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Helicopter Strikes Terrain During Low-visibility Flight to Mountain Helipad

The accident prompted an airworthiness directive from the New Zealand Civil Aviation Authority requiring emergency locator transmitters in forward sections of helicopters to be moved to less-vulnerable locations.

FSF Editorial Staff

About 0930 local time March 7, 2000, during a charter flight to transport technicians to service telecommunications equipment on a mountaintop in New Zealand, an Aerospatiale AS 350BA struck trees and the ground. The helicopter was destroyed, and all four occupants were killed.

The New Zealand Transport Accident Investigation Commission (TAIC) said in its final report that the helicopter was being flown in conditions of reduced visibility and that the pilot "may have inadvertently lost visual reference with the surface."

The morning of the accident, the pilot fueled the helicopter with Jet A-1 fuel at the Hamilton airport, then boarded one of the technicians. Three other passengers also boarded the helicopter, which departed about 0858 for a positioning flight to Raglan, 23 nautical miles (43 kilometers) to the west. Around Hamilton, weather was clear and sunny, with light and variable winds and a few clouds at 2,500 feet; as the helicopter approached Raglan, there were increasing clouds, a moderate southwesterly wind and light turbulence.

At Raglan, one passenger, who had been trained in some ground-crew duties, helped two other passengers deplane; she then helped the second technician and another passenger (the technician's brother) board the helicopter.

"After checking that all three passengers were properly strapped into their seats, she [the helping passenger, who also deplaned at Raglan] asked the pilot how he would get to Mount Karioi," the accident report said. "This was because she had observed that the upper third of the mountain was obscured by cloud. The pilot's reply was noncommittal but to the effect that they would have a look.

"[The helicopter] departed normally from Raglan at about 0920 hours and was observed to head south, climbing toward

the east side of Mount Karioi until lost to sight against the cloud. The helicopter was not seen again, although a witness southwest of Mount Karioi heard a helicopter fly over toward the west at between 0930 and 1000 hours.

"At some undetermined time after leaving Raglan, [the helicopter was flown] into the forest canopy on the south side of Mount Karioi, colliding with several trees before a final collision with the ground, at an elevation of 1,850 feet."

There were no witnesses to the accident.

The helicopter had been expected to return after 1000, and the pilot's housemate said that the pilot had told her that he might be late in returning because of delays on the ground. On some previous flights, he had been as much as four hours late.

The housemate contacted authorities about 1330, and an air search and ground search were begun. At 1757, a helicopter crew observed the wreckage. Rescuers on the ground determined that there were no survivors. No signal was heard from the helicopter's emergency locator transmitter (ELT).

The pilot was the principal of New Zealand Heliwork, which the accident report described as "essentially a one-man operation." He had received his commercial pilot license for airplanes in 1982 and his commercial pilot license for helicopters in 1989. He had accumulated 2,816 flight hours, including 2,417 flight hours in helicopters, of which 288 hours were in AS 350s. He held a Class 1 medical certificate. People who had seen the pilot before he left the airport that morning described him as "his normal cheerful self."

He had flown 94 hours in the 90 days before the accident, and had last flown the accident helicopter about one week before the accident. His pilot logbook contained entries listing eight previous jobs on Mount Karioi since 1991, but other, nonspecific local entries also could have involved flights to Mount Karioi.

The report said that the pilot had "some previous experience of flying the helicopter up mountainsides in reduced visibility, including on Mount Karioi, but was known to be conservative in doing this, typically only through a thin layer of cloud, 100 [feet] to 200 feet [31 meters to 61 meters] thick."

The accident helicopter was manufactured in 1997 as an AS 350B, imported to New Zealand in 1995 and upgraded in 1996 to an AS 350BA. After accumulating 800 operating hours, the helicopter was exported to Australia in April 1999 for a major inspection by Eurocopter Australia and was returned to New Zealand in October 1999. The helicopter was privately owned but was operated exclusively by New Zealand Heliwork and was the company's principal helicopter. Records showed that appropriate maintenance was performed by Eurocopter New Zealand in accordance with the operator's maintenance manual. There were no outstanding airworthiness directives.

The helicopter had accumulated 1,905 hours in service and its last scheduled maintenance was a 100-hour inspection Feb. 2, 2000, at a total time in service of 1,868 hours.

After the accident, the helicopter's weight and balance were calculated using estimates of fuel quantity and baggage weight, and both the weight and the center of gravity were determined to have been within acceptable limits.

Visibility at Raglan when the helicopter arrived was described as good, with broken clouds, which were "not low," the report said. Nevertheless, the report said, the "upper part" of Mount Karioi was obscured by clouds.

A video recording made by a passenger in the accident helicopter showed that, when the helicopter left Hamilton, the weather was clear and sunny, with good visibility, but clouds increased during the flight. The video recording of the departure from Raglan showed "local continuous cloud obscuring the upper third of the mountain, with a base estimated at about 1,500 feet but with some breaks in the cloud to the east and west."

A pilot who had been flying a helicopter in a cattle-mustering operation on the western side of Mount Karioi until about 0900 said that winds were from the west at about 30 knots, visibility was "okay, with no rain, and cloud was broken away from the mountain but closed in on Mount Karioi with a local base of about 500 feet." The top of the mountain had been obscured by clouds since about 0700, the pilot said.

The crew of a Royal New Zealand Air Force helicopter that was flown southbound past the western side of Mount Karioi about 0845 said that the local cloud base was "pretty solid at 1,500 feet, and no shower activity was noted."

The report said that the differences in the reported cloud base around the mountain were "consistent with the nature of orographic cloud, which is typically lower on the weather side of a mountain, where it forms, than on the lee side."

New Zealand Heliwork's policy required a person on the ground to provide flight following when an aircraft was being flown in a remote area and to alert authorities if a flight was overdue. In this instance, the pilot's housemate performed that function.

The accident helicopter was not equipped with flight recorders (and was not required to be equipped with them) or global positioning system equipment. ATC radar recordings showed no recorded data that correlated with the accident helicopter's flights from Hamilton to Raglan or from Raglan to Mount Karioi.

The accident site was in a forested area on the eastern side of Mount Karioi, about 1,850 feet above mean sea level. The fuselage was inverted on a southerly heading, and the main transmission, rotors, tail boom, right skid, four doors and all

detachable panels had separated from the fuselage and were distributed along the trail of wreckage through the forest.

The cabin floor had collapsed upward, with the most severe damage to the left front; the accident report said that the condition of the cabin floor "was consistent with a severe ground collision while in forward flight, probably nose down and banked left."

The helicopter collided with trees about 27 meters (89 feet) from where the main wreckage came to rest. The pattern of main-rotor slash damage continued to the accident site. The report said that the pattern of the slash marks indicated that the helicopter had been banked 10 degrees to the left and that the length of the wreckage trail and the ground-impact damage indicated that the helicopter had struck the ground at a moderate speed. Main-rotor-blade damage on all three blades was severe, "consistent with multiple tree strikes while rotating under power and at normal rotational speed," the report said.

Inspections confirmed the pre-impact integrity of the engine controls and flight-control systems and indicated "the delivery of engine torque when the main-rotor strike occurred," the report said. Dual collective controls and dual cyclic controls had been installed at the front-passenger seat; there was no evidence of whether the controls had been operated by the passenger. (Typically, the pilot removed the dual controls, but he installed them to allow the helicopter's owner to handle the controls while en route on private flights. The pilot's housemate also had flown the helicopter en route on positioning flights. The flight before the accident flight was a private flight with the owner.) Examination of light bulbs revealed that no warning lights had been illuminated at impact.

The fuel tank was punctured and almost empty, but there was evidence of a "substantial" fuel spill, the report said. There was no post-impact fire.

The impact ejected the ELT from its mounting in the nose of the fuselage and broke the ELT antenna connection and printed circuit board. When the ELT was found, its master switch was in the OFF position. A second, manually operated, personal ELT, also was switched "off"; this ELT probably belonged to the front-seat passenger, the report said.

"The absence of an ELT signal removed the possibility of an earlier alert from overflying aircraft or from the SARSAT [search and rescue satellite] system, as well as preventing any location by an electronic search once the official search had begun," the report said. "The failure of the ELT mounting resulted from the severity of the damage to the nose section of the fuselage, which generated forces well beyond the ELT's design parameters. The broken [antenna] connection and internal damage were direct consequences. The 'off' position of the master switch could have occurred during the ejection of the ELT from the helicopter, or it could have been inadvertently left in that position. The second ELT, being manually operated, could not have produced a signal without action by a survivor."

The report said that investigators could not determine the exact time of the accident or the details of the final flight path. Nevertheless, the report said that the hour-meter reading before the first flight of the day was 1,135.1, and when the wreckage was found, the reading was 1,135.6.

"This gave an elapsed time of 0.5 [hours, plus or minus] 0.1 hours, which would have included the brief flights across Hamilton aerodrome for refueling (about 0.1 [hours]), the flight from Hamilton to Raglan (about 0.3 [hours]) and the accident flight from Raglan to Mount Karioi," the report said. "The inference is that the final flight duration was about 0.1 hours, with a possible maximum of 0.2 hours. A flight time of 0.1 (six minutes) would have been sufficient to fly from Raglan around the east flank of Mount Karioi to the accident site, with some of the flight at less-than-normal cruising speed."

The report said that time might have allowed for two other possibilities — landing at the destination helipad on Mount Karioi, with the accident on the return flight to Raglan, or interrupting the flight to the Mount Karioi helipad, perhaps because of deteriorating weather, and then conducting an intermediate landing at some unknown site on the mountain. Nevertheless, the report said that the first possibility was unlikely because there was no evidence that the technicians had arrived at their destination and that the second possibility was unlikely because a landing at an intermediate site probably would have been more time-consuming than a return to Raglan.

If the pilot approached the mountain from the northeast and flew around the eastern flank, the report said, he "probably encountered thickening cloud with a lowering base on the way. In any event, the height of the accident site … was almost certainly well above the local cloud base on that side of the mountain. The probability is that the helicopter was being flown in reduced visibility in cloud when the accident occurred."

The report said that hover-taxiing probably was the only method of flying to the top of the mountain in reduced visibility.

"Maintaining visual contact with ground features is vital for navigation and for spatial orientation, as well as to avoid collision with the surface, so a low speed commensurate with the available visibility is essential," the report said. "The ability of a pilot to so fly a helicopter is an acquired skill, which requires mature judgment to decide when the additional risks are justified.

"While the pilot … had some experience in this type of flying, it is not known whether he decided to adopt it as the means to fly to the top of Mount Karioi when he saw the cloud around the top of the mountain."

The report said that the pilot probably had been flying the helicopter along a mountain ridge toward the mountaintop helipad when he lost visual contact with the ground.

"In such an eventuality, the pilot would be faced with having to temporarily continue in forward flight by reference to his instruments and with two alternative courses of action: either to climb, hoping to avoid terrain, until clear of cloud, or to descend ahead at a low rate, hoping to regain sight of the ground in time to re-establish flight above the surface by visual reference," the report said.

"The circumstances of this accident suggest that the pilot may have attempted the second alternative but was unsuccessful in regaining sight of the ground before flying into the forest canopy on the far side of the valley. …

"If the pilot did in fact decide to attempt the flight in this way, it would indicate an uncharacteristic lapse in his [decision] making. There was no particular pressure to complete the flight, other than standard commercial considerations relating to unproductive flying. It is probable that on the flight from Hamilton to Raglan in good weather, the pilot had no expectation of encountering difficulty resulting from local weather on the mountain. Having arrived at Raglan and [having] observed the cloud on Mount Karioi less than five [nautical miles (nine kilometers)] away, he was probably reluctant to abandon the intended short flight without exploring the actual conditions, and with an intention of turning back if necessary. … [T]he weather conditions, in particular the visibility, probably worsened as the flight proceeded around the mountain. As a result, the pilot may have encountered conditions beyond his personal minimums before he was able to turn back, or it may have been an attempt to turn back which led to the helicopter flying across the valley toward the accident site."

The report said that the accident demonstrated "the vulnerability of the ELT location in the helicopter's nose section."

In recent models of AS 350 helicopters, the ELT is in the rear locker, and some AS 350 helicopters in New Zealand have been modified to move the ELT to the forward section of the tail boom.

"This has proved beneficial to the survival and functioning of the ELT in some previous accidents," the report said.

As a result of the investigation, TAIC recommended that the New Zealand Civil Aviation Authority (CAA) require, where possible, that ELTs on all helicopters be moved to "a less-vulnerable location than the nose section."

CAA accepted the recommendation and issued an airworthiness directive Sept. 28, 2000, requiring that, by Sept. 28, 2001, any ELT located forward of the pilot's seat be moved further aft.♦

[Editorial note: This article, except where specifically noted, is based on New Zealand Transport Accident Investigation Commission report no. 00-003: *Aerospatiale AS 350BA, ZK-HWK, collision with terrain, Mount Karioi, Waitomo, 7 March 2000*. The 15-page report includes a table.]

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