Aviation Investigation Final Report

Location:	Horseshoe Bend, Idaho	**Accident Number:**	WPR21LA107
Date & Time:	February 5, 2021, 14:00 Local	**Registration:**	N6639R
Aircraft:	Hughes OH-6A	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	1 Serious, 1 Minor
Flight Conducted Under:	Public aircraft		

Analysis

While conducting wildlife damage management operations at low altitude over hilly terrain, the pilot of the helicopter noted a loss of main rotor rpm. To regain main rotor rpm, he reduced the engine power demand by descending into a draw; however, the helicopter impacted terrain, rolled over, and came to rest on its left side. Two days before the accident flight, the pilot experienced a similar loss of main rotor rpm; however, he was able to safely land the helicopter. The pilot was unable to replicate the loss of main rotor rpm and continued the flight. The pilot believed that the event was an isolated anomaly and did not notify maintenance personnel.

Postaccident examination of the helicopter revealed an air leak located in the fuel cell outlet valve near the firewall. Subsequent examination of the fuel cell outlet valve revealed circumferential scratch marks around the barrel of the pipe. Damage due to cross-threading was observed on the first two threads. When the O-ring was removed, metal chips were located embedded throughout the O-ring. A review of the maintenance records indicated that the fuel system components were inspected during the 100-hour inspection, along with correspondence from the maintenance facility that a vacuum check of the fuel system was conducted during that inspection, with no anomalies noted. No entries were found in the maintenance records of any work done to the fuel outlet valve. The approved maintenance manual for the helicopter contained multiple warnings that air in the fuel system will cause a power reduction or flame out. It could not be determined when, or how, the fuel cell outlet valve developed a leak.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

A partial loss of engine power due to a leak in the fuel cell outlet valve.

Findings

Aircraft	(general) - Failure
Aircraft	(general) - Not inspected
Environmental issues	Mountainous/hilly terrain - Effect on equipment

Factual Information

History of Flight

Maneuvering-low-alt flying	Loss of engine power (partial) (Defining event)
Emergency descent	Off-field or emergency landing

On February 5, 2021, about 1400 mountain standard time, a Hughes OH-6A helicopter, N6639R, was substantially damaged when it was involved in an accident near Horseshoe Bend, Idaho. The pilot sustained serious injuries and a passenger sustained minor injuries. The helicopter was operated as a public use flight.

The purpose of the accident flight was to conduct wildlife damage management operations. While maneuvering at low altitude over hilly terrain, the pilot noted a loss of main rotor rpm. The pilot maneuvered the helicopter into a draw to reduce the engine power demand and regain rotor rpm. The helicopter impacted sloped terrain, rolled over, and came to rest on its left side.

The pilot reported that, two days before the accident flight, he experienced a similar loss of rotor rpm while over flat terrain and was able to safely land the helicopter. While on the ground, he utilized the “BEEP” switch (N2 governor control switch) on the collective to increase rotor rpm, but it had no effect. He then changed the position of the throttle from fly to idle and observed the engine instruments for any abnormalities. With no abnormalities identified, he again changed the position of the throttle from idle to fly and regained main rotor rpm. He then utilized the “BEEP” switch and all engine controls returned to normal operations. While remaining on the ground, he repeated the process several times attempting to duplicate the loss of main rotor rpm with no success. As there had not been a prior malfunction and unable to duplicate the loss of rotor rpm, the pilot believed the event as an isolated anomaly and did not notify maintenance personnel.

Postaccident examinations of the helicopter revealed substantial damage to the fuselage and tail boom, as well as an air leak at the fuel cell outlet valve that connected the fuel supply line from the fuel shutoff valve and the frangible in-line fuel valve on the self-sealing engine fuel inlet hose located at the firewall. (see Figure 1.) The fuel cell outlet valve along with the engine fuel inlet hose were shipped to the NTSB (NTSB) Materials Laboratory for further examination.

Figure 1: view of fuel line leak (photo provided by MD Helicopters)

Flight control continuity was confirmed from the cyclic pitch control and collective pitch control systems to the main rotor swashplate. Anti-torque pedal control continuity was established from the pedals up to tail rotor pitch control tube.

The engine was removed and shipped to the manufacturer for additional examination and testing. The engine was installed in a test-run cell, where it was started and ran for about an hour with no mechanical anomalies identified that would have caused the reported sudden loss of engine power. Of note were two decelerations and a singular brief engine stall; both events were within the manufacturers experience of a mid-life engine and would not have contributed to the reported power loss.

According to the engine manufacturer, the accident helicopter had a non-pressure-boosted fuel system that was utilized for normal operation. The engine fuel pump generated a vacuum at its inlet to draw the fuel from the tank to the engine fuel delivery system. A leak in the fuel delivery system prior to the engine can produce air entrainment in the fuel being supplied which could result in the interruption of homogenous fuel flow.

Maintenance records provided by the operator indicated that a 100-hour inspection was completed on May 19, 2020. Correspondence with the maintenance facility revealed that a

100-hour inspection was conducted in accordance with the Rolls Royce maintenance and operation manual, 250-C20 Section 72-00-00. No other fuel system troubleshooting or repairs were completed. A vacuum check of the fuel system was conducted during the 100-hour inspection, with no anomalies noted.

The Rolls Royce maintenance and operation manual, 250-C20 Section 72-00-00, titled "Engine Fuel and Control System -- Maintenance Practices," contained multiple warnings that, "Air leaks in the fuel system or the pneumatic sensing system can cause flameouts, power loss or overspeed."

The fuel cell outlet valve was examined by the NTSB Materials Laboratory. A pressure test utilized soapy water as part of its testing protocols; soap bubbles formed at the barrel of the pipe and fuel outlet valve, which indicated the presence of an air leak. Visual examination of the fitting had circumferential scratch marks on the barrel of the pipe, as seen in Figure 2. A visual examination of the fitting threads revealed that the first two threads were damaged due to cross-threading. The O-ring was removed with both outer and inner diameter surfaces flattened/compressed. Metal chips were found embedded in the O-ring; when the O-ring was removed, a metal chip dislodged and revealed an impression in the rubber.

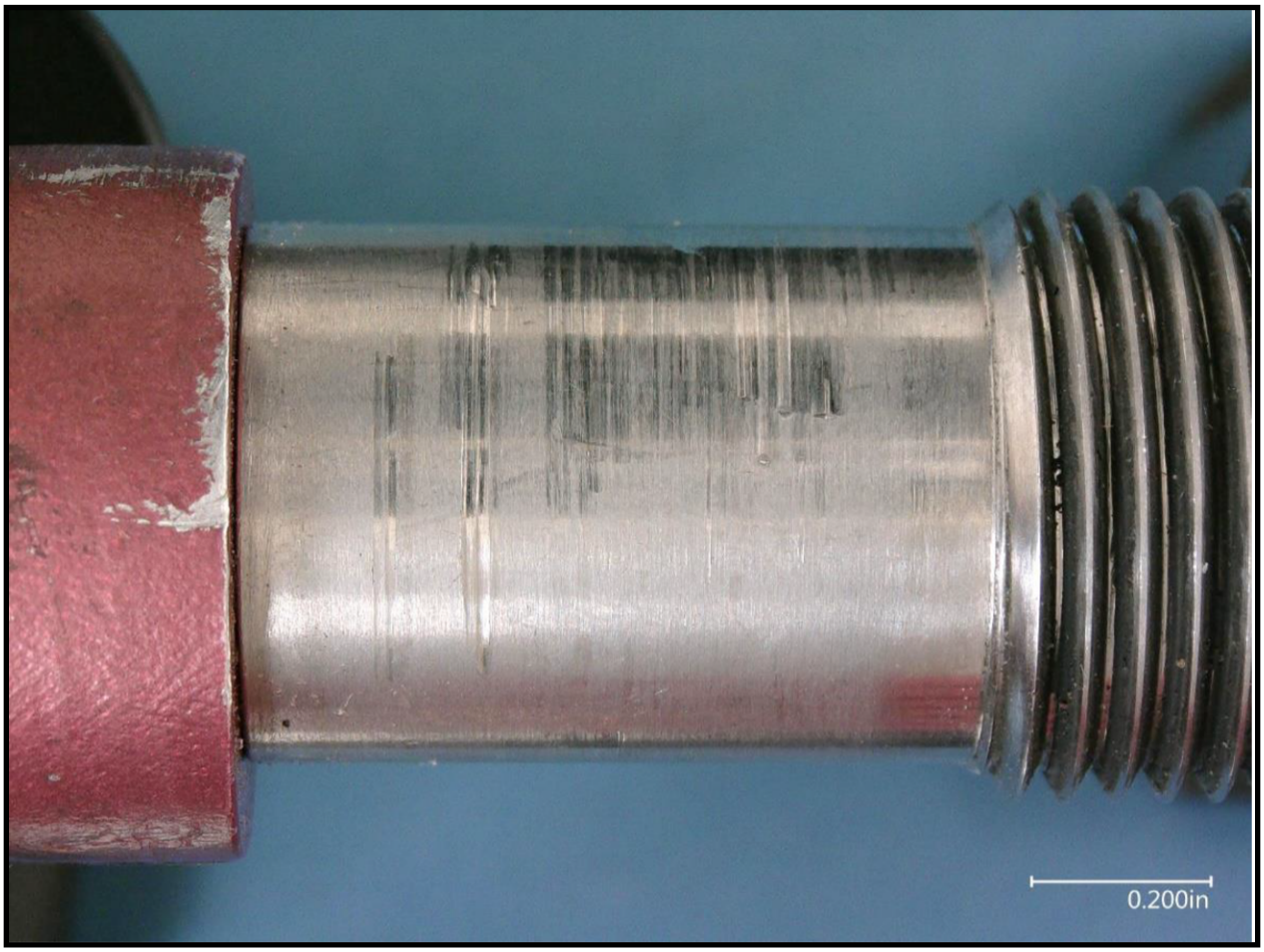

Figure 2: View of optical microscope images showing circumferential scratch marks and pile-up material on the outer diameter surface of the pipe barrel (photo provided by NTSB)

A review of the helicopter's maintenance records could not determine the age of the fuel cell outlet valve, or if any maintenance had been performed on the valve.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	52,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	
Instructor Rating(s):	Airplane single-engine; Helicopter	**Toxicology Performed:**	
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	May 17, 2021
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	August 12, 2020
Flight Time:	(Estimated) 17000 hours (Total, all aircraft), 1500 hours (Total, this make and model), 17000 hours (Pilot In Command, all aircraft), 75 hours (Last 90 days, all aircraft), 40 hours (Last 30 days, all aircraft)		

Other flight crew Information

Certificate:	None	**Age:**	61,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Hughes	**Registration:**	N6639R
Model/Series:	OH-6A	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	None	**Serial Number:**	66-078784
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	May 16, 2020 Annual	**Certified Max Gross Wt.:**	2550 lbs
Time Since Last Inspection:	130 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	14627.5 Hrs at time of accident	**Engine Manufacturer:**	Alison
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	250-C20B
Registered Owner:	USDA APHIS WS ATOC	**Rated Power:**	420
Operator:	USDA APHIS WS ATOC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KBOI,2868 ft msl	**Distance from Accident Site:**	26 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	190°
Lowest Cloud Condition:	Scattered / 6000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Overcast / 6000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	19 knots / 30 knots	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	320°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.06 inches Hg	**Temperature/Dew Point:**	8°C / -1°C
Precipitation and Obscuration:			
Departure Point:	Nampa, ID (KMAN)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Caldwell, ID (KEUL)	**Type of Clearance:**	None
Departure Time:	09:38 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 Minor	**Latitude, Longitude:**	44.00019,-116.13546(est)

Administrative Information

Investigator In Charge (IIC):	Gutierrez, Eric
Additional Participating Persons:	Stanley K. Slinker; USDA APHIS Wildlife Services ; Cedar City, UT Nicholas P. Shepler; Rolls Royce Joan Gregoire; MD Helicopters; Mesa Kevin Harvey; FAA; Boise , ID Jon-Adam Michael; Rolls-Royce Corporation; Indianapolis, IN
Original Publish Date:	September 21, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=102608

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The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties … and are not conducted for the purpose of determining the rights or liabilities of any person" (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available here.