

# National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR23FA083

## **AIRFRAME AND ENGINE EXAMINATION**

July 9, 2023

## **A. ACCIDENT**

Location: New Harmony, Utah  
Date: January 4, 2023  
Airplane: Piper PA34-220T N814WT

## **B. AIRFRAME AND ENGINE EXAMINATION**

|              |                           |
|--------------|---------------------------|
| IIC          | Elliott Simpson<br>NTSB   |
| Party Member | Kathryn Whitaker<br>Piper |

### **1.0 AIRFRAME**

In the days following the accident, the airplane was buried by snow due to multiple winter storms. As such, it was not recovered from the accident site until the summer of 2023. The following examination was conducted on July 8 and 9, 2023 at the facilities of Air Transport in Buckeye Arizona.

#### Airframe

The airframe sustained significant crush and fragmentation damage throughout, exposing the entire cabin contents, flight controls, avionics, and electrical wiring. The cockpit and cabin were crushed through to the leading edge of the vertical stabilizer (see figure1). The aileron control cables throughout were separated into multiple fragments, all the separation features exhibited evidence of recovery cuts, or wire splaying features consistent with overload. No observed cables appeared to have unraveled.

The airplanes delivery documents indicated that it was equipped with a fully electronic avionics suite, which included Garmin GFC-700 autopilot and a Garmin G-1000 series multi-function display, with an Aspen Avionics backup unit. Those units within the cockpit sustained extensive fragmentation damage such that their operational status at impact could not be determined (see figure 2). The components associated with the autopilot sustained varying degrees of impact damage. An iPad was found within the wreckage, the unit was crushed and folded in half and was damaged to the extent that data recovery could not be performed.

There was no evidence of bird strike or fire to any of the airframe, wings or engines.

A total of six seats were located; all appeared fractured and fragmented. Damage to seat rails prevented an assessment of the front seat positions.

The throttle quadrant had detached and was fragmented and twisted, such that the controls were in indeterminate positions. One fuel selector valve was located, and it was twisted and in a mid-tank position.

Remnants of the cabin and baggage doors were located, and the main cabin door had pulled away from the cabin structure by its hinges pulled. The door had folded, and its latch was in the locked position.

### Empennage

The stabilator remained attached to the tailcone (the left side was cut off during recovery) and the anti-servo tabs were still attached to the stabilator and the pitch control rod (see figure 3). The pitch trim actuator showed 19 threads (2 inches), which according to Piper documentation indicated full nose down trim. Closer examination revealed that this value may not have represented the position at the time of the accident, because the pitch trim cables and surrounding aluminum structure exhibited scratch and tear damage consistent with the cables being pulled through to the full nose down position at impact.

Stabilator control cables were continuous from the balance weight arm through to the T-Bar fitting within the cabin

The vertical stabilizer had pulled away from the forward and rear spar mount points. The four rear spar mounting bolts were all in place on the rear spar and had pulled away from the aft bulkhead structure. The single forward spar mounting bolt was still attached to its corresponding fuselage fitting and had pulled away from the forward spar.

The rudder remained attached to the vertical stabilizer by all its hinges. The trim tab was intact, and the trim arm had pulled away from its horn. The rudder trim actuator was in the center position, consistent with neutral rudder trim (see figure 4). The rudder cables had been cut in the tail section by the recovery crew but were otherwise intact through to the rudder pedal fittings.

### Left Wing

The left wing had broken into two parts about midspan. The leading-edge skins were crushed and had mostly detached exposing the main spar. The fuel tanks were breached and split open (see figure 6).

The flap had pulled away from its hinges along its entire length. The aileron remained partially connected by its center hinge. The aileron bellcrank assembly had pulled away and was still attached to the aileron cables. The cables were continuous to the center fuselage; the rest of the aileron control system within the cabin was fragmented.

The pitot tube remained partially attached to the wing and had folded in half such that the condition of its heating element could not be determined. The position of the pitot static switch within the cabin could not be determined due to impact damage.

### Right Wing

The right wing had broken into four distinct sections, all of which exhibited skin deformation such that the main spar was exposed (see figure 5). An inboard 3-ft-long section of the flap remained attached; the rest of the flap had pulled away from the structure. The aileron had completely separated, and both of its outboard hinge eyes were intact.

The aileron bellcrank remained attached to the structure and the aileron cable was continuous to the center cabin. The aileron push-pull tube had separated and showed granular surface features at the fracture point.

### Landing Gear

The nose landing gear assembly had detached from the airframe, and only fragments of the main landing gear remained. The damage prevented an accurate assessment of the landing gear position at the time of the accident.

## **2.0 ENGINE**

### Left Engine

Model: TSIO 360-RB5B  
SN: 1009899

The engine sustained extensive impact damage and remained attached to sections of its mount, which had broken away from the airframe (see figure 7, 8). The alternator, starter motor, air conditioning compressor assembly, vacuum pump, and the right magneto had been liberated during the accident. The oil cooler assembly remained attached to the engine but had been crushed forward. The upper section of the accessory case had detached, revealing the internal gears which were bright, clean, and coated in oil.

The propeller hub had separated from the front of the crankshaft and the forward two cylinders (5,6) sustained crush damage to their front fins and pushrods (see figure 8). The oil sump was detached, revealing the camshaft and followers. The camshaft was intact, and all lobes appeared clear and bright (when wiped clear) with no evidence of galling or lobe deformation (see figure 9). Looking inside the engine, the crankshaft was intact, and there was no evidence of catastrophic internal failure or thermal distress.

The exhaust pipe assembly for cylinders 1, 2, 3, and 5 remained attached to each respective cylinder head. The exhaust pipe assembly for cylinders 4 and 6 had detached with deformation observed around the cylinder head stud areas. The internal surfaces of all exhaust pipes were coated in light tan deposits.

The propeller governor housing remained securely attached to the front of the crankcase, but its flywheel and control assembly had broken away from the case. The input drive gear was still attached to the crown gear on the camshaft.

The left magneto was still firmly attached to the accessory case. The right magneto had broken away, but its lugs and housing remnants were still attached to the accessory case.

The fuel induction tubing assembly was crushed and partially detached from the top of the engine. The fuel servo remained attached to the assembly, and both its throttle and mixture control lines were connected to their respective control arms. The inlet venturi was free of obstruction, and the throttle butterfly valve appeared to be in the 30% short of closed position. The air induction filter assembly had detached, and the element was crushed but otherwise free of obstruction. All air, fuel, and oil lines that had broken away were intact and tight at their respective fittings.

All of the top spark plugs, along with the bottom plugs for cylinders 1, 3, and 5 were removed. All exhibited wear signatures consistent with "normal" to "worn-out normal" when compared to the Champion AV-27 chart. The top plugs for cylinder 2, 3 and 4 and the bottom plug for cylinder 5 exhibited rust collared deposits indicative of post-accident contamination and storage, and all the other plugs exhibited light grey coloration consistent with normal operation (see figure 10).

The fuel flow divider remained attached to top of the engine, and all lines except the outlet to cylinder number 2 and 3 had broken away from their fittings. The unit was disassembled, and the diaphragm was intact.

The vacuum pump had detached at its coupling, which had broken. There was no indication of plastic smear or other rotation signatures that would have indicated rotation following coupling failure (see figure 11, 12). The pump was disassembled,

and the rotor had fragmented put was in place (see figure 13). The vanes were about 19 mm long.

The rocker covers were removed, and all rocker arms were intact, and coated in oil with no thermal discoloration. Borescope examination of all the cylinders through the spark plug bores revealed that there had water intrusion, due rust-like coating and discoloration. All valves and pistons were intact, and there was no evidence of catastrophic failure. The engine could not be rotated due to the corrosion and damage to the forward cylinders and crankshaft at the propeller hub.

The oil filler neck had broken away from the accessory case, but the filler cap was in place. The oil dipstick assembly remained attached to the accessory case and the dipstick was in place and locked.

The fuel control servo was removed and examined. The unit was essentially undamaged, and the regulator nut on the diaphragm assembly displayed a "G" stamp, indicating Service Bulletin PRS-107, R4 had been complied with. The safety wire was in place and both the mixture and throttle arms could be moved through their full travel. There were no obstructions to the air venturi. Disassembly revealed the inlet fuel screen was clear, and the diaphragms were undamaged and intact. The fuel side diaphragm exhibited grey deposits to the diaphragm and casing. According to representatives from Precision Airmotive, such deposits are not unusual when a servo has sat for long periods of time with exposure to fuel and air. (As mentioned, the airplane sat at the accident location throughout the winter before recovery and the exam.)

The fuel flow transducer did not have any blockage, and the inner turbine wheel could be heard to spin when air was lightly blown through the inlet.

The engine driven fuel pump had broken away from its pad and had begun to come apart. Within the pump, the rotor assembly did not show any evidence of seizure (see figure 14).

The left magneto was essentially undamaged. The input shaft was rotated by hand and the impulse coupling could be heard and felt. Sparks were observed at each terminal. The right magneto sustained crush damage inhibiting a functional test.

The entire turbocharger assembly had detached from the engine. The V-Band clamp that connected the compressor outlet to the exhaust pipe along with the clamps for both exhaust inlet branches were intact. The turbine cover had broken away exposing the compressor wheel which had sustained severe rotational damage to all its blades, tearing and bending them opposite the direction of rotation (see figure 15). The compressor wheel could be partially rotated by hand by about 90 °.

## Right Engine

Model: LTSIO 360-RB5B

SN: 1009984

The engine sustained extensive impact damage and remained attached to segments of its mount, which had broken away from the airframe (see figure 16). The starter motor, vacuum pump, and the left magneto had all separated, and the oil cooler assembly remained attached to the engine but was crushed.

The propeller hub back plate and center spring remained attached to the crankshaft, but all three blades had separated. The spinner remained attached and had split open and was formed over the forward section of the crankcase.

The forward two cylinders (5,6) sustained crush damage detaching all of their pushrods. For cylinder number 5, the head had broken away exposing the piston dome and cylinder sleeve assembly (see figure 17). For cylinder 6, the exhaust valve assembly had broken away from the head, and although the intake valve was in place, its rocker had detached.

The oil sump remained attached but was breached just aft of the drain plug with a 6-inch irregular hole that had deformed inwards. Removal of the sump revealed that the camshaft was intact, and all lobes appeared clear and bright with no evidence of galling or lobe deformation (see figure 18). Looking inside the engine, the crankshaft was intact, and there was no evidence of catastrophic internal failure or thermal distress.

The exhaust pipe assemblies for all cylinders sustained varying degrees of deformation and crush damage. The internal surfaces of all exhaust pipes were coated in light tan deposits.

The propeller governor housing remained securely attached to the front of the crankcase, and its control arm was intact but bent.

The right magneto was still firmly attached to the accessory case. The left magneto had broken away, but its lugs and housing remnants were still attached to the accessory case. The gears within the accessory case appeared intact.

The fuel induction tubing assembly was crushed and partially detached from the top of the engine. The fuel servo remained attached to the assembly, and the throttle and mixture control lines were connected to their respective control arms, but the mixture arm had broken away from the shaft. The inlet venturi was free of obstruction, and the throttle butterfly valve was 15% short of the closed position. The air induction

filter assembly had detached, and the element was crushed but otherwise clear. All air, fuel, and oil lines that had broken away were intact and tight at their respective fittings.

The top and bottom spark plugs for cylinders 1 through 4, along with the bottom plugs for cylinders 6 were removed. All exhibited varying wear signatures consistent with "normal" to "worn-out normal" when compared to the Champion AV-27 chart. The plugs for cylinder 1, 3 and 6 exhibited light and dark grey rust-colored deposits consistent with normal operation; the remaining plugs were similarly colored but coated in oil (see figure 19).

The fuel flow divider remained attached to top of the engine, and all lines except the outlet to cylinder number 2 and 4 had broken away from their fittings. The unit was disassembled, and the diaphragm was intact.

The vacuum pump had detached at its pad. The black "finger" couplings were both intact, but the plastic intermediate coupling was not located (see figure 20). There was no indication of plastic smear or other rotation signatures indicating rotation following coupling failure. The pump was disassembled, and the rotor was intact and undamaged (see figure 21). The vanes were about 19 mm long.

The rocker covers were removed, and all rocker arms that had not been already destroyed were intact and coated in oil with no thermal discoloration. Borescope examination of all the intact cylinders through the spark plug bores revealed that they had been subject to water intrusion and were coated in rust-like debris. All valves and pistons were intact, and there was no evidence of catastrophic failure. The engine could not be rotated due to damage to the forward cylinders.

The oil filler neck and dipstick assembly remained attached to the accessory case and were in place and locked.

The fuel control servo was essentially undamaged, and the regulator nut on the diaphragm assembly displayed a "G" stamp, indicating Service Bulletin PRS-107, R4 had been complied with. Disassembly revealed the inlet fuel screen was clear and the diaphragms were undamaged and intact. The fuel side diaphragm exhibited grey deposits to the diaphragm and casing. According to representatives from Precision Airmotive, such deposits are not unusual when a servo has sat for long periods of time, often after exposure to fuel and air.

The fuel flow transducer did not have any blockage, and the inner turbine wheel could be heard to spin when air was lightly blown through the inlet.

The engine driven full pump was not located.

The right magneto was essentially undamaged. The input shaft was rotated by hand and the impulse coupling could be heard and felt. Sparks were observed at each terminal. The left magneto could not be rotated, and disassembly revealed that the small plastic drive gear had broken in half. There were no smearing or scratch marks indicating that it was rotating after the breakage as such it was determined that the damage occurred at impact.

The entire turbocharger assembly had detached from the engine. The V-Band clamp that connects the compressor outlet to the exhaust pipe was intact, along with the clamps for both exhaust inlet branches. The turbine cover had broken away exposing the compressor wheel which had sustained severe rotational damage to all its blades, tearing and bending them opposite the direction of rotation (see figure 22).

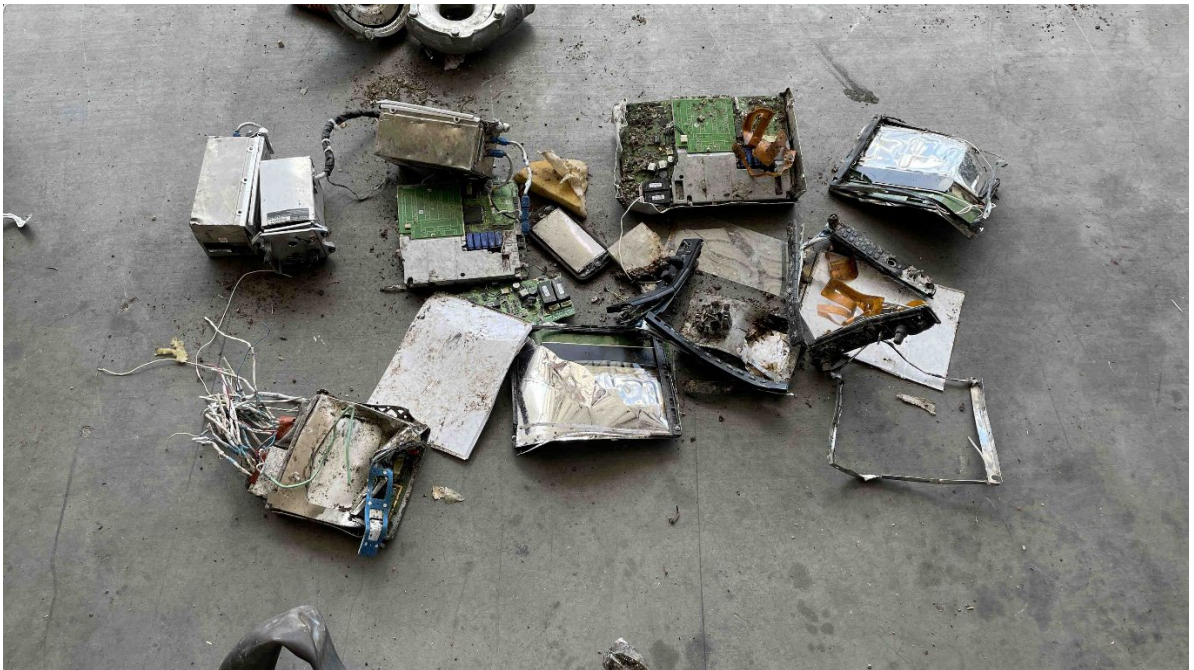
### Propellers

All six propeller blades were recovered. Two from the left engine remained attached to remnants of the hub, the remaining four had completely detached from their respective hubs. All blades exhibited significant leading-edge damage, along with varying degrees of tip curl, serration, chordwise striations and S-beading (see figures 23, 24, 25).

**C. EXAMINATION PHOTOS**



**Figure 1- Main Wreckage**



**Figure 2 - Avionics Remnants**



**Figure 3 - Empennage**



**Figure 4 - Rudder Trim**



**Figure 5 - Right Wing**



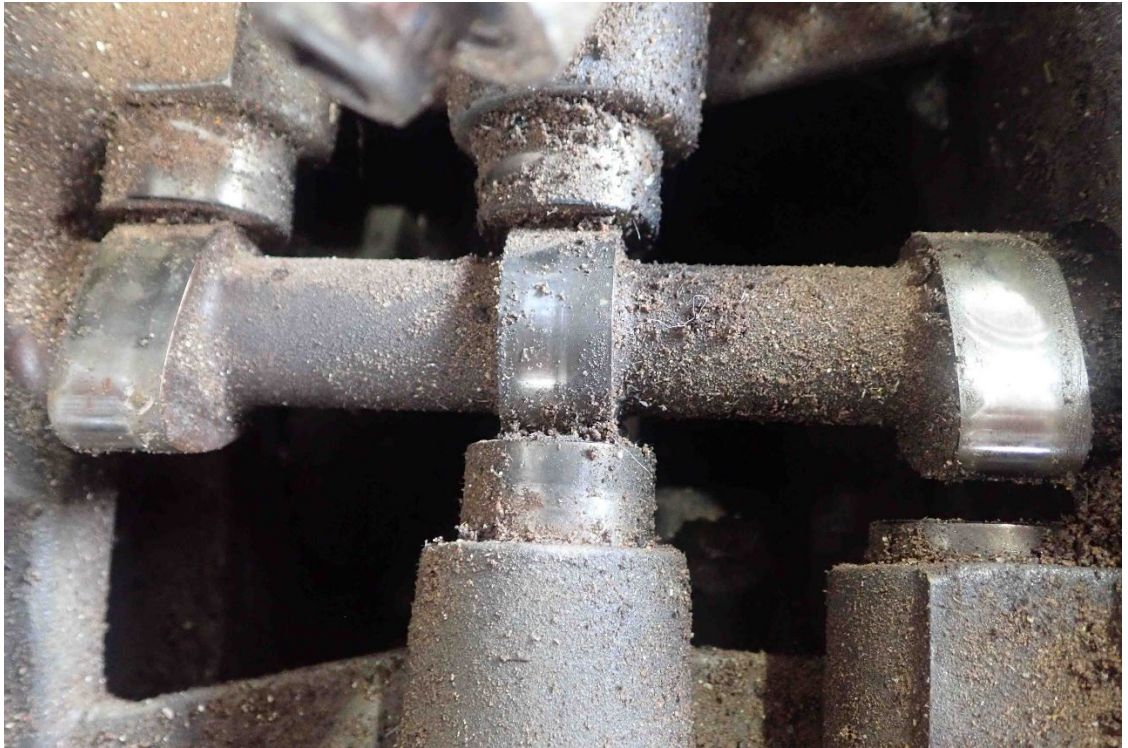
**Figure 6 - Left Wing**



**Figure 7 - Left Engine**



**Figure 8 - Left Engine**



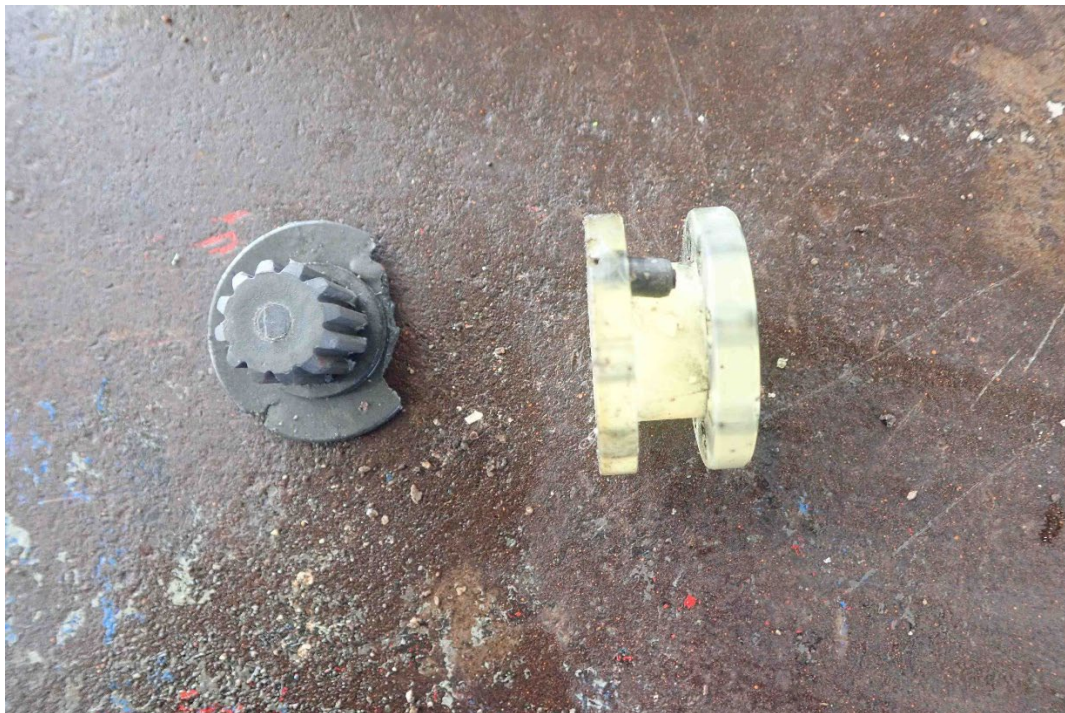
**Figure 9 - Section of Left Engine Cam Lobe**



**Figure 10 - Left Engine Park Plugs**



**Figure 11 - Left Engine Vacuum Pump Drive Input**



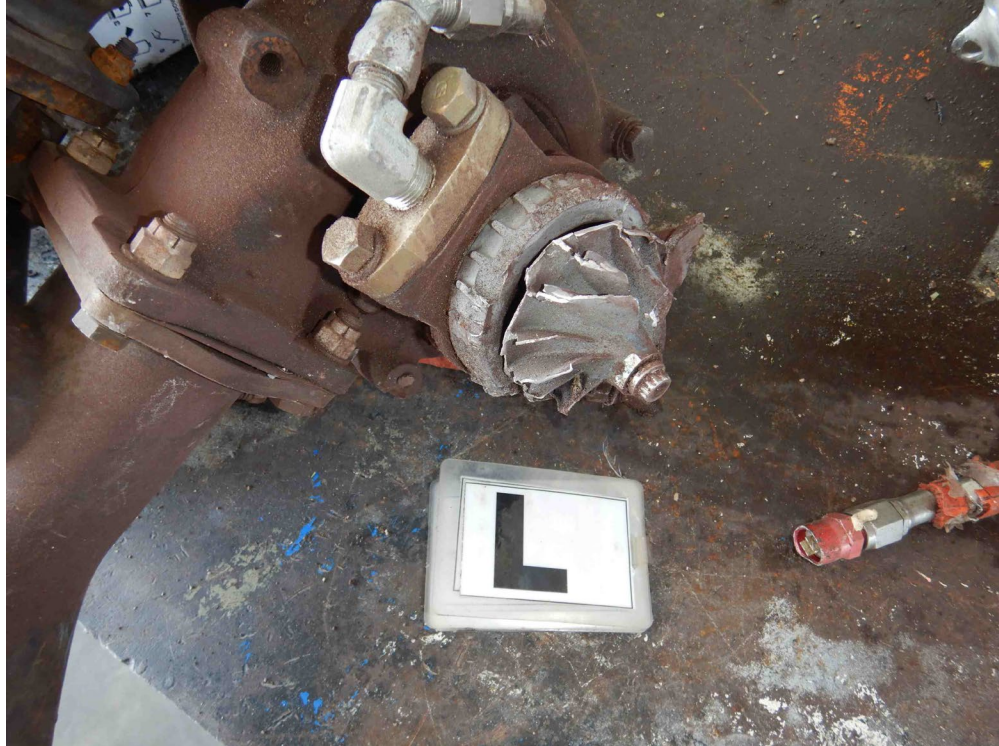
**Figure 12 - Left Engine Vacuum Pump Drive Coupling**



**Figure 13 - Left Engine Vacuum Pump Vane and Blades**



**Figure 14 - Left Engine Fuel Pump**



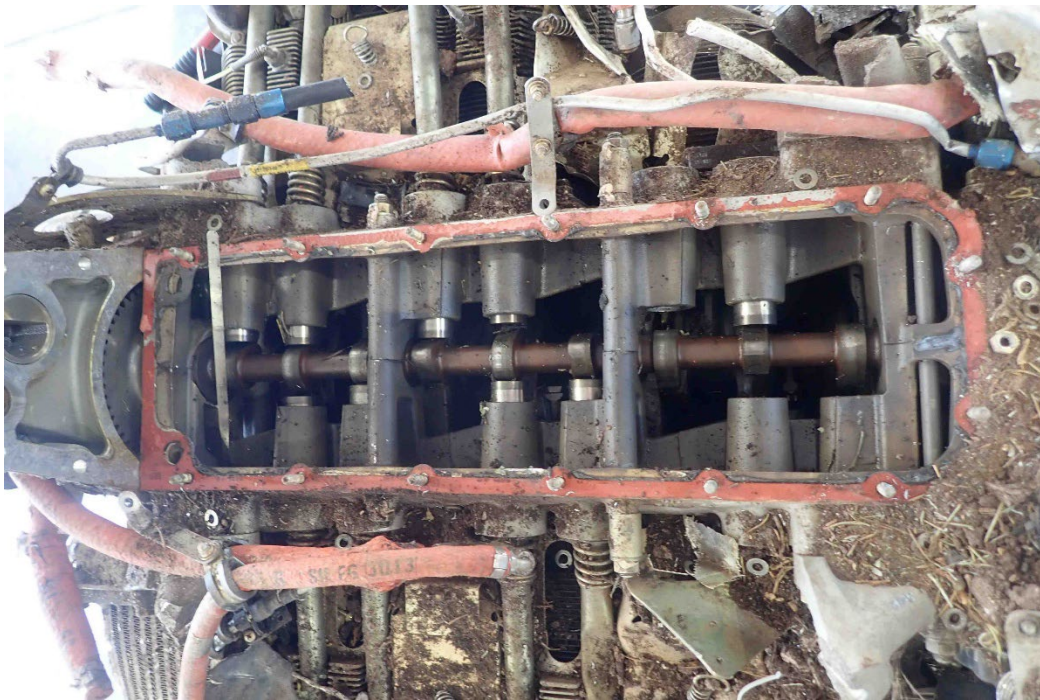
**Figure 15 - Left Engine Turbocharger Compressor**



**Figure 16 - Right Engine**



**Figure 17 - Right Engine**



**Figure 18 - Right Engine Camshaft**



**Figure 19 - Right Engine Spark Plugs**



**Figure 20 - Right Engine Vacuum Pump Drive Coupling**



**Figure 21 - Right Engine Vacuum Pump Vane and Blades**



**Figure 22 - Right Engine Turbocharger Compressor**



**Figure 23 - Left Propeller Blade**



**Figure 24 - Left Propeller Blades**



**Figure 25 - Right Propeller Blades**

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