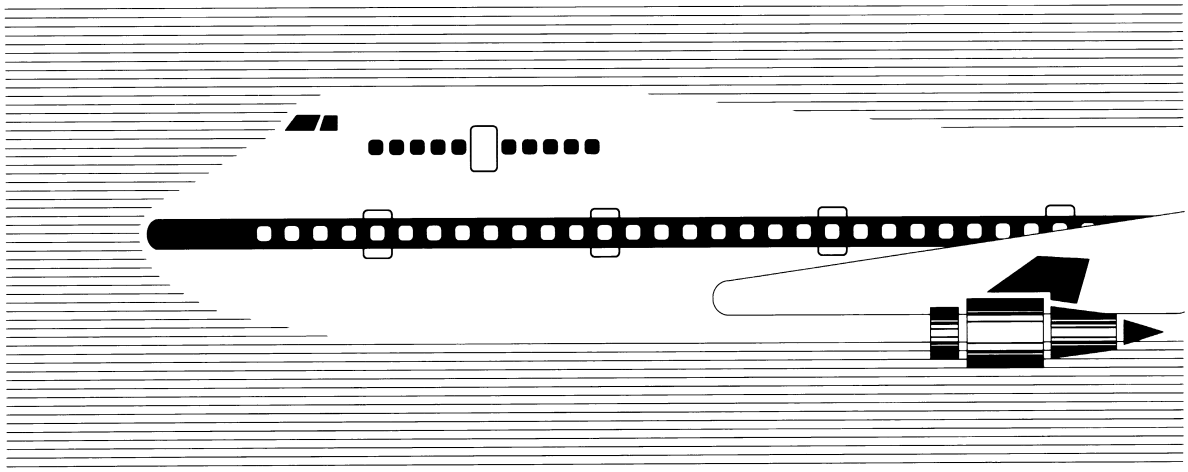
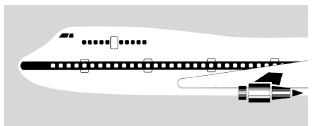
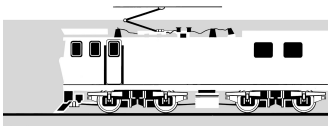


AVIATION OCCURRENCE REPORT

02-011 **Bell 206B JetRanger III ZK-HRC, forced landing following reported power loss on approach, Huka Falls, 3 km north of Taupo** **2 October 2002**


The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

Report 02-011

Bell 206B JetRanger III

ZK-HRC

forced landing following reported power loss on approach

Huka Falls, 3 km north of Taupo

2 October 2002

Abstract

On Wednesday 2 October 2002 at 1215, ZK-HRC, a Bell 206B JetRanger III helicopter, was positioning to uplift passengers for a local scenic flight. Approaching to land at the Huka Falls landing pad, the pilot reported a loss of engine power. The pilot managed to fly the helicopter onto the landing pad, where it slid across the pad and over the edge, rolling on to its side. The 2 occupants received minor scratches and bruising. The helicopter was extensively damaged.

The cause of the power loss was not determined.

No new safety issues were identified.

ZK-HRC accident site

Contents

Abbreviations

km	kilometre(s)
m	metre(s)
UTC	coordinated universal time

Data Summary

Aircraft registration:	ZK-HRC
Type and serial number:	Bell 206B JetRanger III, 2995
Number and type of engines:	one Rolls Royce Allison 250-C20B
Year of manufacture:	1980
Operator:	Helistar Helicopters Limited
Date and time:	2 October 2002, at 1215[1]
Location:	Huka Falls, 3 km north of Taupo latitude: 38° 38.9′ south longitude: 176° 06.0′ east
Types of flight:	positioning for air transport, scenic
Persons on board:	crew: 1 passengers: 1
Injuries:	nil
Nature of damage:	extensive
Pilot's licence:	commercial pilot licence (helicopter)
Pilot's age:	29
Pilot's total flying experience:	1525 hours (1290 on type)
Investigator-in-charge:	I R M^{c}Clelland

[1] Times in this report are New Zealand Standard Time (UTC + 12 hours) and are expressed in the 24-hour mode.

1 Factual Information

1.1 History of the flight

1.1.1 On Wednesday 2 October 2002, ZK-HRC, a Bell 206B JetRanger III helicopter, was booked to fly a scenic flight from its daytime base at Huka Falls, near Taupo. The previous evening another company pilot had refuelled the helicopter and flown it to its overnight hangar, some 7 km north of Huka Falls. During the Wednesday morning, 2 signwriters worked on the helicopter and the pilot offered to fly one of them to the Huka Falls base before starting the scenic flight. The pilot's plan was to fly to the Huka Falls base, keep the engine running, off-load the single passenger, uplift the other passengers and immediately start the scenic flight.

1.1.2 Before repositioning the helicopter for the scenic flight, the pilot did a pre-flight inspection of ZK-HRC, which included a fuel drain and contamination check. This proved satisfactory. At about 1210 the pilot started ZK-HRC, completed an engine run-up and took off for the 3-minute flight to Huka Falls. The weather was fine with a light to moderate south-west wind.

1.1.3 Approaching the landing pad at about 1215, the pilot entered a descending left turn through about 270° to land into the prevailing wind. Several witnesses observed the approach of the helicopter and saw nothing unusual as it neared the landing pad.

1.1.4 At a height of about 200 feet, and 80 m out from the pad, the pilot started to raise the collective lever to increase power and maintain a steady approach angle to terminate in a hover over the pad. He later reported hearing a continuous audio warning as he raised the collective, indicating low main rotor speed.[2] The pilot's initial reaction was to increase the governor setting using the beep switch located on the collective lever to increase rotor speed, but this had no effect. He also confirmed that the throttle was fully open.

1.1.5 The pilot continued to raise the collective lever and maintained the helicopter's forward airspeed to reach the landing pad. The helicopter landed heavily near the front edge of the built-up landing area and slid across the pad. As it did so the pilot tried to slow the helicopter's progress by applying aft cyclic control. The main rotor blades struck and severed the tail boom in the process. The helicopter fell down the far side of the pad onto its nose and rolled on to its right side.

1.1.6 After the helicopter came to rest the pilot recalled hearing the engine still running, although not at its normal high revolutions. To shut down the engine he pulled the fuel valve and fully closed the throttle. The pilot and passenger exited the helicopter, and emergency services arrived about 10 minutes later. With the exception of some bruising, neither occupant was injured.

1.2 Personnel information

1.2.1 The pilot, aged 29, held a Commercial Pilot Licence (Helicopter) and a Class 1 medical certificate valid until 11 March 2003. He was rated on the Bell 206 and had accrued 1525 flying hours, including over 1290 on the Bell 206-type helicopter, mostly on ZK-HRC. His last currency check was on 2 March 2002.

1.2.2 In the previous 90 days the pilot had flown 55 hours, including 17 hours on ZK-HRC. The pilot had been off-duty for 24 hours before starting work on 2 October and considered himself well rested.

[2] The low rotor audio warning activates when the main rotor speed reduces below 90% revolutions per minute (RPM). The main rotor normally operates at 100%.

1.2.3 The pilot had operated from the Huka Falls landing site regularly for the past 3 years.

1.3 Aircraft information

1.3.1 ZK-HRC was a Bell 206B JetRanger III single-engine helicopter, serial number 2995, constructed in the United States in 1980. The owner had imported the helicopter new and used it mainly for private flying until about 2000 when the owner and pilot purchased the scenic flight operation based at Huka Falls. The helicopter had been issued with a non-terminating Certificate of Airworthiness in the standard category and records showed that it had been maintained in accordance with the manufacturer's specifications.

1.3.2 ZK-HRC had flown a total of 3718.8 hours up to the time of the accident. The last check was a 300-hour check, completed on 30 September 2002 – 2 days before the accident. A test flight was conducted at the conclusion of the check. Both the pilot and accompanying engineer reported that the helicopter performed satisfactorily during the test flight. The helicopter flew a further 4.7 hours before the accident with no reported problems.

1.3.3 The engine, a Rolls-Royce (Allison) 250-C20B, serial number CAE 832765, was original with the helicopter and so had also accrued 3718.8 hours and completed 4355 cycles (starts) in that time. In February 2002 the turbine, power turbine governor and numbers 1 and 2 turbine wheels were replaced as they had reached their end of life. The owner's general philosophy was to use new items when engine components required replacing.

1.3.4 During the 300-hour check, the engine governor and fuel pump were removed to assist in fault diagnosis on another company helicopter, which had problems starting. Both items were reinstalled on ZK-HRC before the test flight at the end of the check. At the time of the accident the governor still had about 1792 hours to run to overhaul and the fuel pump 947 hours.

1.3.5 Refuelling was normally carried out using a tanker located at the Huka Falls landing pad. The fuel installation was examined after the accident and fuel appeared to be fit for purpose. Other aircraft also utilised the tanker and no problems had been reported.

1.4 Wreckage and impact information

1.4.1 ZK-HRC was lying on its right side at the base of the landing pad and had sustained considerable damage during the accident. There was a strong smell of fuel present and fuel was observed to be dripping from the tank drain, which had previously been plugged by fire service personnel. The main rotor assembly had broken near the top of the mast and lay next to the fuselage. A section of a main rotor blade had separated and struck the forward left side of the cabin. One of the main rotor blades had struck the rear of the helicopter, forward of the tail boom attachment, and severed the tail boom and tail rotor assembly, which lay about 10 m from the fuselage. The engine cowling was compressed preventing initial access to the engine.

1.4.2 The transmission had remained attached but had moved in its mountings. The short shaft had fractured at its attachment to the transmission. The engine was in place and did not appear to have ingested any debris.

1.4.3 The throttle was in the closed position and the fuel valve had been selected off. The collective pitch lever was stuck in a high pitch setting. The battery switch was on, but the battery had been disconnected. All engine fuel and pneumatic control lines and fittings were checked and found intact. Bleed air pressure was applied and no leaks were observed. The oil levels were normal.

1.4.4 Two parallel tracks ran from near the eastern edge of the landing pad, across the centre of the pad and terminated at the helicopter. The width of the tracks matched the dimension of the helicopter's skids.

1.5 Tests and research

1.5.1 The helicopter was initially transported to a lockable shed to await the arrival of a representative from the engine manufacturer to assist in the investigation. The engine was then removed intact and shipped in a crate to an approved engine maintenance facility in Melbourne, Australia, for ground running and testing.

1.5.2 During the removal of the engine, all engine controls were determined to be intact with no apparent external damage. Engine control continuity was verified and engine control rigging and beep switch were checked within limits. The airframe fuel filter was empty of fuel while the engine fuel filter was full of fuel. The fuel was determined to be of good quality. The aircraft fuel tank contained about 30 US gallons (about 115 litres) of fuel. The magnetic chip indicating plugs were checked and displayed normal amounts of fuzz[3] associated with engine operation. The engine compressor had no significant foreign object damage.

1.5.3 The engine assembly was installed in the test cell facility and operated in accordance with the engine test schedule published in the latest edition of the maintenance manual. The test produced no significant findings. Although the engine was low on power, particularly in the cruise-power range, engine performance was within service limits as defined by the relevant manual. The run lasted for about 30 minutes.

1.5.4 Following the engine run, the engine was again inspected and no anomalies were observed. The engine fuel filter, fuel control unit and fuel nozzle were removed for examination and again no anomalies were found.

1.5.5 The engine was returned to New Zealand and a full strip inspection completed before the engine could be returned to service. The inspection revealed some isolated minor case rubbing, corrosion and foreign object damage, but nothing that would have caused a noticeable loss in engine performance. At the time of writing this report, ancillary engine equipment was being sent for full bench inspection and testing.

Engine history

1.5.6 The Commission and its predecessor, the Office of Air Accidents, have investigated 3 occurrences of unexplained power losses involving the Rolls Royce Allison 250-C20B engine. On 2 May 1989, ZK-HXA, a Hughes 369HS helicopter, had a power loss over the Fox Glacier. On 2 January 1997, ZK-HQA, a Hughes 369D helicopter, was about 40 km south-east of Taupo when "the engine suddenly lost power" and the pilot made a forced landing. The engine continued to run, probably at flight idle power, until the fuel shut-off knob was pulled. On 17 October 2000, ZK-HFT, a MDHC 369E helicopter, was about 30 km east of Te Anau when there was "a sudden uncommanded power loss." The pilot attempted to restore power without success before making a forced landing. Again, the engine continued to run until shut down by the pilot.

[3] Light metal fragments carried in the helicopter's oil system and caught by the magnetic plug.

1.5.7 A review of the Civil Aviation Authority's database going back to 1980 identified a further possible 5 occasions when there was an unexplained power loss involving the Rolls Royce (Allison) 250-C series of engine. Nearly all of these events have involved helicopter types other than the Bell JetRanger, such as ZK-HRC. At the time of the accident there were about 120 aircraft in New Zealand, 110 helicopters and 10 aeroplanes, which were powered by a variant of the 250-C series engine.

2 Analysis

2.1 No reason could be found to explain the initiation of the accident sequence. The flight was a routine positioning flight in good weather conditions. The pilot was experienced on the helicopter and familiar with the operation and landing area. The pre-flight inspection and engine run-up revealed no abnormalities and there was no evidence of anything other than a standard approach being flown.

2.2 Witness marks on the pad indicated the helicopter landed heavily in about level attitude and then remained on the ground. This evidence, combined with the damage sustained by the helicopter, including evidence of a high collective pitch setting as the helicopter slid across the landing pad, was consistent with the pilot's observations of a power loss on the approach to land. With 2 persons on board and a moderate fuel load, ZK-HRC was at a light operating weight. Therefore, had some engine power been available, the helicopter would have been expected to have bounced back into the air again after the first heavy landing.

2.3 The owner had imported ZK-HRC new and had ensured it was well maintained. An example of this was the use of new components where practicable and avoiding the use of partly worn items. The helicopter was normally secured in a large shed overnight and the refuelling facility was adequate. There was no evidence of fuel contamination. However, the ingestion of a small amount of water or other contaminate into the engine could not be excluded. Given that the pre-flight water check was satisfactory and the engine did not "flame-out" but continued to run, the possibility of water ingestion was unlikely.

2.4 The removal and refitting of the engine governor and fuel pump during the 300-hour check were correctly recorded. Had an abnormality been introduced to ZK-HRC on the refit of the components it should have been detected during the post check test flight. Further, none of the pilots who flew ZK-HRC after the check reported any problems.

2.5 The absence of fuel in the airframe fuel filter can be explained by the engine continuing to run after the helicopter rolled onto its side. The inlets for the fuel tank boost pumps may have become exposed and allowed air to enter the fuel line. The fuel that was contained in the line and filter was enough to supply the engine until shut down by the pilot. The amount of fuel found in the tank was more than sufficient to meet the requirements of the planned scenic flight.

2.6 Examination of the installed engine and its rigging revealed no abnormalities. There were no leaks or the like found that could have permitted air to enter the fuel system or a loss of fuel pressure to occur. The engine test confirmed that the engine was capable of producing power, although slightly low in the mid-range. The engine strip and inspection also identified no irregularities that would have contributed to the power loss as reported.

2.7 That the engine continued to run, possibly at about idle speed, would exclude a major component failure as a cause of the power loss. While no obvious cause for the power loss could be found, a transient fuel or air problem could not be discounted. However, the complete disassembly and testing of the engine ancillaries could not identify a potential isolated problem.

2.8 Had the pilot immediately lowered the collective lever on landing and restricted the use of rearwards cyclic, damage to the helicopter could have been minimised. However, the pilot's use of rear cyclic is understandable when considering the size of the landing area and the helicopter's speed across it.

2.9 The Rolls Royce (Allison) 250-C series of engine has been in service for nearly 40 years and has proved to be reliable. While there have been a number of unexplained power losses, these have generally involved helicopter types other than the Bell JetRanger, where the engine installation was significantly different. Research by the manufacturer indicated that many unexplained power losses had probably been related to fuel system performance. The pneumatic fuel control system was susceptible to any air leaks. Damage to fittings during servicing, imperfect seals, pin-hole or hair-line cracks, a malfunctioning primary filter by-pass switch or fuel contamination were all possibilities. However, there was no evidence of any of these problems on ZK-HRC.

3 Findings

Findings are listed in order of development and not in order of priority.

3.1 The pilot was appropriately licensed, familiar with the aircraft and area, and fit to conduct the flight.

3.2 The helicopter was suitable for the operation, had a valid Certificate of Airworthiness, and was recorded as being serviceable at the time of the accident.

3.3 The helicopter was operating satisfactorily up until the time of the power loss.

3.4 The pilot's actions following the power loss were appropriate and prevented any serious injury to the occupants.

3.5 Post-accident inspection and tests disclosed no conclusive reason for the power loss.

Approved for publication 26 May 2003

Hon W P Jeffries
Chief Commissioner

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