

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

AVIATION INVESTIGATION REPORT

A05Q0008



COLLISION WITH TERRAIN

HÉLI-HORIZON INC.

EUROCOPTER AS-350 BA (HELICOPTER) C-FHBG

LA GRANDE-4, QUEBEC, 60 nm SE

24 JANUARY 2005

Canada

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

At about 1500 eastern standard time, the pilot of an Aerospatiale AS 350 BA helicopter, registration C-FHBG, serial number 1440, with four hunters and one guide on board, was on approach to an unprepared landing area at the edge of a lake in the James Bay region 60 nautical miles from La Grande-4, Quebec. On completing the approach, the helicopter commenced hovering, then started to descend in white-out and powdery snow conditions. The snow picked up by the rotor wash caused a total loss of visual references. After the left skid touched the snow-covered surface, the helicopter rolled left in the snow, which was several feet deep at the time. As it rolled, the rotor blades struck the ground and the transmission separated partially from its mounts. Blades entered the cockpit and fatally injured the guide and pilot, who was wearing a helmet. The four passengers in the rear seats were not wearing seat-belts, and they suffered minor injuries. Two of them were thrown about 10 feet from the wreck, and the other two remained in the cabin. The survivors were evacuated around 1630 by two other helicopters.

Ce rapport est également disponible en français.

Other Factual Information

The AS-350 BA had been chartered by Mirage outfitters to transport and move its clients around the hunting area near the Sakami River some 45 nm south of the main camp (see Appendix A). The outfitters had prepared an airstrip on the river, where its clients gathered before being flown to the area near the caribou herds. Four hunters and a guide made up one party. On the day of the accident, the helicopter had made five flights before landing on the Sakami River around 1430¹ to pick up its third hunting party. The pilot left the engine running. The guide assigned to the aircraft disembarked and helped the four hunters to board. He then took the left front seat and fastened his seat-belt. The aircraft took off and, around 1500, after a brief flight, it made an approach for a landing on the frozen surface of a lake (53°02'50" N, 072°29'30" W). When the aircraft touched the surface, it rolled over on its left side.

After the crash, a passenger called for rescue on a satellite telephone he found in the cabin; the telephone belonged to Héli-Horizon. The survivors were rescued around 1630 by two helicopters chartered by Mirage outfitters to fly hunters to the same hunting area.

The pilot was trained, certified and qualified for the flight in accordance with existing regulations. He had been flying as a commercial helicopter pilot since 1996.

The weather on the day of the accident was conducive to white-out; the sky was uniformly overcast. In these conditions, there were no shadows, causing a loss of depth perception. It had snowed the day before and the ground was covered with a layer of powdery snow. The exterior temperature was hovering around -20°C. Last light was at 1701.

The pilot had not reported any faults before the flight. The helicopter had flown 25 hours since its last 100-hour inspection. The aircraft was inspected and maintained in accordance with a maintenance program approved by Transport Canada. The aircraft documentation revealed no deferred maintenance items. At the time of the accident, the windows in the front and rear doors were completely iced up and the left windshield was partially iced up, but the pilot's windshield was defrosted. It was not determined whether or not the two floor windows were iced up.

The accident occurred at the edge of a wood and beside a lake, on terrain that was sloped about 20 degrees (Photo 1). After the accident, the helicopter was lying on its left side with the rotor mast pointing up the slope. The cockpit roof had been torn off. There were blade impact marks on the forward portion of the headliner, the pillar between the windshields and the front door frames. All damages were attributed to instantaneous overload. The transmission was torn away, and the main rotor blades and rotor hub exhibited damages consistent with the aircraft rolling onto its side.

¹ All times are eastern standard time (Coordinated Universal Time minus five hours).

The guide's and pilot's seats separated from their anchors when the helicopter rolled over. Examination of the seats revealed that the rails of both seats were deformed under lateral loading. In 1999, Eurocopter issued service bulletin 25.00.63, recommending that the seat anchors be reinforced in case of a hard landing. The recommended modification was not made on the accident aircraft. Actioning service bulletins is optional.



Photo 1. Aircraft wreckage and accident site

In powdery snow conditions, two landing techniques are recommended as a means of preventing a loss of visual references due to snow being picked up by rotor wash. Over open ground, a landing with no hover phase is recommended. For landings in a confined space, the pilot should hover higher than usual, select specific reference points, and descend very slowly. He can then land when all powdery snow has been blown away by rotor wash.

On a landing on sloping terrain, rotor lift can generate roll and cause the helicopter to roll over on its side. This effect is called "dynamic rollover." Each helicopter has its own critical roll angle, beyond which recovery is impossible. If that critical angle is exceeded, the helicopter will roll even if maximum opposing cyclic input is applied. In fact, the critical angle is equivalent to full cyclic deflection. When only one skid of the helicopter is in contact with the ground, sideways movement can cause a high rate of roll and a roll angle that exceeds the critical angle dictated by the maximum lateral deflection of the cyclic control.

Section 602.89 of the *Canadian Aviation Regulations* (CARs) requires that pilots ensure that all passengers on board are briefed before take-off on:

- the location and means of operation of safety belts;
- the stowage of carry-on baggage;
- the location and means of operation of emergency and normal exits; and
- the location of first-aid kits and the use of survival equipment and the emergency locator transmitter (ELT).

The four hunters in the rear seats were not given the necessary safety instructions prior to departure. Moreover, none of them had their seat-belt fastened; the pilot did not ensure they had done so before take-off. The passengers were not very familiar with the aircraft and did not know there was survival equipment on board. The same was true of the fixed-wing flight earlier that morning that brought the hunters to the Sakami River airstrip, as well as the helicopter flight when they were rescued after the accident. The investigation further established that the two hunting parties that had been flown in earlier on the same helicopter had not been given a safety briefing prior to take-off.

The aircraft was carrying the survival equipment required for the flight under CARs. It was carrying the Survie Max model survival gear approved for six persons for a period of five days, which was manufactured by Survie Saguenay. It also carried a model 300S emergency tent designed for six persons and manufactured by Camshell. The survival gear was in the left baggage compartment. Since the aircraft was lying on its left side after the accident, the survival gear was not accessible at that time.

The helicopter was equipped with a Pointer Sentry model 4000-10 ELT, which activated on impact. It was mounted in accordance with existing regulations in the forward part of the cabin below the instrument panel, and its selector switch was in the correct position for automatic activation. The ELT signal was received by the search and rescue satellite (SARSAT) network 48 minutes after the accident.

Analysis

In electing to land at the edge of the woods near the lakeshore, the pilot could maintain visual contact with the trees during the landing. However, the existing white-out conditions deprived him of depth perception. As a result, he did not see that the slope of the terrain exceeded the lateral limit for a safe landing. During the vertical descent, the rotor wash blew powdery snow outward and upward, which created a snowball effect and restricted visibility. The pilot could not land rapidly because the slope of the terrain exceeded the aircraft's critical roll angle. The result was that prolonged hovering must have exacerbated the snowball effect. The conditions inside the helicopter contributed further to a reduction in visibility; frost on the side windows and the left windshield clearly restricted the pilot's view and would have prevented him from seeing external reference points clearly.

It is highly likely that, in the operational and environmental conditions existing at the time, the helicopter pilot lost all visual reference with the ground. That is why he could not perceive the lateral movement of the helicopter and could not keep his roll angle below the critical angle dictated by the maximum lateral deflection of the cyclic control. Consequently, the aircraft pivoted about the left (uphill) skid, which was in contact with the ground, and rolled onto its side.

On ground impact, the passengers in seats 1C and 1D were ejected from the aircraft and the front seat anchors were deformed. The main rotor blades had already cut through the cabin, tearing off the aircraft's roof in the process. From this, it is clear that, although the service bulletin (25.00.63) recommending reinforcement of the front seats had not been executed on this helicopter, that did not contribute to the injuries sustained by the front seat occupants.

The basic safety requirements were not complied with by any of the three pilots transporting hunters that day. And yet, the prevailing winter conditions necessitated strict safety precautions. Because their seat-belts were not fastened, the passengers risked serious injury in the event of an accident. Also, the passengers were neither prepared for the possibility of an accident nor briefed on search and rescue procedures or the use of the ELT. Moreover, they did not know that the aircraft was carrying survival gear.

Findings as to Causes and Contributing Factors

1. The pilot did not notice that the slope of the landing area exceeded the maximum roll angle allowable for this aircraft because the existing white-out conditions deprived him of depth perception. The helicopter rolled onto its left side in a dynamic rollover.
2. The pilot did not perceive the lateral movement of the helicopter because the snowball effect and the ice on the aircraft's windows prevented him from seeing external references.

Findings as to Risk

1. The front seats were not consistent with service bulletin 25.00.63 and separated from their anchors when the helicopter rolled onto its left side.
2. The rear seat occupants were not given a safety briefing prior to take-off. Their seatbelts were not fastened, they did not know where the emergency locator transmitter (ELT) was or how it worked, and they did not know that the helicopter was carrying survival equipment.

Other Findings

1. Service bulletin 25.00.63 recommending reinforcement of the front seats had not been executed on this helicopter, but that did not contribute to the injuries sustained by the front seat occupants.
2. The investigation revealed that the other pilots who transported the occupants of the accident helicopter did not give the passengers a safety briefing as required by the *Canadian Aviation Regulations*.
3. The survival equipment in the left baggage compartment was not accessible after the accident because the aircraft came to rest on its left side.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 18 April 2006.

Visit the Transportation Safety Board's Web site (www.tsb.gc.ca) for information about the Board and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A – Map of the area

