



Transportation  
Safety Board  
of Canada

Bureau de la sécurité  
des transports  
du Canada



# AIR TRANSPORTATION SAFETY INVESTIGATION REPORT A23C0048

## COLLISION WITH TERRAIN

Custom Helicopters Ltd.  
Bell 206L (helicopter), C-FQHB  
Grise Fiord, Nunavut, 52 NM S (Devon Island)  
28 June 2023

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. **This report is not created for use in the context of legal, disciplinary or other proceedings.** See the Terms of use at the end of the report.

### History of the flight

On 28 June 2023, the Bell 206L helicopter (registration C-FQHB, serial number 45095) operated by Custom Helicopters Ltd. departed on a visual flight rules (VFR) flight from Truelove Inlet, on Devon Island, Nunavut, to a glacier on the Devon Ice Cap, with a pilot and 2 passengers on board. The purpose of the flight was to transport the passengers, who would be performing an ice cap survey as part of the Polar Continental Shelf Program. The flight departed at 0936;<sup>1</sup> however, when the helicopter arrived at the glacier, the pilot determined that surface definition was insufficient for a safe landing. As a result, he returned to the camp at Truelove Inlet to gather supplies and to make markers to drop onto the glacier to improve the surface definition at the landing area.

<sup>1</sup> All times are Central Daylight Time (Coordinated Universal Time minus 5 hours).

The observed local weather at the time was an overcast cloud layer above the flying altitude of 3800 feet above sea level (ASL), with unrestricted visibility.

The second flight departed at 1018. During this landing attempt, the pilot reduced the aircraft's airspeed and used rocks as a visual guide for the initial approach to the glacier. The aircraft crossed the glacier at a height of 75 to 100 feet above ground level (AGL), at approximately 30 knots, in preparation to drop the markers.

Once the helicopter passed the rocks, the pilot lost visual reference to the surface and entered an inadvertent descent. At 1039, the helicopter collided with the rising terrain. It struck the snow-covered surface with a slight lateral motion to the right. This motion progressed to a dynamic rollover. The helicopter came to rest on its right side and the engine shut down on its own. The helicopter was destroyed by impact forces. There was no fuel spill or post-impact fire.

The pilot and 2 passengers received minor injuries. A passenger's satellite phone was used to call the Polar Continental Shelf Program office in Resolute Bay, Nunavut. Approximately 2 hours and 30 minutes later, the pilot and 2 passengers were rescued by another civilian aircraft and taken to Resolute Bay for medical evaluation.

### **Weather information**

The pilot did not have phone or internet access and was unable to check the weather before departure. The closest weather reporting station was at Grise Fiord (CWGZ), which is 52 nautical miles north of the occurrence location. At 1100, the following conditions were reported:

- Calm winds
- Visibility of 5 statute miles (SM) in light rain and mist
- Few clouds at 400 feet AGL, 900 feet AGL, and 1600 feet AGL
- Broken ceiling at 3600 feet AGL, and overcast cloud layer at 4400 feet AGL
- Temperature 2 °C, dew point 1 °C
- Altimeter 29.76 inches of mercury

The graphic area forecast issued at 0629 and valid at 0700 indicated that the area of the occurrence site was forecasted to be the centre of a low-pressure system. The forecast indicated broken cloud layers between 14 000 and 22 000 feet ASL and visibility greater than 6 SM. The forecast for the area just off the east shore of Devon Island indicated broken cloud layers between 3000 and 15 000 feet ASL, with visibility greater than 6 SM, isolated areas of altocumulus castellanus clouds with tops at 20 000 feet ASL and 2 SM visibility in light snow/rain showers, and mist and patchy cloud layers at 600 to 1200 feet AGL.

### **Pilot information**

The pilot held a commercial pilot licence – helicopter, the appropriate ratings for VFR flight, and a valid medical certificate. The pilot had accumulated approximately 6500 hours of total flying time, 2500 hours of which were on the Bell 206 helicopter and 500 hours of which were arctic flying experience. The pilot completed the Custom Helicopters Ltd.'s spring training, which included

2 hours of reduced-visibility training, on 16 June 2023. A review of flight duty records indicates that the pilot was well rested before the flight. According to information gathered during the investigation, there was no indication that the pilot's performance was affected by medical factors.

### **Company information**

Custom Helicopters Ltd. is based in Manitoba and began operations in 1977. It has a fleet of more than 30 aircraft. It provides construction, tourism, mining, forestry, and environmental research services under *Canadian Aviation Regulations* (CARs) subparts 702 (Aerial Work), 703 (Air Taxi Operations), and 704 (Commuter Operations). The occurrence flight was conducted under CARs Subpart 703.

### **Aircraft information**

The Bell 206L is a single-engine, 7-seat, single-pilot, turbine-powered helicopter with a maximum take-off weight of 4000 pounds. It has a single main rotor system with 2 main rotor blades in a semi-rigid configuration. The main rotor system rotates clockwise. The pilot flies from the front-right seat.

The occurrence helicopter was manufactured in 1977 and had accumulated a total of 28 544 hours since new. It was equipped with conventional flight instruments, including an attitude indicator, an altimeter, a vertical speed indicator, and a turn and bank indicator. It was not equipped with a ground proximity warning system or a radar altimeter, nor was it required to be by regulation. A tablet, which was coupled to a portable automatic dependent surveillance – broadcast receiver and altitude and heading reference system, was also on board. The tablet had the ForeFlight application installed, which included the enhanced moving map/aeronautical information display and integrated synthetic vision system. The synthetic vision system provided the pilot with a dynamic backup attitude display and the option to view terrain and traffic in any direction.<sup>2</sup>

The occurrence aircraft was not equipped with a flight data recorder or a cockpit voice recorder, nor was it required to be by regulation.

The investigation determined that the aircraft's centre of gravity was within the manufacturer's prescribed limits, and its weight at takeoff was 3910 pounds. The aircraft had no known deficiencies, and there was no indication of an aircraft system malfunction contributing to this occurrence.

### **Wreckage and impact information**

The main landing gear skids were bent, and the tail boom was broken and twisted. The main rotor separated from the helicopter, and one of the blades was trapped under the fuselage. The main

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<sup>2</sup> ForeFlight, Global Synthetic Vision, at [foreflight.com/products/foreflight-mobile/synthetic-vision/](https://foreflight.com/products/foreflight-mobile/synthetic-vision/) (last accessed on 21 February 2024).

rotor transmission was torn away. The fuselage was torn open at the cabin roof. The front windshield was shattered.

### **Survival aspects**

The impact area had approximately 2 feet of snow buildup. The aircraft cabin and cockpit remained largely intact. The cargo was secured and did not move into the occupied spaces. The fuel tank did not rupture.

The pilot and front-seat passenger were wearing the available 4-point safety belts. The rear-seat passenger, who was seated behind the pilot, was wearing a 3-point safety belt. The pilot was seated in the right front seat and was wearing a helmet.

The 2 passengers exited through the left side doors. The pilot exited through the broken front windscreen. The pilot confirmed that the passengers were okay and then moved the survival gear and a generator away from the wreckage.

The pilot confirmed that the emergency locator transmitter (ELT)<sup>3</sup> was operating; however, the ELT signal was not detected by the Cospas/Sarsat<sup>4</sup> system.

### **Visual flight rules weather requirements**

The CARs outline the minimum visual meteorological conditions for VFR flight, which stipulate that, in uncontrolled airspace and below 1000 feet AGL, a helicopter must maintain visual reference to the surface, remain clear of cloud, and, during the day, ensure that visibility is at least 1 SM.<sup>5</sup> However, Custom Helicopters Ltd. is authorized by Transport Canada via an operations specification to operate in reduced-visibility conditions down to ½ mile in uncontrolled airspace in accordance with specific procedures outlined in its *Company Operations Manual*.

### **Instrument meteorological conditions**

Instrument meteorological conditions are weather conditions that cause the visibility, ceiling, and distance from cloud to fall below the minima required for VFR flight. Continued flight in these conditions requires the proficient use of aircraft instruments and navigational aids to maintain control of the aircraft and continue safely to a destination. Inadvertent flight into these conditions can be dangerous if a pilot is not trained and current in instrument flying, or if the aircraft is not suitably equipped. In these conditions, the pilot can become disoriented without clear references to the surface and may turn or descend into terrain.

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<sup>3</sup> Kannad ELT (part number S184051, serial number 2621026-0128ELT).

<sup>4</sup> Cospas-Sarsat is an international surveillance system that uses satellites to detect emergency locator transmitter signals transmitted by aircraft, ships, or people.

<sup>5</sup> Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, section 602.115.

## Flat light

This accident occurred while the helicopter was crossing a glacier at low altitude. Once the helicopter had passed the rocks being used as visual reference, the pilot lost visual reference to the surface in flat-light conditions.

The Federal Aviation Administration of the United States defines flat light as follows:

Flat-light is an optical illusion, also known as “sector or partial white out.” It is not as severe as “white out,” but the condition causes pilots to lose their depth of field and contrast in vision. Flat-light conditions are usually accompanied by overcast skies inhibiting any good visual clues. Such conditions can occur anywhere in the world, primarily in snow covered areas but can occur in dust, sand, mud flats, or on glassy water. Flat-light can completely obscure features of the terrain, creating an inability to distinguish distances and closure rates. As a result of this reflected light, it can give pilots the illusion of ascending or descending when actually flying level. However, with good judgment and proper training and planning, it is possible to safely operate an aircraft in flat-light conditions.<sup>6</sup>

At the time of the occurrence, flat-light conditions were not specifically discussed in the *Transport Canada Aeronautical Information Manual*; however, the above definition was added to the October 2023 issue of the manual.<sup>7</sup>

Photos taken shortly after the occurrence show that flat-light conditions were prevalent at the time of the accident (figures 1 and 2).

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<sup>6</sup> Federal Aviation Administration, *Flying in Flat Light and White Out Conditions* (2001), at [www.faa.gov/gslac/alc/libview\\_normal.aspx?id=6844](http://www.faa.gov/gslac/alc/libview_normal.aspx?id=6844) (last accessed on 21 February 2023).

<sup>7</sup> Transport Canada, TP 14371, *Transport Canada Aeronautical Information Manual* (TC AIM), AIR- Airmanship (05 October 2023), Section 2.12.8.

Figure 1. Photo taken shortly after the occurrence, showing flat-light conditions with the lack of surface definition (Source: Custom Helicopters Ltd.)



Figure 2. Photo taken shortly after the occurrence, showing the point of impact and flat-light conditions with the lack of surface definition (Source: Custom Helicopters Ltd.)



### Inadvertent flight into instrument meteorological conditions

The hazards associated with continuing VFR flight into IMC are well documented. Accidents involving flights that depart under VFR conditions and continue to a point where pilots lose visual reference to the surface have a high incidence of fatalities. According to data collected by the TSB, these types of flights have resulted in 122 accidents and 135 fatalities in Canada from 1999 to 2023. The TSB has investigated previous accidents that involved flat light or whiteout conditions.<sup>8</sup>

Following its investigation<sup>9</sup> into an Airbus Helicopters AS350 B2 accident on Griffith Island, Nunavut, on 25 April 2021, the Board issued 3 recommendations that aim to mitigate risks associated with inadvertent flight into IMC. The Board recommended that actions be taken to ensure that pilots possess the skills necessary to recover from inadvertent flight into IMC,<sup>10</sup> that technology is implemented on commercial helicopters to assist pilots with the avoidance of, and recovery from, inadvertent flight into IMC,<sup>11</sup> and that reduced-visibility helicopter operations requirements are enhanced.<sup>12</sup>

<sup>8</sup> TSB air transportation safety investigation reports A22C0016, A21C0038, A20Q0015, A19A0025, A19C0016, and A13C0014.

<sup>9</sup> TSB Air Transportation Safety Investigation Report A21C0038.

<sup>10</sup> Transportation Safety Board of Canada, Recommendation A24-01, at <https://www.tsb.gc.ca/eng/recommandations-recommendations/aviation/index.html>.

<sup>11</sup> Transportation Safety Board of Canada, Recommendation A24-02, at <https://www.tsb.gc.ca/eng/recommandations-recommendations/aviation/index.html>.

<sup>12</sup> Transportation Safety Board of Canada, Recommendation A24-04, at <https://www.tsb.gc.ca/eng/recommandations-recommendations/aviation/index.html>.

## Safety action taken

In response to this occurrence, Custom Helicopters Ltd. added flat-light training to its *Company Operations Manual* and now provides arctic meteorological training for pilots who are assigned to remote locations. A Flight Operations Instruction was also issued for arctic, glacier, and winter operations with instructions and training for establishing, using, and maintaining staking/flagging in remote landing areas. Improvements have been made to its flight monitoring and operational support via structured use of satellite communications for flight planning/following and weather reporting. Custom Helicopters Ltd. also made enhancements to pilot training by including the correct set-up and use of ForeFlight's synthetic vision system.

## Safety messages

Pilots are reminded that the local meteorological conditions that produce flat light may meet the minimum criteria for VFR flight pertaining to flight visibility and clearance from cloud. However, flying in flat-light conditions can affect a pilot's ability to detect and correct any changes in the aircraft's attitude, altitude, or airspeed. The degradation of visual cues can result in a loss of situational awareness and possible collision with terrain.

It is important that air operators establish awareness and recovery training to reduce the risks associated with flying in flat-light conditions.

As seen in this occurrence the use of helmets, safety belts, and cargo restraints are essential for improving survivability outcomes.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 28 February 2024. It was officially released on 05 March 2024.

Visit the Transportation Safety Board of Canada's website ([www.tsb.gc.ca](http://www.tsb.gc.ca)) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

## ABOUT THIS INVESTIGATION REPORT

This report is the result of an investigation into a class 4 occurrence. For more information, see the Policy on Occurrence Classification at [www.tsb.gc.ca](http://www.tsb.gc.ca)

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