



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

Accident Date: November 6, 2020

AIRFRAME AND ENGINE EXAMINATION

WPR21LA039

This document contains 21 embedded photos.

A. ACCIDENT

Location: Los Angeles, California
Date: November 6, 2020
Aircraft: Agusta 109S / N109EX
NTSB IIC: Fabian Salazar

B. EXAMINATION PARTICIPANTS:

Name: David Harvey
Duty Position: ASI
Federal Aviation Administration
Los Angeles, California

Name: Richard Lowandowski
Duty Position: ASI
Federal Aviation Administration
Los Angeles, CA.

Name: Brian Petschauer
Duty Position: Chief Pilot
Organization: Helinet Aviation Services
Van Nuys, California

Name: Christopher Lemieux
Duty Position: Technical Advisor
Organization: Leonardo Helicopters

Name: Gary Poteet
Duty Position: Field Support Manager
Organization: Pratt & Whitney Canada
worldwide support network

C. SUMMARY

Examination of the helicopter occurred on December 15, 2020, at a recovery site in Chino, California. The IIC did not attend the examination. Both engines were examined by a member from Pratt & Whitney Canada and a representative of the Federal Aviation Administration (FAA). Postaccident examination of the engines revealed no mechanical malfunctions or failures that would have precluded normal operation. The airframe was examined by a member from Leonardo Helicopters and the FAA. Due to video recorded evidence of the airframe rotating

clockwise about the vertical axis, all major components of the anti-torque system were recovered for further examination. Those components are identified in the report. A visual examination of the rotating controls of the tail rotor assembly revealed the ring nut, part number 109-0130-97-103, had separated from the thrust sleeve, part number 109-0130-94-111, A109S/AW109SP IETP 25th issue. The helicopter was equipped with an Appareo Vision-1000 video recorder. The recorder and the video memory card were shipped to the NTSB Recorders Laboratory. Download of the video revealed a momentary torques spike and nothing to further aid the investigation.

D. DETAILS OF THE INVESTIGATION

The helicopter came to rest on its left side on the helipad. All major components were in the wreckage area. The main rotor blades and the tail rotor assembly and 90° gearbox separated from the airframe.

Airframe Examination

Cockpit. Examination of photos of the cockpit revealed the instrument panel and center console exhibited no damage. All flight instruments, and radios remained attached in their mounts. The flight controls remained attached to their respective mounts. The landing gear handle appeared to be at mid-travel. The %RPM appeared to be in the down or 102% position. The left pedal appeared to be a full forward position. The overhead console appeared un-damaged. The two power control levers appeared to be pulled back near the end of their travel. The two pilot seats appeared to be undamaged.

RIGHT SIDE FUSELAGE

The right-side nose appeared undamaged. The right-side pilot's door was separated and was on the helipad. The right-side sliding door remained attached to the helicopter and was open. The right main landing gear remained attached to the helicopter at its mounts, appeared extended, and locked into place. The right wheel remained attached to the spindle. The right-side brakes appeared undamaged.

The right-side tailboom exhibited minor damage aft of the right-side sliding cabin door back to the horizontal elevator. Forward of the right-side horizontal elevator was an area of wrinkled sheet metal that extended down underneath the tail boom.

The right horizontal elevator remained attached to the tail boom and was displaced upwards. The end of the tail boom, or tail cone, was partially separated from the tailboom. The vertical stabilizer exhibited a hole about mid-span. The tail skid remained attached to the lower section of the tailboom and exhibited minor damage. The right-side of the vertical stabilizer exhibited substantial damage and had a large hole about mid-span.

Main rotor system. The main rotor system exhibited substantial damage. Three of the four rotor blades separated at the hub, along with their respective blade grips. One section of one blade (blue blade) remained attached to the hub and extended outward from the hub about 15 inches. One blade, serial number R2013, was located on the helipad with the blade grip attached. The pitch change link rod end bearing remained attached to the pitch horn. The remaining section of

the blade exhibited complete separation of the afterbody from the spar. There was a fracture and sharp bend outboard of the metal leading edge. A section of a third main rotor blade (unknown color) was found on the helipad. The blade grip remained attached to this blade. The blade extended from the blade grip about 36 inches and did not retain much afterbody. A long section of a main rotor blade lay across it. One blade serial number R-2040, the red blade, was found on the helipad. The blade grip remained attached to the blade root. The pitch change rod end bearing remained attached to the pitch change horn. The steel leading edge remained attached but the after body had separated. The rod end bearing to the blade damper remained attached to the blade grip.

Three of the four blade dampers remained attached to the hub at their respective mounts. The area where the fourth blade damper would have been exhibited a fracture of the damper retention tab and a separated section of said tab.

All but one pitch change links separated from the blade pitch horns but remained attached to the rotating swashplate.

The tail rotor and 90° gearbox separated from the helicopter and was off the helipad on the roof of the hospital. Both composite blades remained attached to the hub and exhibited substantial damage at the tips but retained a significant amount of the yellow paint, consistent with not losing a large amount of the blade tips. One blade exhibited a large dent in the leading edge. One exhibited red paint smearing near the tip. Both pitch change links remained attached at their respective attachment points. A small section of the pitch change push-pull tube and the rod end bearing remained attached to the bellcrank at the 90° gear box.

A photo of the rotating controls of the tail rotor assembly revealed the ring nut separated from the thrust sleeve. A bearing race with no ball bearings was visible. A safety wire fragment was visible, attached to the thrust sleeve. The drive link was attached at both respective attachment points.

Maintenance logbook review. Review of the maintenance logbook revealed that the initial 400-hour/24-month inspection / lube of the rotating controls occurred on May 17, 2013, at an aircraft total time of 324.6 hours. According to a note from the director of maintenance, the rotating controls bearings with the new part number and housing was conducted on April 2, 2014, at an aircraft total time of 426.0 hours. The 400-Hour/24-month tail rotor duplex bearing inspection / lube was now became a 100-hour / 6-month lube. According to Leonardo Helicopters, task 64-01 required adherence to the 400-hour/24-month disassembly of the tail rotor assembly to inspect the duplex bearings. According to the maintenance logbook, the last 400-hour-24-month “swashplate duplex bearing inspection” occurred on May 17, 2019, at an aircraft total time of 1,149.2.

LEFT SIDE FUSELAGE

The left side of the vertical stabilizer exhibited a large hole about mid-span. A second large hole was evident forward of the tail cone. The left side of the fuselage exhibited substantial damage in the area near the left main landing gear. The left side of the tail boom exhibited substantial damage near the horizontal elevator. The remaining left side exhibited minor damage throughout.

The left-side horizontal elevator remained attached to the tailboom and was displaced downward. The outer tip inboard about mid-span had separated.

The left main landing gear partially separated from the helicopter at its mounts. The wheel remained attached at the spindle. The hydraulic brake line separated from the caliper.

The nose wheel remained attached at its mounts and exhibited minor damage.

TOP FUSELAGE. The top area of the helicopter, except for the main rotor system, exhibited minor damage.

BOTTOM FUSELAGE. The bottom of the helicopter exhibited substantial damage in the area near the left main landing gear.

ENGINES. The helicopter was equipped with two Pratt & Whitney Canada turboshaft engines. Each engine was equipped with a data collection unit (DCU). The purpose of this electronic device is to serve as a repository for various engine trim parameters, accumulated operation times, accumulated part cycles and specific operational exceedance excursion data. The EEC's automatically store the data in the DCU in snapshot format.

The left-hand engine, model PW207C, serial number: PCE-BH0383, was manufactured in March 2009. The DCU for this engine was model number 3054276-02, serial number DP09-6065. A visual exam of the engine revealed no mechanical malfunctions or failures that would have precluded normal operation.

The right-hand engine, model number PW207C, serial number: PCE- BH0396, was manufactured in 2009. The DCU for this engine was model number 3054276-02, serial number DP09-5973. A visual exam of the engine revealed no mechanical malfunctions or failures that would have precluded normal operation.

Components retained for further examination.

The tail rotor assembly, rotating controls, and the 90° gearbox were shipped to the NTSB materials laboratory. The tail rotor blades were not shipped. The components were then hand carried to the Leonardo Helicopters facility, in Philadelphia, Pennsylvania, where they were disassembled, then returned to the NTSB Laboratory for examination.

The Data Acquisition Unit (DAU) was retained and shipped to Ametek Inc., Binghamton, New York for further examination.

The Stability Augmentation system (SAS) actuator, serial number: 0810K365, was retained and shipped to Honeywell Aerospace, Boyne City, Michigan for further examination.

The two Digital control units (DCU), one from each engine were recovered and shipped to Pratt & Whitney Canada for further examination.

The tail rotor actuator (hydraulic servo), serial number: 1549, was retained and shipped to Leonardo Helicopters, Brugherio, Italy for further examination.

PHOTO EXHIBIT



Figure 1. View of N109EX at the accident site. Photo courtesy of the operator.



Figure 2. Underside view. Photo courtesy of the operator.



Figure 3. Underside view of the tailboom. Photo courtesy of the operator.



Figure 4. Right-side view. Photo courtesy of the recovery agent.



Figure 5. Left-side view. Photo courtesy of the recovery agent.



Figure 6. Main rotor head. Photo courtesy of the recovery agent.



Figure 7. Main rotor blade. Photo courtesy of the recovery agent.



Figure 8. Red main rotor blade. Photo courtesy of the operator.



Figure 9. Yellow main rotor blade. Photo courtesy of the recovery agent.



Figure 10. Two main rotor blades. Photo courtesy of the recovery agent.



Figure 11. Tail rotor assembly and 90° gear box, Photo courtesy of the recovery agent.

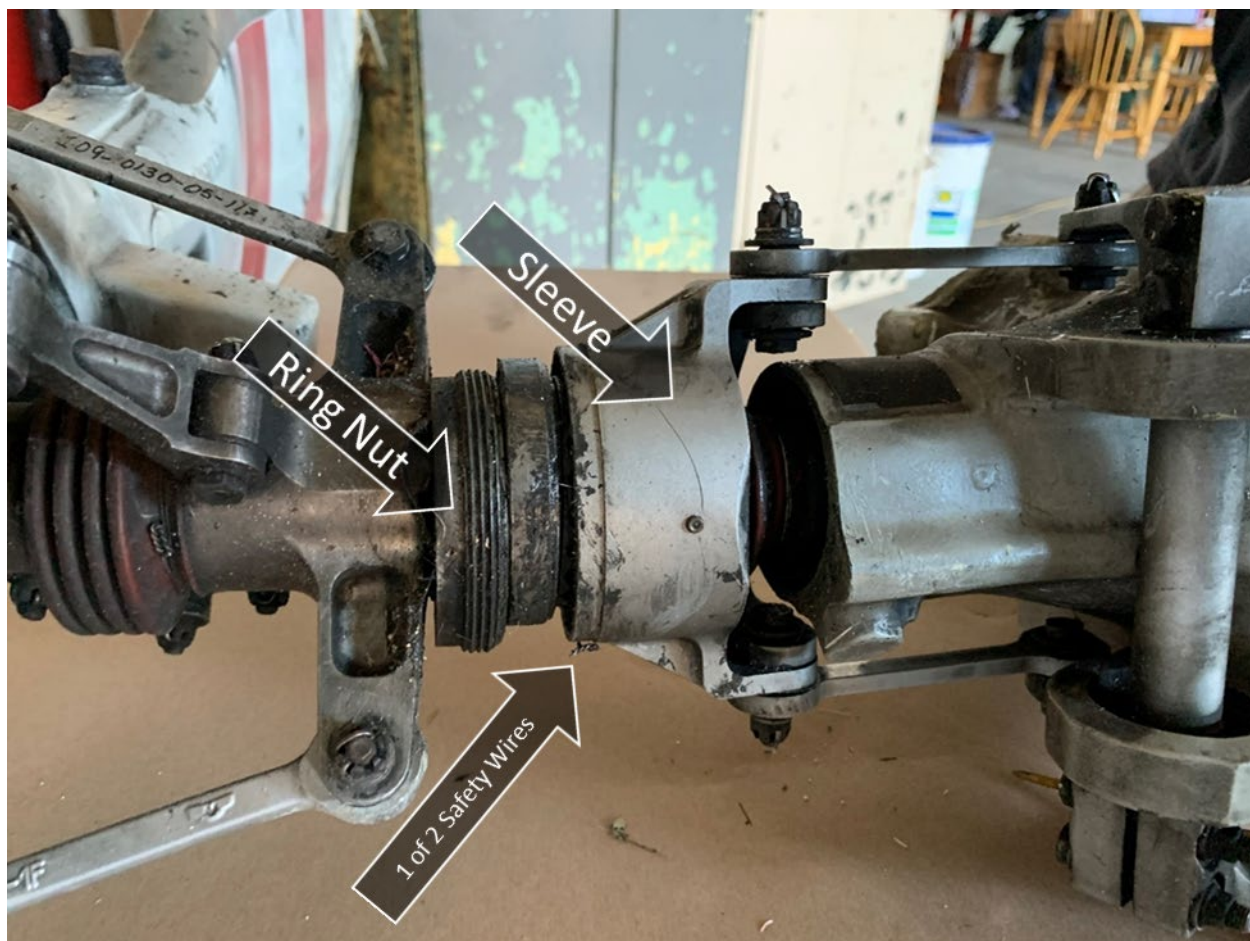


Figure 12. Photo of the rotating controls taken at the recovery site. One of the two safety wires is visible at the bottom of the thrust sleeve.

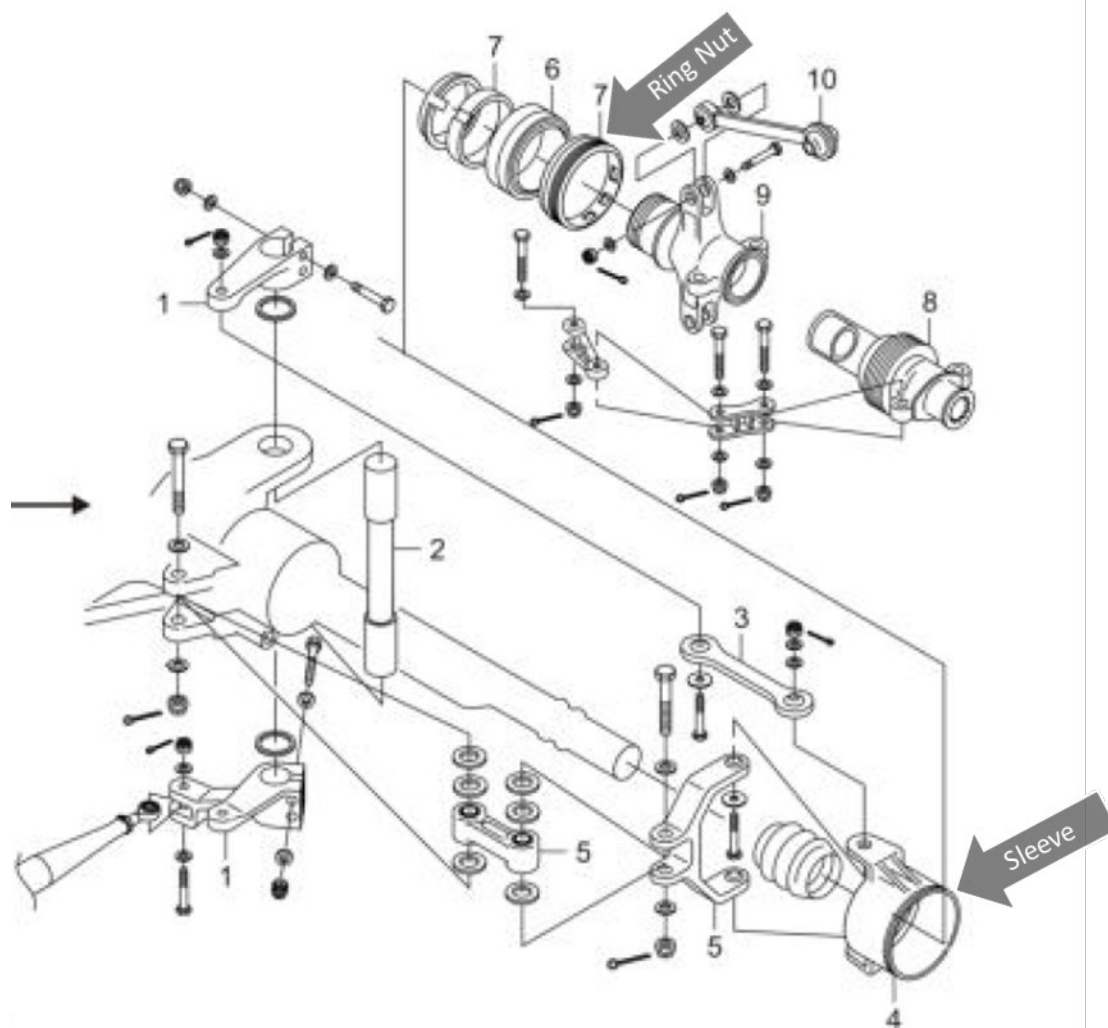


Figure13. Illustration of the rotating controls. The arrows point to the ring nut and thrust sleeve. Illustration courtesy of the airframe manufacturer.

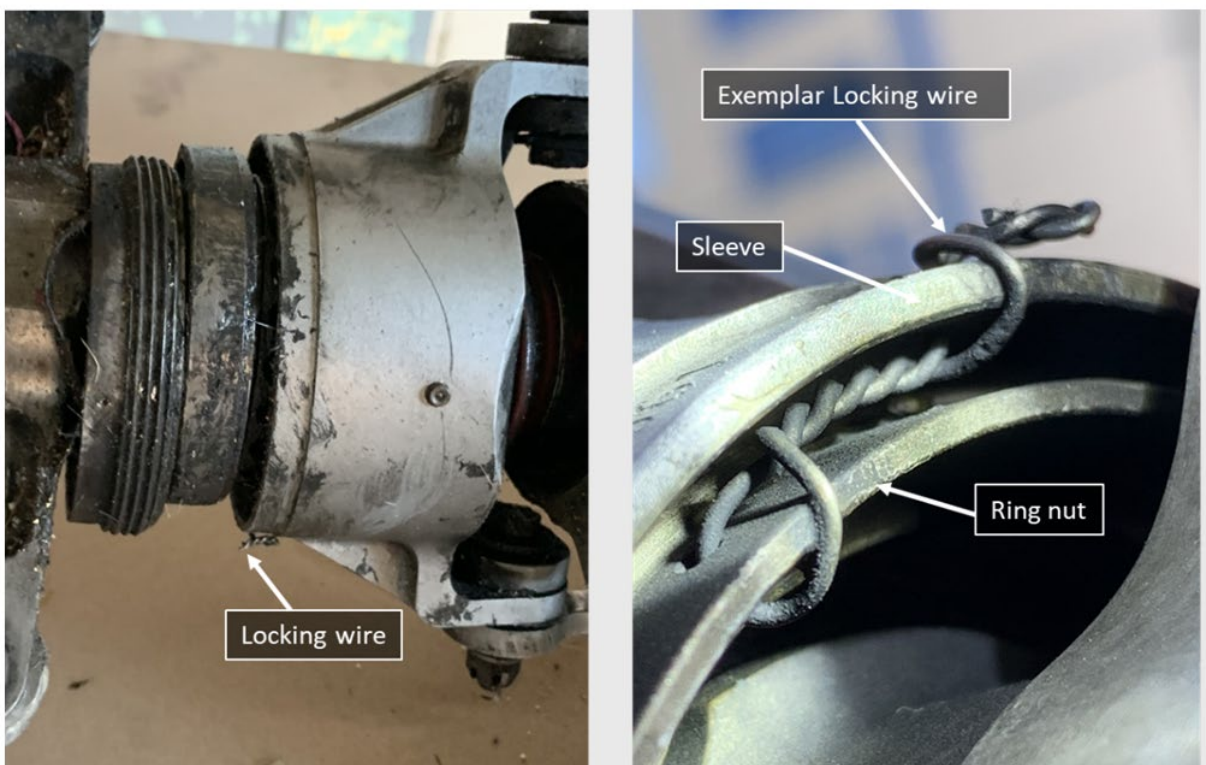


Figure 14. Photo showing part of one locking wire attached to the accident sleeve (left), and a photo that shows an exemplar locking wire from a different helicopter (right). Photo of the accident ring and sleeve, courtesy of the FAA.

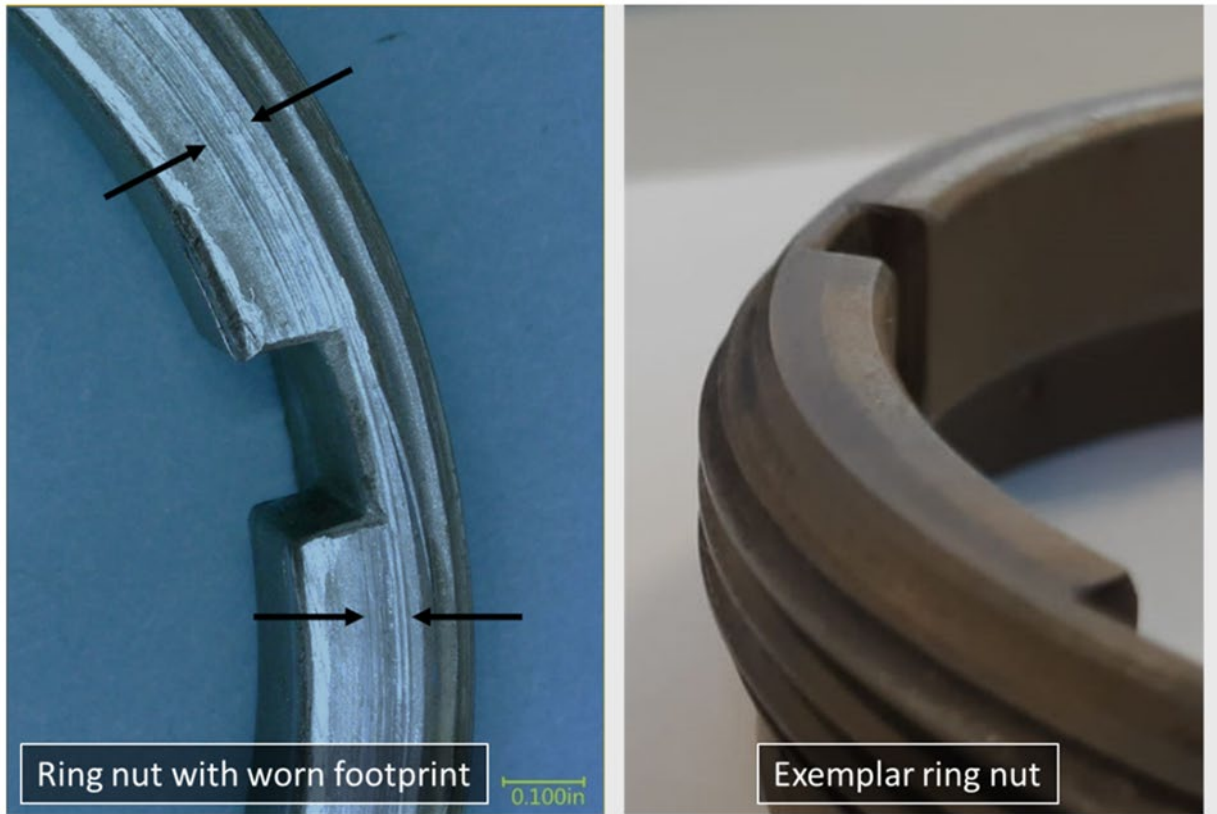


Figure 15. Image showing the step or worn footprint on the accident ring nut, and an exemplar ring nut. Photo of the exemplar ring nut courtesy of the airframe manufacturer.



Figure 16. Left hand Engine, PCE-BH0383, reduction gearbox and output shaft. Photo courtesy of Pratt & Whitney Canada.

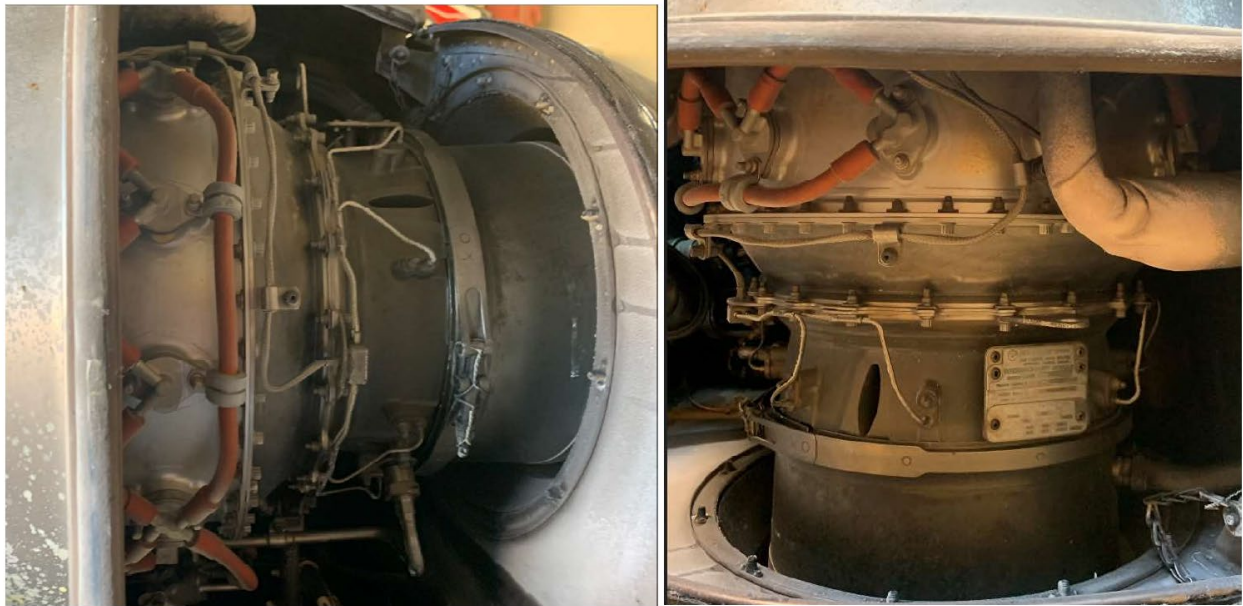


Figure 17. Left hand engine gas generator case and exhaust case. Photo courtesy of Pratt & Whitney Canada.

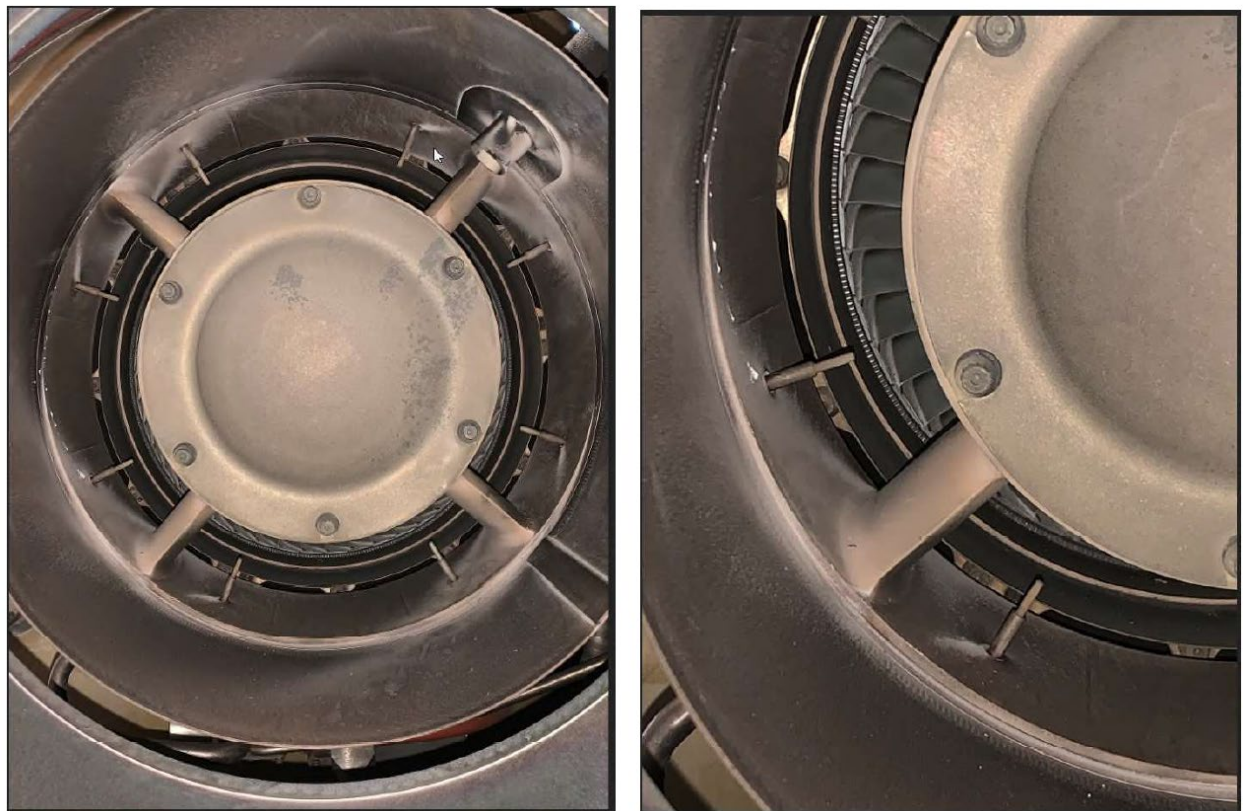


Figure 18. Left hand engine power turbine blades. Photo courtesy of Pratt & Whitney Canada.

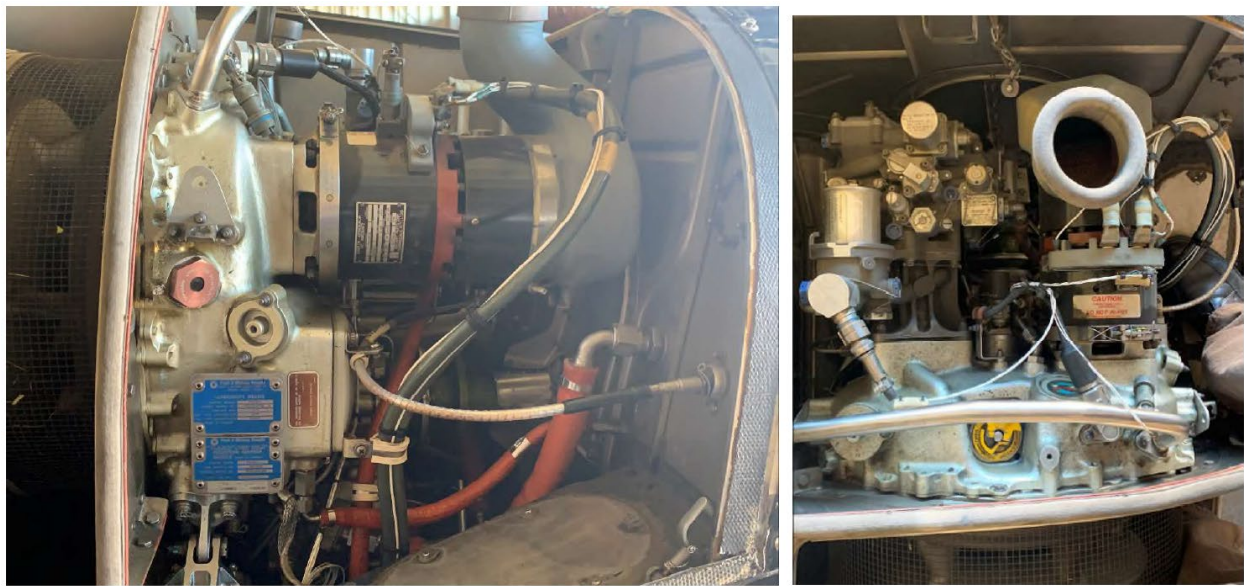


Figure 19. Right hand engine, PCE-BH0396, reduction gearbox and output shaft. Photo courtesy of Pratt & Whitney Canada.



Figure 20. Right hand engine, gas generator case and exhaust case. Photo courtesy of Pratt & Whitney Canada.



Figure 21. Right hand engine, power turbine blades. Photo courtesy of Pratt & Whitney Canada.