



Transportation
Safety Board
of Canada

Bureau de la sécurité
des transports
du Canada

Air Transportation Safety Investigation Report A20O0053

MID-AIR COLLISION

Privately registered
Champion 7GCB, C-FPTR
and

Privately registered
Cessna 172M, C-GEDC
Arnprior/South Renfrew Municipal Aerodrome, Ontario, 12 NM ENE
14 June 2020

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 flights

At approximately 1405¹ on 14 June 2020, a privately registered Champion 7GCB aircraft (registration C-FPTR, serial number 149), equipped with floats, departed Golden Lake, Ontario, for a daytime visual flight rules (VFR) flight to Constance Lake Water Aerodrome (CNQ5), Ontario. Only the pilot was on board.

After departure, the aircraft climbed to 2600 feet above sea level (ASL) and followed a direct track to the area of Braeside, Ontario, along the Ottawa River, approximately 3.5 nautical miles (NM) northwest of Arnprior/South Renfrew Municipal Aerodrome (CNP3), Ontario. The pilot was monitoring the enroute frequency (126.7 MHz) and made a position report as he passed the town of Renfrew, Ontario. As the Champion approached Braeside, the pilot switched over to the aerodrome traffic frequency for CNP3 (122.7 MHz) and broadcast his intentions to remain along the Ontario side of the Ottawa River enroute to CNQ5.

As the Champion approached Chat Falls on the Ottawa River, the pilot started a descent to 1500 feet ASL. He broadcast on frequency 122.7 MHz that he was clearing the area of CNP3 and subsequently

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

switched over to a training area² frequency (123.35 MHz). The pilot made a position report when he was passing Mohr Island on the Ontario side of the Ottawa River.

The Champion was on a track of approximately 085° true at 1500 feet ASL.

At approximately 1435, a privately registered Cessna 172M aircraft (registration C-GEDC, serial number 172-65285) departed CNP3 with the pilot and 3 passengers on board, for a daytime VFR flight east to the area of Constance Bay.

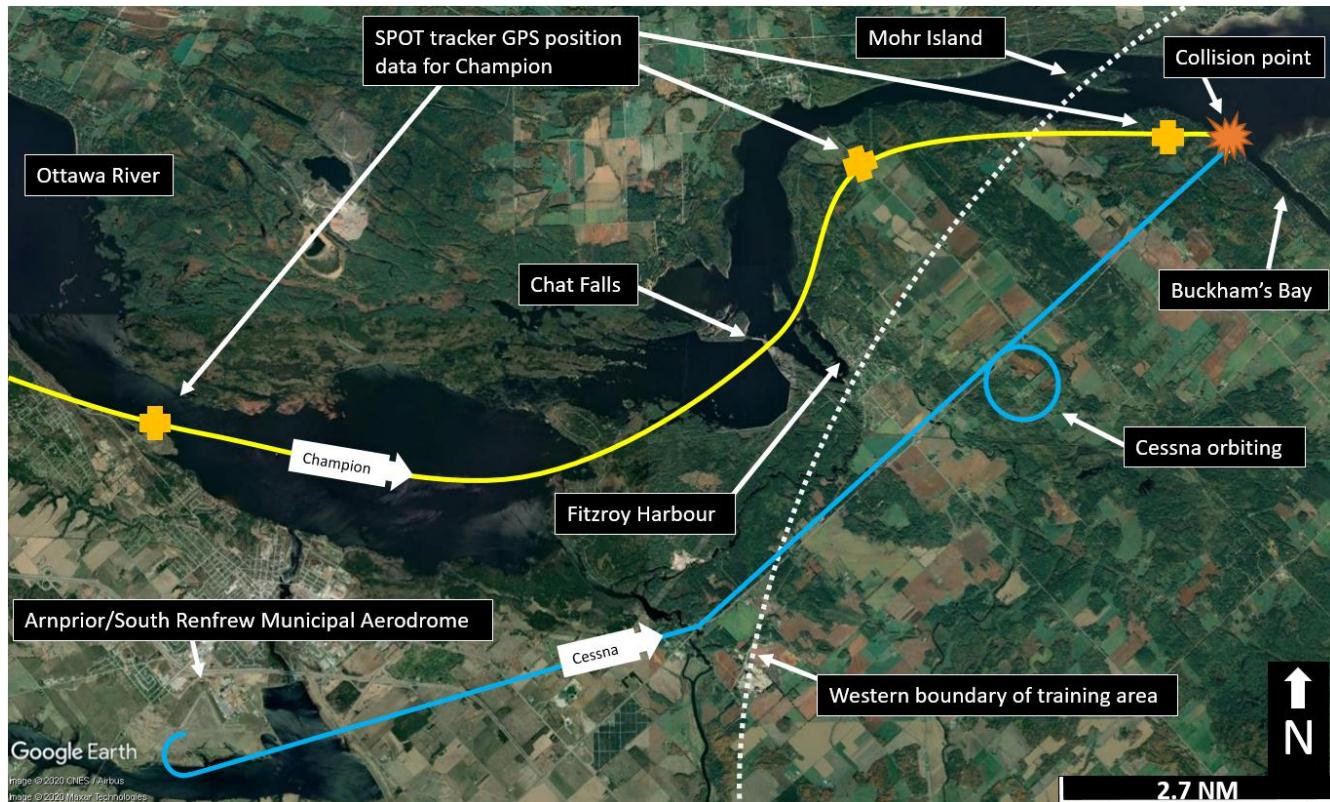
After departure from CNP3, the Cessna climbed to 1500 feet ASL. The pilot was monitoring the aerodrome traffic frequency for CNP3 (122.7 MHz) and remained on that frequency for approximately 5 NM before switching over to the training area frequency (123.35 MHz), and broadcasting the aircraft's position and his intentions for the flight. The Cessna maintained an altitude of 1500 feet ASL, which in that area is approximately 1000 feet above ground level (AGL).

After making a few sightseeing orbits over an area just east of Fitzroy Harbour, the Cessna flew a track of approximately 050° true, parallel to Galetta Side Road, towards Buckham's Bay, Ontario, on the Ottawa River. It maintained an altitude of 1500 feet ASL.

At approximately 1446, the 2 aircraft collided while flying over the Ottawa River near Buckham's Bay, approximately 12 NM east-northeast of CNP3 (Figure 1).

² The aircraft training area northwest of Ottawa/Macdonald-Cartier International Airport (CYOW) is designated in the *Canada Flight Supplement*/ GPH 205 (effective 0901Z 21 May 2020 to 0901Z 16 July 2020).

Figure 1. Estimated flight paths of the Champion and the Cessna (Source: Google Earth, with TSB annotations)



The Champion sustained damage to the tail, entered a descending left-hand turn, struck the water, and overturned. The pilot egressed from the aircraft and was rescued by nearby boaters. The pilot received minor injuries.

The Cessna sustained damage to the propeller, nose wheel fairing and engine cowl. The pilot of the Cessna saw the Champion aircraft strike the water. He flew a few orbits to confirm that the pilot of the Champion had been rescued, and transmitted a Mayday call. He then flew back to CNP3 and landed without further incident.

Pilot information

Records indicate that both pilots were certified and qualified for the flight in accordance with existing regulations.

The pilot of the Champion held a private pilot licence and had a valid Category 3 medical certificate. He had accumulated approximately 1195 hours total flight time in airplanes. According to his personal log, in the 365 days before the accident, the pilot had flown 20.7 hours.

The pilot of the Cessna held a private pilot licence and a valid Category 3 medical certificate. He had accumulated approximately 6247 hours total flight time in airplanes. According to his personal log, in the 365 days before the accident, the pilot had flown 44.2 hours.

Weather information

The weather at the time and location of the accident was suitable for VFR flight and not considered a factor in this occurrence.

Aircraft information

The Champion 7GCB is a single-engine, tandem 2-seat airplane manufactured by Champion Aircraft Company. The occurrence Champion was manufactured in 1962. The pilot of the Champion had a SPOT tracker personal satellite GPS (global positioning system) messenger in the cockpit that was tracking his aircraft for flight-following purposes. The TSB was able to use this GPS data to confirm the aircraft's position before the collision.

The Cessna 172M is a single-engine, 4-seat airplane manufactured by Cessna Aircraft Company. The occurrence Cessna was manufactured in 1975. The pilot of the Cessna had a tablet with GPS capability (ForeFlight application). Although this was onboard the aircraft, the pilot was not using it during the occurrence flight.

Records indicate that both aircraft were certified, equipped and maintained in accordance with existing regulations and approved procedures.

Collision and wreckage information

The damage sustained by both aircraft is consistent with the angle of the collision and correlates well with the direction of flight and converging tracks.

Damage to the Champion

During the collision sequence, the Champion sustained 2 propeller strikes on the top of the right wing: one close to the wing tip, along the trailing edge of the wing, and the other on the right aileron. The tail was extensively damaged in the collision (Figure 2). The damage caused the pilot to lose the ability to control the aircraft using the ailerons, horizontal stabilizer or the rudder. He was, however, able to control the pitch of the aircraft using engine power. Increasing the engine power would pitch the nose of the aircraft up, while decreasing it would pitch the nose down.

Figure 2. Damage to the Champion (Source of main image and tail damage inset image: TSB. Source of tail view pre-accident inset image: Third party, with permission)



Damage to the Cessna

The damage to the Cessna consisted of some scraping and paint marks on both propeller blades, a damaged front wheel fairing, and some damage to the left-hand engine cowl and lower left-hand portion of the fuselage immediately aft of the firewall (Figure 3). The damage did not lead to any control issues for the pilot.

Figure 3. Damage to the Cessna (Source: Ottawa Police Service, with TSB annotations)



Emergency locator transmitter

The 406 MHz emergency locator transmitter installed in the Champion activated during the collision, and the signal was received by the Canadian Mission Control Centre at the Canadian Forces Base in Trenton, Ontario.

The emergency locator transmitter installed in the Cessna did not activate.

Airspace and radio procedures en route

The collision occurred in Class G uncontrolled airspace, "...within which ATC [air traffic control] has neither the authority nor the responsibility to exercise control over air traffic."³ The *Transport Canada Aeronautical Information Manual* states,

[p]ilots operating VFR en route in uncontrolled airspace when not communicating on an MF [mandatory frequency], or an ATF [aerodrome traffic frequency], or VFR on an airway should continuously monitor 126.7 MHz and whenever practicable, broadcast their identification, position, altitude and intentions on this frequency to alert other VFR or IFR [instrument flight rules] aircraft that may be in the vicinity. Although it is not mandatory to monitor 126.7 MHz and broadcast reports during VFR or VFR-OTT [over-the-top] flights, pilots are encouraged to do so for their own protection.⁴

The area where the collision occurred is designated as a training area below 4000 feet within the Ottawa terminal control area. The Ottawa terminal control area VFR Terminal Procedures Chart⁵

³ Transport Canada, TP 14371E, *Transport Canada Aeronautical Information Manual* (TC AIM) (26 March 2020), RAC – Rules of the Air and Air Traffic Services, section 2.8.7.

⁴ Ibid. section 5.1.

⁵ NAV CANADA, *Canada Flight Supplement/ GPH 205* (effective 0901Z 21 May 2020 to 0901Z 16 July 2020), Ottawa TCA VFR Terminal Procedures Chart.

indicates that training aircraft should monitor 123.35 MHz below 4000 feet ASL when operating in that area.

Both pilots were familiar with the local area and indicated that they had made a position report on 123.35 MHz as they entered the designated training area. However, neither pilot recalled hearing any radio transmissions concerning other aircraft in their immediate vicinity.

Survival aspects

Underwater egress training

Egress training provides seaplane pilots with life-saving knowledge and techniques should a situation arise requiring underwater egress. While not required by regulation, the pilot of the Champion had received underwater egress training and relied on this training to successfully egress from his inverted and partially submerged seaplane.

Personal flotation devices

While not required by regulation, the pilot of the Champion was wearing a personal floatation device at the time of the collision. He assessed that there was no need to inflate the floatation device after exiting the aircraft due to the close proximity of rescuing boaters.

Visual lookout

As stated in the *Transport Canada Aeronautical Information Manual*,

[w]hen operating in accordance with VFR, or in accordance with IFR but in VMC [visual meteorological conditions], pilots have sole responsibility for seeing and avoiding other aircraft. Aural and visual alertness are required to enhance safety of flight in the vicinity of uncontrolled aerodromes.⁶

The see-and-avoid principle is the basic method of collision avoidance for VFR flights that is based on active scanning, and the ability to detect conflicting aircraft and take appropriate measures to avoid them. It has been examined in a number of other TSB investigations,⁷ and the TSB has found that, “[b]ecause of its limitations, the see-and-avoid principle cannot be used as the sole means of preventing aircraft collisions when operating under visual flight rules.”⁸

Advisory circular AC 90-48D published by the U.S. Federal Aviation Administration states that “[p]ilots should remain constantly alert to all traffic movement within their field of vision, as well as periodically scanning the entire visual field outside of their aircraft to ensure detection of conflicting traffic.”⁹ The

⁶ Transport Canada, TP 14371E, *Transport Canada Aeronautical Information Manual* (TC AIM) (26 March 2020), RAC – Rules of the Air and Air Traffic Services, section 4.5.6.

⁷ TSB air transportation safety investigations A99P0056, A99P0108, A99P0168, A06O0206, A09C0114, A12H0001, A12C0053, A13P0127, A15W0087, A17Q0030, and A18O0150.

⁸ TSB Air Transportation Investigation Report A17Q0030.

⁹ U.S. Federal Aviation Administration, Advisory Circular (AC) 90-48D, Pilots’ Role in Collision Avoidance, Change 1 (28 June 2016), paragraph 4.2.1.

most effective method of identifying potential conflicting traffic is to quickly scan small segments of the visual field (approximately 10° to 15° wide) to detect movement.¹⁰

Both aircraft are of a high-wing design and the visibility would have been similar, with no obvious obstructions.

Lack of relative motion on collision course

In its report on the limitations of the see-and-avoid principle, the Australian Transport Safety Bureau explained the following:

The human visual system is particularly attuned to detecting movement but is less effective at detecting stationary objects. Unfortunately, because of the geometry of collision flightpaths, an aircraft on a collision course will usually appear to be a stationary object in the pilot's visual field.

If two aircraft are converging on a point of impact on straight flightpaths at constant speeds, then the bearings of each aircraft from the other will remain constant up to the point of collision [...].

From each pilot's point of view, the converging aircraft will grow in size while remaining fixed at a particular point in his or her windscreens.¹¹

Time required to recognize threat and take evasive action

U.S. Federal Aviation Administration AC 90-48D¹² provides data (Table 1), regarding the attention and response time to traffic movement. The AC states in part:

Research has shown that the average person has a reaction time of 12.5 seconds. This means that a small or high-speed object could pose a serious threat if some other means of detection other than see and avoid were not utilized, as it would take too long to react to avoid a collision.

However, in its report on the limitations of the see-and-avoid principle, the Australian Transport Safety Bureau provided the following caveat:

Table 1. Aircraft identification and reaction time chart
(Source: U.S. Federal Aviation Administration, Advisory Circular [AC] 90-48D: *Pilots' Role in Collision Avoidance*, Change 1 [28 June 2016], paragraph 4.2.1.)

Event	Seconds
See Object	0.1
Recognize Aircraft	1.0
Become Aware of Collision Course	5.0
Decision to Turn Left or Right	4.0
Muscular Reaction	0.4
Aircraft Lag Time	2.0
TOTAL	12.5

Therefore to have a good chance of avoiding a collision, a conflicting aircraft must be detected at least 12.5 seconds prior to the time of impact. However, as individuals differ in their response time, the reaction time for older or less experienced pilots is likely to be greater than 12.5 seconds.¹³

¹⁰ U.S. Federal Aviation Administration, "Midair Collision Avoidance: Your Role in Collision Avoidance," at <https://www.jbmdl.jb.mil/Portals/47/documents/AFD-160121-033.pdf> (last accessed on 05 November 2020).

¹¹ Australian Transport Safety Bureau, ATSB Transport Safety Report, Research Report, Limitations of the See-and-Avoid Principle, Reprinted (November 2004), paragraph 2.7.4.

¹² U.S. Federal Aviation Administration, Advisory Circular (AC) 90-48D, Pilots' Role in Collision Avoidance, Change 1 (28 June 2016), paragraph 4.2.1.

¹³ Australian Transport Safety Bureau, ATSB Transport Safety Report, Research Report, Limitations of the See-and-Avoid Principle, Reprinted (November 2004), paragraph 3.1.

Collision avoidance systems

Both the Champion and the Cessna were equipped with Mode C transponders. Neither aircraft was equipped with any type of aircraft collision avoidance system technology, nor was it required by regulation.

There continue to be advancements in collision avoidance technology and a number of systems are available for general aviation aircraft to enhance the defences against mid-air collisions. These systems include:

- flight alarms branded as FLARM and/or PowerFLARM¹⁴
- automatic dependent surveillance – broadcast transceivers
- traffic advisory systems
- portable collision avoidance systems

Safety messages

The 2 aircraft in this occurrence were operating under VFR in uncontrolled airspace. Neither pilot saw the other aircraft prior to the mid-air collision, partly owing to the inherent limitations of the see-and-avoid principle. Relying solely on visual detection increases the risk of collision while in uncontrolled airspace. Pilots are strongly encouraged to broadcast their intentions and maintain a listening watch while operating in uncontrolled airspace in accordance with Transport Canada's VFR communications procedures, even though it is not mandatory for them to do so.

There are a number of airborne collision avoidance systems currently available, some of which are specifically designed for the general aviation market. These technologies offer the potential to significantly reduce the risk of mid-air collisions.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 04 November 2020. It was officially released on 18 November 2020.

Visit the Transportation Safety Board of Canada's website (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.

¹⁴ FLARM works by calculating and broadcasting its own future flight path to nearby aircraft. At the same time, it receives the future flight path from surrounding aircraft. An intelligent motion prediction algorithm calculates a collision risk for each aircraft based on an integrated risk model. When a collision is imminent, the pilots are alerted with the relative position of the intruder, enabling them to avoid a collision.

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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