

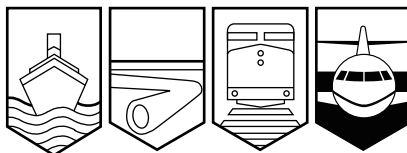
Transportation Safety Board  
of Canada



Bureau de la sécurité des transports  
du Canada

## AVIATION OCCURRENCE REPORT

A98Q0193



### LOSS OF VISUAL REFERENCES / FLIGHT INTO TERRAIN

HÉLICOPTÈRE COLIBRI INC.  
BELL 206L-1 LONGRANGER (HELICOPTER) C-GLBH  
12 nm SW OF  
SAINT-MICHEL-DES-SAINTS, QUEBEC  
04 DECEMBER 1998

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 1202 eastern standard time, the pilot of the Bell 206L-1, C-GLBH, serial No. 45532, alone on board, took off from Dorval Airport, Quebec, to make a visual flight rules (VFR) cross-country flight. He picked up three passengers at the heliport of the horse club in Laval, Quebec, and took off at 1210 towards the north-north-west for Lac Kempt, Quebec. About 12 nautical miles (nm) south-west of Saint-Michel-des-Saints, visibility was reduced slightly in light snow showers and then became nil in moderate snow showers. At about 1300, the pilot was unable to maintain ground visual contact, lost control of the aircraft and flew into the ground at a high rate of descent. The accident occurred in a forest on the side of a mountain. The aircraft was destroyed, and two of the four occupants lost their lives in the accident.

*Ce rapport est également disponible en français.*

## *Other Factual Information*

Records indicate that the pilot was certified and qualified for the flight in accordance with existing regulations. He had held a helicopter commercial pilot licence since May 1980 and had a total of about 2 075 hours' flight time, including 1 525 hours on the Bell 206L. He was night-rated, but not instrument-qualified. He had worked for the company since March 1995 and had performed the duties of pilot and maintenance engineer of the aircraft. He had held an aircraft maintenance engineer licence since 1978.

The private aircraft, owned by Hélicoptère Colibri Inc., was certified, equipped and maintained in accordance with existing regulations and approved procedures. It had a total of 3 576 hours' flight time and had undergone a 300-hour periodic inspection on 21 September 1998. The pilot confirmed that he did not have any problems with the aircraft during the flight. The weight and centre of gravity were within the prescribed limits. The aircraft was equipped for instrument flight.

Shortly after take-off from Laval, the pilot communicated by radio with the control tower of Mirabel Airport, Quebec. Once out of the Mirabel control zone, the pilot operated in uncontrolled airspace. The aircraft was visible on radar until about 18 nm south-west of Saint-Michel-des-Saints when it disappeared beyond the limits of the radar. The last recorded altitude was 3 100 feet above sea level (asl). The terrain in this area ranges between 1 300 feet and 1 950 feet asl.

On seeing the light snow showers ahead, the pilot disengaged the automatic pilot to be ready to slow down or descend. The ceiling was about 2 000 feet, and the pilot had to descend and reduce speed to maintain ground visual contact. The visibility was then reduced rapidly in moderate snow showers. The pilot lost all ground visual reference and entered whiteout conditions. He then initiated a right turn in an effort to maintain ground visual contact. On glancing at the instrument panel, in particular the flight attitude indicator, he noticed that the helicopter was descending; he corrected by trying to return it to level flight. The pilot, still not having regained ground visual contact, became disoriented while trying to regain control of the aircraft. When he saw the ground, the aircraft was nose-down at tree-top level. He straightened the aircraft's nose slightly, and it then struck the ground slightly banked to the left at a high rate of descent and almost zero forward speed. The aircraft was destroyed; the left rear passenger died immediately, and the right rear passenger died sometime later. The pilot in the right front seat and the passenger in the left front seat suffered serious injuries.

Environment Canada determined that the following conditions were prevailing in the vicinity of Saint-Michel-des-Saints at the time of the accident: at about 1300 eastern standard time (EST)<sup>1</sup>, the ceiling was 2 000 feet asl; the weather radar covering the area showed only weak, very scattered precipitation echos. At 1325, a cell was observed near the accident site. The precipitation could have been in the form of drizzle, a mixture of drizzle and snow, or even wet snow. Visibility in the precipitation with the presence of fog might have been almost zero. The winds were blowing from the west-north-west at nearly 15 knots gusting to 30 knots. There was

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<sup>1</sup> All times are EST (Coordinated Universal Time [UTC] minus five hours) unless otherwise stated.

probably moderate turbulence in the area. The Cargair bush air service company, based in Saint-Michel-des-Saints, reported an estimated ceiling of 2 000 feet, visibility of 20 miles and scattered snow showers. The pilot had checked the forecasts on the aviation weather site on the Internet and had judged the conditions suitable for flight.

The *Aeronautical Information Publication* (AIP) explains that various phenomena are known to cause whiteout. The phenomenon that best explains the conditions encountered by the pilot of the LongRanger is precipitation whiteout resulting from small, wind-driven snow crystals falling from low clouds above which the sun is shining. Light reflection complicated by the spectral reflection from the snowflakes and obscuration of landmarks by falling snow can reduce visibility and depth perception to nil in such conditions.

In a three-dimensional environment, pilots use several input sources, including vision, hearing, touch and their body sense, to establish their position in relation to the ground. Sight is the body's most reliable input, but the organs of the inner ear also play an important role in orientation. Semicircular canals in each inner ear detect changes in angular acceleration and respond to linear accelerations and gravitational forces. Due to its form, the inner ear can mislead pilots as to their position in space. Pilots must use their eyes to validate information received from the inner ear. When a pilot enters whiteout conditions, he appears to be engulfed in a uniformly white glow. Neither shadows, horizon or clouds are discernable; sense of depth and orientation is lost. This disorientation occurs very quickly, and loss of control of the aircraft may result.

After impact, the antenna of the aircraft's emergency locator transmitter (ELT) was found to be broken and buried under the snow. Upon checking, the pilot found that the ELT did not appear to be emitting any signal, although the switch was on. In fact, the ELT was operating at low intensity; the signal was not picked up by satellite, but was picked up nearby by helicopters. The pilot and two passengers had cellular telephones. By climbing a few hundred feet up the side of the mountain, the pilot managed to contact the Sûreté du Québec (SQ) by dialling 911. The pilot had to climb up the side of the mountain four times, making four calls from three telephones. Each call was interrupted because the batteries were dead. The first call was made at 1428, the second at 1523, the third at 1610, and the fourth at 1705. In each call, the pilot tried to give directions to the accident site and its vicinity in order to help rescuers locate it, because the SQ took the necessary steps to launch a search and rescue (SAR) operation after receiving the first 911 call. Two SQ helicopters were called, as was Canadian Forces ground support from Longue-Pointe, Quebec, which alerted the Canadian Forces national SAR system. An SQ helicopter located the accident site at 1904, some four and a half hours after the first 911 call.

Examination of the aircraft revealed that all the seat-belts withstood the impact. It should be noted, however, that no shoulder harnesses were installed for the pilot or the passengers. Aviation regulations do not require that safety harnesses be installed in the front of a private aircraft. Section 605.24 of the *Canadian Aviation Regulations* requires safety harnesses for passengers seated in the rear only for aircraft manufactured after 16 September 1992. The accident aircraft was manufactured in 1981. The pilot and the front passenger suffered chest injuries.

Measurements were taken of the rear cabin space at the accident site to calculate the permanent distortion and elastic distortion of the cabin upon impact. By measuring the distance between

the rear seats and the ceiling, it was calculated that the permanent distortion of the cabin was 15 inches on the left side and 13 inches on the right side. As a rule, the elastic distortion of the rear cabin on impact is estimated by multiplying the permanent distortion by two, giving an approximate elastic distortion of 30 inches for the left side and 26 inches for the right side. At the time of manufacture, the distance between the seats and the ceiling was 36.6 inches. The cabin space was apparently reduced on impact by 80 per cent on the left side and 68 per cent on the right side. The transmission, mast and blades of the aircraft's main rotor are located right above the cabin. The considerable weight of these components and the rate of descent on impact appear to have contributed to the distortion of the rear cabin. This distortion explains the seriousness of the rear passengers' injuries.

## *Analysis*

The pilot had checked the weather forecasts before departure and had judged the conditions suitable for flight. The weather study reveals that the weather conditions encountered correspond to the forecasts. When the pilot entered the light snow showers, he thought that he could navigate safely, but he lost ground visual contact when the snow showers turned from light to moderate. He encountered whiteout conditions, in which it becomes impossible for the eye to discern the horizon, shadows and clouds, and lost his sense of orientation. While attempting to correct the situation without any ground reference, the pilot lost control of the aircraft. Not until he saw the tops of the trees was the pilot able to raise the aircraft's nose and return it to level flight, just before striking the trees and the ground.

At the time of the accident, the ELT antenna broke at impact and was buried under the snow. The signal could be picked up only a short distance away.

Registered private aircraft or aircraft manufactured before September 1992 are not required to be equipped with shoulder harnesses. It is highly likely that shoulder harnesses would have decreased the seriousness of the injuries of the pilot and the front passenger. Such harnesses, however, would probably not have lessened the injuries of the rear passengers, given the significant elastic distortion that occurred on initial impact.

## *Findings*

1. Records indicate that the pilot was certified and qualified for the flight in accordance with existing regulations.
2. The pilot encountered whiteout conditions in flight, lost all ground references and became disoriented. While attempting to correct the situation, the pilot lost control of the aircraft and flew into the ground.
3. The aircraft struck the ground at a high rate of descent.
4. The ELT signal was not picked up by satellite because the antenna had broken. The signal could be picked up only very close to the site.
5. The aircraft was not equipped with shoulder harnesses.

6. The significant elastic distortion of the rear cabin explains the seriousness of the injuries of the rear passengers.

## *Causes and Contributing Factors*

After losing all ground visual reference in whiteout conditions, the pilot became disoriented, lost control of the aircraft and crashed.

*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 12 August 1999.*