

AVIATION OCCURRENCE REPORT

COLLISION WITH TERRAIN

MOUNTAIN HIGH HELICOPTERS LIMITED  
AEROSPATIALE EUROCOPTER AS-350BA  
(HELICOPTER) C-FJJH  
KIMBERLEY, BRITISH COLUMBIA 10NM WEST  
11 JANUARY 1997

REPORT NUMBER A97P0009

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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### *Summary*

The pilot, four passengers, and a dog departed from Kimberley, British Columbia, at 1100 mountain standard time (MST) in the Aerospatiale AS 350BA helicopter (serial number 2374), for a visual flight rules flight to an alpine hut located at 6,500 feet above sea level (asl) in the Purcell Mountains, 12 miles to the west of Kimberley. The helicopter did not return to Kimberley and a search was initiated at 1600. The helicopter was found shortly after the search began; it had struck terrain in Boulder Pass, 10 miles west of Kimberley, at an elevation of 7,900 feet asl. All occupants sustained fatal injuries at impact, and the aircraft was substantially damaged.

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<sup>1</sup> All times are MST (Coordinated Universal Time minus seven hours) unless otherwise noted.

*Ce rapport est également disponible en français.*

## *Other Factual Information*

The pilot was the owner of Mountain High Helicopters Limited. At the time of the accident he was the sole pilot flying the helicopter, the company's only aircraft. He was certified and qualified for the flight in accordance with existing regulations and was experienced on the Aerospatiale Eurocopter AS-350BA. He was not instrument rated and had very little instrument training. The pilot's most recent pilot proficiency check was conducted with a Transport Canada inspector on 5 November 1996; the inspector noted that the occurrence pilot was a capable pilot. The pilot was familiar with the Boulder Pass route to the alpine hut, having flown it many times in the past.

Three groups were to be flown to the alpine hut for avalanche training by a tour operator. On the morning of the accident, the flight was delayed because of low cloud and poor visibility along the route. When the low cloud in the vicinity of Boulder Pass began to dissipate, the pilot and the members of the first group decided to make the first flight. The helicopter departed from Kimberley, with the passengers and their supplies, at 1100. The helicopter was expected to return at 1130. When it did not return on schedule, the tour operator's representative felt it was possible that the helicopter had arrived safely at the hut, and that the pilot had decided to wait for conditions to improve before making the return flight. The representative thus delayed reporting the helicopter as overdue.

A high-frequency radio at the alpine hut normally permitted communication with the tour operator's base in Kimberley. This radio required scheduled maintenance, which the tour guide was to have begun once the helicopter arrived at the hut. This task would likely have taken several hours. A search for the missing helicopter was organized after the representative had waited a reasonable time for the radio maintenance to have been completed, and after the weather had improved enough to preclude the possibility that the flight delay was weather-related.

The helicopter was found beside Boulder Pass by another local helicopter operator, just before nightfall. It had struck terrain at an elevation of 7,900 feet asl, 1,000 feet to the left of the centre of the pass, and 60 feet below the top of the obstructing peak. Based on wreckage deformation and occupant injury patterns, the helicopter's speed at impact was estimated to have been between 50-70 knots. The heading at impact was about 300 degrees magnetic, which is consistent with the track leading to the destination.

The main rotor blades had made a slash in the snow, just before impact, while the helicopter was still airborne. From an analysis of this slash, the helicopter's attitude was estimated to have been nose-down, 40 degrees relative to the horizon and about 80 degrees relative to the steep terrain.

The fuel tank was ruptured at impact and its contents spilled, so a precise weight and balance of the helicopter could not be established. However, based on calculations of the fuel load required for the return flight, including reserves, and on (estimated) occupant and cargo weights, the helicopter's centre of gravity and gross weight were computed to have been well within the allowable limits, and were considered normal for this type of flight.

There is no official weather reporting facility close to Boulder Pass. At the time of the occurrence, the weather at the Cranbrook airport (22 miles east of the accident site) was as follows: ceiling estimated at 3,300 feet asl broken, visibility 25 miles with snow showers in the vicinity, temperature minus 4 degrees Celsius, dewpoint minus 14 degrees Celsius, wind 140 degrees magnetic at 11 knots, and altimeter setting 30.12 inches of mercury.

The outside air temperature at 7,900 feet asl was estimated to have been minus 15 degrees Celsius at the time of the accident.

At 1100 on the day of the accident, a helicopter pilot flying at 7,500 feet asl through a mountain pass eight miles south of the accident site reported that the visibility was restricted to one-half mile or less, in heavy snow showers. He also observed low cloud at higher elevations. The pilot's onboard global position system navigation equipment calculated a 40 knot east wind at his level. This strong wind caused blowing snow on the surface, which obscured terrain features. Visual reference with the ground was further restricted by low cloud and flat ambient light that tended to create whiteout conditions, particularly in areas above the tree-line, such as the accident site.

Another witness, at the alpine hut, reported that around the time of the accident the wind was very strong and was blowing long plumes of snow off the surrounding mountain peaks. This witness could not establish the visibility or cloud conditions at Boulder Pass at the time of the accident.

Whiteout is an atmospheric optical phenomenon in which the observer appears to be engulfed in a uniformly white glow. Neither shadows, nor horizon, nor clouds are discernible, and depth perception and orientation are lost.

The wreckage was recovered and the airframe, engine, fuel control unit, transmission, drive train, flight controls, and control actuators were examined. No pre-impact mechanical deficiencies or defects with respect to this aircraft or its component parts were identified.

There was evidence of torsional loading on the engine and rotor drive train components. This evidence included torsional deformation of the engine-to-main-rotor transmission drive shaft, and bursting of the tail rotor drive flexible coupling. There was substantial damage to the main rotor blades, all of which revealed compressive, mid-span buckling. The rotor head Flexstar arms and sleeves were severely damaged or completely fractured.

The Turbomeca Arriel 1B engine, serial number 4275, was removed from the airframe and disassembled. Of particular note was a substantial 3.8 mm shift in the alignment marks on the module 05 muffcoupling nut. During assembly, the muffcoupling nut is installed with a torque of approximately 20 dekanewtons (about 89 foot pounds). After torquing, the assembler marks the assembly with a scribe line. If the engine experiences a substantial over-torque, as would happen with a rotor strike, the muffnut will tighten and the scribe lines will shift. This shift of the alignment marks, the torsional damage in the drive train, and the extent of rotor head damage are conclusive evidence the engine was producing power and driving the rotor systems when the main rotor blades struck the ground.

### *Analysis*

The slash in the snow, immediately forward of the wreckage, indicates that the helicopter was in a 40-degree nose-down attitude when it struck the mountain. This attitude at impact suggests that the helicopter had a loss of control, while the relatively slow speed at impact suggests that the helicopter had been in this nose-down attitude for only a short time. If the helicopter had been at a higher altitude when it turned nose-down, and had remained at this pitch for a longer time, the impact speed would have been greater.

The loss of control may have been the result of a technical malfunction, or of some exterior influence such as weather conditions that limited the pilot's visual reference. The wreckage examination determined that the engine was developing power at the time of impact. Given that there was no evidence of technical malfunction with the airframe, the control systems, or any other system, weather conditions were considered.

Adverse weather—such as the strong winds and whiteout conditions reported eight miles south of the accident site—probably existed throughout the Purcell Mountains and may have been encountered by the pilot en route to the alpine hut. If his visibility had been restricted by these conditions, he would have found it necessary to reduce speed. If whiteout conditions in blowing snow had caused him to lose visual reference with the ground, even momentarily, he would have faced an increased risk of losing control of the helicopter. Such a loss of control could have resulted in the nose-down attitude evident at impact.

As there is no evidence of mechanical malfunction of the helicopter, its systems, or its engine, and no reports of actual site weather, nor any witnesses to the occurrence, the causal elements of this accident are undetermined.

## *Findings*

1. The pilot was certified and qualified for the flight in accordance with the existing regulations.
2. The weight and centre of gravity of the helicopter were computed to have been within the allowable limits.
3. No evidence was found of any airframe failure or system malfunction prior to, or during, the flight.
4. The pilot may have encountered adverse weather and low visibility en route to the alpine hut, and these may have affected the pilot's ability to maintain visual contact with the ground.

## *Causes and Contributing Factors*

The cause of this accident was not determined.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 30 April 1998.*