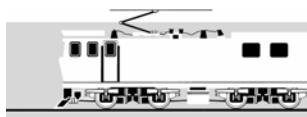
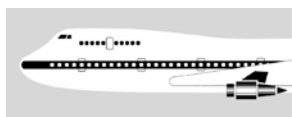


AVIATION OCCURRENCE REPORT

06-004

Robinson R44 *Raven II*, ZK-HUC, wire strike, Motukutuku Point, near Punakaiki, Westland

9 November 2006



**TRANSPORT ACCIDENT INVESTIGATION COMMISSION
NEW ZEALAND**

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.

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Report 06-004

**Robinson R44 *Raven II*
ZK-HUC**

wire strike

**Motukutuku Point, near Punakaiki
Westland**

9 November 2006

Abstract

On Thursday 9 November 2006, ZK-HUC, a Robinson R44 helicopter carrying 3 police officers and the pilot, collided with an electricity transmission line during a coastal search. The helicopter incurred minor damage and the pilot landed immediately. He subsequently twice shifted the helicopter to avoid sea damage and to facilitate the recovery of the helicopter. The pilot received a serious injury but none of the passengers was injured.

The flight was a permissible low-level operation conducted at an appropriate speed and height, but the pilot had not clearly briefed his passengers on the possible hazards at low level, nor had he conducted any form of reconnaissance prior to the low-level part of the flight.

Safety recommendations were made to the Director of Civil Aviation regarding the briefing of passengers on commercial transport operations and the responsibilities of pilots following an aircraft accident. The Director of Civil Aviation was also recommended to facilitate the provision of electricity network infrastructure information to aid pilot situational awareness, and to publicise the details of any agreed service.



Photograph courtesy NZ Police

Robinson R44 helicopter, ZH-HUC, following the accident

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Abbreviations

ACNZ	Airways Corporation of New Zealand
agl	above ground level
AOC	air operator certificate
ATO	air transport operation
CAA	Civil Aviation Authority
CAR	Civil Aviation Rule
CEO	Chief Executive Office
CTO	commercial transport operation
EEA	Electricity Engineers' Association
ENA	Electricity Networks Association
ft	feet
GPS	global positioning system
km	kilometre(s)
m	metre(s)
mm	millimetre(s)
NPRM	Notice of Proposed Rule Making
UTC	coordinated universal time
VFR	visual flight rules

Data Summary

Aircraft registration:	ZK-HUC
Type and serial number:	Robinson R44 <i>Raven II</i> , 10655
Number and type of engines:	one Textron Lycoming IO-540-AE1A5 reciprocating engine
Year of manufacture:	2005
Operator:	Sutton's Moss Limited, trading as Scenicland Helicopters
Date and time:	9 November 2006, 1356 ¹
Location:	Motukutuku Point, 6 kilometres north of Punakaiki, Westland latitude: 42° 03.7' south longitude: 171° 21.7' east
Type of flight:	commercial transport operation
Persons on board:	crew: one passengers: 3
Injuries:	crew: one serious passengers: 3 nil
Nature of damage:	minor
Pilot's licence:	Commercial Pilot Licence (Helicopter)
Pilot's age:	30
Pilot's total flying experience:	1694 hours, with 540 hours on type
Investigator-in-charge:	P R Williams

¹ Times in this report are New Zealand Daylight Time (UTC+13 hours) and are expressed in the 24-hour mode.

1 Factual Information

1.1 History of the flight

- 1.1.1 At about 0830 on Thursday 9 November 2006, the pilot began private under-slung moss recovery operations for the operator's family business in ZK-HUC, a Robinson R44 *Raven II* helicopter. After about one hour, he returned to his base near Greymouth to prepare for a police search task that had been discussed some days previously and confirmed that morning. The pilot's preparation included cleaning the helicopter's windscreen and windows.
- 1.1.2 The operator held an air operator certificate (AOC) permitting commercial flights, but the pilot said he had limited experience of air operations and had not flown a police task before.
- 1.1.3 At about 1300, 3 police officers arrived at the operator's base and briefed the pilot on their plan to search the coast north from near Punakaiki, between the water and just above the high-water mark. The exact length of coast to be searched was not specified, but the flight was estimated to take about 60 to 90 minutes. The pilot obtained weather and other planning information appropriate for the visual flight rules² (VFR) flight.
- 1.1.4 The pilot said that he gave the officers, 2 of whom had experience of helicopter search operations, a comprehensive safety brief for the R44. The pilot could not recall whether he briefed the officers about wire hazards but said he did once airborne, when he had asked them to tell him if they saw any wires. Two officers recalled that the pilot had acknowledged over the intercom seeing wires while they were at low level.
- 1.1.5 At about 1320, ZK-HUC departed with the pilot flying from the front right seat. Each person had a headset with a voice-activated microphone for talking on intercom and at least one of the officers had binoculars.
- 1.1.6 The pilot flew at about 1000 feet (ft) (304 metres (m)) above ground level (agl) to the search area and descended directly to low level for the search. He said that he thought a reconnaissance of the search area before descending to low level was not practical because the search area had been indefinite, but his experience with moss recovery had taught him to be alert for wires and hazards.
- 1.1.7 The pilot said that the search was mostly conducted at a very low "hover-taxi" speed at a height of about 50 m agl, but went as low as 3 m when hovering near something of interest. All the low flying was conducted over beaches or the sea. On several occasions, the pilot confirmed with the officers that the height, speed and general operation suited their purpose.
- 1.1.8 Electricity transmission lines and telephone lines shared the narrow coastal strip with the only road in the area. The transmission lines, in the direction of flight, were usually on the hill side of the road and for the most part closely followed it (see Figure 1). In the vicinity of Meybille Bay, less than 2 kilometres (km) south of the accident site, the electricity network providers changed and there was an area with no lines. The company that operated the northern network advised that all of its lines were above ground and the only place that it knew of in the southern network where the lines were not above ground was where they went beneath a creek.
- 1.1.9 The pilot said that he kept the lines in sight for most of the low-level flight, but sometimes the power and telephone lines went underground, although he could not remember where. One officer said that early in the search the pilot was obviously aware of lines, but the officer felt that they had come too close to wires at one point.

² The rules prescribed, among other requirements, the minimum flight visibility and distance from cloud, minimum heights and required aircraft equipment.

- 1.1.10 One or 2 bays before Motukutuku Point, the officers saw an item of possible interest, but no attempt was made to retrieve it because of nearby wires. The pilot said that the discovery did not cause him to start searching too, but he thought it focused the officers on the search.

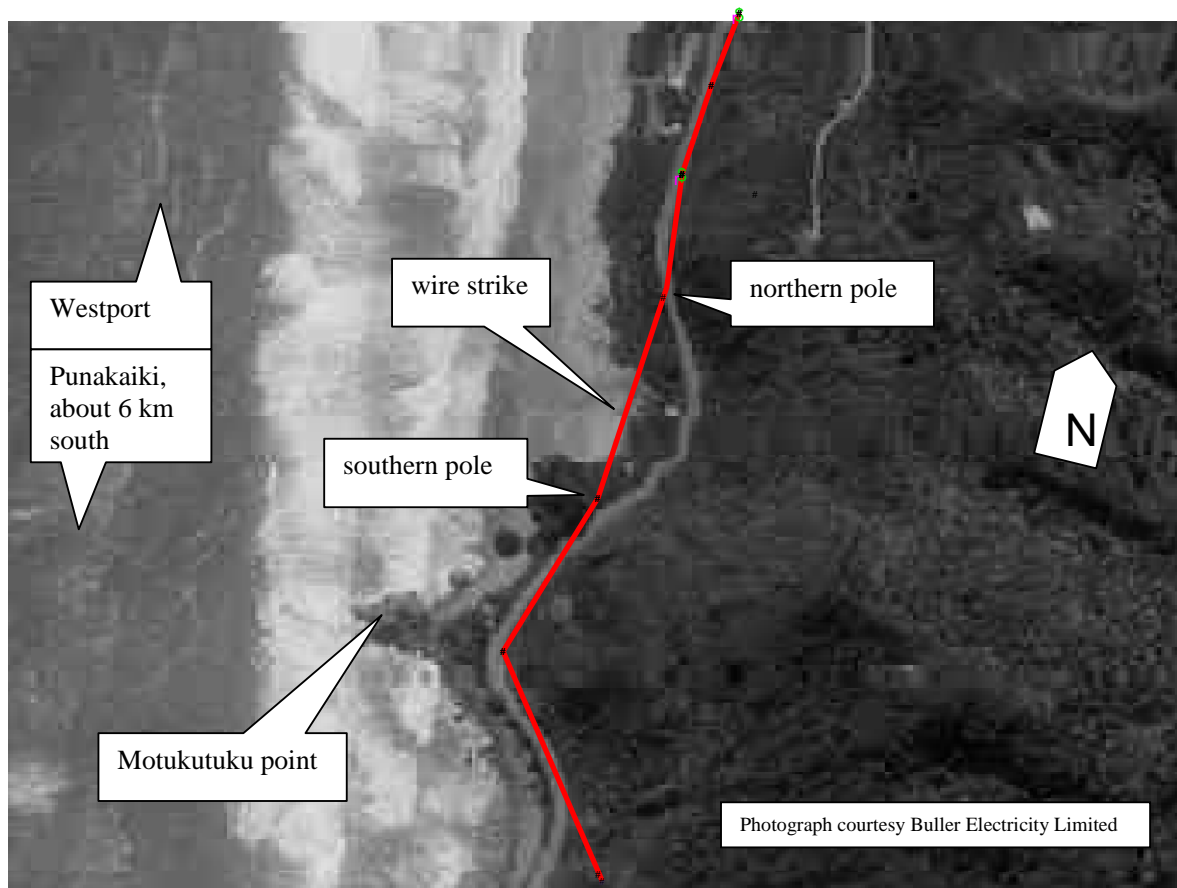


Figure 1
Aerial view of the accident site

- 1.1.11 At about 1356, after flying around Motukutuku Point, the pilot turned slightly to the right towards a small beach and creek. They were flying over the beach when there was a sudden “bang” and some windscreens shattered. The pilot immediately felt winded, but kept control and brought the helicopter to a high hover. He did not detect any unusual vibration.
- 1.1.12 The pilot landed ZK-HUC normally on the beach nearby. The officers disembarked and, after he had shut down the engine, the pilot also got out. They saw wires on the beach, leading to a pole near the headland, but none of them had seen any poles or wires immediately before the impact.
- 1.1.13 There was no fire and the helicopter emergency locator beacon did not activate.
- 1.1.14 Apart from the broken windscreens, the pilot found what he considered to be minor scraping on the underside of a main rotor blade. He used a satellite phone carried in the helicopter to report the accident to his base and to the Greymouth police station, but he did not seek engineering advice regarding the damage. Waves were getting closer to the helicopter skids, so the pilot, who had what he thought was a superficial wound, re-started the helicopter and flew it slowly to a small sand dune about 30 m away, clear of the tidal zone, and shut it down again.
- 1.1.15 A retired medical doctor, who had a holiday house nearby and who had heard the impact, offered to check the pilot’s injury. He found a small puncture wound about 3 millimetres (mm)

in diameter in the pilot's chest but the pilot did not appear, at that stage, to be badly injured. The pilot was dissuaded from flying the helicopter back to his base but he decided to again move the helicopter to a place that would ease road recovery. After he had secured the helicopter, his condition worsened, so an ambulance was requested.

- 1.1.16 The electricity line was not live at the time of the wire strike because of planned maintenance, so no network circuit breakers were tripped when the line was broken. The company was about to restore power when the police and the operator notified it of the accident.

1.2 Injuries to persons

- 1.2.1 The pilot was seriously injured by a piece of copper wire that penetrated his lower chest and abdomen. Medical opinion was that there would have been a high risk of the pilot being incapacitated during flight had he carried out his intention to fly the helicopter back to his base.
- 1.2.2 None of the officers was injured.

1.3 Damage to aircraft

- 1.3.1 The damage was confined to the front windscreens, the right-hand forward door and both main rotor blades.
- 1.3.2 The damage to one blade was assessed by the operator's maintenance provider as negligible wire grazing, but the skin on the other blade had delaminated. Both blades had to be replaced because of blade pairing requirements. The maintenance provider said that the blade damage found was probably not severe enough to have prevented a ferry flight after the accident.

1.4 Other damage

- 1.4.1 Both conductors of the electricity line broke and were replaced over the affected span.

1.5 Personnel information

- 1.5.1 The pilot started flying training in 1998 and obtained his Commercial Pilot Licence (Helicopter) in 2000. All but about 30 hours of his commercial flying experience had been for the operator. When not required to fly, he performed various ground jobs for the family business. The chief pilot of the check and training organisation listed in the operator's Operations Specifications said he considered the pilot to be very careful, thorough and professional.
- 1.5.2 The pilot said that he was fit for flying, rested and in good health prior to the accident flight. His total and recent experience as at 9 November 2006 was as follows:

Pilot's age	30 years
Licence	Commercial Pilot Licence (Helicopter)
Aircraft type ratings	Hiller 12E, Bell 206, Hughes 269, Hughes 369, Robinson R44, Robinson R22
Medical certificate	Class 1, valid to 11 March 2007
Last competency check	20 June 2006
Last biennial flight review	20 June 2006
Flying experience	1694 hours total, 540 hours on type
Duty time	6 hours
Time since end of last duty	More than 100 hours
Flying previous 7 days	4 hours
Flying previous 90 days	84 hours

- 1.5.3 The pilot held a valid Certificate of Maintenance Approval, issued on 26 June 2006, which permitted him to perform specified limited maintenance on ZK-HUC and to certify the release-to-service after such maintenance. He had no aeronautical engineering qualification.
- 1.5.4 The pilot had had one previous helicopter accident, while flying a Hiller 12E in December 2000. He had landed the Hiller to investigate an unusual smell that he thought could be a faulty clutch, but having determined that it was not the clutch, he continued flying to the nearby maintenance base. En route, the transmission torsion coupling failed. He immediately entered autorotation, but during the landing the helicopter sustained substantial damage.

1.6 Aircraft information

- 1.6.1 ZK-HUC was a Robinson Helicopter Company model R44 *Raven II*, a 4-seat light helicopter powered by a Textron Lycoming IO-540-AE1A5 reciprocating engine. The maximum certificated weight was 2500 pounds (1134 kilograms). Prior to departure, the pilot had calculated the take-off weight to be 2492 pounds (1130 kilograms) and the centre of gravity to be within flight manual limits.
- 1.6.2 ZK-HUC was manufactured in early 2005 and bought new by the operator in June 2005. At the time of the accident, it had flown 542 hours since new.
- 1.6.3 The manufacturer had not designed or approved a wire strike protection kit for the R44 because the structure could not support the modification.

1.7 Meteorological information

- 1.7.1 On 9 November 2006, according to a MetService³ analysis, a ridge had formed over the South Island ahead of warm and cold fronts in the far south. The South Island was under a predominantly southerly wind flow. On the west coast, there would have been essentially clear conditions, a few scattered cumulus clouds and a light southerly wind.
- 1.7.2 The pilot and the officers considered that the weather conditions were good, with a high overcast and good visibility. The pilot said that at no stage had the sun or glare bothered him.

1.8 Aids to navigation

- 1.8.1 Topographical charts did not depict the electricity line struck by ZK-HUC.
- 1.8.2 A global positioning system (GPS) receiver was carried on board ZK-HUC. Although there was no GPS obstacle database available for New Zealand at the time of the accident, an operator could customise a route to show electricity lines if their locations were known accurately.

1.9 Communication

- 1.9.1 The accident occurred during the planned duration of the flight so no search and rescue alerting action was taken. The pilot used a satellite phone carried on board the helicopter to immediately advise his base and the Greymouth police station of the accident.

³ The national meteorological service provider.



Figure 2
Southern pole in road cutting



Figure 3
Northern pole against vegetation

1.10 Wreckage and impact information

- 1.10.1 The pilot had moved the helicopter twice and the network company had replaced the lines before the Commission's site investigation began. However, the places where the helicopter had landed were identified, the first point being almost immediately under the restored span. A few short pieces of copper wire from the lines were found in the helicopter cabin.
- 1.10.2 The collision severed both conductors of the 11-kilovolt electricity transmission line that comprised 2 multi-strand copper conductors of 7.5 mm diameter, 2.2 m apart. The network company advised that the accident span was approximately 150 m between the poles and about 11 m above the beach at its lowest point.
- 1.10.3 The lines and poles did not have to be conspicuous to airspace users because they were part of an existing structure that was not covered by Civil Aviation Rule (CAR) Part 77⁴, and because the poles did not exceed the 60 m height specified in the Rule for notifying and marking a new or altered structure.
- 1.10.4 Since 2000, the local body district plan had required poles, but not lines, in "scenic sensitive" areas such as the coast road to be inconspicuous. The transmission line was erected in 1987, so the environmental requirements of the district plan did not apply, but the line company had achieved the same goal by using poles and cross arms of treated timber that had a green hue, and anodised metal anti-possum bands with a bronze colour. The telephone line poles were also treated timber and often lower than roadside nikau palms. The combination of colour and low height caused the electricity and telephone lines to blend with the surrounding bush.
- 1.10.5 After Motukutuku Point, the road and utility lines went through a cutting in the small headland. When heading north, the road then curved around a small beach, but the electricity line went straight above the beach before rejoining the road. Compared with the line south of Motukutuku Point, the span after the cutting was unusually long and displaced from the road. The southern pole was sited just after the road cutting and would not have been clearly visible until the helicopter was over the beach. The northern pole, viewed at some angles from the beach, was camouflaged amongst mature nikau palms (see Figures 2 and 3).

1.11 Survival aspects

- 1.11.1 The accident was survivable, primarily because the flight controls were not damaged and the speed at impact was low. The injured pilot was able to make an immediate normal landing.
- 1.11.2 Network company staff said that had the line been live when struck by the helicopter, there would have been a high risk of arcing and possibly fire.

1.12 Organisational and management information

- 1.12.1 The operator had a sphagnum moss business near Greymouth and used a helicopter for lifting harvested moss from swamps to trucks for transport to a factory. The moss flights were a private use of the helicopter. Prior to obtaining the R44, the operator had used other helicopter types that the pilot had also flown. The operator employed the one pilot.
- 1.12.2 The operator was first issued an AOC in 2003, which permitted it to perform air transport operations (ATOs) and commercial transport operations (CTOs)⁵ anywhere in New Zealand. By 11 December 2006, the pilot had accrued fewer than 100 hours of ATO and CTO experience with the operator.

⁴ CAR Part 77, Objects and Activities Affecting Navigable Airspace.

⁵ Both ATOs and CTOs may involve the carriage of passengers for hire or reward, but in some CTOs the passengers may be, in effect, crew members.

- 1.12.3 The Operations Specifications of the AOC allocated all of the senior person functions to the pilot or his father, who was the Chief Executive Officer (CEO). The pilot was the senior person responsible for flight and ground operations (sometimes referred to as the chief pilot), competency assessment, crew training and maintenance control. The CEO had no aviation experience and said that the pilot's flying activities and performance were largely unsupervised.
- 1.12.4 The pilot's check and training flights, and helicopter maintenance, were contracted to other organisations.
- 1.12.5 When the operator received its AOC, the pilot met the Civil Aviation Authority (CAA) requirement at that time for designation as a chief pilot, including having 750 total flight hours and being "acceptable to the Director".
- 1.12.6 The CAA manager responsible for approving chief pilot applications advised the Commission that the largely subjective "acceptability" criteria had evolved to require an applicant to have 500 hours in relevant air operations, that is, ATOs or CTOs. If an applicant had insufficient experience for the role, the applicant's company was usually recommended to nominate an experienced external supervisor to be chief pilot until the internal applicant met the standard.
- 1.12.7 The CAA advised that an industry study group that had reviewed New Zealand helicopter accident statistics had identified limited pilot experience and inadequate supervision as problem areas. As a result, the CAA on 19 October 2006 issued Notice of Proposed Rule Making (NPRM) 07-04, "Part 135-Pilot Experience Levels", to formalise the 500 hours' relevant operational experience for a chief pilot. The NPRM had no transitional or retrospective provision. The CAA advised that a transitional arrangement that, for example, required the replacement of a chief pilot who did not have the required experience, would be judged to be harsh and could be illegal. Accordingly, instead of a transitional arrangement, the CAA preferred to use targeted oversight of affected operators.
- 1.12.8 The operator's Exposition⁶ sections entitled "Pre Flight Preparations" and "Planning the flight" included the regulated responsibilities of a pilot in command for pre-flight preparation, for example obtaining weather information and ensuring the helicopter was serviceable, but did not specify any requirement to check an area of operations for hazards either before or during the flight.
- 1.12.9 The operator reviewed the circumstances of the accident and concluded that as the pilot had not been aware of the location of all the electricity line poles, he should have performed a reconnaissance prior to the low-level search, and also that the aim of the flight would probably have been achieved if it had been flown higher. The operator resolved to amend its Operations Manual to require a grid reconnaissance prior to any low flying, and to include specifically low-level hazards in the pre-flight briefing.
- 1.12.10 The chief pilot of the contracted check and training organisation endorsed the operator's conclusions, but noted that a prior reconnaissance was not always an option, for example because low-level power line surveys often cover 180 km or more. He suggested that a good defence was to fly 50-100 ft (15-30 m) above the height of any expected obstacles and no lower than absolutely necessary for the job. As a result of that advice, the operator decided that a prior reconnaissance would be performed only when practicable.
- 1.12.11 The same chief pilot noted that low-flying training for pilots was always conducted in designated areas that were surveyed for obstacles that might also be marked, and was mostly dual instruction, so it did not fully prepare pilots for low-level air operations. Individual operators had the responsibility to train their pilots for the roles and skills, which could include low flying, appropriate to their business. In his view, learning how to fly safely in a wire

⁶ An exposition defined an operator's organisation and, among other things, described the means for compliance with applicable CARs and detailed the procedures for various required programmes.

environment was largely dependent on one's experience, but pilots still needed appropriate supervision.

1.12.12 Recent CAA audit reports on the operator were unremarkable.

1.13 Additional information

Regulatory

1.13.1 The minimum height for VFR flights, generally, was 500 ft (150 m) when clear of populated areas, but flight below 500 ft above the surface or any obstacle within 150 m of the aircraft was permitted by CAR 91.311(c), which stated in part:

if the *bona fide* purpose of the flight requires the aircraft to be flown at a height lower than that prescribed in paragraph (a)(2), but only if—

- (1) the flight is performed without hazard to persons or property on the surface; and
- (2) only persons performing an essential function associated with the flight are carried on the aircraft; and
- (3) the aircraft is not flown at a height lower than that required for the purpose of the flight; and
- (4) the horizontal distance that the aircraft is flown from any obstacle, person, vessel, vehicle, or structure is not less than that necessary for the purpose of the flight.

1.13.2 CAR 135.85 distinguished between ATOs, which were not permitted to operate below 500 ft, and CTOs which were, subject to additional requirements. The Rule stated:

- (a) Rule 91.311(c) does not apply to a pilot-in-command of an aircraft performing an air transport operation.
- (b) Notwithstanding rule 91.311(c)(4), a pilot-in-command of an aircraft performing a commercial transport operation may, if necessary for the proper accomplishment of the operation, conduct approaches, departures, and manoeuvres below a height of 500 feet above the surface within the horizontal radius of 150 metres of any person, vessel, vehicle, or structure if the pilot-in-command—
 - (1) prepares a plan for the operation in conjunction with every person and organisation involved in the operation; and
 - (2) takes reasonable care to conduct the operation without creating a hazard to any person or property; and
 - (3) briefs every person and organisation involved in the operation on the plan required by paragraph (b)(1).

1.13.3 The accident flight was a CTO, defined in part by CAR 1.1 as:

an operation for the carriage of passengers or goods by air for hire or reward—

- (1) where—
 - (i) each passenger is performing, or undergoing training to perform, a task or duty on the operation; or...

1.13.4 CAR 91.211, which gave the general requirements for a passenger briefing, did not specifically require the briefing to be completed prior to commencing the flight.

1.13.5 The pilot was also required to give a briefing to comply with CAR 135.13, Passenger Training, which stated:

In addition to the requirements in 91.211, each person performing a commercial transport operation shall ensure that each passenger receives additional briefing or training in safety and emergency procedures appropriate to the characteristics of the flight operation.

- 1.13.6 The pilot later said that his previous pre-flight passenger briefings had covered the hazards around helicopters and landing sites well, but he could have better briefed in-flight hazards.
- 1.13.7 CAR 12.101 restricted the occasions when an aircraft that had been involved in an accident may be moved without the prior approval of the CAA or the Commission. The Rule stated in part:
- (a) Except as provided in the Transport Accident Investigation Commission Act 1990, and paragraphs (b) and (c), no person shall access, interfere with, or remove, an aircraft or its contents that is involved in an accident unless authorised to do so by the Authority.
- 1.13.8 A pilot's medical certificate remained current until the next renewal date unless there was an intervening change in the pilot's medical condition. Such a change could be a physical or mental illness or injury. The requirement to notify a change in medical condition was in the Civil Aviation Act 1990 (the Act) s.27C, which stated in part:
- (1) if a licence holder is aware of, or has reasonable grounds to suspect, any change in his or her medical condition... that may interfere with the safe exercise of the privileges to which his or her medical certificate relates, the licence holder—
 - (a) must advise the Director of the change as soon as practicable; and
 - (b) may not exercise the privileges to which the licence holder's medical certificate relates.

Wire hazards

- 1.13.9 Between 1974 and June 2006, there were 95 wire strike accidents in New Zealand, mostly involving helicopters, which resulted in 41 deaths and many serious injuries⁷. About two-thirds of the strikes involved electricity lines. In most cases, the wire height was below 100 ft (30 m).
- 1.13.10 The above statistics are from a CAA review of a long-standing project to mark those wires deemed most hazardous to aviation activity. The project followed a safety recommendation made by the Commission after a fatal helicopter wire strike in 2000⁸. The review found that more than half of the wire strike accidents occurred during agricultural operations, a permissible low-flying operation, and that 11 of the 95 accidents occurred during “normal” flight activities.
- 1.13.11 Similar statistics from the United States indicated that around 90% of wire strikes occurred below 200 ft (60 m) agl and 70% below 100 ft (30 m), and that 60% of victims did not see the wires. An Australian magazine article, reporting on agricultural aviation operations, said that nearly 75% of wire strike accidents and incidents involved aircraft hitting wires that the pilots did know about because of their job planning and risk assessment⁹.
- 1.13.12 Since 1998, the CAA, the Aviation Industry Association and various electricity industry partners had sponsored a series of wire strike avoidance training seminars conducted by an expert from the United States. Attendance was voluntary, but the pilot had not attended one. The most recent seminar had been held in May 2006 and covered topics such as¹⁰:
- identification of the “wire environment”, that is, below 500 ft (150 m) agl
 - limitations of normal vision, and visual illusions
 - anticipation of the likely presence of wires from power line configurations
 - the importance of a pre-flight briefing, pre-task reconnaissance and crew communication

⁷ CAA Part 77 Wire Marking Review (Stage 2), 2005.

⁸ Report 00-005, Hughes 369FF ZK-HJN, wire strike, West Arm, Lake Manapouri, 28 March 2000.

⁹ Flight Safety Australia, November-December 2006, p.38.

¹⁰ Information taken from the presentation “Flying in the wire and obstruction environment”, Utilities/Aviation Specialist Inc., 2006.

- the pilot's primary concerns are flying the aircraft and avoiding obstacles, not the observation task
 - the variability of line visibility, depending on the relative position of aircraft and wires, and light conditions.
- 1.13.13 According to CAA statistics, the average number of wire strike accidents between 1998 (when the industry seminars began) and 2006 remained close to the long-term average of about 3 per year, but had been trending down since 2003.
- 1.13.14 The CAA last published a major article on wire strike avoidance in its *Vector* magazine in 2000. That article drew on the 1998 seminar content, and was directed particularly at agricultural pilots who routinely operated in the wire environment. The CAA also had a 15-minute training video available for free loan. The video, a production from the 1980s, contained useful and accurate information but lacked the scope and reach of the seminars.
- 1.13.15 The education material published by the CAA and other agencies could be distilled into the following advice regarding wire strike avoidance:
- low flying had to be supervised, and relevant rules adhered to
 - a detailed pre-flight preparation was essential. Hazards should be marked on a map and the location of any new wires found on the flight added for future reference
 - where possible, a high reconnaissance of the area should be conducted before flying low
 - fly above the height of any expected obstacles if possible, and no lower than absolutely necessary for the job
 - flying the aircraft was the priority. The others on board were there for the task and had to be appropriately briefed, including the need to look out for hazards
 - looking out was more important than looking at the hazard map
 - a hazard map was only useful if you knew positively where you were. If in doubt, climb
 - speed was the single most important factor in determining the injury level. Go slow when you go low
 - look for poles and other structures and keep track of the line direction they indicate
 - the minimum horizontal distance from obstacles protects against collision with guy wires
 - don't be distracted when knowingly close to wires and other obstacles
 - think "WIRES" at all times when at low level. If you lose sight of them, climb.
- 1.13.16 The CAA had the statutory obligation to ensure that aeronautical charts were provided in New Zealand, and collaborated with the Airways Corporation of New Zealand (ACNZ), the aeronautical information publisher, in providing the information depicted. The CAA advised that its criteria for depicting lines and obstacles on charts were not stringent, but did include known obstacles that were above 400 ft (120 m) agl, and those of a lesser height that were hazardous because of, for example, their proximity to an airport or a previous wire strike. Although the towers of the high-voltage transmission lines of the national grid operator, Transpower, were about 40 m high, they were shown on charts primarily to assist pilots with orientation. The line struck by ZK-HUC was outside these charting criteria.
- 1.13.17 The Electricity Networks Association (ENA) represented the interests of line companies in New Zealand, excluding Transpower. The line companies supplied power to regions and cities, and had current data on their infrastructure, including actual pole locations. However, at the time of the accident that data was not readily available to the public. The ENA website (www.ena.org.nz) included a small-scale map of line companies' boundaries with links to each company's website.
- 1.13.18 The Electricity Engineers' Association of New Zealand (EEA) was the national body that provided expertise and information on technical, engineering and safety issues affecting the

electricity industry. The EEA said that some professional aircraft operators already made direct requests to line companies for line data prior to certain tasks, and that recreational pilots should also be made aware of the availability of such information.

- 1.13.19 The EEA commented that this and other accidents drew attention to the need to carry a safety observer on low-flying tasks to help identify hazards. Transpower and line companies already followed that practice for line inspections and surveys.
- 1.13.20 The EEA and the ENA saw merit in pilots having a more direct link to network providers so that pre-flight line data could be obtained. They considered that a link from a flight planning website to the ENA website, which would then take the user to the selected network provider's website, might be appropriate.
- 1.13.21 The CAA advised that because the owners of the network infrastructure information were not required to be certificated within the aviation system, information from those sources should be considered an aid to situational awareness rather than meeting a flight planning requirement.

2 Analysis

- 2.1 The flight was a CTO with police officers on board as crew members for a search task.
- 2.2 CARs permitted a CTO to be flown below 500 ft (150 m) agl if necessary for the task and gave the pilot discretion as to the minimum height. As for any flight, the onus was on the pilot to make adequate pre-flight preparation, give a relevant passenger briefing and conduct the flight safely.
- 2.3 The pilot's pre-flight preparation was unhurried and, apart from his not having detailed knowledge of the wire that was struck, was probably as thorough as any pilot's would have been. The intended search did not warrant a complex plan and briefing to meet CAR 135.85.
- 2.4 Industry seminars and the ample educational material emphasised the importance of pilots knowing what hazards were present before low flying. However, many pilots, if not familiar with a planned search area, would be unlikely to do more before flight than check the relevant aeronautical chart or topographical map and ask other persons about known hazards. In this case, none of the relevant charts and maps showed the coastal electricity line, but the pilot knew of the line's existence.
- 2.5 The CAA's ongoing wire-marking project was concerned with line hazards that were typically much higher above ground than the type of line struck by ZK-HUC. The project had not progressed substantially since 2000. The majority of wire strikes, however, occurred at low level and this investigation suggested a complementary safety action was needed to address access to data on low-level wire hazards.
- 2.6 Aeronautical charts would be unreadable if they depicted all power lines, so the current charting criteria are reasonable. However, when electricity lines were not depicted on charts and the poles were also difficult to see because of deliberate measures to make them inconspicuous, practical pre-flight planning was hindered and the effectiveness of a reconnaissance reduced. Such deficiencies would be minimised if pilots had access to current network data that showed the location of lines.
- 2.7 Exact and current line information that could have forewarned the pilot of ZK-HUC, if he had sought and obtained it, was held by the network providers, although the companies did not at the time publicise the existence or availability of the data. It is likely that few pilots would have considered the line companies as a routine source of pre-flight planning information.
- 2.8 The EEA, the ENA and ACNZ indicated that the on-line provision of relevant network infrastructure data for flight planning purposes was technically simple and inexpensive.

Although those parties were willing to work together to achieve this, the CAA's view was that it was the appropriate agency to facilitate a solution. A safety recommendation was made to the Director of Civil Aviation that he facilitate the provision of electricity network infrastructure information to aid pilot situational awareness, and that he publicise any agreed service.

- 2.9 While it was feasible to enter the coordinates of an uncharted electricity line into a GPS receiver, the safety benefit of doing so was not assured. If the exact locations of poles were not available from the relevant line company, the information would need to be obtained by a reconnaissance, which was strongly recommended in any event. Discipline would be required to ensure a pilot did not go "heads-down" looking for entered GPS information at the expense of looking out for nearby hazards. However, if an entered line was no longer visible, the GPS might enable a pilot to relocate it more readily.
- 2.10 The pilot received a search briefing from the officers, then gave them his standard safety briefing. He was also required by CARs to give them a special briefing "appropriate to the characteristics of the flight operation". Obstacles and wires were appropriate items to consider before a low-level flight. However, the pilot did not specifically mention these hazards until later in the flight.
- 2.11 The EEA expressed a preference for a dedicated safety observer on low-level flights, because of the known hazard of wires, however strict adherence to such a practice could exclude smaller helicopter types from some tasks and the use of a larger type would have financial consequences.
- 2.12 The safety briefing would have been more effective if the pilot had delivered it before the flight departed, when the officers could have given it their full attention. If everyone on board had been thinking about this shared responsibility and actively looking for hazards, the wires might have been seen and avoided. Alternatively, one of the 3 police officers on ZK-HUC might have been briefed to primarily assist with looking out for hazards. A safety recommendation was made to the Director of Civil Aviation that he remind operators of CTOs that passengers may require additional briefing or training in safety and emergency procedures appropriate to an intended flight, in part so that they can contribute to the safety of the operation.
- 2.13 The pilot flew to the search area at an appropriate height. The weather was favourable and visibility from the helicopter was excellent. The officers were generally comfortable with the overall conduct of the flight.
- 2.14 In spite of the accumulated wisdom on wire strike avoidance, accidents still occurred, even to experienced and "wire-wise" pilots. Industry experts considered that a high-level reconnaissance was essential prior to letting down into a possible wire environment, even if relevant charts had been checked. Other equally expert operators offered reasons why a high reconnaissance was not always practical; for example, because the complete route was unknown or very long, or the area too large. Faced with such apparently contradictory expert advice, it would be difficult for less experienced pilots to decide which tactic to adopt in given circumstances, unless they had the benefit of experienced supervisors.
- 2.15 Because topographical and aeronautical charts did not, and could not, depict all hazards, and because a low-level hazard might be erected without formal notice, a reconnaissance before operating at low level should be the standard procedure for all pilots, even in areas with which they are familiar. Observation of a planned search area from 2 directions could assist in the location of wires and obstacles that were masked when viewed from certain angles or under some light conditions.
- 2.16 Whether or not a prior high reconnaissance was undertaken, the risk of a wire strike while operating at low level would be greatly reduced if a pilot flew at a height that gave a margin above the highest known or expected obstacle, and always at reduced airspeed. On this flight, the pilot flew at heights and speeds that were generally appropriate to the task.

- 2.17 When viewed against the bush, wires could be impossible to see, but the pilot knew to look for poles and other line support structures rather than wires themselves. After rounding Motukutuku Point, the southern pole of the span was out of sight until the helicopter was close to the wires and, depending on the viewing angle, the northern pole could have been camouflaged by nikau. The police officers' interest was probably directed to the baches that had just come into view near the beach edge, a line of sight that was below the wire span. The use of binoculars would also have reduced an observer's field of view. The pilot was primarily responsible for obstacle avoidance. Although he said he was not actively searching, he may have been momentarily distracted by the new objects of interest.
- 2.18 The coastal electricity line was not high enough above ground to have to comply with the CAR marking requirements and did not fit the charting criteria. The line company's conformance with the intent of a local body environmental policy exacerbated the near invisibility of the line and poles under certain viewing conditions but, even though the wires were over the beach, the span itself was not an exceptional hazard that warranted relocating or marking.
- 2.19 The problem of inconspicuous line structures emphasised the increased risk of operating below 500 ft (150 m) agl, and the critical need for pilots to take all practical pre-flight and in-flight steps to locate and avoid hazards. In particular, the span might have been recognised and avoided if the pilot had maintained awareness of the exact location of the poles and lines at all times. He misunderstood how often and where the coastal electricity line went underground, and that misunderstanding was possibly a factor in his not quickly relocating the line after losing sight of it while passing around Motukutuku Point. The search had been conducted entirely over beaches or the sea and the pilot did not expect wires to be above a beach.
- 2.20 Wires will remain a hazard irrespective of pilot training standards and experience. While inadequate role training for low-level operations raised the risk of a wire strike, greater pilot experience did not eliminate the risk. There remained some risk that not all wires would be identified, even if a prior reconnaissance was carried out. Furthermore, as shown by some accidents that have occurred during aerial inspections of line networks, excessive attention to one identified hazard can lead to another hazard not being seen, with fatal consequences. These persistent threats should remind pilots to consider carefully 2 important questions before undertaking any low-flying operation: is low flying necessary?, and how high can I fly and still achieve the aim?
- 2.21 This accident was survivable because the helicopter remained controllable, possibly because of the low speed at impact, and because the lines were shut down for maintenance.
- 2.22 CAR Part 12 defined limited circumstances when an aircraft that had been involved in an accident may be moved without the prior approval of the CAA or the Commission. Although the relevant Rule was primarily intended to preserve the scene for any subsequent investigation, it also discouraged pilots from attempting to fly aircraft that may not be airworthy. The pilot's decision to move the helicopter away from the rising tide was justified, but he ought to have first sought a maintenance engineer's opinion regarding the main rotor blade damage. An on-site inspection by an engineer would have been required to assess the damage properly.
- 2.23 The pilot's Certificate of Maintenance Approval did not permit him to evaluate accident damage, and his lack of relevant knowledge was shown by the fact that the main rotor blade had been damaged beyond repair. The pilot attempted to minimise the risk of the short flight by flying slowly and at a low height over a short distance, but as his earlier experience in a Hiller helicopter had demonstrated, a flight after an incorrect assessment of damage or a defect was dangerous and could lead to an accident.
- 2.24 The successful short flight no doubt influenced the pilot's decision to shift the helicopter again so that it would be easier to recover to his base. That decision was inappropriate, and came after the doctor and one of the police officers had dissuaded the pilot from thinking of flying back to

Greymouth. If he had not been dissuaded, it was likely that he would have been seriously incapacitated by his injury during the flight.

- 2.25 Compliance with the Act's obligation to notify the Director of any change in medical condition depended upon licence holders being aware of the requirement and recognising that a changed condition existed. Although the Act, like CARs, was accessible on the Internet, most pilots were probably less familiar with the Act.
- 2.26 A pilot was unlikely to ignore an obvious physical injury received in an aircraft accident, but whether or not a physical injury was received, a degree of psychological injury could occur and go unrecognised by the pilot. Because a pilot involved in an accident might not make the correct judgement concerning their medical condition, a pilot should not attempt to operate an aircraft until declared fit by an approved medical examiner.
- 2.27 The pilot's flawed decision-making after the accident was probably due to a combination of his obvious physical injury and some unrecognised psychological stress. This led to his not complying with the rules regarding preservation of an accident site, notification of a changed medical condition, and aircraft airworthiness.
- 2.28 A safety recommendation was made to the Director of Civil Aviation that he emphasise to pilots their responsibilities after an aircraft accident to preserve the accident scene, notify any change in their medical condition, and have the aircraft's continued airworthiness assessed.
- 2.29 Discussions with the operator, an inspection of its place of business and a review of CAA audits gave the impression that the operator conducted air operations with enthusiasm and had a responsible attitude to CAR compliance. As was often the case with small operators, the pilot had responsibility for a diverse range of organisational and operational functions, each of which required some specialised knowledge and experience. Although the pilot had met the CAA criteria at the time he was approved to be chief pilot, his experience may not have allowed him always to meet those responsibilities. For example, it may have been unrealistic to expect him to be able to assess his own competency and capability critically and correctly before accepting a task request. The CEO did not have the aviation experience to enable him to provide effective operational supervision of the pilot.
- 2.30 The CAA and industry had recognised that some small, especially single-pilot, operations did not have adequate operational supervision. Conscientious and diligent piloting would not always compensate for low relevant experience, so supervision by an external party could be warranted. However, flight time experience and capability did not necessarily accrue together for all pilots.
- 2.31 The CAA had addressed part of the problem with NPRM 77-04 to raise the required relevant operational experience for approval as a chief pilot. Although there was no transitional or retrospective provision for dealing with pilots who presently had a chief pilot approval but did not meet the proposed standard, targeted oversight of such operators by the CAA should address relevant concerns until the revised standard was achieved.

3 Findings

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

- 3.1 The helicopter was serviceable and appropriate for the flight.
- 3.2 The pilot was fit, licensed and qualified to make the flight.
- 3.3 The low-level flight was lawful and was flown at a speed and height appropriate to the task.

- 3.4 The helicopter struck electricity transmission lines that were invisible to the pilot because they and the supporting poles blended with the surrounding vegetation.
- 3.5 Although the pilot had seen the lines earlier, he did not become suspicious when he lost sight of them because he believed that they may have been routed underground.
- 3.6 The line struck was not depicted on aeronautical or topographic charts, and did not meet the criteria for marking. Exact data on the line's location was held by the network provider but was not readily available to the public, and therefore did not form part of the pilot's pre-flight preparation.
- 3.7 The CAA's criteria for determining whether to depict an obstacle or hazard on an aeronautical chart were reasonable and minimised chart clutter.
- 3.8 The pilot should have briefed the officers prior to the flight about the possible hazards that could be encountered at low level and the officers' role in helping to avoid any such hazards.
- 3.9 Had the pilot conducted a reconnaissance prior to the low-level part of the flight, he or one of the officers might have detected the electricity lines above the beach.
- 3.10 Had the pilot been more experienced in CTOs, or under the direct supervision of a more experienced pilot, he might have conducted a more thorough briefing and a prior reconnaissance.
- 3.11 The accident was survivable because the helicopter remained controllable and the line was not live at the time.
- 3.12 The pilot should have obtained engineering advice as to the helicopter's airworthiness before moving it after the accident.
- 3.13 After the accident, the pilot was probably affected by physical and psychological injuries, which resulted in his making the flawed decision to move the helicopter.
- 3.14 Some pilots may not be familiar with the legislation that required them to notify the Director if they had a change, or suspected they had a change, in their medical condition, and to not exercise their licence until declared medically fit.

4 Safety Actions

- 4.1 On 30 November 2006, the operator advised the Commission that it had resolved to:
 - amend the Operations Manual to require that low level flying be preceded by a reconnaissance over the area for a distance of one mile at a time, and
 - amend the Operations Manual to include hazards in pre-flight briefings, and
 - invite a flight examiner to independently review the incident and make any necessary recommendations.
- 4.2 On 8 January 2007, the pilot advised that he had reviewed the accident and his operational planning with his usual flight examiner. The examiner later confirmed that he had provided guidance and recommendations based on the known circumstances of the accident, and had included considerations for low-level operations when a prior reconnaissance was not practical.
- 4.3 On 30 May 2007, the EEA and the ENA advised the Commission that they were "willing to make [the ENA website] more accessible (e.g. by encouraging members to provide clear links to appropriate staff or information)" so that pilots could access required line data.

5 Safety Recommendations

Safety recommendations are listed in order of development and not in order of priority.

- 5.1 On 12 June 2007, the Commission recommended to the Director of Civil Aviation that he:
 - 5.1.1 Remind pilots of their responsibility after an aircraft accident to preserve the accident scene, to have the continued airworthiness of the aircraft assessed, and to notify the Director of any change in their medical condition. (013/07)
 - 5.1.2 Remind operators of commercial transport operations that passengers may require additional briefing or training in safety and emergency procedures appropriate to an intended flight so that they can actively assist in the safe conduct of the flight. (014/07)
- 5.2 The text of the above safety recommendations was unchanged from that discussed earlier with the CAA. On 22 May 2007, the Director of Civil Aviation replied that he would:
 - 5.2.1 Accept this recommendation [013/07] and will publish an article in the CAA *Vector* safety magazine to remind pilots of their responsibility after an aircraft accident to preserve the accident scene, to have the continued airworthiness of the aircraft assessed, and to notify the Director of any change in their medical condition.
 - 5.2.2 Accept this recommendation [014/07] and will publish an article in the CAA *Vector* safety magazine addressing the issue.
- 5.3 Accordingly, the Director's responses to the preliminary safety recommendations are accepted as his responses to the final safety recommendations.
- 5.4 On 29 June 2007, the Commission recommended to the Director of Civil Aviation that he:
 - 5.4.1 Facilitate making information about the electricity network infrastructure available to pilots to aid their situational awareness, and to publicise the details of any agreed service. (019/07)

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Hon W P Jeffries
Chief Commissioner



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Transport Accident Investigation Commission
P O Box 10-323, Wellington, New Zealand
Phone +64 4 473 3112 Fax +64 4 499 1510
E-mail: reports@taic.org.nz Website: www.taic.org.nz

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