



Report 95-021

Robinson R22 Alpha

ZK-HUH

Near Gorge River mouth, South Westland

9 December 1995

Abstract

At approximately 2025 hours on Saturday, 9 December 1995, during a deer hunting sortie, the shooter, suspended on a strop beneath R22 helicopter ZK-HUH, fell onto a hard sand beach when the cargo hook opened unexpectedly. The shooter sustained severe internal injuries and died that evening. No definitive cause was established for the opening of the cargo hook. Civil Aviation Authority approval had not been sought for the carriage of a person on the strop, and special conditions to enhance the safety of a person so carried were not in place.

Transport Accident Investigation Commission

Aircraft Accident Report 95-021

Aircraft type, serial number and registration:	Robinson R22 Alpha, 0416 ZK-HUH
Number and type of engines:	1 Lycoming O-320-B2C
Year of manufacture:	1984
Date and time:	9 December 1995, 2025 hours ¹
Location:	Near Gorge River mouth, South Westland 75 km south-west of Haast Latitude: 44°11'S Longitude: 168°12'E
Type of flight:	Aerial work, deer hunting
Persons on board:	Crew: 2 (Shooter on strop beneath helicopter)
Injuries:	Crew: 1 fatal (shooter)
Nature of damage:	Nil
Pilot in Command's Licence:	Commercial Pilot Licence (Helicopter)
Pilot in Command's age:	28
Pilot in Command's total flying experience:	400 hours approximately 170 on type
Investigator in Charge:	D G Graham

¹ All times in this report are NZDT (UTC + 13 hours)

1. Factual Information

- 1.1 On Saturday, 9 December 1995 the pilot and shooter departed in R22 ZK-HUH from their base at Hannahs Clearing, some 15 km south-west of Haast, at about 1900 hours on a deer hunting sortie. They flew for approximately one hour working their way towards the south, searching the grassy flats of the Jackson River and the tops surrounding the upper reaches of the Cascade River. Finding these areas unproductive, they decided to follow the Gorge River out to the coast.
- 1.2 On reaching the Gorge River mouth they turned to the north west and flew along the beach. Shortly afterwards they observed a deer halfway up a steep slip adjacent to the beach, some 200 m from the river mouth. The pilot carried out a 180° turn to head into the light southerly breeze and positioned the helicopter for the shooter to obtain a successful shot. The shot deer subsequently rolled down the slope, ending up amongst trees at the base of the slip.
- 1.3 The pilot assessed the practicability of hovering with one skid against the slope to enable the shooter to retrieve the deer. Control of the helicopter was sensitive in regard to the weight transfer involved in the shooter disembarking from the skid and the pilot considered the area was too “tight” to allow adequate margins for safe manoeuvring. The shooter suggested to the pilot that, as an alternative, he could be lifted into the site on the strop. The pilot agreed that, in the circumstances, he would prefer to transport the shooter to the site by this means.
- 1.4 The pilot flew ZK-HUH the short distance of about 60 m to the beach, and landed. The shooter disembarked and took the long “twenty foot” strop from its stowage in the front of the helicopter. He had three short strops and karabiners around his waist which were normally used in recovering deer. The pilot lifted off and held ZK-HUH in a hover about 1.5 m above the beach to allow the shooter to reach in under the helicopter and attach the long strop to the helicopter’s cargo hook.
- 1.5 The pilot recalled that, during the hover, he made a visual check of the position of his hand while holding the cyclic control. He was wearing a pair of lined light leather gloves and verified that his right thumb was resting against the edge of the hook release bracket, clear of the hook release button.
- 1.6 The pilot maintained the hover, facing into the light wind blowing along the beach. He considered that rather than risk dragging the shooter through the nearby trees by proceeding directly to the slope, it would be best to first gain some height by flying to the south. Accordingly he slowly increased height in the hover looking out of the door and watching the shooter until the slack in the strop had been taken up. The shooter gave him a “thumbs up” signal indicating that all was okay.
- 1.7 The pilot continued to increase height slowly, lifting the shooter off the ground and beginning to move forward through translation. Some five to 10 seconds later the helicopter had reached a speed of 30 to 35 knots and was about 50 feet above the beach when the pilot felt a lurch as the weight on the strop altered suddenly. He looked down immediately and saw the shooter falling, with the strop trailing him through the air. It was evident that the strop had released from the cargo hook beneath the helicopter.
- 1.8 The pilot observed the shooter strike the firm sand feet first and roll over several times in the direction the helicopter had been moving. The pilot turned the helicopter downwind without delay and landed on the beach beside the shooter. His first impression was that the shooter was badly winded and had injured his left arm and shoulder but it soon became clear that he had received internal injuries and needed medical help urgently.

- 1.9 Because of the isolated area in which the accident had taken place, and the late hour, the pilot decided to transport the injured shooter in ZK-HUH to the nearest settlement at Jackson's Bay, about 50 km northwards along the coast, where help could be summoned by telephone.
- 1.10 He managed to lift the shooter into the passenger seat of ZK-HUH and secure his seatbelt. The shooter appeared to be conscious but was unable to speak or to co-ordinate his movements. The pilot was concerned that the shooter's movements might interfere with the safe operation of the helicopter and spent some time positioning him and securing his limbs. At this stage, unexpectedly, another person arrived at the scene.
- 1.11 This person lived with his wife and family on the southern side of the Gorge River mouth. He had heard the helicopter fly down the river and was outside his house, watching, as the pilot manoeuvred ZK-HUH adjacent to the slope and the deer was shot. He continued to watch, from a distance of some 300 m, as the helicopter landed on the beach and subsequently hovered as the shooter attached the strop and was then lifted into the air. He gained the impression that the pilot took special care to gain height smoothly and slowly. All seemed to be going well, and he estimated the shooter was "about 20 or 30 feet above the beach", when the strop suddenly let go from the helicopter. The shooter began to fall and was lost to his view behind an intervening shingle mound. The strop was visible trailing above the shooter as he fell. Except for the final part of the shooter's fall the local resident observed the whole accident. There was no suggestion that a collision, such as a birdstrike against the hook, or any other obvious external event had occurred prior to the separation of the strop from the helicopter.
- 1.12 Recognising that the fall was likely to have caused some serious injury, the resident set out immediately to render assistance. He crossed the Gorge River by canoe and then made his way on foot as rapidly as possible to the accident site, arriving in time to help the pilot secure the shooter in the helicopter.
- 1.13 The shooter's condition was such that he became very agitated when airborne and despite several attempts it proved impracticable for the pilot to fly him any significant distance in ZK-HUH. The pilot eventually landed on a beach about four kilometres from Gorge River and left the shooter in the care of the local resident while he flew to Jackson's Bay. On arrival, shortly before 2100 hours, he advised the police at Greymouth by telephone concerning the accident. He returned to the beach, landing at dusk, and learned that the shooter had died about half an hour earlier.
- 1.14 Rescue operations had been arranged by police, involving a Hughes 369C helicopter from Karangarua, and the en-route pick up of a nurse and paramedic. The ambulance from Haast had proceeded by road to Jackson's Bay. The pilot of ZK-HUH activated the aircraft's ELT, and a fire lit on the beach assisted the rescue helicopter to locate their position in the darkness. The rescue team and the ambulance arrived back at Haast at approximately 0130 hours on Sunday morning.
- 1.15 The pilot, a New Zealand citizen, had lived in Australia for eight years. He had commenced helicopter flying training in Australia in March 1990 and had obtained his Private Pilot Licence (Helicopter) in July 1990. He held approval for stock mustering operations, issued in September 1990. After accumulating the required flying hours he completed his training for an Australian Commercial Pilot Licence (Helicopter) which was issued in January 1991. He held endorsements for Bell 206, Hughes 269, and R22 types. Before returning to New Zealand in 1995 the pilot had accumulated a total of more than 400 hours helicopter flying. This included about 170 hours in the Robinson R22 and 90 hours in the Bell 206. He had carried out five hours of sling endorsement training in the Bell 206 and had flown approximately 200 hours in mustering operations.

- 1.16 Following his return to New Zealand the pilot had been contacted by the shooter and had accepted the offer of a job flying ZK-HUH for the shooter on deer recovery work. The pilot had no previous experience in this type of operation. It was recognised mutually that he would be operating under the guidance and direction of the shooter in regard to the practical techniques required for the task.
- 1.17 As a result of being offered a flying position, the pilot made arrangements to obtain a New Zealand Commercial Pilot Licence (Helicopter). During October 1995 he carried out 7.1 hours dual sling training, and a total of 10.2 hours dual and solo mountain flying training in Robinson R22 helicopters. In addition, to satisfy the New Zealand requirements, he completed an Awareness Training Course in the Robinson R22 type on 8 October 1995, and successfully completed a Biennial Flight Review on 10 October 1995.
- 1.18 The pilot was issued with New Zealand Lifetime Commercial Pilot Licence (Helicopter) No. 45560 on 16 October 1995. He held a Class 1 Medical Certificate with no restrictions which was valid to 4 September 1996, and a Flight Radio Telephone Operator Rating.
- 1.19 The pilot and shooter had commenced deer recovery operations in ZK-HUH on 17 November 1995. Up to the time of the accident the pilot had flown some 19 hours in ZK-HUH. During this period the pilot had carried deer on a strop attached to the helicopter's cargo hook on about 15 different occasions. No problems had been experienced with the operation of the cargo hook. It had locked effectively and released as required. The shooter had been lifted on the strop on one occasion during the same period. No difficulties had been encountered.
- 1.20 The shooter, aged 37, held New Zealand Lifetime Private Pilot Licence (Helicopter) No. 39001, a Flight Radio Telephone Operator rating, and a rating for the Robinson R22 type. The licence had been issued on 13 August 1993. The shooter was qualified for sling load operations. He held a Class 2 Medical Certificate valid to 1 March 1998. The Medical Certificate included the following restrictions:
- 001 Spectacles (distance vision) must be worn
 - 082 Not valid for flight in vicinity of a controlled aerodrome (unless aircraft is in radio contact with aerodrome control)
 - 085 Not valid for night flying.
- 1.21 The number of flying hours the shooter had accumulated at the time of the accident was not established conclusively. At the time of issue of his Private Pilot Licence (Helicopter) in 1993 he had recorded a total of 57 hours. His total flying time was about 150 hours.
- 1.22 The shooter had previously worked for other West Coast helicopter operators, and, in addition to his own helicopter flying experience, was familiar with the activities, equipment, and techniques associated with the deer recovery industry. He had leased ZK-HUH initially with the intention of purchase at a later date. The shooter had provided the strops, karabiners and other items necessary to outfit ZK-HUH for the deer hunting role. He had obtained the used cargo hook, from an Australian source and it had been installed on ZK-HUH by an approved aircraft maintenance organisation before the pilot and shooter commenced deer hunting operations.
- 1.23 The cargo hook was a Classic Aircraft Products CH400-1 type and was attached securely to a designated hard point on the underside of ZK-HUH, which had been modified to accept the installation. The mounting allowed the cargo hook to pivot forward and aft, and to swing freely left and right. The cargo hook had a 1000 pound (453 kg) capability but in the R22, for which it was an approved type, it was limited to a maximum load of 400 pounds (181 kg).

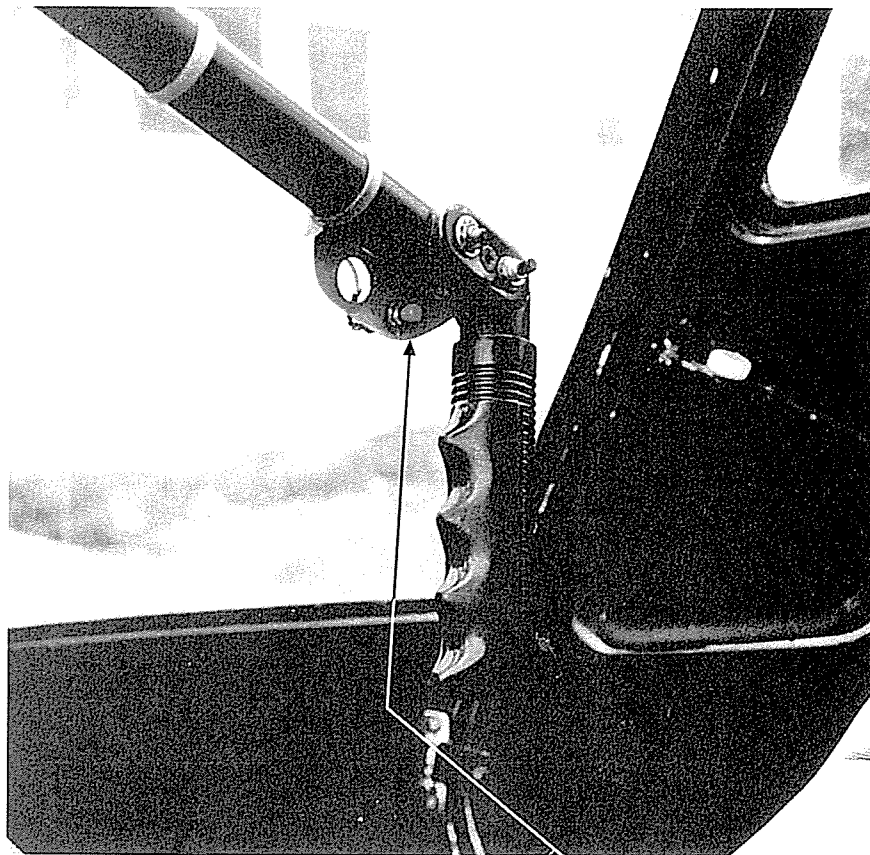


Figure 1
Cargo hook electrical release (red button)

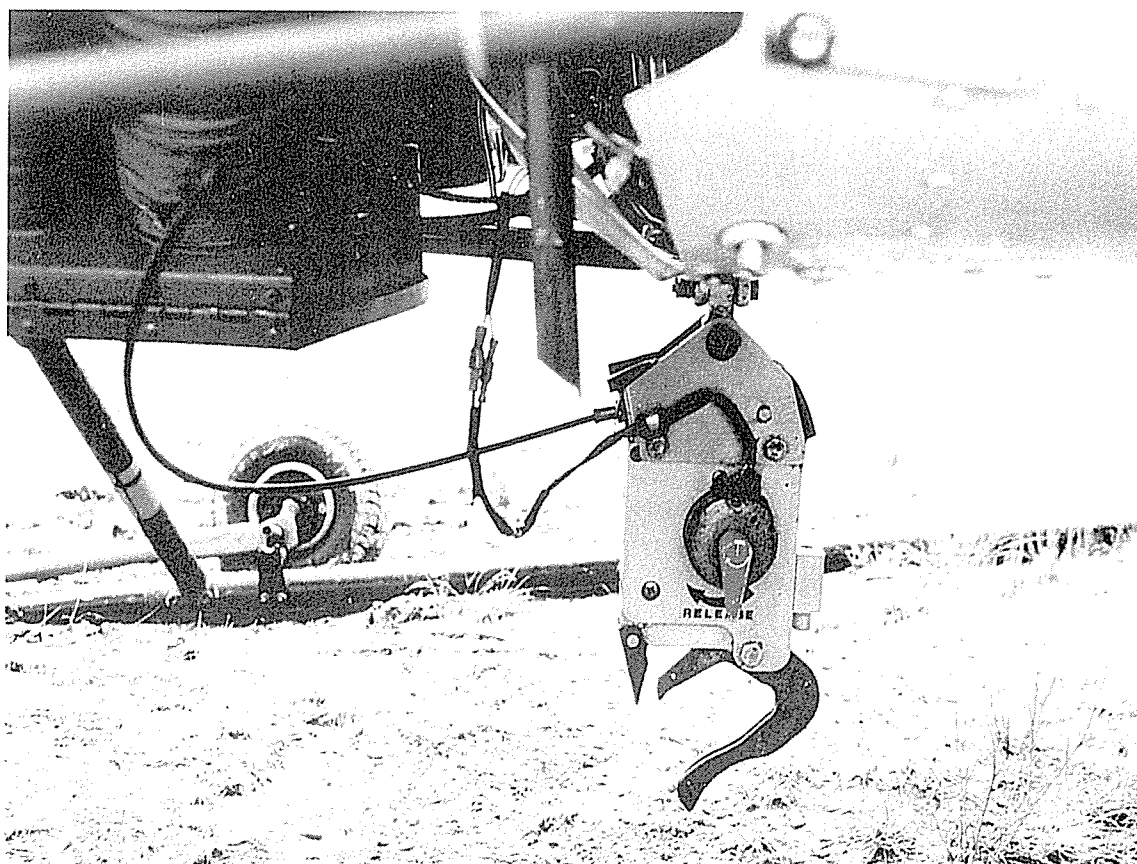


Figure 2
Cargo hook installation (hook open)

- 1.24 The installation in ZK-HUH included a “push to operate” electrical release switch mounted on a bracket attached to the pilot’s cyclic control (see Figure 1). The switch “button” was not shrouded but the attachment of the mounting bracket to the forward side of the cyclic control tubing partially protected the switch within the elbow of the control handle. This was in contrast to the nearby “press to talk” RTF and intercom switches which were positioned just above the control handle for ease of operation during flight.
- 1.25 ZK-HUH had been fitted with a cargo hook previously. The electrical circuit utilised one of the circuit breakers (CBs) in the aircraft’s standard CB panel, forward of the left seat base, as protection against current overload. The CB could be pulled manually, if required, to isolate the hook release switch from the aircraft’s electrical power supply.
- 1.26 The CB wired for this purpose was one of several spares located among the double row of CB’s in the panel. It was rated at 25 amps and was placarded ‘HOOK’. The pilot was unaware that the electrical hook release could be dis-armed by this means. The extent of the shooter’s knowledge of the cargo release electrical system was not known.
- 1.27 A foot-operated cable release connected directly to the cargo hook was fitted on the lower right side of ZK-HUH’s cockpit. This could be used by the pilot to open the hook mechanically if the electrical release failed to function satisfactorily.
- 1.28 The cargo hook itself had a manual release arm, normally in a vertical position on the right side of the outer case which when rotated clockwise some 15°, (rearwards movement of the arm) opened the hook mechanically.
- 1.29 The cargo hook incorporated a “keeper” or safety latch, at the end of the hook load beam. This acted as a one-way latch, allowing a karabiner, or looped strop, to be slid onto the load beam with the hook reset in the closed position. Thus it was retained securely unless the hook was released, electrically or mechanically from inside the helicopter, or externally by movement of the manual release arm.
- 1.30 Normal operation of the cargo hook required only a momentary 12-volt DC electrical supply to release the load. Once the load beam had been released it would remain in the unlocked, hook open, position until it was reset manually by ground personnel.
- 1.31 When ZK-HUH was examined following the accident the cargo hook was open (see Figure 2). There was no marking or other evidence to indicate that the cargo hook assembly, or its load beam, had been subjected to unusual loading by the strop being mis-positioned or mis-aligned in some manner when it was attached.
- 1.32 Functional tests at the time, with no load on the hook, showed that the hook reset normally, and the electrical and mechanical release systems operated satisfactorily.
- 1.33 Detailed inspection of the cargo hook wiring disclosed no evidence of electrical shorts, chafes, or other faults. The helicopter was suspended by its lifting fixture and a load of 160 pounds (73 kg) attached to the hook. The cargo hook wiring was pulled and flexed but no defect was revealed. The load was released only electrically by activation of the release button. It was noted that the contacts at the rear of the switch were not covered. A remote possibility existed that these could be bridged inadvertently by some conducting object or material, and the switch circuit completed.
- 1.34 The 6 m long “twenty-foot” strop on which the shooter had been lifted, was 12 mm diameter, braided polyester. The strop was spliced at each end to form loops approximately 230 mm in length. An oval anodised screw-type karabiner, with its threaded locking sleeve in the unscrewed (unlocked) position was clipped to one loop. A heavy 12 mm galvanised shackle

attached a half tonne capacity forged steel hook to the opposite loop. No swivels were fitted. The strop, karabiner, and hook and shackle assembly were in new condition.

- 1.35 There was no evidence to confirm the manner in which the shooter attached the strop to the helicopter's cargo hook. A rapid and effective method with the hook already closed, or manually reset by the shooter to the closed position, would have been to slide the karabiner, clipped to the strop, onto the load beam, past the keeper. It should then have been securely retained, providing the hook did not open.
- 1.36 The cargo hook was slung from an overhead beam and tests were carried out to simulate the possible methods which the shooter may have used to "hook on", before being lifted off the ground. The "twenty-foot" strop, in unchanged configuration, was used, with an appropriate load applied at various angles. A 12-volt DC power supply was arranged to operate the hook release.
- 1.37 The hook exhibited no tendency to open unexpectedly under load from any angle. A 12-volt DC current, applied momentarily, resulted in hook release on every occasion, whether bare, or under load. The load beam reset without difficulty and the hook remained securely closed each time it was reset.
- 1.38 The manual release arm on the side of the hook opened the hook, as designed, when it was moved rearwards. It did not appear sensitive to vibration, or forward, rearward, or lateral swinging of the hook under load. In one simulation, placing the loop of the strop on the hook rather than the karabiner it was possible to induce the loose karabiner to flick against the manual release arm and open the hook. However, considerable flexing of the strop was required for this to occur. It was considered that unless the strop was grossly mis-positioned or entangled at the time of 'hooking on', external disturbance of the manual release arm was unlikely.
- 1.39 Previous accidents have demonstrated that the practice by shooters of "riding the chain" when deer have been lifted out, or of being transported in some other manner suspended beneath a helicopter while deer hunting, holds considerable potential for a fall with the consequent likelihood of serious or fatal injury. Instances have occurred in which karabiners have twisted in a certain way and released from cargo hooks, and strop and karabiner assemblies have become unexpectedly detached, resulting in fatal falls. These occurrences have indicated that extreme care must be exercised by any individual "hooking on" to a cargo hook, or attaching a strop and karabiner combination, to ensure that the method of attachment will be safe and dependable throughout the period of suspension.
- 1.40 Civil Aviation Safety Order (CASO) 20 Helicopter Operations Part 9, "Low level and sling load operations" contained general conditions relating to these operations. Amongst other conditions this included the following:

Para 9.3 (d). The operations shall be carried out in such a way that there is no unnecessary danger to any persons or property.

- 1.41 CASO 20 Part 10 contained the requirements applying to "Winching, Rappelling, and Human Sling Loads".

Para 10.2 listed a series of general conditions applying to all operations, other than emergency operations, involving the suspension of persons beneath helicopters.

Conditions listed, particularly relevant to the circumstances of the accident involving ZK-HUH, included the following:

- 10.2.1 (a) No such operations shall take place except in accordance with the provisions of an approved operations manual.
- (d) All components of the equipment used shall be of approved types and any additional limitations associated with the approvals shall be complied with.
- (f) The rope or cable on which the person is suspended shall be capable of release from the helicopter by the crew, but the system shall be so arranged that two separate actions must be taken to effect release.

“Approved” in terms of the Civil Aviation Regulations meant “Approved by the Director ... in writing.”

1.42 To satisfy the conditions of CASO 20 Part 10.2.1 (f) and act as a safeguard in this respect, two precautions are normally employed by operators approved to carry persons suspended beneath a helicopter, as follows:

1. The circuit breaker incorporated in the electrical release circuit is ‘pulled’, thereby disarming the pilot’s electrical release switch.
2. The use of a safety strop passing across the cabin floor of the helicopter and suitably connected at each end, normally by karabiners, to the strop attached to the helicopter’s cargo hook, thus taking the load should the cargo hook unexpectedly open for any reason.

(In the event of an emergency involving the helicopter (e.g. an auto rotational descent), a supplementary crew member carried in the cabin is detailed to cut the safety strop. The pilot is then able to release the suspended person(s) using the manual release system, once the helicopter has descended to an appropriate height and the speed has reduced.

1.43 New Zealand Civil Airworthiness Requirements (NZCAR) C.4 paragraph 7.2 “Rotorcraft: Means of attaching external loads” specifies that all rotorcraft which have means for attaching an external load, which is jettisonable and carried on a cargo hook or similar device below the aircraft, must be fitted with a device to enable the pilot to release the external load quickly during flight. This quick release device and the means by which it is controlled must comply with the following:

- (a) A control for the quick release device must be installed on one of the pilot’s primary controls and must be designed and located so that it may be operated by the pilot without hazardously limiting his ability to control the rotorcraft during an emergency situation.
- (b) In addition a manual mechanical control for the quick release device, readily accessible to either pilot or to another crew member must be provided.
- (c) The quick release device must function properly with all external loads up to and including the maximum external load for which authorisation is requested.

2. Analysis

- 2.1 The cargo hook installation in ZK-HUH complied with the NZCAR requirement in that it was specifically designed to be operated from the cockpit both by electrical and manual means.
- 2.2 There was consequent potential for a person suspended from a strop attached to the helicopter's cargo hook to sustain a serious or fatal fall should the cargo hook be operated at an inappropriate height or airspeed whether inadvertently by the pilot or as a result of some fault in the electrical or mechanical release system, or by some external means.
- 2.3 The conditions listed in CASO 20 para 10.2.1 were intended to ensure, as far as was practicable, the safety of persons suspended beneath helicopters. Compliance with the conditions, on a continuing basis, was necessary for a given approval to remain in force.
- 2.4 In the case of the accident involving ZK-HUH, however, no approval had been sought from the Civil Aviation Authority in respect of a shooter being carried on a strop beneath the helicopter. No general dispensation or other provision existed to permit personnel involved in deer recovery operations to be transported in this manner other than for emergency reasons.
- 2.5 On the flight, during which this accident occurred neither of the safeguards normally employed by operators who were approved to carry persons suspended beneath a helicopter were utilised. The second precaution would not have been practicable in the circumstances, given the limited lifting capability of the R22 helicopter and in any event, the absence of a supplementary crew member. However, had the pilot been aware of the electrical protection provided in the cargo hook circuit, it would have been prudent for him to have dis-armed the electrical release by pulling the appropriate circuit breaker, to ensure that no inadvertent action, or system electrical fault, could result in an unexpected hook release.
- 2.6 The pilot and shooter had experienced no previous difficulty with the cargo hook, or sling loads carried on previous occasions, during the brief period of deer hunting for which they had operated ZK-HUH. The tests carried out following the accident disclosed no fault in the cargo hook fitted to ZK-HUH, nor in the electrical or mechanical release systems installed in the helicopter. However the possibility of a transient application of 12-volt DC current sufficient to activate the electrical release, or mechanical release induced by in-flight vibration and/or aerodynamic loading as the helicopter gained speed and height from the hover, could not be eliminated.

3. Findings

- 3.1 The pilot held a valid NZ Commercial Pilot Licence (Helicopter) and was qualified for sling load operations.
- 3.2 The pilot's experience in helicopter deer hunting was limited to the brief period during which he and the shooter had operated ZK-HUH.
- 3.3 The helicopter had a valid C of A and Maintenance Release.
- 3.4 The shooter held a valid Private Pilot Licence (Helicopter) and was qualified for sling load operations.
- 3.5 The shooter had considerable previous experience in helicopter deer hunting operations, including use of the R22 type for this purpose.

- 3.6 The shooter had the necessary experience and qualifications to train the pilot in the activities and techniques involved in helicopter deer hunting.
- 3.7 This was not the first occasion on which the shooter had made a decision to be transported “on the strop”.
- 3.8 The manner in which the shooter had attached the strop to the helicopter’s cargo hook on the accident flight could not be determined.
- 3.9 No post-accident defect was found in the cargo hook, or the electrical or mechanical release systems, to account for the premature in-flight opening of the hook.
- 3.10 The circumstances indicated that the pilot and shooter were unaware that the cargo hook electrical release switch could be dis-armed readily, and consequently this precautionary action was not taken prior to the flight.
- 3.11 Except in an emergency specific approval was required from the Civil Aviation Authority for the shooter to be transported on a strop beneath a helicopter.
- 3.12 Civil Aviation Authority approval would have included the necessity for compliance with special conditions to enhance the safety of the operation.
- 3.13 In the case of the accident flight, Civil Aviation Authority approval had not been obtained and the applicable safety precautions were not in place.
- 3.14 A conclusive cause for the opening of the cargo hook was not established.

23 October 1996

M F Dunphy
Chief Commissioner