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# AVIATION SAFETY LETTER

## In this Issue...

A Glider Pilot's Perspective of CASS 2008

Exchange of Safety-related Information: A Tool to Enhance Safety

Safety Culture: SMS Goes Vertical

Coming Soon to a Theatre Near You: Whiteout

"Damn, Was That Ever Slippery!"

A Holdover Time Paradigm Shift

The Whys, Hows and Whats of the Authorities' Fire and Cabin Safety Research Activities—A Brief Overview

The Case For Documentation: Two Recent TATC Cases

Flight Crew Awareness of Departure Runway Length

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



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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**

section	page
Guest Editorial .....	3
To the Letter .....	4
Pre-flight .....	5
Winter Operations .....	15
Maintenance and Certification .....	24
Recently Released TSB Reports.....	29
Accident Synopses .....	35
Regulations and You .....	38
Debrief: Flight Crew Awareness of Departure Runway Length .....	40
Self Paced Study Program .....	Tear-off

Building public confidence in aviation safety relies greatly on effective channels of communication. This is why I am pleased to have the opportunity to acquaint readers with the diverse roles and responsibilities of the Civil Aviation Secretariat. This branch is an integrated machine, working to provide the most accurate, timely, and best possible information for employees, the aviation community, and the general public.



The Secretariat is made up of four divisions: Issues Management; Strategic Communications; Civil Aviation Web Services; and Aviation Terminology Standardization. Each division is distinct, and the role they play makes a specific contribution to the national Civil Aviation Program. Yet, they are all interconnected by a common goal: to inform.

As a branch, it is our responsibility to provide clear information about the Civil Aviation Program in a transparent manner, contributing to a high public confidence in aviation safety. To achieve this, we co-ordinate information sharing and provide leadership in developing and implementing communication strategies and products.

The Civil Aviation Web site is an important vehicle for communicating with our audience, as it is often the primary method used by Canadians to access the information they need. To ensure that people have access to the most up-to-date information that applies to their own safety, the information posted to the Web site must be current, useful, and intelligible. Our goal is for visitors to feel comfortable using the site and to have them take advantage of the services it offers.

The Civil Aviation Web Services Division has the key responsibility of maintaining both the Intranet and Internet pages. They must ensure that any information made available is up to date, accurate, and accessible. The talented team of terminologists and translators in the Aviation Terminology Standardization Division help to make this possible by working with technical experts to maintain and refine aviation terminology in both official languages for every Web page on the Civil Aviation Web site. They also offer editing and translation services for products other than those on the Web, including each issue of the *Aviation Safety Letter*.

The fast-paced environment of the Issues Management Division is the first stop in the event of breaking news. They are responsible for co-ordinating and processing requests for departmental briefing material and making critical information available on the Web site at a moment's notice to ensure timely and consistent messaging. The Strategic Communications Division is the go-to group and produces internal documents and materials for publication on the Web site. They also manage the Communications Centre—the service provided by Civil Aviation that invites questions and comments from the general public, and offers them a Civil Aviation representative to address their enquiries on the telephone or by e-mail.

The Secretariat sees the benefits of having an informed aviation community—together we provide essential safety information that helps save lives. It is our goal to provide the highest level of service and most current information available to meet the ever-changing needs of the public we serve. If you need information on the Civil Aviation Directorate's programs or services, please call us at **1-800-305-2059**, or e-mail us at [services@tc.gc.ca](mailto:services@tc.gc.ca).

Lucille Kamal  
Director  
Civil Aviation Secretariat



### Mayday at low altitude? Don't yip on the radio!

After over 43 years and 24 000 hr of experience aerial spraying around the world, I respectfully feel that the plot is lost in this accident (*Aviation Safety Letter* [ASL] 1/2007, p. 4, "Return to the runway") and many more like it. I have conducted between 18 and 20 forced landings—mainly behind radial engines that have failed—dating back to the early 1960s, and all were successful. Why do nearly all training establishments and Transport Canada (TC) insist on calling "mayday mayday" at lower altitudes? The pilot-in-command is under intense pressure when the engine stops, so they don't want to yip-yap on the radio. The three most important things to do are: 1. fly the aircraft; 2. fly the aircraft; and 3. fly the aircraft. At my stage of the game, I don't need to look at the airspeed indicator anymore, but I still need to gork around to sort the mess out. Lower-time personnel must concentrate on one thing, and yipping mayday on the radio ain't it, I believe. Once, on a helicopter check ride, during chip light drills or doing autos, I didn't call a mayday, oops, naughty naughty... Right, but we will probably walk away when that chainsaw above hiccups or craps itself, as it is prone to do. Sorry for the opinionated tirade, but so many of these accidents should never happen, as the training in Canada is excellent. If the thing should haemorrhage at 5 000 to 10 000 ft, that's a different story. I have never been that lucky; I would probably stuff it up—too many opportunities to change my mind. P.S. Really good publication.

Don Ussher  
*Vermilion, Alta.*

### Flashlight stuck under the pedal

On February 20, 2008, my friend and I planned a VFR round robin between St-Hubert, Que. and Gatineau, Que. We often rent a PA-28 with which we are quite familiar. We are both private pilots, each with just under 400 flight hours. We are both qualified to fly at night, and we are both quite diligent. As far as we are concerned, there is no room for complacency. I was the first to arrive at the flying club, and it took me approximately 45 min to complete the pre-flight check. This task is an

integral part of our joy of flying, and we even talk about *getting our office ready*... The inspection did not reveal anything unusual. I did notice a very bright light below the instrument panel, but I didn't pay much attention to it. The journey logbook showed several normal repairs, and I told myself that someone must have installed this light to better see the floor area or below the instrument panel. When I stood near the trailing edge of the right wing, I could see the light through the door opening.

I had trouble exiting the parking apron. It was particularly difficult to turn left on the ground. No matter how hard I pressed on the left pedal, I couldn't get the aircraft to turn properly. I was headed straight for a parked aircraft. We then decided to reverse the starting sequence. We shut down the engine, so that my buddy could get out and reposition the aircraft. I had troubles again as I turned left onto the taxiway. I had to make a wide turn, barely avoiding the edge of the pavement, rather than following the yellow line running down the middle of the taxiway. As I was heading for my run-up area in preparation for takeoff, I asked the ground controller for a taxiing pattern, so that I could practise braking and turning exercises on the ground. After a few minutes, while my buddy was at the controls, I bent down to the left pedal to check out the problem. I discovered that the bright light I had seen was in fact a flashlight stuck between the pedal and the back wall! With some effort, I was able to dislodge the flashlight from its position. It was an oblique light in a tubular casing that fit perfectly behind the rudder pedal. Once I removed the mystery object, the aircraft handled with its usual ease.

You have to wonder what might have happened during the take-off roll, and even during the landing roll, if we had simply convinced ourselves that everything would be fine—since cold weather was a factor that night. It would have been easy to think that. The expressions "controls free" and "full deflection" that are found on a checklist make total sense to me now! I suggest that pilots check under the pedals before flying, to prevent an accident that would be both senseless and avoidable.

Robert Loranger  
*Sainte-Catherine, Que.*





COPA Corner—Chief Pilot .....	page 5
A Glider Pilot's Perspective of CASS 2008.....	page 6
Exchange of Safety-related Information: A Tool to Enhance Safety.....	page 7
Cabin Safety—Communicable Diseases .....	page 8
CBAA Column—Safety Management System (SMS): Step Forward or Step Back? .....	page 10
Safety Culture: SMS Goes Vertical.....	page 11

## COPA Corner—Chief Pilot

by John Quarterman, Manager, Member Assistance and Programs, Canadian Owners and Pilots Association (COPA)



Around the breakfast table one morning, sitting with the other pilots, we listened as the owner of a local one-man vintage-aircraft sightseeing operation explained the basis of the safety management system (SMS) and the way he had implemented it for his flying service.

This particular pilot friend, who takes people up flying from a local field—people who are interested in riding for 15 min in a post-war two-place basic trainer—has implemented a safety management program, keeps and maintains a quality assurance program, and has implemented a recurring air and ground training program for the staff pilot (himself).

The pilots in our group were wide-eyed as this fellow explained setting himself (the staff pilot) a written exam (figuring out the answers to check against the written test results), then writing the exam (as staff pilot), then correcting it from the written series of answers he had created in his persona as chief pilot, then briefing himself on his score.

When asked what the Transport Canada inspectors monitoring his operation thought about this process, our friend admitted, “they do see the funny side of my testing myself,” but pointed out that in this process he is maintaining his proficiency and working hard to make his operation a safe and good example of a commercial air service—that is the objective he must strive for.

Now, although we might smile at the picture I just presented, the tale is an instructive one for many private owners or operations involving partners sharing aircraft. Today, many Canadian pilots don't own their aircraft outright, but share their aircraft with two, three, or more partners, who in their joint ownership arrangement manage to keep the costs of aircraft ownership down to reasonable levels. Sometimes in these rather informal arrangements, one partner manages the accounting, one manages the maintenance, one does the shared charts and *Canada Flight Supplement* (CFS) updating and management, etc. Dividing the tasks up and giving each one to a designated person means they are usually done consistently, and the results are better than the alternative.

Although as private owners flying recreationally we are not required to have a chief pilot, an SMS, or a recurrent training program other than the minimum recency requirements we must all satisfy, there is no reason why private pilots can't take the best concepts and practices from commercial operations and apply them to their single-owner airplane operation or partnership.

As a single owner, try putting on some different “hats,” and take a look at your operation! As a “safety inspector,” try looking at the way you operate, the way you fly, and the way you maintain your aircraft and personal proficiency. Does your operation reflect best practices? Is your record-keeping all that it should be? Is your “staff pilot” in need of some regulatory brushing-up or emergency-situation practice? Try looking at the private-pilot curriculum and checking what is fuzzy or you haven't practiced for a while. Why not hire an instructor and practice some of these forgotten items like forced approaches or steep turns?

In an organized group of partners, why not choose someone to act as a recurrent training officer, someone who will come up with some interesting flying training exercises and material that the others can share and do. Why not designate a partner to look at the operation from a safety perspective, and develop best means and safety practices for the partnership. In partnerships that are lucky enough to include an instructor or flying professional, why not make a practice of flying with them once or twice a year to sharpen up your skills on a recurring basis, having them point out the bad habits and deficiencies that we usually all develop without practice. In partnerships that don't include an instructor, why not plan recurrent training days, where everyone takes a turn getting their flying habits scrutinized.

Why not take the story above and develop the concept for your aircraft partnership. It will help your aircraft operation be like the fellow's in the story above—a conscientious, safe operation!

For more information on COPA, visit:  
[www.copanational.org](http://www.copanational.org).

## A Glider Pilot's Perspective of CASS 2008

by Dan Cook, Flight Training and Safety Committee, Soaring Association of Canada (SAC)



I attended the recent Transport Canada (TC) Canadian Aviation Safety Seminar (CASS) in Calgary, Alta., and I wanted to share some of what I took away from the seminar.

First, let me set the stage by saying that we, in the gliding community, have been working on the implementation of a safety management program, using the TC's safety management system (SMS) as a guideline. It has not been an easy implementation process; some of the feedback from clubs has been that it is too difficult a program for them to action. Some clubs have had less difficulty, where a few members have come forward to champion (lead) the change. I think most members see the need for SMS, but making the effort to change club management has been the challenge. Basically, many feel soaring is a leisure activity, so if change for safety's sake is hard to do, most are not really interested.

In contrast, I am always amazed at how much effort pilots will make to become good at cross-country soaring or competition. We have had some recent fatal soaring accidents that have been devastating to some in our soaring community. I am certain that if you speak to anyone who has been personally affected by these events, they are interested in anything that can be done to reduce the chances of losing one of our family members or friends.

SMS has proven to save lives, but why are we reluctant to make the effort to change? Do we have to wait until someone we know personally is affected? If we look at accidents from the perspective of a parent whose child was killed—and don't emotionally disassociate ourselves from the event or pass it off, thinking that it could never happen to us—we might feel and act differently. I think CASS 2008 addressed this, and what follows are from my notes and what I took away from the workshops/seminars!

Bob Aitken from the School of Instructor Education at Vancouver Community College spoke to us about why change is so hard for humans. For a person to make a change, they must engage their brain to process the information. This takes more effort than routine activity, and can make people feel uncomfortable; therefore, they prefer to avoid change. There are also some physiological reasons for this. We are generally good at detecting "errors" or changes in the normal way of doing things.

This part of our brain is also hard-wired to our emotional control centres. When errors are detected, this can activate

the fear centre, which can trigger an emotional response or impulsivity in us.

For most people, the idea of change affects the part of the brain that sees the world comfortably as routines. An effort to change what we are comfortable with releases signals and chemicals in our brains, resulting in the fear emotion being triggered. For most of us, this is uncomfortable, and we will resist—both consciously and unconsciously—what is triggering the undesirable effect.

This may be a "self-preservation" instinct, but for those of us who have come forward to lead the safety management programs in our club, we need to understand what we are up against, and how we can help our club members overcome these difficulties.

Leadership is part of managing change. Mr. Aitken pointed out that "we are creatures of habit," and good leaders are direct but can also be indirect. Good leaders can fashion stories of identity. They are able to embody these stories in their life experiences. This style of leadership is important when dealing with diverse groups like the flying or soaring communities.

Changing our behaviour depends on where we focus our attention. A leader can activate change in our behaviour by creating moments of insight where we can see things differently. To help us discover this insight, we need to make an emotional connection with those we are trying to lead through change. We will attend to things that have emotion and meaning. Therefore, we can learn if we can make an emotional connection to the subject!

Safety management programs can be more effectively introduced if leaders can make an emotional connection for those who need to be part of the process or use the system to create a safer environment. That emotional connection is best made by a leader's influence through personal storytelling about why it is important.


Mr. Aitken also gave an example of an indirect leadership approach taken by a safety management expert's visit to a company that had had some fatal accidents. He asked some of the company supervisors who witnessed the loss of an employee to express how it had affected them. Their personal stories of tragedy and sadness captivated their audience and resulted in collective interest towards improving safety at the plant.

How do gliding club leaders properly implement change management? They need to find the right people for the safety implementation task—they need to manage performance well, and help implementers with their goals and interests.

Mr. Aitken also explained that emotional intelligence (EI), not IQ, was a stronger predictor of whether a person would be better at a leadership style where making personal connections is necessary. EI describes a broad base of emotional maturity and ability in how someone sees and relates to themselves; how they relate to others; how they adapt to changes; how they manage the effects of stress; and their general mood stability. He stated, in our working life we are most often “hired for our

qualifications, promoted for our performance, and fired for our interpersonal skills.” Therefore, we should seek out those who are good with people, rather than those who are generally more knowledgeable about the subject, when trying to find someone to implement safety programs.

Safety management programs are unfortunately about change management. Change management is about leadership, and leadership is about whom we have chosen within our clubs to invoke the proper emotional connections.

If your program is not working, you may need to find someone with good interpersonal skills (EI) to run the program for you. 

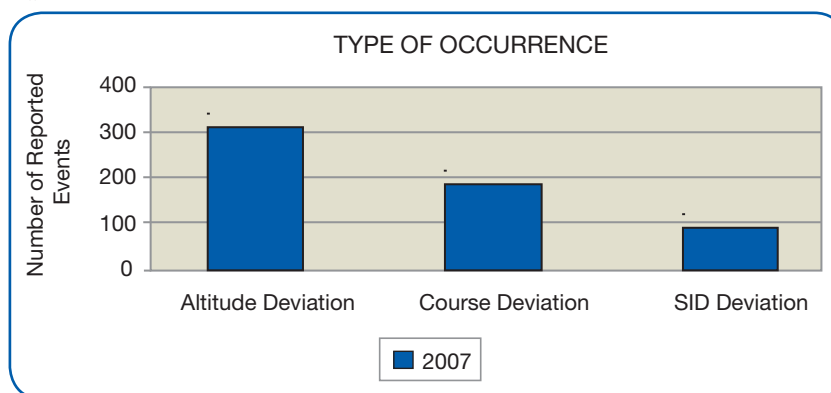
## Exchange of Safety-related Information: A Tool to Enhance Safety

by Serge Thibeault, Regional Safety Manager, Eastern FIRs, NAV CANADA



The aviation industry is upgrading its safety management toolbox to include proactive/predictive processes such as hazard identification and risk analysis, normal operation safety survey (NOSS) and line operation safety audit (LOSA) to complement existing reactive processes such as accident or incident investigations. These various sources of data provide a wealth of information for analysis and identification of potential safety hazards and risks. While most organizations have developed the ability to collect and analyze data pertaining to their own organization, a more complete picture is required for tackling a number of the safety issues facing the industry. This complete picture can only be obtained through the inter-organizational exchange of safety-related information.

The chart below illustrates the national picture in 2007 of some of the events being tracked by NAV CANADA as reported through its Aviation Occurrence Reporting (AOR) system, which feeds Transport Canada’s Civil Aviation Daily Occurrence Reporting System (CADORS) database.



Although NAV CANADA tracks these issues, its ability to be proactive in mitigating them is quite limited, since an in-depth understanding of the “whys” behind these events requires input from other industry stakeholders. It is important to note that none of the events shown on the graph above resulted in catastrophic outcomes, thanks to the strength of the aviation industry’s defences. However, each time one of these events occurred, it pushed the safety envelope and occasionally required quick human intervention to re-establish safety.

To illustrate how sharing safety information has benefited the aviation industry, the sections below describe some of the advances made in understanding standard instrument departure (SID) deviations, course deviations, and altitude deviations.

### SID deviations

A SID deviation is defined as any deviation from the altitude or direction required to follow a standard instrument departure. A rise in SID deviations by pilots departing from Montréal Trudeau International Airport was identified in the summer of 2007. In response to this trend, NAV CANADA held a forum for industry stakeholders to share

information. As a result of this effort, all participants gained a greater understanding of some of the underlying factors, such as:

- Flight management system (FMS) programming errors linked to last-minute runway changes
- Confusion of a SID name (KANUR 2) with an en-route fix name (KANUR)
- Pre-filed flight plans loaded in the FMS based on the company dispatch's assumption regarding which SID will be flown, but the flight crew forgot to update the FMS when ATC actually assigned the SID.

Armed with a better understanding of the issues, the industry is now in a better position to develop appropriate and effective mitigation.

### Course deviations

A course deviation is defined as any deviation from routing, including gross navigational errors, standard arrival or departure paths in terms of direction (excluding SIDs) and any erroneous tracks.


Course deviations are a complex issue as there are a number of different reasons for which they occur. Consider the following example: the dispatch department for a flight from Asia to North America had filed a flight plan which was forwarded from the airline's dispatch office in North America to an air navigation service provider (ANSP) in Asia and simultaneously to the flight crew. A while later, a second flight plan, which included a different route, was entered into the system for the same flight through an Asian dispatch. As the flight progressed to North America, the flight plan information also travelled from ANSP to ANSP and finally, many hours into the flight, in the Montréal flight information region's (FIR) airspace, the flight deviated from the

course expected by NAV CANADA's controllers. To fully understand where the break in communication occurred in this type of event required investigating whether it was somewhere between the various ANSPs involved, between the dispatch and their crew, or between crew members on board the flight. Without collaboration between the various stakeholders in tracking down the problem, it would be difficult for NAV CANADA or any other organization to implement appropriate and effective mitigation.

### Altitude deviations

An altitude deviation is defined as any deviation by any aircraft from an assigned or designated altitude (SID deviations are excluded). This may include deviations due to turbulence or other weather events, deviations from an altitude passed from one area control centre (ACC)—specialty or sector—to another. Flights can be IFR or VFR.

The industry has identified a number of contributing factors to altitude deviations, such as a pilot's limited knowledge of a given airspace classification or procedure or errors linked to miscommunications between pilots and air traffic services (ATS) personnel. As reported in a previous issue of the *Aviation Safety Letter* (ASL), NAV CANADA initiated a national ATS-Pilot Communication Working Group, which includes a variety of aviation stakeholders. The main objective of this group is to identify strategies to reduce the number of miscommunication occurrences between pilots and controllers, which should also have a positive impact on the altitude deviation issue.

Many of the safety issues in aviation are shared responsibilities. In this relatively new era of safety management systems (SMS), we will be in a better position to tackle existing issues and new challenges through the exchange of safety-related information and renewed collaboration between industry partners. 

## Cabin Safety—Communicable Diseases

by Shelley Manuel-Tough, Cabin Safety Inspector, Cabin Safety Standards, Standards, Civil Aviation, Transport Canada

A communicable disease is a disease that can be transmitted from one individual directly to another. Communicable diseases are transmitted through body excretions. While some (e.g. colds and the flu) can be spread by casual contact, others (e.g. tuberculosis) can be spread through respiratory droplets, such as coughing, sneezing or runny noses.

Many communicable diseases have been spread in some way by air travel. Diseases transmitted by person-to-person contact are an obvious air travel concern.

In the past, the incubation period of most communicable diseases was shorter than transit times. This allowed the

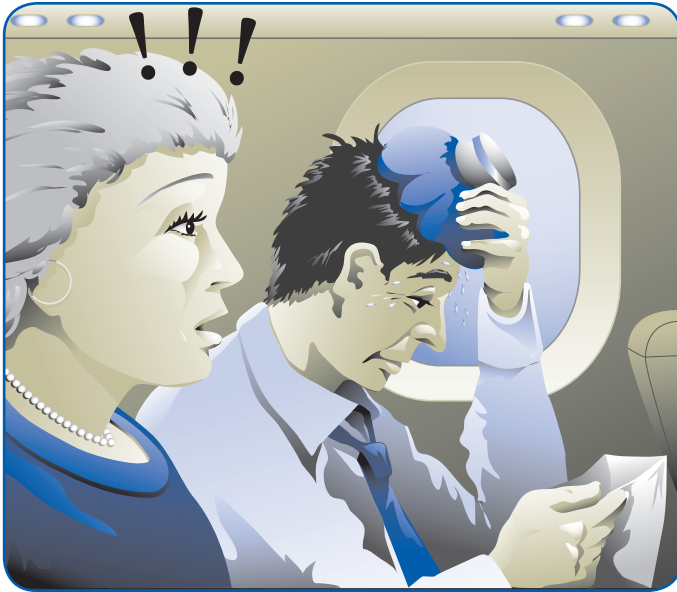
symptoms of some diseases to arise prior to arrival at destination.

With today's jet travel, the world has become immediately linked as a community, and this has reduced the effectiveness of geographic separation as a barrier to disease transmission.

A communicable disease is suspected when a passenger or a crew member exhibits one or more of the following signs or symptoms:

- appearing obviously unwell;
- persistent coughing;
- impaired breathing;





- persistent diarrhoea;
- persistent vomiting;
- skin rash;
- abnormal bleeding;
- reduced mental clarity.

If associated with a fever (temperature of 38°C or greater), the likelihood that the passenger is suffering from a communicable disease is increased.

Basic precautions and safe practices must be followed each time care is provided to a passenger suspected of having a communicable disease.

The International Air Transport Association (IATA) suggests the following general guidelines to help cabin crews deal with passengers suspected of having a communicable disease:

- request medical ground support;
- request medical assistance on board;
- designate one cabin crew member to look after the sick passenger;
- relocate the sick passenger to a more isolated area, if possible;
- designate one lavatory for the sick passenger, when possible;
- use appropriate first aid equipment, such as masks and gloves;
- dispose of contaminated equipment appropriately;
- advise the captain so that the illness can be reported prior to landing.

Communicable diseases may be transmitted to passengers who are seated in the same area of an aircraft, usually as

a result of passengers touching parts of the aircraft and furnishings that an infected passenger has contaminated by coughing, sneezing or touching.

The risks of transmission to fellow passengers will vary according to the disease, the infectiousness of the case, the ventilation in the aircraft, the dose of exposure (which depends on duration and proximity), and the passenger's susceptibility to that disease.

For some communicable diseases, the risk may extend beyond passengers and crew on board the aircraft and include people exposed en route to and from the airport, and workers and other travellers at the airport. Some infected passengers only manifest the disease after arrival, magnifying the potential for epidemic spread.

The advent of Severe Acute Respiratory Syndrome (SARS) in 2003, as well as the continuing concern about the potential for a global influenza pandemic, has highlighted the need to ensure reliable notification procedures to port health authorities at the aircraft's destination, in the event that a suspected case of communicable disease is identified on board.

Section 34 of the *Quarantine Act* requires that conveyance operators arriving in Canada inform a quarantine officer as soon as possible before the conveyance arrives at its destination if they have reasonable grounds to suspect that any persons or cargo they are carrying could be infected with a communicable disease listed in the schedule under the Act.

Transport Canada is proposing an amendment to section 8, "Aviation First Aid," of the *Flight Attendant Training Standard* (TP 12296) to include the subject of communicable diseases. This addition would ensure that flight attendants receive instruction on the signs and symptoms of communicable diseases, and instructions on ways to minimize the risks of spreading the disease.

Transport Canada recently published Advisory Circular (AC) LTA-001, titled *Protecting the Health and Safety of Employees On Board Aircraft in Epidemic Situations Involving Airborne Communicable Diseases* (available on-line at: [www.tc.gc.ca/CivilAviation/IMSdoc/ACs/LTA/LTA-001.htm](http://www.tc.gc.ca/CivilAviation/IMSdoc/ACs/LTA/LTA-001.htm)). This AC recommends that air operators implement certain precautionary procedures in the event that an ill passenger is detected on board.

Although research has shown that there is very little risk of any communicable disease being transmitted on board an aircraft, safety is everyone's responsibility. ▲

## CBAA Column—Safety Management System (SMS): Step Forward or Step Back?

by Tim Weynerowski, Certification Specialist, Canadian Business Aviation Association CBAA. This article was published in the May 2008 edition of News Brief, reprinted with permission.



SMS is seen by some as a means of providing more oversight with fewer resources. However, if we look at how SMS oversight is conducted, it will be apparent that this carefully thought-out approach to risk management has compelling merit.


A well-developed quality assurance (QA) department's objective is similar to that of an SMS. Regulatory oversight of an organization is carried out, at least in part, by assessing the effectiveness of the QA department. If this department is found to be proactive, then the regulator's involvement can be reduced without compromising the organization's level of safety. Included in this assessment are such things as: the development of training programs, internal auditing, maintenance control, and incident investigation. If, on the other hand, the QA department is ineffective, then the demand for regulatory intervention automatically comes to the fore.

The goal of an SMS is to develop the tools and skills to enable an organization to manage and mitigate risk to levels extending beyond the capability of current regulatory oversight. The introduction of an effective SMS involves a change of philosophy within the organization and greater emphasis on operator accountability. For the transition to be effective, regulatory oversight is especially critical during the development phase. Not unlike a QA department, only when the organization demonstrates a significant level of maturity in its SMS can the regulatory oversight be adjusted accordingly.

Regulatory oversight is as important under SMS as ever before. The approach now is somewhat different. Rather than providing oversight in the traditional manner, it becomes a matter of assessing the effectiveness of an organization's SMS. Effective oversight of an SMS relies on the skill and knowledge of the auditor derived through comprehensive training.

The operator, as principal stakeholder, has a vested interest in embracing and engaging in a system that will play a key role in the organization's future success. There is a perceived comfort level in being able to divert responsibility onto the shoulders of the regulator by following the conventional prescriptive method of oversight. The idea of a more active role brought about by the introduction of SMS may initially appear to be slightly intimidating or cumbersome. However, this performance-based system achieves maximum efficiency by tailoring itself to the unique needs and characteristics of each organization.

One of the fundamental requirements of an SMS is to engage in a comprehensive program of hazard assessment and risk analysis performed by key personnel or industry experts. This helps to provide an organization with a solid foundation on which to build effective safety policies and procedures. The goal of an organization is to continue to evolve and mature into an even safer and more efficient establishment with a well-developed safety culture that promotes such things as non-punitive reporting and proactive input from all levels of the organization.

Contrary to some opinions, an SMS is neither designed nor intended to cloak an organization in secrecy. Some efforts have been made to protect personal identity with the intent of encouraging non-punitive reporting. In no way has this reduced the transparency required to conduct effective oversight by the regulator. Hopefully, as a result of SMS, safety culture in Canada will advance to a point where the efficiency of regulatory oversight is maximized to help meet the growing demands of tomorrow. I strongly believe SMS is an important step forward in the evolution of aviation. 

### Call for Nominations for the 2009 Transport Canada Aviation Safety Award

Do you know someone who deserves to be recognized? The Transport Canada Aviation Safety Award was established in 1988 to foster awareness of aviation safety in Canada, and to recognize individuals, groups, companies, organizations, agencies or departments that have contributed to this objective in an exceptional way.

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## Safety Culture: SMS Goes Vertical

by James T. McKenna, Editor, Rotor & Wing magazine. This article was originally published in the Flight Safety Foundation's AeroSafetyWorld magazine, January 2008. Reprinted with permission from the Flight Safety Foundation.

### *Smaller helicopter operators are the target of a new tool kit that will ease the pain of developing a safety management system*

A campaign to convince commercial helicopter operators to embrace a host of new recommendations for improving rotorcraft safety, including a tool kit for developing a safety management system (SMS), has been launched by an international coalition of helicopter manufacturers, regulators, operators and customers.

The coalition, the International Helicopter Safety Team (IHST), modeled on the airline-oriented Commercial Aviation Safety Team (CAST), since late 2005 has been pursuing the goal of reducing by 80 percent the rate of rotorcraft accidents by 2016 (see "International Helicopter Safety Team," p. 13). The team has two main subteams. One spent 18 months analyzing the root causes of 197 helicopter accidents that occurred in 2000, and recommending means to prevent similar accidents. The other subteam is just beginning the task of turning those recommendations into pragmatic actions.

This group aims to gain industry support for its efforts by offering individual helicopter operators a simplified tool to assist in developing and implementing an SMS tailored to each firm's mission and business circumstances. Group leaders expect the SMS tool kit will help persuade operators that its recommendations could improve both safety records and bottom lines. The tool kit is available on-line at [www.ihst.org](http://www.ihst.org).

In developing the tool kit, the group aimed to win acceptance of the SMS approach—and by extension the group's subsequent recommendations—from operators of five or fewer helicopters. Such operators make up the largest single segment of the civil helicopter industry, approximately 80 percent, and are involved in the vast majority of helicopter accidents.

"The real target audience is the operator of two to five helicopters," said B. Hooper Harris, manager of the U.S. Federal Aviation Administration (FAA) Accident Investigation Division. Harris is co-chairman of the subteam that watched over the development of the SMS tool kit and participated in drafting it. He shares the chair of the Joint Helicopter Safety Implementation Team (JHSIT) with Greg Wyght, Vice President of Safety and Quality for CHC Helicopter Corp., among the world's largest providers of helicopter services to the global offshore oil and gas industry.

The IHST calls an SMS "a proven process for managing risk that ties all elements of the organization together laterally and vertically and ensures appropriate allocation of resources to safety issues." It urges that the term "safety management" be taken to mean safety, security, health and environmental management. The key focus of such a system, though, "is the safe operations of airworthy aircraft."

The helicopter industry faces challenges in making such an approach common. To date, the SMS approach has been applied in industries large in scale and homogeneous in mission: railroads, energy, chemicals, airlines, aircraft maintenance and air traffic services. While there are large helicopter operators, such as CHC, and many of them have adopted SMS or major components of SMS, most helicopters are spread among many small operators, and are used in a wide variety of missions.



Photo: Graham Lavery

*Specialty operations are the bread and butter of helicopters. The tool kit will assist in developing and implementing an SMS tailored to each firm's mission and business circumstances.*

When the Joint Helicopter Safety Analysis Team presented its recommendations for mishap-mitigation measures, for instance, it did so in a number of mission-specific categories. They include instructional/training, personal/private, aerial application, emergency medical services, law enforcement, and offshore oil and gas platform support. Other categories are business/company-owned aircraft, aerial observation/patrol, air tour and sightseeing, electronic newsgathering, external load, logging, fire fighting, numerous other commercial activities, and utilities patrol and construction. The Joint Helicopter Safety Implementation Team proposes to adhere to the same divisions in developing its mitigation recommendations.



“That means we’re not after the bigs, we’re after the little guys,” said Roy G. Fox, Chief of Flight Safety at Bell Helicopter, who worked on drafting the SMS tool kit.

There is ample cause to target the small operator. The number of helicopter accidents has remained fairly constant for the last 20 years, including U.S. civil and military operations, and operations outside the United States.

“The rotorcraft industry understands its risks more clearly than other elements of the [aviation] industry,” said the FAA’s Harris, “simply because they have an accident rate that is significant.”

In its bid to change that trend, the IHST adopted the general approach used with great success in the U.S. by the CAST. That team began its work in 1997 with the objective of cutting the U.S. airline fatal accident rate by 80 percent in 10 years; it has nearly achieved that goal. The foundation of its work was basing safety initiatives on reliable, verified data about accident causes.

The helicopter team works on the same basis. Yet its Joint Helicopter Safety Team had not yet completed its work when it called for widespread use of SMS. Team members said that their interim analysis argued strongly for adoption of such systems. The analysis team looking at the 197 accidents found that a major contributing factor in most accidents was the failure to adequately manage known risks, said Keith Johnson, Safety Program Manager for the Airborne Law Enforcement Association. Johnson is a member of the JHSIT and participated in drafting the SMS tool kit.

In addition to the benefits an SMS brings in itself, they said, it also would serve as the framework for subsequent safety recommendations.

“We needed something to start this structure,” Fox said.

“A good, strong SMS is a springboard” [for other improvements,] said Fred Brisbois, Director of Aviation and Product Safety for Sikorsky Aircraft. He is a member of the JHSIT and helped develop the SMS tool kit. “You can have the most modern, best-equipped aircraft. If you don’t have an SMS, you compromise all the other safety advances.”

The drafters of the tool kit said they reviewed several SMS models, as well as regulations and guidance material from around the world, to tailor a kit for the helicopter industry. They also said they included contributions from small, medium and large helicopter operators, airlines, industry groups and from governments.

“We’re taking what’s out there and putting it into laymen’s terms that the smaller operator can use,” said Brisbois.

The result “is somewhat unique,” said Harris. “Almost everybody else talks around SMS in a ‘big system’ way.”

In a bid to win acceptance from the broadest range of smaller operators, he said, the team opted for a tool kit that fosters a performance-based SMS, as opposed to one that lays out a rigid structure and procedures. Harris explained the difference:

“Every person has a financial management system. You balance your checkbook, you pay your taxes and you pay your bills. You may do that by yourself, with a checkbook and a calculator or computer. [Microsoft founder] Bill Gates may rely on accountants and lawyers. Whoever you are, the functions are the same and the performance objectives are the same: to manage your funds, pay your taxes and honor your debts.”

Toward that end, the IHST tool kit lays out 11 attributes of an effective SMS and offers checklists of steps operators should take to achieve each attribute. But it leaves the details up to each operator.

Perhaps most important to its efforts to win widespread acceptance of its SMS tool kit, the team gives operators the option of integrating such systems into their activities in incremental steps. “This allows the organization to become acquainted with the requirements and results before proceeding to the next step,” the tool kit says.

The core attributes of the IHST’s SMS are:

- An SMS management plan;
- Safety promotion;
- Document and data information management;
- Hazard identification and risk management;
- Occurrence and hazard reporting;
- Occurrence investigation and analysis;
- Safety assurance oversight programs;
- Safety management training requirements;
- Management of changes;
- Emergency preparedness and response; and
- Performance measurement and continuous improvement.

Essential to the effectiveness of an SMS, Johnson said, is its acceptance by senior management as a core business responsibility.

The team plans additional steps to promote acceptance of SMS. It is developing computer software to help operators assess the savings that could be achieved



through use of an SMS. It plans to offer training in the use of that software and of SMS at the Helicopter Association International's Heli-Expo annual convention in February in Houston. It also plans to develop a second edition of the tool kit targeted at medium-sized operators.

Team members believe their efforts got an important boost in October, when ExxonMobil Aviation issued a memorandum to vendors. The unit that contracts and oversees aviation support for that company's oil and gas exploration activities worldwide, ExxonMobil Aviation, noted that its "mature and established aircraft operators" have SMS in place.

"However, smaller operators often face challenges in the implementation of a fit-for-purpose SMS that meets operational requirements whilst being economically viable," the memo states. Nonetheless, ExxonMobil Aviation considers 11 elements, or attributes, of an SMS "as a minimum standard template for long-term contracted aviation activities." Those are the same 11 listed in the tool kit.

"Having people outside the aviation community saying it can be done lends credibility" [to adoption of an SMS,] said Sikorsky's Brisbois.

### International Helicopter Safety Team

The Safety Management System Tool Kit for helicopter operators is the first product of a 10-year effort to cut worldwide rotorcraft accidents by 80 percent.

Making this effort is the International Helicopter Safety Team (IHST), the outgrowth of a September 2005 gathering of manufacturers, regulators and operators from around the world. That gathering was supported by the International Civil Aviation Organization (ICAO) and regulators in Canada, France, the United Kingdom and the United States. Also backing it were Canadian, French and U.S. accident investigators, rotorcraft manufacturers, and major civil and military operators.

Convened in Montreal, Que., at the behest of the American Helicopter Society International and the Helicopter Association International, the gathering marked the participants' recognition of a daunting challenge: their inability, year after year, to reduce the number of accidents. That inability seemed to reinforce a public impression of helicopters as unreliable and unsafe, an impression that stood as a critical obstacle to the growth and prosperity of the industry.

To dismantle that obstacle, the 260 attendees of the first International Helicopter Safety Symposium agreed to draw on the successful experience of the Commercial Aviation Safety Team (CAST) in the United States. That is, they would search all credible data on helicopter accidents for root causes and use that data to prioritize mitigation measures to address the most common problems.

The IHST is co-chaired by Matt Zuccaro, President of the Helicopter Association International, and Dave Downey, Manager of the Rotorcraft Directorate of the

U.S. Federal Aviation Administration (FAA) Aircraft Certification Service. It includes the Joint Helicopter Safety Analysis Team, which is doing root-cause analysis of rotorcraft accidents on an annual basis, and the Joint Helicopter Safety Implementation Team, which will develop mitigation measures based on the analysis team's recommendations.

While the IHST is drawing on the model of CAST, its goals are more ambitious in several respects.

First, while CAST focused on an 80 percent reduction in fatal accidents, the helicopter team aims for a similar reduction in both fatal and non-fatal accidents. Second, CAST's target group is a fairly homogeneous one: commercial airlines generally flying large fleets drawn from a small set of fixed-wing transports. Roughly 80 percent of civil helicopter operators have fleets of fewer than five aircraft, and they fly aircraft built by more than 15 different manufacturers, including those from former Soviet republics.

Third, CAST concentrates on scheduled airline service. The helicopter team must cover aircraft used in a variety of missions, with each mission type having unique operational, training, and equipment aspects. The IHST settled on grouping its analysis and mitigation work into 15 different mission sets.

Most challenging of all, perhaps, was the lack of reliable utilization numbers for helicopters. Hours flown by commercial airlines are tracked in detail by regulators and financial markets. But helicopter flight hours in the United States, the world's largest rotorcraft market, are based on sampling by the FAA, an approach that has proven inaccurate for the small fleets involved. So before it could tackle its goal of reducing helicopter accident

rates, the international team had to build the database for establishing those rates.

“You can’t even meet the goal until you know how many hours are flown,” said Roy G. Fox, Chief of Flight Safety at Bell Helicopter, who is leading the effort to compile that database. That work should be completed in 2008.

Most of the team’s work has focused on the United States, but team leaders aim to establish regional teams

throughout the world, already under way to varying degrees in Australia, India and Latin America. The European helicopter community is pursuing a parallel effort. This year, team leaders plan to meet with industry officials in the United Arab Emirates, Japan and South Africa to launch regional teams in the Middle East, Asia and Africa.


—JTM

## Safety Management Systems (SMS) for Canadian Helicopter Operators

by Jacqueline Booth-Bourdeau, Chief, Technical and National Programs, Standards, Civil Aviation, Transport Canada

Safety management system (SMS) regulations impacting the Canadian helicopter industry are expected in 2009. The *Canadian Aviation Regulations* (CARs) reflect the SMS principles established by bodies such as the International Civil Aviation Organization (ICAO) and, in many respects, exceed the basic requirements. Over the years, Transport Canada (TC) has actively supported domestic and international activities relating to SMS through training, working group participation and the provision of feedback to other aviation authorities and organizations. This has provided TC with the opportunity to ensure that the interests of the Canadian aviation industry are heard, while providing the occasion to share ideas and learn from the experience of others. The knowledge acquired from participating in these activities has been used to enhance TC’s comprehensive set of guidance materials, including material specifically designed for smaller operators.

As the knowledge level in the industry increases, we are seeing initiatives emerge, such as the International Helicopter Safety Team (IHST) SMS tool kit. This work will help to enhance our understanding of SMS in smaller organizations and make the prospect of implementation simpler. While no off-the-shelf package is ever a perfect fit—it must be tailored to meet the individual needs of the organization—tool kits like the one offered by the IHST provide a good starting point for implementation. With a little adaptation, operators can take this tool kit and form the basis of their SMS.

An effective implementation strategy will naturally involve changes in processes and procedures and will almost certainly involve a shift in the corporate culture. Getting the foundation of the SMS right will facilitate this and provide a framework that promotes a healthier safety culture. The success of the system will hinge on the development of processes that foster continual improvement through proactive safety assessments and quality assurance. 

## BLACKFLY AIR





Coming Soon to a Theatre Near You: Whiteout .....	page 15
"Damn, Was That Ever Slippery!" .....	page 17
A Holdover Time Paradigm Shift .....	page 20

## Coming Soon to a Theatre Near You: Whiteout

by Bernard Maugis, Civil Aviation Safety Inspector, System Safety, Quebec Region, Civil Aviation, Transport Canada

*A recent search of Transportation Safety Board of Canada (TSB) statistics for occurrences involving helicopters in a "collision with terrain" accident from 1998 to 2008 yielded 303 hits. Of those 303 accidents, 18 occurred in whiteout conditions. There were 45 passengers on those 18 flights; 23 were injured and 13 lost their lives. The pilot's experience level did not appear to be a factor. In anticipation of the upcoming winter season, and considering the above statistics on the dangerous whiteout phenomenon, we felt it would be worthwhile to reprint the following article, titled "Whiteout," which was originally published in Aviation Safety Vortex 4/2003.*

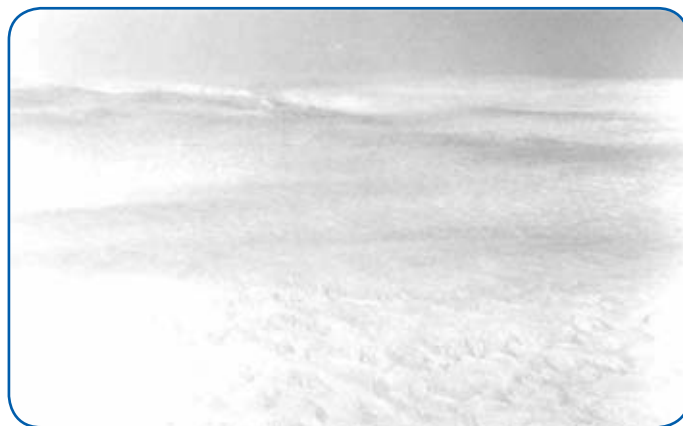
### Whiteout

Back in the old days, a Canso was on a very long IFR ferry trip in the Arctic Islands. For the crew it was a monotonous routine—monitoring the instruments and listening to the roar of the two big radial engines just above their heads. There was nothing to see out of the windows, just a white, featureless blank.

It was a boring and undemanding afternoon, until the captain looked out through the windscreen and saw his flight engineer standing in front of the aircraft with a big grin on his face. This came as quite a surprise to the captain, whose training and background had not prepared him for coming face-to-face with anyone while in cruising flight, let alone a member of his crew.

The Canso had flown into very gentle rising snow-covered and featureless terrain. The impact had been so soft and gentle that amidst the rattling, roaring and vibrating that constitutes cruising flight in this type of aircraft, the crew hadn't noticed the deceleration at all. The flight engineer had happened to look out of one of the Perspex blisters in the tail of the aircraft and discovered that he could see the ground, quite motionless just a few feet below him. So he got the aluminum ladder out, climbed down to the ground and walked round to the front to get the pilot's attention.

Maybe it's urban legend; maybe it's a true story—who knows? I suppose, considering the boat-shape of the Canso hull, that it could happen, but one thing's for sure—it's not likely to happen in a helicopter. I do know one chap who claims to have hit the ice at cruise speed in a Bell 206 on fixed floats, and suffered nothing but a gentle bounce, but the more likely scenario involves a catastrophic break-up, and debris field.



*Whiteout conditions mean a gradual loss of all visual references*

If you are a VFR commercial pilot flying in Canada, sooner or later you are going to experience loss of visual reference to some extent. If you're lucky, it will be for only a second or two before your frantic eyes find a clump of trees or something else that tells you which way is up. If you're not lucky, you'll likely join the ranks of those who have found out the hard way that the "seat of your pants" is easily fooled. For those who haven't experienced it, it can happen something like this:

The weather is deteriorating. You know the situation is not good, but you press on, hoping it will improve. It doesn't—it gets worse, and you find yourself losing good reference. Your eyes are darting from side to side and your pulse increases. You slow the aircraft, still searching for visual clues. Your breathing speeds up, and your pulse is now racing. You feel a cold rush flood through your body, and a strange sensation of your insides relaxing as adrenalin and fear overcome concentration and reasoned thought. Then comes the disbelief; the absolute unwillingness to accept that your body has let you down and you are helpless.

Let's look at some examples of descriptions taken from Canadian accident reports from the past few years:

- *During approach for landing on a glacier and at 8 000 ft above sea level (ASL), the pilot of the 205 entered a whiteout-like condition in swirling snow. He lost all visual reference and touched down hard, causing damage to the skid-gear.*
- *Nearing destination, the aircraft flew into whiteout conditions. All visual reference was lost before the pilot could complete a landing, and the helicopter rolled over on touchdown.*
- *The main rotor hit the ground after the left skid dug into snow surface during a mountaintop landing. The aircraft was still in forward motion at touchdown due to wind shift and whiteout.*
- *The sling load proved heavier than the pilot expected, and he couldn't get airborne. He hovered with the load resting on snow-covered ice and lost visual reference in the blowing snow. The pilot released the sling load, while the helicopter was in a nose-high attitude. The tail rotor struck the snow surface and the machine rolled over.*
- *The pilot encountered whiteout conditions and attempted to turn back. The aircraft crashed on the Arctic sea ice during the turn.*
- *The pilot lost visual reference in whiteout over an ice-covered inlet and flew into the ice.*
- *The pilot aborted his third take-off attempt in blizzard conditions. On touchdown in whiteout conditions, the helicopter rolled on its side.*
- *The aircraft struck ice in nearly flat attitude in whiteout conditions...*
- *The 206 pilot took off on a charter with two passengers for some survey work. The weather was marginal but there were no weather reporting stations in the area, so they decided to "have a look at it." When they turned out over the sea ice to look for some fuel barrels, the pilot soon found himself in whiteout. He asked a passenger to keep an eye on the altitude while he turned the 206 to regain visual reference with the shoreline. In the turn he lost altitude and the helicopter struck the ice.*

This accident resulted in three serious injuries. One has to wonder about what was going through the pilot's mind when he asked the passenger to "keep an eye on the altitude." —Ed.

- *The ceiling was low and the visibility was poor, in falling snow, but the 206 pilot spotted his party on the lake. Day-Glo cloth markers indicated their location. The ice was covered with four inches of fresh loose snow. As the helicopter entered a pre-landing hover, the rotor wash blew up the loose snow and the pilot became*


*disoriented. The machine rolled and the main rotor blades struck the ice.*

- *The 206 was number two in a group of six helicopters en route from Charlottetown, P.E.I., to an ice flow in the Gulf of St. Lawrence to observe the seal-hunting operation. As the group approached the halfway point, they encountered whiteout conditions in light-to-moderate snow. The ice they were flying over was relatively flat and also featureless. The accident helicopter reduced speed to about 60 kt and descended in an attempt to maintain visual contact with the ice. As the helicopter neared the ice, number-three aircraft radioed a warning to pull up, but the warning came too late. The 206 hit the ice with sufficient force to tear the float gear off and crush the crew and passenger seats.*
- *The pilot landed in a mountain meadow to pick up skiers. As the helicopter did not come out of the whiteout as expected on takeoff, the pilot aborted. The right skid dug in and the machine rolled over.*

Sadly, there are many more examples; they happen every year. What may surprise you is that many of them happen in the summer months, when Mother Nature hasn't yet released her grip on winter in our northern regions. One study found that in the preceding nine years, 25 percent of the whiteout accidents took place during the summer operational season. This may indicate that currency plays a role in both the hands-on skills and decision making required to deal with winter weather.

The vast majority of low-speed take-off and landing accidents are preventable by good decision making, with careful consideration given to:

- the conditions of the area;
- the recent weather, wind, temperature (is the snow heavy, or light and fluffy?);
- patience; and
- technique (see "Snow Landing and Take-off Techniques" in *Aviation Safety Vortex* 1/2003).

In the en route phase of flight, many human factors gurus and experienced pilots theorize that the stage is set for the accident long before the whiteout condition exists. They believe that if you start the trip with the mindset that you'll return or divert if the weather deteriorates beyond a given point, you are more likely to do so when it does. Conversely, if you have nothing but the destination or an optimistic forecast in mind, you're more likely to press on. This is definitely something to consider when planning your next flight into the frozen Canadian winter. 



## “Damn, Was That Ever Slippery!”

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



*Runway excursion due to slippery runway*

There isn't a pilot in Canada operating high-performance aeroplanes who hasn't uttered or heard someone utter something akin to the title of this article.

Operations on contaminated runways raise numerous questions from air operators. However, air operators aren't the only ones operating under cold or inclement weather conditions interested in gaining a better understanding of the factors that influence aeroplane braking performance on non-bare and -dry runways. Their flight crews want to know more, too. While air operators are justifiably more concerned with minimizing the payload loss and maximizing their revenue, flight crews are more interested in maintaining a high level of safety in their own operation.

Hence, this article is directed at flight crews who want to know more about the *why* of contaminated runway operations than the *what*. The *what*, they are taught in the many ground school sessions they attend on the subject, generally at the expense of the *why*.

It doesn't take a rocket scientist to figure out that a slippery runway affects the braking performance of an aeroplane. Any time you find yourself in a snowstorm, driving on one of Canada's highways, you will automatically slow down, impelled by a strong sense of survival, because you instinctively know that it will take you a longer distance to stop. Guess what? The same is true for an aeroplane. In fact, even more so, because as all flight crews know, aeroplanes tend to make poor road vehicles! There are, of course, other issues that flight crews must consider when operating an aeroplane on a contaminated runway, such as loss in acceleration performance, if the contamination is deep enough on takeoff, say, or loss in aeroplane lateral controllability on a contaminated runway that just happens to be slippery *and* in a crosswind condition at the same time.

This article will not address all the aspects of operating an aeroplane on a contaminated runway. Instead, for the most part, the article will focus on the following: (1) what the measurement provided by a runway-friction measuring device means; (2) the difference between some of these devices; and (3) the difference between what these devices measure, that is, the difference between what is called a *runway friction coefficient*—or *runway friction index* or *coefficient of runway friction*—and the *braking coefficient*—or *weight on wheels coefficient*—experienced by an aeroplane. The *runway friction coefficient* and the *braking coefficient* are NOT the same thing, and this difference has led to much confusion for flight crews because the manufacturers produce data using *braking coefficient*, while the airport operators report *runway friction coefficient*.

There shouldn't be any conflict between operating an aeroplane safely and being economically viable in the process. In fact, it just makes good economic sense to operate safely at all times, while recognizing that to do so in adverse conditions may have an economic penalty. Pay it, and move on, or don't operate!

### **Canadian Runway Friction Index (CRFI)— Application to Aircraft Performance**

*The information provided below, including information on the CRFI tables, (which have not been provided in this article due to space requirements) is drawn from the Aeronautical Information Manual (TC AIM) and can be found at the following Web site:*

[www.tc.gc.ca/CivilAviation/publications/tp14371/AIR/1-1.htm#1-6](http://www.tc.gc.ca/CivilAviation/publications/tp14371/AIR/1-1.htm#1-6).

The data compiled in Table 1 (CRFI Recommended Landing Distances [No Discing/Reverse Thrust]) and Table 2 (CRFI Recommended Landing Distances [Discing/Reverse Thrust]) is considered to be the best available at this time because it is based upon extensive field-test performance data of aeroplane braking on winter-contaminated surfaces. Pilots will find the data useful when estimating aeroplane performance under adverse runway conditions. The aeroplane manufacturer is responsible for producing information and providing guidance or advice on the operation of aeroplanes on a wet and/or contaminated runway. The information below does not change, create any additional, authorize changes to, or permit deviations from other, regulatory requirements. The tables are intended to be used at the pilot's discretion. Regulations and associated standards have been drafted on the use of the CRFI tables, and they are currently undergoing regulatory review.

Because of the many variables associated with computing accelerate-stop distances and balanced field lengths, it has not been possible to reduce the available data in such a way as to provide CRFI corrections applicable to all types of operations. Consequently, pending further study of the take-off problem, only corrections for landing distances and crosswinds are included.

It should be noted that in all cases the tables are based on corrections to flight manual dry-runway data and that the certification criteria does not allow consideration of the extra decelerating forces provided by reverse thrust or propeller reversing. On dry runways, thrust reversers provide only a small portion of the total decelerating forces when compared to wheel braking. However, as wheel braking becomes less effective, the portion of the stopping distance attributable to thrust reversing becomes greater. For this reason, if reversing is employed when a low CRFI is reported, a comparison of the actual stopping distance with that shown in Table 1 will make the estimates appear overly conservative. Nevertheless, there are circumstances, such as crosswind conditions, engine-out situations and reverser malfunctions, that may preclude the use of thrust reversing.

The landing distances recommended in Table 1 are intended to be used for aeroplanes with no discing and/or reverse-thrust capability and are based on statistical variations measured during actual flight tests.

Notwithstanding the above comments on the use of discing and/or reverse thrust, Table 2 may be used for aeroplanes with discing and/or reverse-thrust capability and is based on the recommended landing distances in Table 1, with additional calculations that give credit for discing and/or reverse thrust. In the calculation of distances in Table 2, the air distance from the screen height of 50 ft to touchdown and the delay distance from touchdown to the application of full braking remain unchanged from Table 1. The effects of discing and/or reverse thrust were used only to reduce the stopping distance from the application of full braking to a complete stop.

The recommended landing distances stated in Table 2 take into account the reduction in landing distances obtained with discing and/or reverse-thrust capability for a turboprop-powered aeroplane and with reverse thrust for a turbojet-powered aeroplane. Representative low values of discing and/or reverse-thrust effect have been assumed; therefore, the data may be conservative for properly executed landings by some aeroplanes with highly effective discing and/or thrust-reversing systems.

The crosswind limits for CRFI given in Table 3 contain a slightly different display range of runway-friction index values from those listed in Table 1 and Table 2. However,

the CRFI values used for Table 3 are exactly the same as those used for Table 1 and Table 2 and are appropriate for the index value increments indicated. Further, it should be noted that the crosswind limits listed in Table 3 are not based on actual flight-test results, as are Table 1 and Table 2, because the hazards associated with such actual testing conditions were considered to be too great. To the best knowledge available, the results contained in Table 3 are based on a best estimate and have been available to flight crews in this very same format for many years.

Table 4 has also been updated based on the best data available, which was generated as a result of the testing program that helped produce Table 1 and Table 2.

Some additional comments about Table 1 and Table 2 are appropriate here.

Hidden in the tables is a middle step used in the development of the quoted distances. The first step was the correlation of the friction-measuring device used in Canada to measure runway friction, namely, a spot-measuring electronic decelerometer, to the  $\mu$  (pronounced *mu*) braking coefficient of several aeroplanes that were tested during the winter runway contamination project. In order to develop landing distances in terms of the  $\mu$  braking coefficient of any aeroplane, once certain values are assumed for the  $\mu$ , all that is required is Newton's Second Law—just some physics. The decelerating force is a function of the assumed aeroplane braking coefficient  $\mu$ . Hence, once the correlation had been established between the measured runway-friction values and the braking coefficient of the tested aeroplane  $\mu$ , the measured runway-friction values were used to calculate the stopping distances *instead of some assumed aeroplane braking coefficient*. Some manufacturers have stated positions indicating that it is not possible to take a runway-friction measuring device and correlate it well enough to the  $\mu$  braking of an aeroplane. Based on extensive testing on winter surfaces in Canada and elsewhere, correlation coefficients over 90 percent have been consistently obtained for a wide range of aeroplane types. It's time for minds to change!

The methodology used to derive CRFI tables is described in a number of reports published by the National Research Council of Canada (NRC). The methodology has also been adopted by a US-based standards organization: ASTM International. To a line driver, the preceding is just meaningless information. This information is provided only because there is a lot of technical literature available to those who want to dig for it. For example, during the production of CRFI, the researchers involved knew they were making a lot of errors—not mistakes of omission, but what we call *known errors*. These are errors that the researchers could do nothing about during the measurement process,

but that had to be accounted for somehow. Using their best engineering judgment, the researchers decided to estimate what errors were being made and account for those errors in the final product you see as the CRFI tables. The generated data was heavily skewed to the lower friction numbers because that's where the highest risks of operating aeroplanes on winter surfaces are found. When all the errors were added up, an accuracy level of close to 95 percent was achieved, which is why the tables come with the reported 95 percent level of confidence attached to them. In statistical analysis, this has a name. And for your next beer call, when you want to really impress, it is called a *non-parametric statistical approach*. Subsequent to this, statistical analysis was applied to the skewed data, what is called *re-normalizing* the so-called non-normal data to make it normal—nothing more than the familiar bell curve you used to get in university and college. It turned out that the data we had collected came in at over a 99 percent level of confidence. That's the long way of saying that it's pretty damn good data! Still, to account for the known errors being made, there is about 1 000 ft of error added in at the lower CRFI numbers and about 700 ft at the higher numbers to account for numerous factors, such as variation in friction cart readings across vehicles, friction levels changing on the runway, etc. This is all described in the early NRC reports referred to above.

How should the CRFI tables be used? This is a business decision that has to be made by every user. Linear interpolation within the tables is O.K., but it's best to simply go to the next most conservative value. The tables are entered from the top with the CRFI value and from either the left- or right-hand columns with either landing distance or landing field length, as appropriate. For example, for a CRFI value of 0.32 and a dry landing distance of 2 500 ft, use 0.30 and 2 600 ft to avoid the interpolation. Extrapolation outside the tables is not recommended.

More needs to be said about the difference between landing distance and landing field length, the so-called 60 percent and 70 percent dispatch factors. There are many issues about aeroplane certification performance that today's flight crews do not understand and that are simply not being addressed in any training material available to them or in a way that is understandable in terms of "pilotees." One issue that is consistently misunderstood is the difference between landing distance and landing field length, which is described below.

There are operational dispatch factors that provide required landing field length and that are *derived* from landing distance. Note that dispatch factors or landing field length is an operational requirement, NOT a certification requirement, although some manufacturers include landing field length data or charts in the performance sections of their aircraft flight manuals (AFM), as noted earlier. Once the aeroplane is

airborne, the dispatch factors no longer apply; only landing distance applies. For turbojet aeroplanes, the dry dispatch factor is calculated by multiplying the landing distance by  $1/0.6 = 1.67$ . For turboprop aeroplanes, the dry dispatch factor is calculated by multiplying the landing distance by  $1/0.7 = 1.43$ . As convoluted as the preceding appears, it is reproduced here because that is the way you will see it expressed in operational regulations. Most regulations on this subject, regardless of the authority that produces them, are almost incomprehensible. It is simply best to think of the numbers 1.67 and 1.43, as applicable, times the dry landing distance to obtain the dry landing field length. Clear!

How do you deal with an unserviceable component, for example, a zero flap landing? If it becomes necessary to apply corrections to the dry landing distance, simply enter the appropriate CRFI table with the normal, serviceable landing or field-length distance, as appropriate, to determine the recommended landing distance, assuming no unserviceable component existed. Then apply any additional corrections specified in the AFM for any aeroplane unserviceable component to the distance just obtained from the CRFI tables; otherwise, you will find yourself trying to use the CRFI tables outside the bounds. Again, extrapolation outside the tables is not recommended. The CRFI tables assume the anti-skid system is functioning normally.

Some concerns have been raised regarding the contaminated surfaces on which the testing was conducted to develop CRFI, the implication being that the results used to obtain CRFI are only applicable to those types of surfaces. The testing to obtain CRFI was conducted on mostly compacted snow and ice. These surfaces were used to obtain the desired low-friction numbers. Which other surfaces were we supposed to test on? CRFI is a non-dimensional number. It has no units and, hence, is not a function of the surface. If you get a decelerometer reading on some surface of, say, 0.2, then the CRFI tables would be applicable.

### Conclusion

The presence of contaminants on a runway affects the performance of any aeroplane by (1) reducing the friction forces between the tire and the runway surface, (2) creating additional drag due to the contaminant impingement spray and displacement drag, and (3) leading to the potential for hydroplaning to occur.

There is a fairly clear distinction between the effect of soft contaminants and hard contaminants. The hard contaminants, like compacted snow and ice, reduce the friction forces only, while the soft contaminants, such as water, slush and loose snow, not only reduce the friction forces, but also have the potential to create additional drag and may lead to hydroplaning.



To develop a model of the reduced braking according to the type of contaminant is a difficult task, to be sure. That said, there is a runway-friction measuring device being used in Canada that has been successfully correlated to the braking coefficient of several aeroplanes, so that at least under certain contaminated runway conditions, such as compacted snow and ice, braking coefficient on

a contaminated surface no longer has to be derived from some theoretical values on a dry runway—a highly suspect procedure at best. There appears to be no better substitute for actually measuring the value of friction on the runway and correlating that value to the braking coefficient of an aeroplane.  $\triangle$

## A Holdover Time Paradigm Shift

by Doug Ingold, Civil Aviation Safety Inspector, Operational Standards, Standards, Civil Aviation, Transport Canada

*This article explores a paradigm shift in the operational use of Holdover Time (HOT) information. A brief history of the origins and use of HOT will be presented. This will be followed by a historical account of the industry and authority efforts to bring about a paradigm shift to the operational use of HOT information. The potential benefits and opportunities provided by using such a system will be highlighted.*

*This article was made possible through the collaboration and contribution of the following individuals: Peter Graverson of D-ICE, Mike Chaput of APS Aviation, Mark Homulos of WestJet, and Bill Maynard of Transport Canada.*

### Background

The operation of aircraft during ground-icing conditions poses potential safety of flight hazards that must be addressed. Contamination consisting of frost, ice, snow, and other frozen particulate create flight hazards. These contaminants must be removed prior to takeoff (*Canadian Aviation Regulation* [CAR] 602.11). Between 1969 and 2007, ground-icing-related accidents have contributed to over 500 deaths and significant property loss.



Dryden, Ont., March 10, 1989

The threat is very real! Some of you will remember the Dryden accident. For those who don't, the March 10, 1989, accident of a Fokker F28-1000 claimed the lives of 24 people (see photo, above). As a result of that accident, a commission of inquiry, led by The Honourable Virgil P. Moshansky, was instituted. Public hearings lasted 20 months and 166 individuals were interviewed. Thousands of pages of transcripts and evidence were condensed into a four-volume report. Typical of many accidents, there were a number of causal

factors. One of the principle causal factors was attempting to take off with contamination on the aircraft's critical surfaces. The report concluded with 191 recommendations in 19 distinct areas. The publication of the report led to extensive regulatory changes. Furthermore, a deluge of research and development (R&D) activities were initiated. These R&D activities brought scientific support to clarify acceptable processes and procedures associated with wintertime operating conditions. Time and space preclude the discussion in this article of R&D conducted by Transport Canada in these areas over the past 20 years. Interested readers can view and download many of the R&D reports by visiting the following Web site: [www.tc.gc.ca/tdc/publication/listing.htm#air](http://www.tc.gc.ca/tdc/publication/listing.htm#air).

There are a number of methods that can be used to remove frozen contaminants from the aircraft surfaces prior to takeoff. The most widely-used method for large aircraft is the use of de-/anti-icing fluids. The focus of this article is on the evolution of HOTs and their operational use.

Early HOT tables were produced by industry and were based on best estimates of fluid performance, see Figure 1: Early HOT table (circa 1989). At that time, there were no performance standards or criteria in place to define the fluid HOT properties. Following the Dryden accident, and a number of significant U.S. aircraft ground-icing accidents, the Society of Automotive Engineers (SAE) ([www.sae.org](http://www.sae.org)), at the request of industry and regulators, put together a working group (SAE G-12) to address ground-icing issues. Its membership includes, but is not limited to, fluid manufacturers, air operators, aircraft manufacturers, aviation authorities and numerous consultants.



OAT [°C]	WEATHER CONDITIONS				
	Frost	Freezing Fog	Steady Snow	Freezing Rain	Rain on Cold Soaked Wing
+ 0 and above	45 min.	30 min.	15 min.	5 min.	15 min.
- 0 to - 7	45 min.	15 min.	15 min.	3 min.	
- 8 and below	30 min.	15 min.	15 min.		

Figure 1: Early HOT table (circa 1989)

As a result of the significant work conducted by the SAE G-12, eventually aerospace standards and recommended practices were developed and published, defining fluid properties, testing methods, acceptable application procedures, etc. By the late 1990s, some of this work led to a standardization of the HOT Guidelines, domestically and internationally, see Figure 2: Recent HOT table (2007). Transport Canada and the U.S. Federal Aviation Administration (FAA) publish HOT Guidelines for operational use on an annual basis ([www.tc.gc.ca/CivilAviation/commerce/HoldoverTime/menu.htm](http://www.tc.gc.ca/CivilAviation/commerce/HoldoverTime/menu.htm)). The HOT Guidelines formats are by their nature limited in terms of the information they can provide to the flight crew.

The information has been simplified to ensure its ease of use, especially during the busy ground-operational phase. HOT Guidelines provide the flight crew with HOTs for a range of precipitation types, precipitation rates and temperature bands.

### Establishing HOT Guidelines

Every year, the FAA and Transport Canada, on behalf of fluid manufacturers, assess the HOT performance of fluids in both laboratory and natural conditions on a cost-recovery basis.

In the laboratory, the tests are conducted under defined and controlled conditions of precipitation type, precipitation rate, and temperature.

Rectangular aluminium plates, coated with the de-/anti-icing fluid being tested are exposed to various types of precipitation.

The quantity of precipitation, also known as **liquid water equivalent (LWE)**, is measured using pans. LWE is measured in units of **grams/decimeter squared/hour**.

Specific failure criteria are used to identify when the fluid on the test plates is considered failed. The amount of LWE required to reach the failure point is then documented and graphed as a data point. This allows the creation of regression curves and associated regression coefficients. These curves plot fluid failure time on the vertical axis versus precipitation rate on the horizontal axis. This information is then assessed and converted into the HOT Guidelines that many flight crew are familiar with.

Unfortunately, the existing HOT Guidelines assume that the pilot has accurate, real-world information on which to base their decision making.

What information is actually available to the pilot when using the HOT Guidelines? Remember that one needs accurate temperature, precipitation type and precipitation rate to use the HOT Guidelines effectively.

TABLE 4-Generic									
SAE TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2007-2008 <sup>1</sup>									
THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER									
Outside Air Temperature		Type IV Fluid Concentration Neat Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
Degrees Celsius	Degrees Fahrenheit		Active Frost	Freezing Fog	Snow or Snow Grains	Freezing Drizzle <sup>2</sup>	Light Freezing Rain	Rain on Cold Soaked Wing	Other <sup>2</sup>
-3 and above	27 and above	100/0	12:00	1:15 – 2:30	0:35 – 1:15	0:40 – 1:10	0:25 – 0:40	0:10 – 0:50	CAUTION: No holdover time guidelines exist
		75/25	5:00	1:05 – 1:45	0:20 – 0:55	0:35 – 0:50	0:15 – 0:30	0:05 – 0:35	
		50/50	3:00	0:15 – 0:35	0:05 – 0:15	0:10 – 0:20	0:05 – 0:10		
below -3 to -14	below 27 to 7	100/0	12:00	0:20 – 1:20	0:20 – 0:40	0:20 – 0:45 <sup>3</sup>	0:10 – 0:25 <sup>3</sup>		
		75/25	5:00	0:25 – 0:50	0:15 – 0:35	0:15 – 0:30 <sup>3</sup>	0:10 – 0:20 <sup>3</sup>		
below -14 to -25	below 7 to -13	100/0	12:00 <sup>5</sup>	0:15 – 0:40 <sup>5</sup>	0:15 – 0:30 <sup>5</sup>				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the outside air temperature and the aerodynamic acceptance criteria are met. Consider use of Type I when Type IV fluid cannot be used.						

Figure 2: Recent HOT table (2007)

**Temperature** is almost always available, either through ATC or meteorological reports, or by direct cockpit reading.

Although **precipitation type is available through aviation routine weather reports (METAR)**, there are cases where this information is not updated frequently enough for ground de-/anti-icing operations.

The **precipitation rate** reported in METARs (as light, moderate, or heavy) is not correlated with LWE used during fluid testing. The result is that the pilots must make a subjective assessment, integrating the various parameters and then consulting the HOT Guidelines. It is plausible that different pilots could draw different conclusions from the same reported or observed weather conditions.

To recap, the HOT Guidelines are generated using a scientific approach to ensure their accuracy and consistency. The operational use of the guidelines is based largely on a subjective assessment of the weather conditions. This is due in large part to the fact that the current weather reporting and observing infrastructure was not designed for use with de-/anti-icing activities.

Is there a better way of making use of all this scientific HOT data?

### **Holdover Time Determination Systems (HOTDS)**

In 2003, Transport Canada was approached by DAN-ICE, now called D-ICE. D-ICE is a Danish company developing meteorological and support equipment for use with HOTs. At that time, they were requesting approval or certification of a system that would simplify the way flight crews obtained their HOTs.

Largely as a result of that original request, Transport Canada supported industry initiatives that would improve the way HOT information is provided and used by pilots and operators in making safety-critical decisions, thus directly promoting safety and aeronautics in Canada.

Transport Canada, as the regulatory authority involved with wintertime aircraft operations and associated R&D, was poised to promote new systems that assist pilots and operators in better coping with wintertime operations. The system can also be thought of as an automated electronic version of the HOT Guidelines. The term Holdover Time Determination System (HOTDS) was coined to describe this system, and will be used throughout the remainder of this article.



*D-ICE HOTDS equipment*

The HOTDS uses the regression curves and coefficients generated during the fluid endurance testing previously described in this article. The regression coefficients are published in a Transport Canada report. The current report only contains coefficients for the two fluids used at sites where the HOTDS is currently installed.

This was the first time such a system would be implemented anywhere in the world, and therefore, a shift in cultural and operational thinking was required. To begin with, there were no standards or design requirements associated with this type of system. Furthermore, the availability of LWE information for ground de-/anti-icing operations through regular meteorological channels was, and currently still is, unavailable.

Transport Canada contracted APS Aviation to conduct R&D into the development of a performance-based standard that would initially be included as part of a regulatory exemption (similar to the automated weather observation system [AWOS] exemption). Eventually, the performance-based standard could be incorporated within the CARs as a regulatory standard. The development of the performance-based standard took two years. Simultaneously with the development of a performance-based standard, Transport Canada was formulating the necessary exemption criteria to support operational implementation of the HOTDS.

WestJet had shown a keen interest in the potential for using the HOTDS. WestJet and D-ICE paired up to conduct initial operational suitability trials during winter 2005–2006 and 2006–2007.

Operational use of the HOTDS was kept as simple as possible. The flight crew would initiate a request for a HOT via the Aircraft Communications Addressing and Reporting System (ACARS). The latest information from the HOTDS, which provides updates every 10 min, would be sent back to the flight crew through the ACARS as a single HOT value for the current weather conditions. The HOT information would then be displayed on the flight deck flight management system (FMS).

Potential benefits associated with the HOTDS included:

- providing pilots with better HOT information on which they could base their decisions;
- providing pilots with the most appropriate HOTs, thus minimizing confusion and errors during the extremely busy ground-operational phase;
- the ability to select the most appropriate fluid type for the given conditions, thereby minimizing environmental impact;
- a potential cost savings associated with optimum fluid selection.

In December 2007, Transport Canada issued a one-off regulatory exemption to WestJet, allowing them to use a HOTDS in place of paper HOT Guidelines at a limited number of airports. It is expected that full operational use of this system will be in place for the 2008–2009 winter season.

Use of the system is contingent on the operator:

- revising their company operations manual;
- conducting the appropriate training;

- having contingency plans;
- ensuring the HOTDS equipment is declared as meeting the performance-based criteria; and
- having the appropriate HOTDS equipment in place at selected airports.

The use of the exemption approach allows limited operational usage of HOTDS, since the onus is on the air operator to ensure that the HOTDS is installed and declared compliant. To truly reap the full benefits of HOTDS, it is necessary to ensure that the requisite meteorological information for de-/anti-icing purposes is disseminated through regular meteorological channels.

### *The Future*

In order to obtain maximum benefits to aviation for improved decision-making capabilities regarding anti-icing and de-icing decision making, it is important that a common global approach be taken, to the extent practicable. Transport Canada is working within the International Civil Aviation Organization (ICAO) and the World Meteorological Organization (WMO) to develop common methods for assessing and communicating information in support of operations under icing conditions. At present, efforts are focusing on whether this data should be added to METARs or aviation selected special weather reports (SPECI) at select stations, and the FAA already has plans to do so for some aerodromes in the not-too-distant future. ▲

## **2008–2009 Ground Icing Operations Update**

In July 2008, the Winter 2008–2009 *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](http://www.tc.gc.ca/CivilAviation/Commerce/HoldoverTime/menu.htm). If you have any questions or comments regarding the above, please contact Doug Ingold at [ingoldd@tc.gc.ca](mailto:ingoldd@tc.gc.ca). ▲

## **Flight Crew Survey on Takeoffs in Freezing Drizzle or Freezing Rain**

Transport Canada (TC) has initiated a Working Group to better understand the current operational practice of taking off during freezing rain or freezing drizzle conditions. To this effect, an independent third party will be administering a survey on TC's behalf.

As a pilot, your participation in this survey will assist TC in determining whether additional guidance material, further interpretation of regulations and standards, or additional regulations and standards are required in the area of takeoff in these conditions. TC is also taking this opportunity to collect information related to takeoff during conditions of ice pellets.

The survey is targeted predominately to IFR-rated pilots who operate in winter conditions. We encourage these pilots to complete the survey, which can be found at the following Web address:

<http://snaponline.snapsurveys.com/surveylogin.asp?k=121576066574>. ▲





<i>The Whys, Hows and Whats of the Authorities' Fire and Cabin Safety Research Activities—A Brief Overview...</i>	page 24
<i>Landing-Gear Accident.....</i>	page 28
<i>Update—Canadian Aviation Regulation (CAR) 703.25—Carriage of External Loads.....</i>	page 28

## The Whys, Hows and Whats of the Authorities' Fire and Cabin Safety Research Activities—A Brief Overview

by Claude Lewis, Manager, Technical Projects, Aircraft Certification Standards, Standards, Civil Aviation, Transport Canada

*"The CSRTG Welcomes You to the Fifth Triennial International Aircraft Fire and Cabin Safety Research Conference"*

It is with these words that the fifth edition of the CSRTG's Triennial International Aircraft Fire and Cabin Safety Research Conference was opened on October 29, 2007, in Atlantic City, New Jersey, USA.



On August 2, 2005, an Airbus A340, with 309 passengers and crew on board, overran the runway on landing at Toronto Pearson International Airport. A post-crash fire followed. All occupants successfully evacuated the aircraft—there were no fatalities. By all accounts, this event should have been a major tragedy, but it wasn't. Why? Why didn't anybody die when similar events in the past have resulted in substantial loss of life? It wasn't a miracle as many may think! All occupants survived because of the successful research that has been conducted and that has provided the basis for improved safety regulations and standards.

This research was specifically what the CSRTG's conference was all about: the current research being conducted by aviation authorities and industry to improve fire and cabin safety on transport category aircraft.

### **But, what is the CSRTG?**

The CSRTG stands for the "Cabin Safety Research Technical Group," an association of civil aviation

authorities formed in the early 90s by the United States Federal Aviation Administration (FAA), Transport Canada Civil Aviation (TCCA), the United Kingdom's Civil Aviation Authority (UK CAA) and the European Joint Aviation Authorities (JAA) to foster co-operation in research in fire and cabin safety.

The CSRTG's chief mandate is to implement *research in support of rulemaking*. The Group identifies and prioritizes needed research, co-operates in setting up joint, co-operative and complementary programs and projects, and co-ordinates pertinent research activities.

The CSRTG's current active membership includes the FAA, TCCA, the UK CAA, the Brazilian *Agência Nacional de Aviação Civil* (ANAC) and the Australian Civil Aviation Safety Authority (CASA), with support from the civil aviation authorities of France, Japan and Russia. Discussions with the recently formed European Aviation Safety Agency (EASA) indicate that it will soon be joining the CSRTG.

The prime objective of the conference was to inform the aviation community about transport category aircraft fire and cabin safety issues and pertinent recent, ongoing, and planned research activities by the participating authorities.

The conference covered both certification and operational aspects. It consisted of an opening session and four concurrent technical sessions which addressed the various aspects of fire and cabin safety: fire safety, evacuation, crashworthiness and operational issues.

### **Opening session**

The opening session consisted of papers presenting the authorities' vision of cabin and fire safety research, as well as presentations discussing the life-saving potential of such research (TCCA project), future research challenges, the cost of safety versus the cost of accidents, and how fire and cabin safety fits into safety management systems (SMS).



### Fire safety session

The fire safety session, which was by far the most expansive of all the sessions, consisted of the following segments and sub-sessions:

1. Fire-General
2. Materials Fire Safety
3. Fire-Resistant Materials
4. Engine Fire Protection
5. Cabin and Hidden Areas Fire Protection
6. Cargo Compartment Fire Protection
7. Fuel Tank Fire Safety
8. Fuselage Burnthrough

accordance with the recently published requirements) was presented. Finally, the recently developed flammability test criteria for ducting and the certification issues of printed wiring assemblies were discussed.

Of great interest was a review of the flammability issues and ongoing research regarding the use of magnesium in aerospace applications.

### Fire-Resistant Materials

This segment was the most extensive of the sessions and also the most technically complex with the presentation of some 18 academic papers.

Reports were given on some of the fundamental scientific research being conducted to develop highly fire-resistant polymers designed, in the longer term,

*“without solid research, there cannot be viable regulations and, without co-operative research, there cannot be unified/harmonized regulations”*

### Fire-General

The papers in this introductory segment of the fire safety session provided an overview of the evolution of fire safety in recent years, of the FAA's transport category aircraft fire safety program and of the issues currently at stake, discussed the fire safety concerns and research activities by different participants, and presented a summary of the research which is currently underway and for which research is planned.

### Materials Fire Safety

Materials flammability test methods formed the main focus of this sub-session.



The results of round robin testing for the rate of heat release (OSU) and smoke (NBS) requirements for interior materials were presented followed by a review of laboratory-scale and full-scale testing of lightweight seat cushions. Also, data regarding radiant panel testing for flame propagation on thermal and acoustic insulation (in

to provide the groundwork for the development of practical, cost-effective, essentially non-flammable aircraft interior materials.

### Engine Fire Protection

This sub-session explored issues related to Halon-replacement fire-extinguishing agents and systems for engines and auxiliary power units (APUs).

The presentations discussed the testing of Halon-replacement options, presented work regarding the use of simulants in fire extinguishing systems testing, and reviewed research into the development of an optical fire detection system.

### Cabin and Hidden Areas Fire Protection

A number of accidents in recent years, including Swissair flight 111 in 1998, have raised the issue of fires in hidden areas.

Presentations given on the subject discussed the research activities being pursued to address these types of fires, including the use of nitrogen-enriched air to suppress fires in hidden areas (e.g. overhead areas) and fire ports to discharge agents in areas behind panels.

Other papers discussed the development of guidance material for Halon-replacement handheld extinguishers and the hazards associated with lithium and lithium-ion batteries onboard aircraft.

Finally, an insight was provided into the fire safety research considerations relative to design for security requirements.

### Cargo Compartment Fire Protection

This segment of the fire safety session focused mainly on the current research that is being conducted to improve cargo compartment fire detection and suppression means.

The presentations firstly expanded on the work regarding various fire suppression and extinguishing agents, including water mist, and the synergistic effects of combining Halon and nitrogen in aerosol can explosion simulations. Of great significance and interest was a paper on the development of an integrated fire protection (IFP) concept—a joint TCCA/FAA/UK CAA activity. Much attention was also given on research conducted on the use of nitrogen to suppress cargo compartment fires. Other presentations dealt with various risks associated with cargo compartments, such as the carriage of lithium batteries and fuel cells. Results were also presented on the development of smoke modeling and multi-sensor technologies.

### Fuel Tank Fire Safety

This portion of the session drew significant attention in light of the subject's origin—the TWA 800 accident—and the associated on-going regulatory activities.

Firstly, an overview was given of the issues relevant to fuel tank inerting and its implementation on large aircraft. This overview was followed by presentations on oxygen concentration measurement and the development of fibre-optic sensing technologies.

### Fuselage Burnthrough

This segment provided an overview of the basis for the fuselage burnthrough requirement and reviewed the development of the oil burner test apparatus, followed by discussion of the development of a next-generation sonic orifice oil burner aimed at achieving higher testing consistency.



Also described was research work on the development of burnthrough test method and criteria for non-metallic composite fuselages, as well as the development of toxicity tests and criteria.

Finally, data was presented on the performance of intumescent/refractory coatings to prevent burnthrough.

As well, two videos that were developed to address specific fire safety issues were presented: a crew fire fighting training video, jointly developed by the FAA, the UK CAA and TCCA in support of FAA Advisory Circular 120-80, and a video on laptop battery fires highlighting the risks associated with lithium-based batteries.

### Evacuation session

This session focused on the human element of the evacuation equation and the use of computer-based modeling to predict evacuation performance.



Included were a number of presentations on the research conducted by TCCA on access to type III exits (in support of a harmonized rulemaking activity between EASA, the FAA and TCCA), on type III hatch operations and on methods used to evaluate crew fatigue.

Further, a number of papers were presented on computer-based simulation and digital human modeling of various factors on egress times and flow patterns, and on the effect of fire on evacuation.

Papers were also presented on injury mechanisms in evacuation slides and on the effect of various configurations on egress times.

Finally, there were presentations on the comprehension of symbolic exit signs—which are increasingly being proposed for installation on transport category aircraft—versus traditional exit signs, passenger safety awareness, and post-evacuation passenger assistance systems (PAS).

### Crashworthiness session

The crashworthiness session examined the research efforts and programs on protection against impact injury.



Papers were presented on the impact-injury patterns and data from past accidents and incidents, as well as on assessments of injury potential of some configurations.

This was followed by presentations which discussed impact-injury criteria, including the development of side-facing seat neck injury criteria and impact design limits.

A third area concentrated on crash dynamics analytical methods and validation metrics, as well as on anthropomorphic test device (ATD) validation testing and procedures.

Another segment included more specific discussions on inflatable restraint systems, automotive child-restraint systems and energy absorbing devices, as well as on the use of cargo compartments as passenger cabins.

### Operational issues session

The operational issues session, though fairly short, nevertheless drew quite a bit of interest and discussion. It addressed two significant areas: passenger safety information and cabin environment.

The first part of the session reported on work related to the presentation of safety information to passengers, i.e. safety briefing cards. Of particular interest were the extensive studies recently conducted by the FAA regarding the comprehension of pictorials and pictograms.

The second part of the session provided an overview of research activities in cabin environment, particularly

health-related and chemical and biological response issues, and cabin air quality.

In addition to the above conference sessions, workshops were conducted on the use of the CSRTG's Accident Database (ADB). The ADB, a joint, ongoing collaboration between TCCA, the FAA and the UK CAA, now includes data on over 3 000 survivable accidents and is the main tool used by the authorities to identify safety issues, define research needs, and conduct benefit assessments and analyses.

Of significance to TCCA was the presentation of a number of papers regarding work under its Fire and Cabin Safety Research and Development (R&D) Project, as well as work by partner authorities in support of, and complementary to, TCCA's R&D Project.

TCCA has been conducting significant research work in fire and cabin safety in co-operation with its partner authorities: the FAA performs testing and provides data and expertise in support of TCCA's R&D Project; the UK CAA provides advice and oversees TCCA's work in the UK; industry supplies needed data; and ANAC and CASA provide technical support.

The overwhelming message conveyed during the conference was that *research is the foundation of regulations, and that without solid research, there cannot be viable regulations, and without co-operative research, there cannot be unified and harmonized regulations.*

The three-and-a-half-day conference, which comprised more than 125 papers by over 100 authors, was an unqualified success. It drew together almost 500 participants from more than 20 countries, representing a broad range of specialties and responsibilities.

Notwithstanding the immense quantity of information it presented, one of the conference's great benefits was that it provided a unique opportunity for those involved in fire and cabin safety research to meet and exchange on their areas of interest.

The various presentations, as well as presenters' backgrounds and bios can be found on the official CSRTG Conference Web site at:

[www.fire.tc.faa.gov/2007Conference/conference.asp](http://www.fire.tc.faa.gov/2007Conference/conference.asp). 

*Further information regarding this conference or previous editions of this triennial event can be obtained from the author.*

## Landing-Gear Accident

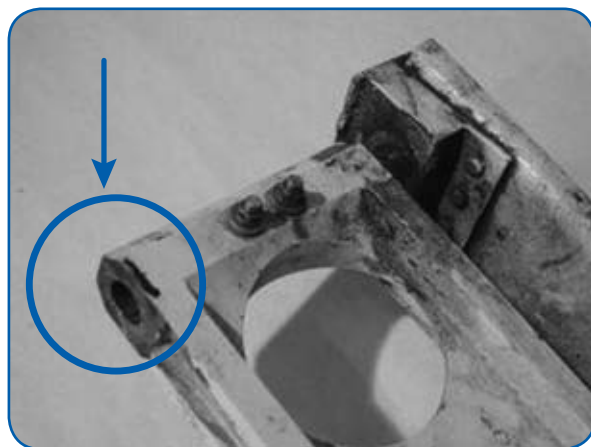
The Twin Turbo Prop Beech King Air A100 was touching down for a landing on the asphalt runway at Buffalo Narrows, Sask., when the nose gear collapsed. The nose gear assembly on the A100, which is canted forward, collapsed forward (opposite to the normal direction of retraction), and the aircraft rolled along the runway on the nose wheel, which had become imbedded in the nose cone. Both propellers, the inside of the nose gear wheel well, and the nose cone were damaged. There were no injuries to the two crew or to the four passengers that were aboard.

The crew reported that the approach and landing were normal until the nose-gear collapse. There was no indication of a landing-gear malfunction prior to touchdown, and the gear lights showed “down and locked.”

Upon initial examination, two points of failure were observed: at the upper drag brace support bracket, which had torn free from the wheel, and at the nose gear actuator shaft, which was broken.

Further investigation determined that the initiating source of the failure was traced to the left-hand upper drag brace attachment pin (P/N 50-820233 or 99-820110-9) that was missing and had not been properly secured to the drag brace assembly. The missing pin caused the transfer of loads to the right upper drag brace attachment fitting,

which fatigued and failed, passing the loads to the right intercostal rib. The rivets securing the intercostal rib to the wheel well began to pull from the sheet metal attachment point until failure occurred, and the landing gear collapsed.



*Arrow points to where the missing left-hand upper drag brace attachment pin should have been*

The aircraft had been imported from the U.S. and issued a Certificate of Airworthiness (C of A) for type-certificated aircraft into Canada. The aircraft had not yet undergone its first-phase inspection. The landing gear was last overhauled and installed on the aircraft eight years earlier (February 25, 2000), 2 051 cycles prior to the failure. △

## Update—Canadian Aviation Regulation (CAR) 703.25—Carriage of External Loads

A general exemption to CAR 703.25 and CAR 605.03(1)(b) was issued in May 2006, effective until December 31, 2008. The exemption includes reporting requirements every six months to continue to foster good practices while capturing knowledge of external loads operations.

The data collected from May 11, 2006, to December 31, 2007, reported 506 flights, most of which were carrying single or multiple canoes (measuring up to 20 ft), aluminum boats (measuring between 14 ft to 16 ft), kayaks, plywood and/or lumber. This data was collected from eight companies located in Ontario, British Columbia, the Yukon and the Northwest Territories.

Commercial operators operating under CAR 703 are now exempted from CAR 605.03(1)(b) and CAR 703.25 until December 31, 2008. However, all other operators who

are not operating under CAR 703.25 (commercial and private) can only carry external loads with an approved configuration change. Carrying an external load on an aircraft changes flight characteristics, which affects airworthiness, and therefore represents a change to the aircraft configuration for which an approval is required.

As of January 1, 2009, CAR 703.25 will become redundant and will be repealed through the Canadian Aviation Regulatory Advisory Council (CARAC) process. No other changes are required as CAR 605.03(1)(b) adequately addresses changes in configuration.

Reporting is still required for operations until **December 31, 2008**. We ask that operators who take advantage of the exemption tell us about their operations, as this will help develop relevant guidance material. △





## 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](http://www.tsb.gc.ca). —Ed.*

### **TSB Final Report A00C0099—Loss of Control—Collision with Level Ice**

*Note: While this report is not recent, it is included as a special insert on the whiteout phenomenon at the request of the Transportation Safety Board of Canada (TSB) as the Board has noticed an increase in recent whiteout occurrences. —Ed.*

On May 20, 2000, a Bell 206L LongRanger helicopter was on a charter flight under day VFR, from a site on the sea ice near Lowther Island, Nun., to Resolute Bay, Nun., about 40 NM east-northeast of Lowther Island. On board were a pilot and two passengers who had been conducting scientific research on the behaviour of polar bears in the sea ice environment. At about 22:05 Central Daylight Time (CDT), the pilot lifted off from the sea ice, heading toward Lowther Island to take advantage, during takeoff, of the visual reference provided by the island's terrain features. At about 400 ft above the ice and 65 kt, the pilot turned the helicopter to the right toward Resolute Bay. During the turn, he realized that he no longer had sufficient visual references because of whiteout conditions. He began a left turn back toward Lowther Island and the visual references on the island. While in the left turn, the pilot lost control of the helicopter, and it descended and collided with the ice surface. Although the pilot and the passengers were wearing their seat belts and shoulder harnesses, they were all ejected from the fuselage as it disintegrated during the impact sequence. Both passengers sustained fatal injuries; the pilot sustained serious injuries. The helicopter was destroyed.



### **Other factual information**

The helicopter was equipped for operations under IFR, although the operator employed it only under VFR. The helicopter contacted the level ice surface in a nose-low, steep left turn, and the wreckage was distributed along a straight path approximately 600 ft long. There was no indication of any pre-impact aircraft system malfunction or airframe failure.

The 45-year-old pilot held a Canadian commercial helicopter pilot licence that was restricted to day flying only and valid for several types of helicopters, including the Bell 206L. He held a Class 3 instructor rating and had accumulated 8 120 hr of total flying time, mostly on the Bell 206L and similar helicopters. In addition, he had accumulated 15 hr in simulators and received 10 hr of dual instrument instruction during training for his instructor rating in late 1998. He did not have an instrument rating, nor was one required by regulation. During the previous 90 days, he had flown 145 hr, including 87 hr during the previous 30 days. *This section is included here to illustrate that a whiteout occurrence can happen to a very experienced pilot. —Ed.*

The weather at Resolute Bay, 35 mi. northeast of the occurrence location, was reported as follows: winds 260° true at 4 kt, visibility 10 SM, a broken cloud layer at 900 ft, temperature -15°C, dewpoint -18°C, and altimeter setting 29.77 in. of mercury. A Twin Otter aircraft had departed from the helicopter's location about 25 min before the accident. It was reported that the weather had deteriorated during the Twin Otter's time on the ground and that the local conditions were overcast, with a layer of stratus cloud at about 2 000 ft; the visibility was about 6 to 8 mi., and there was very little definition to surface features. At the time of the occurrence, the sun was constantly above the horizon, providing 24-hour daylight.

Regulations for VFR flights in uncontrolled airspace required that the aircraft be operated with visual reference to the surface and, for helicopters operating below 1 000 ft above ground level (AGL), that the aircraft be operated in flight visibility of not less than 1 mi. and clear of cloud. When flying VFR, pilots rely on visual orientation cues, such as the natural horizon and surface references, to maintain the desired attitude of the aircraft. The minimum

weather conditions specified in the regulations normally permit pilots to see these orientation cues.

The Transport Canada *Aeronautical Information Manual* (TC AIM), section AIR 2.12.7, describes whiteout as an extremely hazardous visual flight condition. Whiteout occurs over an unbroken snow cover and beneath a uniformly overcast sky. Because the light is diffused, the sky and terrain blend imperceptibly into one another, obliterating the horizon. The horizon, shadows, and clouds are not discernible, and sense of depth and orientation is lost; only very dark, nearby objects can be seen. The real hazard in whiteout is that pilots do not suspect the phenomenon because they may be in clear air. In many whiteout accidents, pilots have flown into snow-covered surfaces unaware that they have been descending, and confident that they could see the surface. Consequently, when pilots encounter the whiteout conditions described above, or even suspect they are in such conditions, they should immediately climb if at low level, or level off and turn toward an area where sharp terrain features exist. Pilots should not continue the flight unless they are prepared to cross the whiteout area using instruments and have the training and qualifications to do so.

### Analysis

Because the pilot was flying VFR, he relied on visual orientation cues, such as the natural horizon and surface references, to maintain the desired attitude of the aircraft. The existing weather conditions were better than those specified by regulation for VFR operations; however, when external visual cues became obscured by whiteout conditions, the pilot was subject to disorientation with respect to the relationship between the aircraft and the surface because there were no distinguishing features. To counteract this disorientation, it is necessary to revert to flight instruments to determine and maintain aircraft attitude. However, the pilot was not instrument rated, was unable to regain visual reference, and was therefore unable to maintain control of the helicopter.

### Findings as to causes and contributing factors

1. Whiteout conditions impaired the pilot's visual reference to the surface. As a result, he was unable to maintain control of the helicopter.
2. The seat belts and shoulder harnesses failed because the fuselage disintegrated.

### Findings as to risk

1. The survival kit would have been extremely difficult or impossible to open for a survivor with hand or arm injuries, especially in the existing cold weather.
2. The emergency locator transmitter (ELT) antenna cable separated during impact, rendering the ELT partially ineffective.

### Safety action taken

The manufacturer of the survival kit conducted field tests with the kit and has upgraded the survival equipment and made the kit easier to open. The company used Velcro on its larger survival kits, rather than snap fasteners, and is replacing the snap fasteners on the kit involved in this occurrence with Velcro. The laces on the inner flaps have also been replaced with Velcro. A utility knife attached with a lanyard has been added to permit piercing and cutting of the inner seals, and an instruction card explaining the opening procedure has been included.

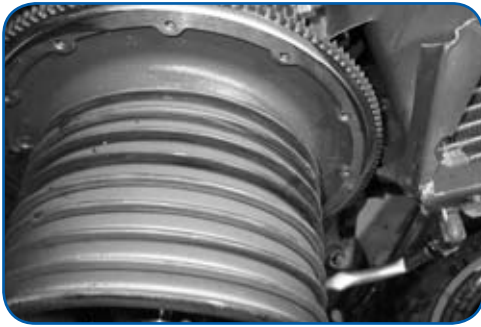
### TSB Final Report A04P0422—Drive-Belt Failure and Collision With Terrain

On December 28, 2004, a Robinson R44 Raven II helicopter landed at the Cranbrook, B.C., airport at 12:37 Mountain Standard Time (MST). There, the pilot filled the fuel tanks to capacity and obtained weather and flight-planning information. The helicopter departed Cranbrook at 13:43 MST for Revelstoke, B.C., evidently following the VFR route north along the Columbia River, towards Fairmont Hot Springs. The flight was expected to take 2 hr. At 14:15 MST, the helicopter struck steep terrain 33 NM north-northwest of Cranbrook, at the 4 200-ft level in a mountainous region. The pilot was fatally injured and the helicopter destroyed by impact forces and a severe post-crash fire.



### Findings as to causes and contributing factors

1. Galling on the engine-cooling fan taper-fit joint within the previous few hours of flight operations introduced vibration to the belt-drive system, which in turn caused the misalignment of the belts within the sheave grooves and led to two vee-belts running off the sheaves in flight.
2. The sudden loss of vee-belt tension caused the remaining two vee-belts on the driving sheave to slip, leading to a rapid loss of main rotor RPM. This, in turn, prevented the pilot from avoiding the trees and led to a collision with the terrain and the destruction of the helicopter.



*This close-up photo shows the uneven wear and belt slip on the engine pulley sheave*

### Findings as to risk

1. The engine-cooling fan taper-fit shaft and socket joint is subject to galling damage, which imparts vibration to the vee-belts and sheaves, a known factor in vee-belt failure, misalignment and loss.
2. The wear found in the exhaust valve guides for cylinders number 3 and 5 was excessive for their time in service and indicated a deviation from manufacturing quality control.

### TSB Final Report A05W0137— Collision with Terrain

On July 6, 2005, the pilot of a Piper PA-18 aircraft departed Cooking Lake Airport, Alta., at approximately 11:30 Mountain Daylight Time (MDT) and landed at the Chipman, Alta., airfield, where a passenger boarded. They departed at 12:12 MDT for the last day of two weeks of aerial photography. The weather was observed to be clear and the winds nearly calm when the PA-18 departed Chipman.

At approximately 18:10 MDT, a farmer found the aircraft wreckage in a hay field, 9 NM west of Andrew, Alta. The aircraft had struck the ground at an extreme nose-down, left-wing-low attitude, and was substantially damaged. Both occupants sustained fatal injuries. There was no post-impact fire.



### Finding as to causes and contributing factors

1. For undetermined reasons, the aircraft departed controlled flight and struck the ground.

### Findings as to risk

1. The tight installation of the emergency locator transmitter (ELT) antenna cable resulted in the disconnection of the cable from the ELT at impact, and there was no effective ELT signal.
2. The pilot did not file a flight plan or a flight itinerary, with the result that the rescue of possible survivors would have been delayed.
3. Procedures for the delegation of management authority in the absence of key company personnel were incomplete, resulting in ineffective flight following and emergency response.

### Other findings

1. Investigators were not able to determine why the aircraft departed from controlled flight. The aircraft was not fitted with a flight recording device, which may have allowed investigators to reconstruct the circumstances that led to the accident.
2. A rear control stub cover could not be found in the wreckage.

### Safety action taken

The company has developed a delegation system to ensure that there is always someone of authority available. Checklists have been drafted for the management positions, and they are to be used by delegated individuals in the absence of management personnel. These measures will ensure that acting managers are assigned on a consistent basis and that they are aware of their responsibilities.

The flight following system has been strengthened by informing pilots of the necessity to submit a comprehensive flight itinerary or flight plan before each flight. The telephone answering service will continue to serve as a message board for delegated individuals and will not be used as the primary flight following system. Acting managers will assume responsibility through use of the



delegated duties checklist. Overdue alerting will be more rigidly followed.

## TSB Final Report A0500142—Difficulty to Control

On July 10, 2005, a Bell 204B helicopter was conducting a survey job at Marathon, Ont., with a crew comprising a pilot and an aircraft maintenance engineer (AME). They departed Marathon on the day of the occurrence at about 09:00 Eastern Daylight Time (EDT) to return to Sudbury, Ont., flew to Wawa, Ont., for fuel, and continued to Sudbury. The helicopter was on final approach to Sudbury Airport at about 11:45 EDT with the wind from the south-southwest at less than 5 kt. When the collective was raised and the cyclic pulled aft to reduce the sink rate and airspeed, the helicopter yawed to the right, and the pilot was unable to correct with the left pedal. The collective was lowered and the cyclic pushed forward to increase the airspeed. The helicopter returned to a normal flight condition at 60 knots indicated airspeed (KIAS), and the pedals were neutral. The pilot aborted the approach and flew a left-hand downwind approach for Runway 22.

During the second approach, when the collective was raised to slow the sink rate, there was a thump and the left pedal went to full deflection. The pilot declared an emergency, then flew several circuits to determine the best way to make a landing. The helicopter flew well at 40 KIAS, and the heading could be controlled by adjusting the throttle. The helicopter was lined up with the runway about 2 mi. back on a shallow approach and crossed the runway threshold at a height of 3 to 5 ft and about 40 KIAS. It touched down gently at approximately 30 KIAS with 80 percent rotor rpm and skidded about 90 ft before coming to a stop. There were no injuries.



*Speed rig and cables as found*



*Properly lock-wired speed rig*

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

1. The tail rotor pitch change cable speed rigs were not lock-wired in accordance with approved methods. As a result, one cable speed rig came undone, and tail rotor authority was lost.
2. The independent control inspection was not carried out in accordance with the standards described in the *Canadian Aviation Regulations* (CARs) or relevant Airworthiness Notice (AN), and the missing lock wire was not detected.

### *Finding as to risk*

1. The pilot conducting the independent inspection was qualified and had received elementary maintenance training that included independent control checks. However, without specific training on maintenance procedures and standards, there is an increased risk of missing maintenance-related deficiencies.

### *Safety action taken*

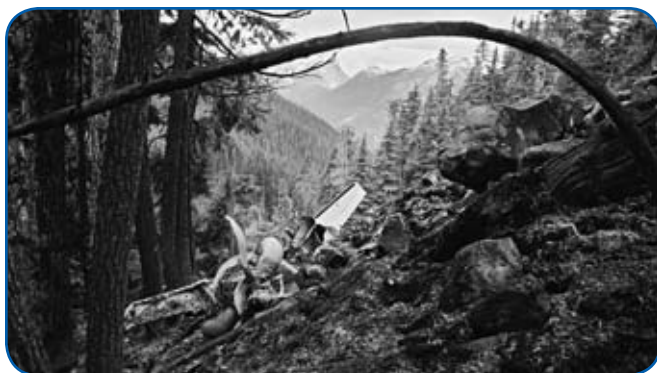
Following the occurrence, the operator conducted a training program for maintenance and operations personnel. The aim of the program was to refresh all personnel in the proper locking of turnbuckles and aircraft components in general, and to educate all personnel on what to look for when conducting an independent inspection on each company-operated aircraft. The AME who was involved in this occurrence developed and delivered the program to employees.

The TSB is concerned that companies using pilots to conduct independent inspections may not have developed training programs of sufficient detail to prevent similar occurrences.



## TSB Final Report A05P0189— Collision with Terrain

On July 28, 2005, a Raytheon Beechcraft King Air 200 departed Vancouver, B.C., at 08:24 Pacific Daylight Time (PDT) for a VFR flight to Smithers, B.C., with a crew of two on board. The aircraft did not arrive at its destination, and a search was commenced later that same day. The aircraft was found on July 30, 2005. The crash site was in a narrow canyon at an elevation of about 3 900 ft above sea level (ASL), in an area of steeply rising terrain. Both occupants were fatally injured. A post-crash fire destroyed most of the aircraft. The emergency locator transmitter (ELT) was destroyed in the fire and no signal was detected. The crash occurred at about 08:40 PDT.



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

1. The aircraft was flown up a narrow canyon into rapidly rising terrain for reasons that could not be determined. The aircraft's proximity to terrain and the narrowness of the canyon precluded a turn, and the aircraft's climb rate was insufficient to clear the rising terrain.
2. The pilot decision-making training received by the crew members was ineffective because they were unprepared for the unique hazards and special operating techniques associated with flying low in mountainous terrain.

### *Finding as to risk*

1. The company operations manual (COM) gave no guidance to the crew for the operation of a VFR flight, except for the provision that it should not be conducted closer to obstacles than 500 ft vertically and horizontally.

## TSB Final Report A05O0204—Aircraft Loss of Control—Collision with Terrain

On September 10, 2005, a Pezetel SZD-50-3 Puchacz glider was flying in the vicinity of Ronan Field (44°02'30" N, 079°50'42" W) near Loretto, Ont., on a pleasure flight with two pilots on board. After approximately 45 min of flight, the glider was about 1 000 ft above ground level (AGL) and appeared to

be approaching the circuit. It then entered a spin and rotated about three times before disappearing behind trees. At approximately 16:05 Eastern Daylight Time (EDT), the glider struck the ground in a steep, nose-down attitude. The aircraft was destroyed, and the two pilots were fatally injured.



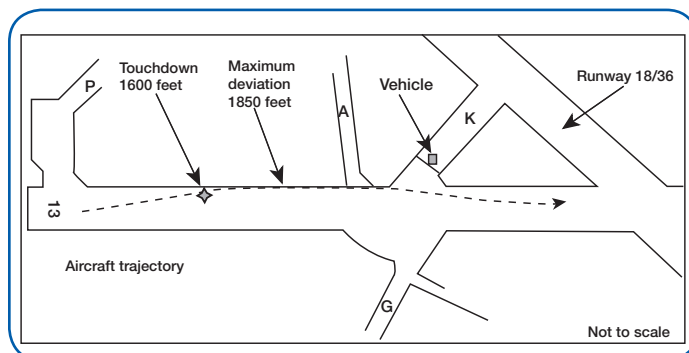
### *Findings as to causes and contributing factors*

1. The glider inadvertently entered a spin at approximately 1 000 ft AGL and did not recover from the spin before ground impact.
2. The glider pilots likely did not execute the proper spin-recovery technique.

## TSB Final Report A05C0222— Runway Excursion

On December 26, 2005, an Airbus A319-112 was landing at Winnipeg International Airport, Man., in darkness at 18:35 Central Standard Time (CST). An instrument landing system (ILS) approach to Runway 13 was flown using the autopilot. At approximately 80 ft above ground level (AGL), the captain disengaged the autopilot and manually completed the approach and landing.

The aircraft touched down firmly approximately 1 600 ft from the runway threshold and well-left of the runway centreline. During the rollout, the left landing gear tracked briefly outside of the runway edge lights on the left side of the runway. Two of the runway edge lights were broken. One tire of the left wheel set sustained a cut and was replaced. There was no other damage to the aircraft, and there were no physical injuries.



*Overhead view of Runway 13 and aircraft trajectory*

### Findings as to causes and contributing factors

1. The captain aligned the aircraft with the runway without compensating for crosswind, allowing the aircraft to drift off centreline. After touchdown, the aircraft's left landing gear tracked off the runway.
2. It is likely that one or more of the effects of the vision correction used by the pilot flying interfered with his ability to effectively use the visual references available to land.

### Other finding

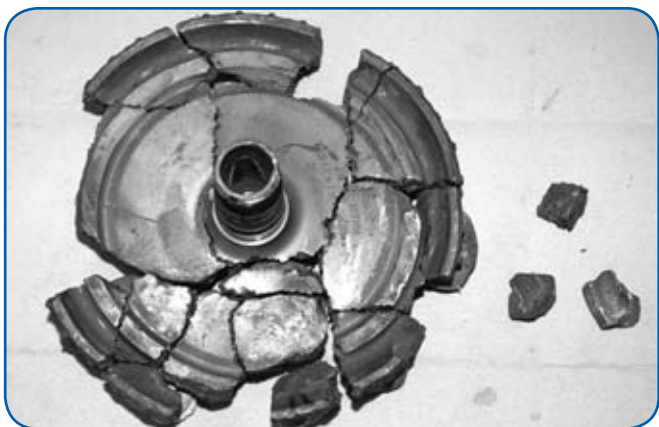
1. The cockpit voice recorder (CVR) was not disabled following the occurrence, and the data were overwritten. Consequently, CVR information relevant to the occurrence was not available to TSB investigators.

### Safety action taken

Following the incident, the operator issued a flight operations bulletin stating that "the use of auto land should be considered for all approaches in marginal conditions."

### TSB Final Report A06Q0091—Engine Failure

On June 7, 2006, a Bell 206L-3 was on a VFR flight from La Tuque, Que., to Val-d'Or, Que. Approximately 20 min after takeoff, at about 08:10 Eastern Daylight Time (EDT) and at 2 000 ft above sea level (ASL), the needle on the engine oil-pressure gauge started to fluctuate. As a precaution, the pilot landed the aircraft in a marsh and shut down the engine. After conducting a pre-flight inspection, the pilot started the engine and took off with the intention of landing on a road 1 km away. Just before the helicopter reached the road, there was a fluctuation in the engine oil pressure and engine torque. Right after that, there was an explosion and the engine stopped. The pilot did an autorotation that ended with a hard landing on the road. The helicopter was heavily damaged. The pilot was alone on board and was not injured.



*First-stage wheel damage due to overspeed*

### Findings as to causes and contributing factors

1. The area adjacent to bearings 6 and 7 had exceeded a temperature of 900°C. The bearings were destroyed for undetermined reasons, causing an engine failure.
2. Moving the helicopter towards the road when the engine was showing signs of malfunction contributed to the failure of bearings 6 and 7.
3. During the autorotation, the helicopter was not levelled at the time of the landing, which resulted in a hard landing.

### Finding as to risk

1. The procedure recommended in the flight manual suggests a less serious problem if engine oil pressure is fluctuating within the limits and the gauge is showing a normal oil temperature. Consequently, a pilot could decide to continue the flight with a defective engine oil-circulation system, which could cause the engine to fail or malfunction.

### TSB Final Report A06A0092—Collision with Terrain

On September 17, 2006, an amateur-built VariViggen aircraft departed Bangor Airport, Maine, United States, at 17:11 Atlantic Daylight Time (ADT), on a non-stop VFR flight to Goose Bay, N.L. The aircraft wreckage was located on September 22, 2006, in a heavily wooded area about 9 NM east of Plaster Rock, N.B. The pilot had been fatally injured in the crash, and the aircraft was destroyed.



### Findings as to causes and contributing factors

1. The wing tanks had become contaminated with water; however, the source of the water contamination could not be determined.
2. The aircraft did not have fuel tank drains to allow for easy pre-flight inspection of the entire fuel system.
3. The engine stopped when water, transferred from the wing tanks to the main tank, settled in the main fuel tank and was subsequently delivered to the engine.

4. The flight was conducted at a relatively low altitude, limiting the pilot's opportunity to cope successfully with the engine stoppage.

### Findings as to risk

1. Because the flight plan had not been activated, Canadian air traffic control (ATC) and search and rescue (SAR) authorities were not aware of the flight, and the initiation of the search was delayed for three days.
2. The emergency locator transmitter (ELT) signal was not detected, primarily because the antenna had been broken during the accident.

### Safety action taken

This report shows that there are VFR aircraft proceeding from the United States to Canada without the protection of SAR notification that an activated flight plan affords. On November 27, 2006, the TSB sent an Aviation Safety Advisory (A060042) to Transport Canada. In the advisory, it was suggested that, in conjunction with NAV CANADA and the U.S. Federal Aviation Administration (FAA), Transport Canada take steps to

ensure that pilots comply with the requirement to file VFR flight plans for transborder flights and ensure that filed transborder VFR flight plans are automatically identified and activated.

Transport Canada published an article titled "Transborder Flights Without a Flight Plan—Revisited" in the *Aviation Safety Letter* (ASL) 1/2007. A copy of this article may be obtained at [www.tc.gc.ca/CivilAviation/publications/tp185/1-07/menu.htm](http://www.tc.gc.ca/CivilAviation/publications/tp185/1-07/menu.htm).

Scaled Composites has advised VariViggen owners to install low-point fuel tank inspection drains in the wing tanks before the next flight. Scaled Composites has produced and provided owners with plans for the drain installation, modifications to the aircraft flight manual (AFM) requiring fuel checks before every flight, and the method to be used when checking the fuel tanks for contamination. Scaled Composites has also sent a safety bulletin to the publishers of the *Central States Newsletter*, and the *Experimental Aircraft Association Sport Aviation* magazine, with a request to publish it in the next available edition of both publications. ▲

## 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, 2008, and April 30, 2008, are all "Class 5," and are unlikely to be followed by a TSB Final Report.*

— On February 2, 2008, a **Beech 100** was on approach to Runway 31 at Regina, Sask. The nose gear did not reach full travel when the gear was selected down. After discussion with company maintenance, the crew landed with the nose gear partially extended. The aircraft sustained substantial damage. There were no injuries, and no fire was reported. The company reported that the actuator failed internally. A Service Difficulty Report (SDR) has been submitted. *TSB File A08C0033.*

— On February 8, 2008, a **Schweitzer 269C helicopter** experienced a gradual loss of engine power while en route. The engine did not stop, but rotor RPM could not be maintained, and an autorotation landing was made into deep snow. The pilot—the sole occupant—was able to make a Mayday transmission during the descent. The helicopter yawed and rolled upon touchdown and was substantially damaged. There was no fire, and there were no injuries. The emergency locator transmitter (ELT) activated and was subsequently turned off when another helicopter pilot, who was in the area and had heard the Mayday call, arrived shortly after. *TSB File A08P0036.*

— On February 14, 2008, a **Cessna 182N** with one person aboard was conducting a local VFR flight from the Mascouche, Que., airport. When the pilot returned to land, several aircraft were conducting circuits on Runway 11, despite a strong tail wind. The pilot had to pull up because the approach brought the aircraft too far from the runway threshold. The pilot attempted a second approach, but the landing was long. The pilot pulled up, but the main wheels hit a snowbank, and the aircraft nosed over. No one was injured; however, the aircraft sustained major damage. *TSB File A08Q0034.*

— On February 15, 2008, a **Cessna 150M** was on a training flight in Stratford, Ont., with one instructor and student on board. The student was flying the aircraft for the landing. On touchdown, the aircraft wheels contacted an icy area of the runway surface and began to veer to the left. The instructor took control and attempted to go around, but was unsuccessful. The aircraft went off the right side of the runway, tilted to the right, and the right wing struck the ground. The aircraft bounced back and came to a stop on its landing gear. The right wing and



propeller were substantially damaged, but neither of the occupants was injured. *TSB File A08O0038*.

— On February 22, 2008, a **Cessna 172M** was conducting a VFR flight in the Val d'Or, Que., area. The pilot attempted a landing on a snowmobile trail next to the Thompson River. On landing, the nose wheel sank into the ground and the propeller hit the snow-covered surface. The nose wheel broke off, and the propeller was damaged enough to cause the engine to shut down. Trying to regain control of the aircraft, the pilot pulled hard on the stick, and the main landing gear hit the ground with force and also broke off. The pilot crash-landed the aircraft a few feet further on its belly. The pilot was uninjured; the aircraft sustained substantial damage. *TSB File 08Q0030*.

— On February 22, 2008, an **R44 helicopter** landed at Jean-Lesage International Airport in Québec City, Que., on the icy surface of a helipad. After the pilot throttled down, the helicopter began to spin to the left. The student-pilot—the sole occupant—released the throttle and pressed the right anti-torque pedal. The governor control increased rotor RPM to 100 percent and the helicopter began spinning to the left on its skids several times. The helicopter finally came to a stop when the tail hit a snowbank. A tail rotor blade, the tail rotor driveshaft, and the vertical stabilizer sustained major damage. The student-pilot was uninjured. *TSB File A08Q0040*.

— On February 23, 2008, the pilot of a **Piper PA-32-300** aircraft was practicing a short field landing at Barrie-Orillia (Lake Simcoe Regional) Airport in Ontario when the aircraft's main wheels contacted a snowbank at the threshold of Runway 28. There was substantial damage to the landing gear and propeller. There were no injuries. *TSB File A08O0046*.

— On February 24, 2008, the pilot of a **Diamond DV 20-A1** aircraft was building hours toward a night rating and had completed about one hour of night circuits at Fredericton, N.B. On the last approach, the pilot was cleared as number three for a full-stop landing on Runway 27. The first aircraft carried out a touch-and-go, but the second aircraft executed a stop-and-go. In an attempt to slow the aircraft down and allow time for the second aircraft to take off, the occurrence pilot reduced power, and the aircraft descent rate increased. Realizing the aircraft was low, the pilot initiated a missed approach and then heard a bang. The pilot thought the gear had hit something, so an immediate landing was requested and granted. The aircraft landed without further incident. It was only afterward that the pilot-in-command (PIC) realized the right wing was

damaged. The aircraft struck some approach lights as it transitioned to the climb, and part of the approach-light system was found embedded in the right wing of the aircraft, approximately halfway along the leading edge. The operator has since amended its night-flying training program to include more information and place more emphasis on the use of precision approach path indicators (PAPI). Also, although not mandated by regulation, the operator now requires every instructor to receive a night-training supervision flight. *TSB File A08A0033*.

— On February 24, 2008, a student pilot on a **Robinson R22 helicopter** departed Bolton Heliport for a solo flight to Volk, Ont. After 1.6 hr of flight, the student returned to Bolton Heliport and parked the aircraft on the company helipad. A flight instructor was performing a daily inspection prior to the next instructional flight and noticed buckling of the aircraft skin under the left door. Upon further inspection, other blemishing and bowing in the aircraft skin were noticed. The student was contacted and asked if there had been anything unusual about his flight to Volk. He reported that an uneven hard landing from the right skid and then onto the left skid occurred when the helicopter landed at Volk. Company maintenance staff have inspected the airframe further and determined that the hard landing caused flexing of the airframe, fuel tank and engine mounts. The aircraft has been removed from service for skin repairs and non-destructive testing (NDT) of the mainframe. There is no damage to the rotor system, tail rotor system, engine or drive train. A hard landing inspection will also be performed. Since the aircraft is due for overhaul, all the required hard landing inspections will be conducted at the same time as the complete overhaul. *TSB File A08O0050*.

— On February 26, 2008, the pilot of a **Robinson R44 helicopter** was landing on the snow-covered surface of Thurston Lake, Alta. Visual reference was lost in blowing snow, and as the pilot was slowly descending the last few feet to touchdown, he didn't notice that the helicopter had started to drift towards the right. The right-hand skid contacted a snowdrift, and the helicopter experienced a dynamic rollover. There were no injuries to the three occupants, but the helicopter was substantially damaged. *TSB File A08W0049*.

— On March 13, 2008, a **Bell 206L helicopter** departed Montréal/Pierre Elliott Trudeau International Airport (CYUL) for a 20-min flight to Montréal/Les Cèdres Airport. A few minutes after takeoff from CYUL, the helicopter was lost on radar. The helicopter collided with the ice surface of Lake St-Louis, approximately 5 NM southwest of CYUL. Whiteout conditions existed at the time of the occurrence. Weather at CYUL was 8 NM in snow, ceiling 2 500 ft, winds 030° at 10 kt. The pilot



sustained minor injuries and was able to call for assistance via a cell phone. The pilot was rescued 2.5 hr after the occurrence. The aircraft was destroyed.

*TSB File A08Q0053.*

— On March 22, 2008, the pilot of a **Cessna 172** aircraft with one passenger on board was landing on Watch Lake, B.C., when the aircraft wheels broke through the crusted snow surface covering the frozen lake. The aircraft nosed over and overturned. The Cessna was not equipped with skis, but the pilot had previously landed on another lake nearby without incident and expected the same result at Watch Lake. Royal Canadian Mounted Police (RCMP) were dispatched to the site to assess environmental concerns. They contacted Prince George Fire/Rescue and Ambulance Services. The aircraft was substantially damaged; however, both occupants were not injured. There was no apparent fuel leakage. The aircraft was recovered and moved to the owner's property along the lakeshore. *TSB File A08P0064.*


— On March 23, 2008, a **Stinson S108** with three people aboard was conducting a recreational flight from Gatineau, Que., (CYND). Over the Montebello, Que., area, the aircraft descended to 1 500 ft. As the aircraft tried to level off from the descent, the power of the engine (Lycoming O-435-A) could not be increased above 1 500 RPM. A forced landing was executed on the Ottawa River and the aircraft nosed over as the wheels went through the layer of snow covering the ice. No one was injured; however, the aircraft sustained significant damage. *TSB File A08Q0056.*

— On March 24, 2008, a **Cessna 152** with a student-pilot on board was on a training flight from St-Hubert, Que., (CYHU). When the pilot returned to land, he was instructed to exit the runway via a taxiway located 6 100 ft from the runway threshold. After landing, the pilot maintained an accelerated speed to minimize the amount of time on the runway. As he exited the runway, the pilot missed the turnoff and hit a snowbank, causing significant damage. No one was injured. *TSB File A08Q0057.*

— On March 29, 2008, a **wheel-/ski-equipped Cessna 206U** aircraft had landed on Runway 02 at MacMillan Pass (CFC4) following a flight from Faro, Y.T. The runway was not subject to winter maintenance and was snow-covered, with the first 1 000 ft smooth, followed by a rough surface of hard snow beyond that point. After

dropping off cargo, the crew took off on Runway 20 with 1 600 ft of available runway. During the take-off run, the aircraft bounced into the air on a snowbank and settled back onto the runway. After two more bounces, the aircraft settled into brush off the end of the strip. The aircraft came to rest in a nose-down position, and the occupants exited with no injuries. Fuel leaking from the right-wing tank fed a post-impact fire, which eventually consumed most of the aircraft. No emergency locator transmitter (ELT) signal was received by the Search and Rescue Satellite Aided Tracking (SARSAT) system. The crew used a satellite telephone to inform the Whitehorse flight service station (FSS) of the accident. Rescue coordination centre (RCC) service was declined, and an aircraft from another company dropped supplemental survival equipment. The occupants spent the night in an unheated shelter at the strip and were picked up by a helicopter the next morning. *TSB File A08W0070.*

— On April 2, 2008, the pilot of a **Cessna 180 floatplane** was conducting one hour of solo flying toward her floatplane endorsement. While landing on glassy water on the Fraser River, just east of Fort Langley, B.C., the aircraft struck the water in a nose-low attitude. The left float dug in, and the right wing struck the water and was torn off outboard of the lift strut. The engine cowls, floats and propeller were also damaged; the engine stopped, but the aircraft remained upright and drifted west of Fort Langley. The pilot, who was not injured, radioed for assistance and was picked up by a local boat. The aircraft was towed to its base at Fort Langley. *TSB File A08P0079.*

— On April 5, 2008, a **ski-equipped de Havilland Twin Otter DHC-6-300** aircraft was on a flight from Nain, N.L., to deposit a cache of seven fuel drums on a frozen lake located 86 mi. to the north. After arriving at the co-ordinates given for the fuel cache, the crew considered a few lakes for the landing. On the first lake, the crew conducted a touch-and-go to test the conditions and found them unacceptable. On the second lake, as the crew conducted a touch-and-go, the nose gear struck a snowbank and broke off. The aircraft came to a stop approximately 100 ft further on. The tie-down ring securing the fuel drum broke, and the fuel drums moved forward up against the cockpit bulkhead. There were no injuries to the two crew members or to the one passenger who was seated behind the fuel drums in the rear of the aircraft. The area was described as treeless and featureless. *TSB File A08A0047.* 



## The Case For Documentation: Two Recent TATC Cases

by Beverlie Caminsky, Chief, Advisory and Appeals, Policy and Regulatory Services, Civil Aviation, Transport Canada

As it has in past issues of the *Aviation Safety Letter* (ASL), the Advisory and Appeals Division wishes to share with readers some interesting developments in Canadian aviation case law. Two recent cases released by the Transportation Appeal Tribunal of Canada (TATC) deal with record-keeping issues. As is our practice, the names of the people or companies involved have been deleted; our goal remains simply to be educational.

### CASE No. 1—Record Keeping: Accuracy Is a Must

A company appealed a review decision that the TATC had rendered against it. The challenged decision dealt with numerous contraventions of the *Canadian Aviation Regulations* (CARs). The contraventions concerned the performance and recording of maintenance or elementary work [CARs 571.02(1) and 571.03], compliance with airworthiness directives [605.84(1)], requirements regarding journey logs and technical records [605.93(1) and 605.94(1)], and maintenance control systems [706.02]. The TATC appeal panel concluded that the review decision was reasonable.

#### *The company was charged with:*

1. Installing equipment in a manner that was not in accordance with recognized industry practices and not entering that task in the technical record of the aircraft;
2. Permitting one of its aircraft to take off on several occasions while it did not meet the requirements of an airworthiness directive (AD);
3. Making false entries in journey logs; more specifically, flights had been conducted by pilots other than those whose names appeared in the journey logs;
4. Making inaccurate entries regarding cumulative air time and recording excessive differences between air time and flight time;
5. Not performing maintenance in accordance with its maintenance control manual (MCM); more specifically, an oil filter had switched to by-pass and the aircraft in question was flown for several days contrary to the required procedures set out in the company's MCM; and
6. Continuing to operate an aircraft despite numerous engine failures and not recording these failures in the journey log.

In conclusion, all entries in records must be documented accurately and maintenance must be performed in accordance with ADs and MCMs. Maintenance and record keeping must both be carried out properly and promptly.

### CASE No. 2—Quality Assurance Programs and Maintenance

This second case involves a company with an ineffective quality assurance program (QAP). In this case, the document holder was a company that held an air operator certificate (AOC) and, over the years, had been subjected to audits conducted by Transport Canada civil aviation safety inspectors.


In the summer of 2007, an audit was conducted and, as a result, a number of non-compliances were discovered and discussed with the document holder's representative. Some of these findings were identical or similar to findings detected during previous audits. The inspectors discovered, among other things, that the quality assurance system and maintenance control system were ineffective, maintenance schedules were not followed, the company's MCM had not been complied with, and corrective actions with respect to certain irregularities had not been implemented.

The Minister of Transport decided to issue a notice of suspension under paragraph 7.1(1)(b) of the *Aeronautics Act* on the basis that the company failed to do the following: establish and maintain a QAP, ensure that the person responsible for maintenance (PRM) carried out his duties as required by CARs 706.07(2) and 706.03, and ensure that the operations manager performed his duties according to CAR 703.07(2)(b)(i). In addition to the grounds for suspension, the notice also contained a number of conditions for terminating the suspension. The company had 30 days to meet those conditions, failing which the suspension was to take effect.

In her review determination, the TATC member concluded that the Minister's decision was reasonable and appropriate. She was satisfied with the post-audit meeting and conclusions regarding the inefficiency of the QAP. She was also satisfied that the PRM did not carry out his

duties and that the document holder's operations manager failed to meet his responsibilities.

Moreover, the Tribunal found no fault with the process employed by the Minister's officials in the application of its procedural guidelines, and rejected the Applicant's argument that Transport Canada's findings were minor and procedural in nature.

This decision confirms that every AOC holder must follow the regulatory requirements regarding QAPs and maintenance control systems or risk having their AOC suspended. 

Corporate/Non-Corporate Offenders

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

*The Canadian civil aviation community may be interested to know that Transport Canada's Aviation Enforcement Program provides for the monthly publication of all contraventions of the Aeronautics Act or the Canadian Aviation Regulations (CARs). The rationale for this policy is that the publication of contraventions fosters a climate of compliance by those charged and acts as a deterrent to others. Both corporate and non-corporate offences are published on the following Web site:*

[www.tc.gc.ca/civilaviation/Standards/Enforcement/Publications/menu.htm](http://www.tc.gc.ca/civilaviation/Standards/Enforcement/Publications/menu.htm).

Corporate offenders

In the case of a corporation, the corporate name is included on the Web site, along with a summary of the offence and the punitive sanction imposed—normally a monetary penalty or a suspension of the applicable Canadian Aviation Document (CAD).

Civil Aviation Web site. Because of the various delays inherent with the enforcement and TATC processes, it is not unusual to see the date of a published violation posted 12 to 18 months after the infraction.

The corporate name is published only after the monetary penalty has been paid or the suspended CAD has been surrendered, the final decision has been made by the Transportation Appeal Tribunal of Canada (TATC) or a court of law, and all associated appeals have been exhausted.


In the past, enforcement information related to aviation companies was available to the public following a specific request made under the *Access to Information Act*, thus not all corporate offenders ended up in the public domain. The current policy treats all corporate offenders equally by publishing the names of all corporations.

The information published remains posted for 6 months before being moved to the archive pages on the

It should also be noted that only infractions for which a corporate entity is charged will be posted on the Web. This means that when charges are laid against an employee of a corporation, information specific to that individual will not be published.

Non-corporate offenders

In the case of a non-corporate offence, only a summary of the offence and the resulting sanction will be published. Information specific to the individual involved will not be published on the Web site.

We invite you to consult these publications periodically, as you may find them informative and helpful in our mutual endeavour to achieve on-going compliance. 

Answers to the 2008 Self-Paced Study Program (tear-off)

20. When the ICAO Standard Atmosphere conditions exist.

21. contrast

22. reaction time; decision-making ability

23. Slight dizziness; a feeling of coldness; a sensation like a tight band around the head; pins and needles in the hands and feet

24. 0.05

25. judgement; co-ordination

26. Tent, tarpaulin, mosquito head nets, etc. as per ATR Annex 1.0

27. 200

28. Weight, location of the centre of gravity, power, turbulence, load factor, use of flaps, surface contamination/aircraft condition

29. descending; visual clues

30. Always cross at the tower.

31. forward

32. 30

33. Straight ahead.

34. release the tow rope immediately

35. Cleaning of burner nozzles; removal and replacement of baskets, burners and gas tanks that are designed for rapid change in service.

36. Fly the aircraft first. Light the burner, rather than the pilot light, and make the burn.
1. Yes.

2. flight information service en route (FISE); remote aerodrome advisory service (RAAS)

3. 24; 1-866-WXBRIDGE

4. 7-10 kt

5. hatched areas enclosed by a dashed green line

6. 25-50

7. 30

8. plus 6 SM with a 40 percent probability of 2 SM in mist

9. 1000; 9

10. power-driven, heavier-than-air aircraft

11. Clear of cloud and 1 mi. visibility for aircraft other than helicopters; and ½ mi. visibility for helicopters

12. Class F advisory

13. 123.2

14. CFS; NOTAM

15. 5; 2; 6

16. 0300; December 23

17. FIR NOTAMS

18. the manufacturer's recommended

19. high

## Flight Crew Awareness of Departure Runway Length

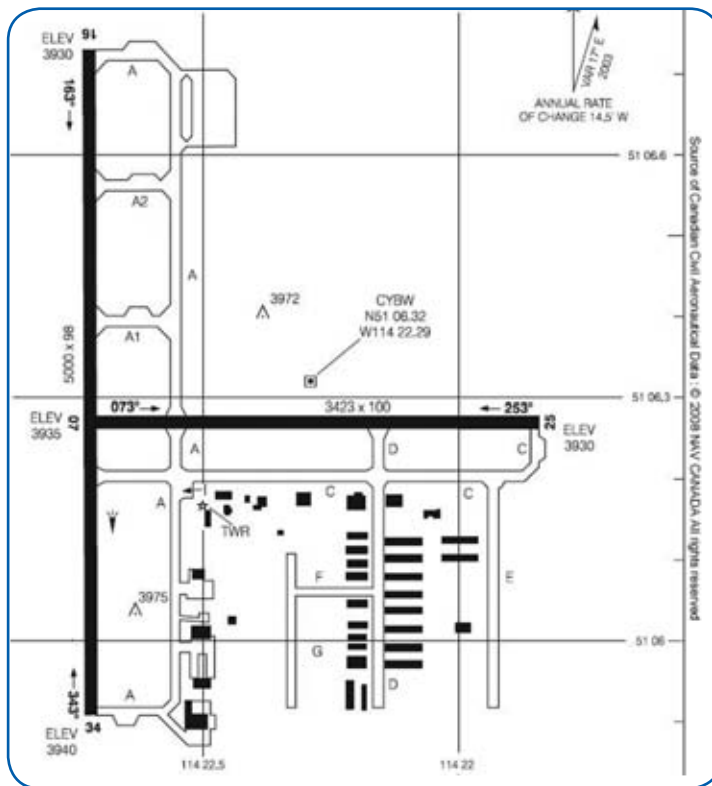
An Aviation Safety Information Letter from the Transportation Safety Board of Canada (TSB)

On October 14, 2007, a Learjet 55C was departing Springbank, Alta., on an instrument flight rules (IFR) flight to Minot, North Dakota. During the take-off roll on Runway 25, the aircraft overran the departure end for approximately 67 ft before becoming airborne. The aircraft settled back to the ground and touched down 130 ft later, where it came into contact with the terrain and remained on the ground for 30 ft until it finally succeeded in taking off. The aircraft sustained substantial damage to the right main landing gear and the right wing. The aircraft diverted to the Calgary International Airport, where it landed uneventfully. There were no injuries.

In accordance with the TSB Occurrence Classification Policy, the circumstances of this occurrence (A07W0181) were assessed and the occurrence was classified as a Class 5 occurrence. Consequently, TSB activity was limited to the collection of data, which has been recorded for safety analysis, statistical reporting, and archival purposes. The following paragraphs contain safety-related information derived during the assessment of this occurrence.

The crew arrived at the fixed-base operator (FBO) at about 09:00 Mountain Daylight Time (MDT) on October 14. Upon arrival, it was determined that the FBO was not equipped to support a corporate charter flight and the first officer had to be dispatched to obtain a bag of ice for the commissary. The captain remained at the FBO to complete the flight planning and aircraft pre-flight inspection. During this time, a take-off and landing data (TOLD) card was prepared for the flight with the intent of departing Runway 34, a 5 000-ft runway. Performance calculations indicated that Runway 34 was suitable for departure.

The captain requested the departure clearance from the Springbank ground controller at 10:36 MDT. The clearance given was for a departure off Runway 25. The controller advised that Runway 34 was available; however, the captain accepted Runway 25. The runway length for Runway 25 (3 423 ft) was not given to the crew by ATC, nor was it required. A revised TOLD card for Runway 25



Portion of the Calgary/Springbank aerodrome chart  
with both runways clearly marked  
**NOT FOR NAVIGATION**

was not completed; the captain believed that the runway lengths of runways 25 and 34 were similar based on his recollection of the airport layout from his arrival three days earlier.

At 11:50 MDT, the crew received taxi clearance for Runway 25 and proceeded to taxi to that runway. The crew could readily see Runway 25 from the taxiway and did not consult the current Jeppesen aerodrome chart available in the cockpit during the short taxi to the threshold of Runway 25. Basing their decision on their perception of the runway length, the crew used a runway that was not sufficiently long to ensure a safe departure, resulting in the aircraft overrunning the runway and sustaining significant damage. ▲



## 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, 2008, to October 31, 2009. 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 26. In addition, aeroplane and ultralight aeroplane pilots are to answer questions 27 and 28; helicopter pilots are to answer questions 29 and 30; gyroplane pilots are to answer questions 31 and 32; glider pilots are to answer questions 33 and 34; and balloon pilots are to answer questions 35 and 36.*

*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](http://www.tc.gc.ca/CivilAviation/publications/tp14371/menu.htm)*

1. If the last digit displayed on your transceiver includes 2 or 7, is your radio equipment capable of 25 KHz operations? (COM 5.3)
2. Remote communications outlets (RCO) are intended only for \_\_\_\_\_ and \_\_\_\_\_ communications. (COM 5.8.3)
3. All flight information centres (FIC) provide \_\_\_\_ hour service and can be reached by dialling \_\_\_\_\_. (MET 1.3.2)
4. When trying to estimate the wind before takeoff, you notice leaves or small twigs in constant motion and a light flag is extended. You could estimate a wind speed of \_\_\_\_\_. (MET 2.6 Table 1)
5. On a graphic area forecast (GFA), areas of showery or intermittent precipitation are shown as \_\_\_\_\_. [MET 3.3.11(e)]
6. On a GFA clouds and weather chart, the abbreviation "SCT," describing convective clouds and showers, means "scattered" with spatial coverage of \_\_\_\_\_ percent. [MET 3.3.11(e)]
7. Effective November 5, 2008, aerodrome forecasts (TAF) may be valid for up to \_\_\_\_ hours. (MET 1.3.4 or 3.2.1, or AIP Canada (ICAO) Aeronautical Information Circular 6/08)

**TAF CYYZ 081140Z 0812/0918 13015KT P6SM BKN030 TEMPO 0818/0823 17025G40KT 1SM TSRA OVC020CB BECMG 0823/0901 SCT015CB BKN020 FM091000Z 15015KT P6SM SCT030 PROB40 0912/0914 2SM BR**

8. In the TAF above, the visibility at 1300Z on the 9th day is forecast to be \_\_\_\_\_. (MET 3.9.3)
9. In the TAF above, a rapid change in the weather will occur at \_\_\_\_\_Z on the \_\_\_\_th day. [MET 3.9.3(k)]
10. When two aircraft are converging at approximately the same altitude, the aircraft that has the other on its right shall give way, except \_\_\_\_\_ shall give way to airships. (RAC 1.10)
11. What are the weather minimums for special VFR (SVFR) flight in a control zone? \_\_\_\_\_. (RAC 2.7.3)
12. Airspace such as training areas, parachute areas, etc., may be classified as \_\_\_\_\_ airspace. (RAC 2.8.6)
13. At uncontrolled aerodromes without a published mandatory frequency (MF) or aerodrome traffic frequency (ATF), the common frequency is \_\_\_\_\_ MHz. (RAC 4.5.1)
14. Updates to the current VFR navigational charts (VNC) are found in the \_\_\_\_\_ and \_\_\_\_\_. (MAP 2.4)
15. The flight crew recency requirements address three time periods. To act as pilot-in-command or co-pilot you must meet the \_\_\_\_ year and \_\_\_\_ year requirements. To carry passengers you must also meet the \_\_\_\_ month requirements. (LRA 3.9)

**080239 CZWG WINNIPEG FIR**

**CYR-223 COLD LAKE ACT SFC TO BLW 18000 FT MSL**

**0812222000 TIL 0812230300**

16. From the NOTAM above, CYR 223 will be active until \_\_\_\_\_Z on (date) \_\_\_\_\_. (MAP 5.6.1)
17. What NOTAM file category would contain NOTAMs of general interest to a flight information region (FIR) but not associated with a specific aerodrome? \_\_\_\_\_. (MAP 5.6.8)

18. In order to avoid mistakes when vital action checks are required, it is strongly recommended that owners equip their aircraft with \_\_\_\_\_ checklists. (AIR 1.2)
19. An altimeter setting that is too high results in an altimeter reading that is too \_\_\_\_\_. (AIR 1.5.3)
20. When is the only time that an altimeter will indicate the “true” altitude of the aircraft at all levels? \_\_\_\_\_ (AIR 1.5.4)
21. If the background landscape does not provide sufficient \_\_\_\_\_ you will not see a wire or cable while flying near power lines. (AIR 2.4.1)
22. When there is any doubt about their health, pilots should consult their physician or Civil Aviation Medical Examiner (CAME). While flying an aircraft, a pilot must have no condition which impairs alertness, \_\_\_\_\_ or \_\_\_\_\_. (AIR 3.1)
23. What are the symptoms of hyperventilation? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. (AIR 3.2.2)
24. A pilot should never fly while under the influence of alcohol. It has been shown, in simulators, that even a small amount of alcohol, as low as \_\_\_\_\_ percent, reduced piloting skills. (AIR 3.11)
25. Unless cleared by a Civil Aviation Medical Examiner (CAME), a pilot should not take medicine in any form immediately before or while flying. It may seriously impair the \_\_\_\_\_ and \_\_\_\_\_ needed by the pilot. (AIR 3.12)
26. As per the survival advisory information, what is the suggested equipment for providing shelter in your geographic area in summer? \_\_\_\_\_ (AIR Annex 1.0)

**Questions 27 and 28 are for aeroplane and ultralight aeroplane pilots.**

27. At controlled airports, before leaving the taxiway holding position or before proceeding closer than \_\_\_\_ ft from the edge of the runway in use, an authorization is required. (RAC 4.2.6)
28. Name at least three factors affecting the stall speed of an aeroplane. \_\_\_\_\_ (Use aeroplane references)

**Questions 29 and 30 are for helicopter pilots.**

29. In numerous whiteout accidents, pilots were confident that they could “see” the ground, unaware that they have been \_\_\_\_\_, the terrain being virtually devoid of \_\_\_\_\_. (AIR 2.12.7)
30. Because the guard (or lightning protection) wires do not sag, they are difficult to see. For this reason, what should be done when crossing a power line? \_\_\_\_\_ (AIR 2.4.1)

**Questions 31 and 32 are for gyroplane pilots.**

31. A gyroplane may not be able to establish a level flight, even with a maximum \_\_\_\_\_ cyclic, if the aircraft took off with its center of gravity aft of the longitudinal limit. (Use gyroplane references)
32. The minimum reserve fuel for a gyroplane when operated day VFR is \_\_\_\_ min. (RAC 3.13.1)

**Questions 33 and 34 are for glider pilots.**

33. If the tow pilot releases the tow rope below 300 ft AGL, where should you normally plan to land? \_\_\_\_\_ (Use glider references)
34. If you lose sight of the tow-plane, or if you are diverging upwards rapidly above the normal tow position, you should \_\_\_\_\_. (Use glider references)

**Questions 35 and 36 are for balloon pilots.**

35. What are the two items of “elementary work” that specifically mention balloons in CAR 605.85/625 Appendix A? \_\_\_\_\_; and \_\_\_\_\_.  
(CAR 625 Appendix A, available on-line at: [www.tc.gc.ca/civilaviation/regserv/Affairs/cars/menu.htm](http://www.tc.gc.ca/civilaviation/regserv/Affairs/cars/menu.htm))
36. If you reach up to make a burn and discover that the pilot light is out, what should you do first? \_\_\_\_\_ (Use balloon references)

**Answers to this quiz are found on page 39 of this ASL (4/2008).**