Report 96-005

Robinson R22 Beta

ZK-HVX

Row Valley, Poulter Range,

Arthur's Pass National Park

20 January 1996

Abstract

On Saturday 20 January 1996 at about 0730 hours, Robinson R22 Beta helicopter ZK-HVX collided with trees and terrain during a private venison hunting flight. The shooter was killed, and the pilot was seriously injured. No safety recommendations were made. A safety issue was identified relating to the suitability of this type of helicopter for this operation. Factors in this accident were mishandling of the helicopter, or misjudgement by the pilot while manoeuvring close to the top of the trees.

Transport Accident Investigation Commission

Aircraft Accident Report 96-005

Aircraft type, serial number and registration:	Robinson R22 Beta, 0553, ZK-HVX
Number and type of engines:	One Lycoming O-320-B2C
Year of manufacture:	1986
Date and time:	20 January 1996, about 0730 hours*
Location:	Row Valley, Poulter Range, Arthur's Pass National Park, 18 nm north east of Arthur's Pass Latitude: 42° 48.8' S Longitude: 171° 54.8' E
Type of flight:	Private, venison hunting
Persons on board:	Crew: 2
Injuries:	Crew: 1 fatal, 1 serious
Nature of damage:	Substantial
Pilot in Command's Licence:	Commercial Pilot Licence (Helicopter)
Pilot in Command's age:	29
Pilot in Command's total flying experience:	1293 hours 1206 hours on type
Investigator in Charge:	J J Goddard

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

1. Factual Information

1.1 Early on the morning of Saturday 20 January 1996 the pilot and shooter drove from their base in Hokitika to Kowhitirangi where the helicopter had been left overnight. After a short local flight to position a moss picker onto his work area, the pilot and shooter lifted off at about 0600 hours and headed into the mountains to the east, to hunt for deer.

1.2 The general route taken was up the Styx River, across the upper reaches of the Arahura and Taipo Rivers, across State Highway 73 near Otira and over to the Poulter Range. These areas were searched for deer, with no sightings. Flying conditions were good, with clear skies and little wind.

1.3 Some 90 minutes after departure the helicopter was flown into the basin at the head of the Row Stream where the shooter spotted, some distance below, a deer which ran into cover in an area of bush.

1.4 The helicopter was flown in a left hand orbit, descending into the basin, and back over the bush. The deer was spotted again running back into cover, so the pilot repositioned the helicopter, descending low over the bush to try to flush out the deer using the air horns on the aircraft and its rotor downwash. When near the estimated position of the deer, he did a tight turn to the right, at low speed just above the trees. Almost immediately after this the pilot lost pedal control and the helicopter started to spin round to the right.

1.5 The pilot promptly lowered his collective control in an attempt to reduce the spin, without much effect. As the helicopter descended into the trees he pulled the collective control to try to cushion the descent. The helicopter collided with several tree limbs and fell to the ground, nose-down but upright, where it remained supported by a tree stump.

1.6 The pilot was able to get out, and after turning off the "Master" switch he went around to help his shooter who was leaning out of the door, restrained by his lap belt. The pilot released him and moved him away from the helicopter onto the ground. After checking for his pulse and finding none he concluded that he was dead.

1.7 The ELT was hanging out of the helicopter, so the pilot checked that its indicator light was flashing. He then moved out of the bush onto open hillside to wait. After several hours he returned to the helicopter and realised that the ELT aerial was broken. He removed the aircraft's VHF radio aerial and lead, and connected this to the ELT, which he took out of the bush with him.

1.8 After waiting for several hours more he decided that the ELT signal might be shielded by his location in the valley, so he climbed some 1000 feet up to the ridge above, where he left the ELT with a written note stating his intentions. He then climbed down to the Row Stream and made his way to a bivouac shelter downstream. This was done with some difficulty because of his injuries, which included a broken ankle.

1.9 The ELT signal was first detected by satellite at 1440 hours. This was subsequently confirmed in the locality by an overflying aircraft, and a helicopter search was mounted from Christchurch. The rescue helicopter crew found the ELT and message, then the injured pilot, and confirmed that the shooter was dead. The pilot was recovered to hospital at about 1930 hours.

1.10 After the accident the pilot stated that he knew that the helicopter was close to the bush during his last manoeuvre, and when he lost pedal control he immediately thought that the tail of the helicopter had collided with a tree.

1.11 The accident site was in an area of native beech forest some 25 to 35 feet high, at an elevation of 3800 feet amsl. It was on the western side of the valley, about 150 feet above the Row Stream. The ground sloped down to the south east at 25°.

1.12 The main wreckage comprised the fuselage with the engine, main gear box and main rotor in place. The rear part of the tail boom, and three meters of one main rotor blade were nearby, separated from the main wreckage at positions of heavy tree impact indentation. The main rotor and fuselage showed evidence of several tree strikes, and a tree limb 35 cm in diameter was embedded between the engine and the fuel tank. The front of the cockpit had collapsed up and back, consistent with a nose down ground impact.

1.13 The empennage, consisting of the vertical and horizontal stabilisers, was lodged in a tree 50 m south of the main wreckage. The overload fracture to the casting which had attached it to the tail boom was consistent with tree impact marks on the leading edges of the stabilisers.

1.14 The rear part of the tail boom, with the tail rotor and gearbox, was lodged in another tree some 20 m north-west of the empennage. The boom showed evidence of heavy tree strikes, but the tail rotor was undamaged. The driveshaft showed evidence that it was rotating under power when it was separated.

1.15 There was no evidence of pre-impact failure of any control systems or dynamic components, and the transmission system damage was consistent with it being disrupted while transmitting appreciable power.

1.16 The main fuel tank was ruptured, but the auxiliary tank held a quantity of Avgas. The cargo hook was closed and empty. No significant evidence was found from instruments or control positions.

1.17 Both occupants had been wearing their aircraft safety harnesses, but the shooter had only worn the lap strap part of his combined lap/diagonal inertia reel harness. As a result his upper torso had not been restrained during the accident. He was not wearing a protective helmet.

1.18 A review of the maintenance records showed that normal maintenance had been carried out, notwithstanding an error in the number of aircraft hours defining the validity of the Maintenance Release.

1.19 The flight had commenced with full fuel tanks, giving about three hours' endurance. Some 1.5 hours had been flown.

1.20 The maximum permitted weight of the helicopter was 622 kg. At the time of the accident, with half the fuel remaining, the weight was estimated to have been 627 kg. At departure, with full fuel, the weight was calculated to have been 667 kg. The centre of gravity was probably within the limits specified for normal weight operations.

1.21 The Aircraft Flight Manual for ZK-HVX did not contain any specific Weight and Balance information for that aircraft, as was required to be included therein.

1.22 At 0730 hours on 20 January, the time of the accident, the position of the sun was at an azimuth of 085° magnetic, and an altitude of 11°. The bush area where the accident occurred would have been in shadow from the high terrain on the east side of the valley until about 0845 hours.

1.23 The pilot had completed his Commercial Pilot Licence in 1991. Since then he had flown 1122 hours, predominantly on venison hunting operations in the R22 type.

2. Analysis

2.1 The examination of the helicopter wreckage showed no evidence of any pre-impact failure of any components. In addition the pilot reported that it had been performing and responding normally up to the loss of pedal control. As a result, the pilot's conclusion that the tail of the helicopter had collided with a tree during his last manoeuvre was considered to be the most likely initiating event in the impact sequence.

2.2 The empennage was probably the component involved in this first impact because it was separated from the tail boom, and was lodged furthest from the main wreckage. It was probable that this impact also caused enough distortion of the tail boom to cause the tail rotor drive shaft to separate adjacent to the tail rotor gearbox without breaking the tail boom.

2.3 This probable loss of tail rotor drive would have caused the pedal control failure reported by the pilot. This, in turn, would have led to the subsequent uncontrolled impact sequence with trees and the ground.

2.4 It was surprising that the tail rotor was undamaged, but this was evidently because it had fortuitously missed the tree which caused the tail boom to separate from the main wreckage.

2.5 The manoeuvre performed by the pilot which led to the accident was probably either misjudged in being too close to the tree tops, or mishandled in allowing the helicopter to descend during the tight turn. Another possibility is that a branch protruding above the bush canopy may have not been seen and avoided.

2.6 An aerodynamic loss of tail rotor authority could have occurred in the circumstances of this manoeuvre, as a result of the pilot applying a large left pedal input in order to stop a rapid turn to the right. At the weight and altitude of the helicopter it would have been susceptible to this effect, caused by a transient stall of the tail rotor blades, or by a vortex ring flow around them. The helicopter, however, had probably not slowed sufficiently to the hover, where this effect was most likely to occur. In addition, the initial tree impact with the empennage would have been unlikely to occur if the helicopter had already started spinning to the right, as would have resulted from this effect.

2.7 The pilot's predominant experience was in venison hunting, with the R22 type, so he should have been well versed in the operation and the necessary margins for safety. This collision did occur however, while he was actively chasing a deer, and the urgency of the moment may have detracted from his judgement, handling or lookout.

2.8 A further contributing factor may have been the position of the sun at the time, which cast the area in shadow. After his descent from sunshine into shadow, it may have been more difficult for the pilot to see the tops of the trees quickly and in detail.

2.9 No other environmental factors were identified as having the potential to contribute to this accident.

2.10 It was evident that this helicopter was operated at a weight in excess of the maximum permitted during the flight. While there was no indication that this had been a factor in the accident, it was of concern because the crew, equipment and fuel load aboard was the minimum likely to be carried on any such venison hunting flight.

2.11 The absence of any weight and balance information in the Aircraft Flight Manual for ZK-HVX did mean that the pilot could not readily check the loading of the helicopter. It may also indicate, on the part of the pilot a lack of awareness of, or disregard for the need to operate it within its certificated limitations.

2.12 The inference of this is that ZK-HVX may have been routinely operated at an overloaded weight, and further, that other Robinson R22 helicopters on venison hunting operations may be operated similarly. This is with the helicopter carrying only the crew, equipment and fuel. In addition, the extra weight involved in external sling loads of animals may well routinely cause significant further overload of these helicopters.

2.13 The risks incurred by such an overload include an enhanced potential for premature failure of airframe structural and dynamic components and of the engine, because of the increased operating stresses imposed; and the reduced margins of performance available, especially at altitude.

2.14 The limited available payload of the Robinson R22 type means that these helicopters are essentially unsuitable for venison hunting operations, unless flown with a lighter than average crew, and a reduced fuel load.

2.15 The pilot's action in jury-rigging an aerial to the ELT after the accident was commendable, and probably assisted in its location and recovery. However, his subsequent action in climbing some 1000 feet to the ridge above, and leaving the ELT, with a written note, where he thought it would transmit the best signal, while he climbed down through the bush to find shelter, was valorous but inappropriate. In his injured condition he was at some risk of collapsing or sustaining a fall and becoming immobilised in bush cover some distance from the ELT, with no means of being found other than by a difficult visual search. Fortunately he was found promptly by the rescue helicopter crew. The purpose of the ELT is to locate the survivors of an accident, not just the ELT itself. Any action which separates the survivors from the ELT has potential to frustrate the search.

2.16 The shooter, who was sitting beside the pilot, did not survive this accident probably because he was not fully restrained by his safety harness. He was wearing only the lap strap part of his harness, and may well have been sitting forward on his seat, ready to use his rifle, so that his lap strap may have been already extended. His chest and head injuries were probably aggravated by the resulting lack of restraint to his upper torso. His head injury might have been attenuated if he had worn a helmet, but medical opinion was that significant head injury would still have been likely in this case.

2.17 It is understood that some shooters claim that wearing a shoulder harness and a helmet restricts their ability to perform their job, and as a result often elect to accept a reduced level of personal safety by not wearing them. While this is permitted by Civil Aviation Regulation 73, it is of note that the fatal injury in this accident did occur in this situation.

2.18 Some other recent shooter fatalities in helicopter accidents have resulted from the failure of improvised restraints. In this case, the shooter had the approved aircraft safety harness available to him, and which did restrain him within the helicopter, even though he only wore the lap strap part of it.

3. Findings

3.1 The pilot was appropriately licensed and experienced for the flight.

3.2 The helicopter was capable of normal operation before the accident.

3.3 No finding was made about the airworthiness of the helicopter.

3.4 The helicopter was overloaded.

3.5 The overloading was probably not significant in the circumstances of the accident.

3.6 The helicopter collided with trees while it was being manoeuvred to hunt a deer.

3.7 The collision probably resulted from a misjudgement or mishandling by the pilot.

3.8 The collision rendered the helicopter uncontrollable.

3.9 The shooter was killed in the resulting collision with the terrain.

3.10 The accident would probably have been survivable if the shooter had made full use of his safety harness.

3.11 The Robinson R22 type of helicopter is unsuitable for venison hunting operations because of its limited payload.

21 August 1996

M F Dunphy
Chief Commissioner

Glossary of Aviation Abbreviations

AD	Airworthiness Directive
ADF	Automatic direction-finding equipment
agl	Above ground level
AI	Attitude indicator
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
amsl	Above mean sea level
AOD	Aft of datum
ASI	Airspeed indicator
ATA	Actual time of arrival
ATC	Air Traffic Control
ATD	Actual time of departure
ATPL (A *or* H)	Airline Transport Pilot Licence (Aeroplane *or* Helicopter)
AUW	All-up weight
°C	Degrees Celsius
CAA	Civil Aviation Authority
CASO	Civil Aviation Safety Order
CDI	Course Deviation Indicator
CFI	Chief Flying Instructor
C of A	Certificate of Airworthiness
C of G (*or* CG)	Centre of gravity
CPL (A *or* H)	Commercial Pilot Licence (Aeroplane *or* Helicopter)
DME	Distance measuring equipment
E	East
ELT	Emergency location transmitter
ERC	Enroute chart
ETA	Estimated time of arrival
ETD	Estimated time of departure
°F	Degrees Fahrenheit
FAA	Federal Aviation Administration (United States)
FL	Flight level
ft	Foot/feet
g	Acceleration due to gravity
GPS	Global Positioning System
h	Hour
HF	High frequency
hPa	Hectopascals
hrs	Hours
HSI	Horizontal Situation Indicator
IAS	Indicated airspeed
IFR	Instrument Flight Rules
IGE	In ground effect
ILS	Instrument landing system
IMC	Instrument meteorological conditions

in	Inch(es)
ins Hg	Inches of mercury
kg	Kilogram(s)
kHz	Kilohertz
KIAS	Knots indicated airspeed
km	Kilometre(s)
kt	Knot(s)
LAME	Licenced Aircraft Maintenance Engineer
lb	Pounds
LF	Low frequency
LLZ	Localiser
Ltd	Limited
m	Metre(s)
M	Mach number (e.g. M1.2)
^{o}M	Degrees Magnetic
MAANZ	Microlight Aircraft Association of New Zealand
MAP	Manifold absolute pressure (measured in inches of mercury)
MAUW	Maximum all-up weight
METAR	Aviation routine weather report (in aeronautical meteorological code)
MF	Medium frequency
MHz	Megahertz
mm	Millimetre(s)
mph	Miles per hour
N	North
NDB	Non-directional radio beacon
nm	Nautical mile
NOTAM	Notice to Airmen
NTSB	National Transportation Safety Board (United States)
NZAACA	New Zealand Amateur Aircraft Constructors Association
NZDT	New Zealand daylight time (UTC + 13 hours)
NZGA	New Zealand Gliding Association
NZHGPA	New Zealand Hang Gliding and Paragliding Association
NZMS	New Zealand Mapping Service map series number
NZST	New Zealand Standard Time (UTC + 12 hours)
OGE	Out of ground effect
okta	Eighths of sky cloud cover (e.g. 4 oktas = 4/8 of cloud cover)
PAR	Precision approach radar
PIC	Pilot in command
PPL (A *or* H)	Private Pilot Licence (Aeroplane *or* Helicopter)
psi	Pounds per square inch
QFE	An altimeter subscale setting to obtain height above aerodrome
QNH	An altimeter subscale setting to obtain elevation above mean sea level
RNZAC	Royal New Zealand Aero Club
RNZAF	Royal New Zealand Air Force
rpm	revolutions per minute
RTF	Radio telephone or radio telephony

s	Second(s)
S	South
SAR	Search and Rescue
SSR	Secondary surveillance radar
^{o}T	Degrees True
TACAN	Tactical Air Navigation aid
TAF	Aerodrome forecast
TAS	True airspeed
UHF	Ultra high frequency
UTC	Coordinated Universal Time
VASIS	Visual approach slope indicator system
VFG	Visual Flight Guide
VFR	Visual flight rules
VHF	Very high frequency
VMC	Visual meteorological conditions
VOR	VHF omnidirectional radio range
VORTAC	VOR and TACAN combined
VTC	Visual terminal chart
W	West