National Transportation Safety Board
Office of Aviation Safety
Washington, DC 20594

WPR22FA210

AIRFRAME AND ENGINE EXAMINATION

August 3, 2022

A. ACCIDENT

Location: Camarillo, California
Date: June 10, 2022
Time: 0803 Pacific daylight time
Airplane: Mooney M20K, N305L

B. AIRFRAME AND ENGINE EXAMINATION

IIC: Eliott Simpson
National Transportation Safety Board

FAA Inspector: Jeffrey W. Fritz
Federal Aviation Administration
Van Nuys, CA FSDO

C. SUMMARY

The examination was conducted by the NTSB IIC and FAA Inspector Fritz at the accident site on June 10, 2022, and by the NTSB IIC at the facilities of Southwest Air Transport in Corona, California on June 11, 2022.

D. DETAILS OF THE EXAMINATION

1.0 Accident Site

The first point of impact was identified by a wing-shaped imprint at the top wall of a building located south of the freeway, and one mile west-northwest of the departure end of runway 26 (figure 1). The imprint was about 50 ft above the ground, and its shape corresponded to a 15° right-wing-down impact attitude. The outboard section of the right wing and aileron were located on top of the building (figure 2). A trail of debris consisting of wing skin fragments and the right flap continued on a heading of 035° magnetic, across the freeway to a secondary impact point in a strawberry field, 750 feet beyond (figure 3).

The debris beyond the secondary impact point consisted of the propeller, cabin skin fragments, and flight instruments, all leading to the main wreckage, which was on the same heading, a further 250 ft downrange (figure 3). The airframe sustained extensive impact and thermal damage through to the leading edge of the tail assembly. Impact and thermally damaged remnants of the left wing, along with the inboard section of the right wing remained attached to the center of the cabin (figure 4).

2.0 Airframe Examination

2.1 Fuselage

The fuselage sustained extensive fragmentation and thermal damage through to the leading edge of the moving tail assembly (figure 5). The flight controls, seats, and instrument panel were crushed and thermally damaged. Most of the flight instruments and avionics components were found distributed in the center of the debris field, and each had sustained varying degrees of impact damage. The vacuum driven attitude indicator and horizontal situation indicator were crushed such that their functionality at the time of the accident could not be determined. The circuit breaker panel was bent and sustained thermal damage, and most of the breakers were in the "open" position (figure 6). The throttle control was set about 1.5 inches aft from full forward, the propellor control was full aft, and the mixture control was full forward (figure 7).

The flight control yoke, push-pull tube, and bellcrank assemblies within the forward cabin sustained extensive crush and fragmentation damage (figure 8). Examination of all separations revealed bending, tear, and other damage signatures consistent with overload. A section of the right seat rail and lower seat was located and appeared to be set in the middle of its travel range, damage and fragmentation of the reaming seat assemblies prevented a determination of their positions. Two rear and one forward-left seatbelt latch assembly were located, all were found locked (figure 9).

The main cabin door had detached, folded in half, and was thermally damaged. The position of the lock at impact could not be determined due to impact damage. The baggage door had detached from the airframe; its handle was in the locked position, and its locking pins were extended.

There was no evidence of bird strike to any of the unburnt airframe or any of the lift and control surface components.

2.2 Empennage

The entire moving tail assembly structure had detached from the airframe and remained partially attached by electrical cables and wires. The vertical stabilizer was intact, and the rudder remained attached by all its hinges. The elevator trim jack located in the lower moving tail assembly exhibited 7 exposed threads, which was consistent with the takeoff trim setting (figure 10).

The lower portion of the rudder skin was bent left (figure 11) along with its rudder control arm, which remained attached and connected to its push-pull tube. The right horizontal stabilizer remained attached and sustained crumpling damage outboard; the elevator remained attached to the horizontal stabilizer at all of its hinges and the

control horn (figure 12). The left horizontal stabilizer remained attached and sustained upward bending damage along its outboard side. The elevator had detached from the horizontal stabilizer but remained attached to the tail by its control horn.

2.3 Wings

The left and right wings remained attached to each other at the cabin floor, which was burnt and separated from the cabin structure. The flap torque tube control assembly remained attached to the aft center spar (figure 13). The flap actuator motor assembly was not located.

The fuel tanks were fragmented and consumed by fire; however, two caps were located, and remained firmly engaged within their respective filler necks.

2.3.1 Right Wing

The outboard section of the right wing, along with the aileron, had detached and was located on the roof of the building at the initial impact point. This wing section sustained crush damage through to the aft spar (figure 14). The aileron had detached, and was spilt in two, midspan (figure 15). The outboard aileron hinge remained attached and had pulled away from the aft spar. The inboard hinge remained attached to the aft wing spar and had pulled away from the aileron (figure 16). The push-pull tube remained attached to the aileron horn, and the wing bellcrank, which remained attached to the wing structure. The lateral push-pull tube had pulled away from the bellcrank, and was folded and buckled, but remained within the leading edge of the inboard wing section (figure 17).

The right flap was intact and bent and had detached from the wing (figure 18). It was located on the ground, about 200 ft beyond the first impact point on the building. The hinges remained attached to the flap and had pulled away from there corresponding attach points on the aft wing spar. The control arm had broken away from the inboard flap root and remained attached to the flap torque tube (figure 19).

2.3.2 Left Wing

The outboard section of the left wing along with its aileron had sustained significant crush, fragmentation, and thermal damage (figure 20). The aileron had detached, and was spilt in two, midspan. The outboard aileron hinge remained attached and had pulled away from the aft spar (figure 21). The push-pull tube remained attached to the aileron and had pulled away from the wing bellcrank. The lateral bellcrank had fragmented with a remnant reaming within the inboard section of the wing (figure 22).

The flap was bent and buckled around the form of the wing but remained attached at all but its inboard hinge (figure 23). The flap control arm remained connected to the flap torque tube (figure 24).

2.4 Landing Gear

Both the left and right main landing gear remained partially attached to the airframe within their wheel wells, both tires had burnt (figure 25 left, figure 26 right). The nose landing gear had sustained crush damage within the forward fuselage. Examination of the landing gear electric actuator revealed that its jackscrew was extended, consistent with the landing gear being raised (figure 27).

3.0 Engine Examination

Model Number: TSIO-520-NB17B
Serial Number: 290582-R

The engine remained attached to its mount, which remained partially attached to the firewall by control lines, electrical cables, and engine supply lines (figure 28). The oil pan had formed around the crankshaft, and there was no evidence catastrophic internal failure such as a perforated crankcase or oil pan. The alternator had detached and was found in the debris field. Examination into the crankcase through the alternator hole similarly revealed no evidence of catastrophic internal failure. Both magnetos detached from their respective pads, leaving fragments of their mounting tabs still engaged.

The throttle body assembly had detached from the inlet manifold. All fuel and oil lines were either twisted or detached. All separation surfaces exhibited features consistent with overload, and all remaining fittings were intact. There was no evidence of inflight fire. At the accident site, the gascolator had separated contained about 2 ounces of fuel, which was negative for water when checked with water detecting paste. The engine driven fuel pump had broken away from the crankcase, leaving two sections of its mounting lugs still connected to the crankcase bolts. The fuel manifold valve remained attached to the top of the engine, and exhibited a breach in its casing, exposing the inner valve and spring assembly. The pressure relief valve remained attached to the induction manifold; its inner valve moved with spring resistance and did not appear to be bound.

The turbocharger assembly remained attached to the engine mount. The compressor and turbine assemblies appeared to be slightly bent at the center housing hub (figure 29). The blades of the compressor where exposed and exhibited blade tears and bending opposite the direction of rotation (figure 30). The turbine wheel was also exposed and caked with mud. With the mud removed, rubbing was observed between the blade tips and outer scroll (figure 31).

The propeller governor had broken away from the forward crankcase exposing its drive gears, which were clear and coated in oil.

The vacuum pump was undamaged and remained attached to its pad on the engine accessory case. The unit was removed, and its plastic coupling was intact (figure 32). The input drive gear could be rotated by hand with no noticeable binding. Disassembly of the unit revealed that the internal rotor and vanes were undamaged and intact (figure 33).

All six rocker covers were removed; all rockers were wet with clean oil, and the springs were intact. The top spark plugs were removed, exhibited no mechanical damage, and normal short service life signatures (figure 34) when compared to the Champion AV-27 Aviation Check-A-Plug chart.

The crankshaft turned freely when rotated by hand utilizing the vacuum drive gear, and cylinder "thumb" compression was noted on all cylinders. Mechanical continuity was established throughout the rotating group, valve train, and accessory section. All rockers had similar amounts of lift. Visual inspection of the combustion chambers was accomplished through the top spark plug bores utilizing a borescope; there was no evidence of catastrophic internal damage and all combustion surfaces exhibited light grey deposits consistent with normal operation.

4.0 Propeller Examination

All blades remained attached to the hub, which had detached from the crankshaft. Two of the balance weights had detached and were located within the debris field. All three blades exhibited leading edge nicks and abrasions, along with and chordwise scratches (Photo 35). One blade exhibited trailing edge s-bending. Slash marks within the dirt in the debris field suggest engine rotation at impact.

E. EXAMINATION PHOTOS

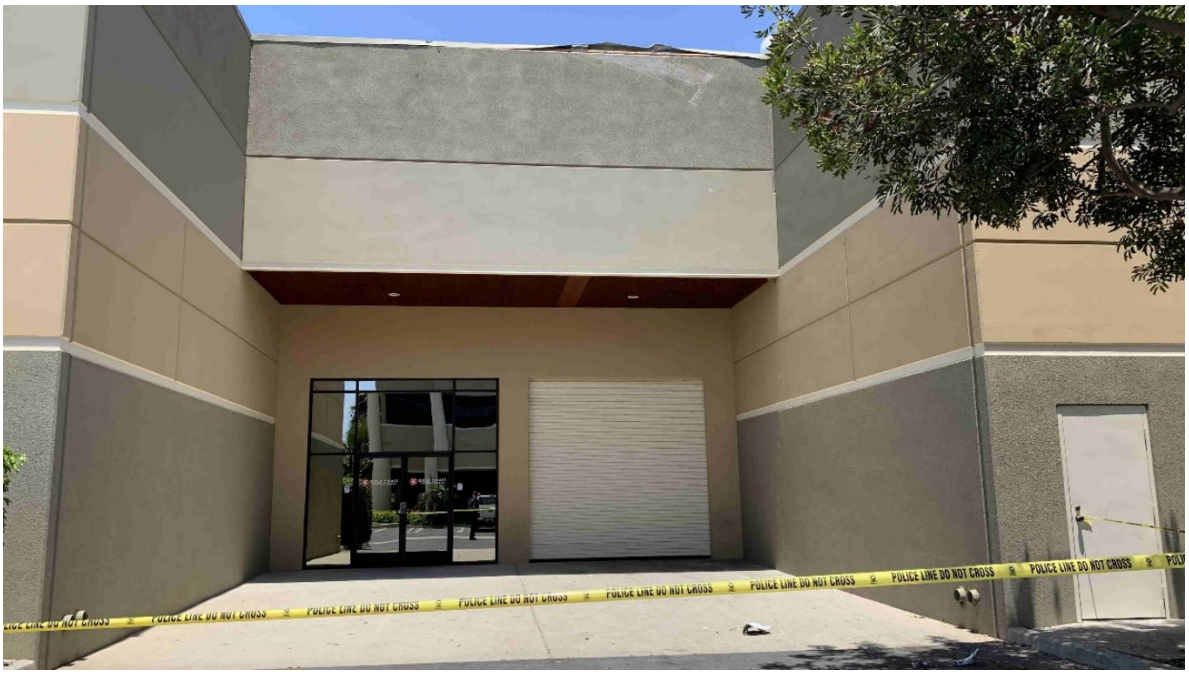

Figure 1 – First impact point

Figure 2 – Outboard right wing

Figure 3 – Debris field

Figure 4 – Main wreckage

Figure 5 - Main wreckage

Figure 6 – Circuit breaker panel

Figure 7 – Throttle quadrant

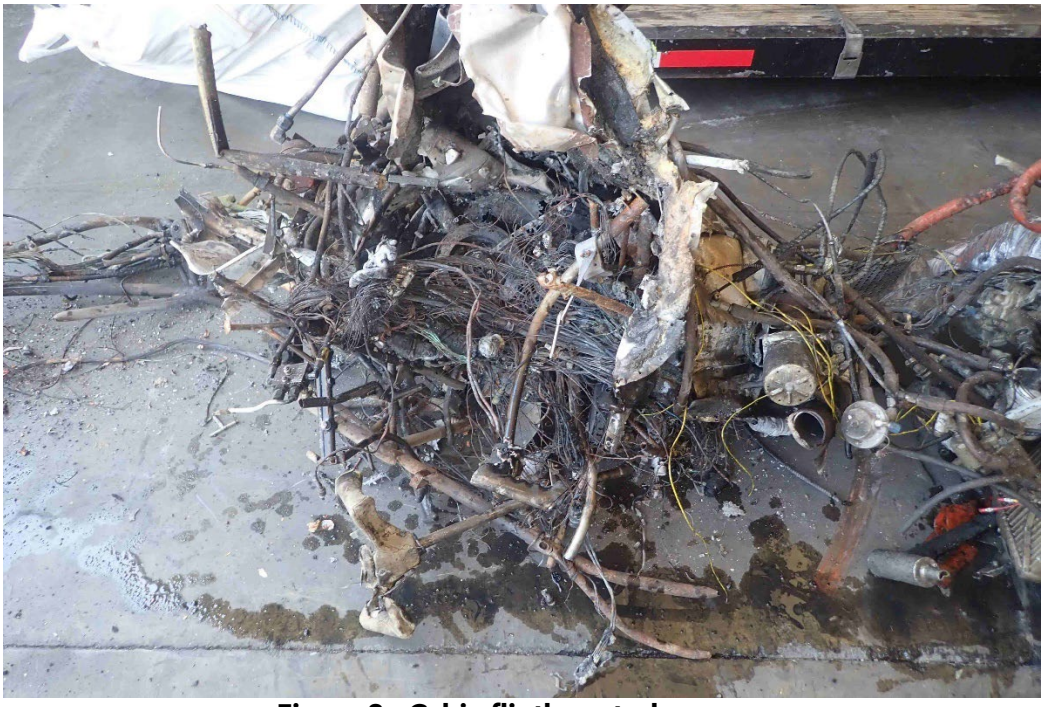

Figure 8 – Cabin fligth controls

Figure 9 – Seat belt buckles

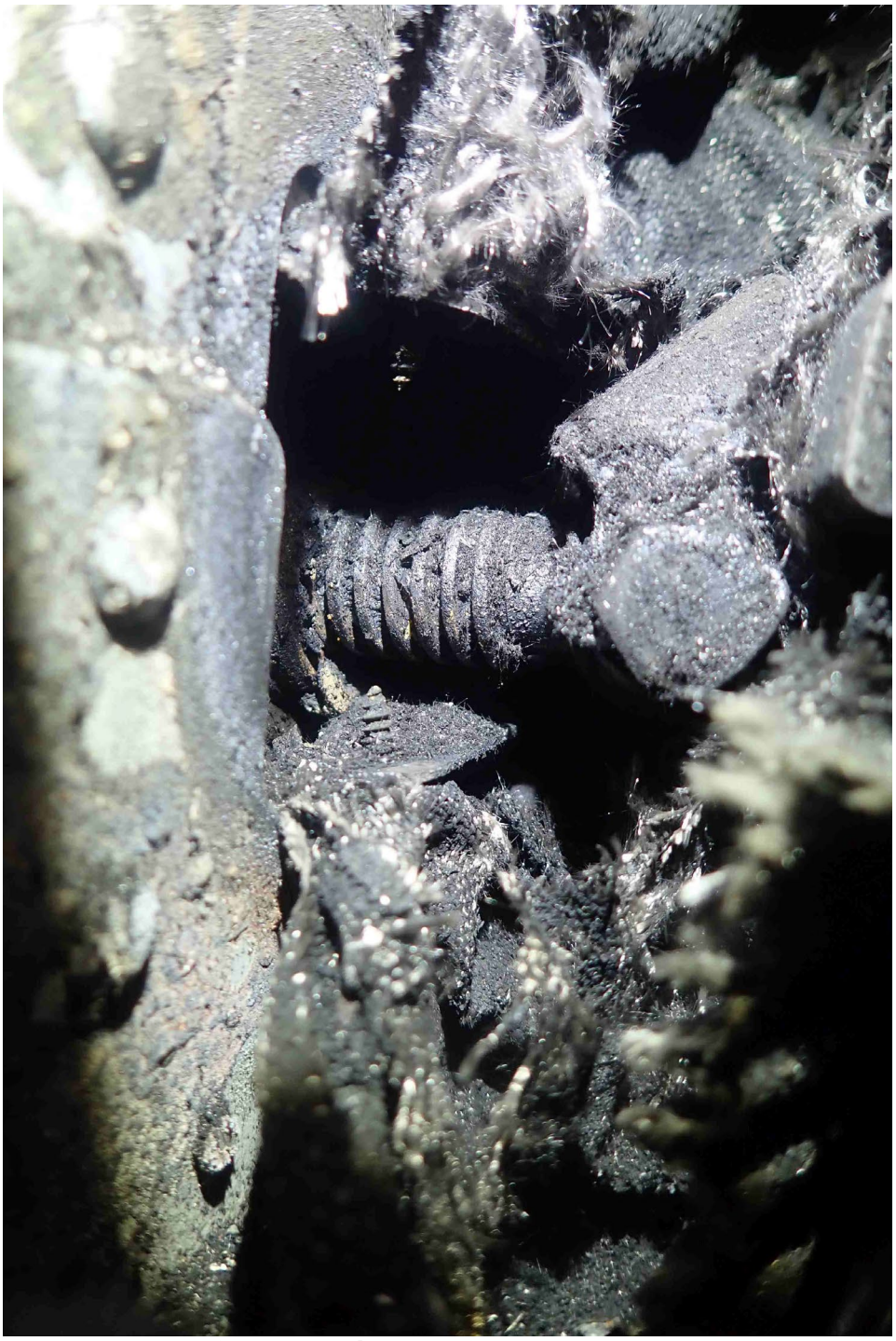

Figure 10 – Elevator trim actuator

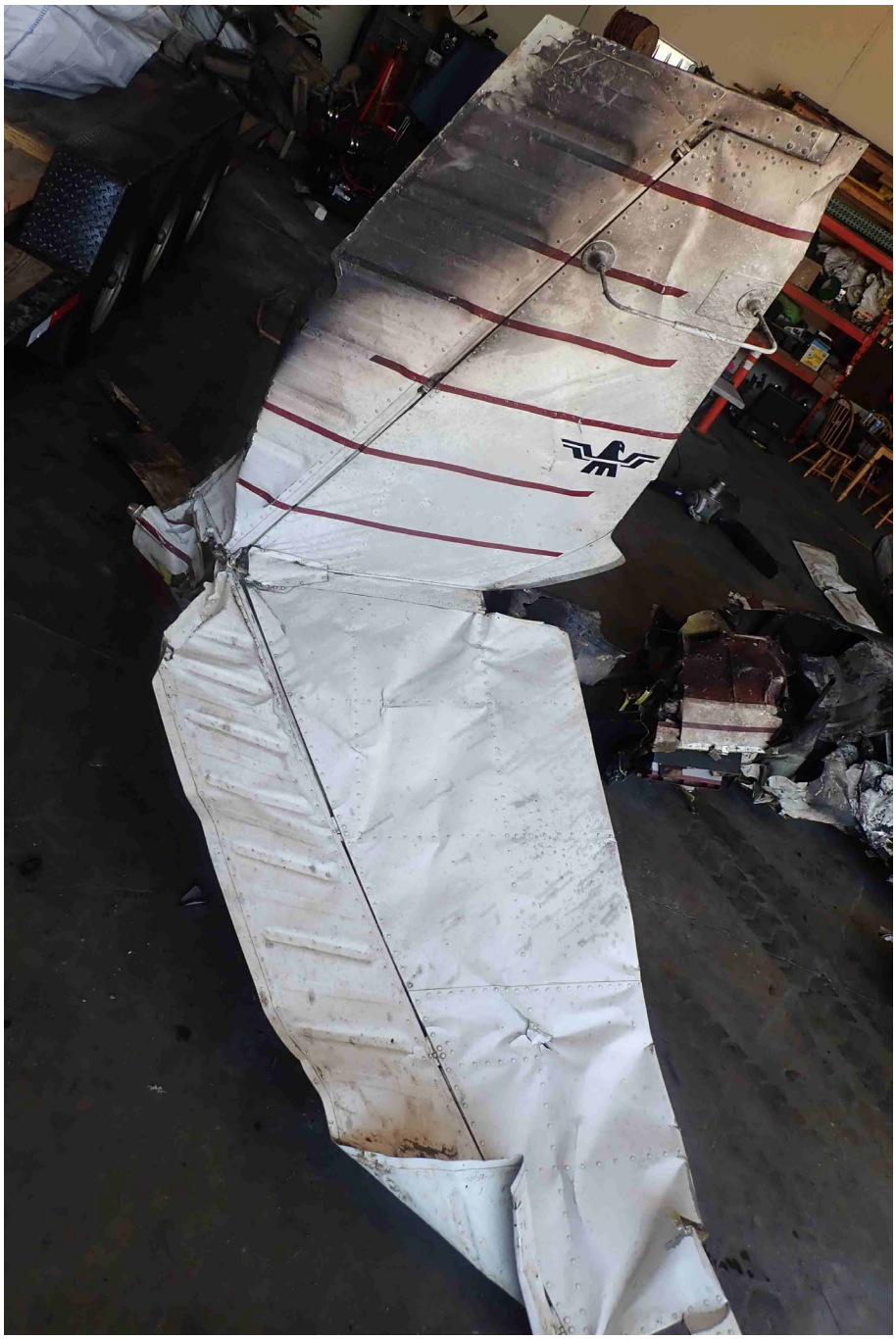

Figure 11 – Empenage

Figure 12 – Right Elevator

Figure 13 – Wing center section

Figure 14 – Outboard right wing

Figure 15 – Right aileron

Figure 16 – Inboard right aileron hinge

Figure 17 – Right wing and aileron control tube

Figure 18 – Right flap

Figure 19 – Right flap control arm

Figure 20– Outboard left wing fragments

Figure 21 – Left aileron

Figure 22 – Inboard left wing with control tube

Figure 23 – Left flap and inboard wing

Figure 24 – Left flap control arm

Figure 25 – Left main landing gear assembly.

Figure 26 - Right main landing gear assembly.

Figure 27 – Landing gear jackscrew

Figure 28 - Engine

Figure 29 - Turbocharger

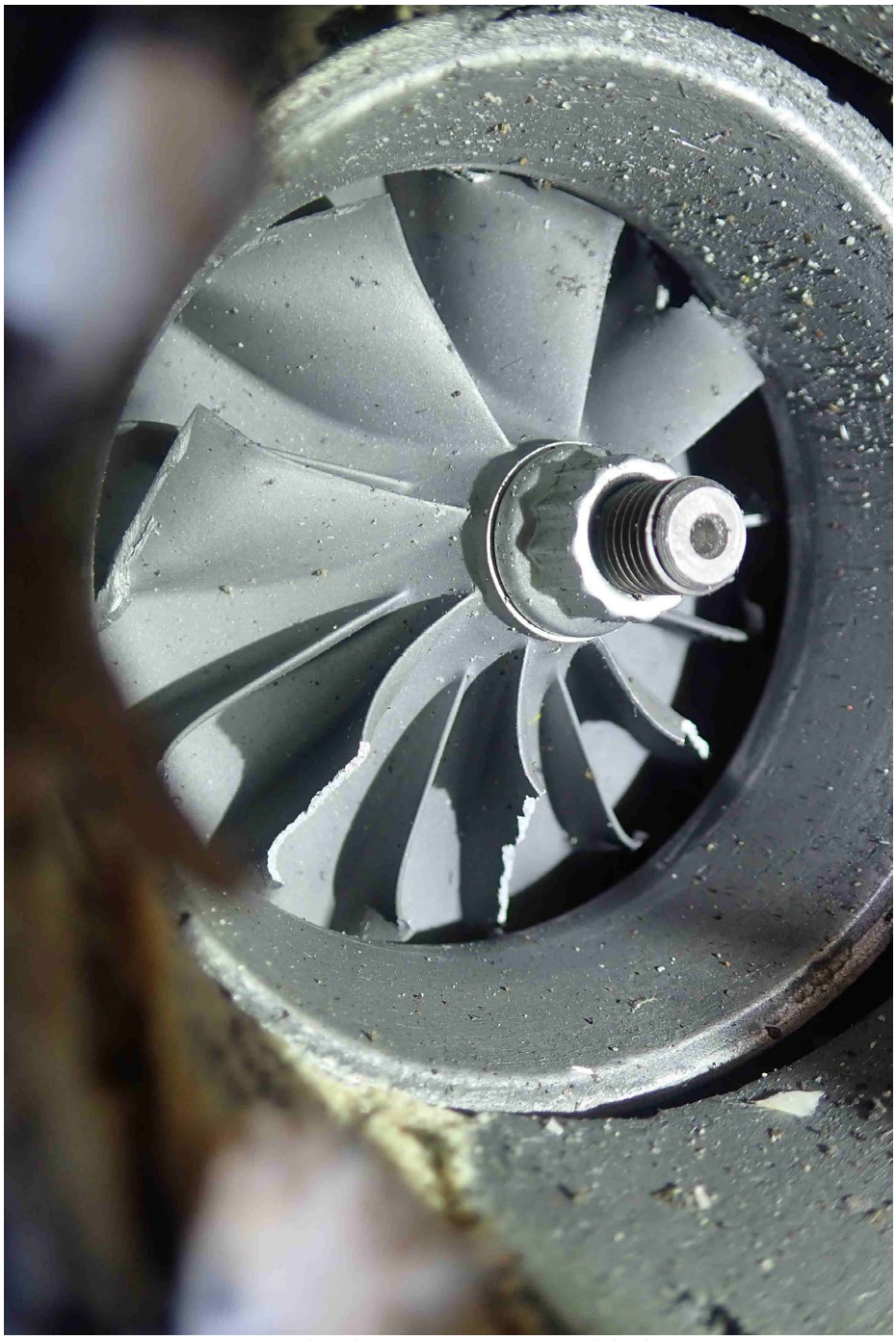

Figure 30– Turbocharger compressor blades

Figure 31– Turbocharger turbine wheel

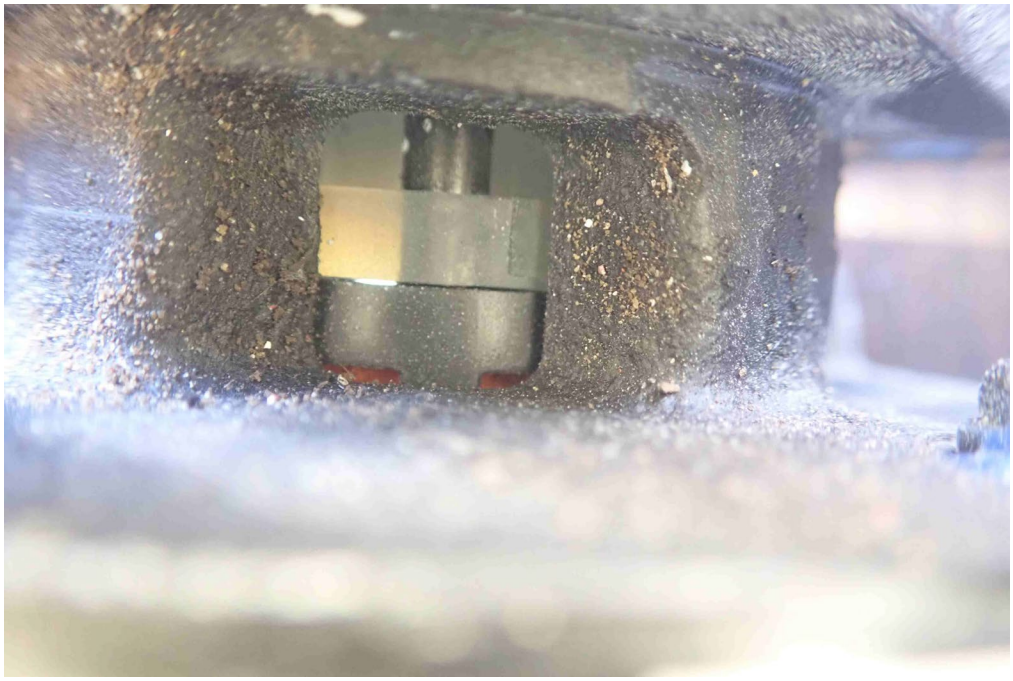

Figure 32– Vacuum pump coupling

Figure 33- Vacuum pump rotor and vanes

Figure 34 – Top spark plugs

Figure 35 - Propeller

Submitted by:

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