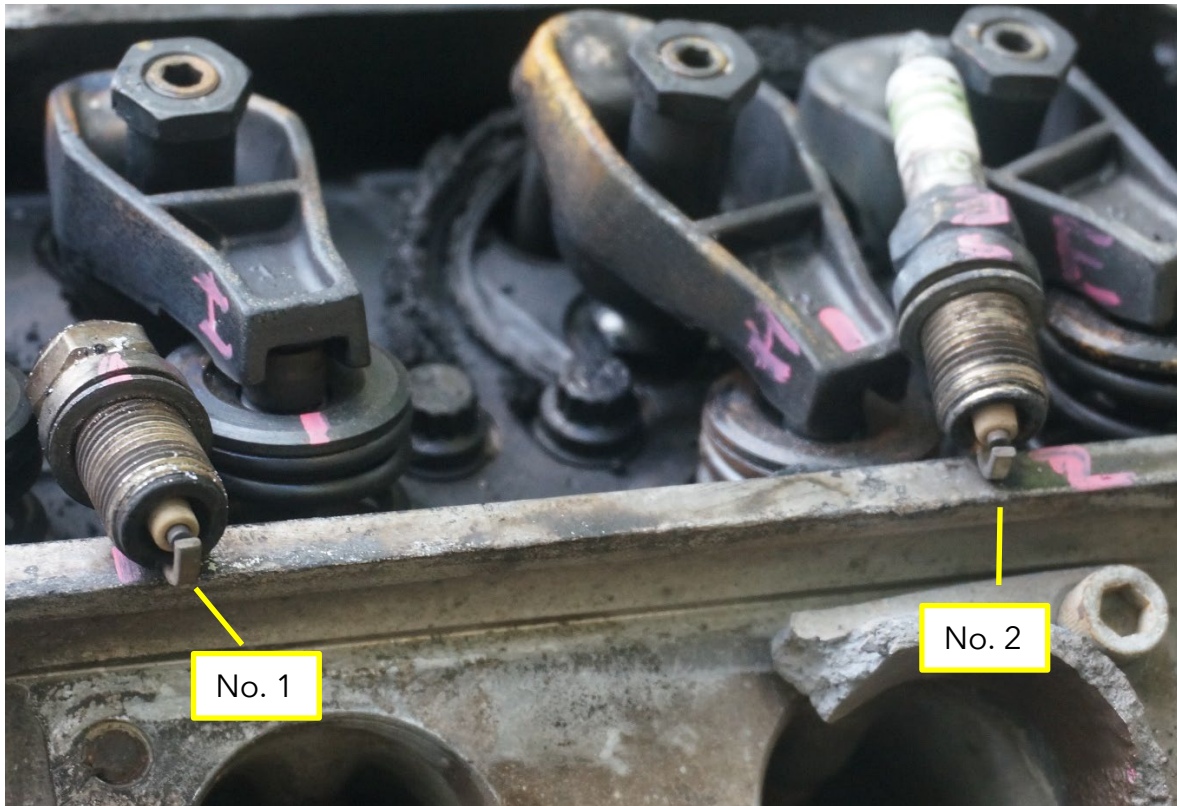


Figure 28 - Nos. 1 and 2 Spark Plugs



Figure 29 - Nos. 3 and 4 Spark Plugs

The electronic engine control unit was impact and thermally damaged.



Figure 30 - Electronic Engine Control Unit

The throttle body was separated from the engine, it was impact and thermally damaged.



Figure 31 - Throttle Body

Two fuel manifolds were found, both damaged and fractured, separated from cylinder heads. One had fuel injector nozzles that remained installed, The had no nozzles attached. Some nozzles were found loose on ground. Neither manifold had any fuel lines attached.



Figure 32 - Intake Manifold, Unknown Side

The air filter element was impact and thermally damaged.



Figure 33 - Air Filter Element

The fuel pumps remained attached to their mount, no fuel lines remained connected, and were thermally damaged. The rotors fell out of their case when pulled and appeared relatively intact.



Figure 34 - Fuel Pumps

V-belt remnants were found near the crankshaft sheave and the secondary drive sheave, which contains the autorotation or sprag type clutch. The remnants were mostly consumed by fire and none remained around the secondary drive sheave. The secondary sheave could not be rotated by hand in either direction.



Figure 35 - Secondary Drive Sheave

Remnants of the primary drive toothed belt, which drives the main rotor shaft through a series of pulleys from the secondary sheave to the main rotor shaft sprocket, were found along the belt path. No rotational scars were found on the main rotor shaft sprocket.

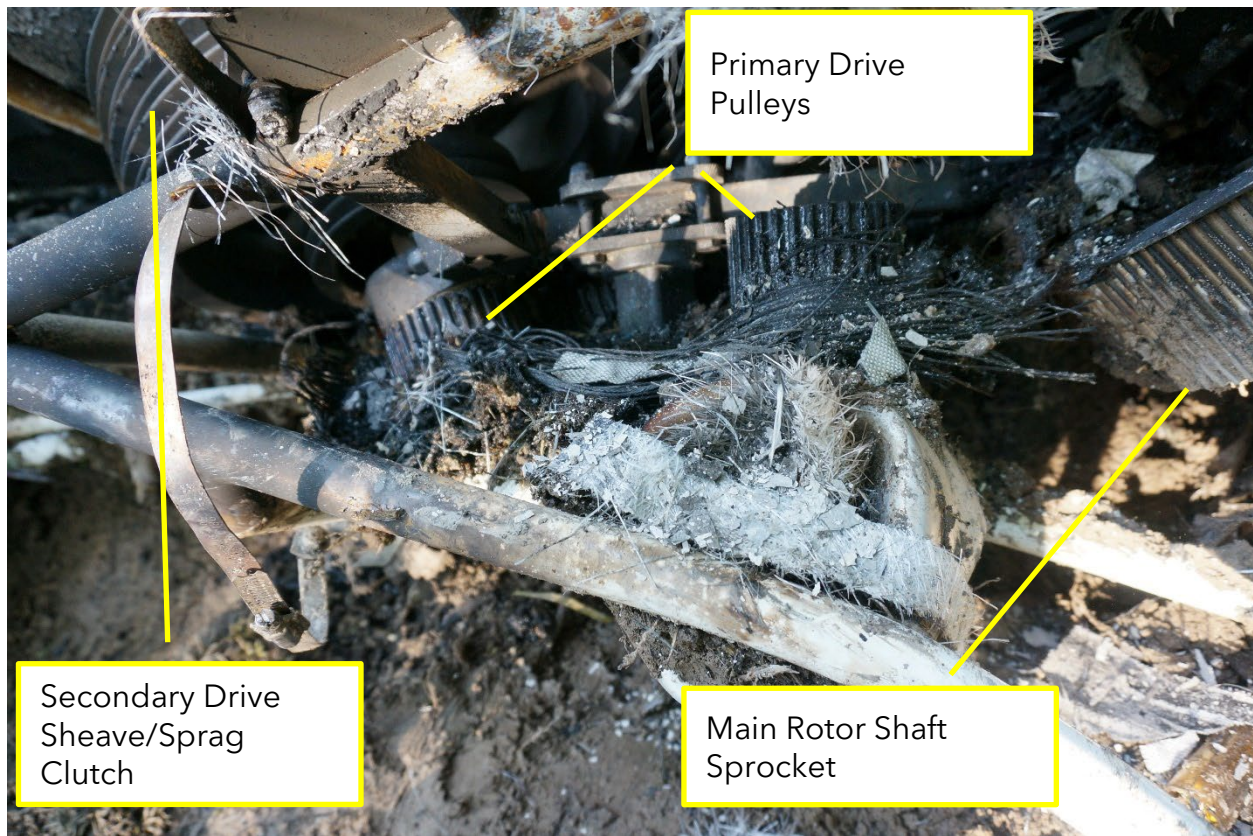


Figure 36 - Primary Drive Pulleys, Sprocket, and Belt Remnants