Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A01O0164

IN-FLIGHT COLLISION

BETWEEN
ROBINSON R22 MARINER HELICOPTER C-FFFM
AND
CESSNA 170B C-GKGG
UXBRIDGE, ONTARIO
20 JUNE 2001

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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and
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Summary

At 2005 eastern daylight time, a Robinson R22 Mariner helicopter, serial number 1071M, with only the pilot on board, departed Lindsay, Ontario, for the Toronto / Buttonville Municipal Airport. At 2022, a Cessna 170, serial number 26290, took off on Runway 18 from a private grass strip, locally known as Sandford Field, with only the pilot on board. The pilot planned to conduct one left-hand circuit and landing. At 2025, the two aircraft collided in visual meteorological conditions at approximately 700 feet above ground level. The accident occurred near Uxbridge, over a farmer's field one nautical mile south of Sandford Field. The helicopter's tail and the main-rotor system sustained catastrophic damage, rendering the helicopter uncontrollable. The helicopter pitched inverted and plunged to the ground, and the pilot was fatally injured. The Cessna 170 sustained substantial damage; however, the pilot was able to control the aircraft and conduct a forced landing in a nearby cornfield.

Ce rapport estégalement disponible en françois.

Other Factual Information

The helicopter pilot planned to fly to the Toronto / Buttonville Municipal Airport for fuel before continuing to a private helicopter pad at the Toronto harbour. After liftoff, the pilot took up a heading of approximately 230° magnetic. The flight path of the helicopter was reconstructed from ground eyewitness reports, impact and collision marks, and an analysis of the accident debris field.

After take-off, the Cessna pilot climbed out at 70 mph on a southerly heading, establishing his aircraft on a 50° intercept angle with the helicopter. He did not see the helicopter until the Cessna was climbing through 700 feet above ground level (agl) and the helicopter was at his 11 o'clock position at very close range. The Cessna pilot initiated evasive action to the right immediately before impact with the helicopter. The Cessna 170 was in a climbing, right-banked attitude at impact. The helicopter was reported to be in straight and level flight at the time of the collision. The Toronto Area Control Centre radar did not record the flight paths of the helicopter or the Cessna before the collision.

The Cessna's twin-bladed, variable-pitch, constant-speed propeller was severely damaged from the impact with the helicopter's tail and main rotor. One propeller blade was severed in half perpendicular to the leading edge. The remaining blade sustained a trailing-edge radial cut, 5.5 cm deep, at the midpoint of the propeller blade. The propeller spinner separated from the aeroplane. The propeller hub was severely damaged, compromising the variable-pitch system's oil reservoir. Airframe vibration was significant, and the Cessna's windshield became contaminated with oil, dramatically reducing pilot visibility. The Cessna pilot realized that the aircraft was not capable of returning to the runway and elected to execute a forced landing into a cornfield one nautical mile south of the departure runway.

At 2000 eastern daylight time,[1] the weather observation taken at the Toronto / Buttonville Municipal Airport was reported as follows: a few clouds at 16 000 feet agl, thin broken clouds at 24 000 feet agl, visibility 15 statute miles, temperature 20°C, dew point 9°C, wind from 140° true at 2 knots, and altimeter setting 30.18 inches of mercury.[2]

The helicopter pilot had been a pilot for 25 years. He held a valid medical certificate and a Canadian commercial pilot licence—helicopter endorsed for BH06, HU30, HU50, RH22, and SK76 helicopters and a current Group 4 instrument rating. He also held a commercial pilot licence—aeroplane and a current Group 1 instrument rating. In addition, he had held a Canadian glider pilot licence since 1992. The pilot was a well-known local flying enthusiast who, during the past 12 years, had been a frequent performer at air shows. He had accumulated more than 948 total flight hours, 688 of which were on rotary wing aircraft. During the previous 90 days, he had flown 74 hours, approximately 2 of which were flown on the day of the occurrence.

The Cessna pilot began flying lessons in 1978 but had not completed his flight training or undergone a flight test to obtain a pilot licence. His Canadian student pilot permit had expired

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

2 Toronto / Buttonville Municipal Airport is 35 nautical miles south of Sandford Field and is the closest weather reporting station to the accident site.

in October 1995, and his aviation medical certificate had expired in August 1995. He had accumulated approximately 250 total flight hours at a rate of 10 to 20 hours per year.

The Robinson R22 Mariner helicopter, equipped for visual flight rules (VFR) operations, was manufactured in 1989 and had accumulated 2190 hours. Records indicate the helicopter was equipped and maintained in accordance with regulations. The helicopter had no known defects before the flight, and its weight and centre of gravity were within approved limits. The helicopter was equipped with a functioning two-way VHF (very high frequency) radio and a transponder.

The Cessna 170 was manufactured in 1954 and had accumulated 3535 hours as of November 1997, the date of the last recorded flight. Since then, no entries had been recorded. The Cessna pilot had owned the occurrence aircraft for 12 years. The Cessna's certificate of airworthiness had expired on 06 September 1999. Since then, the aircraft had not been inspected or maintained in accordance with Transport Canada regulations. The aeroplane had no defects or nonstructural restrictions to visibility through the front, back, or side windows. It was equipped with a VHF radio, but the pilot had not used it during the occurrence flight and regulations did not require its use.

The collision occurred at approximately 700 feet agl in Canadian Class G airspace. Section 2.8.7 of Rules of the Air and Air Traffic Services (RAC) in *Aeronautical Information Publication* (AIP) defines Class G airspace as all uncontrolled domestic airspace within which air traffic control (ATC) has neither the authority nor the responsibility for exercising control over air traffic. There is no requirement for pilots to make mandatory position or traffic advisory calls on a common VHF radio frequency or even to have a radio on board the aircraft. There is no requirement to have a transponder or any kind of collision-avoidance instrumentation installed in the aircraft.

For aircraft en route in Class G airspace, AIP RAC 8.10 advises: "When aircraft are manoeuvring in the vicinity of uncontrolled aerodromes or cruising in Class G airspace, the lack of information on the movements of other aircraft operating in close proximity may occasion a potential hazard to all concerned. To alleviate this situation, all pilots are advised that when operating in Class G airspace, they should continuously monitor frequency 126.7 MHz whenever practicable."

Analysis

The environmental conditions at the time of the occurrence were favourable for safe VFR flight; however, a number of factors combined to allow the collision to occur. The analysis will examine those factors, including procedures at uncontrolled aerodromes and minimum equipment required for flight in Class G airspace.

The helicopter was flying on a heading of approximately 230° magnetic as it passed one nautical mile south of Sandford Field. Simultaneously, the Cessna 170 was climbing out from Sandford Field to an altitude of between 500 and 700 feet agl on a heading of approximately 180° magnetic. The Cessna 170 pilot was climbing into the helicopter's flight path from below and to the right of the helicopter on an intercept heading of approximately 50°. The helicopter pilot did not see the Cessna because of the blind spot created by the lower right cabin wall/door of the helicopter. The Cessna pilot did not see the helicopter because of the blind spot created above and to the left by the aircraft's high wing. Although the Cessna pilot's forward visibility was not

restricted, he did not see the helicopter while visually scanning the horizon during climbout.

As the helicopter came into the Cessna pilot's field of vision, it was slightly above at the pilot's 11 o'clock position, at extremely close range. Collision was imminent, and although the Cessna pilot initiated a climbing right-hand collision-avoidance turn, he was unable to gain positive separation. The helicopter tail rotor struck the under side of the Cessna's engine cowl, and the tail-rotor blades broke. Simultaneously, the helicopter's retreating main-rotor blade struck the top left side of the Cessna's engine cowl, and the blade separated from the main-rotor system. The helicopter became uncontrollable and pitched forward to an inverted attitude. This pitching movement caused a bending moment of the remaining main-rotor blade. The blade flexed downward and severed the tail boom from the main body of the helicopter. The helicopter then descended to the ground and was destroyed by impact forces.

Pilots are not required to make mandatory traffic advisory calls on a common frequency at uncontrolled aerodromes. The existing regulations only recommend that pilots monitor 126.7 MHz whenever practicable. Furthermore, aircraft are not required to be equipped with a functioning two-way VHF radio while operating in Class G airspace. Although see-and-avoid is the primary means of providing safe separation between aircraft operating under VFR, it has limitations and cannot always provide separation. All aircraft have inherent design limitations with respect to pilot visibility. In this occurrence, as the aircraft were merging, it was impossible for the helicopter pilot to see the Cessna approaching from below. Similarly, the Cessna pilot could not see the helicopter, because it was hidden from the pilot's view by the Cessna's high wing. Although neither pilot saw the other aircraft in time to avert the collision, the accident could have been averted had the pilots been aware of each other through other means. For example, had both pilots been monitoring the recommended VHF frequency and making position reports, they likely would have been aware of the other aircraft operating in the area and carried out a more vigilant lookout.

On-board equipment, such as a traffic alert and collision-avoidance system (TCAS), designed to operate independently of the ATC system, will provide pilots with traffic information to assist them in visually acquiring other aircraft. Aircraft without transponders are invisible to the TCAS. The helicopter was equipped with a transponder but the Cessna 170 was not. Aircraft operating in Class G airspace, without the benefit of ATC traffic advisories, are not required to be equipped with a TCAS or a transponder. TCAS, if installed and functioning, would have warned the pilots of their proximity to other aircraft operating with transponders. A TCAS warning could have provided either pilot with adequate warning to take appropriate action to avert the collision.

The Cessna pilot had been flying for more than 20 years and had accumulated approximately 250 hours' total flight time. He had not completed the training to obtain a pilot licence, and his skills had not been assessed by a Transport Canada-administered flight test. The pilot's skill level, therefore, cannot be assessed.

Findings as to Causes and Contributing Factors

1. Neither pilot saw the other aircraft in time to avert the collision. The design limitations of both aircraft with respect to pilot visibility, combined with the intercept geometry, contributed to the pilots' failure to see and avoid the other aircraft.

Findings as to Risk

1. Neither aircraft was equipped with a traffic alert and collision-avoidance system (TCAS), depriving the pilots of a defence against collision. TCAS equipment was not required by regulation.

2. The pilot of the Cessna 170 was not appropriately licensed.

3. The Cessna 170 did not have a valid certificate of airworthiness.

4. In Class G airspace, where the aircraft were operating, aircraft are not required to be equipped with a functioning two-way VHF radio, and there is no mandatory frequency on which pilots must broadcast their positions or intentions. Had either pilot been aware of the proximity of the other aircraft through direct or indirect communication, the collision might have been averted.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 13 August 2002.

Appendix A—Impact Sequence