



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

June 16, 2021

AIRFRAME AND ENGINE EXAMINATION

WPR18LA164

This document contains 9 embedded photos.

ACCIDENT

Location: Sanders, KY

Date: 6/5/2018

Aircraft: Bell 206B / N518Z / serial number: 3991

NTSB IIC: Fabian Salazar

AIRFRAME EXAMINATION PARTICIPANTS:

Name: Jack Vanover

Duty Position: Original IIC

National Transportation Safety Board

Federal Way, WA 98003

Karlton White

Geographic Partial Program Manager

Federal Aviation Administration

Name: Jack Johnson

Duty Position: Air Safety Investigator

Organization: Rolls-Royce Corporation

Mark Stuntzner

Air Safety Investigator

Bell Flight Safety

SUMMARY

The replacement IIC, Fabian Salazar did not attend the airframe exam, the engine exam, nor the engine test run.

Examination of the airframe and engine took place on June 19 thru 20, 2018, at the facilities of AMF Aviation, LLC. in Springfield, TN. After examination of the airframe, there were no preimpact mechanical malfunctions or failures that would have precluded normal operation. The engine was relocated to a Rolls-Royce authorized service facility for a test run. Details are included in this report.

DETAILS OF THE EXAMINATION

Airframe Examination

The helicopter was equipped with single controls at the right pilot station. The copilot pedals were locked out, a cover was placed over the copilot cyclic connection and the copilot collective was not observed connected to the control system. Flight control continuity was observed from the collective and cyclic sticks to the main rotor. The cover was removed from the vertical tunnel and the vertical tail rotor control tube was observed to be binding on the bent vertical tunnel. The tail rotor pedals could be moved slightly, and pitch control movement was observed at the tail rotor blades.

The collective Hobbs meter was 5825.1 hours and the Hobbs in the nose was 3720.9 hours. The throttle was observed to be at idle and the fuel shutoff switch was in the off position. The hydraulic system switch was on. The battery was reattached, and the switch was turned on and the following caution lights illuminated: Fuel Pump, Trans Oil Press, ENG OUT, and Rotor Low RPM.

The helicopter was equipped with boost pump circuit breaker switches for the aft and forward boost pumps instead of normal circuit breakers, and the switches were in the forward on position. Both the pilot and copilot restraint systems were intact with each inertial reel operating properly locking when pulled hard by hand and then releasing when hand pressure was relaxed.

Main and Tail Rotor Drive

Main and tail rotor drive continuity was confirmed when the M/R blades were turned by hand, and free movement was observed through the main transmission and tail rotor gearbox to the T/R blades. No chips or debris were observed on any of the gearbox chip detectors: neither main transmission detector, the freewheeling unit chip detector, nor the T/R gearbox chip detector. The four transmission mounts were securely attached to main fuselage structure. The main transmission isolation mount under the KAflex main driveshaft forward coupling exhibited impacted damage, gouging from rotating contact with the KAflex driveshaft. The KAflex main driveshaft was intact and remained connected to both forward (main transmission) and aft (engine gearbox) ends. The KAflex exhibited evidence of slight rotational scoring on its center tube section from rotating contact with the forward firewall during the impact sequence. The freewheeling unit was removed from the engine and operated properly when tested by hand, rotating freely in the drive direction, and continuing to rotate when the engine gearbox drive spline was stopped by hand which demonstrated that the freewheeling feature operated. The freewheeling unit was disassembled and seen to be intact with only superficial wear observed on the sprag inner race.

Fuel System

The low-pressure fuel filter was removed and disassembled. About 12 oz of fuel was observed in the bowl. The filter was clear of debris and no anomalies were noted. The fuel was checked for water presence with water detecting gel and no water was present. The battery switch and the fuel valve switch were both turned on and then alternately the boost pumps were turned on and were heard to operate independently. About 5 gallons of fuel was poured back into the fuel cell. The forward and aft boost pumps were selected individually, and fuel was observed coming out of the low-pressure fuel filter inlet line. The fuel was collected in a clear bottle and no debris or contaminants were noted. The fuel shutoff valve was removed from the right side of the helicopter and the ball valve was found to be in the open position, which properly agreed with the last position of the fuel valve switch in the cockpit, since the fuel valve switch was turned on during the boost pump check.

The last airframe fuel line between the airframe fuel filter and the engine fuel system was checked for obstructions with shop air applied to one side and a paper towel on the other side. The paper towel was examined, and no debris was found.

Rotors

Both the main rotor and tail rotor systems were intact. The main rotor blades were Bell metal blades. The tail rotor blades were the aftermarket composite Van Horn blades. The tail rotor blades exhibited evidence of green vegetation transfer from contact with grass at the accident site.

Engine

The engine had remained attached securely within the engine bay; all engine mounts were intact, with no apparent deformity. No crash-related damage to the engine or engine bay was noted. The engine exhibited no evidence of operational failure, fire or malfunction. All engine control fittings, including pneumatic and oil lines, B-nuts, clamps and associated hardware, were checked by hand for torque. All B-Nuts were marked with yellow torque paint. 50 psi shop air was applied to the Pc air fitting, in order to check for air leaks. Soap solution was applied to all fittings and no leaks were detected. Shop air was also applied to the compressor's bleed valve to verify function; the bleed valve operated normally.

The helicopter was equipped with a barrier filter, which was removed to facilitate examination of the engine. The filter did not exhibit excessive obstruction.

The N1 (compressor) was rotated by hand. Rotation of the compressor was smooth and resulted in corresponding rotation of the starter/generator, thus confirming N1 drive continuity. The compressor exhibited no significant evidence of FOD; some leading-edge abrasion was noted on the compressor blades. Evidence of minor tip rub from the compressor blades with the compressor lining was noted.

The N2 (power turbine) was visually examined and exhibited no evidence of operational damage or failure. The power turbine could easily be rotated by hand, which resulted in corresponding rotation of the tail rotor drive and main drive shafts. Control continuity from the cockpit to the engine was established. Control movement was correct and smooth. The engine speed adjustment (beeper) control was tested and verified functional.

The engine oil tank was intact and was full of clean, bright oil. The oil did not have any entrained water or metallic particulate and exhibited no unusual odors. The airframe-mounted oil filter was intact; the blocked-filter bypass indicator showed the filter to not be in bypass. The upper and lower magnetic chip detectors were removed and examined; both were free of any debris.

ENGINE TEST RUN

PARTICIPANTS:

Name: Jack Vanover
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Name: Michael D. Bauer
Duty Position: Air Safety Investigator
Federal Aviation Administration

Name: Jack Johnson
Duty Position: Air Safety Investigator
Organization: Rolls-Royce Corporation

SUMMARY

The engine (SN# CAE 834616), was removed and shipped to a Rolls-Royce authorized service facility for a test run. After the test run, conducted on August 15, 2018, it was determined that the engine met all the normal engine test parameters, and there were no preimpact mechanical malfunctions or failures that would have precluded normal operation.

DETAILS OF THE EXAMINATION

Historical Information

The last 100/200-hour inspection was performed on May 25, 2018, at 16,479.5 airframe total hours and the engine had accumulated 22,284 hours and 19,698 cycles. The last compressor overhaul was accomplished on April 19, 2017, Time Since New (TSN): 8,402.9 and the turbine was overhauled on November 1, 2016, TSN: 8,402.9. The governor was overhauled on January 26, 2018 by StandardAero

PRIOR TO TEST RUN

The engine was unpacked from the shipping container and examined prior to being put on the test stand. The pneumatic lines were leak checked with a soap and water solution and 60lbs of air was applied to the system. No leaks or anomalies were noted.

ENGINE TEST RUN

The engine run was performed in accordance with Rolls-Royce M250-C20 Series overhaul manual. The engine run consisted of 15 test settings.

About two minutes after starting up, as part of Setting No. 3 (b) while at idle, the throttle was advanced forward and a decrease of about 2,000 rpm was noted. The throttle was retarded to idle and then advanced forward—no other anomalies were noted during the remaining engine run.

After the engine run was completed, the engine was shut down for about 30 minutes. An additional startup was performed to attempt to replicate the anomaly noted during the first Setting No. 3 (b) test. The anomaly did not occur again. The engine fuel filter was removed and examined; no debris or obstructions were noted. The fuel control and governor were removed for further testing.

FUEL CONTROL AND GOVERNOR BENCH TEST

Fuel Control Unit

The fuel control was placed on the bench test and tested through normal methods. No anomalies were noted.

Power Turbine Governor

The power turbine governor was placed on the bench test and tested through normal methods. One test point was outside of the allowable limits. According to an Engineer / Air Safety Investigator for Honeywell Aerospace, the finding was inconsequential. Additional findings included:

1. Debris was noted in the restrictor and filter assembly
2. Metallic debris was found on the fuel side of the diaphragm speed limiter
3. Corrosion was noted on the tip of the regulator valve

PHOTO EXHIBIT



Figure 1. N518Z, right front view while at the accident site. Photo courtesy of the FAA.



Figure 2. N518Z, left view while at the accident site. Photo courtesy of the FAA.



Figure 3. N518Z, at the recovery site.



Figure 4. N518Z, instrument panel. Photo courtesy of the FAA.



Figure 5. Left-side view of the engine.



Figure 6. Right-side view of the engine.

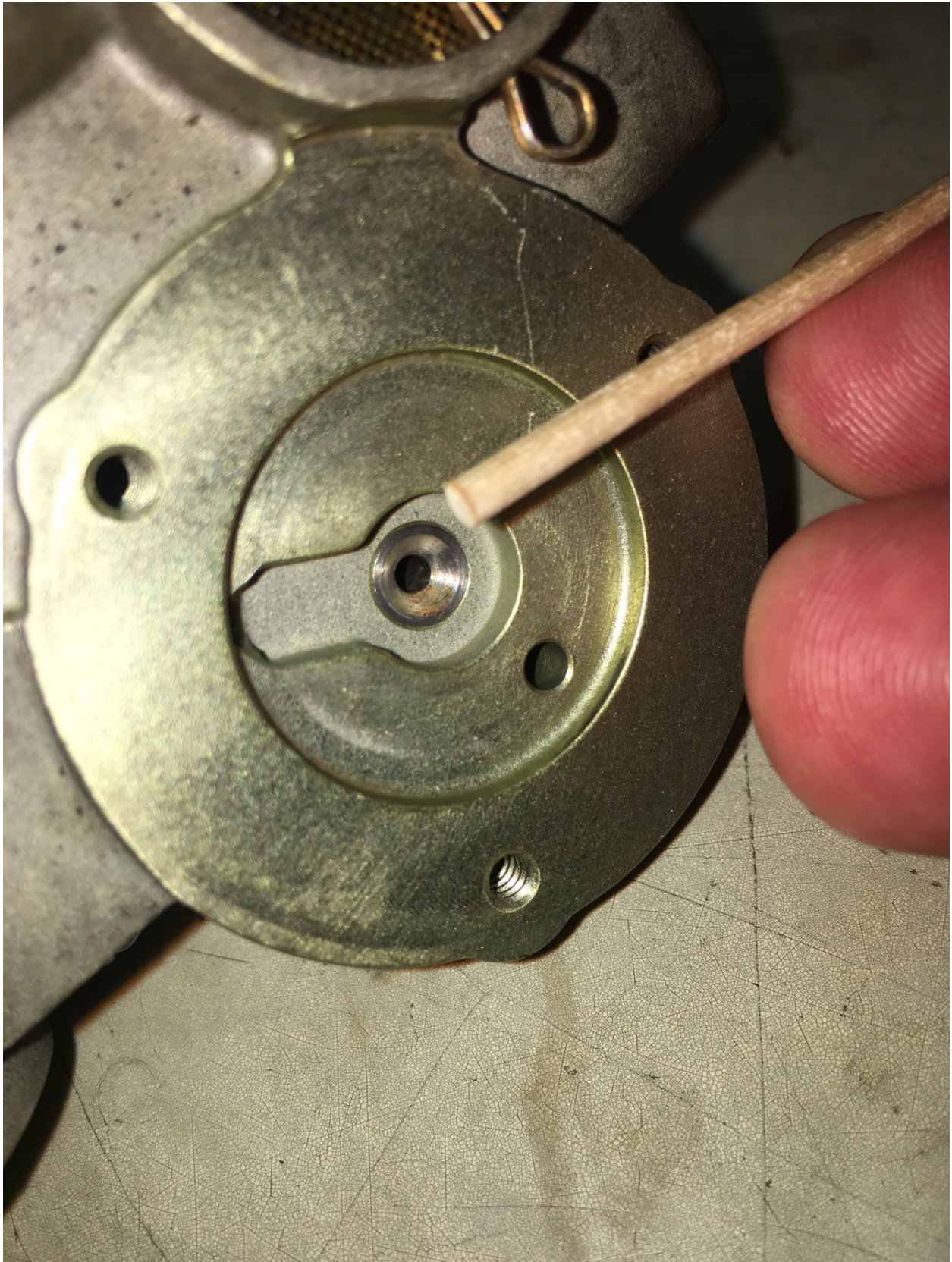


Figure 7. Corrosion noted.



Figure 8. Metallic debris found on the fuel side of the diaphragm speed limiter



Figure 9. Debris noted in the restrictor and filter assembly.