Report 96-012

Hughes 269C

ZK-HVV

near Waiouru

6 July 1996

Abstract

On Saturday 6 July 1996, Hughes 269C ZK-HVV was engaged in a series of NZ Army reconnaissance flights in an area between Waiouru and Taihape. When the helicopter failed to return from its last flight, a search was initiated and the wreckage of ZK-HVV was found some 900 m from the operating site. The pilot and one of the two passengers were killed and the second passenger seriously injured. The helicopter had collided with the ground while being operated at low level. Local loss of depth perception due to snow cover was a probable contributing factor. No new safety issues were raised.

Transport Accident Investigation Commission

Aircraft Accident Report 96-012

Aircraft type, serial number and registration:	Hughes 269C, 440292, ZK-HVV
Number and type of engines:	1 Lycoming HIO-360-D1A
Year of manufacture:	1974
Date and time:	6 July 1996, 1100 hours[1] (approx.)
Location:	6.5 nm south-south-east of Waiouru Military Camp Latitude: 38° 45.4' S Longitude: 177° 57.0' E
Type of flight:	Air Transport - Charter
Persons on board:	Crew: 1 Passengers: 2
Injuries:	Crew: 1 fatal Passengers: 1 fatal 1 serious
Nature of damage:	Aircraft destroyed
Pilot-in-Command's Licence:	Commercial Pilot Licence (Helicopter)
Pilot-in-Command's age:	37
Pilot-in-Command's total flying experience:	468 hours (all helicopter) 399 on type
Investigator in Charge:	A J Buckingham

[1] All times in this report are NZST (UTC + 12 hours)

1. Factual Information

1.1 On the morning of Saturday 6 July 1996, Hughes 269C ZK-HVV was being operated on a series of NZ Army reconnaissance flights, in conjunction with another helicopter, a Hughes 369HS, ZK-HLL. The helicopters, operated by two different companies, were flying pairs of Tactical School students on an exercise centred on the theoretical defence of a bridge on State Highway 1, in an area known as Mulvay's Corner between Waiouru and Taihape. They were operating from the crest of a ridge to the east of the highway.

1.2 The flying for the exercise commenced at about 1000 hours, after being delayed by fog. Conditions after the fog dissipated were clear and sunny, with a light easterly drift. The exercise area was snow-covered, following falls in the preceding few days.

1.3 Several reconnaissance flights were performed by each helicopter, the flights consisting of a wide circuit of the area at an altitude greater than 500 feet agl and lasting approximately 10 minutes. The students were to assess the terrain from the air with respect to placement of defensive positions, although some syndicates were able to make their assessment from the ground and did not require a helicopter flight.

1.4 About 1020 hours, the unit clerk arrived at the operating site with morning tea for the course members and staff. During conversation, the instructor controlling the exercise offered her a flight in one of the helicopters, which she accepted enthusiastically. The instructor arranged for her to accompany him on ZK-HVV. They boarded the helicopter, the clerk sitting in the centre seat and the instructor on the right. Both were secured by lap belts, although there were shoulder harnesses available. They were assisted with boarding and securing by the pilot's ground crew member (loader). The pilot was wearing the combined lap belt and shoulder harness provided at his position. (The Hughes 269C type has three side-by-side seats; the pilot occupies the left seat.)

1.5 The time of departure was not recorded, but was thought to be between 1045 and 1100 hours. The unit clerk described the flight as taking off towards the south (as had all previous flights) and following the other helicopter on its reconnaissance flight, but at a lower altitude. Before take-off, the instructor had said to the pilot "let's give her a flight to remember" or words to that effect.

1.6 During the flight, the instructor explained to the clerk what the exercise entailed and what the course students were looking for. At one stage the clerk asked how fast they were going, and the pilot said "about a hundred". Parts of the flight were conducted at low level, "just under tree height", according to the clerk, who also described it as "definitely an adrenalin rush". She said that the helicopter came to a hover several times to allow the other helicopter to stay ahead.

1.7 The clerk recalled a "massive bang" and an abrupt nose-down pitch, after which the pilot said "we're going in" or something similar. The clerk was aware of the "ground rushing up", a severe impact and the helicopter "flipping over to the right". The interval between the "massive bang" and the severe impact was described by the clerk as "two or three seconds", during which the instructor leaned across in front of her.

1.8 After the impact, the clerk's next recollection was of lying on the ground some distance from the helicopter wreckage, which she could see. She could not see the pilot but saw the instructor was lying motionless across a small bush just above the wreckage. She was aware of "something heavy" lying across her body, and shifted the object, which was later identified as the forward portion of the tail boom.

1.9 At about 1120 hours, the Tactical School Chief Instructor (CI) and two of his instructional staff arrived at the operating site, as the students were to present their exercise solutions at 1130 hours. By this time, ZK-HLL had departed for its Taihape base, and there was neither sight nor sound of ZK-HVV. The loader commented on this, and made a "cellphone"[2] call to the company's Ardmore base to report his concerns to the Chief Pilot. The CI knew that the instructor on board ZK-HVV carried a cellphone, and attempted to telephone him, using the loader's cellphone, with no success.

1.10 The CI was also a volunteer ambulance officer, and at 1140 hours telephoned Ambulance Control in Palmerston North to warn them of a possible callout. Soon after, the CI called the operator of ZK-HLL and requested that the pilot return to the site to search for ZK-HVV. At 1212 hours, ZK-HLL landed and the pilot was briefed by the CI and the loader. With the CI's two colleagues aboard to act as observers, ZK-HLL took off on the search.

1.11 By use of the squelch control on his VHF set, the pilot of ZK-HLL received a weak ELT signal, but was unable to pinpoint it. He landed and reported this to the CI, who called Ambulance Control again and requested that their rescue helicopter be dispatched. ZK-HLL returned to the area where the ELT signal had been detected and this time the pilot obtained a distinct fade-in/fade out of the signal from 500 feet agl. He descended in the area of the strongest signal and saw the survivor (the unit clerk) lying on the ground, waving, as well as one door off ZK-HVV. He landed as close as possible to the wreckage and disembarked the two observers, before returning to the pickup site to inform the CI of the accident and its location. While still airborne, the pilot requested his wife, via their base radio, to call out the rescue helicopter.

1.12 The two observers were joined at the accident site by the CI, who confirmed that the pilot and the instructor were dead. He assessed the survivor's injuries as chest, neck and lower spinal, with possible hypothermia, the survivor having lain in a shaded location on snow-covered ground for at least two hours. The rescue helicopter arrived at 1312 hours and the survivor was flown to Palmerston North Hospital.

Pilot information

1.13 The pilot, male, aged 37, held a valid New Zealand Commercial Pilot Licence (Helicopter) and a valid Class 1 Medical Certificate with no restrictions. He had completed agricultural training, and his logbook was endorsed with a Grade 2 Agricultural Rating. He was type-rated on Hughes 269 and Bell 206 series helicopters. His last Civil Aviation Regulation 76 check was conducted by the company's Chief Pilot on 18 April 1996.

1.14 The pilot had been employed by the operator originally as a loader, and commenced his helicopter flight training in 1991. He obtained his PPL(H) in July 1993, and continued training for his CPL(H) which he achieved in April 1995. All of his flight time was on helicopters, and his training, including his Agricultural Rating, had all been conducted by the same operator. In September 1995, the pilot was assigned to the company's base at Taihape, his home town.

1.15 No evidence was found to suggest that the pilot was in any way unfit for his duties.

[2] Cellular telephone

Aircraft information

1.16 Up to the commencement of the task on 6 July 1996, ZK-HVV had accrued 6838.3 hours in service, and the engine had accrued 914.0 hours, out of a TBO of 1500 hours. The helicopter had flown 7.6 hours since its most recent inspection, a 400-hourly, completed on 13 June 1996. The helicopter had a valid Certificate of Airworthiness, and the Technical Log (which has superseded the Maintenance Release) had been correctly endorsed with the details of the next inspection due.

1.17 According to the company's computerised maintenance records, all lifed components were within their service life, and there were no defects carried forward from the last inspection.

1.18 The helicopter's all-up weight on the accident flight was estimated to be not more than 820 kg, 110 kg below the permitted maximum of 930 kg.

Wreckage and impact information

1.19 The accident occurred at an elevation of about 2800 feet on the ridge on which the operating site was located, about 900 m north-east of the latter. The ridge was oriented approximately north-east/south-west. The initial impact was on a shoulder on the southern side of the crest, and the wreckage came to rest lower down in the gully to the south of the ridge.

1.20 The initial strike mark indicated that the helicopter struck the ground heavily in a left-skid-low, nose-up attitude, descending, with considerable forward speed on a heading of 182° M. The force of the impact was sufficient to tear the left skid from the airframe, and pitch the nose down abruptly with a corresponding upward movement of the tail boom, so that the tail boom was struck and severed by two of the three main rotor blades.

1.21 The helicopter bounced, travelling 72 m before striking the ground heavily on the side of the gully, some 11 m lower in elevation. During the interval between the initial and second impacts, it remained approximately upright, according to the survivor. After the second impact in the gully, the helicopter bounced a further 16 m, struck the ground heavily again and fell to the left into a slip some 3 m below. It became wedged in vegetation at the top of the slip, and this prevented it from rolling to the bottom of the gully.

1.22 Damage sustained at the initial impact comprised the loss of the left skid, the separation of the tail boom in three sections, the separation of the tail rotor and gearbox, the loss of one main rotor blade and the shattering of the cockpit perspex transparencies. The second impact, in the gully, caused the bulk of the remaining damage and inflicted the respective injuries on the occupants. The pilot was located three to four metres beyond the second impact point, his harness having failed at the inertia reel and at the left side attachment, which had torn free of the airframe.

1.23 The right-seat passenger was still attached to the wreckage by a loop comprising both his and the centre-seat passenger's seat belts - the common attachment point between the two had also torn free, forming in effect a double-length belt.

1.24 Examination of the wreckage disclosed no pre-impact abnormalities, and rotational damage to the cooling fan indicated that the engine was running at the time of the second impact. No trapped readings were evident on any instruments, but control and switch positions on the instrument panel were consistent with normal flight selections. The drive train, from the engine to the main and tail rotors was continuous and operating normally at impact, and no pre-impact control deficiencies were noted.

1.25 Clean samples of 100/130 Avgas were obtained from the fuel control unit, the engine-driven fuel pump, the electric fuel pump and filter. The helicopter had been refuelled from an approved plastic jerrycan immediately prior to the accident sortie, and a clean sample was also obtained from that jerrycan and another used earlier. The fuel in the helicopter's tank had drained out through an impact-related split in the tank, leaving about one litre in the bottom.

Other information

1.26 In order to arrive at the initial impact point, ZK-HVV had to fly either around one end of or over a belt of totara trees 80 m upslope to the north. The survivor recalled that the helicopter made a turn immediately before the initial impact, but could not remember in which direction. She described the helicopter as descending in a nose-high attitude prior to the "massive bang", which was established as the first impact. She did not notice any change in engine note or any other indication of a problem prior to impact; it was only after the helicopter had bounced that the pilot said "we're going in".

1.27 The survivor also recalled that their speed appeared to be about the same as it was when the pilot said it was "about a hundred" This was determined to have been miles per hour, based on the survivor's recollection of the position of the ASI needle at the time; the ASI was calibrated in both knots and miles per hour.

1.28 At the time of the accident, the ridge was covered with snow two to three inches in depth. This melted during the day, and had almost completely dissipated by the same time next day. Ahead of the initial impact point and some 15° to the right of the helicopter's heading at impact was an expanse of relatively level (snow-covered) grassed surface which would have been suitable for a forced landing.

1.29 The sun data for the accident site at 1100 hours was: altitude 25°, azimuth 360° M.

Military use of civil helicopters

1.30 The type of task ZK-HVV was performing was previously undertaken by the RNZAF, using Sioux (Bell 47G) helicopters and either Army or Air Force pilots. Attrition and non-replacement has resulted in the few remaining Sioux being used solely for pilot training, and the RNZAF does not currently have a light observation helicopter capability. Army units requiring this capability have for a number of years utilised civilian operators.

1.31 In this context, the Army is the same as any other hirer of helicopter services. A civil helicopter on a military charter does not become a "military" helicopter, for which the operating rules differ significantly in some respects from civil requirements; the helicopter is still required to operate within the Civil Aviation legislation pertinent to the type of task being performed.

2. Analysis

2.1 The accident flight differed from the earlier series of flights in that the actual reconnaissance element of the task had been largely completed, and the purpose of the flight was a familiarisation for the unit clerk. While the instructor in charge of the exercise briefed her on the exercise once airborne, it is clear from his comment to the pilot that he intended that the clerk get a "thrill" from the flight as well.

2.2 From the survivor's description of the flight, there is no doubt that the pilot complied with the instructor's suggestion. Much of the flight was conducted at low level, some at "treetop height" and lower, which the survivor described as "definitely an adrenalin rush". However, there was no operational requirement for the flight to have been conducted below the minimum safe height of 500 feet specified in Civil Aviation Regulations. The previous reconnaissance flights had all been conducted well above this height.

2.3 The helicopter struck the ground in a descending left turn, "flaring" at the same time. This is consistent with an intentional descent into the gully on the southern side of the ridge. Although the pilot had not indicated to the survivor what his intentions were, it is possible that he was going to do one final low-level segment prior to landing back at the operating site. Had he perceived a problem with the helicopter necessitating an immediate landing, there was sufficient clear ground to his right front on which to alight, even in the event of an autorotational landing.

2.4 The rounded shoulder on which the helicopter first impacted was snow-covered at the time, which may have given rise to difficulty in depth perception, in that its prominence above the surrounding terrain may not have been readily apparent. At the time the helicopter struck, the sun was directly behind it at an altitude of 25° above the horizon, and would have been casting a shadow ahead of and below the helicopter. In flight over snow, the aircraft shadow is an effective (and sometimes the only) aid to judging height above the snow, but in this case it is possible that the pilot lost sight of the helicopter's shadow when the nose was raised, blocking his line of sight.

2.5 There were sufficient other cues in the immediate area to gauge height effectively above the ground, but even so, it is possible that the pilot did not detect that the shoulder was higher than the surrounding terrain, because of a local lack of depth perception caused by the snow cover. He was accustomed to low-level operations, being a trained agricultural pilot, but was unlikely to have accrued much experience in operations onto or over snow-covered terrain.

2.6 The survivor did not recall anything amiss with the helicopter until the "massive bang" of the initial impact, and post-accident examination did not reveal any mechanical reason for the accident. There was suitable space available for a forced landing had the need arisen, but the pilot was turning the helicopter away from this area towards a gully which offered no scope for a landing, normal or emergency. This tends to reinforce the indications that the operation of the helicopter was normal at this point.

2.7 There was no evidence to suggest that the pilot was unfit for flight.

3. Findings

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

3.2 The helicopter had a valid Certificate of Airworthiness and appropriate maintenance documentation.

3.3 The helicopter was probably operating normally at the time it struck the ground.

3.4 The pilot was operating below the minimum safe height for the task being undertaken.

3.5 The pilot's ability to judge his height above the ground in the impact area was probably reduced by the presence of surface snow.

3.6 Had the pilot lost sight of the helicopter's shadow prior to impact, he would have been deprived of a further height cue.

3.7 There was no requirement for low-level operation on this flight.

11 December 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	Licensed Aircraft Maintenance Engineer
lb	pound(s)
LF	low frequency
LLZ	localiser
Ltd	Limited
m	metre(s)
M	Mach number (e.g. M1.2)
°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
°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