

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**AVIATION INVESTIGATION REPORT
A08Q0054**



**LOSS OF VISUAL REFERENCES –
COLLISION WITH FROZEN LAKE SURFACE**

**BELL 206B III JET RANGER (HELICOPTER) C-GBKX
RÉSERVOIR GOUIN, QUEBEC
19 MARCH 2008**

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.

Aviation Investigation Report

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Summary

The Bell 206B III helicopter (registration C-GBKX, serial number 2676) was departing Réservoir Gouin, Quebec, on a private visual flight rules flight to the pilot's cottage located 42 nautical miles to the east-southeast. Shortly after take-off, at 0837 eastern daylight time, the aircraft struck the frozen, snow-covered surface of the lake. The pilot, the sole occupant on board, was fatally injured. The helicopter was destroyed.

Ce rapport est également disponible en français.

Other Factual Information

The aircraft was owned and maintained by Hélicoptères Panorama (Panorama) based in Alma, Quebec. Panorama is a commercial helicopter company authorized to operate under Part VII, subparts 2 and 3 of the *Canadian Aviation Regulations* (CARs). The Bell 206 pilot, fatally injured in this occurrence, was a friend of the company co-owner and would on occasion borrow the Bell 206 for private use when it was available. The occurrence flight was a private flight. The co-owner, himself a fixed-wing and rotary-wing private pilot, also privately operates a Cessna 206 fixed-wing aircraft.

At 0700,¹ the Cessna pilot and the Bell 206 pilot called Panorama operations in Alma from the Bell 206 pilot's cottage via satellite telephone, to get the weather conditions and forecast. It was partly sunny in Alma, 67 nautical miles (nm) to the east; however, snow was expected by mid-morning. The weather at the cottage at that time was estimated 1 ½ to 3 miles visibility in light snow showers, ceiling approximately 800 feet above ground level (agl). The Bell 206 was pre-flighted and the two pilots took off for Réservoir Gouin at approximately 0742 to retrieve the Cessna, which had been stuck in the soft snow and slush-covered surface of the reservoir for over a week.

The Cessna pilot was seated in the helicopter pilot's seat on the right-hand side of the helicopter; he flew the Bell 206 from the cottage to Réservoir Gouin. His friend was seated in the front left passenger seat. Upon reaching the reservoir, the helicopter was flown along the north shore, instead of crossing over the expanse of the snow-covered reservoir. The Bell 206 was landed slightly behind the parked Cessna, and the engine was shut down at approximately 0807.

The Cessna, flown by the company co-owner, took off for Alma without difficulty at 0825. The weather at the time was estimated at 1 ½ miles visibility in light snow showers, ceiling 200 feet agl. These weather conditions are considered to be instrument meteorological conditions (IMC). Under IMC weather conditions, pilots are required to operate under instrument flight rules.² The Cessna pilot did not hold an instrument rating. The Bell 206 pilot intended to take off within a few minutes and return to his cottage, 42 nm to the east-southeast. While en route for Alma, the Cessna pilot attempted to communicate with the Bell 206 pilot but did not get a response. The Cessna arrived in Alma at 0937. At 1000, when the Bell 206 pilot did not return to his cottage as planned, Panorama was notified via satellite telephone.

Panorama uses a Guardian SkyTrax (SkyTrax) flight-following system to track its helicopter fleet. The SkyTrax system showed, via the last global positioning system (GPS) position signal, that the Bell 206 was still on Réservoir Gouin. The Cessna pilot boarded another helicopter flown by a company pilot and returned to Réservoir Gouin. The helicopter accident site was located at 1409, 1.2 nm east of its take-off point on the flat, frozen, snow-covered surface of Réservoir Gouin. The pilot was fatally injured and the helicopter was destroyed. The weather at the time of the search was as follows: estimated ceiling 1500 feet agl, vertical visibility

¹ All times are eastern daylight time (Coordinated Universal Time minus four hours).

² As per Section 602.121 of the *Canadian Aviation Regulations*.

approximately 800 feet and horizontal visibility approximately 1 mile, at times ½ mile in constant moderate snow showers. Panorama pays for the SkyTrax system to record the aircraft's position every two minutes. The last SkyTrax system position was recorded at 0836. It is estimated that the occurrence took place after 0836 but before 0838 since no GPS position signal was received at 0838.

The helicopter struck the snow-covered surface of Réservoir Gouin on a northerly heading, in a 45° nose-down, left-side low attitude. The helicopter struck the lake surface while in a high rate of descent. The main rotor blades struck the lake surface and the front cabin. The helicopter then tumbled, destroying the cabin sections and rupturing the fuel cell. The engine compressor and turbine casing deformation revealed signs of power at the time of impact. The main rotor transmission was not found. It is believed to have sunk in the soft snow and slush.

Examination of the helicopter did not reveal any pre-existing mechanical abnormalities that could have contributed to the occurrence. The accident was not survivable because of the total destruction of the cabin area. There was no indication that incapacitation or physiological factors could have affected the Bell 206 pilot's performance.

The Graphic Area Forecast (GFA) weather charts showed a low-pressure system moving eastwardly across Quebec that would have affected the weather in the Réservoir Gouin area by early morning on 19 March 2008 (see Appendix A – Graphic Area Forecast (GFA)). The forecast predicted:

Overcast ceilings between 2500 feet to 20 000 feet, visibility ¾ to 2 statute miles (sm) in light snow showers and patchy ceilings at 800 feet agl.
Isolated altocumulus castellanus cloud at 22 000 feet, ½ sm visibility in snow showers with patchy ceilings 400 feet agl. Locally 1 sm visibility in light snow pellets in vicinity of the rain-snow boundary.

Chibougamau and Roberval are the closest aviation weather reporting stations to the accident site location. The Aviation Routine Weather Report (METAR) at 0800 for Chibougamau, located 85 nm north of the occurrence site, was as follows:

Wind 140° true (T) at 12 knots gusting to 17 knots, visibility 1 sm in light snow showers, blowing snow, a few clouds at 800 feet agl, vertical visibility 900 feet agl, temperature -4° C; dew point -6° C; and altimeter setting 29.69 inches of mercury (in. Hg), remarks 2 oktas³ stratus fractus, 6 oktas snow, visibility variable ¾ to 1 ¼ sm.

³ Oktas – Cloud layer opacity in eighths of sky obscured.

The 0800 METAR for Roberval, located 80 nm east of the accident site, was as follows:

Winds 130°T at 7 knots, visibility 40 sm, ceiling 8000 broken, temperature -4°C, dew point -10°C, and altimeter setting 29.91 in. Hg, remarks 7oktas altocumulus.

The Aerodrome Forecast (TAF) for Roberval valid at 0824 was as follows:

Wind 120°T true at 5 knots, visibility greater than 6 sm, ceiling broken at 800 feet agl. Temporarily between 0800 and 1000, visibility 2 sm in light snow showers, ceiling broken at 200 feet agl. From 1000, wind 140°T at 8 knots, visibility 2 sm in light snow showers, ceiling overcast at 1200 feet agl. Temporarily between 1000 and 1200, visibility $\frac{3}{4}$ sm in light snow showers, vertical visibility 600 feet agl.

The CARs⁴ applicable to minimum visual meteorological conditions (VMC) for visual flight rules (VFR) flight within uncontrolled airspace state that no person shall operate an aircraft in VFR flight within uncontrolled airspace unless the aircraft is operated clear of clouds and with visual reference to the surface. Where the aircraft is a helicopter and is operated at less than 1000 feet agl during the day, flight visibility should not be less than 1 sm, except if otherwise authorized in an air operator certificate or a flight training unit operator certificate – helicopter.

Réservoir Gouin is a large, irregular-shaped body of water extending 55 nm east-west and 40 nm north-south. It is situated in Class G uncontrolled domestic airspace. The irregular-shaped shoreline made up of multiple inlets, fingers, and islands makes it particularly difficult to navigate especially in poor weather. The weather at the time of the occurrence was fluctuating between VMC and IMC. The environment was conducive to whiteout conditions where the degree of contrast was low due to the overcast, obscure sky, flat light, reduced visibility in snow showers and the snow-covered reservoir. Upon taking off in an easterly direction, the pilot had a finger of trees as a reference below the helicopter and the expanse of the white snow-covered reservoir surface in front of him (see Appendix B – Site Diagram).

Flight in whiteout conditions may result in a poorly defined visual horizon that will affect the pilot's ability to judge and stabilize aircraft attitude, or reduce the pilot's ability to detect changes in altitude, airspeed, and position. If visual cues are sufficiently degraded, the pilot may lose control of the aircraft or fly into the ground or surface of the water.

A search of the TSB database for the period of January 1998 to the end of December 2007 revealed 18 occurrences involving collision with terrain in whiteout conditions. These 18 helicopter occurrences involved 45 persons, 13 of which were fatally injured and 23 were injured. Studies⁵ have indicated that a majority of whiteout condition occurrences happen during VFR weather conditions where the pilot is justified in initiating the flight or chosen route

⁴ Section 602.115 of the CARs.

⁵ Civil Aviation Authority (United Kingdom), Safety Regulation Group, Paper 2007/03 – *Helicopter Flight in Degraded Visual Conditions*, September 2007.

but where visual cues are limited due to flat light, restrictions in visibility, overcast sky conditions and snow-covered terrain. In most cases, the pilot is unaware of a loss of visual references and a loss of control of the aircraft happens insidiously. The study did not indicate that low time pilots were more at risk of being involved in this type of occurrence in comparison with high time pilots.

The pilot obtained a Canadian private helicopter pilot licence in May 2005. His helicopter training was conducted on Robinson R22 helicopters and he was endorsed on the Bell 206 helicopter in November 2005. He did not hold an instrument rating. The pilot's Category 3 aviation medical certificate was valid at the time of the occurrence; he was restricted to day flying only, with operational two-way radio communications. It was not possible to confirm the pilot's experience on rotary-wing aircraft but it is estimated that he had approximately 130 hours' total time; 85 hours of which were completed on C-GBKX, the accident helicopter. The pilot also held a private fixed-wing licence obtained in May 2001. The total number of hours on fixed-wing aircraft is unknown, but at the time of obtaining his helicopter licence, he had approximately 65 hours on fixed-wing aircraft.

Both the fixed-wing and helicopter training included five hours of instrument flight training, including unusual attitudes flight training. Flying in whiteout conditions is discussed during the ground school training, and if weather conditions permit, will be demonstrated during dual instruction on the helicopter. Because the Bell 206 pilot's training took place from March to May, it is likely that whiteout conditions could not have been demonstrated; this could not be verified during the course of the investigation.

The helicopter was operated and maintained by Panorama's approved maintenance organization (AMO) in accordance with existing regulations and approved maintenance and inspection program. All mandatory airworthiness directives and required maintenance had been completed. Maintenance records indicate that the Bell 206 had flown 13 hours since the last 100-hour inspection and the annual inspection. No deficiencies had been reported. The helicopter's weight and centre of gravity were within the prescribed limits at the time of the occurrence. The Cessna pilot had flown the helicopter just minutes before and did not report any technical difficulties with the Bell 206. The accident aircraft was not certified or equipped to fly under instrument flight rules nor was it required.

The emergency locator transmitter (ELT) was mounted on the left front passenger window door frame. The unit was torn from its retaining brackets, the moulded plastic casing was damaged and the antenna connection was severed. Both the battery compartment and circuit board were damaged on impact, eliminating the possibility to transmit a distress signal and the wreckage location.

Information from the Bell 206's SkyTrax tracking system provided its last known position to the company, which helped locate the wreckage in a timely manner. The SkyTrax unit survived the impact forces, and information contained in memory provided a record of the aircraft's movements. The SkyTrax system service provider's database and operator's flight tracking records allowed investigators to review the morning flight from the Bell 206 pilot's cottage to Réservoir Gouin, the time at which the pilot started the engine while positioned on Réservoir Gouin and the helicopter's last known position.

On 13 March 2008, a similar helicopter occurrence (TSB occurrence A08Q0053) took place at dusk in whiteout conditions over a large, frozen, snow-covered expanse of water. The pilot survived the accident with minor injuries; the helicopter was destroyed. In this occurrence, the ELT unit's moulded plastic casing was damaged and the antenna was severed. Post-accident testing of the ELT unit showed that, although the *g* switch had been activated during the impact, the severed antenna rendered the unit incapable of transmitting an adequately strong emergency signal. The control tower at the airport from which the aircraft had just taken off, located five miles from the crash site, did not capture an ELT signal. Because the aircraft's SkyTrax tracking system was programmed to register its position every 15 minutes, the aircraft's last known position was on engine start-up at the airport from which it departed. The review of radar data and the pilot's physical ability to use a cellular telephone after the crash assisted in locating the aircraft. Unlike the Réservoir Gouin occurrence, this occurrence took place close to a populated area. Confusion over the aircraft's last reported position, unknown safety of the lake's surface and reduced visibility in snow showers delayed timely rescue. The pilot managed to walk on the frozen lake surface towards the rescue units' flashing vehicle lights and was assisted by rescue personnel 2.5 hours after the occurrence.

Analysis

The weather at the time of the occurrence was reported to fluctuate between VMC and IMC. The minimum visibility for operating VFR in uncontrolled airspace below 1000 feet is 1 sm. The pilot had little experience flying in marginal weather. It is possible that the pilot's decision to take off in low visibility and low ceilings was affected by fluctuating weather conditions and that the Cessna pilot had taken off in similar conditions just minutes before.

Whiteout conditions existed at the time of the occurrence, reducing the visual cues available to the pilot to maintain control of the aircraft. The pilot had little exposure to helicopter flight in whiteout conditions and may not have known to fly close to shore in order to use the trees and shoreline as contrasting cues against the white snow of the frozen lake. Inadequate ground references prevented the pilot's accurate perception of the helicopter height and attitude in reference to the surface. It is likely that the pilot lost control of the helicopter while flying in whiteout conditions over the vast snow-covered frozen surface of Réservoir Gouin.

Both the 121.5 MHz ELT from this occurrence and that of the A08Q0053 occurrence were damaged on impact and could not fulfill their role in signaling the accident. Because the SkyTrax tracking system installed on this occurrence helicopter was programmed to record the helicopter's last known position at a frequency of every 2 minutes instead of 15 minutes, it helped reduce the search area and locate the helicopter in a relatively timely manner.

The following TSB Engineering Laboratory reports were completed:

LP 045/2008 – Skytrax Data Plotting
LP 049/2008 – ELT Analysis

These reports are available from the Transportation Safety Board of Canada upon request.

Finding as to Causes and Contributing Factors

1. It is likely that the pilot encountered whiteout conditions, making it difficult to maintain visual reference and causing disorientation, which resulted in impact with the frozen snow-covered lake.

Finding as to Risk

1. The 121.5 MHz emergency locator transmitter (ELT) was destroyed on impact and the antenna was severed from its connection; therefore, it could not fulfill its role in signaling the accident.

Other Finding

1. The Skytrax tracking system provided additional aid in reducing the search area and locating the helicopter in a relatively timely manner.

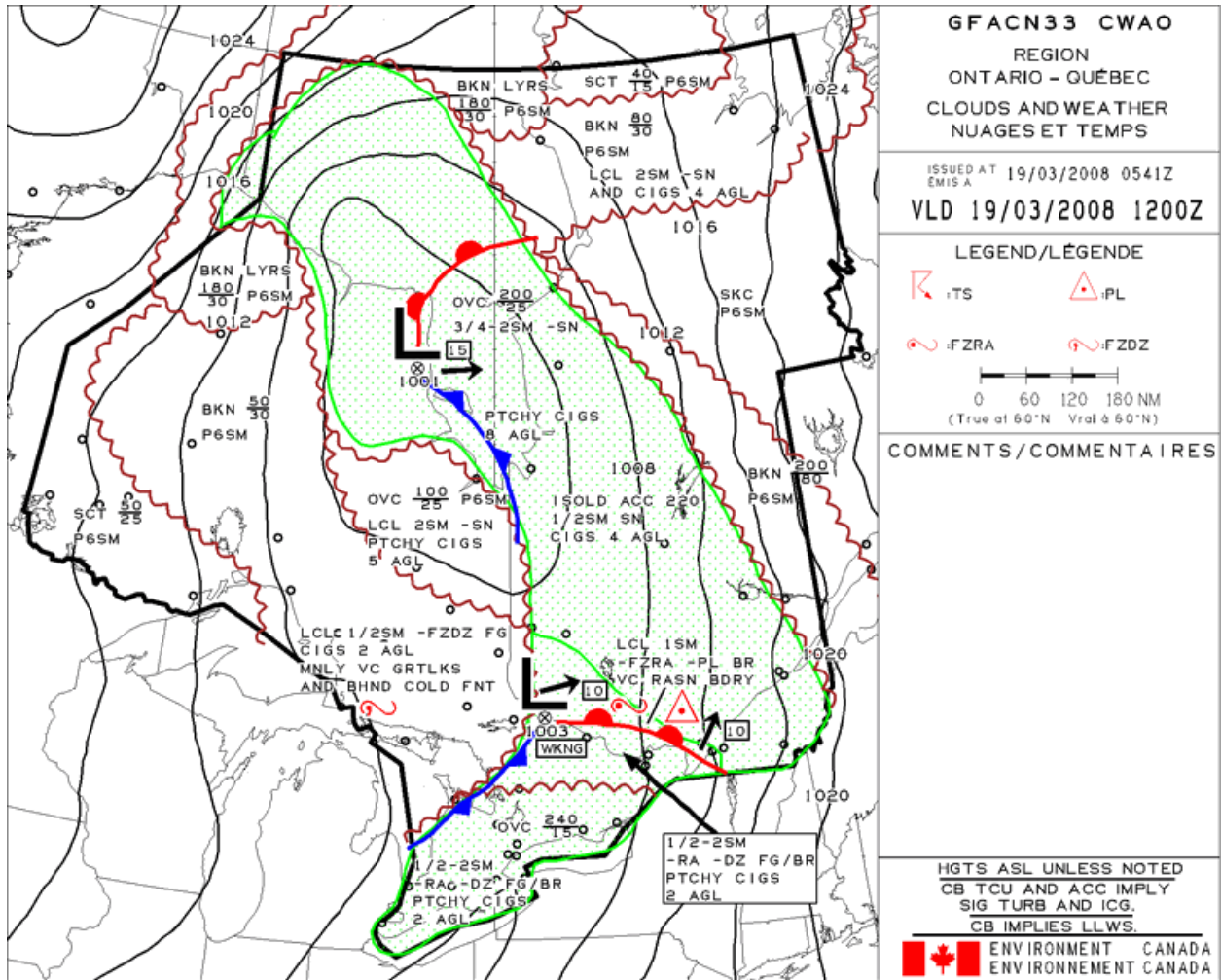
Safety Action Taken

Transport Canada published an article entitled “Coming Soon to a Theatre Near You: Whiteout” in the 4-2008 edition of the *Aviation Safety Letter (ASL)*, which is distributed to approximately 90 000 subscribers worldwide.

This report concludes the Transportation Safety Board’s investigation into this occurrence. Consequently, the Board authorized the release of this report on 04 February 2009.

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

Appendix A – Graphic Area Forecast (GFA)



Appendix B – Site Diagram

