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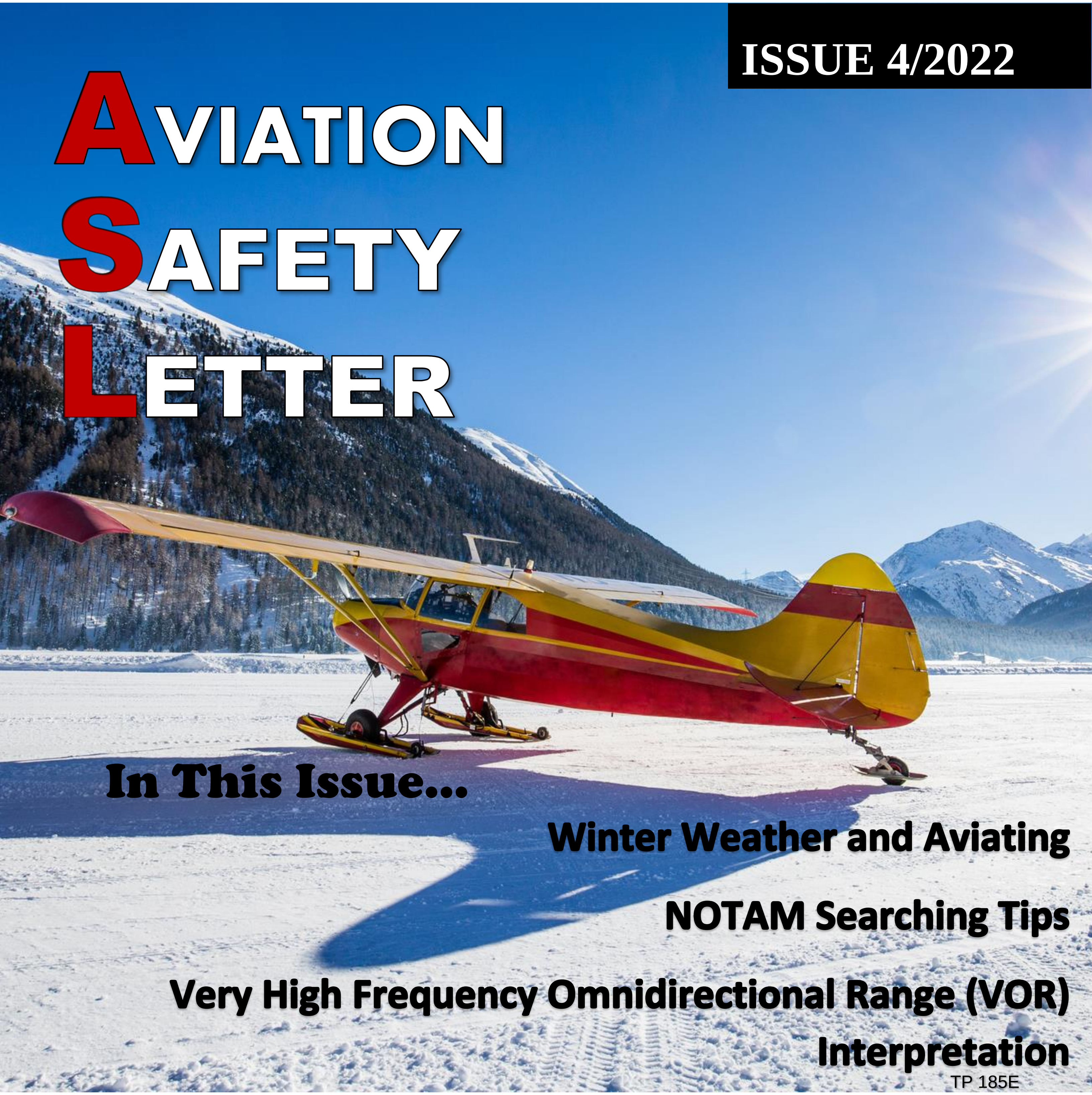
ISSUE 4/2022

Aviation Safety Letter



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Very High Frequency Omnidirectional Range (VOR) Interpretation

TP 185E

Cover photo: iStock

Canada

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Articles, comments and suggestions are invited. The editor reserves the right to edit all published articles. The author's name will be withheld from publication upon request.

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TIPS AND TOOLS

Winter Weather and Aviating

by Bryan Webster and Kevin Elwood, Aviation Egress Training Systems

Preparing for a winter flight starts with being properly dressed in the morning before you head to the airport. There is nothing worse than finding yourself in adverse conditions and being ill-prepared once it's too late.

Passengers' survival when faced with an emergency could depend on the thorough briefing received earlier from you, the pilot, to ensure their safety during all private or commercial flights.

Seriously consider your passengers' clothing upon arrival previous to a departure as they may not be properly dressed for that day's weather conditions.

Photo credit: Doug Ronan
Semi-submerged plane through the ice

Depending on geographical locations across Canada, conditions could include sub-zero temperatures in excess of −40°C until spring returns.

Understand that all persons on board become the pilot's responsibility in the unlikely event you find yourselves stranded, for any reason, in adverse conditions.

In order to dramatically improve survivability during these events, clear thinking and having additional resources on board the aircraft is the answer. A lack of proper winter clothing, including gloves, toques, and footwear, could be the difference between an uncomfortable experience in the wilderness and a real-life survival episode until help eventually arrives.

West Coast pilots and passengers who fly year-round could possibly find themselves standing on a shoreline, soaking wet, and awaiting rescue.

Although temperatures may not be life-threatening, it could be one or more long, cold nights if there is not any dry wood or the ability to light a fire.

One idea is to keep a space blanket, lighter, and anything else you feel is necessary along with the personal floatation device (PFD), which has saved the day in a few cases.

Another consideration would be finding yourself and possibly any number of passengers on top of an inverted set of floats with the aircraft hanging below.

At some point, you must decide the best course of action: whether to stay with the somewhat precarious vessel or swim to a nearby shore until help arrives.

Photo credit: Doug Ronan

Water temperature and swimming distance are the two key decision factors when weighing the options.

Today, all commercial seaplane flights with nine passengers or less on board must be wearing a PFD, including the pilot, so at least the concern over drowning en route has diminished.

Depending on the time of year (early spring thaw after the ice has gone out) or the body of water (Atlantic Ocean) and the temperature, time to function effectively could be limited to only a few minutes.

Also understand that when your emergency locator transmitter (ELT) is submerged in water, it is no longer capable of sending out a distress signal. In most cases, the antenna is on the back of the aircraft, and therefore would be pointing to the bottom of the lake, river, or ocean.

Northern operators may find themselves subjected to bitterly cold winds while huddling on a wide-open frozen lake in harsh conditions, which could cause frostbite or worse.

Both spring and fall for any ski-equipped aircraft offer a host of perils. For example, simply falling through thin ice unable to support the weight of the aircraft. Cold water will quickly rush in and the wings may be the only thing supporting the aircraft and preventing it from sinking, thus forcing all the occupants to depart upward, as the doors could be blocked.

Failing that, a front or back window may be the only way out. In many instances, there is an escape hatch installed in the ceiling of De Havilland products to alleviate this concern.

An extra layer of security may be to carry an additional tracking system as a private operator—similar to most commercial aircraft that are flight followed by their office staff.

In any event, winter conditions demand far more thought as to how pilots must plan their flights compared to any other time of the year.

For further information on this subject, consult one of the numerous books or Internet resources where this material is readily available.

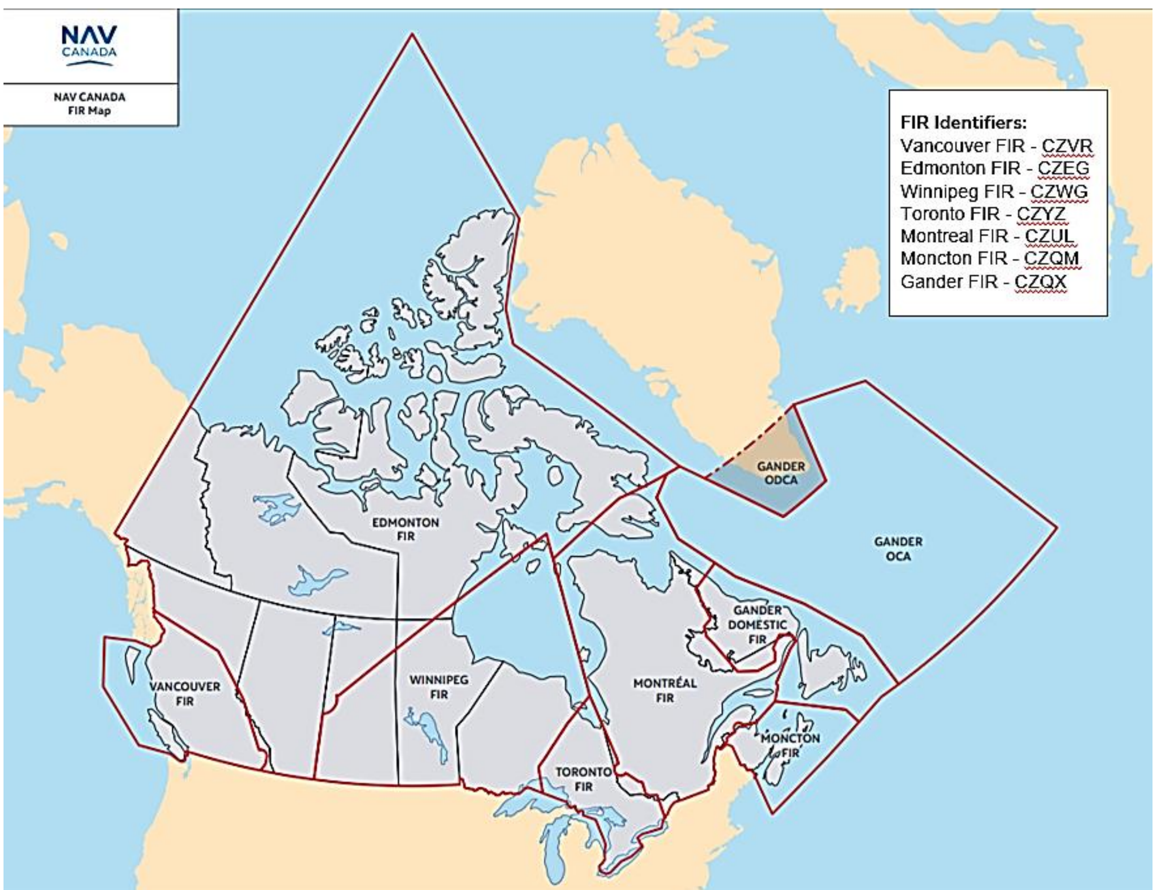
Note to all commercially rated seaplane pilots: Please be advised that as of March 6, 2023, you must be water egress trained as per *Canadian Aviation Regulations* (CARs) 703.98(2)(c.1) and 704.115(2)(a.1). △

Notice to Airmen (NOTAM) Searching Tips

by Phillip Tate, Aeronautical Information Operations Specialist, NAV CANADA

It's a beautiful day for visual flight rules (VFR) flying. You've carefully checked the weather and reviewed the NOTAM for the applicable aerodromes without seeing any concerns. You don't bother to look at the flight information region (FIR) NOTAM because there are so many, and they never seem applicable to your flights. After departing, about halfway through your flight, something catches your eye, and you see people jumping from an airplane above you. They are no more than a mile away and it feels uncomfortably close as you watch them parachute to the ground. You decide to query a nearby flight service station and are advised that you were in the middle of an active parachuting activity. How could this have happened?

NOTAMs published under an aerodrome normally contain information regarding situations affecting only that particular aerodrome's operations. Examples would be NOTAMs regarding runway closures or fuel availability. However, NOTAMs published under the FIR pertain to everything else and can affect both VFR and IFR traffic. Some examples are Transport Canada (TC) airspace restrictions, airshow activities, blasting operations, remotely piloted aircraft system (RPAS) operations, parachuting or gliding activities, and activation of exercise or training areas. NOTAMs on these subjects are only published under the FIR identifier, even if they occur at or in the vicinity of an aerodrome. Although an aerodrome reference is included in the NOTAM text, this is only to help the reader understand where the activity is occurring (as this is easier to visualize than a set of coordinates).



Canada FIR Identifiers Map

The mention of an aerodrome in these NOTAMs is not meant to identify the affected aerodrome(s), especially if the activity covers a large area and multiple aerodromes are in the vicinity of the activity described in the NOTAM. Typically, the aerodrome closest to the event is used as a reference. Therefore, a NOTAM search should include searching for NOTAMs issued under the applicable FIR identifiers to ensure crucial information regarding your flight is retrieved.

To help with this, some flight planning tools may take advantage of the geographic reference feature by searching for NOTAMs within a specified radius from a designated route. This is sometimes called a “route radius,” where a user defined distance around the specified flight route is searched for all NOTAMs affecting the flight. This will help to ensure that only applicable FIR NOTAMs are included in the search results. Other tools may have the default selection to only show aerodrome NOTAMs and so a selection must be made to ensure FIR NOTAMs are shown as well.

Regardless of how NOTAMs are retrieved, it is important to review those NOTAMs published under the applicable FIR identifier as well as those NOTAMs published under the aerodromes of interest to ensure that you have reviewed all applicable NOTAMs. By doing so, you will be doing your part in keeping the skies safe. △

INSTRUCTOR’S CORNER

Very High Frequency Omnidirectional Range (VOR) Interpretation: Determining Position Relative to a VOR Station

by John Picone, Brantford Flight Center

The first thing is to understand HOW the VOR sends out its signals. We ALWAYS talk about a VOR *radial*. So, think about the signal *radiating outward* from the station. The purple arrow (Figure 1) indicates the 50° radial; the red arrow lies on the 230° radial. If you had the VOR set up to choose the 50° radial—that is, you’ve turned your omnibearing selector (OBS) and put the number 50 at the top—and the course deviation indicator (CDI) was centred, then you are positioned on that radial. The same with the red arrow radial: 230°.

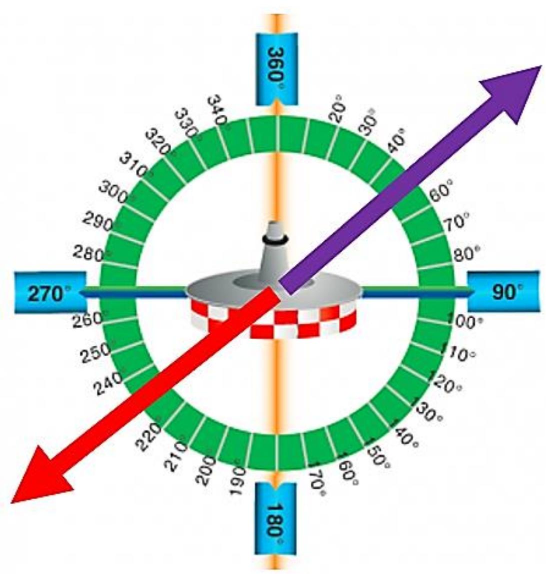


Figure 1

NOW THIS IS IMPORTANT: This only means you are positioned ON the radial; it in NO way indicates your heading. The nose of your plane could be pointed in any direction whatsoever—even up or down! Nonetheless, you are ON that radial.

Here's where it gets tricky. The VOR instrument in your plane not only has an omnibearing selector (OBS) that allows you to choose one of the 360 signals, but it also has a sense indicator which shows "TO" or "FROM." Well, the FROM is pretty straighforward: if my CDI is centred and there's a FROM indication, then I'm on that radial—the radial that is radiating FROM the station. My VOR would look like **A**, (*Photo A*). I'm on the 50° radial.

Photo A

But, what about the TO indication? What if I have 50° at the top (50° radial), my CDI is centered, but I have a TO indication, as in Photo B. What does that mean? Where am I relative to the VOR station? I certainly can't be in the same spot as with a FROM indication. Well, if your OBS has the number 50 at the top, your VOR instrument will pick up that 50° radial from anywhere within range. Now, the 50° radial doesn't *radiate* backwards. But on the southwest side of the station (blue airplane in Figure 2), because your VOR instrument is sort of *behind* the radial (that's why the purple line is broken), the sense indicator points TO the station (as you can see in VOR **B**), instead of FROM the station. And that's why you get a TO indication. So, Rudolph Red is on the 50° radial FROM the station; his VOR looks like **A** (*Photo A*). Brenda Blue, however, is on the 50° radial TO the station and her VOR looks like **B** (*Photo B*).

Photo B

REMEMBER: the airplane's heading makes no difference whatsoever!!! If you're on the 50° radial, *no matter what your heading*, your VOR will read as either Brenda's or Rudolph's.

So, just how do you figure out where you are? The first step is to determine the FROM side and the TO side. That's not difficult: imagine a line perpendicular to the radial at the top of the OBS that simply divides that side of space on the side of the station where the radial *radiates* FROM the station from that side of space where the radial is, as it were, *radiating* TO the station (Figure 3).

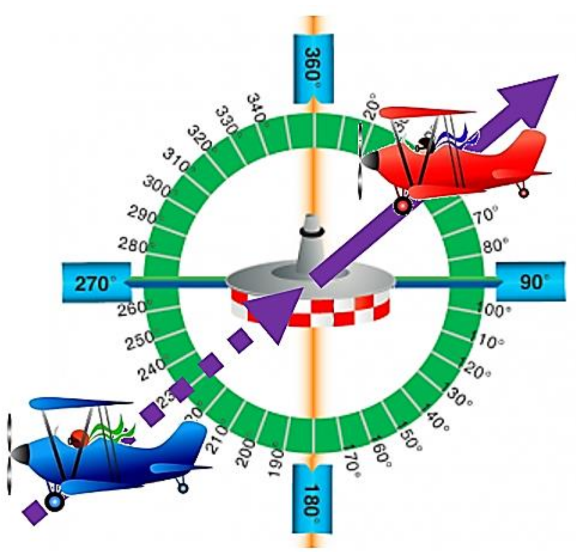


Figure 2

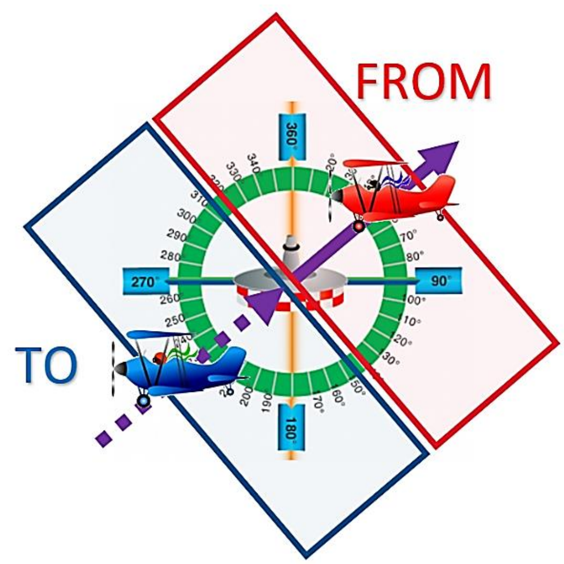


Figure 3

OK, you say, that's easy enough. But what if *I'M NOT ON THE RADIAL AND THE CDI IS NOT CENTERED??? Now, where am I?*

Good question! Here we go…

The CDI always indicates whether you are *right* or *left* of the signal you've chosen. It's really quite simple and to explain it, we're going to put Rudolph Red and Brenda Blue in hot air balloons. The reason for this will become clear to you presently. So, be patient.

Photo C

Study Figure 4 below: It looks like Rudolph Red, with OBS set to 50°, is on the FROM side of the station and he is left of the radial. So, his VOR would look like VOR **C**: CDI deflected to the right because the radial is right of the balloon.

Now, what about Brenda Blue? Well, Brenda, also with her OBS set to 50°, is clearly on the TO side of the station and it looks like she's on the right side of the signal. So, Brenda's VOR would look like VOR **D**. The CDI is deflected to the left because the signal is left of Brenda's balloon.

Photo D

So, where's the difficulty in all this? Well, it might be easy to figure out with balloons because there no heading indicator! There's no "nose" like an airplane. No front and back. Here's where the confusion comes from. Let's put the aircraft back in the picture.

If, in fact, both Rudolph and Brenda (*Figure 5*) are flying in the direction of the sense indicator with respect to the VOR station (FROM the station in Rudolph's case and TO the station in Brenda's case), then things work out in a pretty straightforward manner. The reason is because the signal is, literally, on their right-hand or left-hand side. That is, right or left according to their heading indicator.

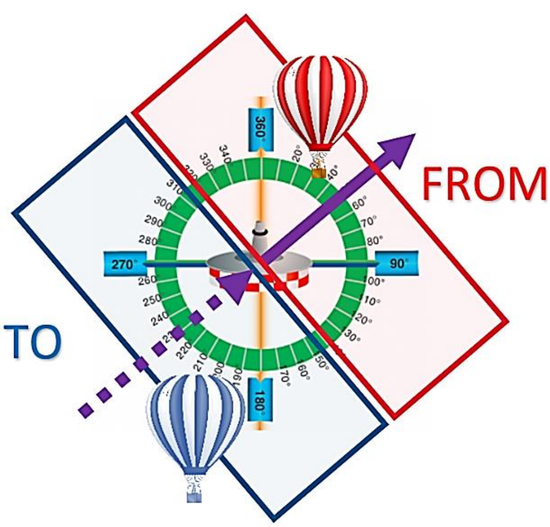


Figure 4

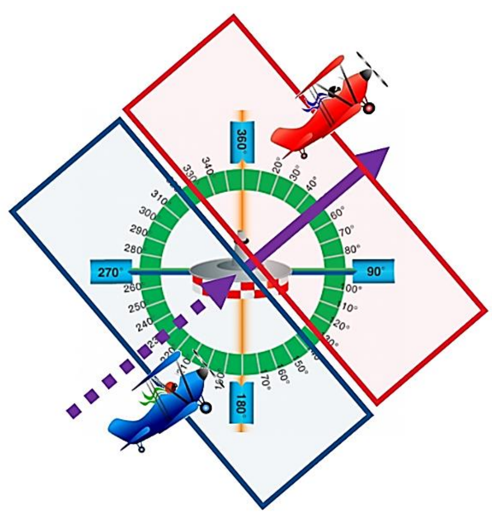


Figure 5

But, remember: **the heading of your airplane has no bearing on whether you are right or left of the VOR signal**.

Carefully consider the situation for Rudolph and Brenda as depicted in Figure 6. Although their heading has changed, their *position relative to the VOR signal has not.* So, their VORs look the same as **C** and **D** (on page 8).

Do you see the problem? Rudolph Red is still *LEFT* of the 50° radial signal! The CDI, therefore, is deflected to the right. But because of the heading Rudolph is flying, it appears—only *appears*, mind you—that the signal is on his left. Brenda Blue is in the same dilemma: her aircraft is still on the right side of the 50° signal, and the CDI is therefore deflected to the left but, because of her heading, she might think she is left of the signal and the CDI should be deflected to the right.

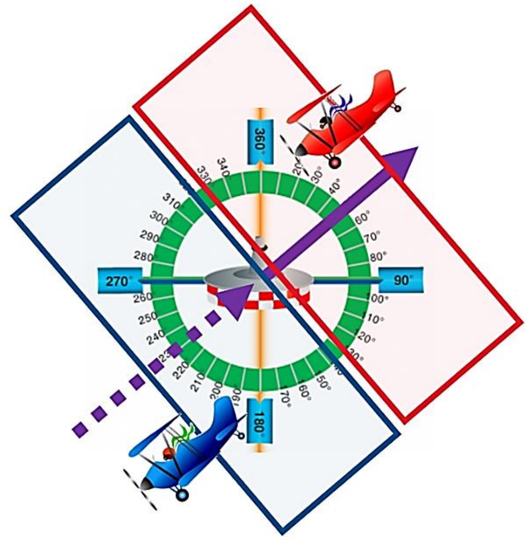


Figure 6

So, you ask, how do I figure out where I am? How do I avoid the confusion that seems to arise from being distracted by the heading of the airplane?

When you set about solving a problem like this, ALWAYS draw a picture if there's not one in the question. Looking at the OBS, determine the TO side and the FROM side of the VOR signal. Then, regardless of the depicted heading of the aircraft in the question, in your imagination or on your diagram, point the aircraft TO the station if the sense indicator is TO; point it FROM the station if the sense indicator says FROM. At least then your heading indicator will be working *with* you; your sense of the right and left side of your aircraft will be consistent with the VOR signal being right or left of the aircraft. In terms of setting up your OBS on a real flight, that, of course, is the way you would navigate TO or FROM the station. *Or, you could just draw in some balloons!* △

ON THE RADAR

Important Notice: 2022-2023 Flight Crew Recency Requirements Self-Paced Study Program

From now on, the Flight Crew Recency Requirements Self-Paced Study Program will no longer be published in its entirety in the *Aviation Safety Letter* (ASL). With the expansion of the exam and technological advances, it will be more convenient to complete the exam online. Each year, a reminder will be published in the ASL with a link to the exam to remind readers that it is now available online.

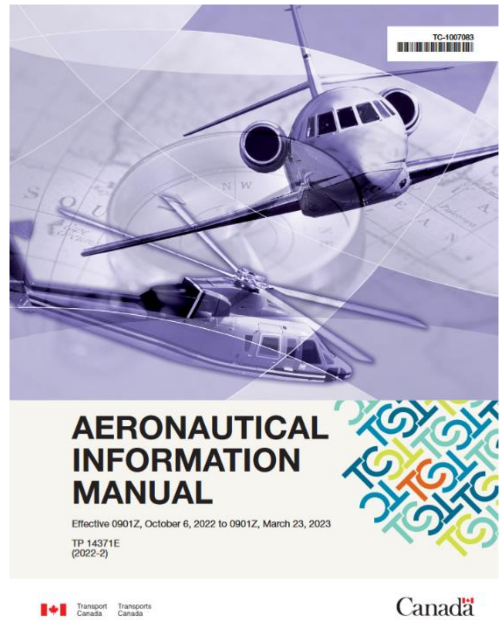
It is important to note that a printable version of the exam will still be available online as a PDF.

If you have any questions or comments regarding the Flight Crew Recency Requirements Self-Paced Study Program, please send an e-mail to the flight crew licensing group at: PilotLicensing-LicencesdePilote@tc.gc.ca △

Let’s Talk About the *Transport Canada Aeronautical Information Manual* (TC AIM)

by Jason Kowalski, Civil Aviation Safety Inspector/TC AIM Coordinator

Greetings. My name is Jason Kowalski, and I am the new Transport Canada Aeronautical Information Manual (TC AIM) coordinator. I am writing to formally introduce myself and share a little bit about the work I do here. As the TC AIM coordinator, I am responsible for planning, coordinating, and executing all our internal and external functions regarding the TC AIM.



Transport Canada AIM, 2022

The TC AIM coordinator works for the Technical Programs, Evaluation and Coordination Division within the Standards Branch and, more specifically, the Safety Promotion Group.

The TC AIM has been developed to consolidate pre-flight reference information of a lasting nature into a single primary document. It provides flight crews with a single source of information concerning rules of the air and procedures for aircraft operation in *Canadian Aviation Regulations* (CARs) of interest to pilots.

The TC AIM is updated and published twice a year, in March and October, following aeronautical information regulation and control (AIRAC) date publications.

ICAO’s Annex 15, Section 6.2 on aeronautical information regulation and control specifies that important changes should be maintained through a predetermined production schedule. The schedule of dates internationally agreed to by AIRAC are for the years 2020 to 2029.

Next’s year’s editions are scheduled for March 23, 2023 and October 5, 2023.

What does it take to publish a TC AIM update?

1. Consultation with Transport Canada’s Office of Primary Interest (OPI) regarding all Transport Canada AIM amendments, changes, and proposals
2. Interior page design (i.e., graphic design)
3. Editing
4. Typesetting
5. Proofreading
6. Printing and distribution

Who can benefit from reading the TC AIM?

- Student pilots

- Recreational pilots
- Private and commercial pilots and crew
- Drone pilots
- Air traffic controllers
- Aviation inspectors and Transport Canada staff
- Airport and aerodrome personnel
- Emergency personnel

Note: The TC AIM is an interpretation of the CARs and its best practices. When in doubt, please consult the CARs.

We want to hear from you! Comments or questions about TC AIM can be sent to: TCAeronauticalInformationManual-Manueldinfomationaeronautique.TC@tc.gc.ca.

Contributors are required to send their requests for amendments or changes in Microsoft Word format. Please note that when sending amendment requests, the track changes function must be used. △

Phraseology Guides

by Nicolas Jean, Shift Manager, Montréal ACC, SMS Coordinator, NAV CANADA

How can you increase efficiency and safety simultaneously? By simply using standard, normalized phraseology. You might have full surveillance coverage, but without communication it is worthless. Standard, normalized phraseology is valid for ground-to-air communications but also for ground-to-ground communications. The last thing you want is having an unauthorized vehicle on your landing runway! Communication is air traffic control's (ATC's) main tool.

The use of the standard, normalized phraseology allows for quick and efficient communication and has a positive impact on frequency congestion. Don't forget that one unclear transmission will generate a minimum of two additional transmissions. In a world without boundaries, the use of the standard, normalized phraseology mitigates the differences associated with language and "foreign" accents. Furthermore, with its limited glossary, standard, normalized phraseology reduces the opportunities for misunderstanding and helps the "hear-back/read-back" process.

A few years ago, and in collaboration with the industry, NAV CANADA developed four phraseology guides: *IFR Phraseology*, *RNAV Phraseology*, *VFR Phraseology*, and *Ground Traffic Phraseology*. These four free guides are available on NAVCANADA.ca and can easily be found by searching "phraseology." △

Aviation Safety Letter (ASL) Article Submission

Do you have an aviation safety topic you are passionate about? Do you want to share your expert knowledge with others? If so, we would love to hear from you!

General information and guidance

The ASL's primary objective is to promote aviation safety. It includes articles that address aviation safety from all perspectives, such as safety insight derived from accidents and incidents, as well as safety information tailored to the needs of all holders of a valid Canadian pilot licence or permit, to all holders of a valid Canadian aircraft maintenance engineer (AME) licence and to other interested individuals within the aviation community.

If you are interested in writing an article, please send it by e-mail to TC.ASL-SAN.TC@tc.gc.ca, in your preferred language. Please note that all articles will be edited and translated by the Transport Canada Civil Aviation (TCCA) Aviation Terminology Standardization Division and will be coordinated by the ASL team.

Photos

In order to captivate our readers' interest, we recommend that you include one or two photos (i.e., photo, illustration, chart or graphic) for each article, if possible. Please send us your photos as an e-mail attachment (preferably as a jpeg).

We are looking forward to hearing from you! △

Cold Weather Operations

The cold weather is upon us and so is the season for de-icing and anti-icing. Past incidents and research have demonstrated that even small amounts of contamination on an aircraft's critical surfaces can have a very large effect on the aircraft's performance and handling qualities. Contamination such as frost with thickness as small as 0.40 mm (1/64 in.) can disrupt air flow over the lift and control surfaces of an aircraft, potentially leading to increased drag, lift loss and impaired manoeuvrability. This is especially true during the takeoff and initial climb phases of flight. Ice can also significantly increase aircraft weight, interfere with the movement of control surfaces, and prevent the functionality of critical aircraft sensors.

Photo credit: iStock

The holdover times for SAE-qualified de-icing and anti-icing fluids are obtainable in the Transport Canada holdover time (HOT) guidelines by visiting the Holdover time (HOT) guidelines for de-icing and anti-icing aircraft page or requesting a copy of the winter 2022-2023 *Holdover Time Guidelines* at services@tc.gc.ca. △

RECENTLY RELEASED TSB REPORTS

The following summaries are extracted from final reports issued by the Transportation Safety Board of Canada (TSB). They have been de-identified. Unless otherwise specified, all photos and illustrations were provided by the TSB. For the benefit of our readers, all the occurrence titles are hyperlinked to the full report on the TSB Web site. —Ed.

TSB Final Report A19O0178—Loss of Control and Collision with Terrain

History of the flight

On 27 November 2019, at approximately 1530, the pilot and six passengers arrived at Toronto/Buttonville Municipal Airport (CYKZ), Ont., where the pilot's private aircraft, a Piper PA-32-260 (United States [U.S.] registration) was parked. Their intention was to conduct a visual flight rules (VFR) flight to Québec/Neuville Airport (CNV9), Que., which is 9 nautical miles (NM) west-southwest of Québec/Jean Lesage International Airport (CYQB), Que. Using the planned direct route, the 372 NM flight was to take approximately three hours.

At 1601, the aircraft departed from Runway 15 at CYKZ. Although the departure took place during daylight hours, the majority of the planned flight, including the landing, was to be conducted at night.

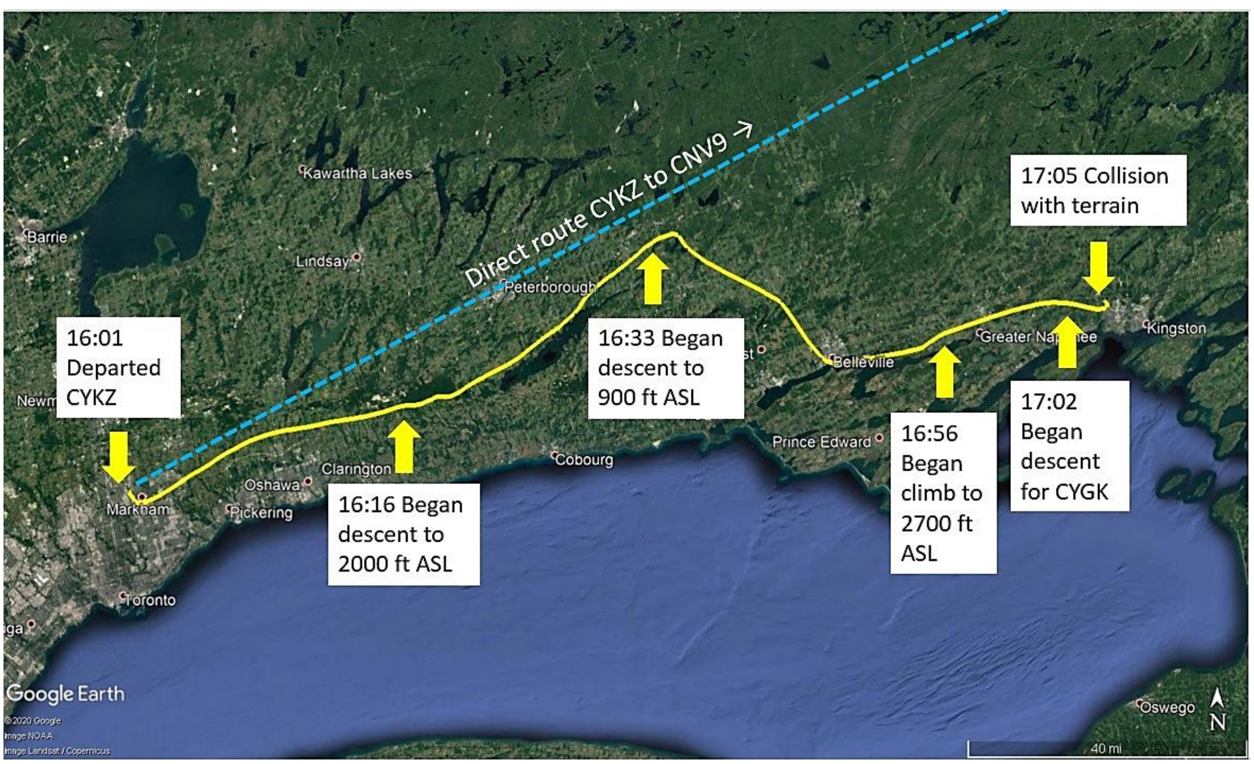


Figure 1. Occurrence aircraft's route as compared to the planned direct route (Source: Google Earth, with TSB annotations, based on data retrieved from the pilot's global positioning system)

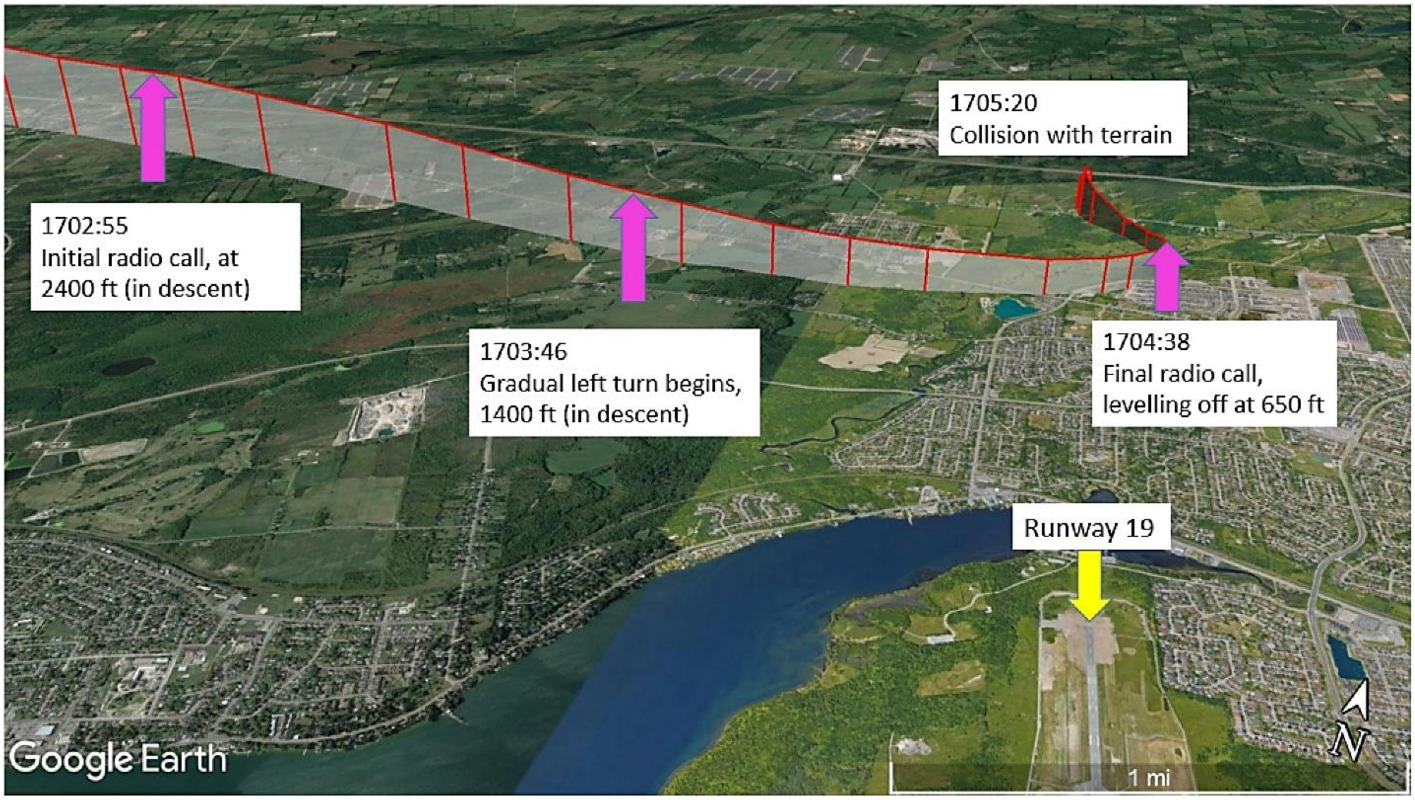


Figure 2. Occurrence aircraft's flight path during communications with the Kingston flight service station (Source: Google Earth, with TSB annotations, based on data retrieved from the pilot's global positioning system)

The aircraft proceeded in the general direction of CNV9 for approximately 33 minutes (Figure 1). It climbed initially to the planned altitude of 3 500 ft above sea level (ASL), where it flew for 15 minutes, before descending to 2 000 ft ASL.

At 1633, the aircraft began a further descent and, at 1635, made a significant deviation toward the southeast, descending to as low as 900 ft ASL (200 ft above ground level [AGL]) near Havelock, Ontario. As the aircraft continued in a southeast direction toward Belleville, Ont., the altitude varied between 1 000 and 2 800 ft ASL. Southwest of Belleville, at 1646, the aircraft turned toward the northeast at 2 500 ft ASL.

At about 1656, the aircraft climbed to 2 700 ft ASL and flew eastward, and then began descending at 1701:45. At this time, the aircraft was approximately 6 NM west of Kingston Airport (CYGK), Ont.

At 1702:55, the pilot made his first radio call to the CYGK flight service station (FSS) indicating that he was 4 NM north, inbound for a straight-in approach on Runway 19. At this time, the aircraft was actually 4.5 NM to the west, tracking 102° magnetic (M), in a steady descent through 2 400 ft ASL at approximately 760 fpm (Figure 2).

At 1703:10, the CYGK FSS flight service specialist asked the pilot to confirm his position. The pilot replied that he was 4 NM to the north. The aircraft was actually 3.5 NM to the west, still tracking 102°M, in a steady descent through 2 200 ft ASL. At the end of his transmission, the pilot began a sentence indicating that he would just overfly the field, but he hesitated and did not complete the sentence.

At 1703:46, the specialist informed the pilot that he had made his initial contact too late, and that initial contact should be made 10 to 15 NM away from the airport. The specialist then requested the original point of departure of the flight.

During this transmission, the pilot began a gradual left turn (away from the airport), while maintaining a steady rate of descent through 1 400 ft ASL, and slowed to about 90 to 95 kt.

As the aircraft continued the left turn at up to a 40° bank angle, it continued descent at a rate approaching 2 000 fpm.

At 1704:01, the specialist asked the pilot for the aircraft type and to confirm his intention to land on Runway 19; the pilot replied to both questions, stating his aircraft type and confirming his intention to land on Runway 19.

At 1704:24, the specialist informed the pilot of the current wind and altimeter setting. He also informed the pilot that he did not have the aircraft on radar and requested the aircraft's current position.

At 1704:38, in a delayed response that would be his final radio transmission, the pilot replied that he was 2.5 NM to the north, which was the actual position of the aircraft as it continued its turn to the left, away from the airport. The specialist responded by indicating that the runway lights were on and asking whether the pilot had the runway in sight.

By 1704:45, the aircraft had descended to about 650 ft ASL (roughly 370 ft AGL) and the airspeed had increased to about 130 kt. At this point, the aircraft pulled up into a steep climb.

During the pull-up, which produced a vertical acceleration of about 1.7 g, the left bank began to reduce.

At 1704:55, while the climb rate was peaking at almost 4 000 fpm, the aircraft rolled through wings level and continued rolling to the right in one continuous motion. The airspeed dropped by as much as 7 kt per second in the steep climb.

By 1704:59, the airspeed was approaching 60 kt. At this point, based on estimates derived from the data contained in a global positioning system (GPS) retrieved at the accident site, the angle of attack and lift coefficient increased rapidly, the pitch angle dropped, and the right roll increased rapidly. The specialist attempted to contact the pilot. The aircraft was on the extended centreline of the approach for Runway 19, heading away from the airport.

At 1705:02, the aircraft's altitude reached a peak of just over 1 400 ft ASL before the final descent began. The final data points suggest that the airspeed fell to about 30 kt, the descent rate reached 2 500 fpm, and the aircraft rolled right and inverted into a steep nose-down attitude.

The specialist made numerous attempts to contact the aircraft following their last transmission, but there were no further radio broadcasts from the aircraft.

A 406 MHz emergency locator transmitter (ELT) signal was received by the Canadian Mission Control Centre in Trenton, Ont. Two aircraft were dispatched and began an aerial search, while some Kingston police officers were dispatched to perform a ground search.

At approximately 1940, the aircraft was located in a wooded area 3.5 NM to the north of CYGK. All seven occupants were fatally injured. The aircraft was destroyed and there was no post-impact fire.

Personnel information

The pilot held a valid private pilot certificate issued by the Federal Aviation Administration (FAA) in the U.S. He did not hold a Canadian aviation document, nor was he required to by regulations. He was operating a U.S.-registered aircraft in Canada on the basis of his FAA certificate and was certified in accordance with existing regulations in the USA.

The pilot began flight training in April 2017 and obtained his U.S. private pilot certificate in May 2018. He had accumulated 281 total flight hours before the occurrence flight, including 190.2 hours on the occurrence aircraft since purchasing it in February 2019.

According to his personal logbook, he had accumulated 29.7 hours of night flight time, of which 20.7 hours were in the occurrence aircraft.

Aircraft information

Records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. Nothing indicates that there was any airframe failure or system malfunction before or during the occurrence flight.

According to the *Piper Cherokee Six Owner's Handbook*, the stall speed of the aircraft with flaps up is 70 mph.

Weight and balance

The maximum take-off weight for the occurrence aircraft was 3 400 lb. The most recent weight and balance report for the occurrence aircraft was dated June 2010. This report stated the empty weight as 1 929.25 lb, leaving a useful load of 1 470.75 lb (for passengers, fuel, and baggage).

The investigation did not locate any documentation indicating the weight and balance calculation for the occurrence flight; however, weight and balance calculations completed by the TSB after the occurrence indicate that, at the time of takeoff, the aircraft was approximately 200 lb over the maximum permissible take-off weight.

Based on fuel consumption estimates, the aircraft was approximately 100 lb overweight at the time of the occurrence.

Meteorological information

Weather information checked and available during flight planning

On 25 November 2019 (two days before the occurrence flight), the pilot began to plan the occurrence flight using the ForeFlight Mobile application installed on his tablet, entering a direct route between CYKZ and a few airports in the area around the city of Québec. On 26 November, the pilot entered a direct route between CYKZ and CNV9, with a few different proposed altitudes, one as high as 13 500 ft.

At 0830 on the morning of the occurrence flight (27 November 2019), a proposed departure time of 0830 the next morning (28 November 2019) was selected. Nearly an hour later, at 0925, after having reviewed numerous weather charts, the proposed departure time was adjusted to 1530 the same day. It was later reported that the pilot made the decision to leave on the occurrence day due to snow in the forecast for the next day.

The graphical weather products viewed on the pilot's ForeFlight account[1] were depictions of a scale that covered the entire continental USA. The weather shown on these charts did, however, depict weather over the intended area of the occurrence flight, which closely adjoined the Canada–U.S. border.

The 1300 surface analysis chart was accessed at 1529, 32 minutes before departure. It showed a large area of low pressure centred on the Great Lakes and moving toward the proposed route of flight. This type of weather system is typically associated with precipitation, reduced visibility, and low ceilings.

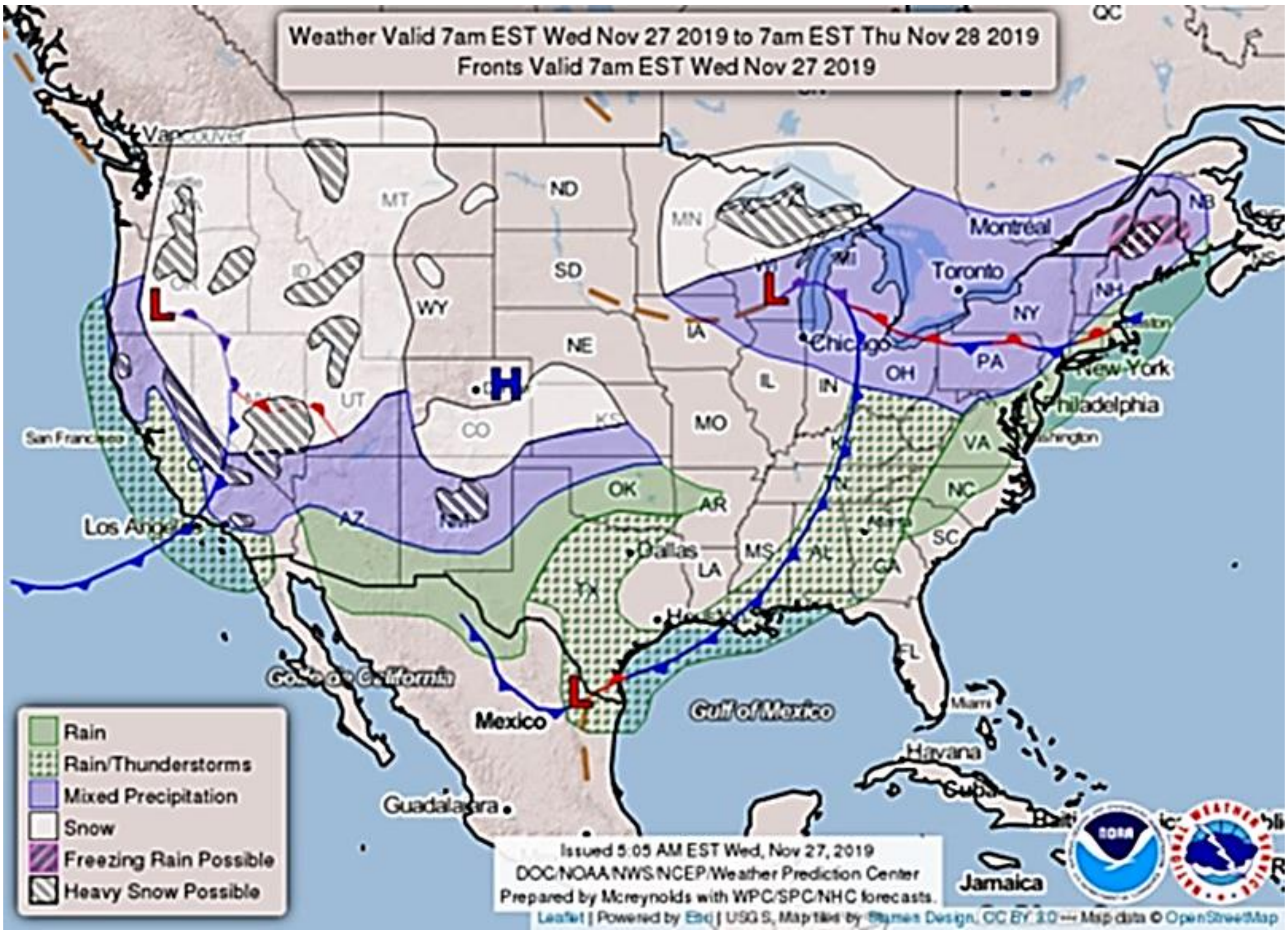


Figure 3. Forecast for 27 November 2019, accessed by the occurrence pilot through ForeFlight (Source: National Oceanic and Atmospheric Administration)

[1] The pilot's tablet recovered from the accident site was so severely damaged that it was not possible to retrieve any information from it. However, the TSB obtained information from ForeFlight, which included the flight planning data that the occurrence pilot viewed before the flight, such as the weather information, routes, and airport information that was viewed.

The low-pressure system depicted on the surface analysis was consistent with a chart the pilot viewed that morning entitled “Today’s Forecast,” produced by the U.S. National Oceanic and Atmospheric Administration (NOAA) and the U.S. National Weather Service (Figure 3). The NOAA chart clearly depicts a wide area of mixed precipitation (rain and snow) over the entire route of the planned flight.

Other aviation weather products, such as aerodrome routine meteorological reports (METARs) and aerodrome forecasts (TAFs), were available using ForeFlight when the pilot viewed the departure and arrival airport information on the morning of 27 November 2019.

CYKZ and CNV9 do not issue METARs and TAFs. The airport nearest to the arrival airport (CNV9) that issues a TAF is CYQB, which is 9 NM east-northeast of CNV9. For the expected arrival time of approximately 1900, the forecast was for winds from 070° true (T) at 20 kt, gusting to 30 kt, 1 statute mile (SM) visibility in light snow, and an overcast ceiling at 600 ft AGL. There was also a 30% probability of ¼ SM visibility, heavy snow, blowing snow, and an obscured ceiling at 400 ft AGL.

TAFs for the airports along the route of flight indicated that there would be strong, gusty winds, and periods of reduced visibility and rain at each of these airports, during the period of time that the aircraft would be overflying them.

The TAF for Ottawa/Macdonald-Cartier International Airport (CYOW), Ont., indicated that for the time that the flight would be passing overhead CYOW, which was 1.5 hours after departure on the proposed route of flight, the visibility was expected to drop as low as 2 SM, and the ceiling to be as low as 600 ft AGL.

At the time of departure from CYKZ, the METAR at CYOW indicated visibility of 3 SM due to light rain and mist, with a temperature of 3°C, and a dew point of 2°C.

Prior to departure, the pilot had asked around inside the terminal building at CYKZ and obtained assistance to access weather information for his planned route that day. The pilot had reportedly shown a weather forecast map to an acquaintance and had pointed out an area of precipitation near the destination, but the pilot had said that it would not be a problem because it was not a very large area, and he could simply fly around it.

Weather encountered en route

At the time of departure, there were two significant areas of precipitation depicted on Environment and Climate Change Canada radar between CYKZ and CYOW, approximately halfway to the planned destination along the flight-planned route. The first area, a narrow band of precipitation in a line from the northwest to the southeast, would be encountered near Peterborough, Ont. Reduced visibility due to rain, mist, and low cloud (600 ft AGL) were reported in the area at the time of departure. The second area contained more intense precipitation echoes and was widespread. The weather was moving in an eastward direction and the western edge formed a ragged line from the Pembroke, Ont., area to the Kingston area.

After flying for about 33 minutes, the aircraft descended to as low as 900 ft ASL and altered course from northeast to southeast. The weather radar at this time showed a band of weather from the northwest to the southeast, directly in the flight path of the aircraft before its diversion. The METAR for a nearby station (Peterborough) at 1626 reported a broken ceiling of 600 ft AGL and a visibility of 6 SM with light rain and mist.

After turning to the southeast, the aircraft flew in that direction until it reached the Belleville area, after which it returned to an eastbound direction. Although clear of the weather that resulted in the diversion, the aircraft then approached a larger band of weather and precipitation near the Kingston area.

The radar depicted some gaps in the precipitation, where the ceiling and visibility would have likely been more favourable, but these gaps appeared to be getting smaller as the weather progressed eastward.

At 1700, 5 minutes before the occurrence, the CYGK METAR reported winds from 060°T at 5 kt, visibility of 5 SM due to mist, scattered cloud at 700 ft AGL, and a ceiling overcast at 4 000 ft AGL. Weather radar obtained after the occurrence indicated that at 1700 there was moderate to heavy precipitation just to the west of Kingston, as the aircraft was approaching the airport (Figure 4).

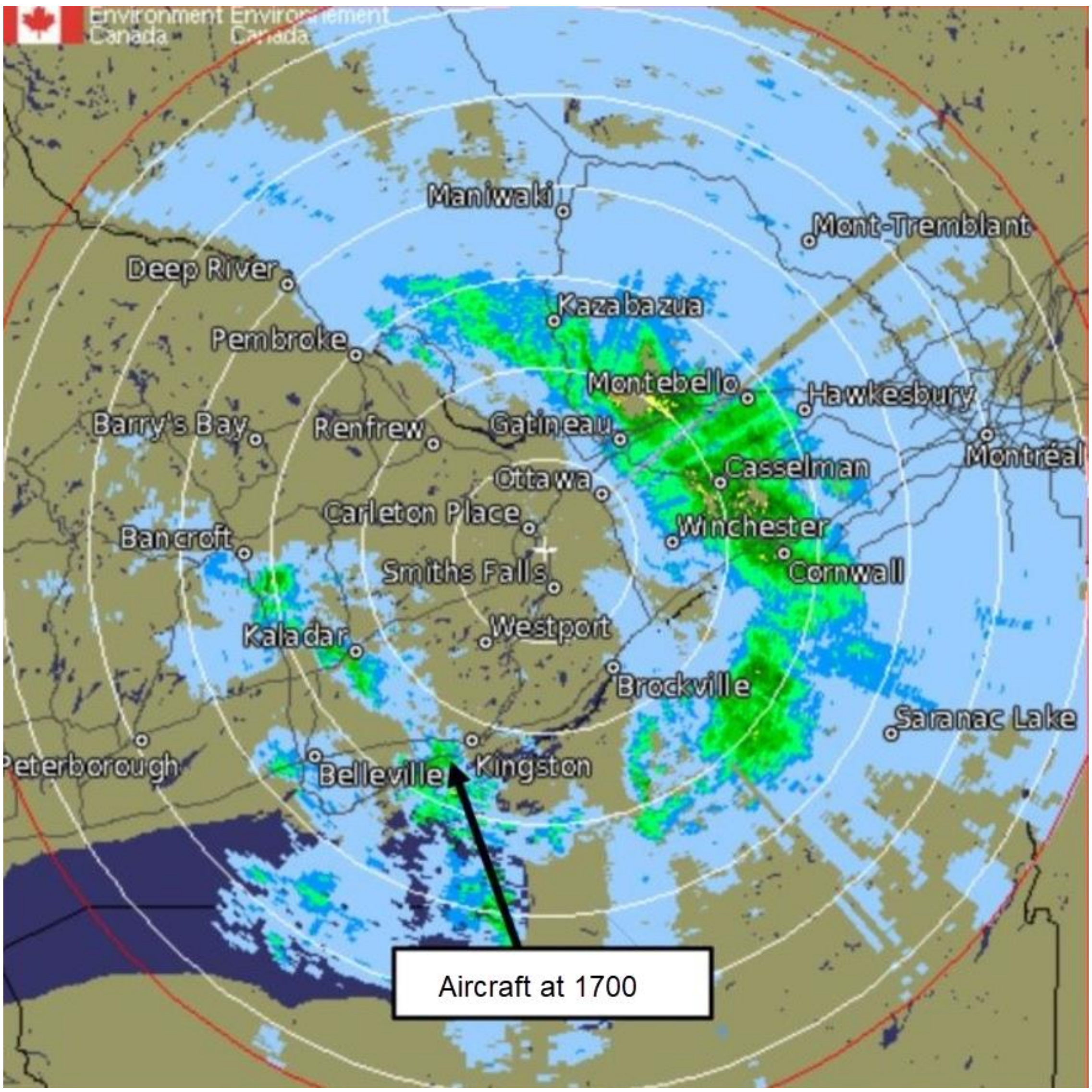


Figure 4. Franktown, Ontario, weather radar at 1700 Eastern Standard Time, showing moderate to heavy rain just west of Kingston, and the approximate position of the occurrence aircraft. (Source: Environment and Climate Change Canada, with TSB annotations)

Due to the cloud cover, combined with the precipitation and reduced visibility, the sky would have appeared to be dark well before official night (the end of civil twilight) began in the Kingston area, at 1702.

Aids to navigation

The aircraft was equipped with an autopilot and two GPS units. The pilot also had a tablet with the ForeFlight Mobile application installed on it, which he used for flight planning and navigation.

ForeFlight Mobile

ForeFlight Mobile is an application for smartphones and tablets. It is used by pilots to aid in a variety of pre-flight tasks, such as flight planning (including accessing weather information), flight plan filing, accessing aviation navigational charts, and aircraft weight and balance calculations.

The application also has the capability to be used in flight and can display aviation charts with the aircraft position depicted in real time (moving map), provided that the device being used has GPS reception.

The occurrence pilot had a Basic Plus subscription to U.S. ForeFlight, which includes navigational maps for the USA only, although there is some overlap in map coverage near the Canada–U.S. border. This overlap would enable the occurrence pilot to conduct the entire planned route of flight without having to purchase navigational charts for Canada.

The aircraft was equipped with an ADS-B In receiver,[2] which has the capability to display weather and traffic information on the ForeFlight Mobile moving map display while airborne. However, because ADS-B In in the USA is based on receiving data from ground-based stations, aircraft need to be in range of an ADS-B ground-based station to receive this data. Because this type of system is not available in Canada,[3] the pilot would have received weather only if he had been in range of a U.S.-based ADS-B ground station.

Communications

CYGK is located within a Class E control zone, for which a mandatory frequency exists,[4] and which extends 5 miles around the airport and to 3 000 ft above aerodrome elevation. Weather information for CYGK can be obtained while airborne through the automatic terminal information service (ATIS) broadcast. At the time of the occurrence, the pilot had been communicating with the Kingston FSS (see “Factual information” section)

Wreckage and impact information

The aircraft wreckage was located in a wooded area approximately 1 NM northeast of the community of Westbrook, Ont., and 3.5 NM north of CYGK. The elevation of the impact site was approximately 400 ft ASL.

[2] This ADS-B In receiver can be mounted in the panel of the aircraft, or it can be a portable unit.

[3] Canada uses a GPS-based ADS-B system and does not have the same ADS-B In system for weather or traffic information.

[4] A mandatory frequency (MF) means “a VHF [very high frequency] frequency specified in the *Canada Air Pilot* or the *Canada Flight Supplement* for the use of radio-equipped aircraft operating within an MF area.” (Source: Transport Canada, SOR/96-433, *Canadian Aviation Regulations*, subsection 101.01(1).)

Indeed, examination of the wreckage site indicated the aircraft struck the ground while travelling at high speed, in a steep nose-down attitude. There was no pre- or post-impact fire. Further examination of the aircraft wreckage was completed at the TSB regional facility in Richmond Hill, Ont., and nothing was found to indicate there were any pre-impact anomalies of the airframe or engine components.

Pilot decision making

Pilot decision making (PDM) is a cognitive process to select a course of action between alternatives. The FAA defines aeronautical decision-making as "a systematic approach to the mental process used by pilots to consistently determine the best course of action in response to a given set of circumstances. It is what a pilot intends to do based on the latest information he or she has."[5]

According to an educational package from Transport Canada (TC), PDM is a function of time, so that before the flight, there is "ample-time decision-making," and while in flight, in a dynamic environment, there can be "time-critical decision-making." Thorough pre-flight planning allows for informed decisions on the ground to avoid the need for potentially more difficult in-flight decisions.

Night visual flight rules

The flight departed CYKZ at 1601, which meant that the estimated time of arrival at CNV9 would be approximately 1900. Because official night began at 1702 in CYKZ, and at 1634 at CNV9, a significant portion of the planned flight would be undertaken in darkness under night VFR.

During the night portion of the flight, the pilot could have expected some cultural lighting from communities along his intended route, but much less in more remote areas (e.g., cottages, traffic on roads and highways). Furthermore, there were several areas of very little or no lighting and, therefore, areas with no reference to the ground or the horizon. In addition, there was little or no ambient illumination from the moon due to the cloud coverage.

Night flying involves numerous risks owing to poor visual cues, especially on takeoff and landing. The fact that there are few or no visual references at night can lead to various illusions causing spatial disorientation due to the lack of discernible horizon. Night flying in, out of, or over featureless terrain, such as bodies of water or wooded terrain, is difficult. These areas are referred to as black holes.

Flying VFR at night is more hazardous than flying VFR during the day due to human vision limitations, vulnerability to illusions, and the potential absence of external visual cues. Estimating distance from cloud and adverse weather at night or in darkness is difficult for pilots and increases the risk of inadvertent VFR flight into instrument meteorological conditions (IMC), which can quickly result in spatial disorientation and a loss of control.

Simply put, night VFR flight inherently offers the pilot limited visual cues to be able to see and avoid worsening weather conditions. Pre-flight planning is especially important for night flights: specifically, a review of weather conditions and their corresponding impact on the intended aircraft track; the available moonlight; the estimated

[5] Federal Aviation Administration, FAA-H-80803-25B, *Pilot's Handbook of Aeronautical Knowledge* (2016), Chapter 2: Aeronautical Decision-Making, at https://www.faa.gov/regulationspolicies/handbooksmanuals/aviation/phak/media/04phakch2.pdf (last accessed 02 February 2021).

flight time over large bodies of water or areas with little or no cultural lighting; and the flight path's proximity to rising terrain and significant obstacles.

While in flight, it is important for pilots to obtain weather updates and compare visual weather indications at regular intervals for visibility and proximity to cloud against expectations established in the flight-planning phase. Because it is difficult to visually detect and stay clear of terrain and obstacles at night, it is critical that pilots plan and maintain flight above the published maximum elevation figure altitudes published on VFR charts.

Analysis

The investigation found no deficiencies or anomalies with the mechanical operation of the aircraft. The pilot was qualified for the flight, and there is no indication his performance was degraded by medical or pathological factors.

Therefore, in an effort to understand why this accident happened, the analysis will focus on the following areas: the pilot's decision-making, including pre-flight planning and the effect of experience; night visual flight rules (VFR) flight; inadvertent flight into IMC; the operation of aircraft that exceed the maximum permissible take-off weight; and safety belt use.

Decision making

Pre-flight planning

The pilot departed Toronto/Buttonville Municipal Airport (CYKZ), Ont., when the weather conditions for the intended flight were below the limits required for a night VFR flight.

The effect of experience

While the pilot was qualified for the flight, he had held his private pilot certificate for only a short period of time. He did not have an instrument rating and had only limited experience flying at night. Most of the pilot's flying experience was conducted in Texas, where the climate is significantly different from Canada's, and where he would have had greater access to weather information on his tablet while airborne.

Given the pilot's limited flying experience, it is likely that he did not recognize the hazards associated with night VFR flight into poor weather conditions

Night visual flight rules flight

The aircraft departed during daylight hours; however, a significant portion of the planned flight was to be conducted under night VFR. Because it can be difficult to estimate their distance from clouds and adverse weather during the hours of darkness, pilots may inadvertently fly into them, which can result in spatial disorientation, especially for pilots with very little instrument training or without an instrument rating.

The flight was planned over areas that had very little or no cultural lighting at times; therefore, the pilot would have had no reference to the ground during portions of the flight.

Although the area of the collision with terrain was surrounded by cultural lighting, there would have been little or no illumination from the moon, and the pilot would have had difficulty seeing outside visual references owing to a combination of darkness and adverse weather conditions.

The *Canadian Aviation Regulations* (CARs) require the pilot to maintain visual reference to the surface for night VFR flight, but do not define "visual reference to the surface." As identified in TSB Recommendation A16-08, this term has been widely interpreted by the industry to mean visual meteorological conditions, which are based on visibility and distance from cloud.

Finding as to risk

If the CARs do not clearly define what is meant by "visual reference to the surface," night flights may be conducted with inadequate visual references, which increases the risks associated with night VFR flight, including controlled-flight-into-terrain and loss-of-control accidents.

Inadvertent flight into instrument meteorological conditions

After flying for approximately 30 minutes in the general direction of Québec/Neuville Airport (CNV9), Que., the aircraft descended and turned to a southeasterly direction toward Kingston Airport (CYGK), Ont. This manoeuvre was likely in response to encountering poor weather conditions. Weather radar images obtained after the occurrence confirm that there was precipitation in the area at the time, and the METAR for a nearby station also reported low ceilings and reduced visibility.

After the pilot contacted the CYGK FSS and indicated his intention to land on Runway 19, he began to descend and slow down, which denotes the beginning of an approach. During his final radio call, he correctly reported his position 2.5 NM north of the airport, demonstrating that he had some awareness of his horizontal location; he did not convey any sense of urgency.

It is unclear why the pilot then made a left turn away from the airport. However, it is likely that while manoeuvring for landing and attempting to locate the airport visually in the poor weather conditions, the aircraft entered a cloud or area of reduced visibility and the pilot lost visual reference to the surface.

In these circumstances, it would have been difficult for the occurrence pilot to correctly interpret the aircraft's attitude, altitude or airspeed.

Vision is our strongest orienting sense, and when pilots lose this sense by losing outside visual references, the likelihood of disorientation is greatly increased. Spatial disorientation can be overcome by switching to instrument flight. However, the pilot did not have an instrument rating, and had little experience flying with instruments. With only limited instrument flight experience and limited outside visual cues, the pilot likely became spatially disoriented, which led to the initiation of a steep climb and the aircraft commencing a roll from a left bank to a right bank.

At this point, the pilot lost control of the aircraft, the airspeed dropped well below the stall speed, and a rapid descent ensued. The aircraft rolled inverted into a steep nose-down attitude before impacting the ground.

Finding as to causes and contributing factors

While the aircraft was approaching CYGK, the pilot likely lost visual reference to the surface, became spatially disoriented, and lost control of the aircraft.

Findings as to causes and contributing factors

These are conditions, acts or safety deficiencies that were found to have caused or contributed to this occurrence.

The pilot departed Toronto/Buttonville Municipal Airport, Ont., when the weather conditions for the intended flight were below the limits required for a night visual flight rules flight.

Given the pilot's limited flying experience, it is likely that he did not recognize the hazards associated with the night visual flight rules flight into poor weather conditions.

While the aircraft was approaching Kingston Airport, the pilot likely lost visual reference to the surface, became spatially disoriented, and lost control of the aircraft.

TSB Final Report A19P0187—Collision With Terrain

History of the flight

On 21 December 2019, the privately registered Cessna 172H aircraft was conducting a visual flight rules (VFR) flight from Courtenay Airpark (CAH3), B.C., with only the pilot on board. Shortly after departing CAH3, the aircraft appeared on radar at 1132 climbing through 1 900 ft above sea level (ASL). At 1203, the aircraft levelled off at 17 400 ft ASL. For the next 15 minutes, it followed the planned flight path for the air-sampling mission with a pattern of flight consistent with previous air-sampling flights, including a transponder code change at 1214.

When the aircraft reached 9 500 ft ASL at 1217, it did not level off to conduct a sampling as planned. Instead, it descended through 9 500 ft ASL on a steady track heading southwest and continued its descent for 4 minutes at 80 to 100 kt groundspeed and an average rate of 1 800 fpm, until it was no longer visible on radar. The last radar return was at 2 800 ft ASL. There was no record of any radio communications from the aircraft.

The on-board National Oceanic and Atmospheric Administration (NOAA) sampling equipment's global positioning system (GPS) indicated that the aircraft came to rest at 1222 (Figure 1). It had struck trees and collided with the ground near Stewardson Inlet, B.C. The pilot was fatally injured. The aircraft was destroyed. There was no post-impact fire.

Note: Flight data for the 27 November flight comes from the NOAA GPS, which only captures data from the first to the last sample.

Figure 1. Flight paths of the occurrence flight and the previous sampling flight, based on NAV CANADA radar and National Oceanic and Atmospheric Administration GPS data (Source: Google Earth, with TSB annotations)

When the pilot did not return to his home at the expected time, a ground and air search was initiated. The local police were contacted just less than 4 hours after the accident, and approximately 5½ hours elapsed between the time of the accident and the time that the Joint Rescue Coordination Centre in Victoria was notified of a possible missing aircraft. The aircraft's 121.5 MHz emergency locator transmitter (ELT) emitted a signal, which assisted the search-and-rescue (SAR) aircraft in finding the occurrence location at approximately 2000. Due to poor visibility, cloud, and heavy rain, SAR personnel could not get to the scene until the following morning.

Pilot information

The pilot held a recreational pilot permit with a valid Category 4 medical certificate. The permit was valid for single-engine, land- and seaplanes, in daytime visual flight rules (VFR) conditions. Additionally, the pilot held a glider licence originally issued in 1995.

Wreckage and impact information

The wreckage was found at approximately 2 600 ft ASL on a steep, densely wooded mountainside, 31 nautical miles (NM) northwest of Tofino/Long Beach Airport (CYAZ), B.C. The damage was consistent with a low-energy impact (Figure 2).

Figure 2. Occurrence site on 12 February 2020, looking west (Source: TSB)

Few treetops and tree limbs were broken. The average height of the trees at the occurrence site was approximately 150 ft.

The fuel tank caps on both wing tanks were secured; both wing tanks were damaged, and no fuel was found in the tanks. The odour that remained in the fuel tanks was consistent with automotive gasoline. The fuel selector was set to BOTH. A note found on the pilot's kneeboard at the occurrence site indicated the aircraft had departed CAH3 with 87 L (23 U.S. gal.) of fuel. A typical air sampling flight would consume about 50 L (13 U.S. gal.) of fuel.

The aluminum fixed-pitch propeller remained attached to the engine crankshaft. Both propeller blades exhibited S-shaped bending and one blade had significant leading-edge damage. The spinner was crushed. These indications are consistent with the propeller turning and the engine producing power at impact.

The aircraft had an oxygen tank installed with an attached nasal cannula. The oxygen tank valve was in the OFF position and there was approximately 500 psi remaining.

Both the left and right control yoke tubes were broken 6 in from their respective control yoke, which is consistent with them being fully out, or in nose-up, elevator position.

The wing flaps were found fully retracted and the elevator trim was found in the neutral position. Because the engine had partially pulled away from the airframe, the positions of the engine controls, carburetor heat, throttle, and mixture at the time of impact could not be determined. The aircraft was equipped with a pitot heat system; however, due to the nature of the impact, the position of the switch prior to the accident could not be determined.

Aircraft information

The occurrence aircraft was a Cessna 172H manufactured by the Cessna Aircraft Corporation in 1967. The aircraft was not certified for flight in instrument meteorological conditions nor in known icing conditions.

The fuel used in the aircraft was a mixture of 100LL aviation fuel and automotive gasoline. The investigation determined that this fuel mixture had been used by the pilot for many years. There is an available supplemental type certificate (STC) for automotive gasoline for this airframe and engine; however, the aircraft's technical records did not indicate that this STC had been completed.

Meteorological information

The closest aviation weather reporting station to the occurrence site is located at CYAZ, 31 NM to the southeast. An aerodrome special meteorological report (SPECI) was issued at 1225 and indicated the following:

- winds calm;
- visibility 10 statute miles (SM) in rain showers;
- scattered clouds at 2 500 ft above ground level (AGL), a broken ceiling at 3 000 ft AGL including cumulonimbus clouds, and an overcast layer at 4 700 ft AGL;
- temperature 6°C, dew point 5°C;
- altimeter setting 29.75 in Hg.

According to the upper winds forecast valid at the time of the occurrence, for the altitudes between 6 000 and 12 000 ft ASL, the winds were forecast to be from 280° true (T) to 230°T at 13 kt, increasing steadily to 28 kt, with temperatures decreasing from −5 °C to −17 °C. At 18 000 ft ASL, the wind was forecast to be from 220°T at 61 kt with a temperature of −28°C.

The local graphic forecast (LGF) issued on 21 December at 0946 and valid at 1000 depicted, in the area of the occurrence, broken ceilings of cumulus clouds based at 2 000 to 4 000 ft ASL, with tops at 12 000 ft ASL and visibility expected to be greater than 6 SM. The forecast included an expectation of occasional towering cumulus clouds with tops at 22 000 ft ASL and visibilities from 4 to greater than 6 SM in light rain showers and mist. Patchy ceilings were expected from 800 to 1 500 ft AGL with local visibility of 2 SM in light rain showers and mist. In addition, the LGF for the occurrence area included towering cumulus clouds with frequent isolated cumulonimbus clouds with tops at 26 000 ft ASL and visibility of 2 SM in thunderstorms and rain with wind gusts up to 30 kt. The freezing level was forecast to be at 2 500 ft ASL.

Lightning strikes were recorded near the occurrence site between 1000 and 1300 and clouds of vertical development were observed on satellite weather imagery just south of the accident site (Figure 3).

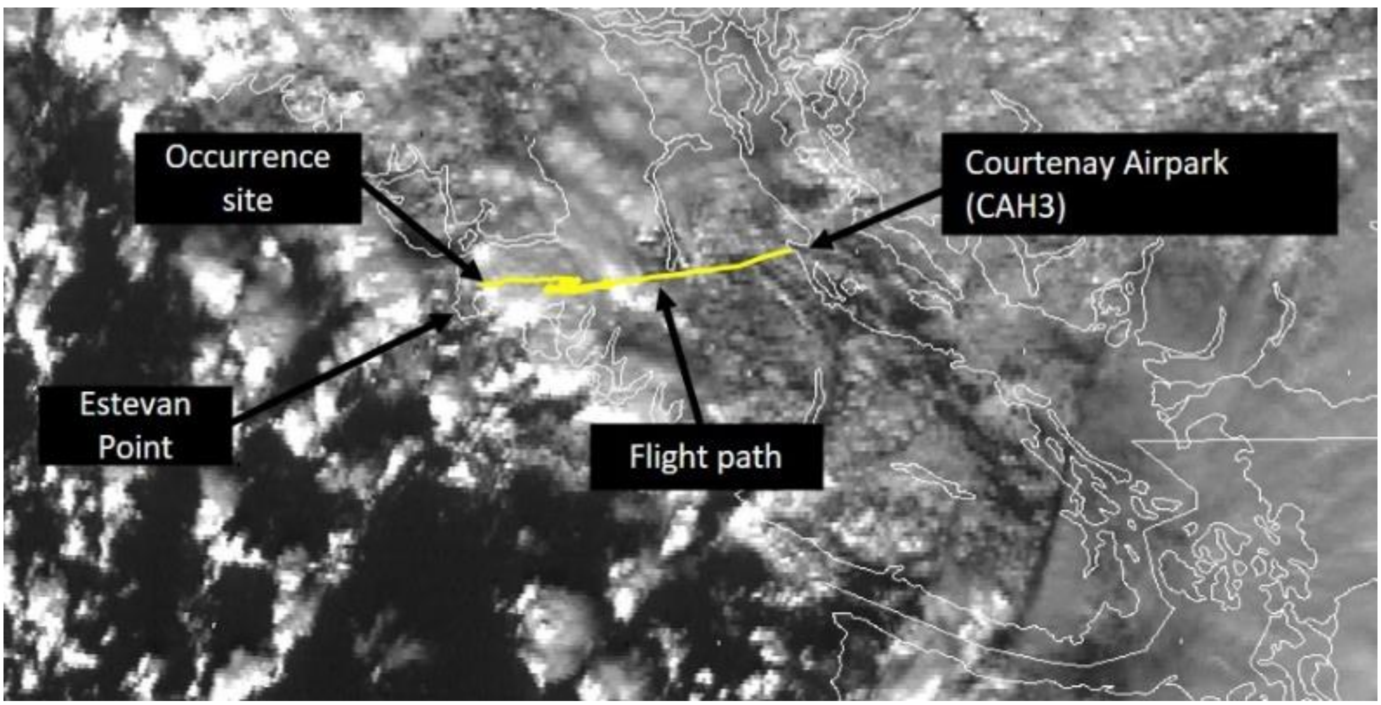


Figure 3. Geostationary Operational Environmental Satellites (GOES) 15 visible satellite image of clouds taken approximately 15 minutes after the accident (Source: Environment Canada, with TSB annotations)

The hazards associated with towering cumulus and cumulonimbus clouds are: tornadoes, turbulence, squall lines, microbursts, heavy updrafts and downdrafts, icing, hail, lightning, precipitation static, heavy precipitation, low ceilings and visibilities.

The *Transport Canada Aeronautical Information Manual* (TC AIM) describes several performance decrements when ice builds up on various areas of the aircraft. Ice on the wings can reduce lift, increase drag and reduce the angle at which the wing stalls. Ice on the propeller can reduce efficiency and create vibrations due to an imbalance. Ice on the windshield can reduce or completely block forward vision.

Emergency locator transmitter

The aircraft was equipped with a 121.5 MHz ELT. As of 01 February 2009, Cospas-Sarsat satellites no longer detect 121.5 MHz distress beacons.

Safety messages

In this occurrence, the aircraft was flying in an area of forecasted convective cloud activity, icing, and instrument meteorological conditions. While the investigation could not determine if any of these affected the occurrence flight, it is important that pilots assess all available weather information before departure, plan alternate routes, and operate within the limitations of their aircraft and the privileges of their licences or permits.

The Cospas-Sarsat satellite system only detects signals emitted by 406 MHz ELTs. As a result, occupants in aircraft equipped only with 121.5 MHz ELTs may be exposed to life-threatening delays in SAR service following an occurrence.

Is it a Micro Drone or a Small Remotely Piloted Aircraft (RPA)?

Micro drones are RPA with a takeoff weight under 250 g. Any payload carried by your drone when it takes off is considered part of its takeoff weight, including cameras, lights, batteries, propeller guards, and any other accessories or attachments. If the weight of these accessories pushes your drone above 250 g, then it is considered a small RPA. In this case, you'll need to register your drone through the Drone Management Portal (DMP), get the appropriate RPAS pilot certification, and follow Part IX Subpart 1 of the *Canadian Aviation Regulations* (CARs).

Regardless of takeoff weight, always operate your drone responsibly to avoid any potential risks to bystanders, buildings, or other aircraft. △

Drones by the Numbers

Curious about how many drones have been registered in Canada, or how many RPAS pilot certificates Transport Canada has issued? Check out the statistics below!

- Number of drones registered: **72 318**
- Number of Basic Pilot Certificates issued: **75 397**
- Number of Advanced Pilot Certificates issued: **8 925**△

*Statistics current to October 31, 2022