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Low Altitude Sight-seeing Flight Ends in Sudden Descent and Death

When the low time pilot elected to make a low-altitude turn near a steep glacier face, there was little time or room to maneuver when an emergency situation developed.

Editorial Staff Report

The pilot of the Hughes 500 Model 369HS helicopter, with four passengers on board, had embarked on a short, scenic charter flight over New Zealand's Fox Glacier.

The 10-minute "round trip" tourist flight to view the glacier and surrounding mountain and bush scenery was uneventful until the return phase of the journey, when the helicopter began a turn to the left across the glacier at an altitude of between 200 and 300 feet "above the surface of the icefall, which fell away steeply below."

At a speed of about 70 knots, the helicopter yawed suddenly to the left and began to lose altitude rapidly. Despite corrective actions that stopped the helicopter from turning, the pilot was unable either to control or stop the descent. The aircraft crashed onto the ice, killing two passengers and seriously injuring the pilot and two other passengers.

A subsequent inquiry conducted by the New Zealand Transport Accident Investigation Commission (TAIC) concluded that lack of sufficient altitude, combined with the hazardous nature of the glacier surface, was a major factor in "reducing the likelihood of a successful emergency landing."

The TAIC report said that the "pilot flew the aircraft some 700 to 800 feet below the minimum height required" by New Zealand Civil Aviation Regulations cited in the company's Operations Specifications.

The accident investigation report quoted the pilot as saying that the sudden yaw resembled the "abrupt effect of a tailwind gust when coming to a hover, although the helicopter's speed was relatively high at the time."

According to the TAIC report, local helicopter operators had developed a standard route used for scenic flights over the glacier. This involved flying to the north side of the glacier, climbing to an altitude of about 6,500 feet

and overflying the upper snow slopes in an orbit to the right before descending the face of the glacier in a zig-zag pattern.

[The standard route scenic flight pattern (Figure 1), developed in conjunction with the Department of Conservation and the Ministry of Transport's Civil Aviation Division, was designed to reduce the danger of conflicting flight paths and to minimize environmental intrusion. "In addition, the rapid initial gain of height while flying up the northern side of the glacier and the subsequent zig-zag pattern down the glacier were intended to provide a suitable compromise enabling passengers to obtain an impressive view of the area, yet allowing for the opportunity for an autorotational descent to suitable terrain at the side of the glacier...at the base of the glacier or to lower ground beyond in case of an engine malfunction." But the report stressed: "The availability of an autorotational descent path to such areas varied considerably, depending on the aircraft's height at the time...the slope of the glacier in the immediate vicinity and the distance...(from) the nearest suitable landing surface."]

The accident occurred as the helicopter was making a descending turn to the left to enter the zig-zag pattern for the homeward route. The torque reading during the turn was between 35 and 45 psi (pounds per square inch), the report said.

"The pilot raised the collective in an attempt to arrest the descent, but this was ineffective so he lowered collective fully, considering that at that stage of the turn his only option within the height remaining was to carry out an immediate autorotational landing on the surface of the glacier. He did not recall hearing any 'warning horn' in his headphones, nor did he have any recollection of illumination of the 'engine out' warning light."

The pilot applied right pedal to correct for the yaw and was able to stop the aircraft from turning. "Prior to contact with the ice he [the pilot] remembered 'pulling all the collective,' but recalling nothing further," the report said.

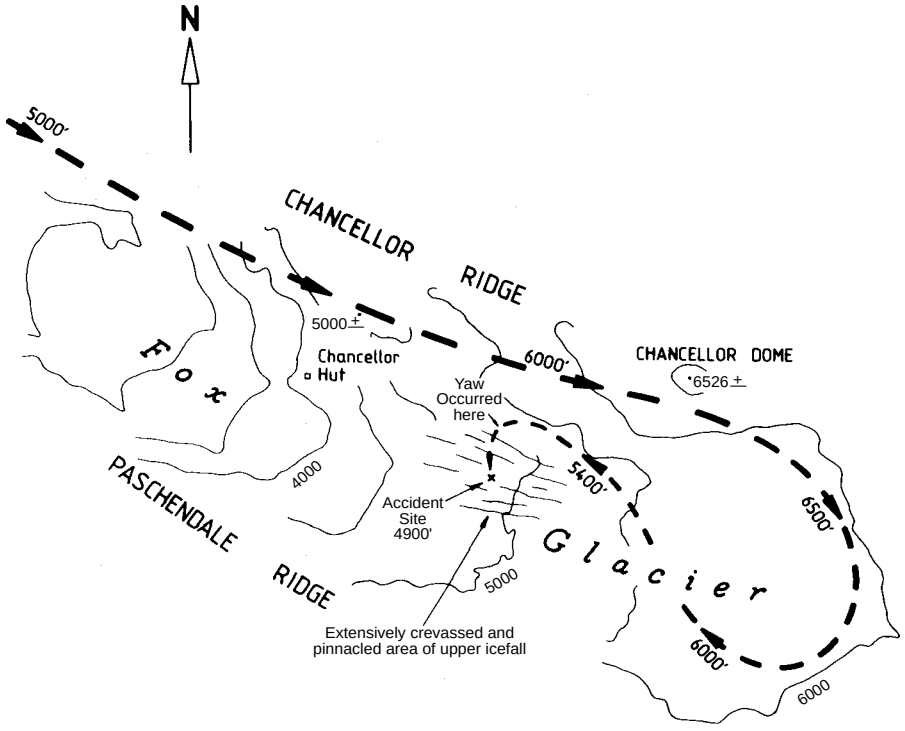
After the pilot regained consciousness, he realized that the passenger who had occupied the middle seat adjacent to him had been thrown from the aircraft [and killed] and that the passenger in the right front seat had also received fatal injuries. The pilot then joined the two injured passengers in the rear compartment, which was relatively intact, to await rescue.

The crash occurred at 1720 hours local time during daylight. Although the pilot activated the emergency locator transmitter (ELT) after the crash, he decided to turn it off about 2100 hours to conserve battery power. The ELT was turned on again at 0700 hours. Search aircraft picked up the ELT signal at 0813 and the wreckage was located at 0820. The pilot and surviving passengers were evacuated from the site at 1100, more than 15 hours after the accident occurred.

A surviving passenger described the flight's final seconds this way: "We were enjoying the scenery and taking photos. Everything happened so fast. There was a sort of a bang and I saw the glass all smashed. I think I was flung to the left. Eventually everything stopped."

The pilot, aged 22, had received basic helicopter flight training on a Hughes Model 269A helicopter. He later obtained a rating on the Robinson R22 and a rating for the Hughes 369HS turbine-powered helicopter in 1988. At the time of the accident, the pilot had 234 total flight hours of which 86 hours were in the 369HS.

Standard Scenic Route for Fox Glacier



Source: New Zealand Transport Accident Investigation Commission

Figure 1

After successfully completing a preemployment check ride and area familiarization flights with the charter company's chief pilot, the accident pilot began flying tourists on April 21, 1989. Up to the time of the May 2, 1989 accident, the pilot had completed 22 flights (amounting to about seven hours flight time) as pilot in command on flights similar in profile to the accident flight, the TAIC report said.

The Hughes helicopter involved in the accident was built in 1974 and brought to New Zealand in 1984. It had been flown a total of 4,549 hours since new and eight hours and 40 minutes since its last routine inspection, the report said. The Allison 250-C20 engine had run a total of 4,538 hours and five minutes.

Weather conditions at the time of the flight were reported to be steadily improving after a period of overcast and drizzle. The pilot reported that the mountaintops were obscured by clouds, but that the glacier was clear. "There was no significant precipitation and he did not consider that there was any likelihood of engine icing," the report said.

Weather conditions at the time of the flight were reported to be steadily improving after a period of overcast and drizzle.

According to the pilot, there was little wind at the time of the accident. Accounts from surviving passengers indicated that the helicopter took off in a light drizzle, but that conditions improved rapidly. "It was spitting a wee tiny bit," said one passenger. Another passenger said she could "see quite clearly" after takeoff and that the flight was smooth with no low clouds over the glacier.

However, a pilot with considerable helicopter flying experience in the area reported that he had experienced an unexpected severe "downflow" near the crash site at an altitude of about 5,500 feet.

"There was no prior evidence of the downflow and no turbulence associated with it, but the severity of the 'sink' required application of full power and a flat turn away from the rising glacier. A significant feature of the encounter was that further down the glacier, at about 4,000 feet, there was no noticeable wind. This localized effect occurred during north-easterly conditions similar to those that existed at the time of the accident," the TAIC report said.

Physical conditions at the crash site made it difficult to determine the attitude and speed of the helicopter at impact, the report said. But it said that based on the extent and distribution of the damage to the fuselage [which included the complete destruction of the forward section on the right side and severe crushing of the helicopter's undersurface], the "initial impact occurred with considerable forward and downward energy."

The report said that parts of the main rotor blades were scattered up to 40 meters from the fuselage. At least two of the blades were fractured in short lengths, but one blade remained intact although severely bent, according to the report.

Post-crash investigations of the wreckage found no fuel abnormalities and determined that the engine was delivering power to the helicopter's main rotor when the aircraft collided with the glacier.

The TAIC report said that the crevassed icefall terrain at the crash site was "formidable for an attempted autorotational landing. Irregularly shaped ice islands were interspersed with projecting 'ice pinnacles' among a maze of deep fissures and slots," the report said. "The undulating, unyielding and slippery nature of the surface also combined to present hazards reducing the likelihood of a successful outcome for any landing in which the helicopter was not under full control."

In its analysis of the crash, the TAIC report said that the aircraft's relatively high speed at the time of the accident and the yaw "rendered it unlikely that the helicopter had entered a typical power settling regime.

"The possibility existed, however, that [the helicopter] may have unexpectedly encountered a region of isolated but severe downflow, the yaw being associated with a tailwind gust as the helicopter descended in a turn to the left. In such a circumstance, despite the pilot's action in fully raising the collective at the conclusion of the autorotational descent, the [aircraft] may have struck the glacier surface before engine power could take effect. The application of full collective was likely to have caused a drop in rotor rpm and consequent activation of the auto-relight system."

But the report added: "The pilot's description of events, including the yaw to the left, raised the alternative possibility that a sudden loss of engine power occurred during the descending turn to the left."

A comprehensive series of engineering tests, including a complete strip down of the engine, found no indications of mechanical failure of the engine, gearbox or transmission components, the report said. "The possibility could not be eliminated, however, that a sudden deceleration of the engine occurred with a consequent loss of available power in flight as the

pilot maneuvered the helicopter over the glacier." At such a low altitude, recovery would be difficult even if the power loss was brief, the report said.

The report noted evidence that suggested "a history of unexplained power losses" involving the Allison 250 series engine, "particularly when installed in the Hughes 369 series helicopters." But it reiterated that no conclusive evidence was found to suggest that power loss was a major determining factor in the crash.

"The extensive damage sustained by the main rotor blades was consistent with torque being transmitted to the rotor head at the time of impact. However, the extent of power available could not be established with certainty." But the report added: "Damage to the main rotor head itself suggested a relatively high power level."

The TAIC report focused considerable attention on the pilot's decision to fly at low altitudes during the return phase of the flight, which it said put him in the situation of facing an "immediate autorotational landing with little opportunity available to execute a planned descent ... or to assess and monitor the helicopter's instrumentation."

The report said that New Zealand aviation regulations, along with the charter company's operations manual, specified that flights should remain at predetermined safe altitudes.

But the report noted that the operations manual did not fully quote the regulation regarding minimum altitudes, opening the door for misinterpretations. According to the report, regulations stipulate that altitude minimums relate to "500 feet above the highest point of the terrain," while the operations manual describes this requirement as meeting "500 feet terrain clearance." [Terrain clearance as defined in regulations was the height above the ground within a 2,000-foot radius of the aircraft.]

"Therefore in the glacial 'U'-shaped valley, the aircraft would [should] have been flown 1,000 feet or higher above the glacier surface during the descent over the Fox Glacier, particularly as the aircraft flew a zig-zag path," the report said.

The company operations manual, the report said, stressed that the safety of the passengers was the pilot's responsibility. "Therefore, the pilot's decision to fly the helicopter over inhospitable terrain at low altitude, even if it could be argued that this was permitted by ambiguities in the operations manual, was inappropriate. The known history of unexplained power losses ... underlined the need for sufficient height to be maintained at all times for the aircraft to reach a suitable forced landing area in the event of a complete loss of power from the engine." The TAIC said that low altitude at the time of the accident "reduced the options open to the pilot and decreased the likelihood of a successful forced landing. This was especially relevant in view of the inhospitable nature of the glacier surface."

The report also suggested that the pilot erred in his decision to turn off the ELT during the night that the crash survivors spent on the glacier. It said that the pilot's action, "while well intentioned, held the potential for delaying rescue."

Single-engine helicopters, the report concluded, must strictly adhere to altitude regulations, especially in such hostile environments.

"The use of single-engine helicopters for air transport operations dictates that the pilot always maintain a flight path that will give him the optimum prospect to carry out a forced landing in the event of an engine failure." ♦

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