



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

AIRFRAME AND ENGINE EXAMINATION

WPR18LA214

Accident Date: August 7, 2018
Exam Date: October 3, 2018

This document contains 22 embedded images

A. ACCIDENT

Location: Basin City, WA
Date: August 7, 2018
Aircraft: Bell 206B, N607RA, Serial # 678

B. EXAMINATION PARTICIPANTS:

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C. ACCIDENT SUMMARY & GENERAL INFORMATION

1.0 Accident Synopsis

On August 7, 2018, about 1000 Pacific daylight time, a Bell 206B helicopter, N607RA, struck the ground during an agricultural spray run near Basin City Washington. The commercial pilot received minor injuries, and the helicopter was destroyed by a post-impact fire. The helicopter was registered to Ranger Aviation Leasing, and operated by Northwind Aviation as a 14 Code of Federal Regulations Part 137 aerial application flight. Visual meteorological conditions existed at the time of the accident. The flight originated from a landing zone near the accident site.

2.0 Exam Synopsis

The helicopter was presented for examination in a secure hangar at Auburn Municipal Airport. The majority of the airframe and engine had been exposed to a significant and/or relatively long-duration post-accident fire. In addition, fire-fighting water, and then subsequent collateral dousing by the accident site irrigation system resulted in post-accident corrosion of some portions of the wreckage.

D. MAINTENANCE RECORDS

3.0 General

- FAA records indicated that the helicopter was purchased by the current owner (Ranger Aviation Leasing LLC) on 3/30/15, and registered to them about 4/22/15
- The operator (Northwind Helicopters) reported that they took the helicopter on leaseback from Ranger in November 2017
 - Northwind flew the helicopter minimally between November 2017 and spring 2018
- The operator reported that the most recent maintenance records were onboard the helicopter at the time of the accident
 - This was reportedly at the request of an FAA inspector at the Spokane FSDO, which was the CMO for Northwind's 135 and 137 certificates
- The operator provided copies of some prior maintenance records to the investigation
- Some partially-burned and water-soaked maintenance records were found in the wreckage (cabin area)

4.0 Operator-Provided Records

- In response to an NTSB request, the operator provided copies of its most recent 2 previous years of maintenance records
- A total of 20 pages were provided
- The oldest, an annual inspection, was dated 2/29/16; TT 17,539.2
- The most recent, a 50h inspection, was dated 9/12/17; TT 17654.6
- Unlike some sheets recovered from the wreckage, no Hobbs times were cited on the above sheets containing the earliest & most recent entries

5.0 Records Recovered from Wreckage

- A partially-burned, waterlogged book of records was located in the wreckage
- A total of 11 discrete pages with entries on them were able to be separated
 - One of those pages was a duplicate (cc) of one of the pages
 - One of those pages was also a cc, but the two pages (original and cc) had different printed stick-on entries
- No other pages with entries were located in the wreckage
- Only two pages had both a full date and aircraft times on them
 - These were the two pages mentioned above, that had different printed stick-on entries
 - The original page had a stick-on entry which cited an engine 100/300 hour inspection, with a Hobbs time of 972.9, a TT of 17,687.7, and a date of 3/3/18
 - The cc page had a stick-on entry which cited an annual inspection, with no Hobbs time, a TT of 17,687.7, and a date of 3/2/18
- The earliest Hobbs & TT entry (date consumed by fire) were 947.9 & 17662.7 respectively
- The most recent Hobbs time (date consumed by fire) was 1,012.1 (no corresponding TT cited)

[illegible]

Figure 1 - Exemplar Burned Maintenance Record

E. AIRFRAME EXAMINATION

1.0 Fuselage:

- The majority of the forward and intermediate fuselage was consumed in the post crash fire, with the exception of most of the lower fuselage, which remained attached to the landing skid crosstubes.
- The tailboom detached from the intermediate fuselage, with indications of both possible blade strike and thermal damage
- Portions of the spray rig were observed in the wreckage
 - Some remained attached to the wreckage, other sections did not



Figure 2 - Fuselage & Left Skid



Figure 3 - Cockpit/Cabin



Figure 4 - Aft Cabin/Fuselage

2.0 Doors and Cabin Transparencies

- The majority of the doors and cabin transparencies were consumed by the post-crash fire.

3.0 Main Rotor/Main Drive System

- The mast was fractured immediately below the hub
- Both main rotor blades remained attached to the MRB hub
- Main rotor blade s/n A-8101 was fractured at the outboard end of the blade doublers, with additional fracturing near the blade tip
 - Upward bending of the fractured portion of the blade was noted
 - This was consistent with ground contact
- Main rotor blade s/n A-7835 was missing the tip of the blade, and exhibited aft and upward bending.
- Both main rotor blades exhibited additional damage (scrapes, dents, and gouges)
- Main drive continuity was demonstrated by rotating the input drive quill by hand, and observing the rotation of the mast.

- The forward outer coupling of the engine-to-transmission driveshaft was not able to be located in the wreckage; presumed to be fragmented and/or consumed by fire
- Rotational scoring was observed on the transmission isolation mount
- The engine to transmission driveshaft remained attached to the aft outer coupling that remained attached to the engine
- No evidence of any non-impact or thermal exposure damage was observed on the transmission
- The transmission was visually inspected and suffered thermal damage
- No abnormal sounds were heard when the transmission was rotated by hand
- The two transmission chip detectors were removed and visually inspected, with no particulate matter observed. The mast chip detector was unable to be removed.



Figure 5 – Main Rotor Blade Hub



Figure 6 - Main Rotor Blade



Figure 7 - Damaged Main Rotor Blade



Figure 8 - Transmission and Mast

4.0 Tail Rotor Drive System

- The helicopter was equipped with aftermarket composite tail rotor blades (TRBs)
- Both TRBs remained attached to the TRB hub
- Both tail rotor blades were unremarkable except for the tip of blade s/n A592 that appeared to have contacted the ground with the tip broken off
- The other TRB (s/n unable to be read) was undamaged
- The tail rotor hub was unremarkable
- Due to fragmentation and consumption by fire, tail rotor drive continuity could only be established from the tail rotor through the tail rotor gear box
- The majority of the tail rotor driveshaft segments were consumed by fire
- The forward short shaft (steel shaft) and the oil cooler blower shaft were identified in the wreckage
- Oil was present in the tail rotor gearbox; it appeared normal in color and no contaminants were present
- The chip detector was removed and visually inspected, with no chips observed



Figure 9 - Tail Rotor Assembly

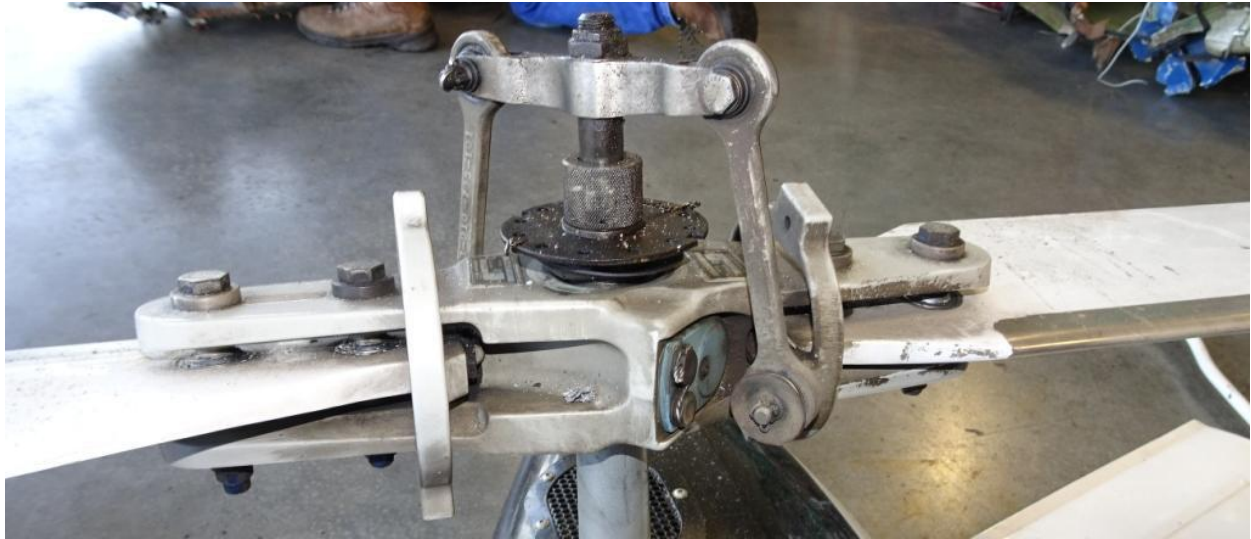


Figure 10 - Tail Rotor Hub



Figure 11 - Tail Rotor Gearbox



Figure 12 - TRB Gearbox Chip Detector

5.0 Flight Controls

- Most of the flight controls were consumed in the post-crash fire
- The right collective stick was present, but the throttle twist grip was missing
- The left collective stick was missing
- Both cyclic sticks were missing
- The yoke that connects the right and left cyclic sticks was missing
 - The mixing lever was present, with significant thermal damage
- The left seat anti-torque pedals were missing
- The right seat inboard pedal remained, but the outboard pedal was not located
- Only one of the three servo actuators was identified, and it was thermally damaged
- No other flight control components were located; they were apparently consumed by fire



Figure 13 – Collective Jackshaft (looking right)



Figure 14 – Collective Jackshaft and Pilot's Collective



Figure 15 - Right Station Anti-Torque Pedal Assembly

6.0 Fuel & Hydraulic System

- The majority of the fuel and hydraulic system was consumed in a post-crash fire
- The remainder were significantly fire-damaged
- The forward and aft fuel boost pumps, along with one of the fuel bladder floats, were found in the wreckage
- The airframe fuel filter was found detached in the wreckage
 - The paper filter was burnt, and no fuel was present
- The fuel shutoff valve, with its non-steel housing, was not located in the wreckage
 - It was presumed to be consumed by the fire
- The hydraulic oil reservoir was located, it was significantly damaged by fire
- No fuel records were available at the time of examination

7.0 Landing Gear Assembly

- The components of the high skid landing gear were only partially damaged by post crash fire

- The landing gear retained its basic geometry; it did not appear to have been spread by a hard landing.
- The left skid tube and step was detached from the fuselage
- The right skid tube and step remained attached to the fuselage, and were mostly unaffected by the fire.

F. ENGINE EXAMINATION

1.0 Background

- Engine Model Allison 250-C20B
- Rating: 420 HP
- Serial Number CAE-834648
- Engine Total Hours Unknown
- Engine Last Overhaul Unknown

2.0 General

- The engine was presented in a separate debris container from the fuselage.
- The engine was lifted from the container for examination.
- The engine was still partially attached to the horizontal and vertical firewalls, as well as loosely attached to the main transmission via various lines and cables.
- The magnesium accessory gearbox had mostly burned away, revealing the interior gears
 - The intensity of the magnesium fire also consumed or badly damaged the attached engine accessories.
- The engine exhibited significant corrosion; this was attributed to the post accident exposure to firefighting and accident site irrigation water
- All available/accessible engine B-nuts and fittings were checked by hand for proper torque
 - All were found to be at least hand tight.
- The Power Turbine Governor (PTG) was completely consumed by fire
- The Fuel Control Unit (FCU) was fire damaged, and the control arm could not be manipulated by hand.
- The bleed valve body was partially melted by the post-crash fire.



Figure 16 - Engine



Figure 17 - Engine

3.0 Compressor

- The compressor, like the rest of the engine, had been exposed to the post-crash fire.
- The binder of the composite compressor liner had melted or burned away, and left ashen debris throughout the compressor
- Examination of the compressor revealed no evidence of mechanical failure
- The leading edges of numerous blades exhibited evidence of small hard-body impact marks.
- Neither the N1 nor N2 rotor systems could be rotated by hand.



Figure 18 - Compressor Inlet Face

4.0 Turbine Section

- The turbine module exhibited no evidence of operational failure or malfunction
- Visual inspection of the 4th stage (power turbine) revealed no evidence of FOD, operational damage or thermal degradation



Figure 19 - Turbine Outlet Blades

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- The igniter was removed to permit boroscope inspection of the 1st stage (gas generator) turbine
- Visual examination revealed no evidence of FOD or thermal degradation of the 1st stage nozzle or turbine blades
- A significant quantity of metal slivers and chips were found adhered to the leading edges of the 1st stage turbine nozzle
- Shiny metal splatter was also noted adhered to the turbine nozzle shield
- The source of the metal slivers and chips was determined to be from the engine inlet plenum, inside which was located a splined shaft coupling that failed during impact
- Normally, a transmission isolation mount and a splined coupling are located inside the plenum, and not in contact with one another
 - The isolation mount and splined coupling were not in contact with one another during the exam
- The splined coupling is formed by two primary components

- An inner section, with external splines
- An outer section, with internal splines; this outer section sleeves over the inner section to form the coupling
- The isolation mount had a ground-out transverse (perpendicular to the shaft axis) channel that was not its design configuration
 - The damage is consistent with structural flexing during impact, which caused the outer splined section to contact the isolation mount and disintegrate.
 - Further flexing caused the still-rotating inner splined section to contact and grind into the mount
- The material liberated by the grinding of the isolation mount was ingested by the engine and deposited within the turbine section.
- It is presumed that this metal ingestion was also the cause of the minor FOD damage observed (and noted previously) on the compressor blades
- This evidence is indicative of continued engine operation during impact



Figure 20 - Grinding-Damaged Isolation Mount

5.0 Lubrication System

- The lubrication system, including both magnetic chip detectors, was mostly consumed by fire
- The engine-mounted oil filter was essentially intact
 - It had been exposed to intense heat, and some of the filter's solder had melted and re-solidified within the filter housing and at the base of the filter itself.
 - Otherwise, the filter was free of debris.

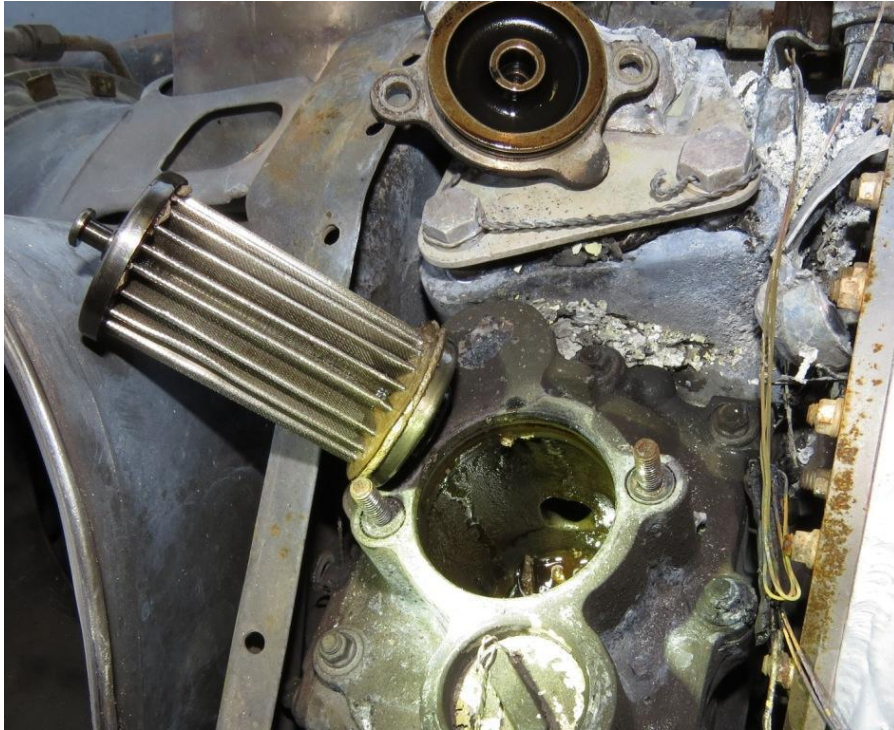


Figure 21 - Engine Oil Filter

- The Fuel Spray Nozzle spray face was corroded but otherwise unremarkable



Figure 22 - Fuel Spray Nozzle Face

6.0 Component PNs & SNs

- All PNs and SNs below were obtained by visual inspection of the engine and its components
- No cross-checks with the maintenance records have been accomplished to date
- At the time of this report, complete engine and aircraft maintenance records were not available
- Some records were known to have been destroyed on-board the aircraft in the post-accident fire

Component	Part Number	Serial Number	TSO	Total Time
Engine	6893660	CAE-834648	UNK	UNK
Gearbox	6894171	CAG-30362F	UNK	UNK
Compressor	TBD	CAC-24066	UNK	UNK
Turbine	6898735	CAT-37400	UNK	UNK
PTG	UNK	UNK	UNK	UNK
FCU	23070606	BR-88090127	UNK	UNK
Fuel Pump	6899253	T108820	UNK	UNK
Bleed Valve	23053176	FF23335	UNK	UNK
Fuel Spray Nozzle	UNK	UNK	UNK	UNK

7.0 Summary of Engine Findings

- Examination revealed no evidence of any condition which would have prevented the engine from delivering power
- Available evidence suggests the engine was making significant power at impact and continued to operate for a period of time after the accident occurred
- Fire and/or impact destroyed or otherwise eliminated some evidence; the extent of the loss was not able to be determined