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AVIATION SAFETY LETTER

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Canada

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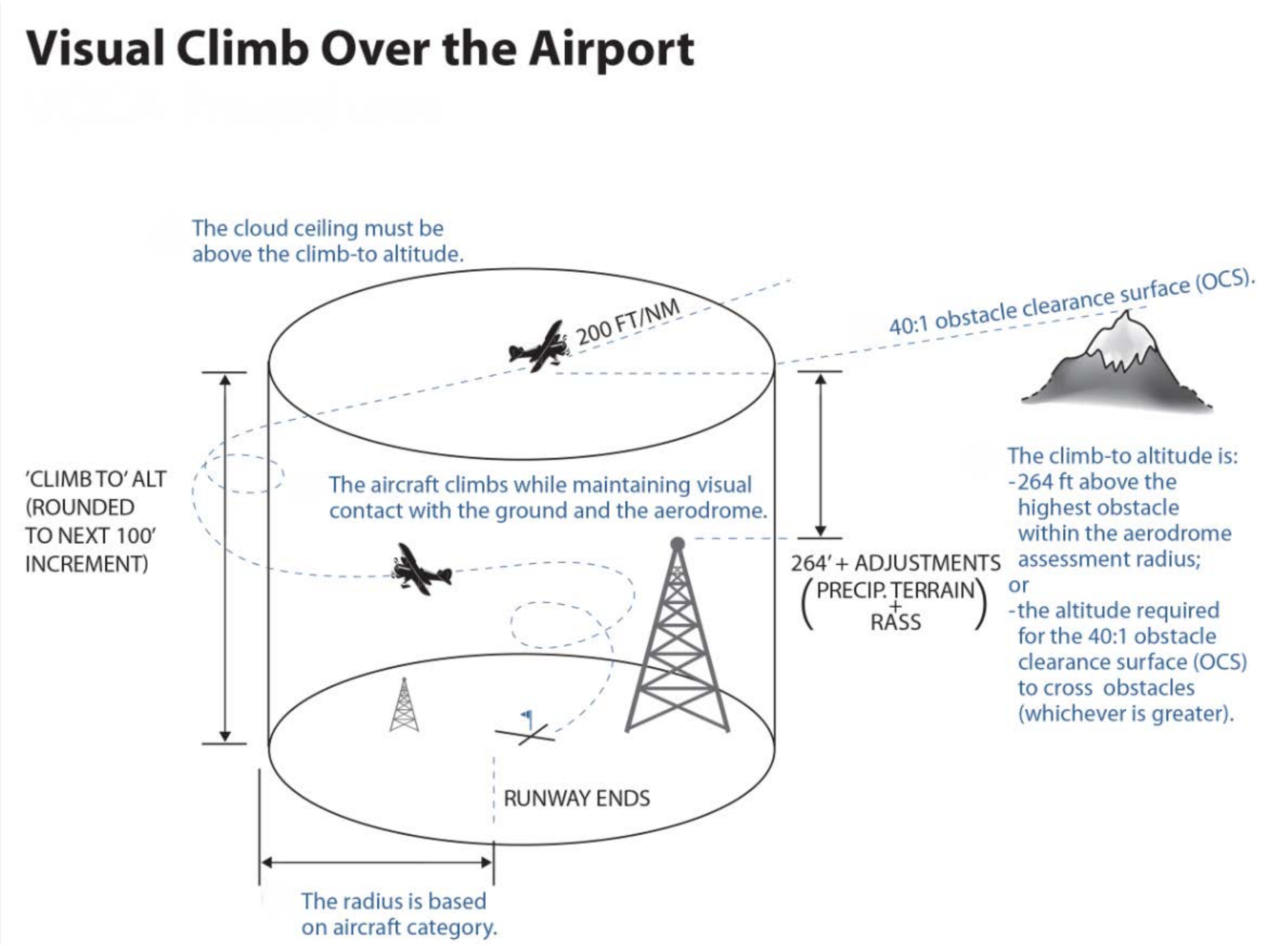
Demystifying the Instrument Flight Rules (IFR) Visual Climb Departure

By Pierre Laroche, Civil Aviation Inspector, Flight Standards, Civil Aviation, Transport Canada

You cannot make the charted climb gradient on that departure route today. Your options include reducing the aircraft take-off weight or waiting for more favourable weather; but did you know that the *Canada Air Pilot* (CAP) may have another option that you may have overlooked?

Nearly all of the aerodromes in the CAP have their runways assessed for instrument flight rules (IFR) departures. Most of these departures have take-off minima listed as ½. This means that standard take-off visibility is ½ SM and that obstacle clearance for the departure path is assured in any direction. These departures assume, amongst other criteria, a standard aircraft climb gradient of 200 ft/NM. Other departures will have an asterisk (*) next to them. The asterisk means that it is a non-standard departure and that the details listed under Departure Procedure (usually on the Aerodrome Chart page) should be followed. These departure procedure notes will usually be split into two parts. One part is a route description with a greater than standard climb gradient, and the other part is the SPEC VIS—visual climb details. "SPEC VIS" stands for specified take-off minimum visibility.

What is the SPEC VIS—visual climb? First off, the visual climb procedure gives a pilot the option to fly a departure designed with a standard climb gradient (instead of the depicted non-standard climb gradient). This provides lower performing aircraft the chance to depart IFR when unable to comply with the requirements of the regular routing. This departure procedure is essentially a visual climb to an instrument departure.



Is this option safe? To ensure safe operation, the visibility (SPEC VIS) and cloud ceiling limits must be adhered to. The SPEC VIS is the minimum visibility required to manoeuvre the aircraft safely during the takeoff and initial climb; the cloud ceiling must be greater than the posted climb-to altitude. The SPEC VIS is dependent on aircraft category, for details see the Operating Minima section of CAP GEN. These weather limits are required for the pilot to position the aircraft correctly and begin the instrument portion of the departure.

How is it flown? A common misconception of the visual climb procedure is that the aircraft must remain overhead the airport as it is climbing. While this may be the best thing to do when visibility is low, it may not be the best thing to do when visibility is good. As long as the pilot is operating visually and can safely return to the aerodrome, the aircraft need not manoeuvre near the aerodrome. This is especially true if there is other traffic operating in the vicinity, such as aircraft doing circuits. The pilot needs only to return to the crossover position (usually the aerodrome of departure) at or above the climb-to altitude to end the visual portion of the departure procedure; at which point, the pilot can then set the heading and commence the instrument portion of the departure. Remember, the pilot is responsible for avoiding all obstructions while climbing visually until reaching the instrument portion of the departure.

The reason that the pilot must cross over the selected location, at an altitude that is at or above the climb-to altitude, is that this now places the aircraft in IFR assessed airspace. From this moment on, if the aircraft continues to climb at (or above) the standard rate (200 ft/NM), and remains on the approved routing, the aircraft will safely reach the en route structure and clear the obstacles that necessitated the higher than standard climb gradient.

Now that you understand the basic concepts behind the visual climb departure procedure, here are a few other considerations to think about.

Will air traffic control (ATC) allow this manoeuvre with today's traffic? ATC may not be accustomed to departing aircraft that return to the field. It may be best to phone them first.

Do you have local area knowledge? It is very important, before you take off visually in reduced weather, that you have a general idea of the terrain and obstacles that you may encounter during your climb.

Is it night time? Even if you are familiar with the terrain, think twice about night time visual climbs—not all obstructions will be lit and terrain is difficult to judge in the dark.

Have you considered your alternatives if you are airborne and the weather takes a turn for the worse? The best option is to maintain or regain visual conditions and return to land. If you are unable to regain visual conditions, continue to climb and turn towards the predetermined departure point; then you can decide whether it is safer to continue to climb en route or to join an approach procedure to the nearest aerodrome.

At which point do you get the IFR clearance? SPEC VIS—visual climb is an IFR departure and therefore the pilot must obtain an IFR clearance from ATC *before* takeoff. This is not to be confused with an aircraft that departs visual flight rules (VFR) and obtains its clearance *after* takeoff.

If the weather is below VFR but above the minimums for a visual climb departure, do you need special VFR to get airborne? An aircraft departing with an IFR clearance for a visual climb departure from a control zone is not required to obtain special VFR as the airspace has already been checked for other IFR aircraft.

Finally, make sure you advise ATC (or traffic) of your intentions BEFORE getting airborne because there is no standard way to do a visual climb. Keeping everyone informed is always good practice.

For additional information on visual climbs over the airport, consult the *Transport Canada Aeronautical Information Manual* (TC AIM) RAC 7.7.1.△

Seconds to Live

By Bob Grant, Civil Aviation Inspector, Flight Standards, Civil Aviation, Transport Canada

Photo credit: Mathieu Pouliot

As you taxi out for what you think will be a routine night trip to another northern aerodrome, you note how truly dark it is. The weather man said there was a new moon, and the forecast weather was 5 000 overcast with visibility 15 plus. There is zero light from above. No problem you say, still a good visual flight rules (VFR) night. You line up on the runway, apply power and start the take-off roll. Little do you know that the trip will end in 66 seconds and that this will be your last flight.

The takeoff is normal and by the book, but things begin to change after you leave the end of the runway. It is now black above and below with no visual references—no horizon, no stars, no moon, and no vehicle lights, farm lights or town lights—nothing but black everywhere. No problem you think, I have my global positioning system (GPS) and compass to guide me. As the gear starts up, you begin a left turn—accelerating and climbing toward destination. About half way through the turn, you turn your head sharply to the left in an attempt to acquire the airport lights but by now they are out (42 s to go). You turn your head back to the front and instantly feel a bit dizzy and nauseous—it must be the extra coffee you had. No problem you say, and you try to stop the turn to your track by rolling wings level (26 s to go). When you feel like the wings are level—remember, there is no visible horizon—you notice that the compass is still showing a left turn. Then, for some strange reason, you feel like you are in a right turn, so you roll back to the left. You also feel that the aircraft is very nose high so you push forward on the yoke (18 s to go). The attitude indicator is now showing 40° of left bank, the compass is still showing a left turn and you still feel like you are turning right (11 s to go); airspeed is in the red, rate of descent is near 2 000 ft/min, and now you feel dizzy, nauseous and very afraid. The instruments are showing one thing but your body senses something different, so the instruments must be wrong (4 s to go). But they are not wrong and the last thing you see before impact is a horizontal image of trees and big rocks and then more black.

The accident investigators are unable to find anything wrong with the aircraft and the pilot was in good medical condition, so what caused the crash? With nothing else to go by, the investigators turn to the following factors.

Spatial Disorientation (SD)

Spatial disorientation (SD) is the inability to determine your relative position in space or, in other words, to know which way is up. This phenomenon is experienced mostly by pilots and underwater divers but it can also be chemically (using alcohol or drugs) or physically induced. To a pilot, it means being unable to interpret the aircraft's attitude relative to the earth's surface or some other point of reference. This is particularly true when a key reference point, such as the horizon, has been lost. It is a condition in which a pilot's perception of position, direction and motion does not match reality. It can be brought on by disturbances (refer to the section on the Barany chair further on) or disease, but it is more typically a temporary condition brought on by flight into poor weather or darkness with limited or no visibility. Take away the external visual horizon and a low time VFR pilot is quite likely to be in big trouble. Unless the pilot can transition to instrument flight easily and safely, due to having qualifications and **recent** instrument flight rules (IFR) experience, a successful and safe outcome is very unlikely.

A few years back, researchers at the University of Illinois conducted an experiment with 20 students. The students were put in simulators in instrument weather conditions and all went into some form of uncontrolled flight that ended with ground impact.

The outcome differed in only one area: how long it took before control was lost. The interval ranged from 20 s to 480 s. The average time was 178 s—two seconds short of three minutes.

Our capacity to know where our body is located or oriented in any setting is based on four physiologic systems. Sensory orientation is provided by our visual system, vestibular system, proprioceptive system, and auditory system. Let us look at each system independently, before looking at how each can break down and, in some cases, provide inaccurate information in flight leading to a crash and, far too often, a fatality.

Visual System

Vision is the most vital sense for determining orientation. Without vision, determining your position on or relative to the ground can be difficult or impossible. Visual perception is often separated into two categories: focal vision and ambient vision. Focal vision is used for object recognition and occurs when light reflected by an object is focused on the fovea at the back of the retina. This process is dominated by photoreceptors known as cone cells. This type of vision relates to the central 30° of the visual field. It can be said that focal vision answers the "what" question and relies on higher cognition for interpretation. Ambient vision, on the other hand, is described as answering the "where" question; it is derived from the stimulation of photoreceptors known as rods in the periphery of the retina and corresponds to the peripheral visual field. Rods function better than cones in darker environments, but rods also detect far less detail and colour. Technically, rods do not perceive colour at all as there is only one kind of rod. On the other hand, there are three different kinds of cones and their signals combine to give us colour perception. Ambient vision is usually processed subconsciously; it can provide vital information about your position relative to the environment, while your focal vision focuses on other unrelated objects.

Dark Adaptation and Night Vision

What you see or do not see at night is dependent on your eyes and their ability to adapt to the dark. When you first enter a dark area, your vision improves very slowly. After six or seven minutes, your eyes are 100 times more sensitive than when you first entered the dark but this does not help much as full adaptation takes 30 min or more. After half an hour, the rods in your eyes can be 100 000 times more sensitive.

This is due to the buildup of a photosensitive chemical called rhodopsin (visual purple), which is one of the keys to night vision. Visual purple is dependent on vitamin A and a healthy diet (especially one that includes eggs, milk, cheese and most vegetables). Vitamin A cannot be stored by the body so it is necessary to eat well-balanced meals before night flying.

Although it takes 30 min for dark adaptation to occur, it can quickly be lost by exposure to bright light. As a result, you should minimize the use of white light in the cockpit. Dark adaptation is an independent process in each eye so if you anticipate exposure to light, close one eye to preserve half of your dark adaptation.

Scanning Techniques

The cones of the eye, used for day vision, provide central vision. The centre of the retina where the lens provides the best focus is called the fovea and is almost exclusively made up of cones; at the periphery of the retina, the perceptual cells are mainly made up of rods. The so-called blind spot at night exists because the cones require a lot of light to work whereas the rods respond to relatively low stimuli. Since night vision uses rods, this creates a very inefficient spot in the center of the eye at night. If you detect something with peripheral vision, the natural tendency is to turn and look directly at it. Night vision is weak at the center of the eye, so you should develop a technique called off-centre scanning. Look away from the object you wish to see and use your peripheral vision.

Autokinesis

A visual illusion called autokinesis is common at night if you stare at one light for an extended period of time. Involuntary muscle twitches cause the light to be displayed on a different portion of the eye, creating the illusion of motion. To avoid autokinesis, use the off-centre scanning technique.

Vestibular System

Although not as dominant as the visual sensory system, the role of the vestibular apparatus—located in the inner ear—is critically important in determining spatial orientation. This system both cooperates with the visual system to assist with the stabilization of an image on the retina when the head and/or body is in motion and acts independently to provide sensory information about the body's position and motion in the absence of vision.

The anatomy of the vestibular apparatus resides within the bony labyrinth of the inner ear, located in the temporal bones of the skull. The cochlea, the vestibule, and the semicircular canals make up the vestibular apparatus. The cochlea is the sensory organ used for hearing. The vestibule is comprised of the otolith organs, the utricle and the saccule, which sense linear acceleration. The semicircular canals sense angular or rotational motion and accelerations of the head. Within the various vestibular end organs is a fluid called endolymph.

Photo credit: Mathieu Pouliot

Although the actual way in which mechanical energy in the form of motion and acceleration translates into a neural input is quite complicated, it is sufficient to say that relative motions and accelerations provoke either movement of the endolymph (fluid in the inner ear) and/or other moving parts within the vestibular apparatus. When these materials move, microscopic projections, known as cilia, physically bend. Depending on which way the cilia bend, a cellular depolarization or hyperpolarization will occur, thus initiating or terminating an action potential that travels down neural pathways to the brain for further interpretation. In this way, mechanical energy from physical motion and position are converted into a neural signal, which is then transformed by the brain into a spatial map of one's orientation. **This spatial map may not be accurate.** In other words, during a turn, climb or descent, once the endolymph stops bending the cilia, the vestibular system thinks that things are back to normal. Since the vestibular system is best at picking up changes in angular motion, a constant rate turn eventually ceases to stimulate. Rolling out of the constant rate turn gives you the impression that you are turning in the opposite direction. During night flight, the problem may be that the earth is not where the brain thinks it is and the visual system may not be helping at all.

Proprioceptive System

The third way in which humans sense their position and motion is through proprioceptors in connective tissue, joints, and the skin. Muscle spindles, Golgi tendon organs, cutaneous mechanoreceptors and other sensory receptors relay information about the relative position and interaction of the body's extremities and skin with its environment (i.e. where you feel pressure, which muscles are engaged).

Auditory System

Lastly, the sense of hearing (acoustic energy transmitted to the cochlea due to vibration of the eardrum through the three small bones known as the hammer, anvil and stirrup) also assists with spatial orientation by perceiving the location of a sound's source.

"Flying by the seat of their pants" describes a situation where sensory cues from the latter three systems are relied upon rather than relying on the dominant sense of vision.

SD is the inability to determine one's position, location, and motion relative to the environment. SD is one of the most common causes of fatal aviation accidents. The death of John F. Kennedy Jr. was likely a result of unrecognized pilot SD. Any pilot at any time can fall prey to this deadly human condition. The main contributing factor leading to this condition is the fallibility of human anatomy and physiology in the flying environment. There is no doubt that the human body did not develop for the purpose of flight. In order to fully understand SD, we must appreciate the anatomy and physiology that allow a person to orient themselves in space.

In order to comprehend SD (as experienced by a pilot), we need to note several characteristics of these sensory systems and how they work together to determine the body's relative motion and orientation. Each of the four senses have specific minimum thresholds beyond which point a particular sensation initiates a neural input perceived by the mind. Below a certain signal intensity, inputs will not be perceived and no action will occur. Studies have been conducted demonstrating that these thresholds—and therefore one's insensitivity to stimuli—increase with inattention. It is easy to see how a pilot who is distracted or not vigilantly monitoring flight instruments is at increased risk of not noticing important sensory information. These senses also demonstrate both adaptation and habituation, which means that responses to persistent or repetitive stimuli decrease or possibly cease altogether over time. This phenomenon allows SD to be intentionally reproduced in an aircraft, simulator, or spinning Barany chair to demonstrate how the mind can be very easily fooled by persistent angular motion, such as what is experienced during a prolonged banked turn on a dark night with no visible horizon.

Barany Chair Training

The importance of the interaction between the above senses must be considered. The vestibular system seems to take a back seat to visual dominance and is enhanced by new and novel sensations. This means that when vision is in command and unobstructed, the mind will far sooner use visual spatial information if the vestibular system provides conflicting data. If, however, a pilot enters instrument meteorological conditions (IMC) or a dark night, visual cues are impaired or nonexistent so the mind reverses the suppressive effect on the vestibular system. This quite often occurs with disastrous results as the vestibular system is prone to very specific and reproducible errors when linear or angular accelerations are maintained for significant periods of time. Even on the ground at 1 G and 0 kt, such as when sitting in a Barany chair, the various senses that provide humans with their spatial orientation can be prone to error. Barany chair training does not really help because the error that produces SD is due to the design of our orientation system, rather than a misinterpretation of it. Experience does not overcome SD. SD training in an aircraft does help because it teaches pilots to rely on their instruments and to ignore their senses. It can now be understood how human biology can predispose pilots to an erroneous perception of their location and motion relative to the earth.

Aircraft on final approach

Photo credit: Dimitrije Ostojic

Night Flight Tips and Traps

1. Night flying is NOT just like day flying in the dark. It requires a totally different mindset, so be prepared.
2. If the night is void of any light (no moon, no stars and no lights on the ground), it may technically be considered visual meteorological conditions (VMC) but you should still make sure that you are proficient on the dials.
3. A couple of flashlights are a must, just in case.
4. If you plan for flight above 4 000 ft, ample oxygen is necessary for adequate night vision. The eye is susceptible to oxygen deficiency and mild hypoxia negatively affects vision. This is especially true at night.
5. Fly higher on a night flight to give yourself more time to handle emergencies.
6. Pre-flight inspection is more difficult at night so consider performing the inspection in the daytime.
7. Although some things stand out at night, clouds do not. They tend to merge with the dark sky. You may not see a cloud until you are flying straight into the side of it.
8. As we age, our vision degrades; if you are over 50, even if your vision is still 20/20, you should consider supplemental oxygen.
9. Make sure you give yourself plenty of time to properly prepare for night flying.
10. Make sure you are night current before you fly at night.
11. Three takeoffs and landings at a well-lit airport do not prepare you for takeoff into a black hole.
12. Review your emergency procedures.
13. Try a cockpit blindfold test with a fellow pilot.
14. Two pilots are usually better than one.
15. Raise your personal safety parameters at night and raise them even more when you are fatigued.
16. Remember, dark adaptation takes about 30 min from when you were last exposed to light and it takes even longer as you get older.
17. In Canada, an instrument rating is not required for night flight. Should there be such a requirement? Perhaps we should have an instrument rating designed for night flying.
18. If you are flying along and the lights ahead suddenly blink, this is a warning that there is something between you and the lights, such as clouds or trees or a pile of rocks. If you have flight-planned properly and you know that you are clear of all terrain, then it is probably weather.
19. Avoid rapid head movement and anticipate the possibility of disorientation.
20. Double-check the weather.
21. We are not nocturnal creatures, and it is much harder for us to see at night. Some critters actually see better at night but we do not.
22. Fatigue and night flight do not mix, so do not go if you are not well rested.

If you are going to fly at night, try to put the odds on your side. While it may seem obvious that flying when the moon is out will help, it will probably surprise you how much it will reduce your chances of an accident. The bottom line is that the darker it is, the more likely you are to have a fatal accident.

SD remains a constant threat to all pilots. Globally, SD is thought to be one of the leading causes of flight accidents with a very high percentage of them ending in fatalities.

Night flying is not for everyone. To some, much of the joy and wonder of flying disappears when the sun goes down. Others love night flying but it is a challenge and it requires a different mindset and preparation. Even those who claim to enjoy aviating after dark acknowledge that there is usually not much to see, and the safety margin is significantly reduced. However, if you do embark on a night flight, make sure to…

… BE PREPARED.

TSB Issues Advisory on Minimum De-Icing Fluid Quantity Calculations

On December 17, 2013, a Boeing 737-300 experienced control difficulties shortly after takeoff from Fort MacKay/Albian Airport (CAL4), Alta., in moderate snow, visibility of ⅝ mi. and a temperature of -22ºC. The 737 departed without delay after being applied with Type I de-ice fluid followed by Type IV anti-ice fluid. At approximately 800 ft AGL, the crew noticed a smooth, consistent and uncommanded left roll. Control corrections were applied to compensate, but the roll continued to approximately 10° left-wing down with full right roll control input. Pitch input was also applied to correct decaying airspeed. The flight data recorder indicated that pitch attitude reached approximately 28° nose-up with the control column in a 10° nose-down position. Flaps were retracted as the airspeed recovered, resulting in dissipation of the left roll tendency. No further difficulties were encountered and no emergency was declared. The crew elected to continue to its destination of Edmonton (CYEG), where a reduced flap landing was accomplished without incident.

The Transportation Safety Board of Canada (TSB) conducted a Class 5 investigation (*TSB File A13W0201*) and determined that the quantity of Type IV fluid applied was approximately half the required amount. The TSB indicated that when an insufficient amount of Type IV fluid is applied, asymmetric lift can occur, resulting in control difficulties. As a result, on September 10, 2014 the TSB sent an aviation safety advisory letter to Transport Canada (TC) stating that the proper application of de-icing and anti-icing fluids is paramount to ensure safe flight operations during periods of active precipitation and in ground-icing conditions. The advisory suggested that TC may wish to amend ground-icing reference material to include a minimum fluid quantity calculation method to increase the awareness of flight crews and de-ice/anti-ice personnel as to how much Type IV fluid is required for safe operations.

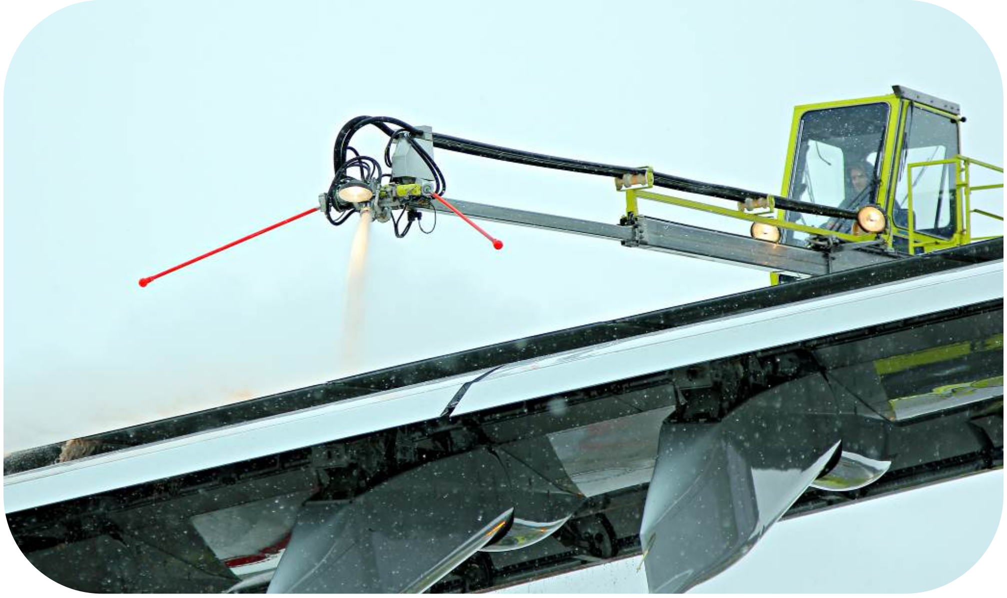
TC replied to the TSB aviation safety advisory in November 2014, explaining that guidance on minimum fluid quantity application already exists. Section 10.6.2.2 of Guidelines for Aircraft Ground-Icing Operations (TP 14052) contains clear, prescriptive wording on fluid usage.

The document states:

> For a typical ethylene-based Type IV fluid, between 1 mm and 3 mm thickness layer is required. It takes 2 L of fluid to cover 1 m^2 to a depth of 2 mm. Since application is never perfect, it will take more than 2 L/m^2 to achieve this 2 mm fluid thickness (In non-metric units, it will take at least 2 U.S. gal./40 ft^2 to achieve 0.08 in.).
>
> Conversion factors:
> 1. 2 L = 0.5284 U.S. gal.;
> 2. 2 mm = about 0.08 in.; and
> 3. 1 m^2 = 10.76 ft^2.
>
> NOTE: For more detailed information on specific fluids, contact the de/anti-icing fluid manufacturer.

Example of an aircrafit getting de-iced

The TC reply to the TSB emphasizes that many anti/de-icing fluids are commercially available and contain, in addition to ethylene glycol or propylene glycol, proprietary chemicals that affect the individual performance of one fluid versus another. Therefore, it is highly recommended that the end user of any fluid consult with the manufacturer to obtain specific usage instructions.



Example of an aircrafit getting de-iced

Nevertheless, TC strongly recommends that all air operators verify that the training portion of their approved ground icing program (AGIP) meets the most recent industry-accepted standards and practices to ensure thorough and sound training procedures for de/anti-ice personnel. Chapter 8 of TP 14052 provides guidance on the use and recommended practices for fluid application. The industry standard is the Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) Aircraft Deicing/Anti-Icing Methods (ARP4737H) and Aerospace Standard (AS) Aircraft Ground Deicing/Anti-Icing Processes (AS6285).

Furthermore, TC has begun a consultative process with its stakeholders, including the operator involved in the December 2013 occurrence, to review and update *Guidelines for Aircraft Ground-Icing Operations* (TP 14052) to ensure the material is reflective of new industry practices, technologies and standards. TC anticipates publishing this document in 2017/2018.

If you have any questions or comments regarding this subject or TP 14052, please contact Yvan Chabot at yvan.chabot@tc.gc.ca. △

Summary of TSB Report A15W0069

An amphibious float-equipped Air Tractor AT-802A Fire Boss was operating in support of wildfire management operations 25 NM northwest of Cold Lake, Alta. This aircraft was the last in a formation of four AT-802A Fire Boss aircraft followed by two CL-215T aircraft. The Air Tractor had completed two drops on the fire, from west to east, with a turnout to the north. When exiting its third drop, the aircraft encountered severe turbulence and then pitched to a nose-up attitude. The aircraft climbed to approximately 400–500 ft above ground level (AGL), where it rolled to the left and entered a nose-down attitude. It struck the ground right-wing low and close to nose level at 16:30 MDT. The pilot was fatally injured as a result of non-survivable impact forces. There was no post-impact fire. △

An amphibious float-equipped Air Tractor AT-802A Fire Boss

TSB Aviation Investigation Report A14W0181—Severe Icing Encounter and Forced Landing

The Cessna 208B was operating from Yellowknife Airport (CYZF), N.W.T., to Fort Simpson Airport (CYFS), N.W.T. The flight had originally been scheduled for November 19, 2014, at 18:00[1], but it was cancelled because freezing drizzle was reported in Fort Simpson. The flight was rescheduled for November 20, 2014, at 6:00. Its early morning departure was intended to enable the regularly scheduled return flight (CYFS to CYZF) to depart CYFS at 8:00 with minimal delay. The aircraft was fuelled to 2 200 lb, as it was normal practice to carry extra fuel for the return flight.

Aircraft after it came to rest on the North Arm of Great Slave Lake.

The pilot reported for duty at 5:00 to prepare for the flight. A pre-flight inspection was performed, wing covers were removed, and no contamination was observed on the wings. The pilot obtained weather information via the Internet and contacted the North Bay, Ont., flight information centre (FIC) to file an instrument flight rules (IFR) flight plan. A request for en route icing condition reports was also made; there were no AIRMETs or pilot weather reports (PIREPs)[2] for the flight-planned route. No other weather information was requested or offered.

Passengers arrived at the terminal at 6:00 and were boarded at 6:30. A passenger safety briefing, which included information on safety equipment and exit locations, was conducted. Passengers were given a verbal explanation of the operation of the doors and they were referred to the passenger safety cards provided. Passenger baggage, along with bulky winter clothing, was loaded into the belly cargo pod.

The aircraft departed CYZF at approximately 6:42 with an IFR clearance to 8 000 ft above sea level (ASL) direct to CYFS. During the climb, the aircraft encountered cloud layers; at approximately 6:51, flying through 6 000 ft ASL, it encountered icing conditions. The aircraft continued to climb and levelled off at 8 000 ft ASL, where cruise power was set. The airspeed did not accelerate beyond 120 knots indicated airspeed (KIAS), and the aircraft began to descend with cruise power set[3]. At 6:59, the pilot contacted the Edmonton, Alta., area control centre (ACC) and requested a lower altitude as he was unable to maintain 120 KIAS. Edmonton ACC cleared the pilot to 6 000 ft ASL direct to CYFS. During the controlled descent, airspeed continued to decline below 120 KIAS even with the application of maximum continuous power.

[1] All times are Mountain Standard Time (UTC - 7).

[2] An AIRMET is a short-term weather advisory intended for aircraft in flight and used to notify pilots of potentially hazardous weather conditions not described in the current graphical area forecast (GFA). A pilot weather report (PIREP) refers to observations of actual weather conditions reported by pilots while in flight.

[3] Normal cruise speed is 156 KIAS (174 kt true airspeed). See the Cessna Aircraft Company, D1329-23-13PH, *Pilot's Operating Handbook and Federal Aviation Administration (FAA) Approved Airplane Flight Manual: Cessna Model 208B*, Revision 23 (May 4, 2007), Table 5-17: Cruise Performance.

At 7:06, a request was made to Edmonton ACC to return to CYZF because of severe icing. The pilot was ultimately cleared to CYZF via ADRIS[4] at 3 000 ft ASL. At approximately 7:10, the pilot advised the company operations control centre, using a company frequency that DA223 was returning to CYZF, with an estimated time en route of 30 min.

The pilot experienced periods of elevator buffeting and uncommanded forward pitch movements during the turn. He continued the descent in order to maintain 110 KIAS. Flap position remained fully up, as the pilot was concerned that movement would further affect tailplane effectiveness.

Edmonton ACC passed control of the aircraft to the Yellowknife air traffic control (ATC) tower at 7:16. At 7:17, the pilot advised Yellowknife tower that the aircraft was in severe icing conditions and was unable to maintain altitude. The pilot was cleared to 2 100 ft ASL (the minimum vectoring altitude). At 7:19, the pilot experienced a significant uncommanded pitch forward and advised ATC that the aircraft was unable to maintain 2 100 ft ASL; a MAYDAY was declared.

Figure 1

At 7:20, when the aircraft was 300 ft above ground level (AGL), the pilot experienced a series of wing drops and an associated rate of descent of 1 200 ft/min at 100–110 KIAS. In response, the power lever was pushed fully forward, exceeding the maximum continuous rating of 1 865 ft-lb of torque. No flap selections were made.

While still in darkness, the aircraft contacted the frozen surface of Great Slave Lake at 7:21 and continued moving for 2 300 ft before it struck a rock outcropping with its nose and left main landing gear. The aircraft came to rest approximately 600 ft from the outcropping and 2 900 ft from the initial touchdown point (see Figure 1). The occupants were not injured, but the aircraft was severely damaged. There was no post-impact fire.

Passenger evacuation was ordered once the pilot had assessed the situation. Passengers attempted to open the main cabin door but were unable to do so. After several failed attempts to evacuate, the passengers succeeded in exiting via the left cockpit door with the aid of cockpit lighting. Cabin lighting had not been turned on. △

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[4] ADRIS is the final approach waypoint for the area navigation (RNAV) global navigation satellite system (GNSS) Runway 10 approach at CYZF.

Answers to the 2016 Self-Paced Study Program

1) Prior permission required. The aerodrome operator's permission is required prior to use.
2) 5
3) control towers; flight service stations (FSSs)
4) 6; 8
5) NAV CANADA flight information centres (FICs)
6) 12 NM on a bearing of 320° from the Princeton Aerodrome (CYDC).
7) An area of non-showery, continuous precipitation.
8) To advise pilots of the occurrence or expected occurrence of weather phenomena, which may affect the safety of aircraft operations.
9) 200 ft obscured.
10) 5 SM, temporarily 1 SM.
11) Temporarily from 1800Z to 2000Z on the 24th, and after 1500Z on the 25th.
12) one hour; half
13) Prevailing visibility is 1¾ SM, variable from ¾ SM to 3 SM.
14) It is given in degrees true.
15) A station altimeter setting for an instrument procedure.
16) 3 000
17) 2 200
18) two miles for non-helicopter and one mile for helicopter; clear of cloud
19) 25; a VFR flight plan or a VFR flight itinerary
20) Report departing from the aerodrome traffic circuit.
21) TC AIM; *AIP Canada (ICAO)*
22) Per the identity page of your ADB.
23) five year; 24 month; six month
24) 300; no guarantee that all such structures are known
25) 10 000.
26) a 30-ft tree
27) five or six; two or five
28) NOTAM; "VFR Chart Updating Data"
29) Per the NAV CANADA Web site.
30) Per the NAV CANADA Web site.
31) from the upwind side; on the downwind leg
32) Per the aircraft manual.
33) Per the aircraft manual.
34) apply enough power; keeping enough weight on the aircraft to prevent it from moving
35) completed reconnaissance of the area
36) 1.56; 25
37) pull the release handle
38) Push the stick forward to maintain speed.
39) Turning.
40) Hold in all free lines, control lines and hoses to avoid entanglement.
41) A propane leak at the valve stem. △

TAKE FIVE...

TP 2228E-26 (10/2016)

for safety

Five minutes reading could save your life!

Let’s Stop UNSARs!

Canada's search and rescue (SAR) crews are amongst the finest in the world. Together, they save hundreds of lives each year in the difficult and demanding role of rescuer. An "UNSAR" is an unnecessary search and rescue alert. When our rescuers respond to UNSARs from emergency locator transmitters (ELT), personal locator beacons (PLB), and emergency position-indicating radio beacons (EPIRB), there is a cost to Canadian taxpayers; however, more importantly, rescue crews are diverted away from real emergencies while endangering their own lives when responding to false alarms in difficult weather conditions. Fortunately, most of these false alarms can be avoided. Owners are strongly encouraged to ensure their device is in good working condition and proper maintenance is carried out to avoid inadvertent transmission. Your emergency beacon should be readily available and functioning properly when you really need it—during an actual emergency!

Some examples of UNSARs include:

- Over 18 hours spent by CASARA and Industry Canada inspectors locating an Aeronca parked in a hangar. The ELT had been accidentally activated.
- 6.8 hours spent by a Canadian Forces Hercules aircraft in locating a helicopter whose ELT was activated during maintenance.
- 4.2 hours of Canadian Forces time to locate an ELT in a courier truck. The ELT had been shipped for maintenance armed and with the batteries in place.

To put the wasted resources into perspective, approximate total operating costs for various military SAR aircraft run anywhere from $3,000 to $5,000 per hour and per aircraft type...no chump change by anyone's standards. Of course, this does not include all the smaller CASARA aircraft.

- You can help minimize this number and amount of time spent dealing with those incidents by:
  - Making sure the ELT is part of your pre-flight check:
    - Secure, free of corrosion and antenna connections are secure
    - Armed
    - Batteries are current
    - Listen on 121.5 to ensure the ELT isn't transmitting
  - After landing—as part of your post-flight routine:
    - Listen on 121.5 to make sure you did not set off the ELT with that bounce on landing.
    - Turn your ELT function switch to "OFF" if practical.

If your ELT does go off accidentally, let an air traffic service (ATS) unit or Joint Rescue Coordination Centre (JRCC) know, advising them of the ELT location and how long it was activated. This may prevent the unnecessary launch of search aircraft. Just turning your ELT off without telling anyone will leave SAR officials in doubt about the incident and whether or not the search should continue.

Any testing of an ELT that transmits on 121.5 MHz must be conducted only during the first 5 minutes of any hour UTC and restricted in duration to not more than 5 seconds. Most 406 MHz ELTs are equipped with an integral self-test function. The manufacturer’s instructions describe how to carry out this self-test and interpret its results. The instructions should be followed closely to avoid false alerts. If your self-test will cause a transmission on 121.5 MHz then it should also only be conducted during the first 5 minutes of any hour UTC. When shipping your ELT for maintenance, turn the ELT function switch to "OFF" and remove the batteries if possible. Finally, take a few more minutes to review the *Transport Canada Aeronautical Information Manual* (TC AIM), SAR 3.0.

2016 Flight Crew Recency Requirements Self-Paced Study Program

Refer to paragraph 421.05(2)(d) of the *Canadian Aviation Regulations* (CARs) standard.

Completion of this questionnaire satisfies the 24-month recurrent training program requirements of CAR 401.05(2)(a).
It is to be retained by the pilot.

All pilots are to answer questions 1 to 30. In addition, aeroplane and ultralight aeroplane pilots are to answer questions 31 to 33; helicopter pilots are to answer questions 34 and 35; glider pilots are to answer questions 36 and 37; gyroplane pilots are to answer questions 38 and 39; and balloon pilots are to answer questions 40 and 41.

References are listed at the end of each question. Many answers may be found in the *Transport Canada Aeronautical Information Manual* (TC AIM). Some of the material is now found in the AIP Canada *(ICAO)*. Amendments to these publications may result in changes to answers and/or references.

1. When an aerodrome is listed in the *Canada Flight Supplement* (CFS) or *Canada Water Aerodrome Supplement* (CWAS) as "PPR", what does this mean?

   ____

   (Ref: TC AIM-AGA 2.2)

2. At aerodromes certified as airports, a dry, Transport Canada (TC) standard wind direction indicator will react to a wind speed of 10 kt with an angle of ___° below horizontal.

   (Ref: TC AIM-AGA 5.9)

3. In the air navigation system, only ______________ and ____ have 121.5 MHz capability, and this emergency frequency is only monitored during these facilities' hours of operation.

   (Ref: TC AIM-COM 1.12.2)

4. Currently, global positioning system (GPS) horizontal and vertical positions are accurate to __m and __ m, respectively, 95% of the time.

   (Ref: TC AIM-COM 5.2)

5. The pilot briefing service is provided by ____.

   (Ref: TC AIM-MET 1.1.3)

6. According to the PIREP below, where was the reporting aircraft?

   UACN10 CYKA 161752

   VR

   UA /OV CYDC 320012 /TM 1751 /FL105 /TP C182 /SK 060BKN100 /RM SCT TCU EMBD

   ____

   (Ref: TC AIM-MET 2.1.1)

7. On a graphic area forecast (GFA), what does a stippled area enclosed by a solid green line symbolize?

   ____

   (Ref: TC AIM-MET 4.11)

8. What is the purpose of an AIRMET?

   ____
   ____________________________.

   (Ref: TC AIM-MET 5.1)

9. Based on the aerodrome forecast (TAF) below, what is the lowest forecast ceiling for CYOW?

TAF CYOW 241741Z 2418/2518 06015G25KT 3/4SM -SN BLSN VV008 TEMPO 2418/2420 3SM -SNPL BR OVC010 PROB30 2418/2420 2SM

-FZRA -PL BR
FM242000 07020G30KT 5SM -FZRA -PL BR OVC010 TEMPO 2420/2504 1SM
FZRA BR OVC004 PROB30 2421/2504 1SM +FZRA BR
FM250400 07022G32KT 2SM -RA BR OVC005
FM250800 08012G22KT 1SM -SHRA BR OVC003
FM251100 09010KT 1/2SM -DZ FG VV002
FM251500 28012KT P6SM -SHSN BKN015
RMK NXT FCST BY 242100Z=

____

(Ref: TC AIM-MET 7.4 and MET 8.3(k))

10. Based on the TAF above, what is the forecast visibility for CYOW at 2100Z? _________________________

(Ref: TC AIM-MET 7.4)

11. Based on the TAF above, when can you expect visual flight rules (VFR) weather conditions in the CYOW control zone?
____

(Ref: TC AIM-MET 7.4)

12. In a TAF, "TEMPO" is only used when the modified forecast condition is expected to last less than ________ in each instance, and if expected to recur, the total period of the modified condition will not cover more than _____ of the total forecast period.

(Ref: TC AIM-MET 7.4)

13. What is the reported visibility in the SPECI below?

SPECI CYMO 232021Z AUTO 07004KT 1 3/4SM -SN BKN011 BKN016 OVC023 M05/M06 A3006 RMK VIS VRB 3/4-3 SLP181=

____

(Ref: TC AIM-MET 8.3 and MET 8.5.4)

14. In a METAR, is the wind direction given in degrees true or magnetic? ______

(Ref: TC AIM-MET 8.3)

15. For an airport listed in the CFS as "UNICOM (AU)", what can the Approach UNICOM (AU) operator provide?
____

(Ref: TC AIM-RAC 1.2.1)

16. Cruising altitudes appropriate to aircraft track shall apply when VFR aircraft are operated at more than __________ ft above ground level (AGL).

(Ref: TC AIM-RAC 2.3.1)

17. Low-level airways are controlled low-level airspace extending upward from _____ ft AGL up to, but not including, 18 000 ft above sea level (ASL).

(Ref: TC AIM-RAC 2.7.1)

18. In uncontrolled airspace below 1 000 ft AGL, the minimum day VFR flight visibility is ________, and the minimum distance from cloud is _____.

(Ref: TC AIM-RAC Figure 2.8 and CAR 602.115)

19. Except where the flight is conducted within _____ NM of the departure aerodrome, no pilot-in-command shall operate an aircraft in VFR flight unless ______________________________________ has been filed.

(Ref: TC AIM-RAC 3.6.1)

20. What radio transmission is mandatory after takeoff from an uncontrolled aerodrome within an aerodrome traffic frequency (ATF) area? ____

(Ref: TC AIM-RAC 4.5.7)

21. Aeronautical Information Circulars (AICs) provide advance notice of major changes to legislation, regulation, procedures or purely administrative matters where the text is not a part of the ____ or __________________.

(Ref: TC AIM-MAP 2.3)

22. When does your aviation document booklet (ADB) expire?___________________

(Ref: TC AIM-LRA 1.2)

23. The flight crew recency requirements address three time periods. To exercise the privileges of your permit, licence or rating you must meet the _________ and _________ requirements. Additionally, to carry passengers you must also meet the________ requirements.

(Ref: TC AIM-LRA 1.12, CAR 401.05)

24. All known objects ___ ft or more AGL are depicted on visual navigation charts. However, because there is only limited knowledge over the erection of man-made objects, there can be ____.

(Ref: TC AIM-AIR 2.4)

25. By _______ ft ASL the partial pressure of oxygen is low enough that all pilots will experience mild hypoxia and some will become symptomatic.

(Ref: TC AIM-AIR 3.2.1)

For questions 26 to 29 refer to AIP Canada *(ICAO)*, available on NAV CANADA's Web site at

26. .*AIP Canada (ICAO)* GEN 1.5.1 describes survival in sparsely settled areas of Canada. According to Table 1.5.1—Survival Equipment, pencil pyrotechnics used for signalling will not go above _______________ in winter.

(Ref: *AIP Canada (ICAO)* GEN 1.5.1)

27. For aeronautical charts covering the less densely populated areas, the topographic base maps are reviewed every __________ years and the aeronautical overlays are reviewed every __________ years.

(Ref: *AIP Canada (ICAO)* GEN 3.2.2)

28. New or revised information which is required to be depicted on VFR Navigation Charts (VNCs) is advertised by ______ until such time as it can be published in the __________________________ section of the CFS.

(Ref: *AIP Canada (ICAO)* GEN 3.2.2)

29. Go to the NAV CANADA Web site and familiarize yourself with the AICs and *AIP Canada (ICAO)* Supplements available at http://www.navcanada.ca/EN/products-and-services/Pages/AIP-current.aspx.
Record the most recent AIC number here: _____

30. What is the date of the most current VNC for your area? ______________ (*AIP Canada (ICAO)* GEN 3.2.5; http://www.navcanada.ca/EN/products-and-services/Pages/aeronautical-information-products-charts-VFR-navigational-charts.aspx)

Aeroplane

31. At uncontrolled aerodromes not within a mandatory frequency (MF) area or when no MF procedures are in effect, aircraft should approach the traffic circuit ______________________. Alternatively, once the pilot has ascertained without any doubt that there will be no conflict with other traffic entering the circuit or traffic established within the circuit, the pilot may join the circuit ____________________.

(Ref: TC AIM-RAC 4.5.2)

32. In the case of an engine failure at 3 000 ft AGL, what is the gliding speed and no-wind range of the aeroplane that you typically fly? ______ indicated air speed (IAS); __________________

(Refer to aircraft manuals)

33. For the aeroplane that you typically fly, what is the proper sequence of actions for a go-around procedure?
____
____
____
____

(Refer to aircraft manuals)

Helicopter

34. Refer to the article entitled "Take Five: Snow Landing and Take-off Techniques for Helicopters" in *Aviation Safety Letter* [TP 185], 1/2008.

When conducting takeoffs in conditions conducive to re-circulating snow, ____________________ to get the snow blowing while ____.

(Ref: *Aviation Safety Letter* [TP 185] 1/2008)

35. Visit the Transportation Safety Board of Canada (TSB) Web site at http://www.tsb.gc.ca/eng/rapports-reports/aviation/.

TSB Aviation Investigation Report A95A0040 says that contributing to the accident was the pilot's decision to conduct a portion of the flight over the river at low altitude without having first ____ for obstructions.

Glider

36. In a level 50° banked turn, the g load will be ____ and the stall speed will increase by ___ %.

(Use glider references)

37. If, when prepared for launch, one of the ground crew shouts "STOP" and raises both hands above their head, the glider pilot must ________________________.

(Use glider references)

Gyroplane

38. If you experience an engine failure during the initial climb, what should you do first?
____.

(Use gyroplane references)

39. When descending in autorotation, if the rotor RPM decreases, what action other than rounding out your descent would increase your rotor RPM? ____________________.

(Use gyroplane references)

Balloon

40. If your balloon contacts a tree and is moving free of it, what should you do to reduce the risk of adverse consequences?
____

(Use balloon references)

41. If frost develops at a propane tank valve stem, what should you suspect is the cause?
____

(Use balloon references)

Date completed ________________________ Pilot ________________________

Answers are found on page 14 of ASL 2/2016.