Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

Air Transportation Safety Investigation Report A18O0134

CONTROLLED FLIGHT INTO TERRAIN

Essential Helicopters
Robinson R44 Raven II (helicopter), C-GMCT
Toronto/Buttonville Municipal Airport, Ontario, 9 nm N
25 September 2018

History of the flight

On 25 September 2018, the Essential Helicopters Robinson R44 Raven II helicopter (registration C-GMCT, serial number 10795) departed North Bay Airport (CYYB), Ontario, at about 1141[1] on a visual flight rules (VFR) flight to Toronto/Buttonville Municipal Airport (CYKZ), Ontario, with only the pilot on board. The purpose of the flight was to reposition the helicopter for a series of survey flights scheduled to begin the next day.

The weather at CYYB at the time of departure was 30 statute miles (sm) visibility and overcast ceilings at 600 feet above ground level (AGL). For the majority of the flight, the helicopter flew at altitudes of less than 1000 feet AGL and at an average ground speed of about 75 knots.[2]

At about 1335, when the aircraft was 16 nautical miles (nm) from CYKZ, the pilot contacted the tower controller to report his position and that he was inbound for the airport. At the time, the helicopter's altitude was about 300 feet AGL, and its ground speed was about 65 knots.

As the helicopter continued toward CYKZ, its altitude varied, the lowest being about 100 feet AGL, and its ground speed gradually decreased to less than 10 knots.

At 1350, when the helicopter was 6 nm from CYKZ and flying over a residential area at approximately 200 feet AGL, it slowed to a ground speed of about 6 knots. At about the same time, the pilot contacted the tower and informed the controller that he was in zero visibility conditions and was turning around.

---

1 All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours).

2 The helicopter was equipped with a SkyTrac global positioning system, which recorded flight information—including position, altitude, ground speed, and track—every 5 seconds. The data were extracted by the TSB Engineering Laboratory and used to create an image of the occurrence flight path.

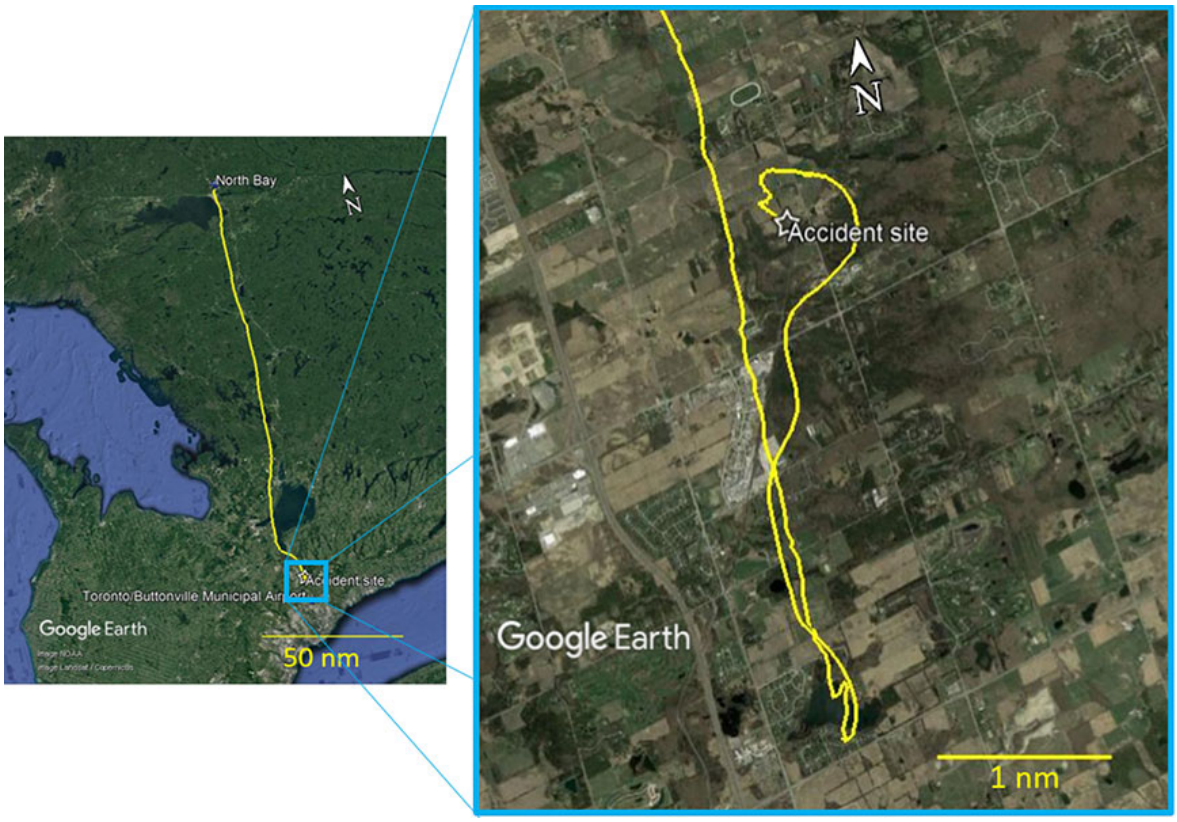
Canada

The controller stated that the ceiling at CYKZ was overcast at 500 feet AGL.[3] The elevation of the terrain over which the helicopter was flying at the time was 300 to 400 feet higher than the elevation of the airport.

Immediately after the helicopter turned around, its ground speed increased rapidly to more than 80 knots. Over the next several minutes, the helicopter's altitude, ground speed, and direction continued to vary as it flew north. During this time, the controller continued to communicate with the pilot, informing him of landmarks to the west that might assist him in navigating.

The helicopter started to turn toward the west and continued turning toward the south, over mostly cleared farming fields (Figure 1). The helicopter's altitude varied between 200 and 300 feet AGL, and its ground speed varied between 5 and 40 knots. At no time did the pilot indicate that he was experiencing any difficulties.

Figure 1. Occurrence helicopter's flight path with expanded view of accident site (Source: Google Earth, with TSB annotations)



The last communication between the controller and the pilot was at about 1354. At 1355, the helicopter struck trees. The pilot was fatally injured. The helicopter was destroyed, and a post-impact fire ensued.

When the controller lost communication with the pilot, a search was initiated. The accident site was found approximately 9 nm north of CYKZ.

The 406 MHz emergency locator transmitter (ELT) activated, but the search-and-rescue satellite system did not receive a signal.

[3] The elevation of CYKZ is 650 feet above sea level.

Weather information

The investigation was unable to determine what weather information the pilot had reviewed before the flight.

The aerodrome forecast (TAF) for CYKZ, issued at 0741, indicated that from 1100, the winds would be 190° true (T) at 12 knots, gusting 22 knots; visibility greater than 6 sm in light rain showers; scattered clouds at 800 feet AGL; and overcast ceiling at 1500 feet AGL. Between 1100 and 2000, there would be a temporary change, in that there would be no significant weather (i.e., no rain showers); a few clouds at 800 feet AGL; and a broken ceiling at 2500 feet AGL. There was a 30% probability between 1100 and 1400 that the visibility would be 4 sm in light rain showers and mist; cloud layers would be broken at 800 feet AGL and overcast at 1500 feet AGL.

Figure 2. The occurrence helicopter seen at about 100 feet above the ground, 10 minutes before the accident, about 9 nm from CYKZ (Source: J. Snowden)

An amended TAF for CYKZ was issued at 1105, which indicated that from 1300, the winds would be 170°T at 10 knots, gusting to 20 knots; visibility of 5 sm in light rain showers and mist; a broken ceiling at 700 feet AGL and overcast layer at 1500 feet AGL. The TAF also indicated a temporary change between 1300 and 2000 of visibility greater than 6 sm; no significant weather; scattered cloud layer at 800 feet AGL; and overcast ceiling at 1500 feet AGL.

As the pilot approached CYKZ, he informed the controller that he had received the automatic terminal information service (ATIS) bulletin issued at 1300, which stated that the winds were 180° magnetic at 7 knots; visibility 5 sm; overcast ceiling 300 feet AGL; temperature 18 °C and dewpoint 18 °C. A special weather report was issued at 1311, indicating that the visibility had improved to 8 sm and the ceiling had increased to 500 feet AGL. The controller had relayed the ceiling information to the pilot.

First responders described the weather at the time as foggy and misty with light rain (Figure 2).

Pilot information

The pilot held a Canadian commercial pilot licence - helicopter and a valid Category 1 medical certificate. He was certified and qualified for the flight in accordance with existing regulations. He had received an instrument rating in 2003 but had not maintained his currency. The pilot had accumulated approximately 7355 hours total flight time in helicopters, of which 1550 hours were on the Robinson R44. He held a Class 2 instructor rating and, in the past 2 years, held positions as assistant chief flying instructor and chief flying instructor at Essential Helicopters.

The pilot had previously worked in the Toronto area and was familiar with the area.

Aircraft information

The Robinson R44 Raven II is a 4-seat helicopter with a maximum gross weight of 1134 kg (2500 pounds). At this weight, it has a cruise speed of 202 km/h (109 knots). The occurrence helicopter was acquired by Essential Helicopters in the fall of 2016. It was equipped with basic instruments, including an attitude indicator with inclinometer, and a heading indicator. It was not equipped or certified to fly according to instrument flight rules.

Accident site and aircraft wreckage information

The area around the wreckage was heavily treed. The main rotor blades struck some of the upper branches of the trees in a level attitude. Following the impact with the trees, the main rotor blades began to break off, the helicopter's airspeed decreased, and its descent rate increased until it collided with the ground, about 150 feet from where it first struck the trees.

There were no signs of pre-impact mechanical failure or system malfunction that contributed to this accident. The damage to the engine and rotor indicate that power was being produced during the impact sequence.

The last SkyTrac global positioning system position, which was approximately 450 feet from the accident site,[4] showed the helicopter at about 300 feet AGL. This would suggest that the helicopter had a high rate of descent.

Company information

Essential Helicopters operates as a flight training unit and holds a valid air operator certificate under subparts 702 (aerial work) and 703 (air taxi) of the *Canadian Aviation Regulations* (CARs). The company is limited to day VFR operations. At the time of the occurrence, the company operated a fleet of Robinson R44 Raven IIs, Robinson R22s (Beta and Mariner), Bell 206s (206L-1 and 206B) and an Aerospatiale AS 350 B-2 helicopter.

The company uses a pilot self-dispatch system, which requires the pilot-in-command of a flight to ensure that the appropriate documents (e.g., operational flight plan, flight plan, flight itinerary) are prepared and filed before departure.

The weather limitations indicated in the CARs for helicopters operating under VFR in uncontrolled airspace below 1000 feet AGL are flight visibility of not less than 1 mile and clear of cloud.[5] The Essential Helicopters operations manual mirrors the CARs' minimum weather limitations for VFR flight.[6]

Loss of visual reference

Loss of visual reference with the ground can result in a pilot becoming disoriented and losing control of the helicopter. The Robinson Helicopter Company Safety Notice SN-18 states the following:

---

[4] The elevation of the accident site was about 985 feet above sea level.

[5] Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, section 602.115.

[6] Essential Helicopters, *Essential Helicopters Aerial Work/Air Taxi Operations Manual* (13 July 2009), section 4.11.

LOSS OF VISIBILITY CAN BE FATAL

Flying a helicopter in obscured visibility due to fog, snow, low ceiling, or even a dark night can be fatal. Helicopters have less inherent stability and much faster roll and pitch rates than airplanes. Loss of the pilot's outside visual references, even for a moment, can result in disorientation, wrong control inputs, and an uncontrolled crash.[7]

Loss of visual reference with the ground can occur in several situations. For example, weather phenomena may decrease visibility, or visibility through the windshield may be reduced due to internal fogging of the windshield or to the external accumulation of water droplets when heavy precipitation is encountered.

Helicopter pilots have more options to land than fixed-wing pilots should the weather deteriorate. Transport Canada's *Helicopter Flight Training Manual* states that "[u]nless you are over extremely inhospitable terrain you can normally find a suitable area and land until the weather moderates."[8]

TSB data on accidents involving operators governed by CARs Subpart 703 show that airplane or helicopter accidents in which flights that had departed under visual meteorological conditions continued to a point where pilots lost visual reference with the ground had a higher fatality rate than other types of accidents.

Low flying

According to CARs 602.14(2),

Except where conducting a take-off, approach or landing or where permitted under section 602.15, no person shall operate an aircraft

(a) over a built-up area [...] at an altitude that is not lower than [...]

(iii) for an aircraft other than an aeroplane or balloon, 1,000 feet above the highest obstacle located within a horizontal distance of 500 feet from the aircraft; and

(b) in circumstances other than those referred to in paragraph (a), at a distance less than 500 feet from any person, vessel, vehicle or structure.[9]

The *Transport Canada Aeronautical Information Manual* contains the following warning in bold font regarding low flying:

Warning — Intentional low flying is hazardous. Transport Canada advises all pilots that low flying for weather avoidance or operational requirements is a high-risk activity.[10]

Emergency locator transmitter

During the impact sequence, the antenna on the 406 MHz ELT broke off, preventing it from transmitting a signal to the search-and-rescue satellite system.

---

[7] Robinson Helicopter Company, Safety Notice SN-18: Loss of Visibility Can be Fatal (June 1994).

[8] Transport Canada, TP 9982E, *Helicopter Flight Training Manual*, second edition (June 2006), p. 87.

[9] Transport Canada, SOR/96-433, *Canadian Aviation Regulations* (last amended 12 December 2018), section 602.14.

[10] Transport Canada, TP 14371E, *Transport Canada Aeronautical Information Manual*, AIR - Airmanship (11 October 2018), section 2.4.1, p. 394.

During its investigation into the May 2013 occurrence involving the controlled flight into terrain of a helicopter near Moosonee, Ontario,[11] the TSB expressed concern regarding ELT crashworthiness. The TSB also noted previous accidents in which an ELT antenna broke off during the impact sequence, or the wire to an antenna was damaged, and no signal was received by the search-and-rescue satellite system. The 2013 investigation determined that although the crashworthiness design specifications are robust for the ELT unit itself, the specifications are significantly less stringent for the other key components of the ELT system (i.e., the wiring and antenna).

As a result of that occurrence, the Board recommended that the International Civil Aviation Organization, the Radio Technical Commission for Aeronautics, the European Organisation for Civil Aviation Equipment, and the Department of Transport

> […] establish rigorous ELT system crash survivability requirements that reduce the likelihood that an ELT system will be rendered inoperative as a result of impact forces sustained during an aviation occurrence.
>
> **TSB recommendations A16-02, A16-03, A16-04, and A16-05**

The Board is encouraged by the responses received from these organizations regarding updates to industry specifications as they relate to antenna, cabling, and crash-safety specifications. It has therefore assessed the responses to these recommendations as **Satisfactory Intent.**

Flight recorders

The helicopter was not equipped with a flight data recorder or cockpit voice recorder, nor were these required by regulation. Although the TSB has formally recommended[12] the mandatory installation of lightweight flight recording systems by commercial and private operators not currently required to carry these systems, there has been no recent progress for implementation by Transport Canada.

Safety messages

Flying in deteriorating weather conditions is challenging, especially when flying at low altitudes, and the associated risks need to be managed properly before and during flight. Pilots need to take early, decisive action when conditions are not suitable for continued flight. Helicopter pilots, in particular, have more options than fixed-wing pilots for landing in poor conditions and waiting for the weather to improve.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 11 March 2019. It was officially released on 25 March 2019.

[11] TSB Aviation Investigation Report A13H0001.

[12] TSB Recommendation A18-01.

ABOUT THIS INVESTIGATION REPORT

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 the result of an investigation into a class 4 occurrence. For more information, see the Occurrence Classification Policy at www.tsb.gc.ca

TERMS OF USE

Citation

Transportation Safety Board of Canada, *Air Transportation Safety Investigation Report* A18O0134 (released 25 March 2019).

Transportation Safety Board of Canada
Place du Centre
200 Promenade du Portage, 4th floor
Gatineau QC K1A 1K8
819-994-3741
1-800-387-3557
www.tsb.gc.ca
communications@tsb.gc.ca

Air transportation safety investigation report A18O0134

Cat. No. TU3-10/18-0134E-PDF
ISBN: 978-0-660-30190-7

This report is available on the website of the
Transportation Safety Board of Canada at www.tsb.gc.ca

Le présent rapport est également disponible en français.