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

Air Transportation Safety Investigation Report A20A0027

LOSS OF CONTROL AND COLLISION WITH TERRAIN

Privately registered
Robinson R44 Raven II (helicopter), C-FPBL
Thorburn Lake, Newfoundland and Labrador
20 July 2020

History of the flight

On 20 July 2020, the privately registered Robinson R44 Raven II helicopter (registration C-FPBL, serial number 13276) was returning from a remote fishing camp located 7 nautical miles (NM) east of Reeds Pond, Newfoundland and Labrador (NL), on a day visual flight rules flight to St. John's (Paddy's Pond) Water Aerodrome (CCQ5), NL. On board were the pilot and 2 passengers. A second Robinson R44 helicopter, which was conducting the same flight, departed the fishing camp at about the same time.

As the flight progressed, the pilots of both helicopters made a number of enroute stops due to ground fog along the south coast of Labrador, and planned to refuel at the Springdale Aerodrome (CCD2), NL. However, after landing at CCD2, they realized that fuel service would not be available for several hours. The pilots were familiar with an approved maintenance organization (AMO) located on the east side of Thorburn Lake, across the lake from the Thorburn Lake Water Aerodrome (CCW5), NL. The occurrence pilot made contact with the AMO by telephone and confirmed that fuel was available on site. At 1425[1], both helicopters departed CCD2 for CCW5, located about 110 NM southeast.

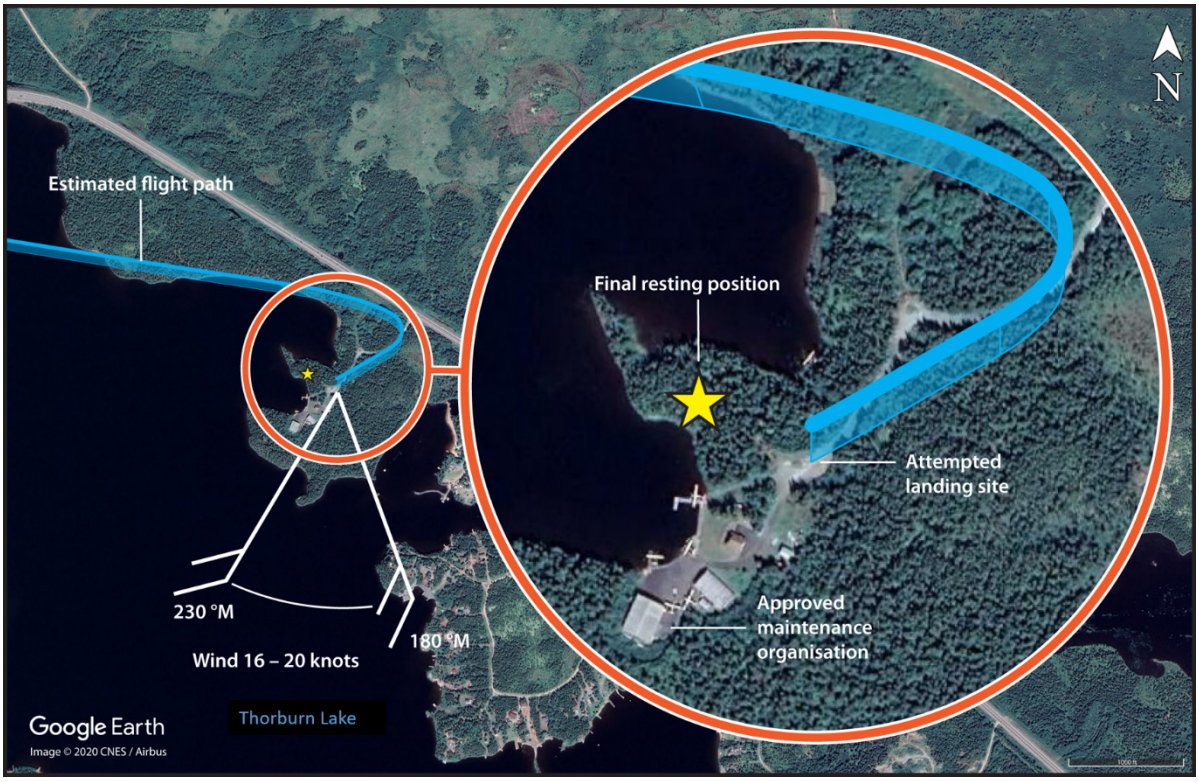
The intended landing site at CCW5 was a small clearing approximately 60 feet in diameter on the road just outside the main entrance gate to the AMO. The site was a confined area surrounded by trees that stood approximately 80 feet tall.

[1] All times are Newfoundland Daylight Time (Coordinated Universal Time minus 2.5 hours).

The pilot of the second helicopter flew over the landing site first. He rejected the landing based on the wind conditions and the size of the site. He then transmitted his intention to land elsewhere to the occurrence pilot and orbited in the area while the occurrence pilot attempted to land in the confined landing site.

At approximately 1535, the occurrence helicopter made a right base leg turn onto the final approach heading of 240° magnetic (M). The wind direction at the time varied from 180°M to 230°M at an estimated speed of 16 to 20 knots. The occurrence pilot continued his approach to the landing site and entered an out-of-ground-effect hover over the landing site, just below the tree tops (Figure 1). Once established in the hover, the pilot determined there was not enough room to continue with the landing and initiated a vertical climb.

Figure 1. Estimated flight path, derived from global positioning system data (Source: Google Earth, with TSB annotations)



When the helicopter cleared the tree tops, it began to slowly yaw to the right. The pilot applied left anti-torque pedal input; however, the helicopter continued to yaw and the yaw rate increased. The pilot then deflected the anti-torque pedals to the right and back to the left several times to check for pedal response while the helicopter continued the right yaw. The pedal inputs did not arrest the right yaw.

As the pilot was trying to control the yaw rate, alternating nose-up and nose-down pitch excursions began with increasing amplitude. After at least 2 full rotations to the right the main rotor severed the tail boom as the pitch excursions increased beyond a controllable range. All control of the helicopter was lost and it fell into the trees. The helicopter came to rest upright on the forest floor against several large trees. The helicopter was destroyed. The pilot, who was sitting in the right front seat, and

the passenger sitting in the left front seat were seriously injured. The passenger seated in the right rear seat was fatally injured. All occupants were wearing the available lap belts and shoulder harnesses.

The 406 MHz emergency locator transmitter activated on impact.

Bystanders attended the site and extinguished a small post-impact fire, which was confined to the engine compartment area. First responders transported the pilot and the surviving passenger to a local hospital.

Following the occurrence, the pilot of the second helicopter flew to the west side of the lake and landed uneventfully in an open area.

Pilot information

The occurrence pilot held a private pilot licence – helicopter with an R44 rating, and a recreational pilot permit – aeroplane. The pilot kept 2 separate personal logs to record his flight hours (1 for helicopters and 1 for airplanes). The last flight entered in the pilot's personal helicopter log was on 25 March 2015. At that time, the total time accumulated on helicopters was 148.9 hours, with 91.1 hours on type.

The pilot had purchased and taken delivery of the helicopter 8 days before the occurrence and received 3.7 hours of dual flight time with the previous owner. At the time of the occurrence, he had accumulated 15.7 hours as pilot-in-command while on the fishing trip to Reeds Pond.[2]

The pilot's Category 3 medical certificate had expired on 01 October 2017, which meant his licence was not valid at the time of the occurrence. The pilot's medical status was not considered a factor in this occurrence.

Aircraft information

The helicopter was being operated within its weight-and-balance and centre-of-gravity limits. Wreckage examination did not identify any pre-existing system malfunctions that would have played a role in the loss of control in this occurrence. The helicopter was not equipped with a flight data recorder or cockpit voice recorder, nor was it required to be by regulation.

The journey log for the occurrence aircraft had not been updated since it was delivered to the new owner. The CARs require that the pilot-in-command record flight information in the journey log daily, after completing each flight or series of flights.[3]

Weather information

CCW5 does not have a weather reporting station. The nearest limited weather observation site location is Terra Nova National Park, NL, approximately 20 NM north-northeast. At the time of the occurrence, there was a heat warning issued for high ambient temperatures and humidity in the area. The following weather data was recorded at Terra Nova Park:

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[2] These times are based on global positioning system data obtained by the TSB.

[3] Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, subsection 605.94(1).

- temperature 23.6 °C
- humidex 28 °C
- wind from 220°M at 7 knots

In close proximity to the landing area at Thorburn Lake, winds were observed to be from 180°M to 230°M at an estimated speed of 16 to 20 knots. Clouds and visibility were not a factor in this occurrence.

Landing site

The occurrence pilot was familiar with the landing site from the ground because it is part of the access road to the AMO. Although he had driven by the landing site many times in a vehicle, he had never landed a helicopter there. The pilot also knew that other larger helicopters, such as a Bell 206 and a Eurocopter AS 350, had landed there in the past.

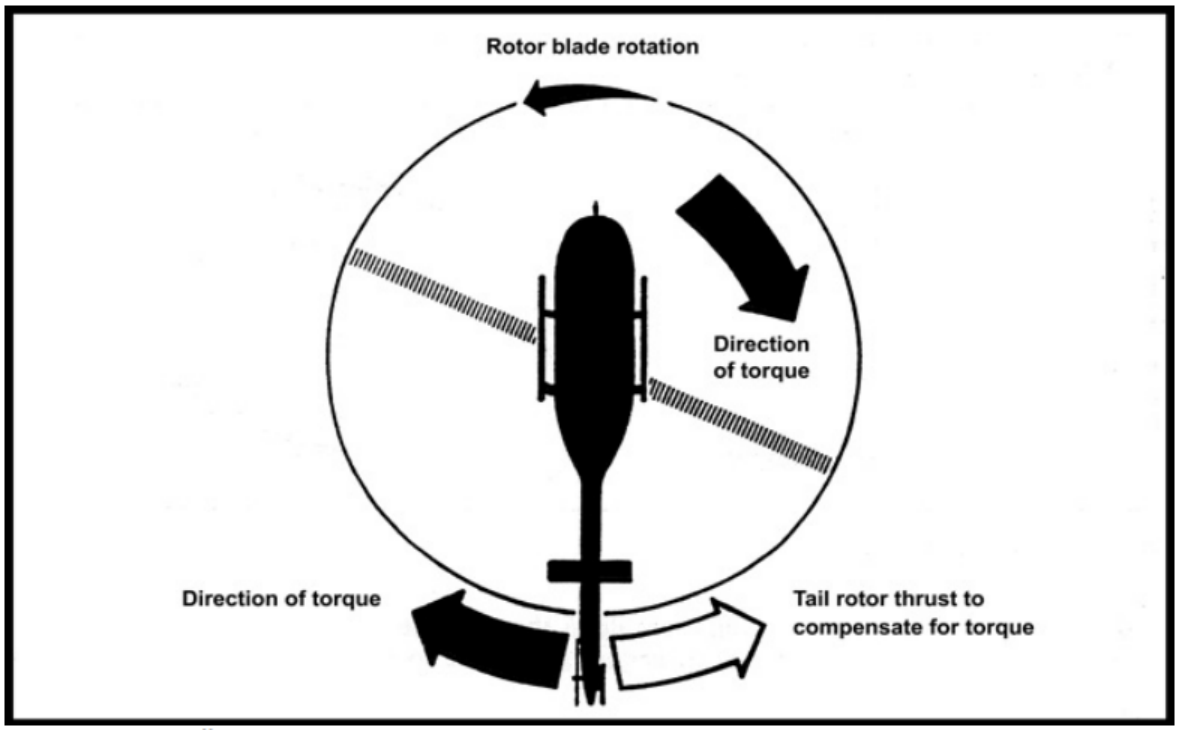
The combination of the terrain, wind direction, and velocity was conducive to conditions of mechanical turbulence.

Unanticipated yaw

When seen from above, the main rotor blades of the Robinson R44 turn counterclockwise. Due to this rotation, the helicopter experiences a torque reaction in the opposite direction, which results in the helicopter yawing to the right (Figure 2).

To counter this movement, the helicopter is equipped with a tail rotor that produces lateral thrust. To compensate for the torque created by the main rotor during many normal regimes of flight, the pilot applies pressure to the anti-torque pedals to increase or reduce tail rotor thrust, as required.

Figure 2. Torque effect (Source: Transport Canada, TP 9982, Helicopter Flight Training Manual, Second Edition [June 2006], Figure 3-3)



However, when this yawing movement is not expected, it is referred to as an unanticipated yaw, or loss of tail rotor effectiveness (LTE), which is defined as follows:

> LTE is a critical, low-speed aerodynamic flight characteristic which can result in an uncommanded rapid yaw rate which does not subside of its own accord and, if not corrected, can result in loss of aircraft control.[4]

LTE is unrelated to equipment failure or defective maintenance, and any single-rotor helicopter flying at low speeds can experience this phenomenon. Rather, it is the result of the tail rotor not providing sufficient thrust to maintain directional control.

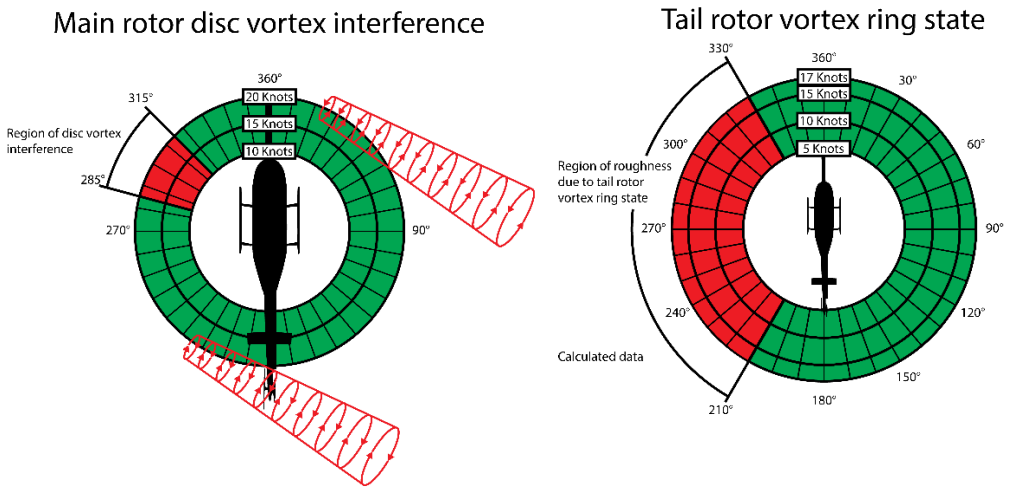
In addition, 4 relative wind azimuth regions can produce an environment that is conducive to LTE (Figure 3):

- main rotor disc vortex wind (winds from 285° to 315° relative to the helicopter);
- weathercock stability (winds from 120° to 240°);
- tail rotor vortex ring (winds from 210° to 330°); or
- loss of translational lift (winds from all directions).[5]

[4] Federal Aviation Administration (FAA), Advisory Circular (AC) 90-95: Unanticipated Right Yaw in Helicopters (1995), p. 1.

[5] Ibid., pp. 3–7.

Figure 3. Main rotor disc vortex interference and tail rotor vortex ring state angle (Source: TSB, based on figures included in Federal Aviation Administration, Advisory Circular 90-95: Unanticipated Right Yaw in Helicopters [1995])



At the time of the occurrence, the helicopter was approximately 130 pounds below the maximum gross weight and in an out-of-ground-effect hover. Winds were estimated to be gusting up to 20 knots, turbulent, and approaching the helicopter from the left. Given these conditions, the helicopter was operating in a high power regime within the critical wind azimuth regions of the main rotor disc vortex wind and tail rotor vortex ring that could induce an unanticipated yaw.

Safety notices are issued by the Robinson Helicopter Company as a result of lessons learned from various occurrences. The safety notices reside in the helicopter Pilot Operating Handbook (POH) and are also available on the manufacturer's website. Safety Notice 42 entitled *Unanticipated Yaw* was issued in May 2013, with the latest revision issued in July 2019. The POH for the occurrence aircraft did not contain any version of Safety Notice 42. According to this safety notice, operations in strong left crosswinds may require significant pedal inputs; failure to do so may result in unanticipated yaw without the helicopter necessarily experiencing LTE.

Confined area operations

Confined area operations are advanced manoeuvres that require a pilot to use a detailed and methodical process to conduct the operation safely. Transport Canada outlines a comprehensive process to conduct a confined area approach, landing, and departure in its *Helicopter Flight Training Manual* (TP 9982).[6]

In general, before landing, the pilot conducts a high and a low reconnaissance of the confined area to help identify the many factors that require consideration during the approach, such as the size of the confined area and the wind direction. Then, the pilot prepares an approach and landing plan, which

[6] Transport Canada, TP 9982, *Helicopter Flight Training Manual*, Second Edition (June 2006), Exercise 25 – Confined Area, at https://tc.canada.ca/en/aviation/publications/helicopter-flight-training-manual-tp-9982 (last accessed on 18 February 2021).

should include a practice approach to confirm that the plan is sound. Lastly, after any modifications determined necessary by the practice approach, the actual approach is flown.

Safety messages

Landing and taking off in a confined area presents unique challenges. All helicopter pilots—no matter how experienced—need to conduct a detailed and methodical evaluation of a confined area to assess the factors that could affect the approach, hover or landing, and departure.

An unanticipated yaw can pose a significant threat during flight at low speeds and in high power regimes, and when a helicopter is operated within critical wind azimuth regions. It is important for helicopter pilots to recognize the factors that may induce unanticipated yaw that, if not corrected, can result in a loss of control of the helicopter.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 24 February 2021. It was officially released on 11 March 2021.

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

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