TRANSPORT ACCIDENT INVESTIGATION COMMISSION
TE KOMIHANA TIROTIRO AITUA WAKA

AIRCRAFT ACCIDENT REPORT

No. 91-014

ROBINSON R22 BETA ZK-HYN

Dart River, Near Glenorchy, Otago Province

23 May 1991

Transport Accident Investigation Commission
Wellington · New Zealand

Price $12.60 (including G.S.T.)

ISSN 0112-6962

Transport Accident Investigation Commission
Wellington

Chief Commissioner
Transport Accident Investigation Commission

The attached report summarises the circumstances surrounding the accident involving Robinson R22 Beta helicopter ZK-HYN on 23 May 1991 at Dart River, Near Glenorchy and includes suggested findings and safety recommendations.

This report is submitted pursuant to Section 8(2) of the Transport Accident Investigation Commission Act 1990 for the Commission to review the facts and endorse or amend the findings and recommendations as to the contributing factors and causes of the accident.

6 August 1991

R CHIPPINDALE
Acting Chief Executive

APPROVED FOR RELEASE AS A PUBLIC DOCUMENT

22 August 1991

M F DUNPHY
Chief Commissioner

AIRCRAFT:	Robinson R22 Beta	**OPERATOR:**	Roto-Wing Helicopter Limited
REGISTRATION:	ZK-HYN	**PILOT:**	Mr N S MacColl
PLACE OF ACCIDENT:	Dart River, 9 km north-north-west of Glenorchy, Otago Province	**OTHER CREW:**	Nil
DATE AND TIME:	23 May 1991, 1241 hours (0041 hours UTC)	**PASSENGERS:**	One

SYNOPSIS:

The Transport Accident Investigation Commission was advised of this accident at 1330 hours on 23 May 1991. Mr D.G. Graham was appointed Investigator in Charge and commenced the field investigation next morning. At the conclusion of a brief local flight the pilot descended the helicopter over the Dart River. The helicopter collided with a pair of electric fence feeder wires, spanning a dry channel between the eastern bank and an adjacent island, and shortly afterwards struck the river bed. The pilot received fatal injuries but the passenger survived the accident.

1.1 HISTORY OF THE FLIGHT:	1.2 INJURIES TO PERSONS:	1.3 DAMAGE TO AIRCRAFT:	1.4 OTHER DAMAGE
See page 4.	Pilot: 1 Fatal Pax: 1 Serious	Substantial	See Page 5.

1.5 PERSONNEL INFORMATION:

See page 5.

Flight Times

	Last 90 days	Total
All Types	26	242
On Type	26	240

1.6 AIRCRAFT INFORMATION:

See page 6.

1.7 METEOROLOGICAL INFORMATION:	1.8 AIDS TO NAVIGATION:	1.9 COMMUNICATION:
See page 6.	Nil.	Nil.

1.10 AERODROME:	1.11 FLIGHT RECORDERS:	1.12 WRECKAGE AND IMPACT INFORMATION:
Not Applicable	Nil.	See page 7.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION:	1.14 FIRE:	1.15 SURVIVAL ASPECTS:
See page 9.	Fire did not occur.	See page 9.

1.16 TESTS AND RESEARCH:	1.17 ADDITIONAL INFORMATION:	1.18 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES:
See page 10.	See page 10.	Nil.

2. ANALYSIS:	3. FINDINGS:
See page 12.	See page 14.

4. SAFETY RECOMMENDATIONS:	5. REGULATORY:	6. APPENDICES:
See page 14.	See page 15.	Map & Diagram, see page 16. Photographs, see page 17 & 18.

* All times in this report are NZST (UTC + 12 hours)

1. FACTUAL INFORMATION

1.1 History of the flight

1.1.1 ZK-HYN was owned and operated by Roto-Wing Helicopter Limited of Invercargill but was, on occasion, leased for an agreed period to suitably qualified pilots who wished to carry out their own private flights.

1.1.2 The pilot in command of the helicopter at the time of the accident was included on the company's list of pilots approved for this type of arrangement. He had leased ZK-HYN for ten days at the beginning of the year and again during a period of about a month from the end of March to late April. He had based ZK-HYN on these occasions at Arrow Junction, close to his own farm property near Arrowtown and had used the helicopter on a variety of tasks in the area around Queenstown and for flights as far as Big Bay on the West Coast.

1.1.3 The pilot had arranged to lease ZK-HYN for a further two week period from 11 May 1991. He had flown the helicopter from Queenstown Aerodrome, where a Maintenance Check had just been completed, to Arrow Junction. He had subsequently used ZK-HYN for an extended flight to Big Bay and had landed at Glenorchy during the return from this flight several days before the accident.

1.1.4 On the morning of the accident the pilot and a friend, had planned an early flight in the Beansburn, a tributary of the Dart River, located some 25 km north of Glenorchy. Fog delayed their departure until mid morning, by which time the pilot had flown from Arrow Junction to Queenstown Aerodrome to refuel ZK-HYN before returning to pick up his friend.

1.1.5 The flight to Glenorchy proceeded uneventfully and the pilot landed ZK-HYN at "The Hillocks" a property located on the eastern side of the Dart River near the Dart Bridge. Both doors were removed and left at "The Hillocks" and the flight was then continued to the Beansburn.

1.1.6 About 30 minutes later ZK-HYN returned to "The Hillocks" and the pilot landed in the same paddock (located to the north-west, adjacent to the rear of the homestead), in which the previous landing had been made. The pilot's friend reported that both landings were made directly from a high approach and turn overhead. Neither the flight from Glenorchy, nor from the Beansburn included any excursion or reconnaissance over the two islands situated in the riverbed just to the west of "The Hillocks".

1.1.7 The helicopter was shut down and the pilot and his friend were invited for a cup of tea at "The Hillocks". Prior to leaving to return to Arrow Junction it was arranged that the pilot would take their hostess for a short local flight. The departure of ZK-HYN was unobserved, as the friend, and the local school teacher who had arrived a short time earlier, remained inside the house. Both men however heard the engine start and the helicopter subsequently depart from the paddock. Neither of the doors had been refitted before the flight.

1.1.8 After about five minutes, the pilot's friend, who could hear ZK-HYN flying in the vicinity and considered that the pilot would shortly be returning to land, decided to walk to the paddock. He recalled that as he left the house, the

helicopter passed overhead "quite high up and round toward the Dart Bridge, as though commencing a circuit to come in".

1.1.9 He did not see the latter part of the flight but just as he reached the paddock he heard the unmistakable sound of an impact. Realising that ZK-HYN had struck the ground heavily he immediately ran to the house and telephoned the pilot of a local helicopter company, whom he knew frequently acted in a rescue capacity, to alert him regarding the occurrence of an accident. At the same time the school teacher who had heard the impact while inside the house, ran to the nearest vantage point and confirmed that ZK-HYN had crashed in the riverbed.

1.1.10 The pilot's friend alerted emergency authorities by telephone, while the school teacher, who was a qualified ambulance officer, ran to the accident site and rendered assistance to the occupants of ZK-HYN who had been ejected from the helicopter on ground impact. Police and medical personnel arrived at the scene by helicopter from Queenstown about twenty five minutes after the occurrence of the accident and the pilot who was the most seriously injured occupant was transferred immediately to Lake County Hospital. A second helicopter was used to transport the passenger (who was suspected of having sustained pelvic injuries), on a special stretcher to Lake County Hospital. The pilot succumbed to his injuries approximately two hours after the accident.

1.1.11 The accident occurred at about 1241 hours. The accident site was 500 m downstream of the Dart River Bridge, 9 km north-north-west of Glenorchy, on the eastern side of the river at an elevation of 1100 feet amsl. National Grid Reference 256001 (NZMS 1 Sheet S122 "Hollyford"). Latitude 44°46'S, longtitude 168°20'E.

1.4 Other damage

1.4.1 The double span of electric fencing wire was broken close to its attachments at the northern and southern ends of the span and at several intermediate points.

1.5 Personnel information

1.5.1 The pilot in command, Neil Stewart MacColl, 30, had commenced a course of helicopter training in June 1988 on the Robinson R22. He had been issued with a Private Pilot Licence - Helicopter on 3 November 1988.

1.5.2 Mr MacColl continued training and building up his experience (including sling load and mountain flying) in order to obtain a Commercial Pilot Licence - Helicopter (CPL H). On 1 May 1990 he was issued with CPL H number 26913. He had renewed this licence in April 1991 and the associated Validity Certificate was valid from 9 April 1991 to 8 April 1992.

1.5.3 Mr MacColl's total flight experience amounted to 242 hours of which 240 hours was on the Robinson R22. The total comprised 82 hours dual instruction and 160 hours as pilot in command. Two hours had been flown in a Hughes 269C helicopter, for which he held a type rating.

1.5.4 Within the last 90 days he had flown a total of approximately 26 hours, all on the Robinson R22 type. He had first flown Robinson R22

ZK-HYN on 29 December 1990 and at the time of the accident had accumulated 29 hours in this particular helicopter. Although his training was conducted elsewhere, a substantial portion of Mr MacColl's later helicopter flying had involved operations in the vicinity of Queenstown and in the surrounding area.

1.5.5 Mr MacColl's most recent medical examination for the renewal of his flight crew licence had been undertaken on 22 March 1991. He had been assessed fit in accordance with the standards required for the renewal of his CPL.

1.6 Aircraft information

1.6.1 Robinson R22 Beta helicopter Serial number 0503 was manufactured in the United States of America in 1985. It was imported to New Zealand in 1987, having accumulated 108 hours total time in service. It was registered as ZK-HYN and a Certificate of Airworthiness (C of A) in the Standard category, valid until 5 July 1991 was issued on 6 July 1987. The validity of this C of A was dependent on the aircraft being maintained in accordance with the approved maintenance programme.

1.6.2 ZK-HYN had received the required periodic maintenance. The last Maintenance Inspection prior to the accident comprised a routine 100 hour inspection and replacement of parts as appropriate completed on 16 May 1991. Maintenance Release number 0288117 was issued following that inspection and remained valid until 16 November 1991 or until the attainment of 1350 hours time in service whichever occurred sooner.

1.6.3 At the time of the accident ZK-HYN had flown a total of 1310 hours since new and approximately 4 hours since the most recent inspection. Lycoming Model O 320 B2C engine, serial number L131914-39A had also run 1310 hours since new and 4 hours since the last inspection. (Times determined from Hobbs meter indication).

1.6.4 The mass of ZK-HYN at the time of the accident was estimated to have been about 100 kg below the Maximum Permitted All Up Mass of 622 kg (1370 lb). The Centre of Gravity was estimated to have been within limits both longitudinally and laterally.

1.7 Meteorological information

1.7.1 On the day of the accident an extensive area of high pressure covered the Tasman Sea and a south-westerly airstream flowed over New Zealand. Although there was extensive cloud and showers around the south and west coasts of South Island, the Queenstown and Glenorchy areas were sheltered from this. Satellite pictures taken during the morning showed that many of the valleys were filled by low cloud or fog. This cleared slowly during the day.

1.7.2 Queenstown Aerodrome observations at 1200 hours NZST indicated:

Wind:	Calm
Visibility:	70 km
Cloud:	1 octa altocumulus 10000 feet
QNH:	1022 Hectopascals (Hpa)

1.7.3 The surviving passenger recalled that in the Glenorchy area it was "sunny and fine, no wind and calm". Other local reports confirmed these conditions and emphasised that the sky was cloudless.

1.7.4 At the time of the accident the sun was 24 degrees 50 minutes above the horizon on an azimuth of 001° True. (The likely heading of the helicopter when it collided with the wires was approximately 125° True).

1.7.5 At 1240 hours on the day after the accident, similar fine sunny weather prevailed, with no cloud. It was noted that, observed from an upstream viewpoint with the sun shining from behind the observer, the pair of wires which remained suspended did not "flash" in the sunlight or otherwise attract attention. Despite the bright conditions the wires were difficult to distinguish against either the light background of the gravel riverbed or the sky.

1.12 Wreckage and impact information

1.12.1 The wreckage of ZK-HYN was lying on the level gravel surface of a dry branch of the Dart River which ran between the true left bank of the river and a small narrow island. The wreckage was some 500 m downstream from the road bridge across the Dart River which provided access from Glenorchy to the Routeburn Valley, and Kinloch. (See Map and Diagram Page 16.)

1.12.2 A large island located in the centre of the river bed downstream from the bridge contained an extensive area of open grazing land although it was well wooded around its shoreline. A small island, adjacent to, but separated from the large island by another dry branch of the river, lay to the east. It was largely covered in trees and undergrowth.

1.12.3 In order to electrify stock control fencing on the large island two lengths of 12 gauge high tensile galvanised steel wire (nominal diameter 2.5 mm) had been suspended from the eastern riverbank, across the riverbed to the north end of the small island, and thence in another double span to the large island. The date of erection of these spans was not confirmed, but reports suggested that the wires had been in place for at least ten years.

1.12.4 ZK-HYN had struck the easternmost span, (suspended between the true left bank and the small island) while flying downstream above the dry riverbed on an easterly to south-easterly heading. The span was aligned 165°/345°T and was about 115 m long. The upper and lower wires were spaced about 200 mm apart at the point of collision, which was approximately mid-span. The wires were estimated to have been suspended some 10 m above the riverbed.

1.12.5 The two wires of the span had been attached to an insulator at the top, and directly to the base, of a steel "waratah" at the end of a fence line which terminated on a small knoll on the east bank, about 10 m above the riverbed. At the opposite end, the wires were attached to an insulator at the top, and directly to the base of a substantial strainer post located on elevated ground at the northern end of the island, also at a height of about 10 m above the riverbed.

1.12.6 The trees at the north end of the island varied considerably in height but some rose to about 20 m above the riverbed. The undergrowth

surrounding the end of the span and the trees and foliage which rose well above it completely masked the area where the wires reached the island. On the east bank low scrub and trees along the river's edge obscured the fence line from which the span originated, from the view of a pilot approaching the area from upstream.

1.12.7 ZK-HYN had struck the riverbed some 44 m downstream from the collision point with sufficient force to produce an elongated gouge mark 3.5 m in length and 1 m wide and 200 mm deep in the gravel surface. At ground impact the helicopter was probably in a nose-down attitude and banked to the right. Several large portions of perspex from the cockpit canopy lay adjacent to the crater and other perspex fragments were scattered to each side and further downstream. The position of these items suggested that the cockpit canopy had remained intact until ground impact, although some of the perspex fragments bore marks, probably from flailing wire after the initial collision.

1.12.8 A section of the right skid lay just beyond the impact crater, while the "tail bumper" attached to the base of the lower vertical fin was lying 20 m to the north-west.

1.12.9 The fuselage had come to rest lying on its left side, with a heading of 315°M, 26 m downstream of the ground impact crater. A trail of wreckage between this point and the fuselage, on a heading of 100°M, comprised various items including the aircraft battery and parts of the instrument console, consistent with the break-up of the cockpit area, and the severe deformation of the lower structure of the helicopter, most marked on the right side, which had occurred on ground impact.

1.12.10 The fuselage was lying 37 m from the east bank of the riverbed and 16 m from the island. The upper part of the console containing the main instrument cluster was located 12 m to the west of the wreckage trail. A portion of the right skid and a seat cushion were lying some 7 m further downstream of the fuselage.

1.12.11 No significant information was obtained from the position of switches and controls in the cockpit. The "Hobbs" Meter Reading was 1310.2, Altimeter QNH Setting was 1019.5 mb and the Emergency Locator Transmitter selected to "AUTO". The clock, which had stopped, indicated 1241 hours.

1.12.12 The helicopter was equipped for the installation of dual controls. However, the dual yaw pedals, and the dual cyclic and collective controls remained stowed in the storage compartment beneath the passenger seat. Other items stowed on board included a first aid kit, main rotor tie-downs, ammunition and various strops and bags.

1.12.13 The leading edge and left side of the mid section of the mast fairing which covered the drive to the main rotor head and the cyclic and collective push-pull control tubes, bore a clear imprint of collision with two parallel wires. The marks which were 210 mm apart, matched the diameter of the wires which had formed the electric fencing "feeder" span. Crushing of the leading edge of the fairing had occurred, but it was evident that shortly after initial impact, the wires had become tightly stretched against almost the full width of the left side of the fairing. The angle of the "witness marks" suggested that the helicopter had assumed a nose-up attitude of about 10° at the time of the impact.

1.12.14 The marks on the mast fairing were approximately 2 m above the level of the skids. Extensive lengths of wire had become entangled around the rotorhead and also the tailboom of ZK-HYN. At least nine turns of wire were tightly wrapped around the mast itself between the fixed swashplate and the rotating swashplate. Both pitch links had broken, and the cyclic and collective control linkages had fractured under impact loads. The main rotor blades, which remained attached to the rotorhead, exhibited relatively little leading edge damage but had both sustained chordwise fractures approximately 1.6 m from their tips, suggesting that main rotor rpm had been slowed considerably by the wire wrapped around the mast.

1.12.15 The tailboom was lying alongside the fuselage but had separated completely from the helicopter at a point about 620 mm aft of its forward attachment. A loose tangle of wire remained around the tail rotor assembly and the stabiliser and fin. Marks close to the aft end of the tailboom showed that wire had wrapped tightly around this area during the accident sequence. One tail rotor blade had been sheared off and the other blade severely deformed. The lower vertical fin had been buckled by ground impact.

1.12.16 Extensive damage had occurred to the lower sections of flight control systems due to the deformation of the floor and lower structure of the helicopter. No evidence was found however to indicate any pre-impact failure of the control systems.

1.12.17 ZK-HYN was fitted with a main and auxiliary fuel tank installation. There was ample fuel on board for the flight. Both tank caps were still in place and the "gascolator" contained a quantity of Avgas 100 fuel. The fuel filter was clean, and the residual fuel uncontaminated.

1.13 Medical and pathological information

1.13.1 Post mortem and toxicological examination did not reveal any pre-existing medical condition likely to have adversely affected the ability of the pilot in command to control the aircraft.

1.13.2 He was reported to be in normal health and good spirits at the time the flight was undertaken.

1.13.3 Results from the post mortem examination indicated that the cause of the pilot's death was haemorrhage due to severe chest and abdominal injuries. He had not received any significant head injury.

1.13.4 The main injuries sustained by the passenger resulted from impact to the chest and thigh and a blow to the head. She was hospitalised in Invercargill and later at Queenstown for a total period of 14 days.

1.15 Survival aspects

1.15.1 The pilot was wearing the standard safety harness installed in the Robinson R22 helicopter which comprised a lap belt and diagonal upper torso restraint. He was wearing a protective helmet. The helmet was not equipped with a visor of any kind. The passenger was wearing a modified lap belt (see Additional Information). Both doors had been removed from the helicopter.

1.15.2 The pilot and passenger were ejected from the helicopter after ground impact but before the fuselage came to rest. The pilot was lying about 18 m beyond the initial impact point in the riverbed with the passenger to his left and some 3 m further on. The pilot's helmet was found nearby with the strap done up.

1.15.3 Examination of the wreckage showed that the short metal "strap" which comprised the structural attachment for the left side of the pilot's safety harness had failed in overload, releasing the harness. The buckle of the passengers lapbelt had failed as a result of side loads applied by the karabiner which formed part of the improvised lapbelt installation.

1.15.4 The passenger, who had been seated in the left seat, survived the accident. The extent of damage to the right side of the helicopter, together with medical evidence indicated the likelihood that the pilot was crushed during the accident sequence. The injuries he had sustained were unsurvivable.

1.15.5 ZK-HYN was equipped with an Emergency Locator Transmitter, Dorne and Margolin Type 8-1, which was mounted horizontally on the right side of the horizontal firewall in the rear compartment adjacent to the main transmission. It was selected to the "AUTO" mode, but did not transmit an emergency signal at the time of the accident. (See Tests and Research paragraph 1.16.2).

1.16 Tests and research

1.16.1 All the light bulbs from the instrument panel warning lights were examined microscopically. There was no indication that any warning light was illuminated at the time of ground impact.

1.16.2 Examination of the ELT installation showed that the aerial was satisfactory and its co-axial cable and connections were intact. A bench test determined that the ELT was capable of transmitting an emergency signal but the "G" switch required a substantial impact before the unit would activate. No definitive reason was found to explain its non-activation but the ELT unit itself had received considerable damage at the time of the accident.

1.16.3 Observations were made from a helicopter hovering at low level about 20 m upstream of the pair of wires spanning the adjacent dry channel (between the small and large islands) in the Dart Riverbed. Although the location of the wires in this instance was already known, their small diameter and colour, which varied from light metallic grey to black, provided little contrast against the background of the riverbed and the span could not readily be seen.

1.17 Additional information

1.17.1 Roto-Wing Helicopter Limited, from whom the pilot had leased ZK-HYN, were aware that he intended to use the helicopter for rabbit shooting sorties and had made arrangements to ensure that the insurance cover was not compromised by such use. The company was not aware however that any modification would be made to the seatbelt installation.

1.17.2 In the event, in order to permit maximum freedom in upper body movement for the "shooter", who occupied the left (passenger) seat, the lower attachment plate of the combined diagonal/lap belt assembly had been removed and a plain lap belt installed. The existing short belt and flap-type buckle assembly on the right side of the harness installation was left in place.

1.17.3 The lap belt which had been installed had a metal tongue at its free end with two square holes. To utilise the seat belt a karabiner, inserted through one of these holes, was clipped through the "slot" in the buckle assembly which was accessible when its flap was lifted. The use of the karabiner between the two sections of the lap belt assembly was intended to provide a secure link, obviating any risk of inadvertent disengagement and release of the lap belt during shooting operations. During the accident sequence however, the side of the buckle fractured as a result of the load applied to it by the karabiner (See photographs).

1.17.4 The alterations to the manufacturer installed seatbelt/harness arrangement constituted a modification to the helicopter and required the approval of the Airworthiness Section of the Air Transport Division of the Ministry of Transport. No application for modification of ZK-HYN in this manner had been received by the Airworthiness Section as at the time of the accident.

1.17.5 Whether the pilot's view through the front "bubble" transparencies of ZK-HYN was obscured in any way prior to the accident could not be established. Examination of the perspex fragments showed no evidence of birdstrike. The pilot was known to take particular pride in maintaining ZK-HYN in a clean and tidy condition while the helicopter was in his care and the transparencies were unobscured during the earlier flying carried out.

1.17.6 The pilot had been wearing sunglasses earlier in the day. The pilot's friend could not recall whether he was wearing them at the time of the accident flight, but it was his normal habit to do so. Whether or not the wearing of sunglasses affected the pilot's ability to observe the wire span could not be established.

1.17.7 The Civil Aviation Regulations (1953) stated:

"Regulation 38 Minimum Safe Heights

(1) Subject to the provisions of these regulations, no aircraft shall be flown over any city, town, or populous area except at such altitude as will enable the aircraft to complete a safe landing should engine failure or other cause necessitate a forced landing.

(2) Without limiting the provisions of subclause (1) hereof, no aircraft shall be flown over —

(a) Any city, town, or populous area at a lower height above the area than 1000 feet, or

(b) Any other area at a lower height above the area than 500 feet.

(2A) A height specified in subclause (2) hereof is the height above the highest point of the terrain or any obstacle thereon, within a radius of 2000 feet of a line extending vertically below the aircraft.

(3) The provisions of subclauses (1) and (2) of this regulation shall not apply if —

(a) Through stress of weather [encountered enroute] or any other unavoidable cause it is essential that a lower altitude be maintained,

(b) The aircraft is engaged [in] operations of a nature which necessitates low flying and approval has been given by the Director either for all flights or for a specific flight [or flights to be made at a lower altitude, and the flight is in accordance with such conditions as the Director may prescribe],

[(c) The aircraft is being flown in an area designated by the Director for use as a low flying area by the operator of the aircraft and the flight is in accordance with such conditions as the Director may prescribe,]

(d) The aircraft is landing or taking off."

1.17.8 A helicopter operator who had been engaged in spraying the vegetation along the shoreline of the islands during 1983, recalled that while manoeuvring very slowly he had suddenly been alerted by the glint of sun on wires and was surprised to discover that he was operating in close proximity to a low level span. He had previously been unaware of any wires in the area and recalled that he had flown over their location earlier in the day, at about 100 feet agl, without apparently seeing the wires.

1.17.9 Several experienced helicopter pilots, based at Queenstown and the surrounding region, who frequently operated in the Glenorchy area knew of other low-level wires in the vicinity of the Dart Bridge but were unaware of the electric fence "feeder" span struck by ZK-HYN. The span was not marked in any way to make it more conspicuous.

2. ANALYSIS

2.1 ZK-HYN was being flown on a brief local scenic flight when it collided with a pair of electric fence feeder wires spanning a dry branch of the Dart River. While it was impracticable to determine conclusively the pre-impact integrity of the aircraft's control systems, and completely rule out the possibility of a malfunction necessitating a descent to the riverbed, the available evidence, including that of the witnesses who heard the helicopter, indicated that ZK-HYN had performed normally during the flight and was under the pilot's control until the collision occurred.

2.2 The imprint of the two parallel wires against the leading edge and on the left side of the mid section of mast fairing, and the distribution of the wreckage following the collision, indicated that ZK-HYN was being flown in a downstream direction, between the east bank and the island, at a probable skid height of about 8 m. Whether the pilot observed the wire span at the last moment and began to flare the helicopter and/or commenced an avoiding turn to the right could not be established with certainty, but was a likely reaction. In the event it was clear that avoidance action, if taken, was ineffective, and the pilot was unable to prevent the helicopter descending to impact the riverbed heavily, shortly after the collision.

2.3 The fuselage of ZK-HYN had come to rest some 70 m downstream from the collision point. This distance together with the considerable ground impact forces which resulted in severe deformation of the helicopter's structure and the ejection of the occupants, suggested that the helicopter was being flown at low level at medium speed when the collision occurred, rather than completing the final stage of an intended or emergency landing in the riverbed.

2.4 The pilot lived near Queenstown and was familiar with the surrounding area. He had previously landed at "The Hillocks" but was likely to have been unaware of the existence of the wires. A number of other local helicopter pilots, were unaware of the existence of the electric fencing feeder spans to the Dart River islands. Whether he had conducted any reconnaissance, or specifically searched for wires, during some portion of the brief scenic flight before descending to fly down the riverbed could not be established. It was probable however that even if a reconnaissance had been made the spans would have been difficult to distinguish unless the helicopter was in close proximity to them.

2.5 Towards the conclusion of the flight the pilot had flown over the property where the passenger lived, and the helicopter had last been observed proceeding in the direction of the Dart Bridge "as though commencing a circuit to come in". The paddock where the helicopter had previously landed was situated to the north-west of the house. A direct approach to this paddock from the vicinity of the Dart Bridge involved a descending flight path over grazing land and the undulating "hillocks", rather than any requirement for a descent or prolonged low flight over the riverbed, which lay further to the west.

2.6 No conclusive reason could be established for the pilot's decision to fly between the island and the riverbank at low level. The "islands" however, like the nearby "hillocks" were prominent local features, and given the existing calm and sunny conditions, the pilot may have elected to enlarge his landing "circuit" to allow his passenger a close view of the smaller island prior to concluding the flight. Alternatively, being evidently unaware of the hazard presented by the wire span, the pilot may simply have decided to conduct an extended low level approach to the paddock from the direction of the island. It was reported to be his usual practice to carry out a long low approach when a passenger on board was new to helicopter flying.

2.7 The passenger who received a blow to the head in the accident, had no recollection of the events of the flight other than entering the helicopter, recalling its relatively small size and the fact that the doors had been removed. The accident occurred in the middle of the day. The small diameter of the wires and the manner in which their colour blended with the surroundings rendered the wires difficult to see even under bright illumination. Viewed from above or at an oblique angle, the wires would have presented little contrast against the background of the riverbed or sky. There were no poles or other obvious supporting structures at either end of the span which might have assisted in alerting a pilot to the existence of the wires. The wires themselves were not marked in any way.

2.8 The electric fence "feeder" span traversed the riverbed well below the height of the tree tops on the island. A helicopter maintaining height over the riverbed at or above tree-top level would not have been in danger of colliding with the span.

2.9 The pilot of ZK-HYN had descended to a level lower than the adjacent tree tops. The evidence showed that the pilot of a helicopter flying downstream at such a level, at other than a slow speed, and unaware of the existence of the span, would have been unlikely to have observed the wires until it was too late to take effective avoiding action. Following the collision wire wrapped around the main rotor head and swashplates of ZK-HYN resulted in an irretrievable loss of control.

3. FINDINGS

3.1 The pilot in command held a valid Commercial Pilot Licence - Helicopter and Type Rating for the Robinson R22 type.

3.2 The helicopter's Certificate of Airworthiness and Maintenance Release were compromised by an unapproved modification to the passenger seat belt installation.

3.3 The helicopter's gross mass and centre of gravity were within the specified limits.

3.4 The helicopter had descended to a low height when it struck a pair of electric fence "feeder" wires spanning a branch of the Dart River.

3.5 Prior to the collision with the wires the helicopter was capable of normal operation.

3.6 The pilot was probably unaware of the existence of the "feeder" wires.

3.7 When approaching the "feeder" span from upstream it would have been difficult for the pilot to distinguish the wires against the background of the riverbed or sky.

3.8 The collision with the wires resulted in structural damage to the helicopter which rendered it uncontrollable.

3.9 The wires could have been made more conspicuous by some form of marking.

3.10 The probable cause of this accident was the pilot's decision to descend the helicopter to a low level in an area where, unbeknown to him, an obstruction to low level operations was located.

4. SAFETY RECOMMENDATIONS

4.1 As a result of the investigation into this accident it was recommended to the General Manager of the Air Transport Division of the Ministry of Transport that attention be drawn, once again to:

The insidious hazard of low strung wires, to any aircraft which has descended to low level in an area with which the pilot is unfamiliar, or where the pilot has not positively confirmed that no wire hazard exists, and

The hazards of altering the configuration of a seatbelt installation. The proper approval process should be followed as it is intended to ensure that any modified seatbelt or harness installation will serve the purpose for which it is to be used with due regard to the loads which may be placed upon it and will not compromise other safety aspects.

4.2 The General Manager responded that he agreed with the recommendations and commented as follows:

"A forthcoming issue of New Zealand Flight Safety will reiterate the message [relating to wire strikes] last published at length in the June 1985 issue (and referred to occasionally since). The 1987 'Wirestrike' video produced by New Zealand Flight Safety will continue to be regularly promoted.

"[The Air Transport Division] proposes to publish a reminder to maintenance organisations on the need to obtain approval for such [seatbelt] installation. A similar reminder will also be published in New Zealand Flight Safety."

5. REGULATORY

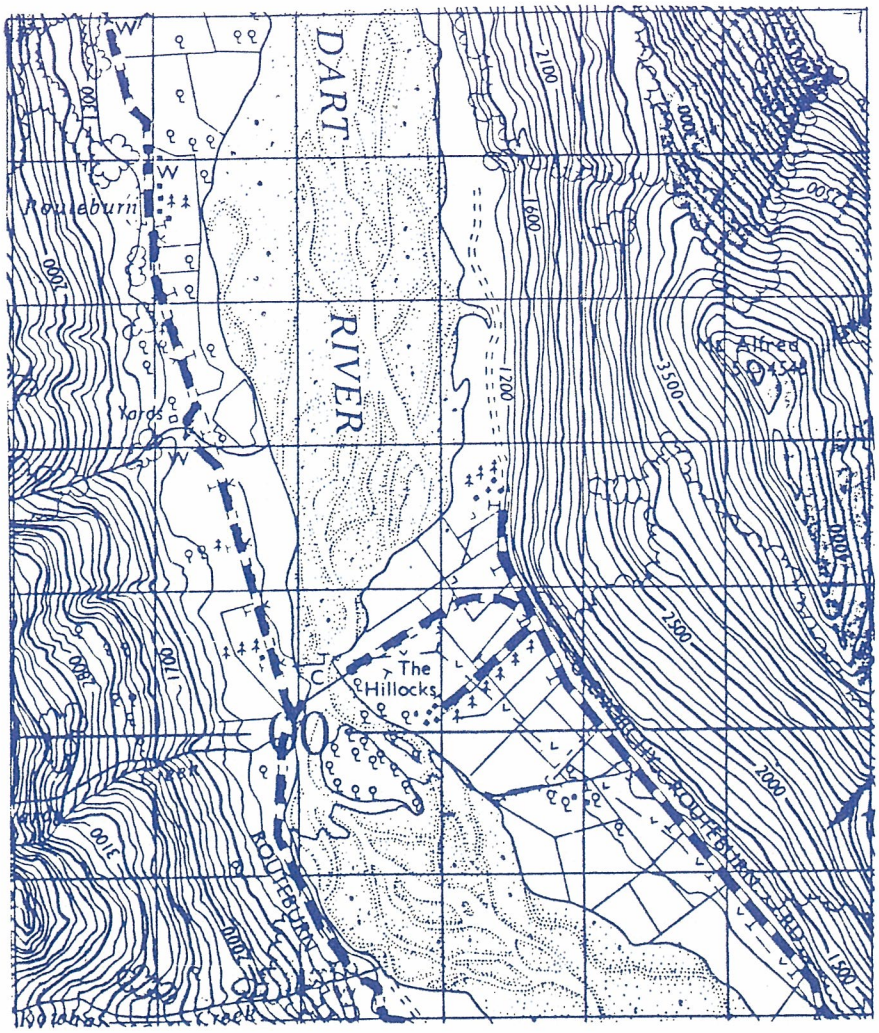
5.1 Pursuant to Section 14(5) of the Transport Accident Investigation Commission Act 1990 the legal personal representative of the pilot in command was invited to avail herself of the opportunities afforded to her thereunder.

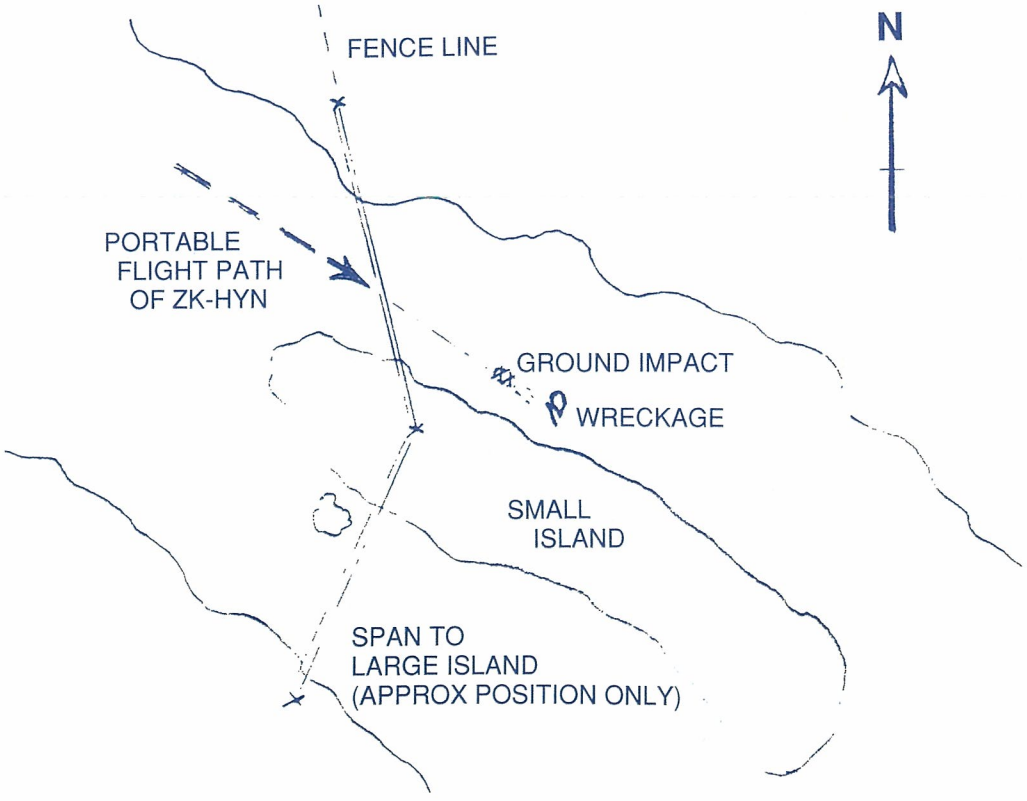
5.2 As a result of representations received the report was amended and amplified to clarify some of the points raised.

5.3 The representations made to the undersigned are not to be taken as an admission of liability on the part of the pilot in command and the statement of his personal representative is without prejudice to her right to act in any way she may consider fit in any proceedings or action which may be based on the events to which this report refers.

22 August 1991

M F DUNPHY
Chief Commissioner


DART RIVER
Routeburn
Yards
The Hillocks
Mt Alfred
ROUTEBURN FLATS ROAD
ROUTEBURN


FENCE LINE
N
PORTABLE
FLIGHT PATH
OF ZK-HYN
GROUND IMPACT
WRECKAGE
SMALL
ISLAND
SPAN TO
LARGE ISLAND
(APPROX POSITION ONLY)

ROBINSON R22
STANDARD SEATBELT
INSTALLATION

Figure 1.

Figure 2.

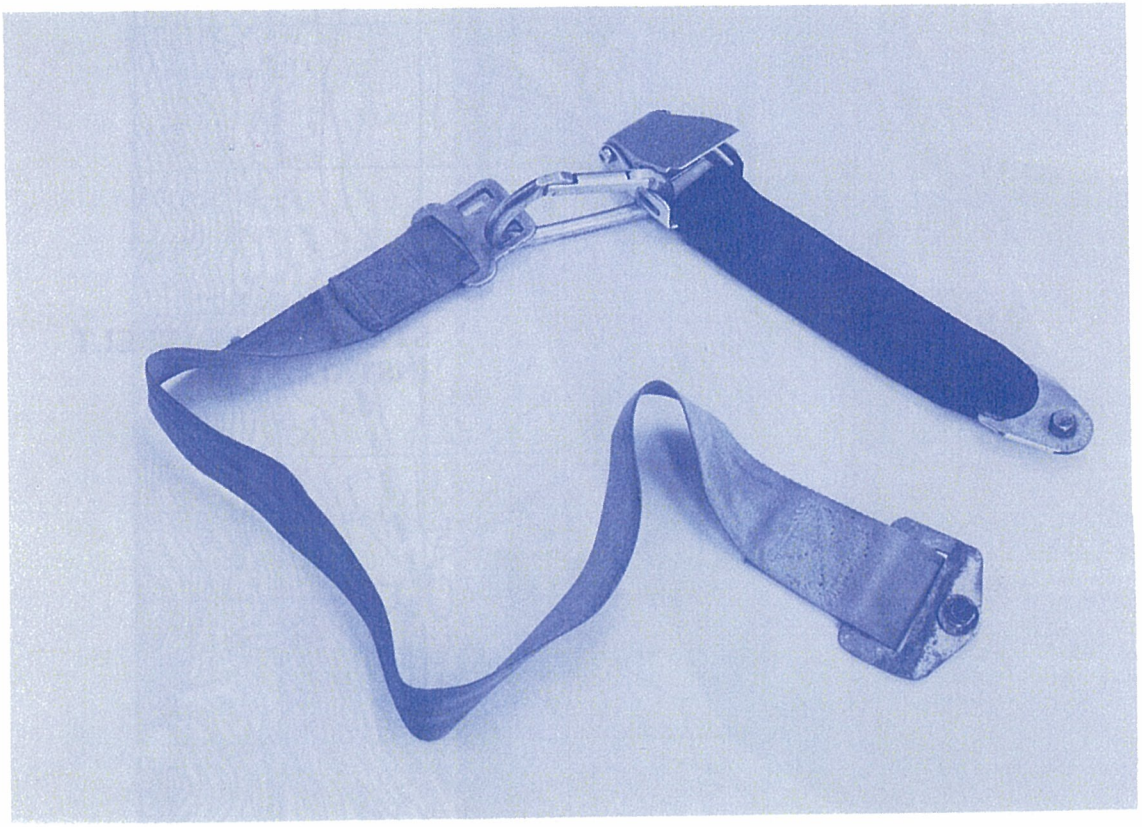


Figure 3. Improvised Lap Belt Installation

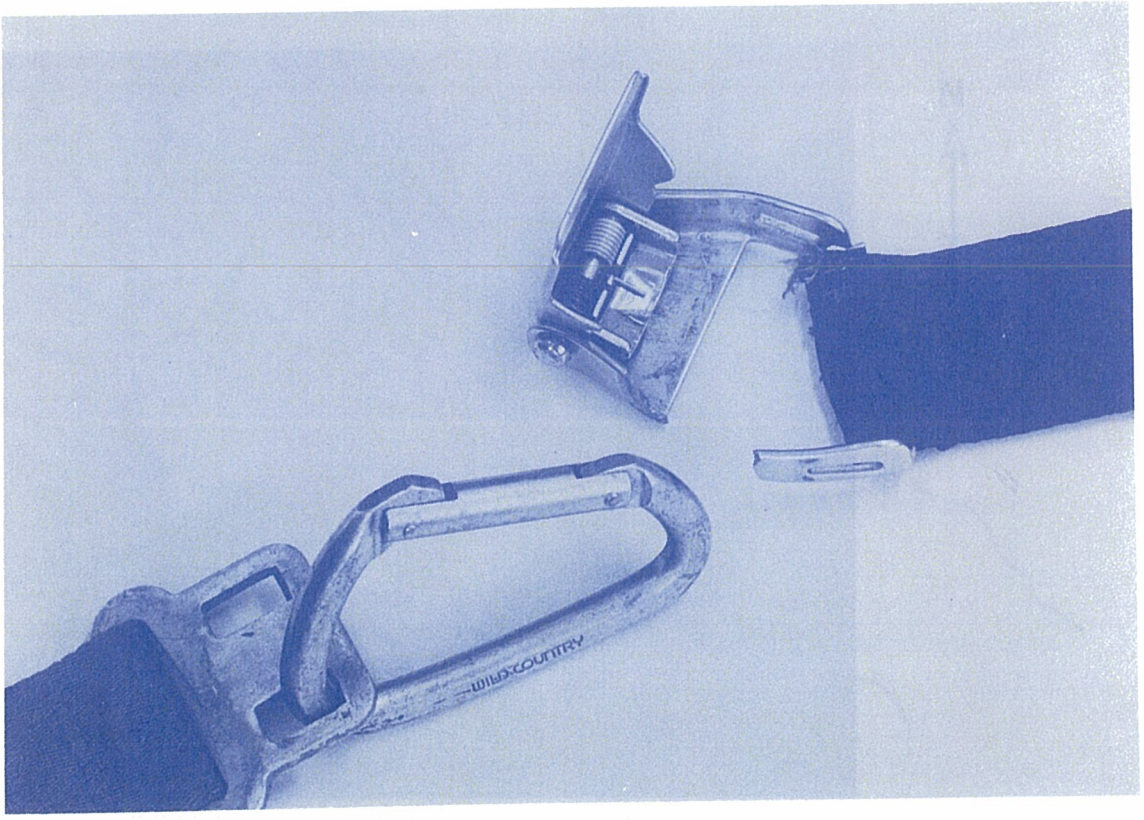


Figure 4. Failed Buckle