



**Report 97-001**

**Hughes 369D**

**ZK-HQA**

**loss of engine power in flight**

**20 nm south-east of Taupo**

**2 January 1997**

### **Abstract**

On Thursday 2 January 1997, at approximately 1520 hours, the pilot was flying three hunters and a dog in ZK-HQA from Poronui to a hut in the Kaimanawa Ranges. Some five minutes after departure, while the helicopter was in a cruise-climb at about 3400 feet, the engine suddenly lost power. During the subsequent auto rotational landing two of the hunters were injured and the helicopter was substantially damaged. No conclusive reason was found to account for the unexpected loss of power.

# Transport Accident Investigation Commission

## Aviation Accident Report 97-001

<b>Aircraft type and registration:</b>	Hughes 369D, 1280392D ZK-HQA
<b>Number and type of engines:</b>	One Allison 250-C20B
<b>Year of manufacture:</b>	1978
<b>Date and time:</b>	2 January 1997, 1520 hours <sup>1</sup>
<b>Location:</b>	Approximately 20 nm SE of Taupo Latitude: 39° 02.5' S Longitude: 176° 13.4' E
<b>Type of flight:</b>	Air Transport (charter for hunters)
<b>Persons on board:</b>	Crew: 1 Passengers: 3
<b>Injuries:</b>	Crew: nil Passengers: 2 serious, 1 nil
<b>Nature of damage:</b>	Substantial
<b>Pilot-in-Command's Licence:</b>	Commercial Pilot Licence (Helicopter) Private Pilot Licence (Aeroplane)
<b>Pilot in-Command's age:</b>	22
<b>Pilot-in-Command's total flying experience:</b>	310 hours 85 hours on type
<b>Investigator-in-Charge:</b>	A J Buckingham/D G Graham

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<sup>1</sup> All times in this report are in NZDT (UTC + 13 hours)

## 1. Factual Information

- 1.1 On the afternoon of Thursday, 2 January 1997, the pilot of Hughes 369D, ZK-HQA, made an uneventful flight transporting two members of a rafting group from the Rangitikei River to his base at Poronui Station. After unloading he refuelled the helicopter to provide a total fuel quantity on board of 250 pounds. He then conducted a fuel drain check. He said the samples were “clear and bright with no evidence of water or other contamination”.
- 1.2 The next flight was to transport three hunters, a dog, and their equipment from Poronui to Waipakahi Hut in the Kaimanawa Ranges about 20 nm to the south-west. The pilot briefed the three men on the safety aspects of the helicopter, loaded their gear into the back, and ensured that one hunter and the dog were suitably secured in the rear compartment. One of the hunters occupied the middle front seat and the other the right front seat. The right door was installed but in the prevailing warm (20° C) conditions the pilot had removed the left door.
- 1.3 ZK-HQA departed from Poronui (altitude 2200 feet) at about 1515 hours. The pilot lifted off on a northerly heading into the 8 to 10 knot wind, and gained height before making a 180° turn and entering a steady climb to the south. The helicopter passed over the Kaipo Saddle at about 1518 hours.
- 1.4 Some two minutes later, while in a cruise climb at an indicated airspeed of 95 to 100 knots, the engine power out warning ‘beeps’ sounded, and there was a marked yaw to the left. The pilot estimated that the helicopter was 900 to 1000 feet above the dense beech forest slope at this time. Looking down through the open doorway he noted a small gap in the trees. He immediately lowered collective and spiralled the helicopter vertically, down towards the gap which was the only clearing in the vicinity.
- 1.5 The pilot recalled checking, during the descent, that the rotor revolutions per minute (r.p.m.) was at the top of the green and noticing that the engine and rotor r.p.m. needles had split showing that the helicopter was in autorotation. As the helicopter entered the gap in the trees he raised collective fully to cushion the landing. The helicopter struck the ground heavily but remained upright although tilted nose up and to the right. The main rotor blades were destroyed by contact with the trees but the rotor head was still rotating after the helicopter had come to rest. The engine continued to run, probably at flight idle power in the pilot’s estimation, until he pulled the fuel shut-off knob.
- 1.6 The pilot, the rear passenger, and the dog were uninjured. The hunter in the right front seat received a head injury, and an injury to his thigh as a result of a tree stump penetrating the right door. The passenger in the middle front portion sustained fractured ribs and an eye injury.
- 1.7 After administering appropriate first aid the pilot and passengers unloaded ZK-HQA and prepared for a rescue. The pilot confirmed that the emergency location transmitter had activated and switched it from AUTO to ON. He set the transponder to code 7700 and turned it ON. He also attempted to transmit on emergency frequency 121.5 megahertz. He and the uninjured hunter built a signal fire but did not light it until they heard the rescue helicopter arrive in the area some two hours after the accident.

- 1.8 ZK-HQA was examined on site the next day. The lower end of the engine had contacted the ground resulting in a broken high tension lead at the igniter plug connection but the engine appeared otherwise intact. All of the mechanical controls to the engine operated normally. The throttle was wide open and the throttle friction tight. The power turbine r.p.m. beep switch functioned satisfactorily. (The “as found” position of the actuator was at the bottom end of the operating range. No conclusive reason was found to explain the actuator position. The pilot was certain that he had not ‘beeped down’ the power turbine governor to a low setting in flight.) The auto relight functioned when tested and the start pump operated satisfactorily. All “B” nut connections were tight. There was ample fuel on board, and samples were free from contamination.
- 1.9 The helicopter was lifted out and transported to an approved helicopter maintenance facility. The engine was removed and inspected (as far as practicable) in accordance with a post-accident test schedule supplied by the engine manufacturer. The compressor rotated without restriction after the removal of a small piece of ingested bark and both the gas producer turbine and the power turbine rotated freely. There was no significant debris on the magnetic chip plugs. The combustor showed no unusual indication and the fuel nozzle operated satisfactorily when flow tested. The fuel system plumbing and components showed no evidence of any defect. Pressure testing disclosed no leakage in any of the connections or pneumatic lines associated with the operation of the fuel control unit, power turbine governor, fuel pump and filter assembly or other external components of the engine and its power control system. It was found impracticable however to carry out specific vacuum checks of the fuel control system.
- 1.10 The fuel control unit and power turbine governor were inspected by the engine manufacturer in the United States. Rig testing and specialist examination showed that the units met overhaul limits. The aircraft manufacturer advised that analysis of their accident database covering the long service history of the Hughes 369D disclosed no reported instance of ‘uncommanded’ governor actuator operation.
- 1.11 The engine was subsequently disassembled at an approved New Zealand overhaul agency. Inspection of the separated modules disclosed no defects or abnormalities which might have contributed to a sudden loss of engine power.
- 1.12 ZK-HQA was imported from the United States and first operated in New Zealand in July 1995. At importation the airframe had a total time of 3692.7 hours. Allison 250 C20B engine serial number CAE 832111 had a recorded total time since new (TTSN) of 2113.7 hours.
- 1.13 Subsequent maintenance had included regular 100 hour and 300 hour checks, component changes, and defect rectification as required. At the time of the accident the engine had accumulated a TTSN of 2808.45 hours.
- 1.14 The engine had been removed from ZK-HQA in early December 1996 and sent to an approved overhaul facility due to erratic torquemeter and high inter turbine temperature indications. Repair had involved rectification of a combustion case airleak and an oil leak in the gearbox front case. After re-installation, an engine test run and a subsequent test flight were conducted satisfactorily.
- 1.15 The most recent maintenance on the airframe and engine comprised a 100 hour inspection carried out on 23 December 1996. The aircraft had flown a further 11.1 hours, with no reported defect or malfunction up to the time of the sudden in-flight loss of power on 2 January 1997.

- 1.16 The engine installation in the Hughes 369 series has been proven over many years, and the helicopter has been used with marked success in military and civilian roles world-wide. Some isolated instances have occurred, however, of in-flight power loss similar to the sequence of events involving ZK-HQA. Research has indicated that, in the absence of conclusive evidence to explain these occurrences, the problems experienced have probably been related to fuel system performance.
- 1.17 The pneumatic fuel control system is susceptible to any air leaks. Leakage sources identified in previous occurrences have included imperfect seals, pin-hole or hair-line cracks or slightly loose connections. In the occurrence involving ZK-HQA, however, no obvious defect of this nature was found.
- 1.18 Operational and maintenance guidelines produced by the engine manufacturer provide a summary to assist operators in preventing the possible occurrence of flame-out or unexpected power loss, and improving overall fuel system reliability. Among other important information, emphasis is placed on the precautions to be observed to avoid the possibility of air leakage in the fuel system.

## **2. Analysis**

- 2.1 No conclusive reason was found to account for the unexpected power loss. The helicopter had operated satisfactorily earlier in the day. There was ample fuel on board and samples taken showed no indication of contamination of any kind. The helicopter was climbing steadily, in a normal cruise-climb attitude and configuration and had reached an altitude of about 3400 feet when the loss of power occurred. Although weather conditions were warm, resulting in the pilot flying ZK-HQA with the left door removed, ambient temperature and pressure should not have had any effect on engine operation.
- 2.2 The left yaw, and activation of the engine power out warning system, was consistent with a substantial reduction in engine power. The pilot acted promptly in lowering collective and carrying out an auto-rotational landing into the only available clearing. Inevitable damage was sustained by the helicopter due to the descent through the trees but serious injury was confined to two of the four persons on board.
- 2.3 The engine of ZK-HQA continued to run after the helicopter came to rest. The engine had not flamed out, or if a flame-out had occurred the auto-reignition had functioned as intended and ensured a relight. The level of power available was not established but the pilot had the impression that the engine was operating at a low power setting. If this was the case it supported the probability that the fuel control system, for reasons undetermined, had scheduled a reduced fuel flow to the engine. The significance of the “as found” position of the power turbine governor actuator, at the bottom end of the operating range, was not established.
- 2.4 While post-accident tests on the engine of ZK-HQA disclosed no obvious defect in the fuel control system, or leakage under air pressure, it was not practicable to conduct specific and detailed vacuum checks, or to reproduce precisely the operating conditions of the engine at the time of the in-flight occurrence.
- 2.5 The manufacturer’s research involving previous similar unexplained occurrences, suggested that the most likely cause of a sudden reduction in power was a transient or sustained air leak in the fuel control system, or the fuel system itself.

### **3. Findings**

- 3.1 The pilot was appropriately licensed and rated to fly ZK-HQA.
- 3.2 The helicopter had a valid certificate of Airworthiness and Maintenance Release.
- 3.3 The helicopter had operated satisfactorily during earlier flights.
- 3.4 There was adequate fuel on board.
- 3.5 The operating weight of the helicopter was within the prescribed limits.
- 3.6 The sudden loss of engine power during cruise climb after departure necessitated a steep auto-rotational descent into a small clearing.
- 3.7 Post-accident examination and tests carried out on the engine and its components disclosed no conclusive reason to account for the sudden power loss.

18 August 1997

Hon. W P Jeffries  
**Chief Commissioner**