Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A14O0164

RISK OF COLLISION

BETWEEN
JAZZ AVIATION LP DHC-8-102 C-GJMI
AND
SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY ZLIN Z242L C-FANU
SAULT STE. MARIE AIRPORT, ONTARIO, 8 NM SE
03 SEPTEMBER 2014

Canada

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Jazz Aviation LP DHC-8-102 C-GJMI
and
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Sault Ste. Marie Airport, Ontario, 8 nm SE
03 September 2014

Summary

A Jazz Aviation LP (Jazz) de Havilland DHC-8-102 (registration C-GJMI, serial number 077), operating as Jazz flight 7794 (JZA7794), departed from Runway 22 at Sault Ste. Marie Airport, Ontario, destined for Toronto/Lester B. Pearson International Airport, Ontario. While climbing through approximately 4000 feet above sea level, the Jazz flight crew received a traffic alert from the aircraft's traffic alert and collision avoidance system and spotted a small aircraft (registration C-FANU, serial number 0681) 3 miles ahead and approximately 1000 feet above. Responding to the alert, JZA7794 levelled off at 4500 feet above sea level, but C-FANU initiated a rapid descending turn toward it. The Jazz flight crew took evasive action and banked the aircraft 30° to the left. At 1557 Eastern Daylight Time, C-FANU passed the starboard side of JZA7794, separated laterally by approximately 350 to 450 feet.

Le présent rapport est également disponible en français.

Factual information

History of the flight

C-FANU

Sault College of Applied Arts and Technology (Sault College) offers an advanced diploma program in Aviation Technology—Flight. The flight training portion of the program is based at the Sault Ste. Marie Airport (CYAM), Ontario.

Sault College has approximately 200 students enrolled in this program and operates a fleet of 11 ZLIN 242Ls and 2 Piper PA-44-180 Seminoles. The ZLIN 242L is a 2-seat low-wing, single-engine, fully acrobatic aircraft intended for basic and advanced training (Photo 1).

Photo 1. ZLIN 242L C-FANU (Source: Sault College of Applied Arts and Technology)

On the day of the occurrence, C-FANU departed from Runway 22 at CYAM at approximately 1515,[1] with an instructor and a student on board. The planned exercises for the flight included a few circuits and some upper airwork,[2] including steep turns, stalls, and spins.

The aircraft exited the CYAM control zone to the south at approximately 1538 and was cleared by air traffic control (ATC) to leave the tower frequency. The student pilot changed

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

2 The term "upper airwork" in this context refers to manoeuvres generally performed by training pilots, such as slow flight, stalls, spins, and spiral dives, at altitudes that allow for safe recovery. Sault College requires students to complete these manoeuvres as part of private and commercial flight training syllabuses.

the frequencies of the 2 radios to monitor a Sault College dispatch frequency and a common traffic advisory frequency (CTAF)[3] for a nearby airport located in the United States.

For the next 20 minutes, the aircraft remained in an area 6 to 12 nautical miles (nm) to the south of CYAM at altitudes varying from 2500 to 5700 feet,[4] as necessary, to complete the planned exercises. The instructor and the student had previously completed upper airwork in this area, and had not experienced any conflicts with departing instrument flight rules (IFR) traffic.

At approximately 1552, in preparation for the first of 2 planned spins, the student completed the required checks as per the school's standard operating procedures (SOPs), executing a lookout for other traffic by turning the aircraft and scanning the area ahead, above, and below. The instructor assisted with this lookout.

The spin was entered at 5700 feet, and the recovery was complete by 5000 feet. The student then entered a climbing turn to increase the aircraft's altitude in preparation for the second spin. During this climbing turn, the student and instructor again completed a lookout for other traffic. None was spotted.

The aircraft entered the second spin, to the right, from 5200 feet, at approximately 1557.

The student arrested the spin and the descent at approximately 4500 feet. Just as the rotation stopped, the student and instructor both noticed a large aircraft very close ahead and the student banked the aircraft sharply to the left.

The large aircraft (JZA7794) passed to the right of C-FANU at the same altitude, separated laterally by approximately 350–450 feet (Figure 1).

The investigation did not reveal any aircraft issue that could have contributed to the occurrence.

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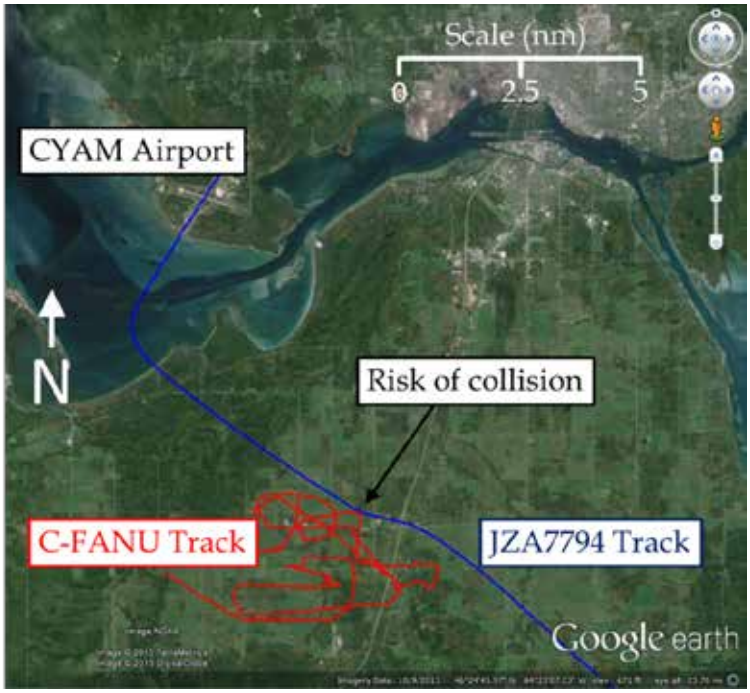
3 A frequency designed for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, Multicom, flight service station (FSS), or tower frequency and is identified in appropriate aeronautical publications (Source: Federal Aviation Administration, *FAR/AIM 2010: Federal Aviation Regulations/Aeronautical Information Manual*).

4 All altitudes are in above sea level (asl), unless otherwise noted.

Figure 1. Depiction of the aircraft tracks leading to the risk of collision (Source: Google Earth, with TSB annotations)



JZA7794

There were 3 crew members and 34 passengers on board flight JZA7794, which was departing CYAM bound for Toronto/Lester B. Pearson International Airport (CYYZ), Ontario.

The captain was the pilot flying (PF), and the first officer was the pilot not flying (PNF).

When the crew of JZA7794 contacted ATC requesting departure clearance, they were informed that the flight was cleared to CYYZ via the flight-planned route and that they should use the Sault Six standard instrument departure, which requires that the crew maintain the runway heading after departure until reaching 4000 feet, unless otherwise directed by ATC.

When JZA7794 contacted ATC and requested taxi instructions, the crew was informed that Runway 22 was in use and that the wind was from 220° magnetic at 10–15 knots.

When JZA7794 reached Runway 22, the tower controller instructed its crew to contact the Toronto area control centre (CZYZ) once airborne, and cleared the flight for takeoff.

Shortly after takeoff, while maintaining the runway heading, the flight crew contacted CZYZ and informed the controller that they were climbing through 2000 feet. The controller instructed JZA7794 to turn directly toward the DARID intersection, and cleared the aircraft

to climb to flight level 210 (FL210).[5] JZA7794 turned left toward DARID at 1555 and continued climbing at approximately 1200 feet per minute.

At 1556:21, while climbing through 4000 feet, the traffic alert and collision avoidance system (TCAS) on board JZA7794 issued a traffic advisory (TA) alerting the flight crew—both aurally and on the cockpit display—to the presence of traffic at their 1 o'clock position,[6] 3 nm ahead and approximately 1000 feet higher. Within seconds, the flight crew acquired the traffic visually. The traffic was a light aircraft, heading in the opposite direction. The PF began to level the aircraft, intending to pass below the traffic.

Shortly after JZA7794 levelled off at 4500 feet, the flight crew noticed the right wing of the light aircraft drop and the aircraft enter a rapid descending turn. The flight path of this rapid manoeuvre was diagonally right to left from the perspective of JZA7794 and put the 2 aircraft on a collision course. Almost instantly, the TCAS issued a resolution advisory (RA), aurally instructing the flight crew to descend. The PF assessed that, due to the flight path of the descending aircraft, a descent would not be sufficient.

Without delay, the JZA7794 PF banked the aircraft 30° to the left. While in the turn, the flight crew noticed that the light aircraft had recovered from its rapid descending turn and passed to their right at the same altitude, separated by approximately 350–450 feet.

Once clear of the conflict, the JZA7794 flight crew turned the aircraft back toward DARID, reinitiated the climb, and informed the CZYZ controller that they had responded to a TCAS RA.

The investigation did not reveal any aircraft issue that could have contributed to the occurrence.

Events in Sault Ste. Marie Airport control tower

Air traffic control surrounding CYAM is provided by a control tower at the airport and by CZYZ, which is located at CYYZ.

At the time of the occurrence, the CYAM control tower was staffed by a trainee controller in the tower position and an on-the-job instructor. The CYAM tower position is responsible for providing aircraft with air traffic services within the CYAM control zone.[7]

The departure of C-FANU was routine. The student pilot informed the tower controller that they were departing for a visual flight rules (VFR) flight to the southwest, and when the aircraft exited the control zone, the controller released C-FANU from the tower frequency.

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5 FL210 is a pressure altitude of approximately 21 000 feet asl.

6 Position in relation to a clock face, where 12 o'clock is straight ahead, and 6 o'clock is directly behind.

7 The CYAM Class D control zone is an area with a radius of 5 nm from the centre of the airport, with an extension toward the YAM very high frequency (VHF) omnidirectional range (VOR), from the surface up to an altitude of 3000 feet asl.

The tower had no further contact with C-FANU until its return to the airport after the incident.

The departure of JZA7794 was also routine. During the takeoff clearance, the tower controller instructed the aircraft to contact CZYZ once airborne, as the responsibility for separation for airborne IFR aircraft rests with the CZYZ controller.

Occasionally, if a tower controller notices possible conflicting traffic within the control zone, the controller may hold the departing IFR aircraft on the tower frequency, to be able to pass on traffic information until the IFR aircraft is clear of the potential conflict.

At the time of JZA7794's departure, neither tower controller noticed conflicting traffic visually or on radar and, as a result, the standard takeoff clearance was issued to JZA7794 without restriction.

Events at the Toronto area control centre

CZYZ is responsible for the controlled airspace within an area defined in the *CZYZ Unit Operations Manual*; generally speaking, it covers the airspace over most of Ontario.

This responsibility is divided into several specialties, and these are further subdivided into sectors. The sector responsible for the occurrence airspace is labelled Sault Low. This sector forms part of the North Specialty. The sector (Figure 2) is relatively large and encompasses an area of approximately 150 nm by 235 nm.

Figure 2. Approximate boundaries of the Sault Low sector (Source: Google Earth, with TSB annotations)

At the time of the occurrence, the volume and complexity of air traffic in the Sault Low sector was considered low to moderate. The sector controller was responsible for 8 aircraft and was communicating with 4 to 5 of those aircraft during the 5 minutes surrounding the occurrence.

At 1549, the tower controller contacted the CZYZ controller and requested validation of the IFR departure clearance for JZA7794. The CZYZ controller observed no conflicting IFR traffic and validated the clearance.

At 1554:30, the crew of JZA7794 contacted CZYZ and stated that they were climbing through 2000 feet. Around this time, the controller was controlling 3 other IFR aircraft nearby in the sector. Noticing no imminent conflicts with these aircraft, the controller cleared JZA7794 direct to the DARID intersection and to continue a climb to FL210.

As JZA7794 turned toward DARID, the controller returned attention to ensuring that the other IFR targets did not conflict with this new flight path, and issued one minor adjustment to the flight path of an IFR aircraft 35 nm to the southeast, to ensure continued separation.

When the controller's attention returned to JZA7794, it was noticed that the aircraft was no longer headed directly toward DARID but, rather, was in a left turn. Shortly thereafter, the JZA7794 flight crew informed the controller that the deviation was due to a TCAS RA.

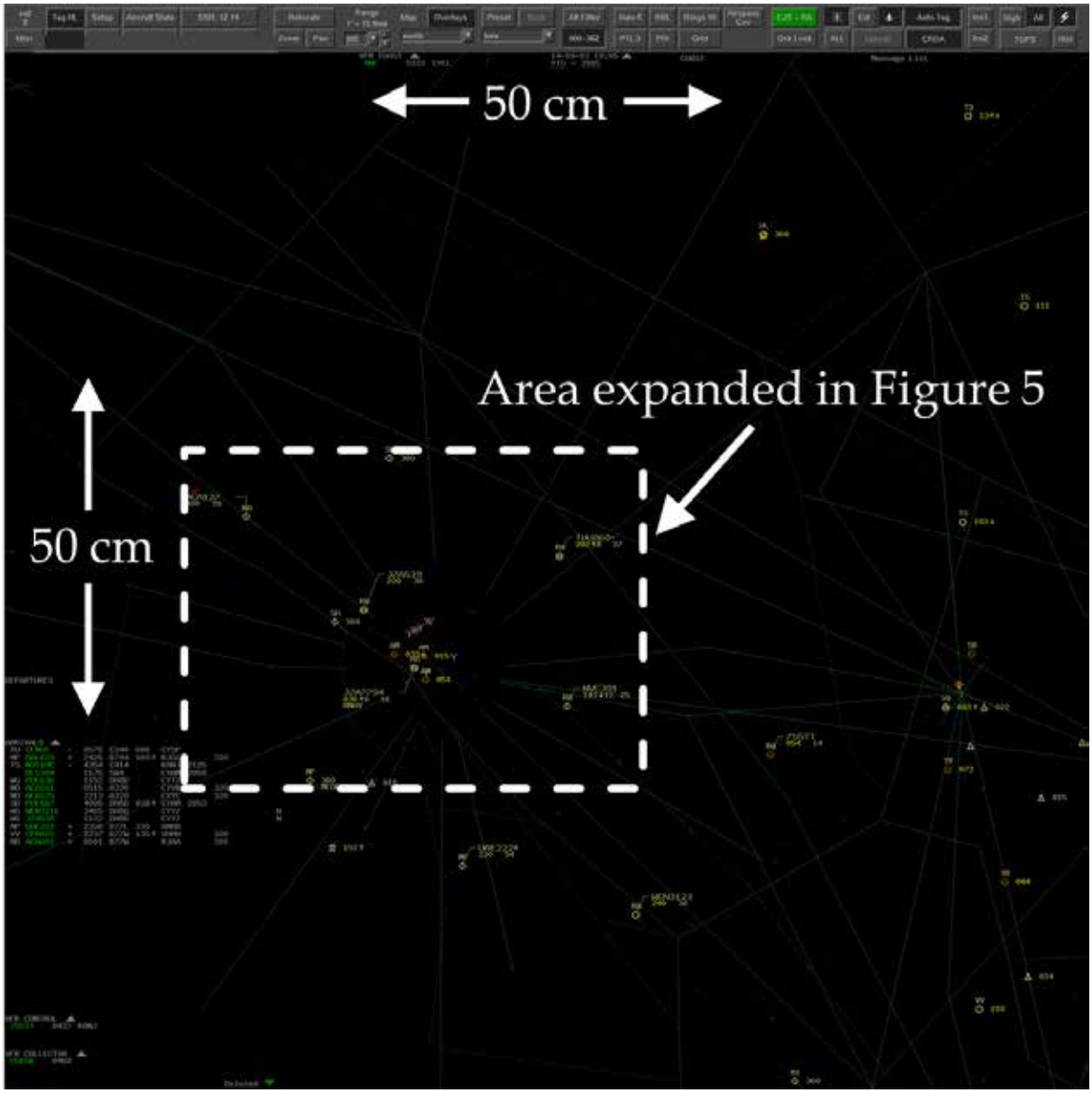
Area control centre equipment

CZYZ controllers view radar traffic on a Canadian Automated Air Traffic System (CAATS) situational display (CSit). The CSit is a relatively large monitor measuring approximately 50 cm by 50 cm.

The settings on this display can be altered by the individual controller to suit personal preferences. Among the items that can be adjusted are the amount of information displayed for each present position symbol (PPS) or target, the brightness of groups of targets, and the scope or range of the radar. The PPSs for both JZA7794 and C-FANU had their associated altitude information displayed.

Given the large size of the Sault Low Sector, the radar range is normally set to 305 nm, a setting that enables the controller to see the entire sector (Figure 3). With the range set to this scale, 1 cm of screen resolution equals 6 nm.

Figure 3. The CAATS situational display (CSit) at the time of the occurrence (Source: NAV CANADA, with TSB annotations)

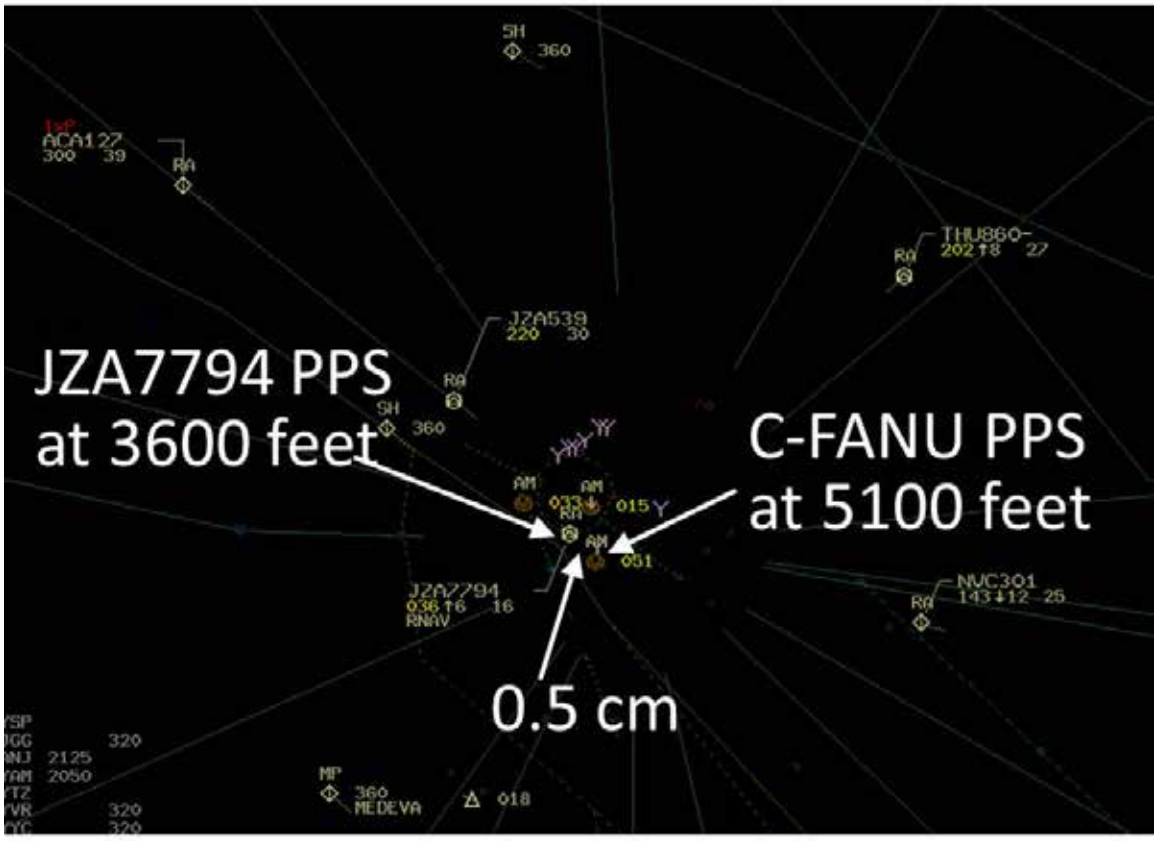


The CZYZ controller was used to seeing VFR targets surrounding CYAM and preferred to have the PPSs associated with these targets dimmed to the lowest available setting to ensure that the IFR PPSs stood out. In the controller's experience, these VFR targets were most often at low altitudes (less than 5000 feet) and generally didn't conflict with IFR traffic.

When the clearance direct to DARID was issued to JZA7794, the 2 occurrence targets were separated by 8 nm, or 1.3 cm on the screen. Just before the JZA7794 flight crew received the TCAS TA, the targets were separated by 3 nm, or 0.5 cm (Figure 4).

As the aircraft passed each other, their PPSs overlapped.

Figure 4. Expanded portion of the CSit in Figure 3, as it appeared shortly before the traffic alert and collision avoidance system (TCAS) traffic advisory (TA) (Source: NAV CANADA, with TSB annotations)



Individuals

All of the pilots and controllers involved in the occurrence were certified and qualified for their respective positions in accordance with existing regulations. They were all considered sufficiently experienced for their current roles, as detailed below.

Table 1. Information on individuals

Individual	Organization	Years of experience	Flight time
C-FANU instructor	Sault College	approx. 5 years	1025 hours
C-FANU student	Sault College	approx. 3 years	300 hours
JZA7794 captain	Jazz Aviation LP	approx. 14 years	11 500 hours
JZA7794 first officer	Jazz Aviation LP	approx. 10 years	3500 hours
CYAM tower on-the-job instructor	NAV CANADA	approx. 10 years	N/A
CYAM tower trainee	NAV CANADA	approx. 2 years	N/A
CZYZ controller	NAV CANADA	approx. 22 years	N/A

At the date and time of the occurrence, all individuals were considered adequately rested, and there was no indication that fatigue was a factor.

Weather

The weather at the time and location of the occurrence[8] was adequate for VFR flight:

- wind was from 230° magnetic at 12 knots, gusting to 17 knots;
- visibility was greater than 15 statute miles;
- few clouds at 5300 feet above ground level (agl);
- broken ceiling at 18 000 feet agl.

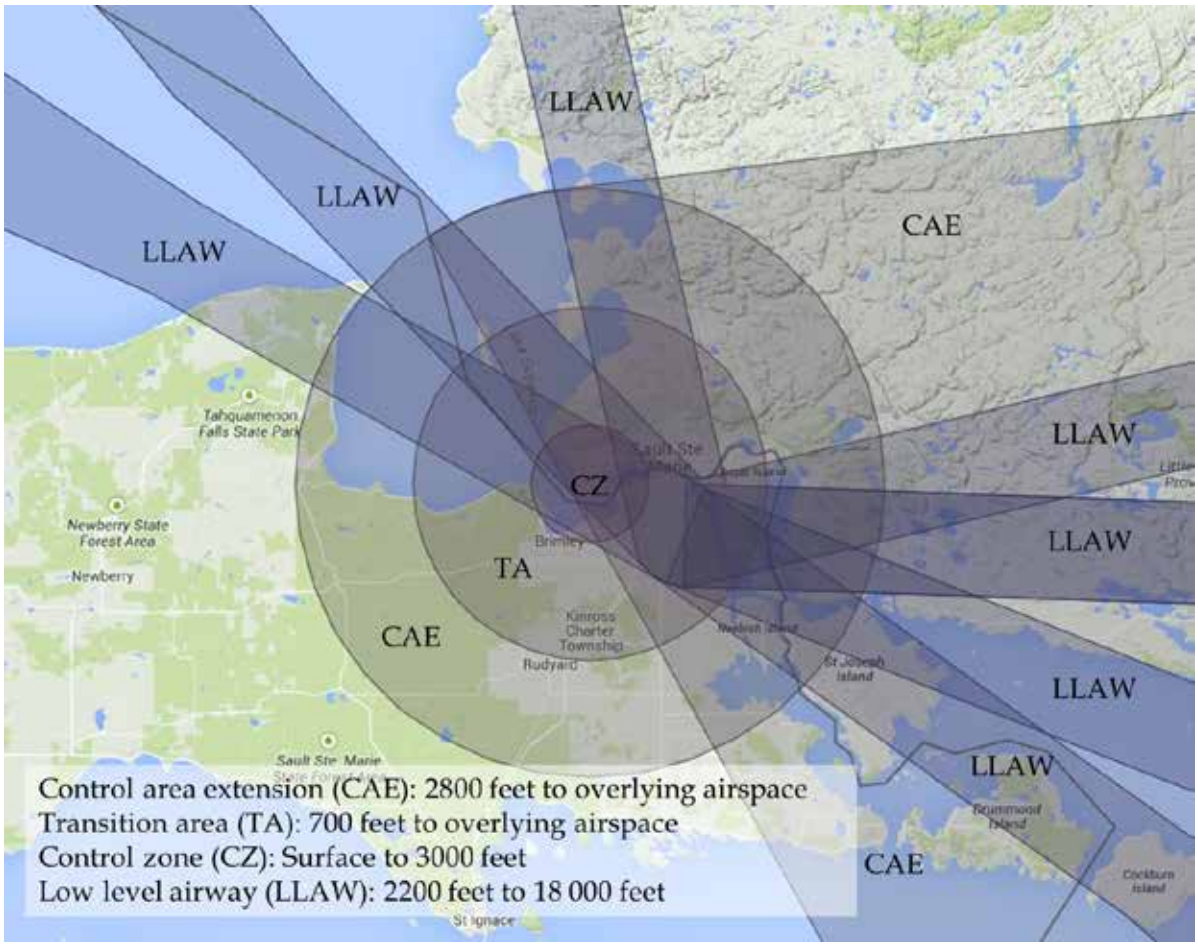
Airspace and air traffic control requirements

The airspace and associated governing regulations surrounding CYAM are relatively complex given its close proximity to the Canada–United States border. For example, there are portions of controlled airspace that are over United States soil, but are controlled by a Canadian ATC unit.

There is a Class D control zone with a radius of approximately 5 nm surrounding CYAM from the surface up to 3000 feet. Outside of this zone, there are several different configurations of Class E controlled airspace, which contain the majority of low-level airspace within 25 nm of CYAM (Figure 5).

[8] As obtained from the 1900 UTC CYAM aerodrome routine meteorological report (METAR).

Figure 5. Class D and Class E controlled airspaces surrounding CYAM (Source: Canadian Airspace Viewer, with TSB annotations)



The airspace where the occurrence took place is over the United States, near a small town called Dafter, Michigan, within Class E controlled airspace under the ATC jurisdiction of CZYZ.

In Class E airspace, ATC is required by regulation to provide separation between all IFR aircraft,[9] and all IFR aircraft must have a clearance from the associated ATC unit to enter the airspace.[10]

There are no special entry or communication requirements for VFR aircraft in Class E, and no ATC separation is provided.

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9 *Canadian Aviation Regulations* (CARs) 801.02(4): "Where air traffic control services are provided to aircraft operating in Class E airspace, the services shall include separation between IFR aircraft."

10 *Canadian Aviation Regulations* (CARs) 601.05(1): "No person shall operate an IFR aircraft in Class A, B, C, D or E airspace or in Class F Special Use Restricted or Class F Special Use Advisory controlled airspace unless the aircraft is operated in accordance with an air traffic control clearance or an authorization issued by the Minister."

The *Air Traffic Control Manual of Operations* (ATC MANOPS) requires[11] that in Class E airspace, workload permitting, controllers provide traffic information to radar-identified IFR aircraft if the radar target appears likely to merge with another radar-observed target.

The ATC MANOPS also requires,[12] workload permitting, that traffic information be provided to VFR aircraft in Class E airspace. However, given that there are no special requirements for VFR aircraft to enter the airspace and they are not required to monitor the applicable ATC frequency, application of this requirement is often unachievable.

Busy flight training areas

There are several airports across Canada that have a high volume of aircraft movements related to flight training. Most are near relatively built-up areas and are associated with large flight schools.

The combination of a built-up area, with associated commercial airline traffic, and a large flight school can result in a busy mix of IFR and VFR traffic. This level and mix of traffic often requires the operation of a control tower (such as in CYAM) to help ensure that aircraft remain safely separated.

Training aircraft completing upper airwork can vary their headings and altitudes frequently and, often, rapidly. For an aircraft transiting the area in which these manoeuvres are taking place, it can be difficult to spot the training aircraft and, once they are spotted, prediction of their future flight paths to ensure separation can be difficult. Similar difficulty can be faced by a controller attempting to point out these training aircraft to transiting IFR or VFR traffic.

In Canada, there are a few methods used to address this risk. One method involves placing a training aircraft symbol (Figure 6) in the general vicinity of the training area on the applicable VFR navigation chart (VNC) and terminal area chart (TAC). This symbol serves to notify transiting VFR aircraft to be on heightened alert, given the possibility of unpredictable training aircraft in the area. The symbols do not have a defined area, are not depicted on IFR enroute low-altitude charts, and are not generally known to the area control centre (ACC) controllers responsible for the particular sector.

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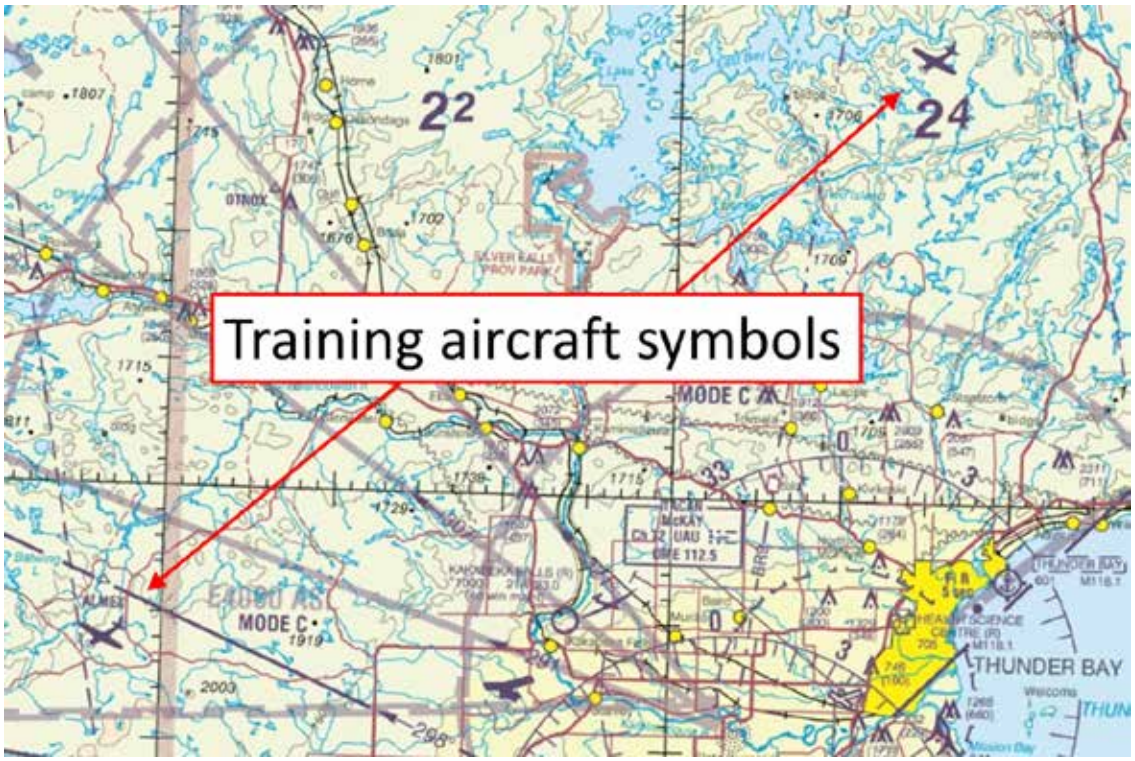
11 NAV CANADA, *Air Traffic Control Manual of Operations* (ATC MANOPS), section 165.3 and 165.3 B. Note.

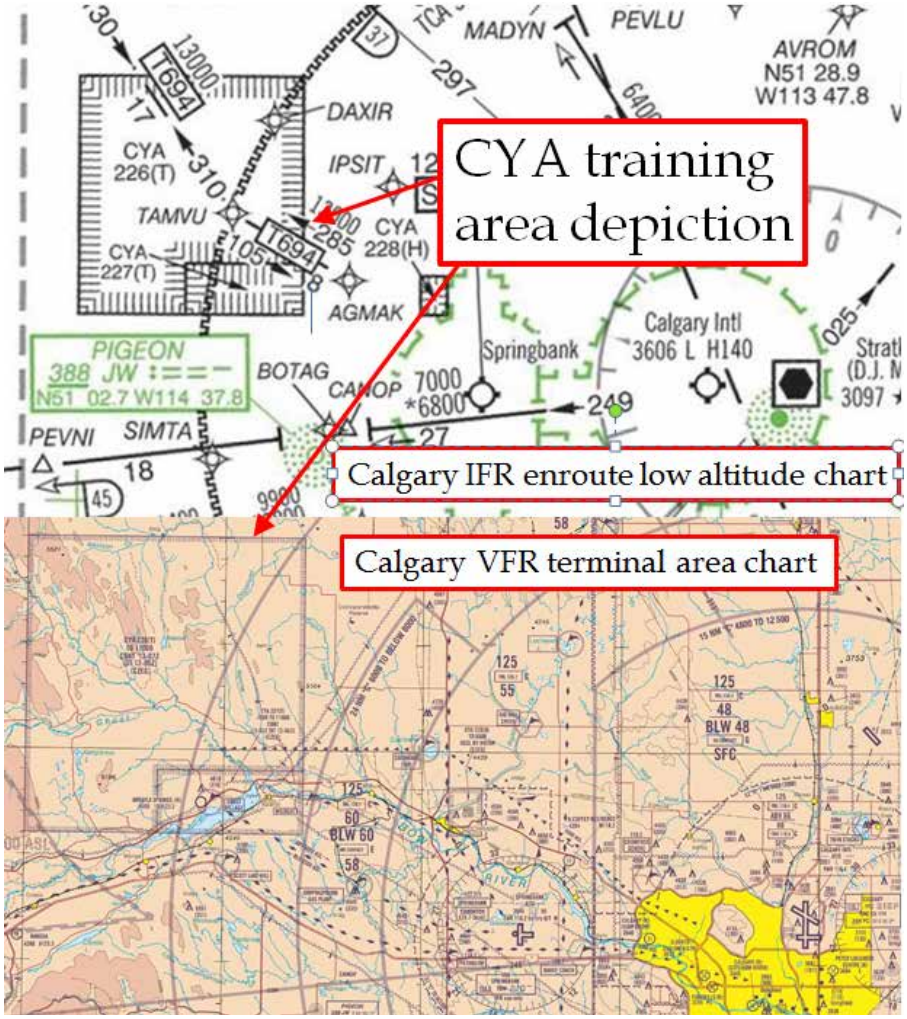
12 Ibid., section 165.2.

Figure 6. Training aircraft symbols on a visual flight rules (VFR) navigation chart (VNC) (Source: NAV CANADA, with TSB annotations)



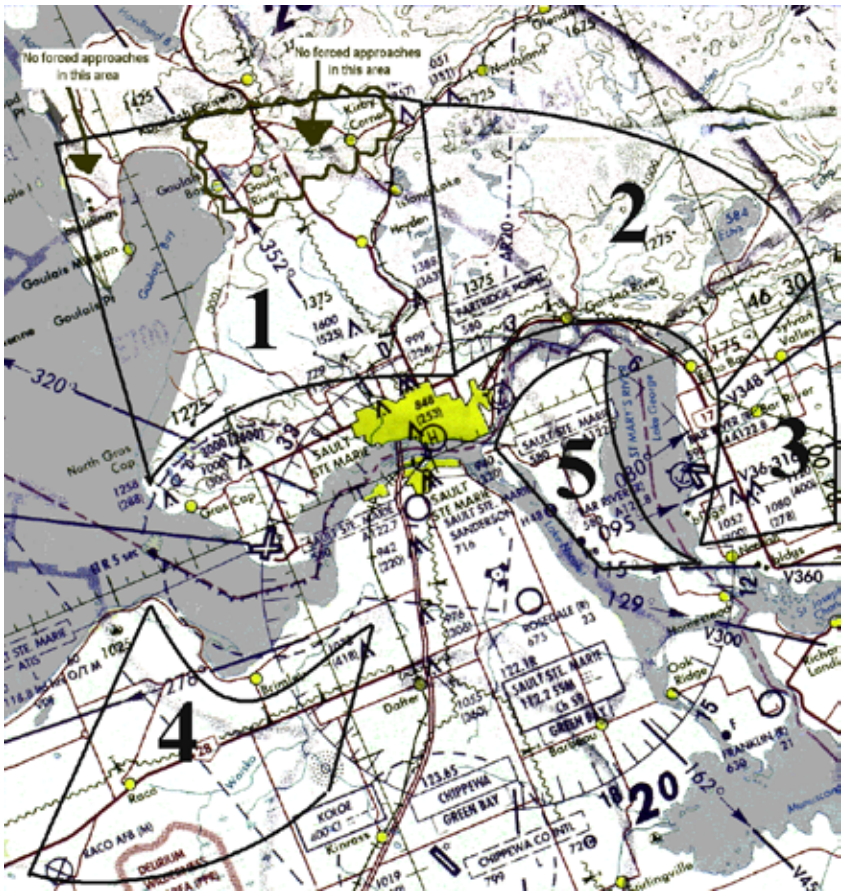
Another method involves establishing a block of airspace designated as Class F Special Use Advisory Airspace (CYA). These defined blocks of airspace are designated as such within the *Designated Airspace Handbook* and are depicted on both VFR and IFR charts (Figure 7). The blocks often have associated common frequencies and hours of operation, and are known to the relevant ATC units. ACC controllers will not generally route an IFR aircraft through an active CYA.

Figure 7. Depiction of training areas on VFR and instrument flight rules (IFR) charts (Source: NAV CANADA, with TSB annotations)



Prior to the occurrence, in part to address the risk of conflicts, Sault College had published specific designated practice areas within its SOPs (Figure 8). The purpose of the areas was to keep Sault College aircraft somewhat separated as students and instructors discussed their planned areas of operation before departure and during flight on the company dispatch frequency. Additionally, the areas served to detail where some specific training manoeuvres could and could not take place. However, no guidance was provided regarding the use of the areas for upper airwork.

Figure 8. Sault College designated practice areas (Source: Sault College of Applied Arts and Technology)



At the time of the occurrence, the instructor and student were somewhat familiar with the practice area designations. As the areas were published only in the Sault College manuals, the CYAM control tower and CZYZ were not aware of their existence.

Risks of collision around CYAM

Over the past 10 years, there have been several recorded risk-of-collision events near CYAM. A search of the Civil Aviation Daily Occurrence Reporting System (CADORS) identified 15 similar occurrences of TCAS RAs resulting from a risk of collision between an IFR and a VFR aircraft. At least 7 of those occurrences involved aircraft operated by Sault College.

Sault College safety management system

Sault College operates a flight training unit (FTU) under the authority of an operator certificate issued under Subpart 6 of Part IV of the *Canadian Aviation Regulations* (CARs). Under this CARs subpart, FTU operators are not required to maintain a safety management system (SMS), although Sault College had begun to implement such a system.

The *Sault College SMS Policy Manual* details the safety oversight of the operation, including internal reporting and risk management.

Since 2013, the internal reporting system had captured 15 events identified as near miss, close call, or risk of collision. In contrast to the previously mentioned CADORS TCAS events, all 15 of these reports detailed events between 2 VFR aircraft, occasionally between 2 Sault College aircraft.

The Sault College safety officer aggregated these reports, and the college's internal safety committee met to discuss them in June 2014. Following this committee meeting, it was decided that new practice areas would be established, and that their establishment would include procedures regarding specific radio calls and position reports. An effort would also be made to have a training aircraft symbol and company frequency added to the VNC.

At the time of this occurrence, none of the committee's proposed actions had been implemented.

TSB Watchlist

Safety management and oversight is a 2014 Watchlist issue

The Watchlist is a list of issues posing the greatest risk to Canada's transportation system; the TSB publishes it to focus the attention of industry and regulators on the problems that need addressing today.

Some transportation companies are not effectively managing their safety risks, and Transport Canada oversight and intervention has not always proven effective at changing companies' unsafe operating practices.

The TSB urges Transport Canada to implement regulations requiring all operators in the air industry to have formal safety management processes, and to oversee these processes.

It also calls on companies that do have SMS to demonstrate that it is working—that hazards are being identified and effective risk-mitigation measures are being implemented.

See more information about this Watchlist issue.

TSB Laboratory reports

The TSB completed the following laboratory report in support of this investigation:

- LP173/2014 (FDR/Data Analysis)

Analysis

General

The investigation determined that all of the individuals involved in the occurrence were qualified, trained, and licensed. There were no issues with the functioning of the aircraft. Weather conditions did not significantly affect visibility, and were not considered a factor.

Therefore, the analysis will focus on the underlying reasons why the crew of C-FANU was not aware of the traffic, why the initial action by JZA7794 was insufficient to avoid the conflict, and why the conflict situation was not recognized by the Toronto area control centre (CZYZ) controller.

Sault College aircraft (C-FANU)

The Sault College flight training unit (FTU) requires that all students complete upper airwork as part of their private and commercial flight training syllabuses. This training must be completed at a safe altitude that allows for recovery from descending manoeuvres, such as stalls, spins, and spiral dives.

Sault College instructors and students determine a suitable location based on airspace, convenience, and anticipated traffic from other school aircraft. In the case of the occurrence flight, no other school aircraft were expected to be in the selected area, and the airspace was nearby and clear of the Sault Ste. Marie Airport (CYAM) control zone.

When C-FANU departed CYAM and cleared the control zone, its crew switched communications to the school's dispatch frequency in order to monitor other school aircraft in the general area and ensure that their intentions didn't conflict.

Outside of the control zone, C-FANU entered Class E airspace, where there is no requirement to contact air traffic control (ATC)—in this case, Toronto area control centre (CZYZ)—or to monitor the frequency for instrument flight rules (IFR) traffic. As a result, the clearance issued by CZYZ to JZA7794 was not heard by the C-FANU flight crew. Hearing the clearance may have alerted C-FANU to the possible conflict.

Given their experience with previously completing upper airwork in this area without conflict, the student and instructor did not anticipate spotting a departing IFR aircraft during their scan of traffic in the area prior to the spin.

In preparation for the second spin, the student executed a climbing turn to scan for traffic and gain altitude. This would have placed C-FANU in a nose-high attitude, with JZA7794 approaching from below. As a result, the conflicting traffic was not seen by the C-FANU flight crew during their visual scan prior to the spin, possibly due to its position below the aircraft nose or wing, or due to a lack of anticipation.

Toronto area control centre

When JZA7794 contacted the CZYZ controller while climbing out of 2000 feet above sea level (asl), the controller determined that clearing the aircraft direct to DARID and up to FL210 would be expeditious, and that the only conflict with another IFR aircraft could be rectified with a slight adjustment to the route of the conflicting traffic.

When the controller issued the clearance to JZA7794, the radar target on the controller's screen associated with C-FANU was directly in line between JZA7794 and DARID, and displayed an altitude of 5600 feet.

The controller was familiar with seeing VFR targets in the area of CYAM, and was aware of the busy flight school in the area. In the controller's experience, the targets in close proximity to the airport were much lower than 5000 feet. This expectation may have resulted in the aircraft target's altitude going unnoticed. This may also have occurred due to the fact that the brightness of the target—and all other VFR targets—was set to the minimum setting, or potentially due to the clutter of the targets in the CYAM area, given the large scale of the display for the Sault Low sector.

Therefore, the target's altitude went unnoticed when the CZYZ controller cleared JZA7794 direct to the DARID intersection, possibly due to a combination of clutter between radar targets, dimness of display, and expectation of a lower altitude for the training aircraft.

Jazz aircraft (flight JZA7794)

When the traffic alert and collision avoidance system (TCAS) on board JZA7794 initially alerted the flight crew to the traffic, the action taken to level off the aircraft and pass beneath C-FANU should have provided a safe margin, given that the traffic was also slightly to the right of their flight path.

The flight crew was unaware of the possibility that there were training aircraft in the vicinity and, lacking this information, had no reason to anticipate that the opposing traffic would initiate a rapidly descending turn. As a result, their initial action of levelling off the aircraft at 4500 feet was insufficient to resolve the risk of collision once C-FANU initiated the spin.

The irregular flight path of the spin put the 2 aircraft on a collision course before an evasive turn by JZA7794 caused the aircraft to pass each other, separated by 350–450 feet laterally.

Addressing risks of collision

There have been several near misses or risks of collision surrounding CYAM in the past decade. As a significant portion of the aircraft movements at CYAM are directly related to the Sault College program, a representative portion of these near misses involved school aircraft.

The Sault College safety management system (SMS) highlighted this risk, but the safety committee's proposed mitigation action remained incomplete at the time of the occurrence.

The committee's proposed altering of internally known practice areas and in-house procedures for frequency use may reduce the risk of collision between 2 Sault College aircraft, but may not address the more general risk.

The committee's proposed attempt to address the risk of collision with the addition of flight training symbols on the visual flight rules (VFR) navigation chart (VNC), along with an associated frequency, may only reduce the risk of collision between a Sault College aircraft and a transiting VFR aircraft. However, the symbol would do little to address the risk of collision between IFR and VFR aircraft, as the training symbol and respective surrounding area would most likely remain unknown to ATC and to IFR aircraft.

Unlike other busy flight training areas, there are no Class F Special Use Advisory Airspace (CYA) training areas near CYAM. A CYA has defined dimensions, and can have restricted times, altitudes, frequencies, and entry restrictions. A CYA is displayed on all published maps, is known to ATC, and can be depicted on the controller's radar displays.

If manoeuvres related to flight training take place in controlled airspace that is not specifically designated for such training or known to ATC, there is an increased risk of collision, as these types of manoeuvres can be difficult for controllers or the crews of conflicting traffic to anticipate.

Findings

Findings as to causes and contributing factors

1. The altitude portion of the radar target representing C-FANU went unnoticed when the Toronto area control centre (CZYZ) controller cleared JZA7794 direct to the DARID intersection, possibly due to a combination of clutter between radar targets, dimness of display, and expectation of a lower altitude for the training aircraft.

2. The conflicting traffic was not seen by the C-FANU flight crew during their visual scan prior to the spin, possibly due to its position below the aircraft nose or wing, or due to a lack of anticipation.

3. The JZA7794 flight crew was unaware of the possibility that there were training aircraft in the vicinity and, lacking this information, had no reason to anticipate that the opposing traffic would initiate a rapidly descending turn. As a result, their initial action of levelling off the aircraft at 4500 feet was insufficient to resolve the risk of collision once C-FANU initiated the spin.

4. The irregular flight path of the spin put the 2 aircraft on a collision course before an evasive turn by JZA7794 caused the aircraft to pass each other, separated by 350–450 feet laterally.

Findings as to risk

1. If manoeuvres related to flight training take place in controlled airspace that is not specifically designated for such training or known to air traffic control, there is an increased risk of collision, as these types of manoeuvres can be difficult for controllers or the crews of conflicting traffic to anticipate.

Safety action

Safety action taken

Sault College

Following this occurrence, Sault College established an internal notification process for operational issues. This information was promulgated through a book entitled *Memorandums*. The purpose of the book is to store corrective measures or changes to the standard operating procedures (SOPs). The book is to be initialled by all pilots following issuance of a new memorandum to ensure that the latest memorandum has been read.

In the first weeks following the incident, Sault College distributed a message to all pilots, requesting them to advise the control tower if spins were planned within 10 nm of the control zone.

Three months after the incident, Sault College published a memorandum detailing the following new procedures:

1. Notify CYAM tower once within 10 nm of the control zone if/when doing spins;
2. Do not to do any spins within the departure/approach paths of the surrounding area aerodromes (CYAM/KCIU/KANJ/CPF2/CPV3); and
3. Contact TOR CTR (Toronto centre) when completing exercises in the VOR (VHF omnidirectional range) area.

In addition to this memorandum, the school followed up with Transport Canada and NAV CANADA with regard to the safety committee's proposed addition of training symbols to the visual flight rules (VFR) navigation chart (VNC). At time of writing of this report, the outcome of the request is uncertain.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 23 September 2015. It was officially released on 15 October 2015.

Visit the Transportation Safety Board'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 transportation safety issues that pose the greatest risk to Canadians. 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.