CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

# AIRCRAFT ACCIDENT REPORT

# OCCURRENCE NUMBER 02/71

# ROBINSON R22 BETA

# ZK-HEZ

# BALFOUR RANGE, NEAR FOX GLACIER

# 14 JANUARY 2002

**Glossary of abbreviations used in this report:**

| | |
|---|---|
| amsl | above mean sea level |
| C | Celsius |
| CAA | Civil Aviation Authority |
| E | east |
| ELT | emergency locator transmitter |
| ft | foot or feet |
| hPa | hectopascals |
| km | kilometre(s) |
| m | metre(s) |
| MHz | megahertz |
| nm | nautical miles |
| NZDT | New Zealand Daylight Time |
| rpm | revolutions per minute |
| UTC | Coordinated Universal Time |
| VHF | very high frequency |

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# AIRCRAFT ACCIDENT REPORT

## OCCURRENCE No. 02/71

| | |
|---|---|
| **Aircraft type, serial number and registration:** | Robinson R22 Beta, 0539, ZK-HEZ |
| **Number and type of engines:** | One Lycoming O320-B2C |
| **Year of manufacture:** | 1986 |
| **Date and time:** | 14 January 2002, 1100 hours* (approx) |
| **Location:** | Balfour Range, 9 km south of Fox Glacier,<br>Latitude: S 43° 33.5'<br>Longitude: E 170° 01.2' |
| **Type of flight:** | Private (hunting) |
| **Persons on board:** | Crew: 2 |
| **Injuries:** | Crew: 2 fatal |
| **Nature of damage:** | Aircraft destroyed |
| **Pilot-in-command's licence** | Commercial Pilot Licence (Helicopter) |
| **Pilot-in-command's age** | 33 years |
| **Pilot-in-command's total flying experience:** | 2000 hours approximately, most on type |
| **Information sources:** | Civil Aviation Authority field investigation |
| **Investigator in Charge:** | Mr S J Walker |

* Times are NZDT (UTC + 13 hours)

## Synopsis

The Civil Aviation Authority was notified of the accident at 1430 hours on Monday 14 January 2002. The Transport Accident Investigation Commission was also notified but declined to investigate. A CAA field investigation was commenced next day.

The pilot and shooter were on a hunting flight in mountainous terrain near Fox Glacier, having already delivered one load of deer to their ground crewman. When the helicopter did not return by the expected time, the crewman raised the alarm. A subsequent aerial search located the helicopter wreckage in the Balfour Range area; both occupants had died in the accident.

## 1. Factual information

### 1.1 History of the flight

1.1.1 At approximately 0530 hours on 14 January 2002, the pilot and his shooter took off in ZK-HEZ from the pilot's property at Paringa. Their intention was to hunt deer in the Mahitahi and Cook Rivers area.

1.1.2 Meanwhile, a ground crewman drove to the Highway 6 bridge over the Cook River to rendezvous with the helicopter, clean the deer carcasses and deliver them to a chiller located nearby.

1.1.3 At approximately 0930 hours the pilot arrived alone at the Cook River Bridge with an underslung load of deer. After dropping the load off and landing the crewman refuelled the helicopter with approximately 20 litres of fuel. The crewman recalled that the pilot said they had not shot any more animals at that time, and left at approximately 1000 hours to continue hunting.

1.1.4 The crewman cleaned up the deer and awaited the return of the helicopter, which he expected within about half an hour.

1.1.5 When the pilot had not returned by 1215 hours, the crewman became concerned and made contact with a workmate, who telephoned the Police. The Rescue Coordination Centre was notified a short time later, and an aerial search, eventually involving four helicopters, was organised.

1.1.6 The wreckage of a Robinson R22 was located at about 1600 hours; the helicopter registration was confirmed as ZK-HEZ and that both occupants were dead.

1.1.7 The accident occurred in daylight, at approximately 1100 hours NZDT, on the northern side of the Balfour Range, 9 km south of Fox Glacier, at an elevation of approximately 4500 feet. Grid reference 260-H36-693347, latitude S 43° 33.5', longitude E 170° 01.2'.

## 1.2 Injuries to persons

| *Injuries* | *Crew* | *Passengers* | *Other* |
|---|---|---|---|
| Fatal | 2 | 0 | 0 |
| Serious | 0 | 0 | 0 |
| Minor/None | 0 | 0 | |

## 1.3 Damage to aircraft

1.3.1 The helicopter was destroyed by impact forces.

## 1.4 Other damage

1.5 Nil.

## 1.5 Personnel information

1.5.1 The pilot held a Commercial Pilot Licence (Helicopter) and a Class 1 medical certificate valid until 12 July 2002.

1.5.2 The pilot's logbook could not be located, so an accurate record of his total flight time was not available. However, at his last medical examination on 1 June 2001, he stated on the medical report form that he had flown a total of 1850 hours, with 200 of those in the preceding six months.

1.5.3 The pilot had been a partial paraplegic since being involved in a helicopter accident in September 1997. His Class 1 medical certificate contained an exemption due to his physical disability, and was subject to a number of specific restrictions which included, in summary:

- Restricted to helicopters only; the helicopter to have approved pedal modifications;
- Restricted to Robinson R22 helicopters only, but permitted to undertake dual or solo training in other types;
- Required to wear right leg knee-ankle-foot orthesis (essentially a leg brace) and left ankle-foot orthesis with full leg coverings.

1.5.4 The pilot was wearing the ortheses and full leg coverings at the time of the accident, and the helicopter had the appropriate pedal modifications installed. There was no evidence to suggest that the pilot's disability contributed to the accident.

## 1.6 Aircraft information

1.6.1 Robinson R22 Beta helicopter serial number 0539 was manufactured in January 1986 and had accrued a total of 1278.7 hours up to the last maintenance logbook

entry on 27 December 2001. It was first registered in New Zealand on 17 May 1996 and had been issued with a non-terminating airworthiness certificate.

1.6.2 The last scheduled maintenance was a 100-hourly inspection carried out on 27 December 2001. An annual review of airworthiness was completed on 26 July 2001.

1.6.3 Lycoming O-320-B2C engine serial number L-14780-39A was installed in ZK-HEZ on 23 August 2001. The most recent maintenance inspection was a 100-hourly, also performed on 27 December 2001, and it had accrued 286.6 hours since overhaul.

1.6.4 Fuel used was 100/130 avgas, which had been drawn from the main supply at Haast the previous day. The pilot had briefed his crewmen on the precautions to be taken to avoid and detect fuel contamination. He had installed a larger approved airframe fuel filter to the helicopter as he had experienced a previous accident due to contamination of the fuel system with deer hair.

1.6.5 The actual weight of the helicopter at the time of the accident was estimated by taking the empty weight of the machine plus the combined weights of the pilot and the shooter. This left a margin below maximum all-up weight (1370 pounds) of only 81 pounds for fuel, equipment including firearms and ammunition, and any external load. Adding a nominal one hour's fuel (35 litres/55 pounds) reduces this margin to 26 pounds.

1.6.6 It was reported by an experienced helicopter shooter that pilot had mentioned to him that he was frustrated by the poor performance of ZK-HEZ when compared with other helicopters of the same type that the pilot had flown. The shooter had experienced this poor performance first-hand when he accompanied the pilot on previous hunting sorties.

## 1.7 Meteorological information

1.7.1 On the morning of 14 January 2002, a complex area of low pressure lay to the west of New Zealand, with another low centred to the east of the South Island.

1.7.2 The forecast wind profile for Hokitika (some 68 nm to the north of the accident site) was: 3000 ft 065 degrees 18 knots; 5000 045/16; 7000 020/16; 9000 005/18. For the West Coast area, no significant weather was forecast, apart from scattered cumulus and stratocumulus cloud, base 3000 and tops to 6-7000 feet.

1.7.3 The 1100 METAR[1] for Hokitika indicated: calm, visibility 70 km, cloud "few" (1-2 oktas[2]) and "scattered" (3-4 oktas), temperature 20 (°C), dewpoint 10, QNH 998 hPa.

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[1] Aviation routine weather report

[2] Eighths of sky cover

1.7.4 According to a report by a local operator, the prevailing easterly flow was undercut by a sea breeze around midday; this resulted in the formation of cloud in some of the valleys, hampering the search effort.

**1.8 Aids to navigation**

1.9 Not applicable.

**1.9 Communications**

1.9.1 The helicopter was fitted with a VHF radio and transponder, but no relevant transmissions from ZK-HEZ were heard by other operators during the morning.

**1.10 Aerodrome information**

1.11 Not applicable.

**1.12 Flight recorders**

1.13 Not applicable.

**1.12 Wreckage and impact information**

1.12.1 The unsettled weather soon after the accident prevented access to the accident site, however a picture of the site was constructed using police photographs together with information provided by police and rescue personnel.

1.12.2 The wreckage was found in a very steep sided gully at about 4500 ft amsl, on the northern side of the westerly end of the Balfour Range, about 1.5 km due south of Saddle Lake.

1.12.3 All of the wreckage was recovered from the site with the exception of most of one tail rotor blade and the tail rotor driveshaft.

1.12.4 The initial ground impact point appeared to be a main rotor ground strike a few metres below the ridgeline on its northern side. This main rotor strike was seen as disturbed tussock grass in a small depression described as just big enough for a small helicopter.

1.12.5 It would have been necessary for the helicopter to climb out of this depression to have made the second heavier main rotor strike mark, about 10m beyond and slightly below the first strike mark at the top of the gully and at the start of the wreckage trail.

1.12.6 The main impact point was approximately 150 m below the ridgeline on a small rocky step within the confines of the gully, some 5 to 10 metres above where the helicopter eventually came to rest. The shooter's body was recovered from a point adjacent to this rocky step. Either side of the main impact point there were marks present in the ground, and the tussock grass had been disturbed. The distance across the gully between the marks equates roughly to the diameter of the main rotor.

1.12.7 The main portion of the helicopter, had come to rest in the bed of the gully after bouncing and rolling from the main impact point. This consisted of the centre fuselage with engine, main rotor transmission, main rotor head and blades still attached, cockpit area and forward section of the tail boom. The cockpit had been substantially destroyed with the cockpit floor area having broken from the rear bulkhead and rotated about its rear attachment to come to rest at position underneath the centre fuselage.

1.12.8 The main rotor blades were still attached to the main rotor hub. It appears that bending consistent with coning had occurred to one blade however the other blade had been broken in the opposite direction. The outermost section of one main rotor blade had been deflected backwards in relation to the direction of rotation, consistent with a significant ground strike.

1.12.9 The forward section of the tail boom was severed from its attachment casting but remained with the main portion of the wreckage connected by the tail rotor control input rod. A significant indentation in the forward section of the tail boom indicated that it had been struck and severed from the fuselage by the main rotor during the accident sequence. The strike mark on the tail boom indicated a strike from directly above, relative to the tail boom.

1.12.10 The initial pieces of the wreckage trail, comprising some wires and the engine air filter, were on the northern side of the ridge at the top of the gully close to the second main rotor strike.

1.12.11 Two aftermost sections of the tail boom were found close together a short distance further down the gully. Their riveted seams showed signs of failure in shear consistent with a significant lateral force such as a main rotor strike to the tail boom. To one side of these tail boom sections was found the tail rotor driveshaft.

1.12.12 The tail boom midsection was found 10 metres below the two aft sections. It had been split along its length by the application of a considerable force.

1.12.13 The ammunition box, which was carried in the cockpit between the shooters feet, was found another 10 metres further down the gully, along with the strops and karabiners used to sling the deer underneath the helicopter. These items were probably ejected from the cockpit, indicating that the helicopter was probably being subjected to significant rotational imbalance and vibrations resulting from the loss of the tail rotor and damage to the main rotor.

1.12.14 A shotgun was found close to the ammunition box and tail boom. Its barrel was embedded in the ground. The safety catch was applied; it had a full magazine and a cartridge in the chamber. This indicates that the pilot and shooter were probably not in pursuit of a deer at the time of the accident.

1.12.15 The tail rotor gearbox, with one blade attached, was found further down the wreckage trail near the main wreckage. The tail rotor gearbox attachment casting exhibited overload failure consistent with the gearbox being forcibly severed from its tail boom attachment probably by the force of the main rotor blade strike. There did not appear to be any indication that the tail rotor blade that was

recovered had suffered a ground strike. This was also confirmed by the lack of damage to the bottom of the vertical stabiliser. Its attachment casting had failed in overload probably by the forces applied by the main rotor severing the tail boom.

1.12.16 Examination of the flight control system as far as possible indicated pre-impact integrity.

1.12.17 Damage to one side of the engine-cooling fan indicated that engine appeared not to have been producing high power at the time of the final impact.

1.12.18 Instrument and bulb examination and analysis did not provide any useful information.

1.12.19 The engine fuel system was sufficiently damaged to afford no useful information.

1.12.20 There was no suitable area close to the accident site where an emergency landing could have been made safely. However it was observed that the terrain to the north-west of the first main rotor strike could have provided a safe escape route should mechanical problems have occurred.

**1.13 Medical and pathological information**

1.13.1 Post mortem examination of the occupants concluded that death in both cases was due to multiple injuries.

1.13.2 Toxicological tests of the pilot disclosed no evidence of alcohol, or medicinal or recreational drugs.

**1.14 Fire**

1.14.1 Fire did not occur.

**1.15 Survival aspects**

1.15.1 The accident was not survivable due to the forces involved. Combination lap and shoulder harness restrained the pilot, but the shooter's harness was found, at the accident site, to be unbuckled. This indicated that he may have either jumped or been ejected from the helicopter. It was reported that use of the harness was not normally overlooked when the shooter boarded the helicopter.

1.15.2 The cockpit design and construction meant that there was little protection afforded to the occupants in the event of an accident. Any significant impact in this type of helicopter usually results in the destruction of the cockpit area with consequential effects on the occupants.

1.15.3 The pilot was wearing a protective helmet and post-mortem examination found that he had sustained no head injury.

1.15.4 The helicopter was fitted with a Pointer ELT, which operated on impact. An ELT signal on both 121.5 and 243 MHz was detected by satellite at 1148 hours and the resulting position obtained was subsequently found to be within 4 nm of the

accident location. The ELT signal was also received by searching helicopters and by an airliner en route Sydney – Christchurch.

### 1.16 Tests and research

1.16.1 The engine was removed from the wreckage, installed in a test rig and a test run was performed. The engine was started and operated over its full rpm range, and was able to deliver and sustain full power as required. The only anomaly experienced was a magneto drop due to a defective ignition lead. The damage to the lead was consistent with accident damage.

1.16.2 The sprag clutch was dismantled and inspected to determine serviceability. No anomalies were found.

1.16.3 Though the tail rotor driveshaft was not recovered from the accident site, the parts of the drive shaft couplings still attached to the sprag clutch shaft output flange and the tail rotor gearbox input flange were inspected and found to have failed in overload, probably when the tail boom was severed by the main rotor.

### 1.17 Organisational and management information

1.17.1 Not applicable.

### 1.18 Additional information.

1.18.1 The pilot was experienced with this type of helicopter and had suffered two serious accidents. The most recent occurred in April 2001 as a result of an engine failure caused by deer hair blocking the carburettor jets. The accident in which the pilot suffered his physical disability occurred in September 1997, and was caused by a tail rotor driveshaft failure.

1.18.2 The pilot had briefed his shooters that they should jettison their weapon if they should lose power. This was a precaution resulting from his 1997 accident in which the shooter suffered serious injury from being struck by the weapon.

1.18.3 Another precautionary measure adopted by the pilot was that the shooter should be prepared to jump clear of the helicopter should a power loss occur in flight.

1.18.4 The ground crewman reported that normal deer hunting operations were flown up to 2000 ft. The flight up to 4500 ft coincided with the pilot's intention to commence hunting chamois. The first of these chamois hunting flights occurred on the day before the accident. The ground crewman acted as the shooter for this flight. He was aware that the pilot had rarely hunted at this altitude.

1.18.5 Reference to the performance section of the Robinson R22 flight manual, specifically the OGE (out-of-ground-effect) versus gross weight hover performance graph, shows that the pilot did not have OGE hover capability at his disposal. Instead, he would have had to maintain airspeed in the range above the onset of translational lift, or if slower flight was required, he would be obliged to descend to maintain rotor rpm. This would have limited his manoeuvring

capability particularly whilst in pursuit of a deer, flying slowly in cloud or when the shooter was getting in, or out, of the helicopter.

### 1.19 Useful or effective investigation techniques

1.19.1 Nil

## 2. Analysis

2.1 There was no evidence to suggest that the engine was not running at the time of the accident. It was confirmed by post-accident testing that the engine was mechanically sound and capable of normal operation.

2.2 Had there been an engine failure, possible causes include fuel exhaustion/starvation and carburettor icing. However, the pilot was known to be particular about fuel matters, therefore fuel problems would be less likely.

2.3 The rotor strike marks on the ground were indicative of high rotor energy at the time, that is, the main rotor was probably at or close to its normal operating rpm, with or without power applied. Possible reasons for the ground strikes include, but are not limited to:

- An attempted autorotational landing following an engine failure or power loss, using the gully either as a possible landing site or an escape route to lower terrain;
- Misjudgement of the clearance of the helicopter from the terrain while manoeuvring;
- Use of the gully as an escape route, performance demands having exceeded the performance available.

2.4 During hunting operations, the helicopter is necessarily flown close to the ground, particularly when the weapon used is a shotgun. However, the pilot had considerable experience in this role, and is unlikely to have made a basic manoeuvring error of this nature.

2.5 The helicopter was being operated in adverse conditions: a combination of low atmospheric pressure, higher than standard temperature, and on the lee side of the main divide in terrain conducive to local wind effects. The estimated density altitude at 4500 feet elevation in the area of operations was about 5500 feet.

2.6 With an all-up weight range that could have approached the maximum permitted, performance available would have been, at best, marginal. The pilot would have been limited in the type of manoeuvre he could perform; he certainly would not have been able to hover out of ground effect, and the choice of landing site that would have afforded in-ground-effect performance was extremely limited.

2.7 To avoid overpitching and consequent loss of rotor rpm, the pilot would have had to maintain a forward airspeed above the onset of translational lift, and if such a

loss occurred, the required recovery action was to lower the collective pitch lever and accept a descent. The descent would have to be made clear of terrain, and the gully in which the helicopter ultimately crashed could have been a suitable "escape route" in this type of situation.

2.8 Thus, out of the possibilities discussed, no conclusive reason for the accident could be discerned, but the possibility of a performance-related mishap appears to be the most likely.

2.9 No specific safety recommendations were made as a result of this investigation.

## 3. Conclusions

3.1 The pilot was appropriately licensed and rated for the flight being conducted.

3.2 The aircraft was generally airworthy and properly maintained in accordance with the rules currently in force.

3.3 There was no evidence to suggest that a mechanical malfunction of the aircraft contributed to the accident, but this possibility could not be eliminated.

3.4 No determination regarding engine operation at the time of the accident could be made, although the possibility of an engine power loss could not be completely ruled out.

3.5 The helicopter was being operated in conditions that left little or no performance margin available to the pilot.

3.6 Although no definite cause for the accident could be established, the lack of available performance was considered to be the most likely initiating factor.

(Signed)

Steve Walker
Safety Investigator

(Signed)

Richard White
Manger Safety Investigation
14 August 2002