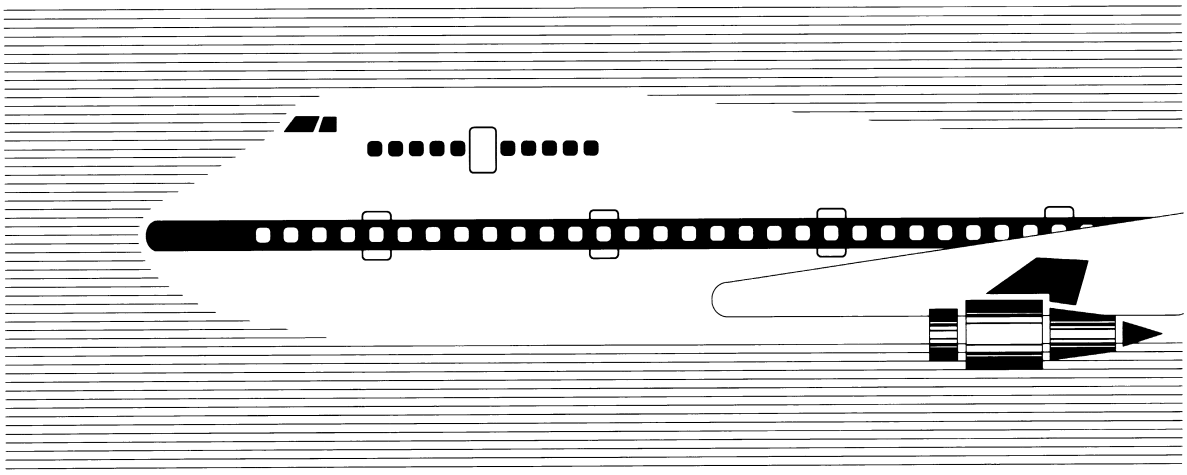
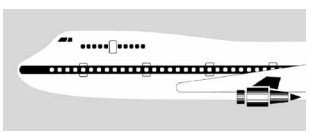
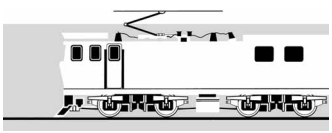


AVIATION OCCURRENCE REPORT

04-009 **Hughes 360D, ZK-HHT, heavy landing, Wanganui River, South Westland** **21 December 2004**


TRANSPORT ACCIDENT INVESTIGATION COMMISSION
NEW ZEALAND

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

Report 04-009

Hughes 369D

ZK-HHT

tail rotor strike with sling load and emergency landing

Wanganui River, South Westland

22 December 2004

Abstract

On Wednesday 22 December 2004, the pilot of a Hughes 369D helicopter, ZK-HHT, was flying a party of 3 kayakers into the upper reaches of Wanganui River, South Westland. The party's kayaks and paddles were suspended in a cargo net underneath the helicopter. As the helicopter flew up the river the net swung back and struck the tail rotor, resulting in an immediate loss of tail rotor control.

The pilot regained control by promptly entering autorotation and made a successful, but heavy, forced landing onto the riverbed. An ensuing fire destroyed the helicopter, but all 4 occupants escaped with minor scratches and bruises only.

The accident was caused by the sling load being too light for the speed of the helicopter.

The safety issues identified included:

- benefits of good safety briefings
- flying at a safe height
- effective emergency training.

A safety recommendation was made to the operator regarding a training deficiency.

Contents

Figures

Abbreviations

agl	above ground level
ELT	emergency locator transmitter
ft	feet
kg	kilogram(s)
kt	knot(s)
m	metre(s)
UTC	coordinated universal time

Glossary

autorotation	flight without engine power where the airflow from below the rotor disc sustains rotor speed at an operation level.
sling load operation	the external carriage, lowering, or picking up, of a load, cargo, or passengers by a helicopter by means of a bucket, net, harness, sling, or stretcher, suspended beneath the helicopter.

Data Summary

Aircraft registration:	ZK-HHT
Type and serial number:	Hughes 369D**,** 790539D
Number and type of engines:	one Rolls Royce (Allison) 250-C20B
Year of manufacture:	1979
Operator:	Alpine Hunting Adventures Limited
Date and time:	22 December 2004**,** at about 1110[1]
Location:	Wanganui River, South Westland latitude: 43° 11.49′ south longitude: 170° 38.30′ east
Type of flight:	commercial transport, charter
Persons on board:	crew: 1 passengers: 3
Injuries:	nil
Nature of damage:	helicopter destroyed
Pilot's licence:	Commercial Pilot Licence (Helicopter)
Pilot's age:	40
Pilot's total flying experience:	3455 hours (415 hours on type)
Investigator-in-charge:	I R McClelland

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

1 Factual Information

1.1 History of the flight

1.1.1 On Wednesday 22 December 2004, ZK-HHT, a Hughes 369D helicopter was chartered to carry a rafting group from the Wanganui River Bridge, 6 km east of Harihari, to the upper reaches of the river. On the previous evening a local river adventure company representative had contacted the pilot of ZK-HHT and asked if it was possible to also carry in a 3-person kayak group in conjunction with the rafters. The pilot agreed and arranged to take the kayakers first followed by the rafters.

1.1.2 At about 1045 on 22 December 2004, ZK-HHT took off from its base near Franz Josef Glacier and flew to the prearranged pick-up point near the Wanganui River Bridge. After landing, the pilot left the engine of ZK-HHT running while he met the leader of the kayaking group. Together they offloaded from the helicopter a cargo net and some containers of spare fuel, and confirmed where the group was to be taken. The leader, who was experienced in working with the pilot and helicopters, had previously given the other 2 members of the group a safety briefing. The 2 members were secured into the front passenger seats of the helicopter while the pilot and leader loaded the kayaks and paddles into the cargo net. The pilot and leader boarded the helicopter, with the leader sitting behind the pilot.

1.1.3 The 2 front seat passengers kept their kayaking helmets on, as briefed, but the leader removed his helmet and donned an aircraft headset to talk to the pilot. The pilot lifted ZK-HHT into a hover and an instructor from the rafting group, also experienced in working with helicopters, placed the cargo net strop onto the helicopter's cargo hook. The strop was about 2 m long.

1.1.4 The pilot lifted ZK-HHT off at about 1105 and initially flew to the west before turning left and flying up the river. As the helicopter climbed and accelerated, the pilot kept his door partially open to see how the sling load was performing. A mirror was fitted to the skid mount to help view the cargo hook and underside of the helicopter. After a few hundred metres the pilot was satisfied that the load was secure and so closed his door.

1.1.5 The pilot said later that he climbed to about 500 feet (ft) above ground level (agl) and slowly accelerated to about 70 knots (kt). As the helicopter rounded a bend near a disused quarry about 3 km up the river, the pilot felt an increase in turbulence and the sling load start to oscillate. The pilot prepared to slow the helicopter down as the oscillations increased in magnitude, but before he could there was a "loud bang and a jolt". Suspecting the net had contacted the tail rotor, the pilot lowered the collective lever to start an immediate descent. The helicopter started to yaw right and so the pilot closed the throttle to control the yaw.

1.1.6 With the helicopter in autorotation, the pilot identified an area on the far southern side of the riverbed on which to land and steered towards it. Approaching the ground, he flared the helicopter hard to reduce its rate of descent and forward speed. The pilot levelled the helicopter and applied collective lever in an attempt to cushion the landing. The helicopter sank quickly, striking the rocky riverbed hard, before tipping forward, turning right and rolling onto its left side.

1.1.7 After the blades had stopped rotating, the occupants vacated the helicopter and gathered a safe distance away. They saw heavy smoke coming from the engine bay and exhaust area. The pilot returned to the helicopter and was able to retrieve some emergency equipment before there was a small explosion and the helicopter became engulfed in flames.

1.1.8 Attempts to contact emergency or support services by cellphone and satellite phone were unsuccessful so the leader of the kayak group tramped back to the pick-up point and was able to organise helicopter support to uplift the remainder of the group. Other than some minor scratches and bruises there were no injuries.

1.2 Damage to aircraft

1.2.1 ZK-HHT was destroyed by the heavy landing and fire.

1.3 Personnel information

1.3.1 The pilot was aged 40. He held a Commercial Pilot Licence (Helicopter) and a Class 1 Medical Certificate valid until 22 March 2005. There were no restrictions on his licence.

1.3.2 The pilot's logbook showed that at the time of the accident he had flown about 3455 hours, with all but about 200 hours being on helicopters. He was rated on the Hughes 369 in March 1993 and had accrued some 415 hours on the type. He had flown 2 hours in the 7-day period before the accident, 7 hours in the 30-day period and 310 hours in the 12-month period.

1.3.3 The pilot's last annual proficiency check was completed on 6 April 2004. The check included several practice autorotation approaches to simulate a possible loss of engine power, and forced landing. However, no sling load flying was completed as part of the check.

1.3.4 The pilot recalled his last sling load training was about 5 years previously as part of a helicopter type rating. He routinely flew sling loads as part of his job, including hunters' equipment and deer carcasses, as well as rafts and kayaks.

1.4 Aircraft information

1.4.1 ZK-HHT was a Hughes[2] 369D (commonly referred to as a Hughes 500D) single-engine helicopter, serial number 790539D, constructed in the United States in July 1979. ZK-HHT was fitted with an Allison (Rolls Royce) 250-C20B engine, serial number CAE 834032.

1.4.2 The helicopter was imported into New Zealand in February 1993, inspected by the Civil Aviation Authority and issued with a non-terminating Certificate of Airworthiness in the standard category.

1.4.3 The operator purchased ZK-HHT in August 2001 and it was based in South Westland and used for local aerial work. The helicopter was approved for sling load operations and, in accordance with Civil Aviation Rules[3], to simultaneously carry passengers associated with the sling load.

1.4.4 At the time of the accident, ZK-HHT had amassed some 11 858.9 airframe hours and 6995.8 engine hours since new. The maintenance records showed that ZK-HHT was maintained in accordance with the operator's maintenance manual. The last scheduled inspection was a 100-hour check completed on 24 July 2004. During the check a new cargo hook was installed on the helicopter. The helicopter had flown a further 67.2 hours, so had 32.8 hours to run to the next check.

1.4.5 The next Annual Review of Airworthiness for ZK-HHT was due on 15 January 2005. The last unscheduled maintenance was a full repaint of the helicopter and some minor rectification, completed on 27 August 2004. Work included the replacement of a faulty gauge and repair of wiring for 2 external aircraft lights. There were no deferred maintenance items.

1.4.6 With 4 persons on board, a light fuel load and 3 kayaks and paddles weighing about 55 kg, calculations showed ZK-HHT was within its centre of gravity limits and below its maximum weight limit at the time of the accident.

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[2] Hughes Helicopters became a subsidiary of McDonnell Douglas in 1984 and later became part of The Boeing Company.

[3] Civil Aviation Rules Part 133 Helicopter External Load Operations, and Part 135 Air Operations – Helicopters and Small Aeroplanes.

1.5 Wreckage and impact information

1.5.1 The accident occurred in a gorge area of Wanganui River, about 4 km upstream of the roadbridge and pick-up point. ZK-HHT had landed on a rocky riverbed on the southern side of the river. The fuselage, destroyed by the post-impact fire, lay on its side about 5 m from the river's edge. The tail boom separated from the fuselage and was in 2 pieces. The tail rotor assembly was severed from the boom about 0.5 m forward of the vertical fin and lay about 20 m from the main wreckage. The remainder of the boom was closer to the wreckage. Three of the 5 main rotor blades broke from the rotor head and were found between 10 and 25 m from the main wreckage (see Figure 1).

Figure 1
Wreckage of ZK-HHT looking east
(photograph courtesy of the pilot of ZK-HHT)

1.5.2 A partially burnt and torn cargo net lay beside the wreckage. The 3 kayaks and paddles were found between 150 and 200 m downstream on the opposite side of the river.

1.5.3 Marks on the tail boom were consistent with several of the main rotor blades striking and severing the tail boom. The blades had then struck the rocky riverbed causing them to either separate or fold back at the hub.

1.5.4 The 4-bladed tail rotor assembly was badly damaged. All the blades were bent and one blade displayed evidence of having struck the tail boom. This blade and its coupled partner blade had separated from their retaining hinge and were flapping loose. Several of the tail rotor blades had blue coloured transfer marks and held small pieces of material that matched the construction of the cargo net. Damage to the kayaks was consistent with them being struck by the tail rotor, with numerous saw-tooth type strikes (see Figure 2).

Figure 2
Damaged kayaks from cargo net

1.6 Fire

1.6.1 The damage inflicted by the post-accident fire was too severe to determine its exact origin. From eye-witness accounts and remaining evidence, the fire appeared to have emanated from the engine bay area and fed by aircraft fuel. The fire was reported to have enveloped the fuselage quickly and no attempt was made to extinguish it.

1.7 Survival aspects

1.7.1 The passengers all said they had received a helicopter safety brief, either immediately before the accident flight or as part of a previous helicopter flight briefing. The leader of the kayaking group was experienced in working around helicopters and advised it was normal for passengers to keep their kayaking helmets on unless they were to use the headsets provided.

1.7.2 The majority of the emergency survival equipment carried on board the helicopter was not recovered because of the enveloping fire. No emergency locator transmitter (ELT) signals were received as a result of the accident. The ELT was destroyed in the post-impact fire.

1.7.3 Flight following was provided by the pilot's home base but the accident was reported before the helicopter was recorded as overdue and any search action initiated in accordance with the operator's emergency plan.

2 Analysis

2.1 The flight began as a routine carriage of kayakers and their equipment by helicopter and sling load, as permitted by Civil Aviation Rules and the aircraft flight manual for ZK-HHT. The pilot was experienced in the operation, and the weather was suitable for the flight.

2.2 The carriage of the kayakers was an addition to the day's main task of carrying in a large party of rafters and their equipment. The pilot did not want to disrupt the carriage of the rafting party and so elected to carry spare fuel in containers to the pick-up point, allowing him to complete both tasks without having to return to base to refuel. At the pick-up point, the pilot quickly prepared for the first flight. With only a short time planned on the ground, it was normal not to shut down the helicopter. The pilot possibly elected not to shorten the length of the strop to save time.

2.3 As ZK-HHT lifted off, the net would have started to stream back underneath the helicopter as it climbed and accelerated. The 3 kayaks and paddles weighed about 55 kg, so there was little weight to hold the net down as the helicopter approached 70 kt. The size and shape of the kayaks also meant that they were easily affected by the airflow. The higher speed, combined with the turbulence ZK-HHT encountered as it rounded the bend in the river, was probably enough to start the load oscillating underneath the helicopter. With a 2 m strop, the net was able to swing back and strike the tail rotor.

2.4 The bang and jolt that the pilot and passengers heard and felt would have occurred when the net and kayaks contacted the tail rotor. The impact would have caused an immediate total loss of tail rotor control. The pilot was able to re-establish limited control of the helicopter by entering autorotation and closing the throttle. He then managed to steer towards the only safe landing area available, flare the helicopter and complete a heavy but effective landing. While it may have been advantageous to slowly re-introduce power to see if the helicopter could be recovered from the steep descent, given the information available to the pilot and the fast approaching ground, he appropriately focused on the approach, flare and landing.

2.5 During the flare, the tail stinger struck the riverbed and resulted in the main rotor blades striking and severing the tail boom. The helicopter tipped forward and rotated right as a result of the tail stinger and main rotor blade strikes, before rolling onto its side. What role the cargo net played during the flare could not be determined. However, it would have been advantageous for the pilot to have released the cargo net during the autorotation to reduce the chances of the net interfering with the flare and landing.

2.6 The accident could have been prevented by a number of means. The pilot could have flown at a lower speed, thus reducing the amount the net streamed backwards. Extra weight could have been added to the sling load to hold it down. The spare fuel containers were readily available for this option. The strop could have also been shortened so the net would have been unable to reach the tail rotor.

2.7 While the pilot was familiar in working with sling loads, he had flown little in the last month and it had been some time since he had carried a load of kayaks. The pilot was also probably more used to carrying a full load of 4 passengers and their equipment. The lack of currency and the desire to promptly complete the first job before moving onto the rafters possibly combined to affect the judgement of the pilot in preparing the sling load.

2.8 However the pilot, having perhaps displayed a degree of poor judgement in organising the sling load, did act skilfully in positioning the helicopter for a heavy but survivable landing. By establishing a controlled autorotation, the pilot was able to flare the helicopter approaching the riverbed and reduce its rate of descent and forward speed to the point that the heavy landing was survivable and the occupants sustained minor injuries only.

2.9 The accident highlighted the benefits of safety briefings, flying at a safe height and effective emergency training. By climbing to about 500 ft agl soon after take off, the pilot had sufficient height to enter autorotation and select the best available landing area. The pilot's actions in almost automatically entering autorotation, closing the throttle and flaring off the high rate of descent and forward speed, were a reflection of his emergency training. The passengers were all securely fastened in their seats and did not to attempt to vacate the helicopter until everything had stopped rotating. The wearing of the helmets by the 2 front seat passengers possibly minimised any head injuries they might have sustained.

2.10 Although familiar with flying sling load flights, the pilot had not completed any sling load refresher training for many years. Had he completed such training he may have been more careful in his preparation of the sling load and considered releasing the net during the autorotation. Annual proficiency checks should complement the type of operations a pilot might fly during the next year.

3 Findings

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

3.1 The pilot was appropriately licensed and fit to conduct the flight.

3.2 The helicopter had a valid airworthiness certificate and was approved and suitable for the operation.

3.3 The weather was suitable for the flight.

3.4 The accident resulted from an incorrectly prepared sling load, which trailed back and struck the tail rotor.

3.5 The pilot was experienced and familiar with carrying kayaks in a cargo net but had not flown this type of load for some time.

3.6 In preparing the load, the pilot did not fully consider all the ramifications of the task, and had possibly become distracted by the demands of the following job.

3.7 By quickly climbing to a safe height after lift off, the pilot was in a good position to enter autorotation and conduct an effective landing.

3.8 Had the pilot undertaken some form of sling load refresher training he may have considered adjusting the load prior to take off, thereby preventing the accident.

3.9 The pilot's actions after the load struck the tail rotor were appropriate and probably prevented any serious injury or loss of life.

4 Safety Recommendation

4.1 On 31 May 2005, the Commission recommended to the Chief Executive of Alpine Hunting Adventures Limited that he:

> include in the flight training programme for company helicopter pilots, sling load re-currency training as part their annual proficiency training programme (038/05).

4.2 On 21 June 2005, the Chief Executive of Alpine Hunting Adventures replied:

> Our company has included in the flight training program for the helicopter pilots the following:
>
> Sling load re-currency training as part of the annual proficiency training.
>
> Following the accident and on arrival of a new helicopter the pilot had a flight dedicated to sling load operations. This progressed well.

Approved on 30 June for publication

Hon W P Jeffries
Chief Commissioner

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