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# AVIATION SAFETY LETTER

## In this Issue...



*Learn from the mistakes of others;*
*you'll not live long enough to make them all yourself ...*

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Canada

The *Aviation Safety Letter* is published quarterly by Transport Canada, Civil Aviation. It is distributed to 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 free of charge. The contents do not necessarily reflect official government policy and, unless stated, should not be construed as regulations or directives.

Letters with comments and suggestions are invited. All correspondence should include the author's name, address and telephone number. The editor reserves the right to edit all published articles. The author's name and address will be withheld from publication upon request.

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## Table of Contents

# GUEST EDITORIAL

## Regional Aviation Safety Council, Atlantic Region

On February 23, 1909, Canada's first powered flight took place over the frozen Bras d'Or Lake in Baddeck, N.S., when J.A. Douglas McCurdy, a native of Baddeck, piloted the Silver Dart to the dizzying height of 9 m and flew for almost a kilometre at approximately 65 km/hr.

The Flight of the Silver Dart took place that day because Dr. Alexander Graham Bell had a vision of powered flight in Canada. He gathered around him a team of folks who shared his passion for aviation and who possessed the skills and knowledge required to bring his vision to reality. They demonstrated clearly what could be achieved by bringing together experts from different disciplines to work together on complex issues. In February 2009, as we gathered in Baddeck and watched the events surrounding the re-enactment of that first flight, those I spoke with reflected on how far we have come in the past one hundred years, and on the opportunities and challenges that lay before us.

With the increasing complexity of our aviation industry, advances in technology, aircraft design, varied operating environments, increasing traffic levels and complex traffic mix, Transport Canada and members of the aviation community must continue working together to identify and discuss issues impacting aviation safety. This is vital to maintaining and improving the high level of aviation safety in Canada.

In the Atlantic Region, our Regional Aviation Safety Council (RASC) provides an opportunity for members of the aviation industry to meet twice a year and identify, discuss, and resolve issues that have the potential to impact aviation safety. Approximately 70 representatives from all aspects of the aviation community attend the RASC. These include air operators, maintenance organizations, airport operators, Canada's Air Force, representatives from industry associations, labour groups, NAV CANADA and Transport Canada. The Canadian Business Aviation Association (CBAA) typically holds its Atlantic Chapter meeting the night before to allow their members to attend both events. NAV CANADA holds a Customer Service Forum in the same location on the following day, again, allowing participants to maximize the benefit of their trip to the RASC.

The RASC has existed for many years and, more recently, has evolved into the key regional forum for industry to work collaboratively to resolve issues. The members suggest topics for presentations, and agenda items for discussion. The agenda items are discussed in an open forum with suggestions to resolve issues often proposed and, in many cases, implemented. Some proposals require additional information and/or analysis, which are carried out between the semi-annual sessions by industry participants, NAV CANADA or Transport Canada, as appropriate, and presented at the subsequent meeting. The participation of Canada's Air Force has increased civilian and military operators' awareness of each others' presence in the region.

Over the past few years, discussions initiated at the RASC have resulted in the formation of smaller working groups and committees, operating separately from the RASC, to focus on the specific issues. A recent success story involves the collaborative work of the companies operating into the Deer Lake, N.L., airport. Their initial concerns surrounded IFR traffic congestion at certain times of the day into the uncontrolled airport in a non-radar environment. A working group composed of air operators and NAV CANADA was formed, which allowed the operators to discuss the issues and agree on solutions to address their concerns. As a result of the discussions, and with the agreement of the operators concerned, NAV CANADA implemented a voluntary pilot project involving pre-departure clearances for those companies involved. The project was a success and the pre-departure clearance system is now in place at the Deer Lake airport.

A similar agenda item concerned traffic volumes and mix at the Fredericton, N.B., airport, due in large part to the marked increase in flight training activity. This resulted in the formation of a committee—made up of operators, NAV CANADA and the airport authority—which meets monthly to discuss the issues. This has led to many positive initiatives to assist in managing the traffic growth in the short term and maintain a safe operating environment.

Not all issues identified at the RASC can be resolved easily, but those that remain do benefit from the increased awareness resulting from the open discussion that takes place. It is important to note that while Transport Canada acts as the facilitator for the RASC, the issues and agenda items come from the participants; resolving many of those issues depends on industry involvement in identifying workable solutions.

Our latest RASC in May was attended by a member of industry who happened to be in town from another part of the country. He sent us an e-mail afterwards, which I would like to share with you: "*Thank you very much for the opportunity to be involved in the Atlantic Regional Aviation Safety Council meeting. I was particularly impressed by the community feeling among the group and that there was acceptance amongst all the participants of the varying types of operations in the region. Each group or presentation had something of value for the others*." It is comments like these that remind us of the value of our collaborative efforts. The participants in the RASC should be proud of their contribution to aviation safety in Canada.

As a final thought, although the RASC is used in our region as a convenient forum to initiate the discussion on many issues, it is not the only avenue. When you identify issues that affect your operation, either as a result of your safety management system (SMS) or other means, I encourage you to reach out to other members of industry—competitors and partners alike—who can contribute to the resolution of those issues.

Experience in our region has clearly shown that, by working together, members of the aviation community can, and do, work their way through the issues, proposing solutions or mitigation that works for them, while at the same time contributing to aviation safety in Canada.

Arthur W. Allan
Regional Director, Civil Aviation
Atlantic Region

## Canada-European Union Agreement on Civil Aviation Safety

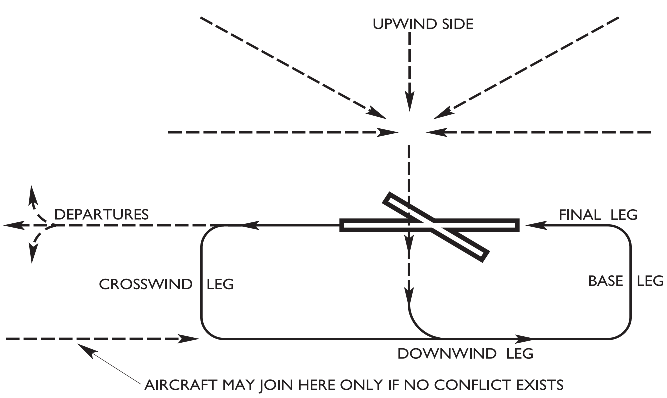
At the European Union-Canada Summit held in Prague, Czech Republic, on May 6, 2009, Canadian Prime Minister Stephen Harper and European Commission President José Manuel Barroso signed the Canada-European Union Agreement on Civil Aviation Safety. Under the new agreement, the European Aviation Safety Agency (EASA) will recognize certification of Canadian aviation products and services, allowing the Canadian aviation industry to be more competitive in the European market. Civil aviation safety will also be enhanced, as EASA and Transport Canada will work co-operatively to resolve unforeseen safety issues. A similar agreement was signed between Canada and the United States in 2000, and has had a positive impact on Canada's civil aviation industry, resulting in stronger harmonization of safety requirements. The Canada-European Union Agreement on Civil Aviation Safety has been signed by both parties and will enter Parliament for ratification in the upcoming session.

## Airmanship rules supreme in the circuit

It's much safer for everyone if we all follow the same procedures for joining the circuit at uncontrolled aerodromes. The *Transport Canada Aeronautical Information Manual* (TC AIM) states:

> "...aircraft should approach the traffic circuit from the upwind side...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 also join the circuit on the downwind leg (Figure 4.6)."

Figure 4.6—Standard Left-hand Circuit Pattern




NOTES 1: The circuit is normally flown at 1 000 ft AAE.
2: If a right-hand circuit is required in accordance with CAR 602.96, the opposite of this diagram is applicable.

Source: TC AIM 09 April 2009 TP 1437E 2009-1

I don't like this statement because it seems to imply that conflicts with other traffic are only a concern when joining the circuit straight onto the downwind leg. This is clearly wrong. Every time I read this (and look at Figure 4.6), I wonder if it means that we can join the circuit from the upwind side even if there will be a conflict. I certainly doubt that is the intent of the TC AIM.

So what do the *Canadian Aviation Regulations* (CARs) say? Here are the four most applicable regulations for this discussion, found in CARs 602.19 and 602.96, about right of way and operating an aircraft on, or in the vicinity of, an aerodrome (controlled or not). These are my words, not the CARs.

- When two aircraft are converging at approximately the same altitude, the pilot-in-command of the aircraft that has the other on its right shall give way—CAR 602.19(2)
- Before landing or taking off, the pilot must be satisfied that there will be no risk of collision with other aircraft or vehicles and that the aerodrome is suitable for his intended operation—CAR 602.96(2)
- The pilot must observe the traffic circuit so as to avoid a collision—CAR 602.96(3)*(a)*.
- The pilot must conform to, or avoid, the circuit made by other aircraft operating at the airport—CAR 602.96(3)*(b)*

The CARs do not state that one must join the circuit from the upwind side, or on the downwind leg, or from anywhere in particular; nor do the CARs relieve pilots entering or established in the circuit of their right-of-way obligations under CAR 602.19(2).

Nowhere in the CARs does it say that traffic established in the circuit can ignore the right-of-way rules; still, the CARs do require all pilots to avoid collisions in spite of who has the right of way.

Therefore, according to the CARs, pilots joining a standard left-hand circuit from the upwind side or on crosswind who see traffic on the downwind, that is, on their right, should give way in accordance with CAR 602.19(2). If, on the other hand, the aerodrome has a right-hand circuit, then the pilot on downwind will have any traffic arriving from the upwind side on his right. If there is a risk of collision in this situation, again according to CAR 602.19(2), the pilot joining from the upwind side has the right of way over traffic already on downwind.

Needless to say, pilots should do their utmost to avoid joining a right-hand circuit in such a situation, and forcing their fellow pilot already established in downwind to give way. In fact, pilots should avoid joining any circuit at the upwind entry if there is any possibility of a conflict, no matter if it's a right or left pattern.

The statement in the TC AIM about avoiding conflicts when joining the circuit on the downwind leg must apply equally to all situations when joining the circuit, not just joining on the downwind leg. The CARs clearly require us to observe the traffic circuit so as to avoid a collision, and require us to conform to, or avoid, the circuit made by other aircraft operating at the airport. It further requires that we ensure that we will not risk collision with other traffic, no matter how one chooses to join the circuit.

On a related note, pilots doing circuits should give way to traffic joining straight onto the downwind by extending their climb straight out a little farther from the airport for separation. If there is traffic on downwind and they turn crosswind, they risk collision with that traffic (thereby contravening CAR 602.19). I believe it is better to climb straight out farther from the aerodrome for separation than it is to ultimately extend the downwind leg far past the airport because of traffic ahead. A case study which illustrates the perils of extending the downwind leg too far is the midair collision at Mascouche, Que., in December 1997 (read it at www.tsb.gc.ca/eng/rapports-reports/aviation/1997/a97q0250/a97q0250.asp). The 5.8-mi. downwind leg by the Cessna 150 stretched outside the aerodrome's five-mile zone.

Good airmanship suggests we follow the circuit-joining procedures as laid-out in the TC AIM, but perhaps the wording should be fixed to reflect more closely the CARs. We are better off if we all follow the recommended procedures, as it is better to know what the other pilot is likely to do and vice versa.

**Michael Shaw**
*Captain COPA Flight 8*
*Ottawa, Ont.*

*Thank you for writing to us. Your comments are appreciated and will be considered in an upcoming revision of the TC AIM. —Ed.*



## Airspace Restrictions for the 2010 Olympic and Paralympic Games

The Vancouver 2010 Olympic and Paralympic Games will take place over an eight-week period during the months of February and March, 2010. Athletes, dignitaries, spectators and media will come together from around the world, arriving predominantly by air. Therefore, special plans and security measures are being established in preparation for the expected increase in aviation activity.

Activation and deactivation dates for Olympic airspace restrictions will coincide with the opening and closing of the Olympic and Paralympic Athlete's Villages in Vancouver and Whistler, B.C.: January 29, 2010, to March 24, 2010. Airspace restrictions will remain in effect during that entire period.

Class F restricted airspace in the form of two conjoined Olympic rings will be established within a 30-NM radius of the Vancouver International Airport and Whistler Athlete's Village, respectively. Detailed information regarding operating rules and procedures will be published in the following documents:

- *AIP Canada (ICAO)* Supplement
- 2010 Vancouver/Whistler Olympic Supplemental VFR Terminal Area (VTA) Chart
- NOTAMs

For the most current information on aviation requirements for the 2010 Games, please visit www.navcanada.ca.

For more information regarding security measures, please visit the Vancouver 2010 Integrated Security Unit Web site at www.v2010isu.com.

## A New Layer of Safety—Minimum Safe Altitude Warning (MSAW)

*by Bill Crawley, Manager, ATS System Integration, NAV CANADA*

Pilots flying in mountainous terrain face a number of dangers, including inadvertently flying below the minimum safe altitude and flying in icing situations where the aircraft cannot reach or maintain a safe altitude. Pilots rely on a number of methods to mitigate the dangers, including on-board ground proximity warning systems (GPWS), published minimum vectoring altitudes, as well as pilot and controller knowledge of terrain. NAV CANADA recently developed a new safety net, the minimum safe altitude warning (MSAW), that can be used by air traffic services (ATS) to help prevent flight into obstacles and terrain.

### *How does MSAW assist controllers?*

MSAW produces visual and aural cues to controllers for aircraft whose flight vector puts them in a predicted or immediate conflict with a digital model of surrounding terrain or obstacles. The MSAW functionality also includes tools that can be used by the controller to aid aircraft that are not in an MSAW condition, such as an aircraft that is experiencing icing conditions and cannot maintain its current altitude. In such situations, the controller can initiate the display of terrain contours surrounding any point on the display, or they can be dynamically associated with a manoeuvring aircraft, thereby providing tactical terrain information that can be relayed to the pilot.

If an aircraft is in a predicted or immediate terrain/obstacle conflict situation, the controller is alerted by flashing indications in the subject aircraft's data tag. The data tag is linked to the aircraft's on-screen target and contains important information about the flight, such as the aircraft call sign, altitude and speed. The MSAW alert indicates:

- the height of the offending terrain/obstacle;
- an indication of the "immediate safe altitude," which is the height of the highest terrain, plus adapted buffers, within a 2-min look ahead of the aircraft and 45° each side of the aircraft's track; and
- in the case of a predicted MSAW event, the time to fly to the object.

These visual indications are accompanied by an audible voice alarm, enunciated at the controller's display, which further helps to draw attention to the MSAW condition.

NAV CANADA

Collaboration between NAV CANADA and various operators led to the development of compatible controller and pilot procedures. If a controller receives an MSAW notification, specific phraseology will be used to inform the pilot, depending on the nature of the situation. For example, the controller may verify the pilot's intentions and/or verify the altimeter setting that is in use:

Controller:
"TERRAIN WARNING, CONFIRM…":

1. "LEVELLING AT (ALTITUDE)"
2. "TURNING TO INTERCEPT (TRACK OR HEADING)"
3. "PRINCE GEORGE ALTIMETER (SETTING)"

Or, the controller may ask the pilot about their awareness of terrain:

Controller:
"TERRAIN WARNING, DO YOU HAVE THE TERRAIN IN SIGHT?"

If appropriate, the controller will provide direction based on the displayed MSAW information:

Controller:

1. "EXPEDITE CLIMB THROUGH SEVEN THOUSAND"
2. "CLIMB TO SEVEN THOUSAND"

### *How does MSAW work?*

MSAW performs processing of aircraft trajectories against adapted airspace volumes that define airspace to protect around terrain and known obstacles. An adaptable vertical buffer is added to the ceiling of the digital terrain model and to the height of known obstacles to derive the final height that MSAW will protect against. Different vertical buffers can be applied independently to terrain and obstacles.

MSAW employs adaptable horizontal and vertical "look-ahead" time parameters that are used to predict the trajectory of an aircraft. It is possible to adapt different look-ahead values for different areas. For example, it may be desirable to have greater look-ahead times for en route aircraft than for aircraft operating in the vicinity of an airport.

### *Test phase*

The MSAW functionality was initially turned on in the Vancouver, B.C., area control centre (ACC) in June 2008. During this first on-test phase, the MSAW functionality was limited to a 50-NM radius centered on the Prince George, B.C., airport. The other component of MSAW, the on-demand display of background contours (at 1 000-ft increments) was enabled at all sectors in the Vancouver ACC. On the afternoon of June 19, 2008, in the Airports Specialty, the MSAW background feature was used to help a Caravan that was in an emergency icing situation. The controller was able to relay terrain clearance information to the aircraft through an American B777, and the aircraft was then able to descend below icing levels and land safely.

The Prince George MSAW test phase has been positive, with only a couple of adjustments required to the MSAW adaptation. The test phase is now complete and the next phase for Vancouver will involve the implementation of the MSAW function in the remainder of the Airports Specialty, excluding small areas immediately around all of the airports except Prince George. △

## Transport Canada Civil Aviation Kicks Off the Development of a New Strategic Plan

*by Richard Berg M.B.A., Senior Risk Assessment Advisor, Aviation Safety Intelligence, Policy and Regulatory Services, Civil Aviation, Transport Canada*

### *In the beginning…*

Success starts as a dream; an idea or a desire to do something different, create an opportunity, or reduce risks. Success in innovation, in your career, or in managing a business always requires a strategy. The saying "those who fail to plan, plan to fail" implies that you need an action plan to get the results you want. In fact, your plan should include ways to measure progress and success, as well as ways to react to poor results and to continue to improve results. Below, you will find Transport Canada Civil Aviation's strategic plan, which is what we used to formulate our future priorities.

### *Why is a strategic plan so important?*

Strategic plans are blueprints that help organizations respond to new environments, reduce risks and make the most of opportunities. They are especially important during events such as economic crises or periods of explosive growth. Strategic plans set clear direction that is linked to an organization's vision and goals. Program activities and their performance measures reflect the amount of risk the organization wishes to take. However, unknown factors and influences beyond the control of the organization will always present some degree of uncertainty for reaching expected outcomes.

For the past five years, Transport Canada Civil Aviation has had *Flight 2010* as its strategic plan and is now beginning to develop its new plan looking toward 2015. This plan will embrace the Treasury Board of Canada Secretariat government-wide Management Accountability Framework and will reflect government values and ethics. Its goal will be to offer the best value for Canadians today and for future generations of Canadians. Transport Canada plans to publish its new Civil Aviation strategic plan in the spring of 2010.

### *Six steps of strategic planning*

Building a strategic plan involves:

1. Following the planning process;
2. Reviewing the organization's mission and objectives;
3. Conducting an environmental scan;
4. Developing a strategy;
5. Implementing the strategy;
6. Measuring and controlling performance.

**Step 1: Follow the planning process**

The first thing we are doing is building our team's commitment, outlining activities to collect necessary information, and identifying deliverables with their timelines.

**Step 2: Review the mission and objectives**

This step helps our team fully understand where the organization is, and plan our next steps to achieve our vision. This lays the foundation to form a strategy and helps team members focus on what the customers/stakeholders expect the organization to deliver.

**Step 3: Conduct an environmental scan**

An environmental scan takes a holistic view of the organization and analyzes what has happened in the past and what is happening now, as well as brainstorming about what could happen in the future. We will use a SWOT (strengths, weaknesses, opportunities and threats) analysis tool to:

- identify influences that could affect the organization's bottom line;
- consider key perspectives, namely: financial (accountability of the public purse); external stakeholders (industry/unions and associations, travelling and non-travelling public, government agencies, international community, and future generations); internal stakeholders (within Transport Canada); as well as growth and improvement, and their associated risks;
- clearly understand how goods and services are provided; and
- identify ways to improve safety and add value for the organization.

For an environmental scan to be effective, management has to consider our existing framework and consult with stakeholders to understand their perspectives.

**Step 4: Develop a strategy**

Develop an overall strategy that aligns and leverages our key strengths to achieve organizational excellence and ensure public trust and confidence. This is also based on the SWOT analysis and the organization's vision, values, mission, and regulatory, social, and ethical responsibilities. We will use a comprehensive approach to formulate key strategic outcomes that focus on our organization's highest priorities and highest risks.

This filtering and clustering process can be challenging if many competing interests demand priority status and resources. Management will consider perspectives from key stakeholders and accept the team's strategy before moving on to the next step.

**Step 5: Implement the strategy**

Implementing the strategy will include:

- consulting with subject-matter experts to confirm if the strategic outcomes are realistic;
- ensuring that the organization's resources are properly aligned and leveraged to optimize performance and minimize risk; and
- preparing a communications strategy that informs focus groups of the upcoming changes.

Depending on outcomes, we may need to consult with other stakeholders to ensure that our strategic outcomes positively contribute to our mission and increase stakeholder acceptance.

**Step 6: Measure and control performance**

Develop a performance measurement framework that describes indicators, their condition, and criteria. These indicators must be measured by qualitative or quantitative measures, such as period, frequency, or public opinion, and be based on the level of risk and severity of the impact attached to them.

When controlling performance, evaluators will use these performance measures to identify the difference between the actual and the desired results. This control process will help them identify if and when corrective action is required.

When management has reviewed and accepted the proposed framework, the strategy will be implemented and posted for all to see.

***In summary…***

The steps above provide a transparent, systematic approach for developing and implementing our strategic plan. This plan leverages key activities within governmental policies and provides good governance practices. Using the approach described above, Civil Aviation's 2015 strategic plan will be well designed, effectively direct resources, create the best environment to promote a safe and sustainable air transportation system, and will foster public trust and confidence for today and tomorrow. △

Pre-flight

## BLACKFLY AIR

## The CAMC Leads Update of the Human Resource Study of Commercial Pilots in Canada

### *The CAMC's Aviation Human Resource Sector Studies Provide Important Safety Data*

The Canadian Aviation Maintenance Council (CAMC) is the sector council that represents and assists Canada's aviation and aerospace industry with its human resource strategy, issues, and solutions. With the participation of industry members, the CAMC manages national research studies, and develops and publishes national occupational standards with supporting logbooks (for professional certification) and curricula (for post-secondary training organizations). The CAMC also promotes safety, professionalism, and standardization through national communication with industry; human factors and safety management system (SMS) training; individual certification in 24 occupations; and accreditation of training organization programs. Initially formed through the partnership of the Air Transport Association of Canada (ATAC), labour unions, manufacturers, and airlines to develop maintenance-related standards, the CAMC is evolving to expand its partnerships with all sectors of aviation and aerospace. The CAMC is currently involved in several safety-related aviation sector studies, funded by the Government of Canada's Sector Council Program.

The Human Resource Study of the Commercial Pilot in Canada—Update and the Airport Occupation Rationalization (AOR) projects are examples of important partnerships underway, which will provide data that will be used to develop a comprehensive picture of Canada's commercial pilot and airport worker occupations, describing both the current conditions and the likely developments in the future, at the five-, 10-, and 15-year marks. The results of these studies will help us gain an understanding of the human resource issues facing the aviation industry with the implementation of new training requirements and technological advances in training and transportation methodologies. This research will also provide the foundation for the development of professional occupational standards.

These are important studies of the requirement for aviation operators to implement SMS. Under SMS, the management process will have to be documented and followed by all staff. SMS requires the application of quality assurance principles, including continuous improvement and feedback mechanisms. Continuous improvement means a system of review and change that constantly improves a system or process. The CAMC human resource studies will provide Canadian operators with important data that will be needed in the design of company-specific SMS.

CAMC CCEA
Canadian Aviation Maintenance Council/Conseil canadien de l'entretien des aéronefs

### *Your input is important!*

The Human Resource Study of the Commercial Pilot in Canada—Update requires input from a large group of industry stakeholders. Whether you are a senior pilot or a student pilot, your input is important. Understanding the human resource challenges this sector faces is important to the aviation transportation community. Canada also has an important flight-training industry that needs to understand future knowledge and skill requirements for commercial pilots in order to produce properly trained personnel. This research will provide the foundation for the development of national occupational standards for the professional pilot.

Here are some areas that will be covered in this study:

- Size and scope of Canada's existing aviation industry in 2009;
- Overview of geographical locations, sizes and operational requirements of current operators;
- Overview of services provided, in particular human resource activities, such as training, certification, and standardization;
- Compilation of statistics on student pilot starts and current training levels;
- Analysis of pilot hiring trends and associated pay and benefits;
- Analysis of the international demand for pilots and expected training standards;
- Measurement of the effect of new regulations, such as the multi-crew pilot licence (MPL) and SMS;
- Analysis of current best practices for pilot screening and selection;
- Analysis of the use of simulation and associated instructor competencies; and
- Development and retention issues for flight instructors.

If you would like to participate in this study, and be eligible to receive a copy of the final report, please contact Glenn Priestley by e-mail at gpriestley@camc.ca or by phone at 1-800-448-9715, ext. 258; or Wayne Gouveia by e-mail at wgouveia@atac.ca or by phone at 613-233-7727, ext. 309. For further information on the CAMC, please visit www.camc.ca. △

## Spotlight on Bilingual Briefings at Window Emergency Exits

*by Suzanne Acton-Gervais, Civil Aviation Safety Inspector, Cabin Safety Standards, Standards, Civil Aviation, Transport Canada*

Preparation for departure is a very hectic time, with many pre-flight checks and tasks to complete. Flight attendants are available during boarding to help stow luggage, answer questions, brief and assist passengers who require special attention, and the list goes on. Behind that crisp uniform and smile, as they perform customer service duties, flight attendants are mainly focused on safety. It really can be physically and mentally challenging. Flight attendants are trained professionals—occupational athletes who are extremely observant. They have a real concern for passenger safety and an ability to pay attention to detail while multi-tasking.

During all of this pre-flight activity, flight attendants are observing passengers for safety and security reasons, including who is sitting in the window emergency exit rows. These passengers are considered able-bodied passengers (ABP). In an emergency, the flight attendant could call on them for help.

### *Emergency exit briefings*

One of the many pre-flight tasks is to brief the passengers seated in the window emergency exit rows. Flight attendants perform this same routine task prior to every flight. But even though it is a routine, flight attendants are listening to, observing, and assessing the passenger while giving instructions. From this they gauge the passenger's reactions and answer any questions they may have.

Time is critical during an emergency, and passengers seated adjacent to window exits play a very important role in assisting flight attendants during an evacuation. All passengers need to act according to the crew's verbal commands during the evacuation process. The reaction of passengers seated in a window emergency exit row is even more crucial. The crew commands will vary depending on many factors, such as the nature and location of the emergency, potential fire, and other dangers outside or inside the aircraft. Therefore, it is vital that passengers seated in the window emergency exit rows understand how and when to open specific exits and, perhaps more importantly, when *not* to open them.

Air operators usually develop procedures for a flight attendant to conduct this window emergency exit briefing orally. The benefit of this one-on-one interaction during the window briefing is that the flight attendant can assess if the passenger has really understood what is expected of them should the need for an evacuation occur. They can also determine if the passenger should indeed occupy this restricted seating.


*A flight attendant briefs the passenger seated at an emergency exit row.*

Flight attendants will relocate a passenger before departure if they feel that the individual briefing information has not been clearly understood by the passenger, or if the passenger volunteers that they are not comfortable with, or capable of, operating the emergency exit. In both cases, the relocation is due to non-compliance with the regulatory requirements of the *Canadian Aviation Regulations* (CARs).

### *The challenge of language barriers*

But what happens when a flight attendant and passenger do not speak the same language? In 2005, after receiving complaints from members of the travelling public, representatives of the Commissioner of Official Languages requested that window emergency exit briefings be made available in the passenger's preferred official language, either English or French.

Section 26 of the *Official Languages Act* (OLA) of Canada states that every federal institution that regulates persons or organizations with respect to…the health, safety or security of members of the public has the duty to ensure, through its regulation…wherever it is reasonable to do so in the circumstances, that members of the public can communicate with and obtain available services from those persons or organizations…in both official languages.

Since Transport Canada develops policies and regulations that promote the safety and security of the travelling public, while at the same time respecting the linguistic rights of Canadians, it conducted a review to assess the safety implications. After the review, it was suggested that the window emergency exit briefing be available in both official languages and a recommendation was made to amend the CARs.

***Looking ahead…***

The proposed changes to the CARs will include a requirement for the window emergency exit briefing to be available in the passenger's preferred official language. The proposal will be presented at the Canadian Aviation Regulation Advisory Council (CARAC) meeting in the fall of 2009.

Some passenger relocations seem to be occurring due to the lack of an available briefing in the preferred official language of the person seated in the window emergency exit row. To help mitigate this, air operators should develop procedures to ensure passengers seated in the window emergency exit rows receive the necessary information in their preferred official language.

Transport Canada provides advisory material outlining the abilities that a passenger should meet to be seated in an emergency exit row. You can find this information in the Commercial and Business Aviation Advisory Circular (CBAAC) 0181R—*Passenger Seating Requirements*. Transport Canada also provides advisory material in Advisory Circular (AC) 705-001—*Bilingual Briefings at Window Emergency Exits*. △

## Aircraft Owners and Pilots—The Importance of a Correct Address

*by Bobbie Rawlings, Aircraft Registration Specialist, Aircraft Registration and Leasing, Standards, Civil Aviation, Transport Canada*

There are several reasons for keeping your mailing address up to date, but the most important reason is safety. Without the correct mailing address, Transport Canada isn't able to send you safety information. That's why aircraft owners and permit or licence holders are required to notify Transport Canada of any change of address within seven days after the change (see *Canadian Aviation Regulations* [CARs] 202.51 and 400.07).

The Canadian Civil Aircraft Register is a live database. Changes made in the register are available immediately through the Canadian Civil Aircraft Register Computer System—Evolution (CCARCS-E). CCARCS-E supports several mailings from various divisions of Transport Canada, such as Airworthiness Directives (AD), Annual Airworthiness Information Reports (AAIR), Service Bulletins (SB), and other types of information that pertain to aircraft owners, their aircraft and the safety of flight in Canada. If an aircraft owner does not notify Transport Canada of a change of address, the information in CCARCS-E will be outdated. Various officials and government agencies use CCARCS-E in Canada and around the world. Customs agencies, for instance, frequently check the CCARCS-E to confirm information. Discrepancies between the aircraft documents and the CCARCS-E may result in delays with these agencies.

If an aircraft owner's mailing address is incorrect, any information mailed to them will not reach them and will be returned to Transport Canada. This means that important safety information will not get to the appropriate destination. This also incurs added costs for mailing and time to locate the aircraft owner and update CCARCS-E with the correct information. Unfortunately, we are noticing an increase in the volume of returned documents due to invalid addresses.

CCARCS-E is available on-line at: www.tc.gc.ca/CivilAviation/general/CCARCS/menu.htm. From there, you can view your owner/aircraft information for any discrepancies, and then begin the process of notifying Transport Canada with up-to-date information.

With recent enhancements to the General Aviation Web site, clients can submit changes to information, including address changes, and other requests. Pilots and aircraft owners will be interested in this site, as there are services available from the Flight Crew Licensing Division. You are invited to visit our Web site (www.tc.gc.ca/CivilAviation/general/onlineservices/menu.htm) and explore how these services can help your information be the most up to date. △



## 2009–2010 Ground Icing Operations Update

In July 2009, the Winter 2009–2010 *Holdover Time (HOT) Guidelines* were published by Transport Canada. As per previous years, TP 14052, *Guidelines for Aircraft Ground Icing Operations*, should be used in conjunction with the *HOT Guidelines*. Both documents are available for download at the following Transport Canada Web site: www.tc.gc.ca/CivilAviation/Commerce/HoldoverTime/menu.htm. If you have any questions or comments regarding the above, please contact Doug Ingold at douglas.ingold@tc.gc.ca.

## Aftermath: The Optimist's Approach

*by Peter Garrison, Contributing Editor, FLYING© magazine*

On Christmas night, 2006, it was foggy in Lawrenceville, Georgia. Briscoe Field was reporting half a mile visibility in fog, with the ceiling at 100 ft, when a Cessna 414A arrived from Florida on an instrument flight plan.

The 44-year-old commercial pilot had logged over 400 of his 632 hours in the airplane in which his life and those of his two passengers were shortly to end. His actual instrument time was 26.4 hours; his simulated instrument time, 56.3. He had logged 142 hours at night. He was comparatively inexperienced, but current, qualified, and legal. Despite the festive date he was not, as toxicology tests would later establish, under the influence of alcohol.

As the pilot approached Lawrenceville, the controller advised him of the weather, which was below the airport minimums of 200 and one half. The pilot elected to attempt the ILS [instrument landing system] Runway 25 approach, as he was entitled to do: The criteria for landing are expressed in the FAR [U.S. *Federal Aviation Regulations*] as "flight visibility" because it is understood that what the pilot sees on final approach is not necessarily the same thing as is seen from the tower or from some other weather observation point. The pilot is on his honor not to descend below the minimum altitude unless he has the runway or its lights in sight.

The pilot missed the approach, but he reported to the controller that he had caught sight of the airport as he passed over it and wanted to try again. The controller vectored him back around to the approach course, and repeated the current weather conditions.

On the second approach, the tower advised the pilot that he was drifting to the left of the extended runway centerline. The pilot acknowledged. Shortly after, the tower controller saw a bright orange glow beside the approach end of the runway. He tried without success to contact the 414. It had crashed into an asphalt plant, clipping the tops of trees and striking a gravel berm before eventually coming to a stop 1 100 ft south of the runway, heavily fragmented, amidst the machinery of a rock crusher.

The NTSB [U.S. National Transportation Safety Board] neatly, if unhelpfully, summed up the probable cause: "The pilot's failure to follow the instrument approach procedure [and his] descent below the prescribed decision height altitude."

This is the kind of accident that the newspapers will describe with some such phrase as "The airplane crashed while attempting to land in fog." The image conveyed to the lay reader is of the pilot feeling his way toward the airport and inadvertently bumping into something, just as a driver, creeping forward in dense fog and darkness, might, in a moment of divided attention, collide with an inconveniently situated tree.

To an instrument pilot, the picture is more complex. An instrument approach is not a matter of feeling one's way. It is a mechanical procedure which, if executed rigidly, will end either in a safe landing or in a safe abandonment of the attempt. It goes without saying that if you follow the instrument approach procedure to the letter, you will not hit the ground. So how does it happen that pilots, even ones flying precision approaches in which both altitude and lateral position are continually displayed, so often crash in the vicinity of the approach end of the runway, particularly at night?

You seldom learn exactly what happened on a particular flight—unless the pilot survives—but you can imagine a plausible scenario. On the first approach, the pilot stops descending at the decision height, and overflies the runway. Looking down, he glimpses the runway lights, and possibly, if the fog is spotty enough, even discerns illuminated features on the ground—a pool of light around a windsock or in front of a building, airplanes parked on the ramp. After all, these things are only 200 ft away, and the visibility under the overcast is half a mile. It appears that with a little luck he ought to be able to land. So he comes around for another try.

But there is a big difference between vertical and slant visibility. The conditions are reported as 100 and a half—round numbers. Looking straight down, one is separated from objects on the ground by, at most, 100 ft of cloud and another 100 ft of moderate fog. It is easy to see lights through that much fog—easier, in fact, than to discern surface features in daylight. But a standard three-degree glidepath has a slope of nearly 20:1. To see the same lights ahead of the airplane would require looking through 2 000 ft of cloud and another 2 000 ft of fog. The same

Flight Operations

principle applies here as applies to the ground fogs that sometimes form in otherwise clear weather. It may be possible to see an airport clearly from above through a thin layer of ground fog, but if you try to land, you find yourself suddenly blind in the critical final instants of the approach and flare. Looking straight down and looking straight ahead are two quite different things.

*Looking straight down and looking straight ahead are two quite different things.*

But the glimpse of the lights subtly alters the pilot's behaviour. He knows that he just has to get close enough to pick up the first few runway lights, and he'll be okay. He's already glimpsed the lights. He's almost there.

The second try is the dangerous one. He now knows how tantalizingly close his destination is, and the urge to descend just slightly below decision height—to violate his pact of honour with the system, but only by a little—is very strong. His passengers know too; they have seen the lights sweep past the windows; they expect that they will soon be on the ground. The arcana of minimums and decision heights are beyond them; they just know that this big, expensive, pressurized airplane and its instrument-rated pilot are going to get them home.

Because the successful completion of the approach requires visual contact with the runway environment, the pilot is now obliged to divide his attention between the instrument panel and the windows. This is not the ideal way to fly an ILS to minimums. In principle, the pilot's attention should be on the instruments, and the instruments alone, until he has either broken out of the clouds or has almost reached decision height. At this point he looks outside. If he sees the runway or the approach lights, he lands; if not, he misses.

But fragmentary visual cues before decision height confuse the matter. The final approach to Runway 25 at Lawrenceville is unobstructed, but one reaches decision height three-quarters of a mile from the touchdown point and still far from the approach lights. One passes over a divided highway and alongside a railroad yard with a large, illuminated parking lot. It is not hard to imagine that in the same way that some drivers whose attention is diverted by a car parked on the shoulder of the road unconsciously veer toward it, a pilot searching for lights on the ground might unconsciously drift toward the large lighted area of the train yard, which lies like a magnet just to the left of the final approach course and barely half a mile from the threshold.

What has happened in this situation is that emotion has entered into the picture, and the pilot has exchanged the role of the robotic executor of a mechanical operation for that of the newspapers' baffled motorist poking his way through pea-soup fog. The ILS cross-pointers are drifting awry, but the pilot is no longer looking for needles; he is looking for lights.

The pilot acknowledged the tower's warning that he was left of course, but by then he was already too low and too far from the localizer. Lawrenceville has medium-intensity approach lighting without sequenced flashers. Perhaps he mistook a light on the asphalt plant for an approach light. On a three-degree approach at 100 kt, 16 s elapse between a 200-ft decision height and the top of a 50-ft tree. Sixteen seconds sounds like a long time, and feels long when you're sitting in an armchair looking at the second hand on your watch. But for a pilot hoping for a gift on a Christmas night approach to minimums, torn between doing the right thing and descending just a little bit lower, it may not be enough time to change his mind.

*This article is based on the National Transportation Safety Board's report of the accident, and is intended to bring the issues raised to the attention of our readers. It is not intended to judge or to reach any definitive conclusions about the ability or capacity of any person, living or dead, or any aircraft or accessory.*

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**HAVE YOU CHECKED NOTAMS?**

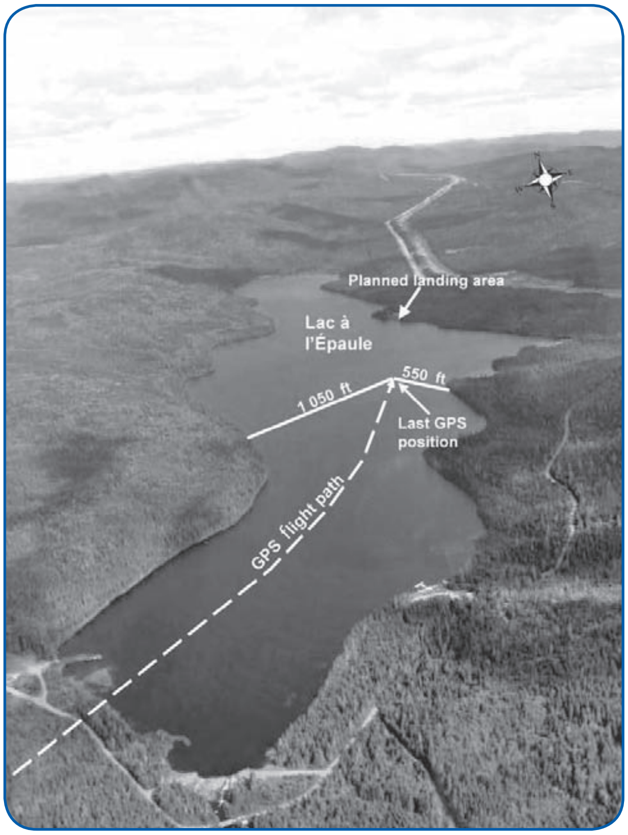
## Helicopter Windshield Flash Fogging

On June 19, 2008, a Eurocopter EC 120B helicopter departed Lac des Neiges, Que., on a visual flight rules (VFR) flight to Québec, Que., 42 NM to the south. Approximately 15 min after takeoff, the weather deteriorated and the pilot chose to land at Lac à l'Épaule, 28 NM north of his destination. While overflying the lake at low altitude to verify the chosen landing spot, the pilot turned on the demist hot air to clear the front windshield of condensation. The windshield immediately misted up, the helicopter lost altitude, and struck the surface of the water. The pilot and passenger sustained minor injuries and evacuated the aircraft successfully. The pilot helped the passenger towards the shore. They were assisted by two fishermen in a small boat and were then transported to hospital by ambulance. While the passenger initially survived, he subsequently died due to exposure to the cold water and intense stress. This article is based on the Transportation Safety Board of Canada (TSB) Final Report A08Q0110.

Weather conditions for the planned route were not checked prior to departure. Although the forecast was for mainly VFR weather, low patchy ceilings and precipitation were forecast for the area. The flight was to take place in a mountainous area where the cloud level would likely, at times, restrict free passage in some areas, especially over the elevated terrain. The pilot encountered unexpected conditions of reduced visibility in moderate to heavy rain showers in the vicinity of Lac à l'Épaule that forced him to find a safe landing spot to wait for the weather to improve.

The pilot chose to execute the approach over the water. This allowed for a shallower approach and kept the helicopter away from any obstacles that might have been difficult to detect. It is not unusual to fly over a river or lake in conditions of low visibility. However, in the event of an unforeseen problem (such as an engine failure), the helicopter may not be within gliding distance from shore, thereby posing a risk to the aircraft and its occupants. Even if there was no place to land along the shoreline, if the helicopter had been flown closer to it, the risk associated with swimming long distances in cold water would have been reduced.

When the pilot selected demist hot air to clear the windshield, the warm air from the ceiling ventilation ducting was instantly cooled when it hit the relatively cooler windshield. This rapid cooling caused the air to condense, and fogged the windshield and front side windows. The immediate fogging of the windshield and front side windows, combined with the heavy precipitation, restricted the pilot's ability to maintain outside visual references. He did not have time to open the bad weather window, which could have given him some outside visibility. Without any outside visual cues, the pilot did not perceive that the helicopter was descending from 100 ft above ground level (AGL); the helicopter struck the surface of the water at low airspeed.




*Map showing the trajectory and impact point of the helicopter, which was proceeding towards a cottage at the north end of Lac à l'Épaule.*

Warm air can hold more moisture than cold air. Therefore, with time, the warm air entering the cabin via the ceiling diffusers would have allowed the temperature of the windshield to rise to a point where the water vapour contained in the warm air from the ducting would not transform into water droplets. At this point, the windshield would then start to clear. Therefore, had the demist been selected while flying at a higher altitude, it is likely that the fogged windshield would have cleared in enough time for the pilot to notice and to correct the descent prior to striking the water surface. No documentation cautions EC 120B flight crews about the risk associated with the selection of demist during certain critical phases of flight, which can, under certain weather conditions, cause a temporary loss of outside visibility and a loss of control of the aircraft.

### *Findings as to causes and contributing factors*

1. Weather conditions for the planned route were not checked prior to departing Lac des Neiges. The

pilot encountered unexpected conditions of reduced visibility in moderate to heavy rain showers and low ceiling conditions, which forced him to land.

2. The windshield fogged up immediately after the pilot had selected demist hot air. This, combined with the heavy precipitation encountered, restricted the pilot's ability to maintain outside visual references.

3. With the loss of visual references, the pilot did not perceive that the helicopter was descending from 100 ft AGL and the helicopter struck the water. The pilot did not have time to open the bad weather window, which could have given him some outside visibility.

### *Findings as to risk*

1. The approach for landing took place beyond gliding distance from the shore, which put the aircraft and its occupants at risk in the event of an unforeseen problem.

2. No documentation cautions EC 120B flight crews on the risk associated with activating the demist system during certain critical phases of flight and under certain weather conditions; activating the demist system can cause a temporary loss of outside visibility.

### *Other finding*

1. Selection of the demist system while flying at a higher altitude would likely have allowed the windshield to clear sufficiently in time for the pilot to notice and correct any undesired change in the aircraft's flight parameters.

### *Safety action taken*

Eurocopter has developed an Information Notice on the use of the demist system that was issued on July 15, 2009. This notice alerted all Eurocopter helicopter crews of windshield flash fogging that can occur in certain weather conditions when the demist system is activated, which could, subsequently, reduce visibility and temporarily create a loss of visual references. This notice reminded crews of the importance of using the bad weather window in such circumstances to ensure visual contact with outside references. △



## Bella Bella Nightmare

The day started off earlier than most; I was in to work with the sunrise as I had a long trip to fly a tech to Bella Bella, B.C., in order to fix a broken Cat. When I got there, the owner and his son were busy getting the C206 ready. They were less friendly than usual, but I put that down to the early hour. The owner's son took off as I waited for my passenger to arrive.

My passenger arrives, we load up his tools, and take off. The trip is west across central B.C., and over the plains to the coast. We will fly through the mountains, over Bella Coola, B.C., and on to Bella Bella. The weather looks okay for the trip, but there is no station at Bella Bella, so we will have to rely on any pilot weather reports (PIREP) en route.

I am a newly hired chief flight instructor (CFI) of a small school that also does single-engine VFR charters. My wife and I moved up here from Vancouver, B.C., and I had only 650 hr—mostly instructing time—before coming here. It has been a learning experience to say the least. I always taught my students by the book where navigation was concerned: fly the line, assess the deviation, and correct. VFR charters in the Cariboo call for a different technique: fly the line as much as you can, when you hit the weather, the choice is turn left or right to get around it and then get back on track. GPS with an ancient long range air navigation (LORAN) system is the preferred method.

The trip over the plains is uneventful; I have been out to Bella Coola a dozen times now and I know the way pretty well. My headphones crackle with the owner's son's typical greeting:

"Got your ears on?"
"Hey there. You were out of there so fast I hardly got the chance to say good morning!"
"They needed a fast flight," he replies.
"Charter?"
"Sort of; I've got a pickup."
"Cargo?"
"A body."
"Rog."

It turns out a young man had drowned in the river.

Bella Coola is a beautiful spot nestled in the Coast Mountains. After flying over what amounts to basically one massive clear cut in various stages of re-growth from Williams Lake to the mountains, we fly over a plateau and start to descend into the river valley. The town itself sits where three valleys meet, and the river flows on to the ocean and out to Bella Bella.

Three valleys on the coast make for some interesting winds and currents, as the owner's son's unlucky pickup discovered. Later we loaded the "hummer," as the Air BC Dash 8 captain called him (for human remains). It was odd stacking other people's bags around and on the wooden casket. Especially weird were all the locked gun cases of the many hunters who pass through the area. Death has many faces.

The son tells me the weather looks okay to Bella Coola, so I decide to keep going once I get over the town.

I am flying today with some extra pressure put upon me by none other than yours truly.

One of the perks of my job is that I get to fly a local businessman around in his own airplane—a fast, retractable single.

The week before, we had flown his plane over Bella Bella on a gorgeous day; it was the most fantastic scenery highlighted by the summer sun. After dropping him and his family off for a fishing vacation, I took his plane back home. Several days later, when I got the call to pick him up, I had to turn around because of bad weather over the plains—I tried left, then right, then overhead and got to 13 500 ft before deciding there was no way to get through. Such is the VFR world.

When my boss, a legend in the area with 40 000 hr (all VFR), picked him up the next day, he told me the weather out at Bella Bella was something he wouldn't wish on his worst enemy.

I am leery of his words as we make our way past Bella Coola and over the ocean proper. The terrain in the area is very unforgiving with all the peninsulas and islands rising sharply straight out of the ocean. The only place to put the plane down in an emergency would be on one of the small beaches, and that would be a disaster due to the fact that any marginally flat area is surfaced with jagged rocks.

I am using the "greasy thumb" method of navigation. My GPS is no help now as it only plots a straight line to my destination, and with the ceiling just under 1 000 ft, a direct route is out of the question. My thumb very carefully keeps track of our position on the map as we have several sharp turns around terrain in order to stay over the water. This technique will save our lives.

We are flying in a tunnel. The terrain rises on either side of us into the cloud. Over water is the only way, and what I originally thought was an acceptable ceiling has diminished by several hundred feet. Visibility was good, but with the cloud coming down, it has reduced dramatically. We are in and out of thin areas of mist.

"This is stupid," I say to myself. My companion reads my thoughts and confirms my feelings as he crosses his arms firmly and lets go a loud sigh. This will be his primary commentary for the rest of our flight. My mind is awash in conflict: "continued flight into adverse weather" versus "it's not far now." "Get out of this" versus "we're almost there." We have been dodging the mist for a half-hour now and, while for a time it stabilizes at 700 to 800 ft, it certainly does not improve. We have to descend as low as 400 ft at times to get under it. On we fly as the voices in my head continue to argue.

"Just two more bends and we are there," I tell myself. Home free, almost. It will look really good that I made it and got this guy to his Cat—a brand new machine that is holding up a big project, and costing lots of money in downtime. The other pilot always makes it; my boss gets in no matter what.

We reach the final turn in our tunnel and hit solid cloud. Panic grips my chest like a bear hug. Get it turned around! I am on instruments as I bank steeply, 500 ft above the water.

The unthinkable happens: my attitude indicator topples. I instantly get the familiar taste in my mouth that I always got after wiping out on my dirt bikes years ago—it's like exhaust fumes, but in reality it is pure adrenaline. "Fight or flee" is the primordial command; I force myself to fight.

"Fly, fly by the VSI," [vertical speed indicator] is a term familiar to me from my instructing days at Boundary Bay, B.C.; it is put to good use here. We show a descent.

"Get that nose up! Not too much!" my inner voice yells at me. My old instructor Doug is beside me, ready to rap my knuckles if I break my concentration for an instant. He recently passed away in a car accident.

We are on our reciprocal heading and come out of the cloud. [expletive…]

"I'm heading back to Bella Coola," I tell my passenger, trying my best to sound calm.
"That's fine with me!" is his terse reply.

The nightmare is far from over though. We are 45 min away from Bella Coola. Coupled with the hour and a half it took to get to that town, this is turning into a very long flight. We have four hours of fuel total, so we will land with an hour in the tanks, provided the weather is still okay there. My major problem at this point is the several cups of coffee I had while waiting for my companion to arrive. I use the pain in my bladder to keep focused.

I always prided myself on the fact that whenever I had a bad dream I could just tell myself to wake up, and everything would be fine. There was no waking up from this flight though; I had to battle this to its conclusion.

Again and again we are in the mist, so we are up and down between 800 ft and 400 ft. Just when I can relax a bit, I hit more mist and must go down again. I carefully plot our position on the map and take us around the various peninsulas. Finally, we reach the coast again and land at Bella Coola. Land has never before—or since—tasted so sweet to me.

"I hope I didn't scare you too badly," I say to the Cat tech through clenched teeth.
"No, no problem," he counters. He spends the next hour chain smoking outside the terminal as I wait to see if the weather improves. When it does not, we take the refuelled Cessna back to home base.

***Lessons learned:***

- To compare my abilities with another vastly more experienced pilot was extremely foolish.
- Turning back hurts the pride, but is never a wrong decision.
- Know thine own abilities, and know thy aircraft.

*This account is a true event provided anonymously to the ASL for the benefit of all. Thank you. —Ed.* △

# WINTER OPERATIONS

## Takeoff in Conditions of Freezing Drizzle and/or Light Freezing Rain (Fixed-Wing Airplanes)—Part I

*by Paul Carson, Flight Technical Inspector, Certification and Operational Standards, Standards, Civil Aviation, Transport Canada.*

*This is the first of a two-part article on this critical subject. Part II will appear in* Aviation Safety Letter *(ASL) 1/2010.*

### *Background*

During the winter of 2005–2006, a Transport Canada Civil Aviation (TCCA) inspector observed a number of airplanes operated by various air operators taking off in conditions of freezing drizzle (forecast and actually reported). The inspector considered that the operations were in contradiction of *Canadian Aviation Regulations* (CARs), specifically CAR 605.30:

> *De-icing or Anti-icing Equipment*
>
> **605.30** No person shall conduct a take-off or continue a flight in an aircraft where icing conditions are reported to exist or are forecast to be encountered along the route of flight unless
>
> *(a)* the pilot-in-command determines that the aircraft is adequately equipped to operate in icing conditions in accordance with the standards of airworthiness under which the type certificate for that aircraft was issued; or
>
> *(b)* current weather reports or pilot reports indicate that icing conditions no longer exist.

Subsequent discussion identified that air operators and flight crews have insufficient information when faced with conducting a takeoff in these conditions. These discussions also identified that nothing in the current regulations and standards authorizes takeoff during conditions of freezing drizzle and/or light freezing rain.

### *Certification of flight in icing conditions*

#### *Current certification practice*

Ice accretion on airplanes adversely affects their performance and their operation. Where flight in icing conditions is desired, and in order to operate safely, ice protection systems (IPS) must be incorporated into the airplane design and used appropriately. The type and extent of these protection systems depends on the characteristics of each individual airplane, including its propulsion-system type, aerodynamic configuration, aerofoil geometry and overall size.

Approval of flight in icing conditions includes demonstration of satisfactory performance of the IPS and satisfactory handling qualities. A measurement of the performance degradation with the ice expected on both the unprotected surfaces and any residual ice on the protected surfaces resulting from proper operation of the IPS must also be demonstrated. Ice accretions aft of protected surfaces and due to IPS failure conditions are also considered during the certification process.

*From an airplane certification aspect, it is assumed that the airplane does not have any ice accretion on critical surfaces prior to commencing the takeoff. Also, it is assumed that there is no ice accretion during takeoff until liftoff.*

### *FAR 25, Appendix C*

For certification purposes, the in-flight icing atmosphere has been characterized in U.S. *Federal Aviation Regulation* (FAR) 25, Appendix C. It is important to note that although these envelopes encompass most icing conditions likely to be encountered, it is possible to encounter icing conditions that exceed the certification envelope. In particular, FAR 25, Appendix C does not address supercooled large drop (SLD) icing conditions, which include both freezing drizzle and/or light freezing rain. Also, convective cloud described by Appendix C is largely stratocumulus and cumulus. Towering cumulus, and certainly thunderstorms, should be assumed to include icing conditions that exceed those established in Appendix C.

Appendix C characterizes continuous maximum and intermittent maximum icing conditions within stratiform and cumuliform clouds. Appendix C defines icing cloud characteristics in terms of mean effective drop diameters, liquid water content, water droplet size, temperature, horizontal and vertical extent, and altitude. Freezing drizzle and/or light freezing rain precipitation are not included as these environments typically contain mean effective diameters (MED) that are larger than the cloud mean effective drop diameters defined in Appendix C. Consequently, those icing conditions containing freezing drizzle and/or light freezing rain are not considered during the certification of airplane IPS, and exposure to these conditions could result in hazardous ice accumulations because the larger diameters typically impinge farther aft on airfoil surfaces. Also, mixed phase and ice crystal icing conditions are not currently considered during the certification of the engine, and exposure to these conditions could result in hazardous ice accumulations within the engine, which could then result in engine damage and power loss.

The historical reasons for not including SLD conditions in FAR 25, Appendix C are unclear. However, this "unclear" history may have been the result of the limitations of the icing conditions measurement equipment, the statistical analysis methods used at the time, and the airplanes used in the atmospheric research flights. It should be noted that flights were conducted in the 1940s to develop the icing conditions environment data that eventually became known as Appendix C. It should also be mentioned that Appendix C icing conditions design standard has been used for many decades without significant question. However, the technical evolution of the airplane design has resulted in more critical aerodynamic designs—high performance, super critical wings, etc.—where recent service history has shown them to be more sensitive to critical surface contamination than older airplane designs.

For engine installation certification, additional icing conditions for ground operation are specified including falling and blowing snow, and freezing fog.

### *Aircraft Flight Manual limitations*

In general, the Aircraft Flight Manual (AFM) will contain a statement in the limitations section such as "The airplane is approved for operation in atmospheric icing conditions."

What *is not* specifically stated in the AFM is that this approval is based on the certification design standard of FAR 25, Appendix C icing conditions. In addition, the certification design standards do not require that the AFM include any wording stating what the requirements are for operating in icing conditions.

*At the present time, no design standards exist for icing conditions outside of FAR 25, Appendix C; thus, no airplanes have been certified to icing conditions that exceed FAR 25, Appendix C. This includes takeoff in freezing drizzle and/or light freezing rain*. No manufacturer has conducted the required analyses or tests to show that the existing IPS are effective or that the airplane performance and handling qualities are acceptable when operating in SLD conditions.

Airplane manufacturers, certification and operational authorities know that the "atmospheric icing conditions" in the AFM approval statement do not include SLD conditions. A limitation relating to severe in-flight icing conditions is contained in the AFMs of some types of airplanes and may in fact include freezing drizzle and/or light freezing rain (other than the Cessna 208 which prohibits takeoff, flight into, and landing in freezing drizzle and/or freezing rain). Other AFMs only include in-flight detection and exit strategies.

### *Probability of occurrence of icing conditions exceeding FAR 25, Appendix C*

Because of significant geographical differences and seasonal changes, it is difficult to give a precise definition of the probability of occurrence of SLD icing conditions. However, to a first approximation, the probability of occurrence for any particular location in North America has been estimated as between one and five percent over the winter season for a large part of the continent. Some airports on the east coast of Canada have reported up to 39 "annual freezing rain days."

## Hazards associated with ground operation in SLD icing conditions

### *Ground contamination of ramps, taxiways and runways*

Freezing drizzle and/or light freezing rain falling on ramps, taxiways and runways will likely solidify into an ice layer. This will reduce the surface friction available for airplanes manoeuvring during taxi (cornering friction) and will also reduce the friction available for stopping (braking friction).

During operations in conditions of freezing drizzle and/or light freezing rain, ground de-icing and/or anti-icing chemicals can be used to improve the friction available. In conditions of continuous freezing drizzle and/or light freezing rain, it could be expected that the braking coefficient would further deteriorate. Hence, it could be expected that even on a treated runway, the stopping performance would not be as good as it would be even on a wet runway.

Some air operators make adjustments to the takeoff reference speed $V_1$ and reduce take-off weight, if necessary, when operating on wet or contaminated runways.

### *Ground contamination of airplanes*

Freezing drizzle and/or light freezing rain will solidify on a parked or taxiing airplane, unless it has a recent coating of de-icing/anti-icing fluid. As per CAR 602.11(4), an airplane must either be inspected immediately prior to takeoff to determine whether there is any ice adhering to any of its critical surfaces, or, in the case of air operators, this inspection may not be required if dispatch and takeoff are conducted in accordance with an approved airplane inspection program. This inspection program includes specification of the procedures for de-icing/anti-icing and the use of Holdover Time (HOT) tables. HOT tables provide approximate times for which the de-icing/anti-icing fluid will remain effective in preventing ice adhering to the surface. These tables are provided for various ambient temperature, fluid concentrations and weather conditions for individual specified fluids. It should be emphasized that the HOT tables are based on *fluid performance and not airplane performance*. HOT tables are not defined as being unique to any type of airplane; they are general and unique to the fluid type.

HOT tables include data for weather conditions of freezing drizzle and/or light freezing rain. No data are provided for moderate, heavy and severe freezing rain.

*The provision of HOT tables for freezing drizzle and/or light freezing rain could be assumed to imply that operations to be undertaken in these conditions are authorized. This is quite simply not the case! The bottom of every table contains the following quote:*

> ***"Fluids used during ground de-icing/anti-icing do not provide in-flight icing protection."***

Airplane contamination due to freezing drizzle and/or light freezing rain may be more difficult to visually observe than other types of freezing contamination (e.g. frost, snow). In addition, visual inspection through cabin windows could be impaired due to anti-icing fluid on the windows.

There have been a number of accidents attributed to taking off with ice contamination of wings due to omission of, or incomplete, ground de-icing/anti-icing procedures. Airplanes with "hard" leading edges appear to be more susceptible to the adverse effects of ice accretion on the wing than airplanes with leading-edge slats.

Commercial air operators using smaller (FAR 23) airplanes frequently operate into less busy airports. Smaller airports may not have the extensive ground de-icing/anti-icing infrastructure available at larger airports. For these circumstantial reasons (in addition to technical reasons), smaller airplanes may be more at risk from ice contamination on the ground.

### *Windshield ice protection*

Although it would be normal procedure to de-ice an airplane windshield if it was contaminated, it would not be normal practice to apply anti-icing fluid as this could result in an obscured and/or distorted view during taxi and low speed operations. Although it is believed that windshield IPS, designed to FAR 25, Appendix C icing conditions, would be effective in protecting the view in freezing drizzle and/or light freezing rain, this has not been demonstrated.

### *Visibility*

Freezing drizzle and/or light freezing rain will also be associated with conditions of reduced visibility. Specific limits are placed on the minimum visibility required for takeoff in the CARs and associated Standards.

### *Powerplant ice protection*

Powerplant components that require protection include the engine nacelle, engine rotating and static components, and the engine sensors. It is possible that the airplane

IPS may not be as effective in freezing drizzle and/or light freezing rain. However, there is evidence of engine damage and operating anomalies caused by ground operation in freezing drizzle and/or light freezing rain. Ice can accumulate in inlets and on components at low thrust levels (e.g. ground idle) without any noticeable adverse effect. This ice can subsequently be shed at high thrust levels (e.g. take-off thrust) causing engine operating anomalies and/or damage.

### *Other systems ice protection*

Other systems that require protection include the pitot-static system, and temperature and angle of attack sensing systems. Although probably adequate, the capability of the IPS to protect in freezing drizzle and/or light freezing rain is unknown.

### *Conclusion*

Takeoff into known freezing drizzle and/or light freezing rain is outside of the flight envelope for which any airplane currently operating today is certificated. Not only is it unwise to operate in such conditions, it is also unsafe, and based on the best information available at this time, also illegal.

In Part II, we will address hazards associated with in-flight operation in SLD icing conditions, and also meteorology measurement criteria forecasting/reporting freezing drizzle and/or light freezing rain vs. FAR 25, Appendix C.

### *References:*


1. *J. C. T. Martin, Transport Canada Aircraft Certification Flight Test, Discussion Paper No. 41, The Adverse Effects of Ice on Aeroplane Operation, Issue 2, 4 July 2006. (Paper which was the basis for Mr. Martin's article* "The Adverse Aerodynamic Effects of Inflight Icing on Airplane Operation", *published in ASL 1/2007, and available at* www.tc.gc.ca/CivilAviation/publications/tp185/1-07/Feature.htm)
2. *J. C. T. Martin, Transport Canada Aircraft Certification Flight Test, Discussion Paper No.50, Takeoff in Conditions of Freezing Drizzle or Freezing Rain (Fixed-Wing Aircraft), Issue 2, 29 September 2006.* △


## Answers to the 2009 Self-Paced Study Program

1. Prior notice required
2. Instrument landing system (ILS) localizer and VHF omnidirectional range (VOR); Automatic direction finder (ADF)
3. The identification of the air traffic services (ATS) unit controlling the RCO; the aircraft identification; the name of the location of the RCO followed by the individual letters R-C-O in a non-phonetic form
4. control towers and flight service stations (FSS)
5. 122.75 MHz
6. QS signifies "quasi-stationary" which means the low-pressure area is moving less than 5 kt.
7. Moderate and severe.
8. A short-term weather advisory intended primarily for aircraft in flight.
9. 1 500; WS
10. On the 11th from 1200Z to 1600Z and on the 12th from 0300Z to 1800Z.
11. 700 ft.
12. Stratocumulus.
13. 5 300 ft.
14. The rain ended.
15. be retained but will not be active or monitored by the flight information centre (FIC)
16. 2; 1
17. 1-866-WXBRIEF or 1-866-GOMÉTÉO
18. an air traffic control (ATC) unit, a flight service station (FSS), a community aerodrome radio station (CARS), or a rescue co-ordination centre (RCC)
19. the termination of all alerting services with respect to search and rescue notification.
20. do not
21. One hour past the estimated time of arrival (ETA); At the search and rescue (SAR) time specified, or 24 hr after the duration of the flight or the ETA specified.
22. 7700
23. No. You are required to remain 10 NM clear of the aerodrome from 1900Z until 2030Z.
24. On the NAV CANADA Web site.
25. Calculated to the first day of the month following your medical examination with a validity period determined by your licence/permit and age.
26. 5, 6
27. Antihistamines, tranquilizers and appetite reducing drugs such as amphetamines. They can reduce mental alertness.
28. Yes.
29. is visually aligned
30. CARs prohibit takeoff when frost, ice or snow is adhering to any critical surface of the aircraft.
31. A left turn.
32. Because the helicopter's lower operating speeds produce more concentrated wakes than fixed-wing aircraft.
33. Stick shake, erratic stick forces and rotor roughness.
34. a high sink rate
35. an altimeter; a vertical speed indicator; a fuel quantity gauge; an envelope temperature indicator
36. Deflation
37. slack; tension
38. In the same direction as the glider already in the thermal.

# MAINTENANCE AND CERTIFICATION



## The Authorized Release Certificate Goes Under the Microscope

*by Brad Taylor, Civil Aviation Safety Inspector, Maintenance and Manufacturing, Standards, Civil Aviation, Transport Canada*

This article focuses on the recent changes to the Canadian Authorized Release Certificate (hereinafter referred to as the "certificate"), formerly known as form number 24-0078, and recently reborn as FORM ONE. *Canadian Aviation Regulation* (CAR) Standard 571, Appendix J, was published on December 30, 2008, resulting in the first major change to the certificate in years. While the changes seem significant at first glance—and some of them are—the general use and purpose of the document have changed very little. The scope of this article will be limited to use of the certificate under CAR 571 to keep the discussion focused on issues related to maintenance release.

### *What is driving the change?*

Aviation business has become "globalized," with manufacturers and operators crossing physical, political, regulatory and cultural barriers in order to meet their customers' expectations. As the aviation industry grows, it becomes more apparent that in order for businesses to function, they need to establish standards to facilitate communication and commerce. Transport Canada Civil Aviation (TCCA), the U.S. Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) have identified the need to establish standards at key intersections between the three regulatory systems. The common goal for all has become to standardize certain areas of their regulations and harmonize their goals and objectives to allow for improved safety and future prosperity of the aviation industry. The certificate was identified as one of the key areas for improvement to ease the movement of new and repaired parts between countries and regulatory systems.

### *What does the certificate represent?*

The certificate conforms to a standardized, internationally recognized format for the release of both new and used (maintained) aeronautical products (also referred to as "items" or "parts"). Proper and appropriate use of the document—be it a 24-0078 form, FAA 8130-3 form, EASA Form 1 or Canada's new FORM ONE—sends a message to aviation professionals throughout the industry. It is a clear indication that the part or parts have been maintained in accordance with standard industry practices. A properly completed document will give the installer a comprehensive picture of the condition of the part and the work that has been performed on it.

### *What has changed?*

The new Appendix J has changed the certificate from an official Transport Canada form to a template, allowing more flexibility while establishing the mandatory elements to meet CAR Standard 571.10. There have also been some changes in the data blocks in terms of content, terminology and persons authorized to sign. Let's take a closer look at these changes.

*Block 9 "eligibility" has been eliminated.*

Block 9 was removed, as it was determined to serve no useful purpose and was cause for concern to some when their specific aircraft type was not listed. Some operators felt that the certificate represented an authority to install the part on their aircraft when they should have been referring to their type certificate, illustrated parts catalogue, or other instructions for continued airworthiness (ICA) issued by the manufacturer. Removing this feature from the certificate reduces the possibility of error by the installer, and reinforces best practices by encouraging use of the manufacturer's ICA.

*Block 11 status/work terminology has changed.*

Terminology was changed in an effort to standardize with EASA's terms and definitions. The only term that changed was "inspected/tested." It is important to note that the intent of the new term is NOT to insist that if an inspection is certified, it must also be supported with a test. The new term allows for certification of an inspection, a test, or both. The details should appear in Block 12. The complete term "inspected/tested" must be used even if one of the actions was not carried out. Remember that inspections of aeronautical parts must always be carried out and certified in accordance with approved or acceptable data of some kind. Attesting that a general receiving inspection was conducted would not be subject to a maintenance release and, as such, could not be certified with an authorized release certificate.

*Block 14b requirements have changed.*

> CAR Standard 571, Appendix J, states, "*Only persons specifically authorized by the certificate holder in accordance with CAR 573 are permitted to sign this block*." This means that you must be working under the authority of an approved maintenance organization (AMO) to make a maintenance release on the new FORM ONE. This is a significant change from the previous requirement!

### *What has not changed?*

What is referred to as the "look and feel" of the certificate has not changed. This means that it should not be a challenge for industry to adapt, and global acceptance should be unchanged from form number 24-0078. While the certificate has seen some minor changes, some unacceptable issues still exist.

Use of the term "overhaul" has not changed with the release of the new CAR, yet use of it remains an issue in certain areas of the business. It is generally accepted that if an AMO performs all the functions stated in the CARs definition of "overhaul," they are within their rights to state that the product was "overhauled." Technically this may be correct, but problems arise when we are working on products for which no overhaul criteria exists. An AMO may be tempted to release a product as "overhauled," and in doing so they enhance the value of the product in the eyes of the industry. The product is really only repaired and tested, as no overhaul criteria has been published by the manufacturer. The solution to the problem is to only use the term "overhaul" if the product has been reworked and tested in accordance with the manufacturer's overhaul instructions. If no such documentation exists, the product cannot be overhauled!

### *What about over-tagging?*

There have been numerous questions and concerns submitted from industry regarding over-tagging a certificate—what is it and why is it unacceptable? Over-tagging occurs when someone receives a repaired part with a completed certificate and proceeds to write a new certificate under their company name. There are various justifications given for this activity, including internal process and document flow, as well as hesitance to reveal one's sources. Regardless of the reason for the activity, it does not conform to the regulations. The organization

| | | | | | |
|---|---|---|---|---|---|
| 1. Approving Civil Aviation Authority/Country<br>**Transport Canada** | | 2.<br>AUTHORIZED RELEASE CERTIFICATE<br>FORM ONE | | | 3. Form Tracking No. |
| 4. Organization Name and Address | | | | | 5. Work Order/Contract/Invoice |
| 6. Item | 7. Description | 8. Part No. | 9. Qty. | 10. Serial/Batch No. | 11. Status/work |
| 12. Remarks | | | | | |
| 13a. Certifies that the items identified above were manufactured in conformity to:<br>☐ approved design data and are in condition for safe operation<br>☐ non approved design data specified in block 12. | | | 14a. ☐ CAR 571.10 Maintenance Release<br>☐ Other regulation specified in block 12<br>Certifies that unless otherwise specified in block 12, the work identified in block 11 and described in block 12, has been performed in compliance with the *Canadian Aviation Regulations*. | | |
| 13b. Signature | 13c.Approved Organization Number | | 14b. Signature | | 14c. Approved Organization Number |
| 13d. Name | 13e. Date (dd/mmm/yyyy) | | 14d. Name | | 14e. Date (dd/mmm/yyyy) |

(Previously form 24-0078) Important: See notes on reverse side

**Installer Responsibilities**

This certificate does not constitute authority to install.

Installers working in accordance with the national regulations of a country other than that specified in block 1 must ensure that their regulations recognize certifications from the country specified.

Statements in blocks 13a or 14a do not constitute installation certification. In all cases, the technical record for the aircraft must contain an installation certification issued in accordance with the applicable national regulations before the aircraft may be flown.

*Sample form taken from CAR Standard 571, Appendix J* responsible for performing the maintenance activity needs to be the one responsible and accountable for the certification of the work. How can an organization be responsible if they had no control over the process and quality control involved with the activity? If a second organization takes responsibility for the work, they break the traceability between the installer and the repairer of the part.

### *Bumps on the road of change*

Everyone agrees that change is necessary, but managing change such that all parties involved are well informed and prepared remains the greatest challenge in any organization.

Originally, the certificate was an official form (24-0078). The 24-0078 form was internationally recognized by foreign regulatory authorities in agreements such as the EASA Administrative Arrangement on Maintenance (AAM). These arrangements allowed for acceptance of the 24-0078 form by foreign operators, and provided them with guidance material for its acceptance and use.

With the release of the new Appendix J, Transport Canada is harmonizing the new Canadian FORM ONE template with that of the other regulatory authorities. Canadian organizations have the opportunity to make the transition from the 24-0078 form to the new FORM ONE template, but problems have occurred when Canadian AMOs have sent the new FORM ONE to EASA customers. The issue is a result of the AAM not being revised to recognize the new FORM ONE at the same time as Transport Canada published the new Appendix J. Until such time as the AAM is revised, the 24-0078 form remains the means for Canadian AMOs to certify and ship products to EASA customers.

This brings us to the question currently occupying the thoughts of many Canadian AMOs. How can we continue to use the old form 24-0078 when the CARs Standard has been revised, and the expectation is that we should be adopting the new FORM ONE? The answer lies in the CARs themselves.

1. CAR 571.10 establishes the requirements for a maintenance release to be further detailed in the standard.
2. CAR Standard 571.10 details the key elements that must be contained in any maintenance release, and it suggests that the requirements could be met with the use of the template found in Appendix J.
3. Appendix J gets into the specifics regarding the FORM ONE template and its use.

It seems simple when you follow the progression, but what if you want to use the 24-0078 form to certify parts intended for EASA customers? There is some flexibility built into the Standard, as long as an AMO meets the intent of the regulation while ensuring that all the elements of a maintenance release are met. CAR Standard 571.10(2)*(d)* states:

> "*Where a maintenance release is made using an 'Authorized Release Certificate' (Form One), Appendix J would normally apply.*"

The key word in the Standard quoted above is "normally." If an AMO determines that they are going to make a maintenance release using the 24-0078 form, they are not restricted from doing so as long as the elements stated in the Standard are met and the guidance material to use the document is followed.

**Note**: Instructions for use of the 24-0078 form are still available on the Web by clicking on the "previous version" link located just below the title:

**Appendix J**
**Authorized Release Certificate**
(Refer to section 571.10 of this standard)
(amended 2008/12/30; previous version)

If an AMO determines that adopting the new FORM ONE is the correct option for its business, it can do so by following the guidance material found in the new version of Appendix J, and as long as it has updated its maintenance policy manual (MPM) to recognize the new process.

### *In closing*

By the time this article is published, many changes may have taken place. The one axiom you can count on when moving aeronautical products between different regulatory systems is that you must meet the requirements of the importing country if you expect to have a successful transaction. It is your responsibility to research and understand these requirements before you ship.

**Note:** On June 30, 2009, TCCA received a letter from EASA stating that as an interim measure EASA considers that the updated TCCA FORM ONE template can be deemed to meet the requirements for the previous form 24-0078. This will allow CAR Part V, Subpart 73 approved manintenance organizations, who also hold an EASA 145 approval, to transition to the new TCCA authorized release certificate template. EASA has also committed to inform their stakeholders of their acceptance, which should ensure the acceptance of the new TCCA FORM ONE template when used as part of an EASA 145 approval. △

## Inspection and Maintenance of Flush-Mounted Fuel Caps

*The following is a Safety Information Letter from the Transportation Safety Board of Canada (TSB).*

On September 17, 2008, a privately operated Beechcraft Baron 58 departed Medicine Hat, Alta., on a VFR flight to Fort St. John, B.C. Immediately after takeoff, the right engine (Teledyne Continental IO-520-C) surged and lost power. Power could not be restored and the engine was subsequently secured. The aircraft was unable to maintain level flight with the left engine operating at full power, and it descended and crashed into the South Saskatchewan River several miles from the airport at 19:25 Mountain Daylight Time (MDT). (See Photo 1.) The pilot and two passengers sustained minor injuries; two additional passengers sustained serious injuries. The aircraft was substantially damaged.

*Photo 1: This Beech 58 Baron forced landed in South Saskatchewan River after the right engine lost power.*

The right engine was removed and successfully run on a test stand. Subsequent visual inspection and flow check of the related fuel injection components, and detailed examination of the airframe fuel system, did not reveal any system abnormalities that would have precluded normal function. While the reason for the loss of power was not identified during the assessment of the occurrence, indications of water contamination within the fuel system were noted.

Prior to the engine test run, a small amount of water was recovered from the right-engine-driven fuel pump. The water sample was compared to water from the South Saskatchewan River and the properties were found to be different. Journey logbook records indicated the right engine experienced a power loss during a flight in November 2006—approximately 79 hr prior to the accident—due to water in the fuel system.

One potential pathway for free water, in the form of rain or wash water, to enter aircraft fuel tanks is through fuel caps that do not seal properly. The aircraft was fitted with two standard, flush-mounted fuel caps manufactured by Shaw Aero Devices[1]. (See Photos 2 and 3.) This type of fuel cap is installed in numerous models of small aircraft. The cap seals consist of two O-rings, one around the outer circumference of the cap and one on the shaft of the locking mechanism axle. Water leakage was detected post-accident during in situ testing of the fuel caps, with the fuel caps secured in the filler openings. The handle bearing plates also showed excessive wear and the caps had parts missing.

The fuel caps were forwarded to the manufacturer, where they were tested in accordance with Shaw Aero Devices standard acceptance test procedures for fluid filler caps and adapters. The procedure required the fuel caps to be mounted in a test fixture and 5 to 25 psi pressure to be applied to the underside. No leakage is permitted. At 0.5 psi, both caps leaked past the axle and handle assemblies. (See Photo 4.) The caps were disassembled and inspected. The O-rings on the axle shafts in both

*Photo 2: Top view of flush-mounted fuel cap*


*Photo 3: Bottom view of flush-mounted fuel cap*

1 Shaw Aero Devices, Inc. was acquired by Parker Hannifin Corporation in November 2007.

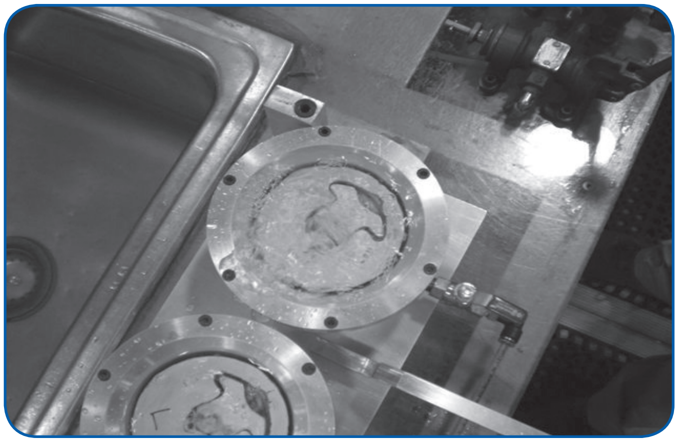


Photo 4: Fuel caps on test pot—note air bubbles above cap in middle of picture that indicate leakage

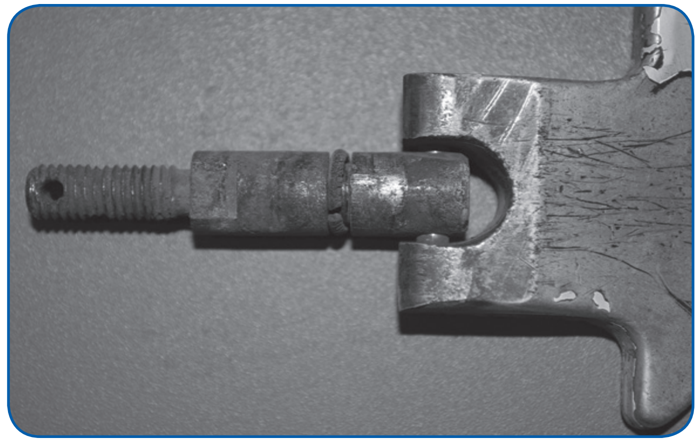


Photo 5: Note deteriorated O-ring and corrosion on axle shaft

caps were cracked and broken, and both axle shafts were corroded sufficiently to indicate long-term exposure to moisture. (See Photo 5.)

Neither the cap manufacturer, nor the aircraft manufacturer provides written guidelines for inspection and maintenance of this type of fuel cap. At least one other small aircraft manufacturer has developed detailed guidelines for inspection and maintenance of flush-mounted fuel caps. The Federal Aviation Administration's (FAA) Advisory Circular AC 43.13-1B, titled *Acceptable Methods, Techniques and Practice—Aircraft Inspection and Repair,* is a primary maintenance reference to be used when manufacturers do not supply repair or maintenance instructions. AC 43.13-1B simply states that fuel cap O-rings are to be inspected to determine that they are in good condition. Furthermore, Shaw Aero Devices considers the fuel caps to be a "return to vendor" item if repair, including O-ring replacement, or overhaul is required.

As shown by this occurrence, the lack of specific original equipment manufacturer inspection and maintenance guidelines for flush-mounted fuel caps can result in discrepancies such as deteriorated cap seals (O-rings) to remain undetected, thereby increasing the risk of water entering aircraft fuel cells, which can ultimately contribute to loss of engine power. △

## Locked Carbon Disc Brake Due to Moisture Absorption and Freezing Lead to Tire Failure

On January 28, 2008, following an extended period of heavy rain, a Bombardier BD700 Global Express departed Van Nuys, Calif., at 2240 UTC from a dry runway for a long-range flight to London Luton Airport, U.K. The flight was without incident and the aircraft arrived at Luton at 0808 UTC on the following day, January 29, 2008.

Shortly after a normal touchdown on Runway 26, the crew became aware of a rumbling noise, which they identified as a burst tire. The aircraft captain applied normal braking and 15 s after touchdown, the No. 2 and No. 3 hydraulic system low-pressure engine indication and crew alerting system (EICAS) messages displayed. The pilot brought the aircraft to a stop on the runway using normal brakes and, as fire vehicles approached, shut down both engines.

During the landing roll, the left inboard main landing gear tire suffered a failure resulting from an initially locked wheel. This tire failure caused extensive damage to the flight control system. The Air Accidents Investigation Branch of the United Kingdom (AAIB) investigated this occurrence and issued AAIB Bulletin 12/2008, which is available at www.aaib.gov.uk/sites/aaib/cms_resources/Bombardier%20BD700%20Global%20Express,%20VP-CRC%2012-08.pdf (English only).

### *Water absorption by carbon brakes*

Prior to departure, the airplane was exposed to a significant amount of rainfall and the carbon disc brakes were soaked by water. The brake manufacturers confirmed that the materials of the rotors and stators, both being carbon-type structures, are porous and slightly absorbent. After extensive water soaking, they require a prolonged period of exposure to dry, warm conditions to ensure that full drying takes place.

Alternatively, significant braking action must be deliberately applied during taxiing before departure to ensure brake drying. It is important to be aware that, on this type, rainfall can cause wetting of the brakes even in light wind conditions when the brakes would normally be assumed to be sheltered by the wing structure. It is also important to be aware that the brakes remain saturated with water for a lengthy period after rainfall ceases and runways and taxiways become dry.

The flight data recorder (FDR) showed that only a brief and light application of the relevant brake took place during taxiing (at a speed of approximately 3 kt). Automatic brake application on the type then occurs for four seconds during retraction. The AAIB concluded that the contact faces of the brake stators and rotors of the brake unit in question remained both wet and in close proximity as the aircraft climbed and the temperature in the wheel bay cooled to a sub-zero level. The cruise took place at ambient temperatures below -25ºC, which is presumed to have caused stationary and moving components to become firmly frozen together, leading to wheel locking and tire failure on landing. Application of sustained torque to the locked wheel, or some effect of the tire rupture process, presumably caused failure of the ice bond, allowing the wheel to rotate and the damaged tire section to flail and destroy areas of structure and critical aircraft systems.

### *Actions by the manufacturer*

Following the occurrence, the manufacturer issued Advisory Wire AW700-32-0244 on March 19, 2008, containing operational and maintenance information to counter the problem of freezing of wet carbon brakes. The manufacturer later issued Advisory Wire AW700-32-0244, Revision 1, which includes additional information to the original Advisory Wire.

### *AAIB*

AAIB Bulletin 12/2008 contained four aviation safety recommendations, one of which was addressed to Transport Canada:

> **Safety Recommendation 2008-073**
> It is recommended that the U.S. Federal Aviation Administration (FAA), the European Aviation Safety Agency (EASA) and Transport Canada (TC) raise awareness of the vulnerability of carbon brakes to freezing in flight following exposure to moisture on the ground, emphasising the significance of the slow drying rate of saturated brakes even in warm, low humidity conditions.

In addition to publishing this article in the *Aviation Safety Letter*, TC has issued Service Difficulty Advisory (SDA) **AV 2008-08, dated December 2, 2008**, in response to AAIB Safety Recommendation 2008-073. The purpose of this SDA is to inform Canadian operators and flight crews operating airplanes equipped with carbon disc brakes of the possibility of moisture absorption and subsequent freezing during flight, resulting in tire failure and damage to the airplane on landing due to a locked wheel brake. The full SDA can be found at: www.tc.gc.ca/CivilAviation/certification/continuing/Advisory/2008-08.htm. △

## *Fatigue Risk Management System for the Canadian Aviation Industry: Developing and Implementing a Fatigue Risk Management System* (TP 14575E)

*This is the fourth of a seven-part series highlighting the work of the Fatigue Risk Management System (FRMS) Working Group and the various components of the FRMS toolbox. This article briefly introduces TP 14575E,* Developing and Implementing a Fatigue Risk Management System. *Intended for managers, this comprehensive guide explains how to manage the risks associated with fatigue at the organizational level within a safety management system (SMS) framework. The complete FRMS toolbox can be found at* www.tc.gc.ca/civilaviation/SMS/FRMS/menu.htm.*—Ed.*

### *The Aim of This Guide*

This guide is designed for individuals who are responsible for managing fatigue risk at an operational level. You should already have completed the *Fatigue Management Strategies for Employees* (TP 14573E) workbook or equivalent, which provided information about the causes and consequences of fatigue, and included practical strategies for managing the impact of fatigue. *Fatigue Management Strategies for Employees* focused on reducing fatigue risk at the individual level. You should now be familiar with the risks associated with fatigue and the major contributors to increased fatigue levels (i.e., inadequate quality and/or quantity of sleep, time of day, and length of time awake). This guide explains how the risks associated with fatigue can be managed at the organizational level within a safety management system framework. You will learn how to implement fatigue risk management controls systematically within your organization.

### *Your Role*

As an individual in a managerial or supervisory role you are accountable not only for managing your own fatigue levels but also the fatigue risk of employees within your organization and/or work unit. The tools and strategies presented in this guide have been developed to help you manage fatigue risk at various levels, ranging from ensuring compliance with legal and regulatory requirements to investigating and learning from accidents and incidents in the workplace. Managing fatigue-related risk in the organization is achieved using a fatigue risk management system (FRMS).

### *How to Use This Guide*

This guide describes how an FRMS is best employed within an organization's safety management system. This allows the risks associated with fatigue to be managed in a way similar to other hazards such as dangerous goods. An FRMS should be based on an internal risk assessment of the organization. This ensures that any fatigue management strategies being implemented are measured, appropriate, and targeted. There are several Canadian national standards for risk assessment, all of which clearly outline acceptable guidelines for risk management (e.g., CAN/CSA-Q850-971, CAN/CSAQ634-912).

The fatigue risk management system described in this guide provides your company and employees with a recognized process based on likelihood and consequence and the need to identify, understand, and control the workplace hazard. The resources and time required for implementing a fatigue risk management system will be determined by the relative risk identified during your risk assessment process.

There are six major aspects to an FRMS:

**1. Policies and Procedures:**
- Outline the commitment of organizational management to manage fatigue-related risk;
- Detail the required procedures for managing fatigue at the operational level.

**2. Responsibilities:**
- List personnel responsible for FRMS design, implementation, and maintenance;
- Document responsibilities of individual employees and work groups.

**3. Risk Assessment/Management:**
- Scheduled versus actual hours of work;
- Individual sleep patterns;
- Symptom checklists;
- Error/incident reporting.

**4. Training:**
- Promote knowledge in the workplace about risks, causes, and consequences of fatigue;
- Ensure employees understand and can apply fatigue management strategies.

**5. Controls and Action Plans:**
- Toolbox of methods used within the FRMS, including error reduction techniques ("fatigue proofing");
- Clear decision trees for managers and employees to use when fatigue has been identified as a risk.

**6. Audit and Review:**
- Documentation and data collection at regular intervals of how the FRMS works;
- Review of the FRMS based on audit results.

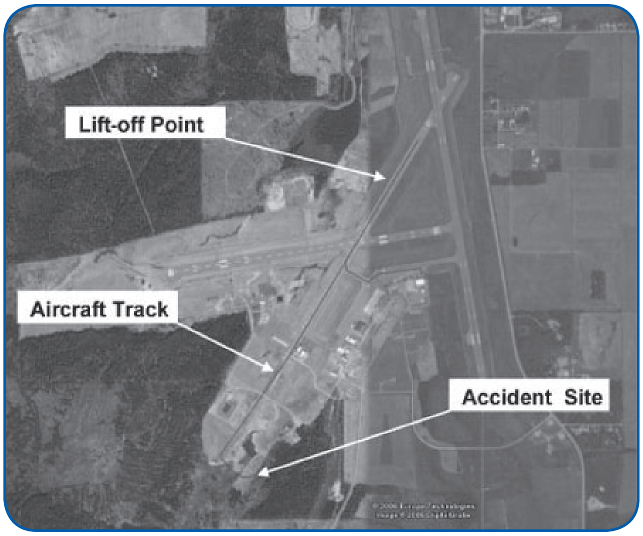
*We conclude this overview of TP14575E by encouraging our readers to view the entire document on-line. Find it at* www.tc.gc.ca/CivilAviation/SMS/pdf/14575e.pdf. △

# 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 and include the TSB's synopsis and selected findings. Some excerpts from the analysis section may be included, where needed, to better understand the findings. We encourage our readers to read the complete reports on the TSB Web site. For more information, contact the TSB or visit their Web site at* www.tsb.gc.ca. *—Ed.*

## TSB Final Report A06P0095—Loss of Control

On May 31, 2006, the pilot of a Cessna 185B departed Prince George, B.C., from Runway 19 on a flight to Scoop Lake, B.C. The aircraft flew on the runway heading until it was about 2 400 ft beyond the departure end of the runway, where it abruptly pitched up, climbed steeply, turned left, and rapidly descended into trees about 600 ft left of the runway's extended centreline. The aircraft was airborne for less than 47 s and reached a maximum height of about 270 ft above ground level (AGL). The aircraft was destroyed, and the pilot, who was the sole occupant, was seriously injured. There was no fire.




*Departure path from Prince George Airport*

### *Analysis*

There are many indications that the engine was operating normally, making engine failure unlikely as a cause or contributing factor to the accident.

The take-off distance and climb speeds were consistent with the performance indicated in the owner's manual.

The aircraft's centre of gravity (CG) was near the aft limit and the flight path after takeoff was consistent with an aircraft that is aft-heavy and unstable about the pitch axis. The horizontal stabilizer was found trimmed to a position consistent with an aft CG. The turbulent, gusty wind at Prince George and the retraction of the flaps would have exacerbated the unstable condition. As well, the unrestrained cargo may have shifted rearward in flight, moving the CG further aft.

It is concluded that a loss of pitch control, consistent with an aft CG, occurred in gusty and turbulent conditions at a height too low for the pilot to effect recovery. The unrestrained cargo likely struck the pilot during the crash and may have contributed to his injuries.

### *Findings as to causes and contributing factors*

1. Loss of pitch control, consistent with an aft CG, occurred in gusty and turbulent conditions at a height too low for the pilot to effect recovery.
2. The cargo was unrestrained, which may have allowed some cargo to shift rearwards during the takeoff and climb, resulting in an extremely aft CG.

### *Finding as to risk*

1. Unrestrained cargo presents a high risk to aircraft occupants during turbulence and during a crash.

## TSB Final Report A06O0141—Loss of Control and Collision with Terrain

On June 16, 2006, the pilot of the privately owned Bede BD5-J aircraft departed the Ottawa/Carp Airport, Ont., at approximately 12:05 Eastern Daylight Time (EDT) to practice his routine for the air show scheduled for the following two days. At approximately 12:10 EDT, the pilot radioed that he was starting his final fly-past before landing. The routine for this low-speed fly-past called for a number of quick extensions and retractions of the aircraft's landing gear while at a height of about 500 ft above ground level (AGL). After several cycles of the landing gear, and while the landing gear was extended, the aircraft rolled sharply to the right. The nose dropped, and the aircraft descended rapidly and hit the ground. The aircraft

was substantially damaged, and the pilot sustained fatal injuries.

*Finding as to causes and contributing factors*

1. The right flap was incorrectly installed during the wing installation, which allowed the right flap to retract during the fly-past. This created a flap asymmetry that resulted in an uncommanded and uncontrollable right roll. The aircraft was at an altitude from which recovery was not possible before the aircraft struck the ground.

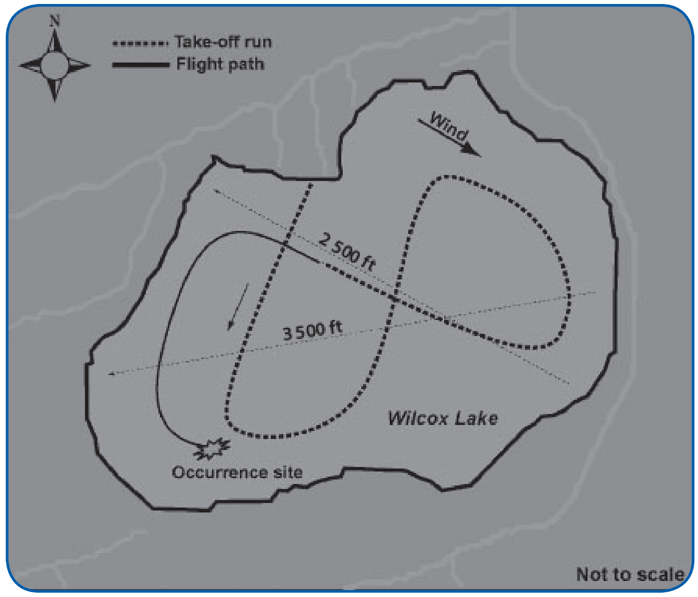
*Findings as to risk*

1. The right-wing taper bolt did not penetrate deep enough through the spars to engage the fibre locking feature of the locknut. Therefore, the taper bolt was not in safety at the time of the accident.
2. The fibre locking feature of the left-wing locknut was worn and did not secure the left-wing taper bolt in safety.

## TSB Final Report A06O0180—Collision with Water

On July 16, 2006, at approximately 17:20 Eastern Daylight Time (EDT), a float-equipped Cessna 172M aircraft was departing Wilcox Lake, Ont., for a flight to Manitoulin Island, Ont., in visual meteorological conditions (VMC). Because of the confined area of the lake, the pilot performed a figure-eight manoeuvre while step-taxiing to increase speed for the final take-off run. This manoeuvre entailed two 180° turns at opposite ends of the lake. After the aircraft became airborne, a steep, low-altitude turn to the left was initiated to avoid obstacles on the shoreline. As the bank angle increased, the aircraft stalled, struck the water in a nose-down attitude with the left float, and flipped over. The aircraft came to rest inverted in shallow water near the shoreline. The pilot and two passengers escaped without injury.

Wilcox Lake is a small lake in a residential area of Richmond Hill, Ont. The shoreline is surrounded by residential buildings, and beyond that, numerous subdivisions. The lake is popular for recreational activities such as swimming, boating, and canoeing; during the occurrence, it was being used extensively. The longest section of the lake is approximately 3 500 ft in an east-west direction. The direction the aircraft was travelling during the final take-off run was northwest. The total distance available from the southeast shoreline to the northwest shoreline for the take-off run was about 2 500 ft.




*Wilcox Lake takeoff diagram*

The figure-eight manoeuvre that was used during the takeoff entailed changing direction twice and, because of the speed of the aircraft, a large radius turn could be expected. The aircraft was approximately 200 ft from the east-southeast shoreline before turning to a northwest direction for the final take-off run. There is an inherent risk related with changing directions while step taxiing, depending on the associated wind and wave conditions. During a step taxi turn from a tailwind to a headwind, the wind acts on the underside of the inboard wing, causing it to rise. This, combined with upward movement caused by wave action and pressure from centrifugal forces acting on the aircraft during the turn, can lead to the aircraft capsizing.

The occurrence take-off procedure was self-taught and was not published in the Cessna pilot operating handbook as a normal or amplified procedure. According to the *Canadian Aviation Regulations* (CARs), the manoeuvre was not a required procedure to learn or demonstrate for a seaplane rating.

The distance available for takeoff into wind, in a northwest direction, was insufficient. While there was enough distance to get airborne, the aircraft would not have been able to climb safely to an obstacle clearance altitude of 50 ft. The pilot elected to use a step-taxi turn in an attempt to shorten the take-off run. However, this had a negligible effect because the turn radius of the aircraft was increased during the final turn, thereby shortening the into-wind take-off distance available. After liftoff, the slow speed of the aircraft did not provide much margin above the stall speed for manoeuvring. As the aircraft banked to avoid obstacles, the stall speed increased, and the aircraft stalled.

The wind and wave conditions at the lake during the occurrence presented a risk of capsizing the aircraft during the step-taxi, figure-eight manoeuvre. The manoeuvre also introduced a potential conflict with watercraft and other persons using the lake for recreational purposes. A takeoff conducted in a fixed direction would have reduced the risk of collision.

### *Findings as to causes and contributing factors*

1. The pilot attempted to take off into wind in a northwesterly direction, although the distance available to take off and clear a 50-ft obstacle was insufficient.
2. After becoming airborne with insufficient distance remaining to clear the obstacles ahead, the pilot attempted a steep turn at low altitude, resulting in a stall and impact with the water.

### *Findings as to risk*

1. During the step-taxi, figure-eight manoeuvre, because of the associated wind and wave conditions, the aircraft was at risk of capsizing.
2. The aircraft was step-taxied in a manner that introduced a potential risk of collision with watercraft and other people using the lake.
3. The figure-eight, take-off manoeuvre employed by the pilot further decreased the into-wind take-off distance available because of the large radius turn of the aircraft while on step.
4. There is no indication that any of the pilot recency requirements under CAR 401.05(2)*(a)* were complied with.

### *Other finding*

1. Due to the absence of a maintenance release for the vortex generator installation, the aircraft was not being operated in accordance with CAR 605.85.

## TSB Final Report A06C0131—Collision with Terrain

On August 13, 2006, the pilot of a McDonnell Douglas Hughes 369E helicopter was transporting a team of two line-cutters from their company's base camp in the vicinity of Davy Lake, Sask., to nearby line-cutting operations. The pilot was flying at altitudes from 300 to 500 ft above ground level (AGL) in the vicinity of a small, unnamed lake when a caribou was spotted swimming across the lake. The pilot turned and descended toward the animal. The helicopter subsequently struck the lake at about 100 kt, at approximately 08:30 Central Standard Time (CST). The helicopter sank soon after impact, but the three occupants were able to egress from the submerged wreckage. The pilot and one passenger, who had both sustained serious injuries, were able to swim to shore. After removing their work clothing, they swam back to rescue the second passenger who was in difficulty in the water. Their attempt was unsuccessful and the second passenger drowned. The two survivors were rescued later that afternoon.

### *Other factual information*

The pilot was flying the helicopter from the left seat. One passenger was in the front right seat and the other passenger was seated in the right rear seat. When the caribou was spotted in the water, the pilot began a right turn toward the lake, leaning forward during the turn to keep the caribou in view. A steep descent developed over the trees and the pilot initiated recovery. The flight path of the helicopter continued over the water, paralleling a portion of the shoreline approximately 100 ft from the shore. The pilot continued levelling the helicopter but did not perceive that collision with the water was imminent and flew the helicopter into the water. For the operating conditions at the time of the accident, the helicopter's never exceed speed ($V_{ne}$) was 130 kt. There was no report of any unusual control forces, warning lights, or warning horns before or during the descending turn.

Fascination is a condition in which the pilot fails to respond adequately to a clearly defined stimulus situation, despite the fact that all of the necessary cues are present and the proper response is available to him. This is commonly referred to as "target fixation" and is fundamentally perceptual in nature. The individual concentrates on one aspect of the total situation to such a degree that he rejects other factors in his perceptual field.

A second perceptual problem occurs over water in conditions of very light or no wind. The water surface is featureless without wave action, commonly called "glassy water," and makes accurate judgement of height above the water impossible. The pilot can experience the illusion that he is higher than he actually is. The pilot in this occurrence had no knowledge of the glassy water phenomenon.



### *Analysis*

Although the pilot had completed pilot decision-making training, he did not apply these principles when deciding to manoeuvre and observe the caribou. The decision was made without consideration of the safety issues for over-water flight or knowledge of the hazards of the glassy, or near glassy, water phenomenon. The pilot likely fixated on the caribou and lost situational awareness, thereby allowing the helicopter to enter a high rate of descent at low altitude. When the pilot became aware that the helicopter was in a steep descent over the trees, he attempted to stop the descent but the helicopter continued out over the water surface. It is likely that difficulty with height judgement over glassy or near-glassy water impeded his recovery. Consequently, he flew the helicopter into the lake at high speed while attempting to level off.

### *Finding as to causes and contributing factors*

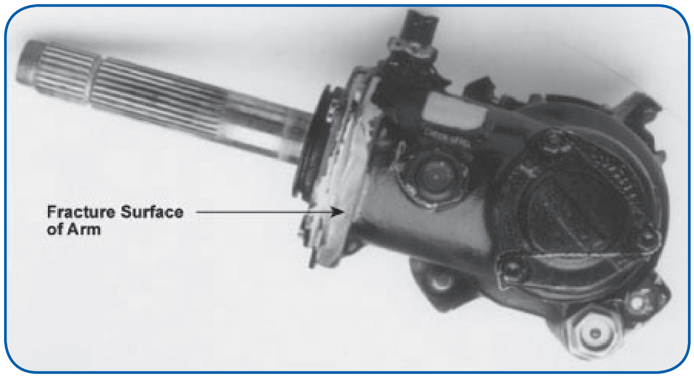
1. The pilot lost situational awareness while turning and entered a high rate of descent at low level. The recovery stage continued over glassy or near-glassy water and the pilot flew the helicopter into the water at high speed.

### *Finding as to risk*

1. Serviceability inspections of the helicopter did not detect the fatigue crack developing in the support arm.

### *Safety action taken*

On February 20, 2007, the TSB issued Safety Information Letter A06C0131-D1-L1, *Pre-Crack/Fatigue Crack of the Tail Rotor Gearbox Bellcrank Support Horn*, to Transport Canada Civil Aviation (TCCA). The Safety Information Letter stated that, in this occurrence, an inspection of the wreckage revealed a suspicious fracture surface of the tail rotor gearbox bell crank support horn.




*Tail rotor gearbox showing fracture of bell crank support arm*

Analysis of the fracture revealed a pre-crack/fatigue crack extending across approximately 75 percent of the entire cross section of the bell crank support horn. The fractured horn did not contribute to the accident.

On March 30, 2007, TCCA responded to the letter, indicating that it had been provided to the appropriate departmental officials for their information and use.

## TSB Final Report A06Q0180—Loss of Electrical Power

On October 18, 2006, a Beechcraft King Air 100, with two pilots and four passengers on board, took off at 09:18 Eastern Daylight Time (EDT) from the Montréal/Pierre Elliott Trudeau International Airport, Que., on an IFR flight inbound to Montréal/St-Hubert Airport, Que. Shortly after takeoff, the generation of electrical power ceased, followed by a complete loss of radio navigation equipment, some flight instruments, most engine instrument panel indicators, and a radio communication failure. The crew left the assigned altitude to descend to the minimum sector altitude. A break through the clouds allowed the aircraft to descend below the cloud cover. The crew continued the flight under VFR, and the aircraft landed without further incident at the Montréal/St-Hubert Airport. There were no injuries or damage to the aircraft.

### *Findings as to causes and contributing factors*

1. Shortly before takeoff, the pilot-in-command inadvertently selected the ignition and engine start switches instead of the auto-ignition switches. As a result, all of the aircraft's electrical needs were powered by the battery, which was unable to maintain the load needed for the normal use of the electrical system and its related instruments.

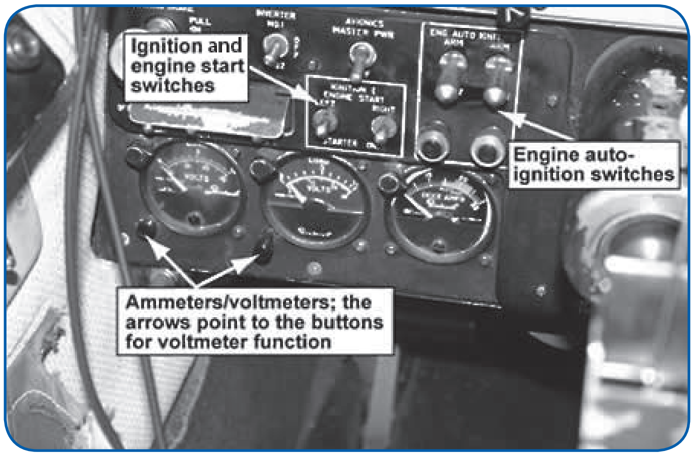
2. The line-up checklist does not require a load indicator reading when the auto-ignition switches are selected, which would confirm that the generators are on-line.

3. The absence of a clear indication by the warning lights that the generators were off-line precluded

the crew from the information needed to quickly recognize the anomaly.

4. The crew completed the "abnormal gear indication—in transit" checklist. This checklist gives the impression that no other procedures are available to rectify the situation and does not refer the flight crew to the "landing gear will not retract" checklist.

5. The crew did not complete the "landing gear will not retract" checklist; if it would have done so, the electrical power could have been cut to the landing gear motor. The energy saved would have kept the radios and flight instruments operational for several minutes.




*The switches*

### *Finding as to risk*

1. The crew descended to an altitude below the sector altitude applicable to its position, without knowing its exact position. This situation increased the risk of collision with the terrain or with obstacles.

### *Other findings*

1. The absence of a formal process for analyzing operational experiences and the lack of disclosure of information on previous similar accidents or incidents allowed the same situation to recur under more difficult conditions.

2. The crew encountered overlapping failures, and did not have the time to complete the checklists specific to each failure, which, eventually, would have helped rectify the situation. Instead, the crew decided to descend to regain and maintain visual contact with the ground.

### *Safety action taken*

Since this incident, during initial and recurrent ground training, the operator's instructors emphasize the risk associated with the starter/generator system and its consequences on some of the company's Beechcraft King Air 100.

## TSB Final Report A07Q0014—Fuel Starvation

On January 21, 2007, a ski-equipped DHC-2 MKI Beaver took off around 11:30 Eastern Standard Time (EST) from Mirage Outfitter, located 60 mi. east of La Grande-4 Airport, Que., with a pilot and four passengers on board, to locate caribou herds. About 40 min after departure, the engine stopped as a result of fuel starvation. The pilot was not able to regain power and made a forced landing on rugged ground. The aircraft was heavily damaged and two passengers were seriously injured. The pilot used a satellite telephone to request assistance. First-aid assistance arrived by helicopter about 1 hr 30 min after the occurrence. The aircraft fuel system had been modified after the installation of wings made by Advanced Wing Technologies Corporation.

### *Findings as to causes and contributing factors*

1. The engine stopped as a result of fuel starvation; the amount of fuel in the wings was less than the amount estimated by the pilot, the fuel senders gave an incorrect reading, and the low fuel pressure warning light could illuminate randomly.

2. The engine stopped at low altitude, which reduced the time needed to complete the emergency procedure. The pilot was unable to glide to the lake and made a forced landing on unsuitable terrain, causing significant damage to the aircraft and injuries to the occupants.

### *Findings as to risk*

1. The wing tank selection system was subject to icing in cold weather, and the pilots adopted the practice to place the wing tank selector in the middle position, which is contrary to the aircraft flight manual supplement instructions and a placard posted on the instrument panel.

2. When the change to the type design was approved through issuance of the Supplementary Type Certificate (STC), Transport Canada did not notice the fact that the fuel senders and triple fuel

level gauge did not meet airworthiness standards; Transport Canada issued an STC that contained several deficiencies.

3. Storage of the shoulder harnesses underneath the aircraft interior covering made them inaccessible; since the pilot and the front seat passenger did not wear their shoulder harness, their protection was reduced.

## TSB Final Report A07Q0085—In-Flight Break-Up

On May 27, 2007, a Eurocopter AS350 B1 Astar helicopter departed a mining camp 176 NM northeast of Chibougamau, Que., at 08:00 Eastern Daylight Time (EDT) en route to a drill site 20 NM to the southeast. Approximately four minutes after departure, the helicopter broke up in flight and descended rapidly to the ground. The pilot, the sole occupant, was fatally injured and the aircraft was destroyed.

### *Analysis*

The TSB post-accident examination revealed that the snap ring within the main gearbox (MGB) epicyclic reduction gear module was installed before installing the spacer assembly. The wrong installation sequence of the snap ring, relative to the spacer assembly, allowed the snap ring to slip from its groove on the mast, which in turn prevented the locking tabs from holding the mast retaining bolts. The bolts loosened by rubbing inside the sun gear, and eventually fell out, allowing the main rotor shaft to move vertically. The vertical movement of the main rotor shaft caused the rotor blades to strike the forward fuselage.

### *Findings as to causes and contributing factors*

1. The aircraft maintenance engineers (AME) did not consult the applicable sections of the work card (WC) for the re-installation of the main rotor shaft and the MGB epicyclic reduction gear module. This resulted in the snap ring being installed in the wrong sequence.

2. The wrong installation sequence of the snap ring ultimately allowed the mast retaining bolts to loosen and the mast to move vertically, causing the rotor blades to strike the forward fuselage.

### *Findings as to risk*

1. The symptoms experienced during ground-runs and test flights, and noted during flights following the maintenance, demonstrated a previously undiscovered link to the incorrect assembly of the MGB epicyclic reduction gear module. Current maintenance manual (MM) troubleshooting instructions do not direct AMEs to a possible MGB epicyclic reduction gear module assembly problem.

2. Referring AMEs to lengthy instructions, not necessarily required in full, may result in a filtering process that causes important information to be missed.

3. The maintenance manual specifies that the same number of threads should be visible on the main rotor shaft retaining bolts during the borescope inspection, but it does not specify the actual number of threads that should be visible to confirm proper installation. Therefore, the installation could appear to be secure when it is not.

### *Safety action taken*

Subsequent to this occurrence, Eurocopter took the following actions:

- Issued a Telex Information Letter (T.F.S. No. 00000393 dated 15 June 2007) titled *Main Rotor Mast Equipped with a 4-contact Bearing. Assembly of the spacer/phonic wheel with respect to the retaining ring*. This telex acts as an initial information letter to all operators prior to a final document amendment. The telex clarified compliant installation of the snap ring.
- Changed its documentation and added a new assembly diagram to WC 62.30.16.701 to ensure a better applicability of the assembly procedures.
- Modified WC 05-53-00-614 for related troubleshooting details.
- Deleted the borescope inspection within the MM 63.10.16.403 and the WC 62.30.16.701.
- Changed the material of the snap ring from steel to elastomeric, making the assembly tolerant to potential assembly error. The new elastomeric ring will shear if it is not installed in the proper order under the torquing loads of the mast retaining bolts. This will result in the assembly becoming secure by all the required contact points.

## TSB Final Report A08W0096—Loss of Control and Collision with Terrain

On May 24, 2008, a MacDonnell Douglas Helicopters Inc. (MDHI) 369D helicopter was transporting drilling personnel near Doctor Lake, N.W.T. Near the landing site, the pilot had been hovering into wind at approximately 300 ft above ground level (AGL) to determine the best footpath between a water body and a landing pad; once this had been accomplished, the aircraft was in the process of descending and hovering sideways to the left with the nose into wind toward the landing pad. At about 75 ft AGL, the aircraft started an uncommanded rotation to the right and crashed. The helicopter was substantially damaged by impact forces and a post-crash fire. The pilot was seriously injured, one of the two passengers was fatally injured, and the other suffered minor injuries.

### *Analysis*

The maintenance and airworthiness of the helicopter, as well as weather, were not considered contributory factors in this accident. Main rotor and engine crash signature indications confirm that the engine was operating at the time of impact. Therefore, the engine is also not considered a contributory factor in this occurrence.

At the time of the uncommanded right rotation, the helicopter was hovering laterally to the left. The relative wind was outside the critical azimuth, and the rotation resumed after the pilot re-applied engine power. It is therefore unlikely that an airflow effect induced the rotation.

Damage to the aircraft indicated virtually no rotation of the tail rotor at the time of ground contact, but there was evidence of low-power main rotor rotation. The engine was producing power but this power was not being transferred to the tail rotor. It was most likely that the tail rotor drive shaft failed at the forward section, but evidence to confirm this was lost in the post-crash fire. Failure of the tail rotor drive shaft would result in an uncommanded rotation of the helicopter around the vertical axis. The helicopter response to changes in throttle setting corresponds to what would be expected for a loss of tail rotor drive. There was insufficient altitude to effect recovery before ground impact.

*This photo shows no twisting or torsional damage to the tail rotor drive shaft (the big tube), just a bending failure where the main rotor struck the tail boom.*

### *Finding as to causes and contributing factors*

1. It is likely that the tail rotor drive shaft failed, which resulted in an uncommanded rotation of the helicopter at an altitude from which recovery was not possible.

### *Safety action taken*

The operator initiated a special inspection and measuring process on the forward section of selected tail rotor drive shafts operating in its fleet for this model of helicopter, in addition to the requirements of the maintenance manual inspection criteria. △

## Farewell to Archie Vanhee

Photo: Bertrand Marcoux

*Archie Vanhee in a vintage biplane aircraft at the Old Rhinebeck Aerodrome, Rhinebeck, N.Y., on May 30, 2002.*

Aviation pioneer Achille (Archie) Vanhee passed away peacefully at his home in Hamilton, Ont., on Sunday, May 3, 2009, in his 100th year. Archie had a long and distinguished career in aviation and is a member of the Canadian Aviation Hall of Fame, Quebec Air and Space Hall of Fame, and Les Vieilles Tiges de Belgique. Archie immigrated to Canada from Belgium in 1925, at the age of 16.

He commenced flying training at the Montréal Flying Club and soloed on October 28, 1928. He flew with Central Airways in Amos, Que., as a pilot engineer in 1935, and joined MacKenzie Air Service in 1937. He flew alongside Canada's Aviation Pioneers until commissioned in the Royal Canadian Air Force (RCAF) as a flying officer in 1939. He attained the rank of Squadron leader and was appointed commanding officer (CO) of 160 Squadron, a Canso Coastal Reconnaissance Unit at Yarmouth, N.S. At the time of his discharge in 1945, he was director of instrument flying training.

After the war, Archie joined Canadian Pacific Airlines (CPA) and moved to Vancouver in 1949 to fly for CPA Overseas Lines. He was one of five captains on the first Canadian-registered aircraft to fly to Tokyo, Shanghai and Hong Kong. Between 1973 and 1982, he acted as the instrument flight instructor for Austin Airways. Archie retired in 1983 at the age of 74, after 56 years in aviation. He had flown over 90 different types of aircraft—from the biplane Curtiss JN-4 to the prototype Boeing 707—totaling more than 25 000 hr. He had a passion for flying and a love for all things aircraft.

# Accident synopses

*Note: All reported aviation occurrences are assessed by the Transportation Safety Board of Canada (TSB). Each occurrence is assigned a class, from 1 to 5, which indicates the depth of investigation. A Class 5 consists of data collection pertaining to occurrences that do not meet the criteria of classes 1 through 4, and will be recorded for possible safety analysis, statistical reporting, or archival purposes. The narratives below, which occurred between February 1, 2009, and April 30, 2009, are all "Class 5," and are unlikely to be followed by a TSB Final Report.*

— On February 4, 2009, a **Cessna 152**, being flown by a student pilot on his first solo flight, bounced upon landing at the St-Hubert, Que., airport, and completed its run in the snow about 50 ft off the runway. The pilot was not injured. The aircraft sustained damage to the propeller and one wing. *TSB File A09Q0021.*

— On February 17, 2009, the student-pilot/owner of a **Robinson R22 helicopter** was practicing a confined area procedure a few miles north of the Gatineau, Que., airport. The helicopter sank in the snow on landing, causing a tail rotor strike. The tail boom, the tail rotor drive shaft, the tail rotor gearbox and the tail rotor were damaged. The pilot was not injured. *TSB File A09Q0026.*

— On February 21, 2009, a **Piper PA-12** airplane experienced a right main landing gear collapse when landing on Runway 27 at the Rockcliffe airport, in Ottawa, Ont. The pilot stopped the engine and held the right wing in the air as long as he could, until there was not enough speed to maintain lift. The airplane went off the right side of the runway and stopped against a snowbank. There was no propeller strike and no damage to the airplane structure, other than the landing gear. The pilot and passenger were unhurt. *TSB File A09O0035.*

— On March 6, 2009, the pilot of a **Cessna 310** was joining the circuit at the Airdrie, Alta., airport. He was demonstrating a single-engine approach and landing for his passenger, and on downwind, shut down the left engine and feathered the propeller. Shortly thereafter, the pilot selected the gear down and extended the flaps to 30°. The aircraft began to descend and full power on the remaining engine could not maintain altitude. The flaps and gear were retracted as the aircraft turned onto the final approach, but there was insufficient time for the aircraft to recover from the descent. The aircraft impacted a snow-covered field about 1 mi. short of the runway threshold, resulting in substantial damaged to the aircraft, but no injuries to the two occupants. *TSB File A09W0042.*

— On March 14, 2009, a **Cessna A185E amphibian** aircraft was on a VFR flight from Shearwater, B.C., to Bella Coola, B.C. While flying down the Labourche Channel, 25 NM west of Bella Coola, at 700 ft, the pilot encountered a heavy snow shower. He began to descend, intending to land on the water, and configured the aircraft for landing. Because of the low visibility and glassy water, the pilot was not aware of how close the aircraft was to the surface. The aircraft's left float touched the surface prematurely and broke the left front float strut. The propeller then sliced through the left float. The aircraft came to rest upright. The pilot and single passenger evacuated the aircraft and were both uninjured. The aircraft later overturned and sank. *TSB File A09P0049.*

— On March 14, 2009, a **Piper PA-44-180** with one instructor and two students on board had departed Fredericton, N.B., for a local training flight. During stall recognition and recovery training, the aircraft inadvertently entered a spin. The instructor took control of the aircraft and recovered from the spin; however, not before the aircraft struck trees. The aircraft continued through the trees and came to rest in an upright attitude at ground level. The three pilots exited the aircraft through the windshield with non-life-threatening, but serious, injuries. The investigation revealed several safety issues, including altitude selection for stall practice, lack of stall demonstration for the student by the instructor, and abrupt aft movement of the control column just prior to the stall. It is unclear whether the instructor followed through with effective preventative control input to reduce the possibility of spin entry. Other findings include the lack of matches in the on-board survival kit and lack of appropriate survival clothing worn by the instructor, which allowed his core body temperature to fall to within two degrees of hypothermic levels before being rescued. Short- and long-term corrective action for these safety issues has been initiated by the operator. *TSB File A09A0017.*

— On March 25, 2009, an **MD600N helicopter** was engaged in avalanche control operations in the Toba Valley, B.C. The centre door on the left side of the helicopter had been removed to allow the blaster to drop explosives onto the slope. While hovering, immediately after dropping explosives on to the mountainside at 7 000 ft above sea level (ASL), a gust of wind in conjunction with rotor downwash and fresh snow caused whiteout conditions and forced the helicopter uphill into the slope. The main rotor blades struck the mountainside and the helicopter slid down about 400 ft. The helicopter was destroyed, the pilot received minor injuries, and the two passengers were uninjured. *TSB File A09P0060*.

— On April 1, 2009, an **AS 350D helicopter** was returning to Kuujjuaq, Que., after a local flight. While the aircraft was hovering toward its parking area, a sign became detached from the Air Inuit hangar because of the turbulence created by the rotor. The sign was projected into the tail rotor. The pilot was able to maintain control of the aircraft and land without incident. An inspection revealed major damage to the tail rotor blades. Debris was also projected, and damaged the vertical stabilizer as well as the main rotor blades. *TSB File A09Q0046*.

— On April 9, 2009, a privately registered **Beech Bonanza** was in the circuit at Beiseker, Alta. The pilot had been in conversation with another pilot who was also in the circuit at the time. When the occurrence pilot called final for Runway 16, radio transmissions involving the other aircraft continued. The landing gear was not lowered for the landing. There was no reported gear warning horn. There were no injuries to the lone occupant and the TSB will follow up as to the serviceability of the warning horn. *TSB File A09W0071*.

— On April 9, 2009, a **Piper PA-18-150 ski-equipped** aircraft took off from Squamish, B.C., for a sightseeing trip with one passenger, and landed on the Mamquam Glacier, 12 NM east of Squamish. The pilot attempted a takeoff, but found the aircraft was not accelerating normally due to the snow conditions, so he abandoned the takeoff. He then disembarked the sole passenger along with some safety equipment and attempted another takeoff. The aircraft again did not accelerate normally. Before the pilot could abandon the second takeoff, the aircraft hit a crevasse and overturned. The pilot suffered minor injuries, and the aircraft was substantially damaged. *TSB File A09P0074*.

— On April 17, 2009, a **Fleet 80 Canuck** aircraft took off from Oliver, B.C., for a private strip located 4.3 NM west of Rock Creek, B.C. During the flight, the ceiling and visibility deteriorated. The pilot made a 180° turn, but found weather conditions in that direction just as bad, so he turned back on his original track. While in the vicinity of a snow-covered mountain saddle, he encountered whiteout conditions and the aircraft impacted rising terrain. The pilot received minor injuries. The aircraft was substantially damaged. Signals were received from the emergency locator transmitter (ELT). A search and rescue (SAR) operation was launched and the pilot was rescued by a Department of National Defence (DND) helicopter about 7 hr after the accident. *TSB File A09P0087*.

— On April 23, 2009, a **Cessna 150M** aircraft was being prepared for start on the ramp at the Langley, B.C., airport. Two passengers were on board. As the battery was dead, the pilot set up the cockpit for start, left the cockpit and swung the propeller. When the engine started, it ran at a high power and the aircraft moved across the ramp, striking an empty Piper PA-28-140, which was parked on the ramp. Both aircraft were substantially damaged. The pilot of the Cessna and his two passengers were not injured. *TSB File A09P0092*.

— On April 24, 2009, a **Enstrom F-28A helicopter** took off from Chemainus, B.C., for Duncan, B.C. Shortly after takeoff, the pilot attempted to adjust the fuel mixture with his left hand, as his right hand had a previously injured index finger. This necessitated reaching across the panel. The adjustment resulted in a too lean mixture and the engine (Lycoming HIO-360-E1AD) began to backfire and run rough. At an altitude of about 300 ft above ground level (AGL), since the engine was no longer producing sufficient power, the pilot decided to enter an autorotation to a field. While flaring to arrest the forward motion, the tail contacted the ground and broke, and the helicopter rolled over several times. The pilot sustained minor injury. The helicopter was substantially damaged. *TSB File A09P0100*.

— On April 26, 2009, the pilot of a privately owned **Maule M-6** executed a pass over the field in Masson, Que., to verify the condition of the grass landing strip. Since the grass strip looked in good condition, the pilot chose to land. On touchdown, the aircraft rolled over. The pilot, sole person on board, was not injured. The aircraft was substantially damaged. *TSB File A09Q0059*.

— On April 29, 2009, a **Cessna Caravan 208** aircraft had landed at the St. Andrews, Man., airport with the pilot and nine passengers onboard. While exiting the aircraft from the front right door, a passenger tripped on the aircraft's folding stairs and fell onto the tarmac. The passenger sustained serious injuries, was taken to a hospital for treatment, and was later released. The operator advised that the folding stairs at the right front door were serviceable and correctly extended. Safety action taken: The rear door stairs are larger and more secure and the operator has decided to exit all passengers from the rear door in the future. *TSB File A09C0066*. △

## Shining Lasers at Aircraft Is a Serious Offence

*by Jean-François Mathieu, L.L.B., Chief, Aviation Enforcement, Standards, Civil Aviation, Transport Canada*

On Sunday, February 22, 2009, in the span of 20 min—between 19:10 and 19:30 Pacific Standard Time (PST)—the crews of 12 airliners landing at Seattle-Tacoma International Airport reported that someone was shining a green laser light into their cockpits. This type of event is symptomatic of a growing problem in the areas surrounding airports. In Canada, the problem is also present; the reported rate of occurrence of these incidents reached an 11-year high in November 2008. It appears that the problem may worsen, as some retail stores that offer these types of products reported that their fastest-selling product for January 2009 was the green laser pointer.

Laser technology was first developed in the 1960s, and now touches our everyday lives in many ways. According to Health Canada, these lasers are not dangerous if used with care. However, the brightness of the laser light can cause damage to the eyes of anyone looking directly into the beam, or it can cause temporary blindness—also called flash blindness. The latter condition is only temporary and a person's vision usually returns to normal after a few seconds. That being said, these lasers are not toys, and shining a laser beam into the cockpit of any aircraft constitutes a serious offence and can jeopardize the safety of the flight. These incidents are of particular concern to all people on board, since they usually occur during the landing phase of a flight. A laser shone in an aircraft cockpit is a distraction for the pilots and can cause temporary visual impairment during the most critical phase of flight—a scenario with potentially catastrophic results.

In a November 2008 article by the CBC, a representative of the Royal Astronomical Society of Canada stated that these green lasers are likely the same powerful green light beams that astronomers use to pinpoint the stars during teaching sessions. He also said that these lasers can travel several kilometres and are easily obtained for a reasonable cost. In the same article, a spokesperson for a renowned pilot's association said that they did not want this activity to become more widespread. He also said that their pilots are not too happy with the increasing frequency of these types of incidents.

As of November 2008, 62 incidents involving lasers had been reported for that year through the Civil Aviation Daily Occurrence Reporting System (CADORS), while only 21 were reported for all of 2007. Many other incidents are believed to have occurred without being reported. Transport Canada takes these incidents very seriously and will investigate and coordinate with the appropriate police agencies in order to prosecute offenders. For those intending to try this activity, be reminded that persons caught in Canada can be charged under the *Aeronautics Act* and, if found guilty, can be fined up to $100,000 or face five years in prison. They can also face charges under the *Criminal Code of Canada*, which can have serious consequences.

In order to apprehend the offenders and obtain the best evidence to prosecute, it is very important to have all incidents reported as quickly as possible after they occur. Therefore, Transport Canada recommends that pilots from all sectors of aviation who become victims of such activities report them immediately to ATC and local police forces.

In April 2000, Transport Canada, in conjunction with Health Canada, established an incident-reporting system to report laser strikes and any other incidents involving directed bright lights. In June 2008, this process was updated with the issue of *AIP Canada (ICAO)* Aeronautical Information Circular (AIC) 24/08, which contains procedures for pilots to adhere to following exposure to laser and other directed bright light sources. Following these procedures will help pilots protect themselves during these occurrences. The AIC includes an incident report form, which should be completed and forwarded to the Chief of Standards, Aerodromes and Air Navigation as soon as possible after the incident. It is also advisable to inform ATC when such an incident occurs so that they may take whatever action is appropriate.

Good co-operation between all agencies is essential to successfully catch these offenders, and to reduce the number of these types of occurrences. Earlier this year, a 29-year-old Calgary, Alta., resident became the first person in Canada to be charged for endangering a flight by shining a bright light into the cockpit of an aircraft. He was fined $1,000 and ordered to forfeit his laser. This example of law enforcement shows what can be achieved when everyone cooperates to catch and prosecute offenders.

We must work together to ensure that the rising trend of these events does not result in a serious incident. Transport Canada continues to work with various agencies to maintain a high level of aviation safety in Canada. Let's remember that the first link in effective enforcement action is the timely reporting of these events by victimized aircrew. For more information, please visit: www.tc.gc.ca/Lasers. △

## Flying the Flying Machines

*by Jim Dow, Chief, Flight Training and Examinations, Standards, Civil Aviation, Transport Canada*

How would we measure up to the first generation of pilots of flying machines? Could we pass the tests these aviators had to pass to get their pilot certificates? The original international standards for aviation had only two kinds of pilot certificate for flying machines: the *Private Pilot's Flying Certificate* and the *Pilot's Flying Certificate for Flying Machines used for Purposes of Public Transport*. The requirements for these certificates were set out in 1919 in the Convention for the Regulation of Aerial Navigation, requirements that were first established at the Paris Diplomatic Conference of 1910.

There were some rules for the conduct of the flight tests. The first rule was the examiner stayed on the ground, and the candidate had to be alone. All the tests had to be completed within a month. The tests could be attempted in any order, but only attempted twice. For the practical tests, candidates had to carry a barograph, too, and have the graph signed by the examiners and attached to their report. Candidates also had to be medically fit.

The *Private Pilot's Flying Certificate* required two practical tests: an altitude and gliding-flight test and a skill test.

### *Test for altitude and gliding flight*

The test for altitude and gliding flight required a flight of at least an hour at a minimum altitude of 2 000 m above the point of departure. The descent had to finish with a glide, the engine being cut off at 1 500 m above the landing ground. The landing had to be made without restarting the engine and within 150 m or less of a point fixed in advance by the official examiners.

### *Test of skill*

The skill test was a flight without landing around two posts (or buoys) situated 500 m apart. The candidate had to make a series of five figure-of-eight turns, each turn reaching one of the two posts. All of this was to be done at an altitude of not more than 200 m above the ground (or water). On landing, the engine was shut off on touchdown, and the flying machine had to be stopped within 50 m of a point fixed by the candidate before starting.

### *Test of endurance*

The test of endurance was a further requirement for the *Pilot's Flying Certificate for Flying Machines used for Purposes of Public Transport*. It was a cross-country or oversea flight of at least 300 km with the final landing made at the point of departure. This flight had to be made in the same flying machine within eight hours with two landings at points fixed by the judges, but not including the point of departure. At the time of departure, the candidate was informed of his course and furnished with the appropriate map.

### *Night flight*

This was the only experience requirement in the standards—a requirement for the public transport certificate. The night flight called for a thirty-minute flight made between two hours after sunset and two hours before sunrise at a height of at least 500 m.

### *Technical examination*

After the practical tests were passed, candidates were summoned to a technical examination on the following subjects:

### *Flying machines*

- Theoretical knowledge of the effects of air resistance on wings and tail planes, rudders, elevators and propellers;
- Functions of the different parts of the machine and of their controls;
- Assembling of flying machines and their different parts; and
- Practical tests on rigging.

### *Engines*

- General knowledge of internal combustion engines, including functions of the various parts;
- General knowledge of the construction, assembling, adjustment, and characteristics of aero engines;
- Causes of the faulty running of aero engines and of breakdown; and
- Practical tests in running repairs.

### *Special requirements*

- Knowledge of the rules as to lights and signals, and rules of the air; rules for air traffic on and in the vicinity of aerodromes;
- A practical knowledge of the special conditions of air traffic and of international air legislation; and
- Map reading, orientation, location of position, elementary meteorology.

These were the earliest international standards for pilot certificates. The standards adopted in Canada under the air regulations of 1920 added a requirement for left- and right-spin recovery, experience requirements, and modified the cross-country distances and skill altitudes. The standards reflected the safety needs of the era, particularly a high degree of skill in dealing with engine failures. △

## Stick to the Basics: Aviate, Navigate and Communicate

*by Mike Treskin, Civil Aviation Safety Inspector, System Safety, Ontario Region, Civil Aviation, Transport Canada*

I was reading the letter sent by an experienced crop-duster ("Mayday at low altitude? Don't yip on the radio!" in *Aviation Safety Letter* [ASL] 4/2008) about trying to send a distress call (mayday) while flying at low altitude. He stated that when push comes to shove and time is critical, you might not have time to make a mayday call. All of your efforts will be required to fly the aircraft to safety.

I tend to agree with the writer's logic simply because if you are a crop-duster and your flying environment is well below 200 ft above ground level (AGL) with an established speed well below $V_{ne}$, then you won't have time to broadcast your situation and intentions.

I always think back to the training I received when I started my flying career. I was taught that during an emergency, the first priority was ALWAYS to fly the aircraft. Whatever the situation, controlling the aircraft is your main concern. I was also taught that once you are in control of your aircraft, you can then get back to the other important aspects of aviation, i.e. navigating and communicating.

Having just returned from an assignment with a major airline where I was part of the pilot recruitment team, I observed over 2 000 pilots in a level D simulator undergo a variety of emergencies, including an engine failure after rotation ($V_r$). Half of all the pilot candidates did the wrong thing. They immediately took control of the radio and transmitted to the tower or departure controller that an emergency was in progress. What they should have done is apply crew resource management (CRM) and ask the pilot not flying (PNF) to transmit the emergency call. In a large commercial aircraft, the pilot flying's (PF) primary responsibility is to aviate, and the PNF's responsibility is to communicate.

Flying the aircraft during a critical phase of flight is the most important action a pilot must follow. Depending on the level of experience and the type of flying, you will always need to use your skills, experience and previous training to emerge safely from a critical emergency. For example, one of the most time-critical emergencies a general aviation pilot can face is an engine failure after takeoff or at circuit altitude. Maintaining control of the aircraft will make the difference between a successful forced landing and a crash. Once the aircraft is under control and properly configured, you can then start looking for a place to put it down. Your next action, time permitting, will be to talk to someone. When time is critical, a mayday call and the aircraft's registration could be the only thing you will transmit before you will need to return to flying.

A failure at altitude is basically the same procedure, except that time is no longer against you. You should have time to select a better field and possibly assess the problem and determine if a restart is possible. Once you know where you are and where you are going, then broadcast your message and your intentions.

I have met a few pilots who have flown all their lives without declaring an emergency. Pilots such as these are very rare. As they say in the ranks, there are those who will and those who have. Be prepared and always review in your mind what you need to do if an emergency occurs in the next phase of your flight. I would encourage all pilots to practice various emergency procedures with a qualified flying instructor at least once a year, especially at the beginning of each flying season. Slow flying, stall recognition and entry, stall recovery, spins, and practice forced landings come to mind as must-do exercises. Practice makes perfect.

During a stressful flying situation, you will likely come out on top if you stick to the basics: aviate, navigate and (time-permitting) communicate. Safe flying! △

## Transport Canada's Safety Management Systems (SMS) Information Session

Marriott Vancouver Pinnacle Downtown Hotel
November 25–26, 2009
www.tc.gc.ca/civilaviation/SMS/Info/menu.htm

# 2009 Flight Crew Recency Requirements
# Self-Paced Study Program

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

*This questionnaire is for use from November 1, 2009, to October 31, 2010. 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 28. In addition, aeroplane and ultralight aeroplane pilots are to answer questions 29 and 30; helicopter pilots are to answer questions 31 and 32; gyroplane pilots are to answer questions 33 and 34; balloon pilots are to answer questions 35 and 36; and glider pilots are to answer questions 37 and 38.*

*Note: Many answers may be found in the* Transport Canada Aeronautical Information Manual *(TC AIM). TC AIM references are at the end of each question. Amendments to this publication may result in changes to answers and/or references. The TC AIM is available on-line at:* www.tc.gc.ca/CivilAviation/publications/tp14371/menu.htm

1. What does the term "PNR" mean in the *Canada Flight Supplement* (CFS)?
   ______________________________. (AGA 2.2)
2. The radiation produced by FM radio receivers and television broadcast receivers falls within which NAVAID frequency band? ______________. Which NAVAID frequency band does the radiation produced by AM radio receivers fall within? ______________. (COM 3.1.2)
3. What information should be included on initial contact with a remote communications outlet (RCO)?
   ______________________________; ______________;
   ______________________________. (COM 5.8.3)
4. In the Air Navigation System (ANS), only ______________ have 121.5 MHz capability, and this emergency frequency is only monitored during those facilities' hours of operation. (COM 5.11)
5. What is the correct frequency to use in Canadian Southern Domestic Airspace (SDA) for air-to-air communications between pilots? ______________.(COM 5.13.3)
6. What do the letters "QS" signify when shown beside a low-pressure area on a graphic area forecast (GFA)?
   ______________________________. [MET 3.3.11(a)]
7. What intensity of turbulence is depicted on a GFA?
   ______________________________. [MET 3.3.12(b)]
8. What is an AIRMET?
   ______________________________. (MET 3.4.1)
9. In an aerodrome forecast (TAF), strong non-convective low-level wind shear within ______________ ft above ground level (AGL) will be labelled as ______________. (MET 3.9.3)

**TAF CYYZ 111207Z 1112/1218 14008KT 3SM -RA BR BKN007 OVC012**
**TEMPO 1112/1116 6SM -RA BR FEW007 OVC012 BECMG 1112/1114 19012KT**
**FM111600 23015G30KT P6SM OVC040 TEMPO 1116/1117 OVC020**
**FM111800 25025G40KT P6SM SCT050 BECMG 1122/1124 26020G30KT**
**FM120300 27015KT P6SM SKC**
**RMK NXT FCST BY 111500Z**

10. In the TAF shown above, when are the winds forecast to be less than 20 kt?
    ______________________________. [MET 3.9.3(f)]
11. In the TAF shown above, what is the lowest forecast ceiling? ______________. [MET 3.9.3(j)]

**SPECI CYVR 021718Z 19014KT 15SM FEW020 FEW053 SCT120 BKN190 10/ RMK SF1SC2AC1AC2=**
**METAR CYVR 021700Z 20014G19KT 15SM -RA FEW030 BKN053 OVC075 10/04 A2967 RMK SC2SC3AC2 SLP047=**

12. In the 1700Z CYVR aviation routine weather report (METAR) shown above, what type of cloud is at 5 300 ft?
    ______________________________.[MET 3.15.3(p)]
13. What is the ceiling in the 1700Z CYVR METAR shown above? ______________.[MET 3.15.3(k)]
14. In the aviation weather reports shown above, why was the aviation special weather report (SPECI) issued at 1718Z? ______________________________. (MET 3.15.4)
15. Flight information service en route (FISE) RCOs will use one of four frequencies. At most RCO sites where one of these four frequencies is used, 126.7 MHz will ______________.[RAC 1.1.3(a)]

16. The minimum day VFR flight visibility for an aircraft in uncontrolled airspace below 1 000 ft AGL is _________________ miles for aircraft other than a helicopter, and _________________________ mile for helicopters. (RAC 2.7.3 Figure 2.7, and CAR 602.115)
17. Long-distance telephone calls can be made to a flight information centre (FIC) toll-free at _____________ ________________________________________________________________________. (RAC 3.2)
18. A flight itinerary may be filed with a responsible person. A "responsible person" means and individual who has agreed to ensure that an overdue aircraft is reported to _____________________________. (RAC 3.6.2)
19. The closure of a flight plan or flight itinerary prior to landing is considered as filing an arrival report, and as such, it will result in _____________________________________________________________. (RAC 3.12.2)
20. Unless otherwise advised by air traffic control (ATC), pilots [do/do not] require permission to change from tower frequency once clear of the control zone. (RAC 4.2.9)
21. If you have landed short of your destination for reasons other than an emergency and you are unable to advise ATC of your situation, when will a search be initiated: a) in the case of a flight plan? __________________________; b) in the case of a flight itinerary? ______________________. (SAR 3.5)
22. Which transponder code should a pilot select to alert ATC of an emergency situation? _______. (SAR 4.4)

**090003 NOTAMN CYXX ABBOTSFORD**
**CYXX SNOWBIRDS ARR SEQUENCE 10 NM RADIUS AD SFC TO 10200 FT MSL NON-PARTICIPANTS SHALL REMAIN CLR OF AREA 0906101900 TIL 0906102030**

23. Based on the NOTAM shown above, should you plan to depart Abbotsford on June 10 at 2000Z? _______. Why? _______________________________________________________________________. (MAP 5.6)
24. Where do you find *AIP Canada (ICAO)* Aeronautical Information Circulars (AIC)? _________________ _________________________________________________________________________. (MAP 6.1)
25. Until what date is your medical certificate valid? ___________________________. (LRA 3.2, CAR 404.04)
26. Prior to carrying passengers, you must have completed ________ takeoffs and landings in the same category and class of aircraft within the previous __________________________ months. (LRA 3.9, CAR 401.05)
27. What type of common-use medications have been associated with aircraft accidents and why? __________ _________________________________________________________________________. (AIR 3.12)
28. Is MOGAS more susceptible to carburetor icing than AVGAS? _____________________________ __________________________________________________________________________. (AIR 2.3)

### *Aeroplane-Specific Questions (including ultralight)*

29. Descent using an approach slope indicator system should not be initiated until the aircraft _____________ ____________________________________________________________ with the runway. (AGA 7.6.1)
30. Concerning aircraft contamination, what is the "Clean Aircraft Concept"? ___________________________ _____________________________________________________________________. [AIR 2.12.2(c)]

### *Helicopter-Specific Questions*

31. With a rotor turning counter clockwise, what hovering turn should be attempted first when flying in a strong wind? ____________________________________________________________.(Use helicopter references)
32. Why do vortices produced by helicopters create problems potentially greater than the ones created by fixed-wing aircraft? ___________________________________________________________________. (AIR 2.9)

### *Gyroplane-Specific Questions*

33. What are the symptoms of a retreating blade stall? ______________________. (Use gyroplane references)
34. The height velocity chart found in the aircraft flight manual (AFM) provides the pilot with guidelines to avoid ____________________________________________close to the ground. (Use gyroplane references)

### *Balloon-Specific Questions*

35. No person shall conduct a takeoff in a balloon for the purpose of day VFR flight unless it is equipped with ________________________________; ____________________________; and in the case of a hot air balloon, ________________________ and _______________________________. (RAC ANNEX, CAR 605.19)
36. Should power-line contact become inevitable, what is the best action for the pilot to take? _____________ ____________________________________________________________________. (Use balloon references)

### *Glider-Specific Questions*

37. The release hook check is made with the launch cable ____ and also under _______. (Use glider references)
38. When joining another glider in a thermal, in which direction should you circle? ___________________ ______________________________________________________________________. (Use glider references)

Answers to this quiz are found on page 21 of ASL 4/2009.