

AVIATION OCCURRENCE REPORT

AIRCRAFT BROKE THROUGH ICE

BELL 206L-1 LONGRANGER (HELICOPTER) C-GZAA  
SNARE RIVER, NORTHWEST TERRITORIES  
23 OCTOBER 1996

REPORT NUMBER A96W0204

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 Occurrence Report

### Aircraft Broke Through Ice

Bell 206L-1 LongRanger (Helicopter)

C-GZAA

Snare River, Northwest Territories

23 October 1996

Report Number A96W0204

### *Summary*

The helicopter, serial number 45537, was chartered by Environment Canada, Water Survey Branch, to conduct hydrometric measurements at sites in the vicinity of the Snare River, 110 miles north of Yellowknife, Northwest Territories. The pilot and two technologists departed Yellowknife at 0925 mountain daylight saving time (MDT) and arrived at the first site one hour later.

High water levels had flooded the landing site, so an alternate drop-off site was found on a small ice-covered bay nearby. The pilot manoeuvred the helicopter close to shore and remained in a hover, with the skids resting lightly on the ice, while the technologists got out and checked the ice surface. They signalled to the pilot that the ice was okay. The pilot bumped the helicopter up and down twice to further test the ice strength.

Both technologists walked to the left rear cabin door to unload equipment, when suddenly, without warning, the helicopter broke through the ice. Both technologists slid into the four-foot-deep water.

The pilot applied power and lifted the helicopter out of the water; however, the tail rotor had separated, and he had no tail rotor control. The helicopter rotated clockwise, rolled right and sank. The pilot was submerged, and evacuated the helicopter with assistance from one of the technologists. The second technologist was fatally injured when struck on the head by a portion of a main rotor blade after, or as, the blade fractured. The helicopter was substantially damaged.

*Ce rapport est également disponible en français.*

## *Other Factual Information*

The pilot was certified and qualified for the flight in accordance with existing regulations. He had approximately 21,000 hours total flying time, of which approximately 10,500 hours was on Bell 206 helicopters. The pilot and technologists had worked together previously conducting water surveys. The procedure they used to check the ice had been carried out before with success.

Records indicate that the helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The company had equipped the helicopter with two emergency locator transmitters (ELT). The ELT mounted on the lower left front side of the cockpit remained above the water level and activated at impact. The second ELT, mounted on the centre post behind the cockpit seats, was submerged and did not emit an audible signal. The gross weight of the helicopter at the time of the occurrence was approximately 3,200 pounds, which was within limits.

Visual flight conditions existed at the time, with an estimated overcast of 700 feet above ground level (agl), 10 miles visibility, wind from the southeast at 6 to 10 knots, and temperature minus 5 degrees Celsius.

The initial plan was for the pilot to remain in a hover, with the skids resting lightly on the ice, while the technologists exited, checked the ice, and unloaded an axe and chain-saw. The pilot would then lift off and remain airborne while they prepared an area for landing. After the technologists checked the ice and signalled that the ice was okay, the pilot decided to shut down to conserve fuel and eliminate the need to divert to a distant fuel cache for refuelling. The helicopter broke through as he reduced power to ground idle and set the full weight of the helicopter onto the ice.

The helicopter was equipped with high skid gear which provided approximately 11 feet of clearance between the main rotor blade and the ice surface. The bear paws mounted on the rear of the helicopter's skids broke through the ice first, and the tail rotor blades struck the ice surface. The tail rotor gear box separated and the helicopter began a clockwise rotation. The main rotor blades struck the ice as the helicopter rolled to the right and one blade separated 45 inches from the blade attachment bolt at the yoke. The technologist's body was found in the water at the nose of the helicopter. A smear on the detached blade, 10 feet 8 inches from the tip, indicates that the technologist was struck after, or as, the blade separated from the helicopter.

The load-bearing capability of ice is dependent on its quality, thickness, and temperature. It is not possible to determine ice thickness from the air; however, the colour of the ice will usually provide some indication of ice quality. Ice colour will vary from clear blue to grey to white, with clear blue being the strongest.

The Treasury Board of Canada's *Handbook of Occupational Safety and Health* provides a rule of thumb of "one inch of clear blue ice for every thousand pounds" to determine the required thickness of fresh water ice. A "Caution" follows the above quote - "Ice that is less than six inches (15 cm) thick should not be used for any crossing. Because of natural variations, thickness may be less than two inches (5 cm) in some areas." For loads that are stationary, as would be the case for a helicopter landing and shutting down, the weight bearing capacity of the ice should be decreased by a factor of 50 per cent.

Moving water under the ice can affect ice thickness and may not be apparent from the surface. A small stream, hidden from view under the ground cover foliage, fed into the bay below the ice layer. The ice was grey in colour and approximately three inches thick where the helicopter broke through.

The helicopter was equipped with a watertight emergency kit with a mirror, matches, and flares secured on the outside under plastic wrap, to facilitate access to these essential items in an emergency. The survivors made use of the emergency kit after the occurrence; however, duct tape used to secure the kit was very difficult to remove with cold hands in freezing temperatures.

The helicopter, on a flight notification, was not expected to return to Yellowknife until late in the day. However, the survivors used a portable satellite phone to call the Water Survey office in Yellowknife. A rescue team, including RCMP members and a nurse, arrived at the scene around 1300 MDT. Without the satellite phone to report the emergency and the prompt response by the rescue team, the survivors would likely have been stranded overnight and not been rescued until the following morning. Both individuals were suffering from hypothermia when rescued about three hours after the accident.

## *Analysis*

The pilot and technologists were experienced in working together as a team. When they arrived at the hydrometric site and found the intended landing site covered with water and ice, they had to formulate an alternate plan to accomplish the project.

The pilot assessed the ice surface characteristics in the bay and judged that he could drop the men off safely from a hover, while maintaining lift on the main rotor. Although the indications on the surface appeared favourable, there was no reliable means to determine the ice thickness and strength from the air. After the technologists exited the helicopter and checked the ice, they signalled the pilot, which reinforced his assessment of the ice condition, and he decided to shut down.

The load-bearing capability of the ice was exceeded when the pilot set the full weight of the helicopter on the ice in preparation for shutdown, and the two technologists moved to the outside of the left rear door of the helicopter to unload their equipment. The small stream feeding into the bay likely had a detrimental effect on the ice thickness and quality.

## *Findings*

1. The pilot was certified and qualified for the flight in accordance with existing regulations.
2. Records indicate that the helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

3. The ice-covered bay was an alternate drop-off site because the original landing site was under water.
4. The load-bearing strength of the ice was not sufficient to support the total weight of the helicopter, equipment, and personnel.
5. The main rotor blades fractured when they hit the ice, and an outer portion of one of the blades struck one of the technologists.
6. The stream feeding into the bay likely affected the thickness and quality of the ice.
7. The survivors were rescued expeditiously because of the availability of the satellite phone.

### *Causes and Contributing Factors*

The thickness and quality of the ice at the drop-off site was not sufficient to support the weight of the helicopter.

*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 29 July, 1997.*