Transport Canada   Transports Canada

AVIATION SAFETY LETTER

In this Issue...

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

TC-1001645

The *Aviation Safety Letter* is published quarterly by Transport Canada, Civil Aviation. It is distributed to all holders of a valid Canadian pilot licence or permit, and to all holders of a valid Canadian aircraft maintenance engineer (AME) licence. The contents do not necessarily reflect official policy and, unless stated, should not be construed as regulations or directives. Letters with comments and suggestions are invited. All correspondence should include the author's name, address and telephone number. The editor reserves the right to edit all published articles. The author's name and address will be withheld from publication upon request.

Please address your correspondence to:

Editor
Aviation Safety Letter
Transport Canada (AARQ)
Place de Ville, Tower C
Ottawa ON K1A 0N8
E-mail: ssinfo@tc.gc.ca
Tel.: 613 990-1289
Fax: 613 991-4280
Internet: www.tc.gc.ca/ASL-SAN

Sécurité aérienne — Nouvelles est la version française de cette publication.

ISSN: 0709-8103

TP 185E

Publication Mail Agreement Number 40063845

Table of Contents

Cabin Safety Event of 2006

23rd Annual International Cabin Safety Symposium
February 13–16, 2006 in Oklahoma City, Oklahoma
Check out the program at www.scsi-inc.com

Dedication to duty

Dear Editor,

This letter is to recognize an outstanding dedication to duty that I was able to observe first hand. My wife and I were passengers on a West Jet charter in January 2005, preparing for a 7:00 a.m. departure from the Victoria International Airport. I occupied seat 12A—an exit seat on the port side of the 737-700. A weather front passed the city of Victoria and area, including the airport, spreading treacherous freezing rain during the previous evening. I would estimate at least one or more inches of clear ice resulted from this frontal passage. From my seat adjacent to and overlooking the port wing, I was able to observe the de-icing procedure of the port wing area. A generous amount of de-icing fluid was spread onto the wing from a "cherry picker" by a ground maintenance person, who then moved away from the aircraft around the tip of the port wing towards the tail section of the aircraft.

A second ground maintenance person drove a vehicle up to the port wing, climbed on top of the vehicle and proceeded to inspect the upper wing surface with his flashlight. It appeared that the inspecting person was not satisfied with the results of the ice removal and the "cherry picker" was recalled to spray the wing again. This time all the ice was removed from the wing.

The flight crew was well organized and carrying out normal aircraft departure duties. A comment made by myself to a flight attendant concerning the ice on the wing was acknowledged, and I was told that the aircraft would be de-iced prior to departure.

I base my observations on 34 years flying as a pilot, with over 16 000 hr flying time; much of it on the Boeing 737. We are all cognizant of the fact that every year there are numerous aircraft accidents resulting from poor de-icing practices. I am also aware that a second application of de-icing fluid is normally applied if the first application fails to remove the ice. My apprehension of flying, as a passenger, in an aircraft covered with ice was abated when I observed the professional and meticulous way the de-icing crew carried out their duties in the cool, early morning darkness, under very adverse conditions. I believe I am safe in pointing out that Victoria is not generally subjected to severe icing conditions.

The two persons I observed are to be congratulated for their dedication to duty. There are unheralded dedicated people in the field that get no recognition for just doing their job. In my humble opinion, both employees should receive official recognition for a job well done, as well as the de-icing company for employing such personnel.

J.W. Carleton
Victoria, B.C.

Thank you for your letter, Mr. Carleton. Indeed de-icing crews deserve our recognition for this crucial and demanding task. I understand your comments were also sent to the aircraft operator and the Victoria Airport Authority. I would like to extend your recognition to all de-icing crews in the country (and all other countries), as a testimonial that your work is critically important to aviation safety, and truly recognized. —Ed.

Pay attention to your instructors

Dear Editor,

The short article, "How Much Gas Is Enough?" on page 10 of ASL 3/2004, made me think of something that I was taught by one of my instructors while taking my training for my private pilot licence (PPL) way back in 1971 (Yes, that's right—1971).

I was told that, and I quote as well as my memory allows me to quote after all these years, "The only thing that you can find out by looking at the electric fuel gauges in an aircraft that is equipped with electric fuel gauges is that the aircraft is equipped with electric fuel gauges."

I'm pleased to report, 34 years of active flying later, that I've had only one single close-call (which I won't embarrass myself by going into the details of) in all that time, and nothing else even remotely close to a fuel incident other than that.

The lesson? (And with flying, there's ***always*** a lesson…) Always dip your tanks, and always pay attention to your instructors—they know what they're talking about!

Rick Silver
Victoria, B.C.

Atlantic Regional Aircraft Maintenance Conference 2006
April 21–22, 2006, in Halifax, N.S.
Check out conference information at www.atlanticame.ca

Back to Basics: The Birds and the…Birds

With a southerly tailwind, ground speed was about 160 kt. I reduced power to 2 200 RPM and the speed settled in to about 140 kt. It was pitch black as I headed out over farmland at 8:00 p.m., and BAM…I was hit in the face. I could feel the air hitting me, there was a high noise level, and I couldn't see. The panel was a white blur, and I could barely make out the difference between the light panel and the dark instruments. It took 4 or 5 seconds as I ran down the list of alternatives and realized I had just had a bird strike. I called approach control and reported the bird strike along with the hole in the aircraft. It was about 2 ft wide and a foot tall in the windscreen, centered on my face. I'm sure my voice was pitched a mite higher than normal. The approach controller gave me an immediate vector to 140° to intercept the localizer.

The description above is a true story, as told by the pilot. Terry Johnson was hit in the face by windshield debris and the remains of a lesser scaup—a 1.5-lb diving duck. Terry succeeded in completing a successful landing in his Van's Aircraft RV-6, but the incident could have been much more serious, had Terry been blinded, or had he hit a larger bird such as a Canada goose, at 15 lbs.

In 2004, there were 15 percent more bird/wildlife strikes reported to Transport Canada than there were in 2003. Given the increasing population of urban-adaptable wildlife—such as ring-billed gulls, Canada geese, cormorants and white-tailed deer—this increase in strikes is not a surprise. We continue to search for ways to minimize the risk associated with collisions between aircraft and wildlife, but the challenges grow as we experience increasing wildlife populations and a renewed growth cycle in the aviation industry.

Transport Canada has a new regulation that should come into force later this year. Airport operators will be required to develop a risk-based management plan that includes staff training schedules, a means to advise pilots of wildlife activity, and the mandatory reporting of all wildlife strikes to Transport Canada.

Birdstrike damage on a Snowbirds *aircraft*

Pilots can do their part to reduce risk. Avoid low-level, high-speed flight whenever possible, and in particular, avoid low-level flight over bird attractants such as landfill sites. Remember, the windshields in light general aviation aircraft have no design requirements related to bird strikes. Birds such as gulls can tower up to 1 800 ft over a landfill on a warm day. Additional information and migration patterns are found in the Transport Canada *Aeronautical Information Manual* (TC AIM) section RAC 1.15. We encourage you to review and be aware of migration paths when planning your flights.

Please report all wildlife strike incidents to Transport Canada, and if you see unusual wildlife activity, report the situation to other pilots and/or the airport operator. For more information, please visit our Web site at: www.tc.gc.ca/CivilAviation/Aerodrome/WildlifeControl/menu.htm. △

CASS 2006 Reminder

The 18th annual Canadian Aviation Safety Seminar, CASS 2006, will be held at the Casino Nova Scotia Hotel, in Halifax, N.S., April 24–26, 2006. The theme for CASS 2006 is *Human and Organizational Factors: Pushing the Boundaries*!

The CASS 2006 program, which includes workshops and plenary sessions, was designed to inform the Canadian aviation industry about human and organizational factors (HOF), and how managers, operations personnel, and maintainers can optimize their performance by designing their environment, equipment and procedures for human use.

Also being offered is a series of workshops aimed at providing participants with practical knowledge of HOF and safety management as well as techniques that can be applied immediately upon their return to the workplace. For information on CASS 2006 please visit www.tc.gc.ca/CASS. △

COPA Corner—Radio Chatter Impedes Safe Flying

by Adam Hunt, Canadian Owners and Pilots Association (COPA)

I'm flying VFR across Ontario, listening to 126.7, and getting ready to make a position report and get an update on my destination weather. There is a lot of traffic on 126.7, which is normal during the daytime, but much of this is non-aviation traffic and it is blocking communication.
"Hey Joe, are you there?"
"Yup"
"Where are you?"
"60 mi. north of [location omitted]."
"You going for lunch at Alice's?"
"Yeah maybe, or I might just head home instead"
This conversation went on for quite a while and I was almost out of range of the remote communications outlet (RCO) when I finally got a chance to make my call.

Another time, I heard "Any traffic 85 mi. north of North Bay, this is C-Fxxx on 126.7, practicing holds at 8 500 ft; we're doing right hand hold on the VOR/DME [VHF omnidirectional range / distance measuring equipment], and we'll probably be here for another half hour or so before we head home for gas and some lunch, although we may descend first and do some holds lower down for a while too, and then head back to base; any conflicting traffic please report." Five minutes later he made the same call—only longer, with more details about his lunch plans! Even more recently, I heard two chattering pilots thrown off the local tower frequency, because that was the frequency they were talking to each other on.

It seems that each year the amount of irrelevant chatter on the radio increases on key frequencies, like 126.7 and the active ATC frequencies. This is of course frustrating for pilots who have to get past all the chatter to try to pick up clearances, pass weather and update flight plans. Sometimes it becomes a safety hazard when the needed communications cannot get through because there is too much unneeded communications on the frequency.

At the same time that the volume of unnecessary chatter seems to be increasing, the correct use of proper radio phraseology seems to be decreasing. Perhaps it is the endemic use of cell phones in our society that has caused this belief that it is okay to "chat" on the aviation frequencies.

We actually do have frequencies for "air-to-air" communication allocated. They are 122.75 MHz in Southern Domestic Airspace (SDA) and 123.45 MHz in the Northern Domestic Airspace (NDA) and over the North Atlantic (NAT). Additionally, 123.4 MHz is available for gliders, balloons and ultralights to use for "air-to-air" and "air-to-ground" communications. This is all explained in the Transport Canada *Aeronautical Information Manual* (TC AIM), COM Section 5—Radio Communications.

Let's re-establish some good radio discipline on the aerodrome traffic frequency (ATF), and ATC and FSS frequencies. Please keep your radio communications short and to the point. If you need to talk to another aircraft, switch to the correct air-to-air frequency to have that conversation. Somebody else's safety may depend on it. △

The Canadian Business Aviation Association Column—The Power of One

The cornerstone of the Canadian Business Aviation Association (CBAA) Private Operator Certificate (POC) Program is the establishment of a systematic and comprehensive process for the management of safety risks that integrates operations and technical systems with financial and human resources.

The premise is that proactive risk management techniques will help to achieve gains in efficiency and safety. Ample guidance material on safety management systems (SMS) is readily accessible, logical and relatively easy to implement. Private operators have successfully implemented the many SMS components into their flight operations.
After first-level SMS audits on CBAA POC holders, the feedback from the CBAA-accredited auditors indicates that there is a solid baseline on which to build. What is frequently missing is the level of individual activity needed to produce the desired efficiency.

The task now is to motivate the individual to be committed and to become a proactive participant. An organization's culture is defined by each person's commitment and consequential actions. For an SMS to work, we all need to be active participants. It is the people in an organization, not the system itself that will produce efficiency. A desired outcome of efficiency will be safety.

When we are all committed to participate, we will have taken the first step towards achieving a culture that ultimately will produce efficiency and the safety goals that must be reached. The CBAA's objective is to build on the power of one to create a positive safety culture; a culture that says everything every individual does is important and value-added. Let us not underestimate the *Power of One*. △

Understanding the Factors That Affect Safety in the Air Navigation Service

by Larry Lachance, Director, Safety, Evaluations and Investigations, NAV CANADA

NAV CANADA has been invited by Transport Canada to provide regular updates on safety issues and new initiatives. The column will look at a variety of initiatives aimed at improving our understanding of factors affecting safety, as well as technological and procedural improvements aimed at enhancing safety. In this column, we will discuss data and analysis in three different areas that will allow us to identify safety-related trends and propose solutions over time.

Human factors trend analysis

In March 2005, NAV CANADA completed a human factors analysis of contributing factors to operating irregularities. By investigating human factors in the delivery of air navigation services (ANS), NAV CANADA seeks to optimize the interface between people and the tasks they perform, the equipment they use, and the physical and organizational environment in which they work.

NAV CANADA analyzed 128 operations safety investigations (OSI). The purpose of the analysis was to identify local workplace or organizational issues where follow-up might lead to the identification of solutions for improvements in safety.

The analysis differentiated between "observations," "front-line human errors" and "contributing factors." "Observations" are based on data routinely collected in investigations, but which are not necessarily "contributing factors." Such data might include staffing levels, whether training was taking place, time in position, workload, complexity, and supervision.

"Front-line human errors" were categorized as planning, execution or monitoring errors, based on an adaptation of James Reason's Generic Error Modelling System (GEMS), which is imbedded in the investigation process.

"Contributing factors" were categorized using the PETE model (Person, Equipment, Task, Environment), which is used to capture the context that has a negative influence on human performance. Identifying the PETE factors is central to the mitigation of human error, as these are the tools, tasks, and operational and organizational factors that increase the risk of human error.

Some of the contributing factors identified in the analysis include:

- miscommunication between the controller/specialist and pilots. Examples include incorrect readbacks and pilots not informing air traffic services (ATS) of their intentions;
- the effect of numerous altitude change requests due to turbulence/chop on the controller's task;
- obstructions to visibility or poor visibility of runways and manoeuvring areas;
- airport layouts that required significant crossing of vehicles/aircraft over active runways;
- confusion due to similar aircraft identifications;
- pilots not flying routes as published.

NAV CANADA's Operations' Safety, Evaluations and Investigations group intends to complete a human factors analysis of contributing factors to operating irregularities every six months. This will provide a national perspective on contributing factors and allow for the identification of trends over time.

Pilot deviations

An analysis of aviation occurrence reports (AOR), which feed into the Civil Aviation Daily Occurrence Reporting System (CADORS), revealed a number of pilot deviations, such as altitude busts, airspace incursions, course deviations, runway incursions and VFR non-compliance with clearances that contribute to operational risk in the ANS. The joint Transport Canada–NAV CANADA Safety Oversight Committee is undertaking additional measures to gain an enhanced understanding of what types of pilot deviations are occurring, as well as where, how often, and ultimately, why they are occurring.

Normal operations safety survey

In the spring of 2004, Transport Canada appointed NAV CANADA as the Canadian representative to the International Civil Aviation Organization (ICAO) Normal Operations Safety Survey (NOSS) Working Group. The NOSS Working Group has been developing a methodology for safety data collection during normal air traffic control (ATC) operations. This concept is similar to line operations safety audits (LOSA) developed for the airlines.

By conducting a series of targeted observations of ATC operations over a specific period of time, and analyzing the data obtained, the ANS is provided with an overview of the most pertinent threats, errors and undesired states that air traffic controllers must manage on a daily basis.

One feature of NOSS is that it identifies threats, errors and undesired states that are specific to an organization's particular operational context, as well as how effectively they are managed by air traffic controllers during normal operations. With this information, the organization can make proactive changes to its safety process without triggering an incident or accident. An initial protocol for NOSS has been developed, and NAV CANADA will be conducting a NOSS trial in 2005–2006.

NAV CANADA, the country's provider of civil air navigation services, is a non-share capital, private corporation with operations coast-to-coast providing ATC, flight information, weather briefings, aeronautical information services, airport advisory services and electronic aids to navigation. More information about NAV CANADA and its services is available at www.navcanada.ca. △

Air Shows

by Line Preston, Civil Aviation Safety Inspector, Recreational Aviation and Special Flight Operations, General Aviation, Civil Aviation, Transport Canada

Did you know that there are approximately 65 air shows conducted in Canada each year? With the air show season fast approaching, we thought we would provide you with an overview of the requirements to conduct an air show.

First, what is an air show? An air show is an aerial display or demonstration before an invited assembly of persons by one or more aircraft.

Special flight operations certificate

In order to conduct an air show, authorization in the form of a special flight operations certificate (SFOC) is required. The certificate will outline general and specific conditions that must be complied with by the applicant and participants of the event.

An SFOC is issued once an applicant has demonstrated the ability to conduct an air show in accordance with the requirements of the *Special Flight Operations Standards*. Subpart 623, Division I, Chapter One of the *Special Flight Operations Standards* outlines the standards that have to be met for the issuance and continuing validity of an SFOC issued for an air show, as provided for in the *Canadian Aviation Regulations* (CARs), Subpart 603, Division I.

The applicant must apply to the appropriate Transport Canada Regional General Aviation office at least 60 days prior to the proposed date of the event. The application must contain such information as: relevant names and phone numbers, dates and location of the air show, identification of the aircraft and air safety support facilities, and a detailed site diagram of the event site. At least 10 days prior to the event, the applicant must send in information pertaining to pilot documents, aerobatic manoeuvres, flight authorities, emergency procedures, and air display traffic control procedures. For more detailed information on the issuance of an SFOC, refer to CAR 623.02.

Management structure

The management structure of an air show will vary according to the circumstances. A small air show may be organized by a local flying club, while a large air show will require the services of a number of persons with expertise in a variety of areas. The scope of any air show will depend on the aviation interests of the community and other local conditions.

It is most important that a certificate holder be aware that, since the Minister issues the SFOC—Air Show, it is the responsibility of the certificate holder to ensure that the air show is conducted in such a way that the safety of persons and property on the ground is not jeopardized. In this regard, air show performers are aware of the hazards to themselves, but Transport Canada, by means of the CARs and *Special Flight Operations Standards—Special Aviation Events*, establishes standards of safety for the protection of the general public.

The certificate holder is responsible for the structure and assigning of the event management, emergency facilities and procedures, crowd control, and air display traffic control. They shall ensure that procedures have been developed and published and that facilities, equipment, and personnel are in place to respond to anticipated emergencies, including aircraft accidents or medical emergencies involving the spectators. Additionally, the certificate holder is responsible for the provision of adequate facilities and personnel to ensure that the crowd is properly controlled, giving attention to designated spectator areas, aircraft and vehicle parking, fencing barriers, emergency entrances, access lanes and exits, public address systems and site cleanliness. Details are contained in CAR 623.05.

Crowd control personnel should be adults and wear some form of distinctive clothing (e.g. jacket, vest, t-shirt) that clearly identifies them as such. A small coloured nametag or similar device may be difficult for a lost child or disoriented person to identify.

Properly briefed adults should be employed for crowd control in restricted and spectator enclosure areas. Youth groups, if properly utilized and directed, can be of great public assistance for direction, vehicle parking, etc.

Participant and aircraft eligibility/qualifications

In order to participate in an air show, certain conditions must be met relating to both the aircraft and the pilot participant. CAR 623.06 outlines these requirements. The certificate holder must ensure that appropriate authority has been granted to these aircraft operators in order to be eligible to participate in the event.

Distances and altitudes from spectators

CAR 623.07 sets standards for the minimum safety distances, both horizontal and vertical, which have to be maintained between aircraft in flight and the primary spectator area, secondary spectator areas, built-up areas, and occupied buildings during an air show.

Parachuting

Parachute descents at an air show must receive prior authorization in accordance with CAR 603.37. Where parachuting by other than military personnel is part of the air show, the application may be made by the event certificate holder on behalf of the parachutists.

The International Council of Air Shows

The International Council of Air Shows (ICAS) was created in 1968 to safeguard and promote air shows and air show professionals. An association of air show producers, performers and support service providers, ICAS is dedicated to air show safety, professionalism, showmanship and economic viability.

If you need any information pertaining to air show issues and procedures that is not related to the CARs, such as air show planning, organizing or marketing, you may contact:

President
International Council of Air Shows Inc.
751 Miller Drive SE, Suite F4
Leesburg, Virginia 20175, USA
Tel.: 703 779-8510
Fax: 703 779-8511
E-mail: icas@airshows.org

Transport Canada is responsible for the conduct of civil aircraft only. Canadian military aircraft, and foreign military aircraft while in Canada, operate under the authority of the Department of National Defence, and are not subject to the CARs. If you require information pertaining to Canadian military performances or performances by foreign military aircraft, you may contact:

1 Canadian Air Division—HQ (1 CAD-HQ)
Box 17000, Station Forces
Winnipeg MB R3J 0T0

Tel.: 204 833-2500 ext. 5206
Fax: 204 833-2637

Who to contact for more information

Additional information on the organization and administration of air shows may be obtained by contacting your local Transport Canada Regional General Aviation office,

OR

Transport Canada
Recreational Aviation and Special Flight
Operations (AARRD)
Place de Ville, Tower C, 6th Floor
330 Sparks Street
Ottawa ON K1A 0N8
E-mail: recavsf@tc.gc.ca
Web site: www.tc.gc.ca/civilaviation/general/recavi/menu.htm △

Hosting a Fly-In?

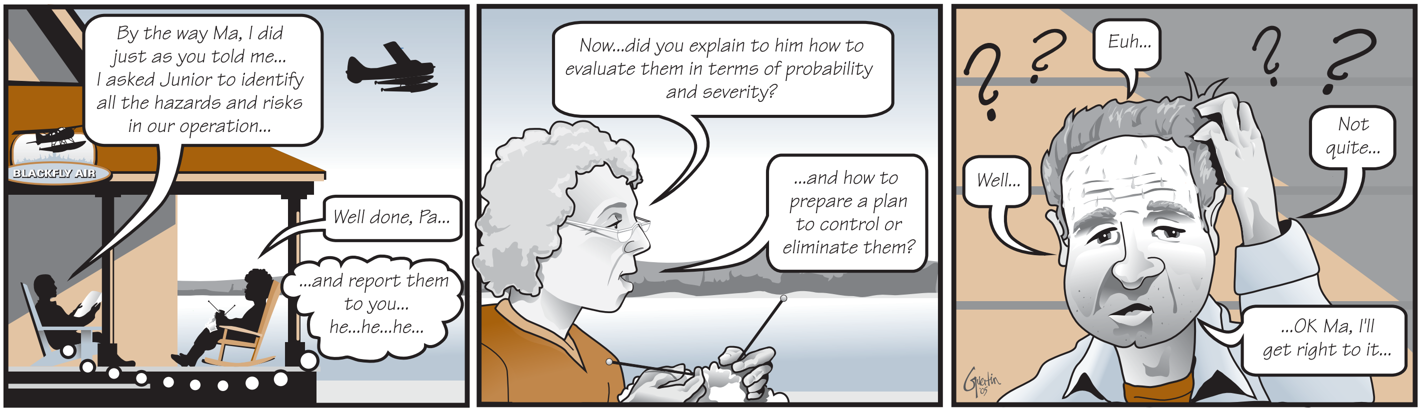
Fly-in breakfasts and airport open houses are common events each year throughout Canada. They provide excellent opportunities to let the general public learn more about aviation—and they can also be a lot of fun.

A fly-in is defined in the *Canadian Aviation Regulations* (CARs) as a pre-arranged meeting of a number of aircraft at a specified aerodrome. Fly-ins involve an invited assembly of persons, but cannot include competitive flying or aerial demonstrations. If your event fits these criteria, there are no special regulatory requirements for you to meet—beyond normal aircraft operational rules.

However, if your event includes competitive flying or any form of aerial demonstration, the CARs impose certain requirements for the protection of the invited guests, who may not be as aware as you are of the hazards present at this type of event.

We encourage you to contact your local Transport Canada General Aviation office. They will be pleased to provide you with all the necessary information to help you organize your event and make it a safe and successful one. △

BLACKFLY AIR ON SMS



Blackfly Air Attempts Hazard Identification and Risk Management!

Blackfly Air managers are back, and this time they're tackling the important safety management system (SMS) task of identifying hazards and risks, evaluating them, and then taking specific steps to manage the risks, and/or eliminate the hazards. All this lingo aside, it is best to refer to the source. Here are a few words on the subject.

Hazard identification and risk management

To make your operation safer, you need to know what could cause injury or damage, how likely it is to happen, and how serious the result could be. The official terminology is "hazard identification" and "risk management." Let's start with some definitions.

A hazard is a condition with the potential of causing loss or injury.

A risk is the chance of a loss or injury, measured in terms of severity and probability.

For example, a wind of 15 kt blowing directly across the runway could be a hazard to a light aircraft operation. The risk associated with this hazard is that a pilot may not be able to control the aircraft during takeoff or landing, resulting in an accident. You could probably think of several consequences of encountering this hazard, ranging from damage to equipment and reputation, to injury and death. Another example of a hazard is an icy ramp. The risks include people slipping and falling, and manoeuvring aircraft or vehicles not being able to stop. In a maintenance operation, an oxygen bottle stored near an oil cabinet, or out-of-date maintenance manuals would be classified as hazards.

Your goal is to proactively identify the hazards in your operation, determine what risks are associated with these hazards and what the level of risk is for each scenario. Then you try to apply rules, or design operating procedures that will reduce or eliminate the risks. This is known as a Corrective Action Plan. In rare cases, you may decide that the risk is too great and that the best choice is to avoid the hazard by not engaging in a particular activity.

While we often think of hazards as being technical in nature, those that lead to accidents can be business-oriented—training, planning, budgeting, procedures and so forth. Here are some of the most hazardous times for an operation:

- When major changes are made to the organization;
- Times of rapid growth;
- When there is significant staff changeover;
- When many employees are inexperienced;
- When new procedures are introduced;
- If financial problems start affecting operational decisions.

Although you look for hazards constantly, you should especially look for them at high-risk times such as those listed above, and you might even plan a safety self-assessment, if these conditions exist.

This is the proactive part of safety management. You are looking for problems before they become incidents or accidents. Occupational Safety and Health (OSH) statistics suggest that for every serious or disabling injury in an organization, there are upward of 600 previous safety deficiencies and minor incidents that may or may not have been reported. In an aviation context, this can mean that, at an organizational and industry level, an increasing number of incidents will increase the likelihood of an accident occurring.

Risk management—it's all about priorities

Once hazards and the risks associated with them are identified, you need to estimate the level of risk. You need to look at the likelihood (probability) and the seriousness (severity) of a potential occurrence. While some need much effort to correct, not all will require that level of resources and sometimes it is just not clear which hazards need the most attention. This is where risk analysis comes in.

This risk assessment process must be practical, simple, and must match the size and complexity of your operation. In discussing the hazards, experienced staff can draw on their own experience; safety publications; the Transportation Safety Board of Canada (TSB) and other databases; research they have done; and other information about accidents over the years.

The measurement scales below are merely suggestions—it doesn't matter whether you use three, four or more descriptions to help you make an estimate, and you can word them in whatever way makes most sense to your work. First, for each risk identified, assess probability:

Probability

H-High	It will likely happen;
M-Medium	It has a fairly good chance of happening;
L-Low	It is possible, but not too likely;
VL-Very low	It will almost certainly not occur.

Second, again for each risk, for the moment assume that the incident DID occur. Now estimate how severe the consequences would be:

Severity

H-High	Serious or irreparable harm to people or to the company;
M-Medium	It would have a significant impact on people or property;
L-Low	It might cause inconvenience, but no real harm.

So where does that take us? You now know how to establish priorities and where to place most resources. Any risks rated at a HH level, in other words a risk that will PROBABLY happen AND would cause SEVERE or irreparable harm if it did so, obviously needs immediate and effective attention. A reported risk rated LL, on the other hand, which is not too likely and would cause no real harm if it did occur, would probably be placed pretty low on the priority list. You could plan to address all risks with a rating equal to, or higher than a MM.

In considering the hazards that you judge as serious, clearly you want to eliminate them. However, that may be impossible, so at least you want to reduce either their likelihood or their seriousness to the point where you can live with the remaining risk. Following that approach, you work out a strategy and you take action. The solutions may include, among other things:

- A change in operating procedures;
- A review of why the activity is necessary;
- Setting up recurrent training;
- Improving supervision;
- Providing safety information or advice aimed at specific areas;
- Doing some contingency planning;
- Limiting exposure to the hazard.

This process of identifying the hazard, determining the risks and developing options for reducing the risk is the *Hazard Identification and Risk Assessment* process. You will need to document this process and the resulting operating procedures. Refer to the SMS toolkit to help design a process that works for you.

For further information, refer to *Safety Management Systems for Small Aviation Operations—A Practical Guide to Implementation* (TP 14135), and *Safety Management Systems for Flight Operations And Aircraft Maintenance Organizations—A Guide to Implementation* (TP 13881). △

Looking for *AIP Canada (ICAO)* Supplements and Aeronautical Information Circulars (AIC)?

As a reminder to all pilots and operators, the AIP Canada (ICAO) *supplements as well as the* AIP Canada (ICAO) *AICs are found online on the NAV CANADA Web site. Pilots and operators are strongly encouraged to stay up-to-date with these documents by visiting the NAV CANADA Web site at* www.navcanada.ca, *and follow the links to "Publications" and "Aeronautical Information Products." This will take you directly to the site of the current* AIP Canada (ICAO). △

The following summaries are extracted from Final Reports issued by the Transportation Safety Board of Canada (TSB). They have been de-identified and include only the TSB's synopsis and selected findings. For more information, contact the TSB or visit their Web site at www.tsb.gc.ca. —Ed.

TSB Final Report A03O0012—Loss of Control and Collision With Terrain

On January 21, 2003, a Eurocopter AS 350 B2 helicopter with the pilot and three passengers on board, departed on a day, visual flight rules (VFR) flight from Sault Ste. Marie, Ont., to conduct a moose survey at a location approximately 45 NM northeast of Sault Ste. Marie. During the survey, at 11:43 Eastern Standard Time (EST), the pilot communicated to the Ministry of Natural Resources ground-based radio operator that the aircraft experienced a hydraulic failure and that he was proceeding to a logging site at Mekatina to land the helicopter. As the helicopter approached the logging site, workers observed the aircraft proceed to the north and enter a left turn. As the helicopter proceeded back towards the logging operation in the left turn, control of the aircraft was lost and it crashed in the rising wooded terrain east of the logging site. The helicopter came to rest in an inverted position. All of the aircraft occupants were fatally injured. There was no post-crash fire.

Findings as to causes and contributing factors

1. After experiencing a hydraulic system failure, the helicopter departed controlled flight and crashed while manoeuvring for landing. The reason for the departure from controlled flight could not be determined.

2. It is likely that the hydraulic pump drive belt failed in flight, precipitating the hydraulic failure.

3. It is likely that the hydraulic circuit breaker was in the tripped position in flight, rendering the hydraulic CUTOFF and HYD TEST switches inoperative. This would result in hydraulic pressure from the main-rotor servos being depleted asymmetrically.

Findings as to risk

1. Laboratory examination of the failed hydraulic drive belt and other similar unbroken belts from other aircraft revealed extensive cracking in the same location in all the comparison samples. A problem may exist at that location, creating a stress/strain concentration that results in a consistent and predictable failure.

Other findings

1. The forces encountered by the pilot during the turn at low altitude may have been too extreme to overcome, making it impossible for him to recover the aircraft to level flight.

2. The disassembly and/or examination of the four hydraulic servo controls and the components of the main-rotor controls revealed no pre-existing condition that would have prevented normal operation.

3. Hydraulic fluid test results identified a water content that was within the maximum allowable limit.

Safety action taken

Significant safety actions were taken as a result of this occurrence. For more information, please consult the complete final report, as well as the applicable communiqué (#A02/2005, issued on March 16, 2005), on the TSB's Web site.

TSB Final Report A03Q0109—Fuel Exhaustion and Forced Landing

On July 26, 2003, a Cessna 172M, carrying the pilot and three passengers, was on a VFR flight from Sept-Îles, Que., to Rivière-du-Loup, Que. After a short stopover at Rivière-du-Loup to drop off the passengers, the pilot decided to continue the flight to Québec, Que., without refuelling. En route, the pilot encountered adverse weather and requested clearance for special VFR to land at the Québec airport. About 9 NM from the threshold of Runway 24, the engine (Lycoming O-320-E2D) sputtered and then stopped. At approximately 20:09 Eastern Daylight Time (EDT), the pilot declared an emergency and carried out a forced landing onto the de la Capitale highway. The aircraft struck a street lamp, and the nose dropped before it collided with the ground. The pilot was seriously injured and the aircraft was severely damaged.

Findings as to causes and contributing factors

1. Fuel exhaustion caused the engine to stop, requiring the pilot to carry out a forced landing onto the de la Capitale highway.

2. The pilot did not use the Cessna 172 flight manual to plan the amount of fuel required for his cross-country flight; he thought he had enough fuel to fly from Rivière-du-Loup to Québec.

TSB Final Report A04C0016—Loss of Directional Control and Runway Excursion

On January 15, 2004, a Fairchild Metro SA227-AC had departed Kenora, Ont., and was landing on Runway 11 at Dryden, Ont., with two pilots and ten passengers on board. During the landing roll, the aircraft went off the left side of the runway into deep snow. The aircraft was not damaged, except for two blown tires on the left main landing gear. The crew and passengers were not injured. The incident occurred during daylight hours at 14:57 Central Standard Time (CST).

Findings as to causes and contributing factors

1. The aircraft was operating in environmental conditions conducive to snow penetration into the brake assemblies during ground operations at Kenora.

2. The brake assemblies on the left main landing gear froze, preventing the wheels from rotating during the landing roll at Dryden.

3. The first officer's foot position and pressure application on the rudder pedals prevented effective use of differential braking and nosewheel steering to maintain directional control of the aircraft after landing.

Findings as to risk

1. Although the practice of pilots placing their feet on the rudder pedals with their heels on the floor reduces the risk of tire damage from an unintentional brake application, it creates a risk that pilots will not be able to use the brakes to maintain directional control.

2. The aircraft manufacturer's aircraft flight manual (AFM) does not provide emergency or abnormal procedures for frozen brakes.

3. The company standard operating procedures (SOP) provide very limited guidance regarding frozen brakes, and the Transport Canada *Aeronautical Information Manual* (TC AIM) does not provide any guidance material regarding the risks associated with frozen brakes.

4. Brake freeze-up risk management strategies are, for the most part, undocumented and inconsistently applied by the industry. Industry strategies in some cases contradict the strategies recommended by the brake manufacturer.

5. Some vehicle movements at the Dryden aerodrome were not communicated to Winnipeg Radio, creating a risk that an aircraft movement could occur while a vehicle was on the runway.

6. The continued operation of the runway with a disabled aircraft and vehicles within Zone 1 of the runway strip increased the risk to aircraft using the runway.

7. The passengers walked across active airport manoeuvring surfaces to the terminal building with no direct control over their movements.

8. The potential exists for misidentifying or delaying the identification of safety deficiencies in future investigations as a result of flight data recorder (FDR) data inaccuracies or undetected cockpit voice recorder (CVR) signal attenuation from phase discrepancies.

Other findings

1. The graded runway strip intended to reduce the risk of damage to aircraft running off the runway fulfilled its purpose for the aircraft's landing.

2. The crew's action of shutting down both engines before the runway excursion most likely prevented structural failure of the propeller system and possible subsequent damage to the cabin integrity.

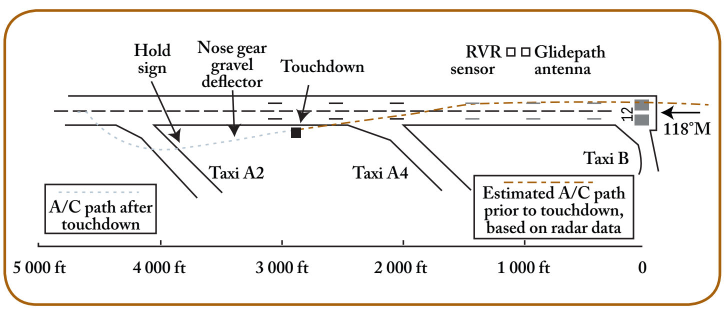
Safety action taken

The operator corrected the wiring of the cockpit audio/microphone jacks and confirmed proper operation of the CVR. The operator reported that no further problems existed with the mixed channel.

The manufacturer of the FA2100 CVR, is in the process of revising the installation and operation manual for the CVR functional and intelligibility test procedures, to ensure that operators check the 120-min channels for proper operation. The TSB sent an *Aviation Safety Advisory* (615-A040037-1) to Transport Canada, suggesting that they may wish to consider action to ensure that pilots understand the risks associated with frozen brakes and are adequately prepared to maintain directional control on landing.

TSB Final Report A04W0032—Landing Beside the Runway

On February 25, 2004, a Boeing 737-210C was operating from Lupin, Nun., to Edmonton, Alta. The runway visual range (RVR) provided to the flight crew prior to commencing the approach to Runway 12 at Edmonton was 1 200 RVR, with a runway light setting of 5. The crew flew the instrument landing system (ILS) approach in darkness and touched down on the infield to the left of the runway surface, at 05:44 Mountain Standard Time (MST). The aircraft travelled approximately 1 600 ft before returning to the runway. After the aircraft was brought to a full stop, aircraft rescue and firefighting (ARFF) was requested by the flight crew. One runway light, four taxiway lights, and one hold sign were struck by the aircraft. There were no injuries and the passengers deplaned via the rear airstair door.



Overhead view of Runway 12 at Edmonton

Findings as to causes and contributing factors

1. With deteriorating visibility and only runway edge lighting for guidance, the captain was unable to manoeuvre the aircraft to stay within the confines of the runway.

Findings as to risk

1. Canadian regulations permit Category I approaches to be conducted in weather conditions equivalent to or lower than Category II landing minima without the benefit of the operating requirements applicable to Category II approaches—in this occurrence, the lack of adequate runway lighting.

2. The approach was conducted in the VHF omnidirectional range / localizer (VOR/LOC) mode rather than the automatic / approach control service (AUTO/APP) mode, which disabled the desensitizing feature of the autopilot while tracking the localizer.

3. Neither the *Canadian Aviation Regulations* (CARs) nor the operator's *Operations Manual* provides sufficient defences concerning the scheduling of crew duty periods so that extended periods of wakefulness, lack of restorative sleep, and rapid changes in crew shift times do not unduly affect crew performance.

Other finding

1. The flight crew members were not using the company SOP for pilot monitored approaches (PMA).

Safety action taken

Transport Canada

In the past, the TSB has identified the safety deficiencies associated with conducting approaches in low visibility. The TSB investigated a landing accident in Fredericton, N.B., where the weather at the time of the accident was as follows: vertical visibility 100 ft obscured, horizontal visibility 1/8 mi. in fog, and RVR 1 200 ft. On 20 May 1999, the TSB issued report A97H0011. The following is an excerpt from that report:

> As demonstrated by this accident, however, Canadian regulations permit Category I approaches to be conducted in weather conditions equivalent to or lower than Category II landing minima without the benefit of the operating requirements applicable to Category II approaches. Therefore, to reduce the risk of accidents in poor weather during the approach and landing phases of flight, the Board recommends that the Department of Transport reassess Category I approach and landing criteria (re-aligning weather minima with operating requirements) to ensure a level of safety consistent with Category II criteria. (**A99-05**)

Changes to the CARs, as proposed by Transport Canada, to improve the safety of runway approaches in poor visibility, were published in the *Canada Gazette*, Part I, on 20 November 2004, with a 30-day public comment period. After consideration of the comments, the regulations will be finalized and published in the *Canada Gazette*, Part II. The regulations will help harmonize Canadian regulations with international standards and will respond to recommendations from the TSB.

On 18 May 2004, the TSB issued *Safety Information Letter* (A040029) to Transport Canada, informing the department that an appropriate standard for ongoing preventative maintenance practices of airport visual aid facilities is not in place. Transport Canada responded to the information letter on 06 July 2004, stating that the current TP 312 standard provides sufficient direction to airport operators on maintenance standards.

Operator

The operator has changed the schedule for its crews flying that particular route, and it is now conducted during the day, eliminating the requirement for flight crews to switch from day flying to night flying within the schedule. The operator has promulgated changes to the low visibility SOPs and PMA SOPs for B-737 aircraft operations. Within these changes is the requirement that the autopilot, if it is to be engaged below decision height, must be in AUTO/APP mode.

TSB Final Report A04P0041—Collision with Water

On February 29, 2004, a Consolidated Aeronautics, Inc. model LA–4–200 Buccaneer departed Delta Heritage Airpark, B.C., at about 13:10 Pacific Standard Time (PST) for a local VFR flight. The departure was normal and the engine was running smoothly. Some time later, the aircraft conducted a touch-and-go landing on the Fraser River on an easterly heading in Plumper Reach, adjacent to Crescent Island. The aircraft appeared to be descending for another landing when it hit the water in a nose-down, wings-level attitude, with a high vertical speed component. Boaters arrived at the accident site in less than one minute. However, the aircraft had already sunk and there was a little floating debris. Sections of the aircraft were recovered two days later, and the pilot's body was recovered almost three months later.

Findings as to causes and contributing factors

1. It is most likely that the pilot became incapacitated while piloting the aircraft, resulting in a loss of control and collision with the water.

Other findings

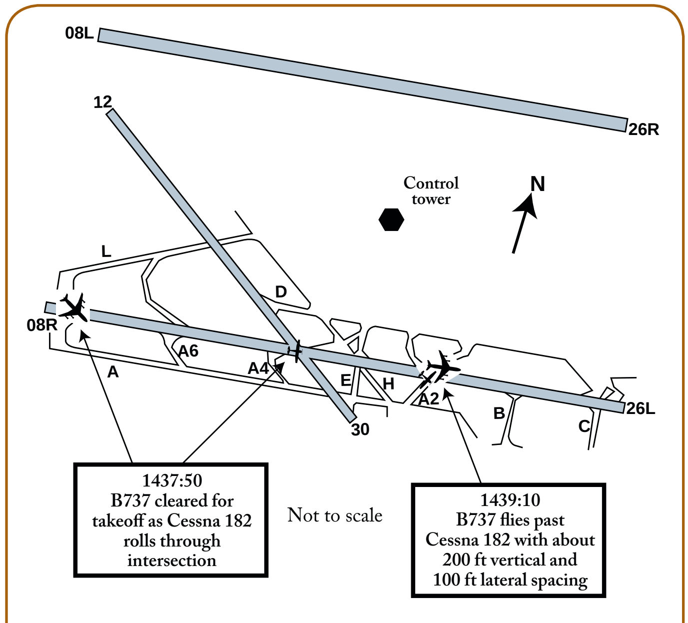
1. Although current pilot medical examinations are intended to ensure that pilots are medically safe to fly, a rational screening policy cannot detect every risk factor that could result in incapacitation.

Safety action

1. The Transport Canada Civil Aviation Medicine branch has initiated a project with the TSB to re-examine the accidents with known or suspected cardiac incapacitation during the past 10 years. This occurrence will be added to those to be studied. Following this review, more frequent or extensive testing may be proposed.

TSB Final Report A04P0047—Risk of Collision on the Runway

On March 3, 2004, a privately-owned Cessna 182 was on a day VFR flight from Victoria, B.C., to Vancouver International Airport, B.C. The aircraft's skin was unpainted aluminum. When the Cessna was about 5 NM from the airport, the Vancouver Tower south (TS) controller cleared the pilot to proceed directly to the threshold of Runway 08 right (08R); the active runway. At the same time, a Boeing 737 was taxiing to Runway 08R for departure to Calgary, Alta.



Vancouver International Airport

Just after the Cessna crossed the threshold, the TS controller cleared the Boeing 737, which was holding at the threshold, to take position on Runway 08R. When the TS controller saw that the Cessna had touched down, he instructed the pilot to exit the runway to the right at Runway 12, which was 4 500 ft from the threshold of Runway 08R, and to contact Vancouver ground control. The pilot correctly read back this instruction. Seconds later, when the TS controller assessed that the Cessna was turning off onto Runway 12, he cleared the Boeing 737 for takeoff. However, the Cessna pilot had passed the exit to Runway 12 and remained on Runway 08R. At about 14:37 PST, with the Boeing 737 now on its take-off roll, the TS controller was advised that the Cessna was still on the active runway. He immediately instructed the Cessna pilot to vacate the runway quickly at the next taxiway and to stay to the right-hand side of the runway. The Boeing 737 passed abeam of the Cessna, about 200 ft above and 100 ft to the left, while the Cessna was still on the runway at the entrance to Taxiway A2.

Findings as to causes and contributing factors

1. The Cessna's landing was faster and further down the runway than normal, causing the pilot to miss the exit at Runway 12 and invalidating the TS controller's air traffic management plan.

2. The TS controller perceived the Cessna to be turning off the active runway when in fact the Cessna remained on the runway. The TS controller cleared the Boeing 737 for takeoff without ensuring that the runway was clear of obstruction, resulting in a risk of collision between the Boeing 737 and the Cessna.

3. The Cessna pilot did not advise the TS controller that he was unsure of his position on the runway, or that he had missed the exit to Runway 12, thereby delaying the TS controller's recognition of the developing conflict.

4. Although the pilot of the Boeing 737 scanned the runway ahead before commencing the take-off roll, he did not detect the Cessna on Runway 08R, resulting in a risk of collision between the Boeing 737 and the Cessna. The Cessna's low visibility due to its lack of contrast against the background, its small size, and the distance between the two aircraft were probably contributing factors.

Findings as to risks

1. The visual scanning techniques used by controllers and pilots to detect and avoid conflicting traffic on or near a runway are not consistently effective in detecting all aircraft or other obstructions, thereby presenting a risk of a collision. Controllers who are not aware of the physiological limitations of human vision may not adjust their scanning techniques to compensate.

2. The pilot of the Cessna acknowledged an ATC instruction to exit Runway 08R at Runway 12, but missed the exit and continued on Runway 08R without advising the TS controller. There is no requirement for a pilot to immediately advise the tower when unable to comply with the exit instructions.

3. The airport surface detection equipment (ASDE) radar system is equipped with a runway incursion monitoring and conflict alert sub-system (RIMCAS) software program to provide an alert to the controller of a potentially hazardous situation on the runway; this alert system was still not operational as of March 2005.

Safety action taken

Transport Canada has noted that guidance material contained in the TC AIM, Section RAC 1.7, provides clear guidelines as to what pilots-in-command (PIC) are expected to do when they find an ATC clearance unacceptable, but it is not clear as to what PICs are expected to do when they cannot comply with an ATC instruction. Transport Canada will therefore amend the guidance provided in Section RAC 1.7 to indicate that PICs are expected to immediately advise ATC if they are not able to comply with an ATC instruction that they have received and acknowledged.

TSB Final Report A04C0051—Loss of Visual Reference—Collision with Terrain

On March 4, 2004, a leased Bell 206B helicopter was being ferried by two pilots from Kitchener, Ont., to the helicopter's owners in Calgary, Alta. On the day of the occurrence, the helicopter departed Regina, Sask., at 13:40 CST on a VFR flight plan for Medicine Hat, Alta. The flight was crewed by two pilots. A licensed junior pilot was flying the aircraft from the right seat, while the company's chief pilot, who was acting as an instructor and was assisting with navigational duties, occupied the left seat. At approximately 14:55 CST, they encountered snow showers that greatly reduced visibility, and the chief pilot assumed control of the helicopter. The visibility continued to worsen until the pilots encountered whiteout conditions and they lost all visual reference with the terrain. Shortly thereafter, the helicopter struck the snow-covered surface of a field 4 NM southwest of the Swift Current, Sask., airport. The aircraft was destroyed. The junior pilot sustained serious injuries, while the chief pilot suffered only minor injuries. The accident occurred during daylight hours at approximately 15:00 CST.

Findings as to causes and contributing factors

1. The chief pilot's decision to continue a visual flight into instrument meteorological conditions (IMC) resulted in his inability to maintain control of the helicopter, and as a result, the helicopter was inadvertently flown into the snow-covered terrain.

2. The chief pilot's decision to continue into deteriorating weather conditions was influenced by a mistaken expectation that the weather at Swift Current was better than the reported conditions, and by the pressure to reach Calgary on the day of the occurrence.

3. The pilots disregarded the safe limits with regard to VFR flight, as described in the CARs.

Findings as to risks

1. The pilots' use of GPS assisted them in navigating into weather conditions in which they could not safely fly the helicopter.

TSB Final Report A04P0110—Loss of Control / Parachute System Descent

On April 8, 2004, at approximately 20:30 Pacific Daylight Time (PDT), a Cirrus SR20 with the pilot and three passengers on board, took off on a night VFR flight from Kelowna, B.C., to Lethbridge, Alta., having originated in Seattle, Washington. The aircraft was climbing through 8 800 ft above sea level (ASL), when it veered quite sharply to the left. The pilot corrected the heading and continued the climb. About 45 seconds after resuming heading, the aircraft again veered to the left; again the pilot corrected the heading. Three minutes later, the aircraft reached the cruising altitude of 9 500 ft ASL. Approximately one minute later, with the autopilot engaged, the aircraft rolled 90° to the left. The pilot disconnected the autopilot, but found himself in a spiral dive from which he was unable to recover. He shut down the engine and deployed the Cirrus airframe parachute system (CAPS).

At approximately 21:11 PDT, the aircraft/parachute landed on a steep mountainside on the southern slope of Mount O'Leary, B.C., at the 2 300-ft level. The aircraft sustained substantial damage, but there were no injuries. A search and rescue operation was initiated. The four occupants were found and rescued early the following morning and returned to Kelowna by military helicopter.

Findings as to causes and contributing factors

1. While cruising at 9 500 ft with the autopilot engaged, the aircraft rolled 90°, left wing down for undetermined reasons, causing the pilot to lose control of the aircraft.

Findings as to risk

1. The armed emergency locator transmitter (ELT) did not activate due to the low impact forces, and was not manually turned on, making it difficult for the rescue helicopter crew to locate the downed aircraft.

2. The aircraft was overweight on departure from Seattle and Kelowna. Therefore, for all of the previous flight, and for much of the occurrence flight it was being operated outside of the envelope established by the manufacturer's flight testing.

Other finding

1. The CAPS was successfully deployed and likely saved the occupants from fatal injuries.

Safety action taken

The aircraft's impact forces, while being supported by the deployed parachute, are not great enough to assure activation of the aircraft's ELT. For that reason, the *Pilot's Operating Handbook* and *FAA Approved Airplane Flight Manual for the Cirrus Design SR20* state that after deployment of the parachute, the ELT is to be selected On.

The TSB is concerned that after losing control of an aircraft and deploying the parachute, the pilot may not remember to activate the ELT. Not having some form of automatic ELT activation increases the risk that the pilot will not be found in time.

TSB Final Report A04P0158—Loss of Control

On May 8, 2004, a pilot flying a privately-owned Cessna 305A float plane departed Ganges Harbour on Saltspring Island, B.C., at about 08:40 PDT (Coordinated Universal Time minus seven hours), and flew to Thetis Island, B.C., to pick up a passenger. They then took off on a local flight to photograph boats and fleet activities related to an annual regatta at Thetis Island. The passenger was seated in the rear cockpit. Both rear windows of the aircraft were opened inward and secured to permit photography. During low-level manoeuvring near the fleet, just before the accident occurred, the aircraft flew in an easterly direction, south of the fleet.

The aircraft was being flown in slow flight at a high power setting; the flaps were extended 15° to 20° and the nose of the aircraft was 10° to 15° nose up. During the initial portion of the pass, the aircraft's height was estimated to be 30 to 50 ft above the water. As the aircraft approached Thetis Island, the engine sound increased and the aircraft began to climb in a steep attitude to 70 to 100 ft above the water. The aircraft then banked sharply to the left and the nose dropped abruptly to a steep, nose-down attitude. There was no recovery from the descent, and the aircraft struck the water in a left-wing-down, nose-low attitude. The pilot was fatally injured on impact; the passenger escaped through the left-side rear window and was rescued from the water by nearby boaters.

Findings as to causes and contributing factors

1. The aircraft stalled at an altitude from which there was insufficient time or altitude to recover.

2. High ambient sound levels reduced the effectiveness of the aural stall warning system.

3. Mounting the stall warning system under the dash placed it outside the pilot's normal field of view and rendered the visual stall warning ineffective.

4. Improperly-placed airspeed range markings eliminated their effectiveness as visual indicators of the normal safe-flight ranges.

TSB Final Report A04A0050—Main Rotor Overspeed—Difficult to Control

On May 15, 2004, an AS350-B3 (Astar) helicopter was conducting aerial surveillance off the coast of Tabusintac, N.B., at an altitude of 700 ft ASL. During a right turn, at approximately 16:00 Atlantic Daylight Time (ADT), the cockpit alarm sounded, accompanied by illumination of the red governor (GOV) warning light. The pilot continued the right turn and headed toward the shore for a precautionary landing. Seconds later, the rotor RPM increased above the maximum limit, and a severe rotor vibration developed. The pilot lowered the collective and reduced twist grip throttle, but there was no apparent reduction in rotor RPM. Believing that manual control of the throttle was lost, the pilot reopened the throttle to the "FLIGHT" detent, and tried to reach the overhead fuel control mode selector switch to move it to the manual position; however, the severe vibrations made it difficult to activate the caged switch. The pilot then raised the collective, attempting to decrease rotor RPM, but there was no apparent change. The aircraft was in a rapid descent and nearing the ground, so the pilot focused on landing the aircraft. After landing, a severe ground resonance developed, and the pilot lifted the helicopter into a hover to stop it. The vibrations continued, so the pilot landed a second time then pulled the ceiling-mounted fuel shut-off lever to shut down the engine. After the main rotor came to a stop, the pilot and two passengers exited the helicopter uninjured.

Findings as to causes and contributing factors

1. The pilot had not received adequate flight training for the red GOV light emergency, and did not realize that the twist grip throttle still controlled fuel flow to the engine. Consequently, the emergency was mishandled, resulting in a severe overspeed of the aircraft's dynamic components.

2. Examination of the digital engine control unit (DECU) confirmed the origin of the red GOV light to be an internal component "U 13 optocoupler" of the DECU.

TSB Final Report A05P0032—Settling with Power—Roll-Over

On February 11, 2005, a Bell 212 helicopter was being used in heli-ski operations near Whistler, B.C. After operations on one glacier with two groups of skiers, the guides and the pilot agreed to move to the Spearhead Glacier. The skiers and guides were dropped off at the top of the glacier, and the pilot chose to pick up the skiers near the toe of the glacier. The first group down the glacier comprised 11 skiers. During takeoff from the toe of the glacier with this group, the helicopter began to settle as it turned downwind. The pilot turned it back toward the take-off area, but the helicopter continued to settle with full power applied. The helicopter struck the snow in a level attitude, turned over, and came to rest on its right side. The helicopter was substantially damaged. The main rotor chopped the tail off, the nose was crushed, and the battery was ejected. There was no fire. The passengers and pilot escaped with only minor injuries.

Finding as to causes and contributing factors

1. Given the helicopter's gross weight, its close proximity to the glacier, and the strong downflowing winds, the helicopter was not able to climb high enough to clear the surrounding terrain. When the pilot aborted the departure, the helicopter settled with power onto the snow, dug in, and rolled over.

Other finding

1. The fact that the helicopter was equipped with stainless steel fuel line fittings and that passenger briefings were enhanced, helped to minimize injuries from this occurrence. △

Erratum—Lost in Translation!

An alert ASL reader caught a translation error on page 16 of ASL 3/2005, in the occurrence summary for A05Q0016. The third sentence, "The pilot tried in vain to correct the path using the *tail rotor control* pedals" should have read: "The pilot tried in vain to correct the path using the **rudder** pedals." —*Ed.*

The Safety Spectrum

by Bryce Fisher, Manager, Safety Promotion and Education, System Safety, Civil Aviation, Transport Canada

This article was originally published in ICAO Journal*, Volume 60, Number 4 (July/August) 2005, reprinted with permission.*

Regulators must oversee companies and people that reflect the entire safety spectrum

Commitment to safe operations varies from company to company, requiring that the regulator develop multiple strategies to ensure compliance with minimum safety standards and provide the right inducements to advance safety management thinking.

We often hear or use the term "minimum safety standards," which implies the existence of an absolute floor below which things are deemed unsafe, but also the potential for a higher standard. In other words, there is a spectrum to safety, and people and organizations can be positioned along this spectrum according to the way they act in reconciling safety, business and management issues.

When one looks inside an organization, it is apparent that certain actions are rewarded while others are sanctioned. Managers and employees learn these patterns and conform. This pattern of values, expectations and behaviours becomes the organization's culture. Certain cultures can advance the cause of safety; while others are counter-productive. The safety spectrum attempts to position the range of cultural attributes and associated approaches to safety management.

Regulators interact with companies and persons across the safety spectrum. They need, therefore, to respond in a fashion appropriate to the behaviours exhibited by the organization or individual. They must develop appropriate strategies to ensure compliance with the minimum safety standards and provide the right inducements or bridging strategies to advance safety management thinking.

The safety spectrum brings together current thinking on safety, management, and business issues. While the notions put forth here relate to safety, they can apply equally to areas such as aviation security, health, and the environment. Management of such issues is virtually the same, notwithstanding the need for a specialized vocabulary, information and expertise.

The safety spectrum draws its inspiration from First Environment Inc.—an environmental consultancy—and is an adaptation of its "Green Spectrum®". It incorporates the safety thinking of James Reason, Charles Perrow and Patrick Hudson; the risk management thinking of A. Ian Glendon and Alan Waring; the business and management thinking of Forest Reinhardt and Joan Magretta; and the regulatory thinking of Malcom K. Sparrow.

Safety spectrum categories

The first category in the safety spectrum, "compliance as cost," lies at the end of the spectrum where "borderline" operators and individuals are found: these are the companies or persons that have difficulty complying with the minimum safety standards.

These companies and individuals have difficulty complying with standards because they view compliance as a cost and are driven to minimize compliance expenditures, addressing problems only after they have been caught violating regulations and are forced to comply. More often than not, the "repairs" they perform are superficial and are meant to satisfy the regulator in the short-term. These companies usually blame someone else and take action against the culpable employees who got caught—usually through their dismissal. Once the "guilty" parties and the regulator are out of the picture, these operators revert to their old ways.

Companies or individuals in this category operate in the extreme short term. They would appear to prefer to run the risk of being caught again rather than investing in reforms to their safety system, if indeed they have one. Sometimes fines are treated as a licence to continue to break the rules, the oft-heard "cost of doing business."

The organizational cultural label attached to such behaviours is "pathological," according to aviation human factors expert Ron Westrum, who developed the series of labels identified in this article.When an accident happens, pathological companies or individuals will run and hide, deny, blame or fold.

Regulators are left with little choice in attempting to alter the behaviours of pathological operators. They are obliged to engage in significant surveillance and enforcement activities. The underlying regulatory philosophy is one where regulators are compelled to prescribe and enforce; they must catch the "illegals" in the act.

It is unfortunate that the iron fist of enforcement and all its trappings—namely, surveillance, fines, suspensions, judicial or administrative proceedings—is the only stimulus to which this category of operators will respond and that, in this day and age, regulators are still obliged to expend significant resources on companies and persons in this category.

The second category, "safety as compliance," describes those companies or persons that view safety as compliance with current safety standards—no more, no less. Their hearts and minds are in the right place and they want to comply with the regulations, though they may not be successful 100 percent of the time. The reason for their non-compliance may be that they just do not know better or are motivated to avoid fines, suspensions or other forms of official sanction. To this end, companies or persons attempt to develop and implement compliance programs, such as internal inspections and audits, and often invoke a system of rewards and punishments to support these programs.

Companies or persons within this category are tactical rather than strategic in their safety thinking. They seek formal recognition from regulators, such as compliance certificates and the like, in order to allay their customers' safety concerns, satisfy their insurers and continue to operate.

Working under the assumption that compliance translates into safety, these companies or persons are sometimes surprised when they have an accident; they have yet to understand that compliance alone will not prevent an accident from happening. When one occurs, these operators are quick to find a "fix" to continue operating. The organizational culture attribute assigned to these companies or persons is said to be reactive.

The regulator's job is somewhat easier here than in the previous category, although intervention is still required at an operational level. This approach is one of helping operators to better understand how to help themselves. The tools available to the regulator are educational in nature (e.g. interpretation of regulations and standards) and involve assisting operators in the development and implementation of compliance programs. Regulators may still have to revert to an enforcement posture under some circumstances. The underlying regulatory philosophy here is one where operators must demonstrate compliance.

Companies or persons in the third category, "safety as risk," have a broader view of safety. They recognize that compliance alone cannot address every safety issue, and admit that there will always be risks in aviation that should be managed.

Companies or persons that fall within this category are motivated to keep their costs in check and manage any short- to mid-term impact untoward events may have on their reputation, their position in the market, or their brand. They are anticipatory, and attempt to identify hazards before they manifest themselves. They eliminate the hazards or hazardous operation, institute controls to reduce the likelihood of hazards and the scope of their effects, or take measures to contain them.

These organizations are organic and learn from their experiences. Thus they have remedial strategies in place to ensure that safety lessons are learned and disseminated and that long-lasting reforms are applied to the safety management system (SMS). These and other safety programs and program enablers, such as reporting systems and the like, are integrated into one single system and applied across the operations of an aviation concern.

From an organizational culture perspective, companies in this category are deemed "calculative" because, as stated by Patrick Hudson in his keynote address to the Canadian Aviation Safety Seminar (CASS) in 2001, "great value is placed upon systematic and managed approaches to operational safety." Put differently, companies or persons in this category develop and implement operationally oriented SMSs. This seems to be the destination desired by many aviation regulatory bodies.

As companies evolve from compliance to safety management thinking, so too must regulators. They must transform themselves from regulatory compliance auditors into system evaluators, as the underlying philosophy here shifts the onus for proving or disproving safety from the regulator to the organization in question.

For the most part, regulatory inspectors are former pilots, air traffic controllers, mechanics, engineers, etc. They are accustomed to dealing directly with their industry peers at a tactical level. But with SMS, this changes. Inspectors are called upon to intervene at a more strategic level, and are required to interact with system managers whose motivations, contingencies, views, frame of reference and language may be completely new to them.

The learning curve may be steep, but is well worth the journey. Robust SMSs that are rigorously applied and in which regulators have confidence can set the course toward a degree of self-regulation.

This level of independence is a good thing. Companies can address emerging hazards before they manifest themselves in advance of, or in the absence of, a regulatory response. They will have the flexibility to address issues in innovative, effective and efficient ways. In the meantime, regulators can focus their resources on those operators in the first two categories that typically demand higher levels of oversight and intervention.

In the fourth category, "safety as opportunity," are found operators that can leverage their safety management capability to their economic benefit. These companies have longer-term outlooks. They are particularly responsive to their customers' and stakeholders' interests in the area of safety.

The strategy of these operators is to include safety issues in their marketing and other business processes as well as their operational decisions. In other words, the business and safety management strategies implemented under an SMS are integrated.

A variety of business strategies, such as product and service differentiation, competitive positioning, cost reduction and risk management, among others, are available to do just that. But the success of any one of these strategies or combination thereof depends on the structure of the industry, the position of the company within the sector, and the managerial acumen of the organization's managers.

Operators in this category foresee problems or issues before they arise and find solutions, translating their successful management of these issues into an economic advantage. Operators in this category are described as proactive.

Companies at this level of safety management maturity see economic advantage to holding themselves to a higher safety standard. From a strictly safety standpoint, they are self-regulating. With this kind of scheme in place, typically a company's approach to safety management is documented and incorporated by reference in government legislation as a formal standard, and the regulator is provided with the means to hold the operator accountable to its own standards. Under this scheme, the role of the regulator is focused on monitoring the safety performance of the company, as reported by the company. The resources needed for exercising this type of oversight are reduced even further than in the previous category.

In essence, this approach introduces the potential for customized regulation. The role of the regulator under a self-regulating scheme needs to be well defined, but clearly it can be diminished significantly, provided certain assurances are built in to that scheme.

At the advanced end of the spectrum, safety is fully integrated into the business. It is part of a company's overall operating principle, and is reflective of its core values. For operators at this end of the spectrum, the overarching philosophy is one of business sustainability and profit maximization in the long term.

Companies in this category incorporate incentives and contingencies so that all executives are accountable for meeting social as well as financial and other business goals. Their strategy is to build safety and other social issues right into their business model. This translates into a cohesive and comprehensive management system that informs and guides every aspect of business management. The corporate culture of such companies is said to be generative.

Moreover, such companies seek to involve their partners and stakeholders in adopting best practices for mutual benefit. This can be achieved through private forms of regulation. Companies and their operating partners come to terms with a standard approach to safety management and, through a third party, hold each other accountable for meeting those standards. The third party that is working for, but independent of, any partner has the responsibility for developing and maintaining the standard and policing its application across the partnership network.

Failure of any one partner to meet the standard is viewed as detrimental to the network and to the industry as a whole, and the spectre of being banished from the network is the largest economic incentive for partners to uphold the tenets of the standard. Partnership networks such as the Star Alliance, oneworld, Sky Team and so on are well positioned to contemplate such an approach.

Within the boundaries of a given country, the regulator's role does not change much here from the previous one. However, as most of these partnership networks are likely to cross jurisdictions, a collective approach among regulators is necessary.

At this juncture, it may be instructive to compare the notions put forward in the safety spectrum with those related to the latest trend in management circles: corporate social responsibility, or CSR.

In the December 2004 issue of the *Harvard Business Review*, Simon Zadek, CEO of AccountAbility and a senior fellow at Harvard University's John F. Kennedy School of Government, examined Nike's progression toward becoming a "leader in progressive practices." Zadek observes that the lessons learned from the Nike experience lend themselves to other organizations.

Zadek argued persuasively that the path toward corporate social responsibility lies in a "company's journey through two dimensions of learning: organizational and societal." He went on to map out five stages of organizational learning that are worthy of repetition here.

Stage	What organizations do	Why they do it
Defensive	Deny practices, outcomes, or responsibilities.	To defend against attacks to their reputation that in the short term could affect sales, recruitment, productivity, and the brand.
Compliance	Adopt a policy-based compliance approach as a cost of doing business.	To mitigate the erosion of economic value in the medium term because of on-going reputation and litigation risks.
Managerial	Embed the societal issue in their core management processes.	To mitigate the erosion of economic value in the medium term and to achieve longer-term gains by integrating responsible business practices into their daily operations.
Strategic	Integrate the societal issue into their core business strategies.	To enhance economic value in the long term and to gain first-mover advantage by aligning strategy and process innovations with the societal issues.
Civil	Promote broad industry participation in the corporate responsibility.	To enhance long-term economic value by overcoming first-mover disadvantages and to realize gains through collective action.

Table 1. The fives stages of organizational learning

It is interesting to note the similarities between the organizational culture attributes of the safety spectrum and Zadek's five stages of organizational learning. The path toward more advanced safety management thinking, it seems, resembles that put forward by Zadek.

A word of caution: The safety spectrum consists of generalizations about issues and behaviours. Categorization in this sense is simple. Any practical application of the safety spectrum, however, is not so easy.

The categorization of individual operators is dependent on a variety of factors not described here. These include but are not limited to:

- the size and scope of the operator in question;
- the complexity of the operations;
- the organizational structure and coordinating mechanisms;
- the business model and processes;
- the company's position within the sector; and
- the level of corporate maturity as compared to the overall maturity of the industry.

In addition, categorization is based on whether the operator is subject to individual, systemic and/or organizational type accidents, as well as the parties at risk and their level of risk tolerance.

In many respects, safety is a social issue. Akin to the stages of "issue maturity" depicted in Table 1, the maturity of SMSs has reached the level where SMS is about to be institutionalized globally in legislation and in business practice. It is fast becoming the new norm, and the way business is done.

This is encouraging. Safety management thinking is taking firmer root in aviation circles. And, if they do their homework well, aviation companies and regulators could usher in the era of self-regulation. Look to mega-carriers or alliances to set the stage for this to happen, with the establishment of SMSs for their current and would-be partners.

The position of operationally-oriented SMSs within the safety spectrum should be clearer. But their potential has yet to be fully realized for the benefit of aviation companies, their customers and stakeholders, and the regulators.

By integrating SMSs and business practices, the aviation industry stands to gain better safety performance with less regulatory intervention. As to how far we want to go depends on the companies, regulators and, in essence, everyone involved in aviation.

		Category 1	Category 2	Category 3	Category 4	Category 5
COMPANIES	View	Compliance as Cost	Safety as Compliance	Safety as Risk	Safety as Opportunity	Safety is a Fully Integrated Business Practice
	Issue	Reducing costs	Sanctions (fines, jail, suspensions, etc.)	Waste	Customer/ stakeholder interests	Sustainability
	Driver	Minimize compliance expenditures	Minimize sanctions	Minimize costs	Maximize revenues	Maximize profits
	Process	Comply when forced to and attribute blame	Internal inspections and audits supported by an internal system of rewards and punishments	Integrate safety programmes	Include safety issues in marketing and operational decisions	Fully integrate safety options and issues into all aspects of business
	Approach to safety management	Devoid of any approach to safety management	Compliance strategies	Safety Management Systems (SMS)	Safety Management Systems (SMS) + Business Strategies	Safety Management Systems (SMS) + Business Strategies + Business Modeling
	Cultural label	Pathological	Reactive	Calculative	Proactive	Generative
REGULATORS	Approach	Surveillance Enforcement	Educating for compliance Assist in implementing self-audit programmes	Evaluate/assess management system	Monitor	Monitor
	Philosophy	Prescribe Enforce	Companies demonstrate compliance	Companies demonstrate safety performance	Self-regulating	Private regulation
	Resource distribution	Regulator resources				Company resources

Table 2. The safety spectrum: companies found at the low end of the safety spectrum operate in the extreme short term, while those operating at the advanced end of the spectrum fullly integrate safety into their business model. △

Note: All aviation accidents are investigated by the Transportation Safety Board of Canada (TSB). Each occurrence is assigned a level, from 1 to 5, which indicates the depth of investigation. Class 5 investigations consist 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 are all "Class 5," and are unlikely to be followed by a TSB Final Report.

— On April 25, 2005, a basic ultralight **powered parachute** was being manoeuvred at low altitude to inspect a field for future use as a landing site. The canopy caught a tree and the cart section of the aircraft fell to the ground critically injuring the pilot (sole occupant) who later died in hospital. The aircraft was a two seat side-by-side model equipped with two lap belts but no shoulder harness. The pilot was in the right-hand seat and was wearing the seat belt and a helmet. There was no post-impact fire. *TSB file A05P0083*.

— On May 5, 2005, a **Chinook Plus 2 ultralight** aircraft was in cruise flight when the top hinge of the rear door failed. The door opened into the airstream, which caused the bottom hinge to fail. The door separated and went through the wooden propeller. All three blades of the propeller failed, which necessitated a forced landing on Highway 503. During the landing roll, the right main wheel struck a highway approach and was torn off. The pilot was not injured. *TSB file A05O0092*.

— On May 27, 2005, the pilot of a **Cessna 185** was going to pickup some fishermen on a lake situated approximately 20 NM east of St-Donat, Que. The weather conditions were marginal and glassy water conditions prevailed. The pilot misjudged the flare over the water and the aircraft flipped on touchdown. The floats were torn off on impact and the aircraft sank. The pilot exited the aircraft without difficulty and was rescued by nearby cottagers. The aircraft was substantially damaged. *TSB file A05Q0086*.

— On May 29, 2005, the pilot of a **Piper PA-28-140** was conducting touch-and-goes at his grass-surface airstrip at Crooked Lake, B.C., about 6 mi. southeast of Bridge Lake, B.C. The pilot was the sole occupant, but the aircraft had full fuel tanks, as well as two 25-kg sacks of grass seed on board to simulate the weight of passengers. Although initially the touch-and-goes were conducted with the takeoffs into the wind and the following climb out was unobstructed over the lake, the pilot later attempted a touch-and-go in the opposite direction. The aircraft crashed immediately after turning to avoid trees at the end of the runway, fatally injuring the pilot. The temperature at the time of the accident was 32°C. The airstrip elevation is approximately 3 800 ft ASL. *TSB file A05P0115*.

— On June 12, 2005, a **Bellanca 7GCBC** aircraft was on climb out with a glider in tow. At approximately 200 ft AGL, the glider pulled along side the tow aircraft and was slowly overtaking it. The tow aircraft was then observed to bank sharply to the right, pitch nose down, and descend until it struck trees in a field. When the tow aircraft pitched nose down, the glider pilot released the tow rope and turned towards the airport, where he carried out a safe landing. Witnesses on the ground rushed to the scene where they found the tow aircraft pilot seriously injured and the aircraft substantially damaged. The aircraft had taken off from Runway 10 and the wind was reported to be fluctuating between 170° to 180° at approximately 10–15 kt. The atmospheric conditions were described as extremely warm and humid. *TSB file A05O0118*.

— On June 13, 2005, a **Cessna A188B Ag Truck** was engaged in a low-level canola seeding operation near Altona, Man. While the pilot was aligning the aircraft for the next pass, the aircraft's right wing contacted the soft earth and the aircraft yawed violently to the right and struck the ground. The pilot sustained serious injuries and the aircraft was destroyed. *TSB file A05C0108*.

— On June 21, 2005, an **Astar AS350BA helicopter** was slinging a wooden log cabin frame on a longline. The load hit trees on initial lift off out of the restricted area and swung to hit a parked helicopter on the ground, also an AS350BA. The tail section of the parked helicopter was struck by the load, causing it to pivot 10°. The vertical fin, lateral fin, tail rotor gearbox, and tail rotor of the parked Astar were substantially damaged. The slinging Astar was not damaged. *TSB file A05Q0101*.

— On June 24, 2005, an **amateur-built RV-9A** aircraft took off from Runway 14 at the Salmon Arm, B.C., airport for a local test flight. Once airborne, the pilot heard a loud wind noise and realised the canopy was not latched shut. He tried to engage the latch but was unable to because of the air loads acting on it. He returned to land on Runway 14, holding the latch with one hand, as he was uncertain of the aircraft's behaviour with the canopy open. He touched down faster than normal and bounced. Because he was holding the canopy latch with his left hand he was unable to apply power easily to cushion the bounce. On the second touch down, the nose wheel collapsed, the aircraft veered to the right, and turned over on its back. The aircraft was substantially damaged. The pilot was uninjured. *TSB file A05P0152*.

— On June 29, 2005, an **amphibious Cessna 208** aircraft flew a short flight (approximately 15 NM) from the Parry Sound, Ont., airport to Lake Joseph, Ont., to pick up passengers. The aircraft touched down with the amphibious wheels extended, and the aircraft overturned on landing. The pilot, the sole person on board, was not injured. The aircraft sustained substantial damage and was towed to a marina for recovery. *TSB file A05O0131*.

— On June 30, 2005, a **Hughes 369D helicopter** was performing a training flight, including autorotations, in the Bonnyville, Alta., area. During the flare of a power-on recovery autorotation, the tail rotor struck the ground, resulting in substantial damage to the tail rotor blades. There were no injuries to the two pilots on board. *TSB file A05W0131*.

— On July 3, 2005, a **de Havilland DHC8** was holding on Taxiway Lima 4 at the Vancouver, B.C., international airport, behind a Boeing 737. An **Airbus A330** was taxiing past Taxiway L4 to the threshold of Runway 08R via Taxiway Lima. As the A330 passed behind the DHC8, a wingtip struck the tail of the DHC8. Both aircraft were damaged and returned to the apron. *TSB file A05P0163*.

— On July 3, 2005, a **Bell 206L-3 helicopter** was departing from its company base to reposition to the fire base at Manning, Alta., to commence fire suppression activity. During the lift off, the right skid of the helicopter contacted some full fuel drums next to the helipad, resulting in a dynamic rollover to the right. The pilot was uninjured; however, the helicopter sustained substantial damage. *TSB file A05W0133*.

— On July 8, 2005, a **Cessna 206** took off from the company float plane base on the St-Maurice River, near Latuque, Que., with two passengers on board. Fog was present in most low-lying areas that morning, but the sky could be seen through it. Immediately after takeoff, the pilot lost reference to the ground, but thought that he would break through the fog layer quickly. Although he attempted to follow his directional gyroscope (DG) to maintain heading, the aircraft banked slowly left and struck trees. The aircraft came to rest nose down in the trees on the side of a hill, 3 NM from the take-off area. Occupants of a nearby boat on the river heard the crash and called 9-1-1. The pilot walked to the riverbank to hail down the boat and get help. Police, ambulance and firefighters were on the scene quickly and the occupants were brought to hospital. The aircraft was substantially damaged. *TSB file A05Q0116*.

— On July 9, 2005, shortly after takeoff, the engine on the **Starduster** aircraft started to run rough, and eventually stopped. A forced landing attempt was made on a small dirt road approximately 10 km west of the airport. The aircraft landed on the road, but a wingtip caught on vegetation and the aircraft was forced off the road. The aircraft nosed over and went end-over-end, breaking the fuselage behind the cockpit. The pilot, who was using a five-point harness, was not injured. He was also protected by the strength of the overhead wing structure. *TSB file A05A0081*.

— On July 9, 2005, the pilot of a **Piper PA18-150** was conducting a landing on Lake Okanagan near Kelowna, B.C. During the step taxi, the aircraft hit a boat wake and flipped over. The pilot was able to evacuate the aircraft unassisted and was rescued by a passing boater. The pilot suffered minor injuries. *TSB file A05P0169*.

— On July 25, 2005, an **amateur-built Rotorway Jetexec (turbine upgrade) helicopter** departed Ootsa Lake, B.C., for a short 20 NM flight to Francois Lake, B.C. It was reported missing when it failed to arrive at destination. The helicopter was not equipped with an emergency locator transmitter (ELT). The helicopter was found on the shoreline of Ootsa Lake on July 26 at about 16:45 Pacific Daylight Time (PDT). The pilot was fatally injured. *TSB file A05P0184*. △

Coming Soon! Helicopter Ground Crew Safety Video

System Safety specialists have been actively working on a brand new safety video, *Keep Your Eyes on the Hook! Helicopter External Load Operations—Ground Crew Safety*, aimed primarily at helicopter ground crews involved in external load operations. The video contains several scenarios and testimonials on precarious and challenging slinging operations from all regions in Canada. This is a must-see, not only for helicopter ground crews, but helicopter pilots, operators and the clients who use such heli-services. The expected release date is spring 2006. Check our Web site soon at: *www.tc.gc.ca/civilaviation/systemsafety/pubs/menu.htm* for this new video, or for a list of our existing safety promotion products. △

Bumps in the Night

by Adrian A. Eichhorn

This article is an authorized reprint from the March 2005 issue of Aviation Safety *magazine.*

Flying at night really isn't more dangerous than during the day, but it can be less forgiving. It just requires more planning and more care.

When pilots inevitably gather to discuss the various risks of certain flight operations, flying over mountains, in IMC [instrument meteorological conditions] or at night is always a lively topic. Someone will point out that, being an inanimate object, the airplane doesn't know what time it is, what the weather is or what it's flying over. Someone else will point out the illogic of refusing to fly at night, while another pilot will draw a line in the sand against it. Regardless of whether flying at night gives you the willies, is night flying really more dangerous than in the daytime?

Night-time flight operations offer a number of benefits when compared with flying the same route during the daylight hours. The air is generally smoother, there's less traffic, controllers are not as busy and can be more helpful, and traffic can be easier to spot. The only real problem is, well, it's dark. And, while it seems simple enough, because a pilot's ability to see and avoid unlighted objects is impaired at night, pilots need to plan ahead and respect the differences. As we shall see, finding and avoiding those objects can mean the difference between a safe, relaxing night flying experience and something else.

Differences

Unlike, say, continuing VFR into IMC, or reckless operation, there is no formal category for an aviation accident occurring during night-time flight operations. Instead, accident investigators simply round up the usual suspects after they collect all the necessary information and when they write a final report. Sometimes, the accident investigator's equivalent of an asterisk is appended to a report, noting that the event occurred at night.

Take, for example, the December 9, 2003, fatal crash of a Piper PA-28-181 in Sugar Land, Texas. The 350-hour non-instrument-rated private pilot was attempting a night landing in good visual conditions. After the pilot confirmed to the controller he saw the runway, the flight was cleared to land. Instead, the airplane struck power lines running perpendicular to the approach end of the runway, which featured a displaced threshold of 1 964 ft. Both aboard the Piper died in the crash. At the time, wind at the airport was reported from 320°, at 16 kt gusting to 25 kt. The NTSB [U.S. National Transportation Safety Board] determined the probable cause was the pilot's failure to avoid power lines and noted the night-time conditions and the high winds.

Later that month, on December 26, 2003, a Cessna 177RG was substantially damaged when it hit a deer during the landing rollout at Waterloo, Iowa. Again, night visual conditions prevailed. Neither the private pilot nor the ATP [airline transport pilot]-rated passenger was injured.

These two accidents demonstrate that, yes, night flying requires more careful operating practices. Rarely are power lines marked for night operations, but displaced thresholds are. Similarly, few deer are equipped with position lights, but airplanes have been known to collide with deer and other wildlife in broad daylight, too.

And then there's CFIT

Similarly, controlled flight into terrain (CFIT) accidents can happen in broad daylight, but operators are especially vulnerable after the sun goes down. A good example occurred on November 19, 2003, near Bellevue, Idaho, when a Cessna T210N crashed in night visual conditions while manoeuvring to land. The solo pilot was killed.

After informing the local controller that he was going to perform a 360° turn to "lose altitude if that's okay," and being cleared to land, there were no further communications. The Cessna's wreckage was located 307 ft below the summit of a mountain 6 NM southeast of the destination airport. The airplane had impacted on a south-westerly heading in a slightly right-wing-low, level attitude. The NTSB noted the mountainous terrain, high winds and the dark night in its finding of probable cause.
Another example of why there is increased risk of a CFIT accident at night occurred on December 22, 2003, in Missoula, Montana. After a night-time takeoff, two pilots flew a pressurized Beech Baron 58P into open terrain,

with one of them suffering minor injuries. The aircraft was destroyed by a post-impact fire.

Shortly after taking off for the night flight in IMC, the flying pilot—who had no previous flight time in this make and model—made a right turn from the runway heading at about 400 to 500 ft AGL to join the departure procedure. During the turn, a "thump" was felt and the right bank angle increased from about 25° to 45°. While the second pilot was attempting to correct the increased bank angle, the aircraft entered a descent. Just before hitting open terrain one mile south of the runway, the PIC [pilot-in-command] took control and levelled the wings. The aircraft skipped across open terrain for several hundred yards before coming to rest on its belly. Neither pilot could recall scanning the instruments to verify a climb or descent.

Predictably, the NTSB determined the accident's probable cause to include the second pilot's failure to maintain terrain clearance while manoeuvring after takeoff. Additionally, the Board gigged the PIC for inadequate supervision and noted the night-time conditions.

It's likely that neither of these two CFIT accidents would have happened in daylight, since it would have been easier for the crews to see and avoid the terrain. But if you choose to fly at night, especially in the mountains or away from well-lit areas, extra precautions must be taken to identify and avoid potential hazards that you just can't see.

The above poster (TP 13717E) was part of our comprehensive safety education campaign on night VFR flight a few years ago. A large colour version of this poster can be obtained by contacting Transact at www.tc.gc.ca/transact/.

Playing tricks

Of course, proper planning and exercising additional cautions are not the only keys to successful night-time flight operations. To identify and avoid those potential hazards, we must also understand and compensate for the tricks our eyes can play at night.

The eye's physiology creates several limitations on our ability to visually acquire objects at night. Perhaps first and foremost is the eye's requirement to become accustomed to low light levels. Bright cockpit lighting can drastically impair our ability to see lighted objects outside the aircraft. Other darkness-related visual limitations include autokinesis (stationary objects appear to move), the so-called "Purkinje Shift" (certain colors are perceived differently) and the need to compensate for the eye's natural night-time blind spot by using our peripheral vision. Understanding and compensating for these unavoidable dark-light vision limitations can make our night flying experience much safer.

Conclusion

Flying between sunset and sunrise can be especially enjoyable, if pilots understand and are prepared for the differences with which they must contend to ensure safe operations. Identifying and avoiding obstacles and terrain while compensating for the eye's physiology are key. So is ensuring the airplane is properly equipped and that the proposed flight doesn't present any additional challenges because of darkness. If it does, it's your responsibility to determine if the additional risks are worth it and whether they can be properly managed.

Pay attention to the details at your departure and destination airports, ensure you have sufficient altitude to clear obstacles and terrain, and do some "what-if" planning to avoid that inevitable bump in the night.

For subscription and other information, call 800 424-7887 or visit www.aviationsafetymagazine.com. △

Night VFR Video *Black Holes and Little Grey Cells—Spatial Disorientation During NVFR*

We would like to remind our audience of the availability of our excellent aviation safety video on night visual flight rules (NVFR) operations. The 10-minute video is called *Black Holes and Little Grey Cells—Spatial Disorientation During NVFR* (TP 13838E). It addresses NVFR, black hole illusion, somatogravic illusion and other traps and challenges facing pilots flying VFR at night. The video also contains some recommended procedures and practices that will assist pilots in making their night VFR flights as safe as possible. This video and the poster depicted above are also included in the *System Safety Summer Briefing Kit*, which is described on page 38 of this issue of the ASL. The video is available individually for loan from your Regional System Safety Office, or can be purchased from the new Transport Canada Transact Web site at www.tc.gc.ca/transact, or by calling the Civil Aviation Communications Center at 1 800 305-2059. △

When a Runway is Not Long Enough to Land On

by Gerard van Es, National Aerospace Laboratory NLR, Amsterdam, Netherlands

A good landing is one that you can walk away from.
A great landing is one where you can use the aircraft again.
Anon.

On 18 December 2000, the crew of an Antonov 124 conducted an instrument landing system (ILS) approach to Runway 25 at the Windsor, Ont., airport. Because of the weather minima on Runway 07, the aircraft was landed with a 4-kt tailwind component. The aircraft was about 20 ft higher, and about 6 kt faster, than recommended when it crossed the threshold of Runway 25. Consequently, the aircraft touched down well beyond the normal touchdown point (3 400 ft from the threshold). The runway was covered with a trace of loose snow, which reduced braking friction and lengthened the landing roll. Finally, the aircraft could not be stopped, and overran approximately 340 ft past the end of the runway. There were no injuries, and the aircraft sustained minor damage. Source: TSB Report Number A00O0279.

Antonov 124 overrun at the Windsor, Ont., airport, 18 December 2000

Each day, thousands of landings are made worldwide. Most aircraft land on runways that are longer than the minimum required length. However, each year there are occurrences reported in which the aircraft could not be stopped on the runway during landing. These occurrences are known as overruns. Many of these overruns are classified as minor incidents, as they do not result in significant damage to the aircraft or injuries to the occupants. However, when the aircraft enters a ditch, an embankment, or collides with an obstacle, the result of the overrun can be more dramatic. This is clearly illustrated by the landing overrun accident with an Airbus A340 that occurred recently at the Lester B. Pearson International Airport in Toronto, Ont. Unfortunately, there are many more examples like this accident.

Why do aircraft overrun? In order to answer this question, it is worthwhile to consider how a landing should be conducted (at least according to the textbook). In short, a "good" landing has the following characteristics: it starts with a stabilized approach on speed, in trim and on glide path; during the approach, the aircraft is positioned to land in the touchdown zone; when the aircraft crosses the threshold, it is at the correct height, speed and glide slope; the approach ends in a flare without any rapid control column movements, which is followed by a positive touchdown without floating; and immediately after touchdown of the main gear, the spoilers (if available) are raised (manually or automatically), the brakes are applied (manually or automatically), the reverse thrust or propeller reverse is selected (if available), and the nose is lowered. These actions are all conducted without delay and according to the standard operating procedures (SOP). This is the landing as it can be found in flight crew training manuals. Of course, not many landings are conducted exactly like this every day. Deviations from this practice often occur without any serious consequences. However, when there are large deviations from the "good" practice, it can become more difficult to stop the aircraft on the runway.

In 2005, a study was conducted by the National Aerospace Laboratory NLR, with the objective of identifying and quantifying the factors that increase the probability of a landing overrun. For this purpose, 400 landing overrun accidents that occurred with commercial transport aircraft were analyzed. This study revealed some interesting facts, which will be briefly discussed here. The study showed that if the landing was long (e.g. the aircraft contacted the runway far beyond the threshold), the landing overrun accident risk was 55 times greater than when it was not long. There are various reasons for a long landing. The touchdown should follow immediately upon the completion of the flare. However, the aircraft often floats for some time before touchdown. If floating occurs, the pilot often (but not always) tries to bleed off the excess speed. This action takes a significant part of the amount of runway remaining to stop the aircraft. The effect of the excess speed on the ground roll distance is usually less than the increase of the flare distance due to floating. This is explained by the fact that the deceleration of the aircraft during the flare is only a fraction of what can be achieved during braking on the ground, even on slippery runways. Therefore, it is important to put the aircraft down with excess speed, instead of bleeding it off in the air.

Ground effect also appears to play an important role in the floating of an aircraft. Ground effect is the aerodynamic influence of the ground on the flow around an aircraft. It increases the lift, reduces the aerodynamic drag, and generates a nose-down pitching moment as the ground is approached. The nature and magnitude of ground effect are strongly affected by the aircraft configuration. Ground effect provides a landing cushion that feels very comfortable to the pilot. This could explain, to some extent, the influence of ground effect on the tendency to float.

Runway surface conditions have been an important factor in landing overruns. The NLR study showed that the landing overrun accident risk increases by a factor of 10 when the landing was conducted on a wet or flooded runway, and by a factor of 14 when the runway was covered with snow, ice or slush.

A fact revealed by the NLR study that is of concern, is that in 15% of the 400 landing overrun accidents that were analyzed, there was late, or no, application of the available stopping devices. In many of these accidents, an overrun was avoidable if the available stopping devices had been properly used. The problems were mainly caused by the fact that the ground spoilers were not armed. In these cases, the pilots often failed to notice that the spoilers did not deploy. Also, late or no application of thrust reversers was often found in the accidents. In some cases, reverse thrust was selected initially; however, shortly afterwards it was deselected again. The NLR study revealed many more interesting facts about landing overruns. Readers are encouraged to have a close look at the report on the NLR study (see reference at the end).

An interesting technology that is worth mentioning here, is the application of a ground arrestor system, which is located beyond the end of the runway and centred on the extended runway centreline. A ground arrestor system is designed to stop an overrunning aircraft by exerting deceleration forces on its landing gear. Although this technology (as will be explained later) cannot prevent overruns from happening, its application can mean the difference between an accident and a minor incident. Different types of ground arrestor systems for civil application were studied in the United Kingdom in the 1970s, and later in the United States. An example

Example of an overrun that didn't become an accident due to a soft arrestor bed.

of a ground arrestor system is the engineered material arresting system (EMAS), which is a so-called soft ground arrestor. A soft ground arrestor system like EMAS deforms under the weight of an aircraft tire that runs over it. As the tires crush the material, the drag forces decelerate the aircraft, bringing it to a safe stop. In recent years, EMAS became popular in the United States at airports that have difficulties complying with the rules on runway safety areas defined by the Federal Aviation Administration (FAA). There have been at least three reported overruns in which EMAS stopped the aircraft. These occurrences took place in the United States with a Saab 340 (May 1999), a MD11 (May 2003), and most recently, with a B747 (January 2005). Clearly, no soft ground arrestor system can prevent overruns from happening; however, it seems evident that such a system can affect the consequences. Other arrestor systems were also studied in the past. Examples are loose gravel, water ponds, and arrestor cables. Application of these systems to commercial airports has been limited.
In the unlikely event that you do run out of runway, let us hope that you do not run out of luck!

Van Es, G.W.H., *Running Out of Runway: Analysis of 35 Years of Landing Overrun Accidents*, National Aerospace Laboratory NLR, Technical Paper TP-2005-498, 2005. △

What's New in Icing

As a result of recent accidents involving ground icing conditions and small aircraft, co-operative work on a computer-based training (CBT) project between Transport Canada, the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), the UK Civil Aviation Authority (CAA), and various air operators commenced in early January 2005.

This CBT addresses training needs for professional/corporate pilots of General Aviation type aircraft, as well as small cargo operators. The CBT program can be accessed from the NASA Web site, where you can download it and subsequently run it on your Web browser at your convenience. To download this program, visit the NASA Web site at: http://aircrafticing.grc.nasa.gov/courses.html. △

Risk of Two Aircraft Colliding in Class D Airspace

by Patrick Kessler, Civil Aviation Safety Inspector, System Safety, Quebec Region, Civil Aviation, Transport Canada

An investigation conducted by the Transportation Safety Board of Canada (TSB) on the risk of two aircraft colliding in class D airspace showed the need to update pilot knowledge.

The management of air traffic in class D airspace is often misunderstood by aircraft pilots flying in accordance with instrument flight rules (IFR) or visual flight rules (VFR).

The article published in *Aviation Safety Letter* 4/2004, regarding the management of collision risk in class G airspace, analyzes the system, the management of risks and defensive barriers that assist in avoiding aircraft collisions. It is also an excellent tool to help remember the classification of airspace.

A fundamental principle applies to flying aircraft:

- **A**viate: control the flight to reach the desired goals.
- **N**avigate: know your position, plan in accordance with the tools available and the type of flight (VFR/IFR).
- **C**ommunicate: exchange necessary information with the air navigation services and the pilots of other aircraft involved.

Communication consists of sending messages between a transmitter and a receiver through signs and signals. The following is a list of communication tools and their effectiveness:

- Verbal language (words) 7%;
- Paralanguage (tone of voice, volume, etc.) 38%;
- Non-verbal language (body language, hand signals, etc.) 55%.

It is evident that the tools available to pilots and controllers are limited to 45%, which emphasises the importance of each word.

To ensure the safety of a flight in a complex environment, the pilot must plan, act, monitor, and re-evaluate to see if the goals to be reached are the same as they were to begin with. Low-level controlled airspace can be complex and contain the following elements:

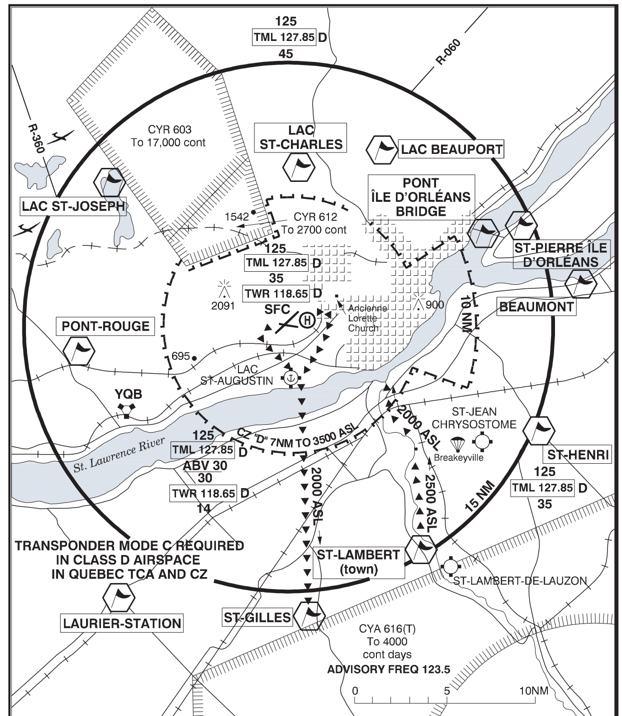
- Low level airways;
- Terminal control area;
- Extensions of a control area;
- Control zone;
- Transition area;
- Military terminal control area.

The Québec terminal area is an example:

NOT FOR NAVIGATION

AERODROME/FACILITY DIRECTORY SECTION B

QUÉBEC VFR TERMINAL PROCEDURES CHART



LOCATION	IDENT	LAT/LONG
BEAUMONT	VCBMT	N46° 49.50 W71° 00.47
PONT ÎLE D'ORLÉANS BRIDGE	VCTMN	N46° 52.75 W71° 08.00
LAC BEAUPORT	VCBOP	N46° 56.80 W71° 16.57
LAC ST-CHARLES	VCLSC	N46° 56.00 W71° 23.00
LAC ST-JOSEPH	VCLSJ	N46° 55.00 W71° 38.63
LAURIER-STATION	VCLST	N46° 32.35 W71° 37.95
PONT-ROUGE	VCRED	N46° 45.00 W71° 42.00
ST-GILLES	VCGLS	N46° 30.50 W71° 21.97
ST-HENRI	VCHRN	N46° 41.50 W71° 03.63
ST-LAMBERT (town)	VCLAM	N46° 35.00 W71° 12.47
ST-PIERRE ÎLE D'ORLÉANS	VCPRO	N46° 53.00 W71° 04.47

QUÉBEC CLASS D AIRSPACE

In order to minimize inflight delays & to augment the tml radar capacity svc, VFR acft wishing to penetrate Québec class D airspace & not having filed a Flt Pln with arr or dep to/fr Québec, may obtain transponder code before tkof. Therefore, flight info could be transmitted to Montréal ACC 514-633-3211, 800-633-1353 or by Fax 514-633-2877 or Québec FIC 866-GOMÉTÉO or 866-WXBRIEF, 30 min before intended flight toward TCA. Following must be specified: ident & type of acft, dep, destn & estimated time for airspace. Dly 11-02Z‡. This transponder code may be obtained inflight thru the Québec FIC on freq 126.7 or 123.55 at least 10 min before entering TCA. Squak assigned code before initial ctc with ACC.

The area of class D airspace around Québec has a complex, stacked shape, that is limited to the north by a restricted area. Arrivals from and departures towards the west are almost in a straight line with the Québec VHF omnidirectional range (YQB VOR), which is also where several airways cross. To the south, there is a training area with heavy traffic.

Class D airspace

Both IFR and VFR flights are permitted in class D airspace. VFR flights must establish two-way communication with the appropriate ATC unit prior to entering this type of airspace.

ATC ensures the separation of IFR flights and provides other aircraft with traffic information.

If equipment and workload permit, ATC will provide a conflict resolution advisory between VFR and IFR aircraft and, upon request, between VFR aircraft.

All pilots who undertake a flight in class D airspace must ensure that:

- the aircraft is equipped with:
  - radio equipment capable of two-way communications with the appropriate ATC unit, and
  - a mode C transponder, when the class D airspace is classified as transponder airspace; and
- a flight crew member keeps a continuous listening watch on a radio frequency assigned by an ATC unit.

Certain conditions concerning aircraft that are not equipped with this equipment may apply (see RAC 2.8.4 in the Transport Canada *Aeronautical Information Manual*).

VFR aircraft

Unless stated otherwise, you must ensure separation with other aircraft on your own. Planning for both departure and arrival are essential because it will allow pilots to develop a pace of work that corresponds to their experience, their skills, and the weather conditions. Up-to-date reference documentation (*Canada Flight Supplement*) is essential for operation in complex airspaces. The consistent use of a mode C transponder will help ATC, and provide a traffic advisory (TA) or a resolution advisory (RA) to aircraft equipped with a traffic alert and collision avoidance system (TCAS). A specific transponder code may be assigned by ATC.

IFR aircraft

ATC provides separation between IFR flights and provides information regarding VFR flights, which requires pilots to be continuously vigilant. It is important to be seen and to use all systems available to make your aircraft visible to others. It often seems easier for an IFR pilot to enter complex controlled airspace and feel protected because ATC provides separation from all other aircraft, but this is not always the case. The high workload on performance aircraft during arrivals and departures, and familiarity with tasks to be completed, may result in the crew being less vigilant of VFR aircraft.

The ATC unit

The ATC unit provides air traffic control, in order to prevent collisions and boost the traffic.
Several factors may influence the controller's work, such as the workload, traffic volume, multiple communications or lack of communication, and available equipment. Effective communication will allow a situation to be represented the same way from both perspectives. Ambiguous situations must be clarified and not tolerated.

Remember that it is your responsibility to plan your flight, establish effective communication with ATC, and maintain an active listening watch. Due to the complexity of airspace, pilots are required to have a good knowledge of the regulations and operational standards applicable to the class of airspace. △

From the Investigator's Desk—Stall/Spin and Collision with Terrain

This summary of occurrence A03O0088 is provided by the Transportation Safety Board of Canada (TSB).

On April 7, 2003, at approximately 09:10 Eastern Daylight Time (EDT), a Found Aircraft Canada Inc. FBA-2C1 Bush Hawk XP aircraft took off from a cleared ice strip, that was approximately 1 600 ft long and 50 ft wide, on the frozen surface of Lake Temagami, 20 km southwest of the town of Temagami, Ont. The ice strip was adjacent to the pilot's residence.

At 08:00 that morning, the pilot had taxied the aircraft to the rear of his residence for pre-flight preparation and refuelling. He returned the aircraft to the front of his residence sometime before 08:30, where it remained until about 09:00. At that time, the pilot and one passenger, who was also a licensed pilot, boarded the aircraft for a visual flight rules (VFR) flight to Parry Sound, Ont.

The aircraft lifted off approximately halfway down the strip, climbed on runway heading to 200–300 ft above the lake surface, then commenced an approximately 30° bank turn to the left. After the aircraft had turned approximately 120°, the aircraft rolled about 90° to the left, the nose dropped, and the aircraft stalled and entered an incipient spin to the left. The spin stopped after about one turn, and the aircraft then rotated briefly in the opposite direction and struck the frozen lake surface in a near-vertical attitude. The accident occurred at approximately 09:10 EDT. The aircraft was destroyed on impact and both occupants were fatally injured.

On the Sunday night before the accident, the weather was clear with an overnight temperature of -20°C and reports of overnight frost. The weather remained clear and, based on reports from a nearby airport, the temperature rose to between -15°C and -10°C by the time of the accident. Upon investigation, ladders and brooms, which the pilot was known to have used on other occasions to sweep snow and frost off the aircraft, were found at the rear of his residence, in the pre-flight preparation area. No de-icing fluids were found. Based on observation two days after the accident, direct sunlight did not reach the spot where the aircraft had been parked until 09:00 and would not have melted any frost that was present.

The TSB makes note of a recent U.S. National Transportation Safety Board (NTSB) advisory that suggests that even "imperceptible" amounts of frost can have catastrophic effects. The NTSB expressed concern that pilots may not be aware that small amounts of frost on an aircraft can have as serious an effect on performance as larger and more visible amounts of ice accumulation.

Findings as to causes and contributing factors

The TSB investigation determined that frost on the aircraft's wing adversely affected its performance, resulting in the aircraft stalling at higher-than-normal airspeed and entering a spin without warning. The single-engine plane had just taken off; as a result, it was too low to permit recovery. In its report, the TSB describes how the pilot may not have noticed the aircraft slowing down because he was making a low-altitude turn and picking up a stronger tailwind. This situation created the illusion of travelling at faster-than-actual speeds. The frost also reduced the aircraft's stability. These two factors negated usual cues that would have alerted the pilot to the slower speed.

The full report on this and other TSB investigations is available on the Internet at: www.tsb.gc.ca, or via the TSB electronic subscription service. △

Seat Belt Use: Reducing the Impact of Turbulence

Most passengers have experienced turbulence—a choppy, bumpy sensation when an aircraft travels through a rough air pocket. Turbulence can be created by a number of different conditions, including atmospheric pressures, cold or warm fronts, thunderstorms, jet streams or mountain waves. The effects of turbulence on aircraft vary in intensity, with light turbulence being a mere inconvenience to travelers. However, many passengers do not realize that turbulence may occur suddenly, and without warning, and that severe turbulence can have disastrous consequences.

In non-fatal accidents, in-flight turbulence is the leading cause of injuries to passengers and flight attendants. Injuries are most common to those not wearing a seat belt. Flight attendant duties, such as cabin checks and securing galley equipment, put them at a greater risk for injury. In some cases of severe turbulence, unsecured passengers and flight attendants have experienced fatal head and neck injuries as a result of being thrown about the cabin.

The *Canadian Aviation Regulations* (CARs) require passengers and crew members to be seated with seat belts fastened:

- during aircraft movement on the ground, during takeoff/landing, and during turbulence;
- when directed to do so by the pilot-in-command; and
- when an in-charge flight attendant is carried, and they direct the use of seat belts when turbulence is encountered.

The CARs do not require mandatory use of seat belts during all phases of flight—such a policy would be impracticable and difficult to enforce. Thus, Transport Canada encourages air operators to take initiatives promoting passenger-use of seat belts at all times during flight. The message that must be conveyed to passengers is that the best protection against unexpected-turbulence related injuries is to remain belted at all times. Communicating this message creates a spirit of cooperation with passengers in preventing such injuries from occurring.

More specifically, Transport Canada encourages seat belt use with a number of recommendations. First, when the seat belt sign is initially turned off during flight, an announcement should be made from the flight deck explaining the hazards associated with not wearing a seat belt, and the importance of keeping seat belts fastened at all times. Second, air operators should discourage the practice of unnecessary illumination of the seat belt sign; in other words, the seat belt sign should be illuminated only during taxi, takeoff, landing and turbulence. Once the threat of turbulence has expired, an announcement should be made to passengers that they keep their seat belts fastened to prevent injuries from unexpected turbulence.

Finally, air operators should encourage their crew members to be proactive in promoting seat belt use, and to lead by example by keeping their restraint devices fastened when seated, even when the seat belt sign is not illuminated.

As injuries to secured passengers are far less likely than to those who are not secured, Transport Canada supports the initiative of any air operator who promotes the use of seat belts throughout flight.

For more information, please refer to Commercial and Business Aviation Advisory Circulars (CBAACs) No. 149—*Seat Belt Use & Seat Belt Discipline* and No. 0070R—*In-Flight Use Of Seat Belts / Safety Harness—Flight Attendants*. △

Flying is a discipline...safety is an attitude.

Surge Damage!

Does an unexpected engine compressor surge event warrant the application of unscheduled engine maintenance?

Aircraft turbine engine operators are all familiar with the phenomenon of compressor surge (also frequently referred to as a compressor stall). A compressor surge is of special concern when engines with axial flow compressors are involved. Such engines may be equipped with up to 1 000 compressor blades, each of which can stall aerodynamically and start the onset of a compressor surge, with the possibility of various degrees of damage to an engine.

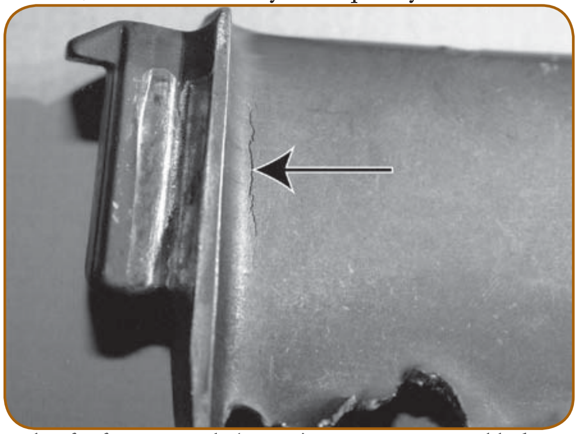
Although the compressor blades in an axial flow compressor act like airfoils and experience changes in airflow, pressure and velocity similar to those felt on an airplane wing, these blades do not physically change their position with respect to the air flowing past them. This means that the stalling of compressor blades is not identical to the stalling of an airplane wing, where the gradual increase of the angle between the chord of the wing and the on-coming air flow (the angle of attack) causes the wing to stall. Instead, compressor blade stalls should be thought of as something caused by changes in the effective angle of attack of the blades. The effective angle of attack depends on the velocity of the air entering the compressor and flowing past the blades, and the speed at which the blades are moving (compressor RPM). Changes in air velocity or compressor speed may cause the gradual onset of one or more blades stalling, with an eventual outcome of a compressor surge if enough blades stall. The compressor surge may cause such a disruption of airflow through the engine that the result will be mechanical damage to some of its components.

What's that noise?

When surging takes place, compressor airflow changes in pressure and velocity will cause anything from the most benign fluttering types of sounds, all the way to loud explosions. Only in severe cases of compressor surge does the pilot have the benefit of quantifying the effects of what is heard (by monitoring engine RPM and/or exhaust gas temperature). Most of the input is audible, perhaps accompanied by vibration, and does not lend itself to measurement. Since the source of the noise is caused by air slowing down, stopping, and even reversing in flow direction inside the engine, the noise severity is an indication of possible damage, keeping in mind that a worst-case scenario is complete engine failure. Since the causes of these air pressure and velocity changes can be attributed to factors such as fuel mismanagement, damaged or contaminated compressor blades, damaged turbine components and/or turbulent or disrupted airflow to the engine inlet, a number of engine maintenance-related factors are immediately introduced. Any components directly affected by the airflow through the engine, as well as those controlling fuel flow and over-pressurization of the compressor, might be suspect.

Will maintenance help?

Compressor surging is unpredictable, so the only kind of maintenance tasks that can adequately determine the effects of a compressor surge on the physical well-being of an engine, are unscheduled maintenance tasks. Since such tasks should be both applicable and effective, it must therefore be possible to do a comparison between the condition of an engine with no damage, and one that has sustained damage as a result of compressor surge effects. The inspection method would have to be applicable while the engine is installed and would generally include a visual inspection, most of which would entail the use of a borescope. The principal intent would be to inspect as many engine compressor and turbine blades as possible without disturbing the engine interior. Since the causes of some compressor surge events may be attributed to malfunctions of the engine's fuel control unit or of its bleed valves, these items may also qualify for some sort



Example of a fatigue crack (arrow) on a compressor blade propagated from multiple origins on both convex and concave sides of the blade indicating cyclic loading in the reverse bending.

of inspection. Typically, the visual inspection of these items would verify their secure attachment to the engine and lack of evidence of damage or leakage. In some cases, operational or functional checks might prove beneficial.

What is applicable and effective?

In all cases of compressor surging, any maintenance action will have to be triggered by a report that an unacceptable level of surging was detected. Such a report usually originates with the pilot of the aircraft. Where a report includes the observed values of engine instrumentation resulting from surging, a determination of harmful effects may be possible. When a compressor surge is the result of improper aircraft or engine operation, it may not be possible to determine what contributed to the problem from the pilot's report. In any case, a number of inspection options are available. The first is undoubtedly the so-called general visual inspection, which looks for obvious damage to the accessible parts of the aircraft and engine. No extensive access preparations need to take place, aside from the normal opening of engine cowlings, as part of this procedure. Particularly suspect parts of the engine may benefit from the next higher level of inspection, referred to as the detailed inspection, which looks for less obvious damage to specific components or areas. This may involve the use of special tooling, such as a borescope, designed to provide access to the engine interior without extensive engine teardown. Unfortunately, access provisions for borescopes (long slender bundles of light-carrying fibers) are limited, so only a small percentage of compressor or turbine blades can be inspected using this method. The highest level of inspection available is the special detailed inspection, which typically requires extensive preparation or special inspection techniques and tooling. It is generally not deemed to be both applicable and effective as an unscheduled inspection with the engine on-wing, since engine disassembly is necessary. Given the above choices, it would now be helpful if we had some (aircraft) manufacturer's recommendations in our maintenance manual to help us along.

Why is no task prescribed?

Since the problem of compressor surge primarily affects engines with axial flow compressors, it may be assumed that a look in some of the maintenance manuals for such engines would lead to the discovery of surge-related maintenance tasks. A general review of the unscheduled inspection sections of these manuals reveals that no mention is made of compressor surge as an unscheduled event that needs to be addressed by the application of manufacturers' recommendations. There are good reasons for this.

The designers of modern turbine engines create products that will function efficiently over the full operational range of the aircraft in which the engine is to be installed. Some of the most innovative skills focus on the design of compressors and turbines that have to tolerate a wide range of air velocity, pressure and temperature conditions. Since all compressors are potentially plagued by the onset of blade stalling, supreme efforts are made to prevent such stalling from becoming a compressor surge. The result of all of this effort is the marketing of an engine that will tolerate some unintentional abuse, and will not have any significant compressor surge problem designed into it. This means that unscheduled maintenance tasks recommended in the maintenance manuals will primarily be restricted to those needed to rectify the effects of externally caused events, including such things as bird strikes, lightning strikes and exceeding engine-operating limits, etc. A review of aircraft flight manuals seems to support this logic as well, since the text devoted to engine malfunctions restricts itself to exceeding engine limits and engine failure (without specifying the many possible causes). Compressor surge events are therefore treated no differently than any other seldom-experienced event that may interfere with engine operation.

Is the status-quo acceptable?

In the past, there have been calls for an increase in the level of flight safety concern when there is evidence that compressor surge has contributed to the incidence of engine damage. These concerns typically have their origin in reports published by flight safety investigators, when it is determined that in-flight engine shut-downs were caused by compressor or turbine blade fatigue mechanisms that ended in blade failure. Such failures are potentially dangerous if the blade containment system on an engine suffering blade failure does not work as advertised. The result then, is possible damage to the aircraft and/or its occupants. Investigators therefore tend to address failure events by recommending the introduction of unscheduled maintenance tasks in the maintenance manuals.

Although such actions are well intentioned, it opens the door to adding a host of possibilities for treating other parts of the engine as potential sources for in-flight shutdowns. A more effective solution might be to make better use of the need for effective pilot reporting with respect to compressor surges. For instance, if it can be determined that the current frequency of compressor surge incidents on commercial aircraft warrants the addition of instructions in flight manuals to report such incidents, pilot reporting might prove advantageous. So far, it appears that even in the absence of such instructions, pilots are reporting surge events and some form of maintenance is being applied as a result. What is also evident is that some of the maintenance actions have not proven effective. In some cases, pilots reported several compressor surge incidents on the same engine, yet no effective maintenance action (such as disassembling the engine and inspecting the engine blades) was taken. Although a thorough borescope inspection of the accessible compressor and turbine blades may be done, followed by engine power assurance runs, fatigue-related defects would be difficult to find on these blades, and impossible to locate on the inaccessible ones. The problem, therefore, is one that involves the cooperation between pilots and maintenance workers in reporting any unusual engine events, and taking the most appropriate maintenance action in response to such reports.

The operator's maintenance program is the key…

Whenever flight manuals or maintenance manuals fail to address compressor surge events specifically, it is up to each operator to ensure that such events do not impact the safety of the operation. The effects of compressor surge problems identified by an operator as the result of unique operating conditions can be mitigated through the introduction of a combination of revised operating and reporting procedures and appropriate maintenance actions. The aircraft manufacturer should be consulted during the search for solutions to the problem, so that the benefits of lessons learned from the operation of the entire fleet can be factored into an operator's solution. Although this appears to place the burden for taking action entirely on the shoulders of the operator, it avoids the application of a "broad-brush" treatment of a problem currently recognized by the industry as one that occurs infrequently and generally has a minor impact on aviation safety. The focus, therefore, should be on ensuring that operators have a suitable system in place that formally addresses what actions to take in the event of a compressor surge. Such a system should include steps to be followed by pilots when reporting, as well as a clear explanation of the proper investigation and rectification procedures to be used by maintenance personnel. It must be recognized that the tendency to avoid engine removal and disassembly (overhaul) is always a strong factor working against recognizing the need to prescribe higher levels of engine maintenance. It is therefore of paramount importance to make the safe decision when it is necessary to do so, and forego the temptation to fly the aircraft one more time, in order to determine if the problem has been solved.

…but regulators have a role to play as well

To provide operators with some assistance, it will be necessary to ensure that manufacturers' recommendations for maintaining an aircraft include specific information addressing unexpected compressor surge events. The unscheduled maintenance section of the maintenance manual provides the opportunity to categorize these events along with such things as bird strike and lightning strike events. Under the umbrella of the regulations governing the need for adequate instructions for continued airworthiness, regulators can impose special conditions on aircraft manufacturers as part of the product certification activity. Such conditions should highlight the need for appropriate unscheduled tasks, directing the operator to effective troubleshooting procedures and clear recommendations to remove the engine from service, if on-wing maintenance fails to rectify the problem. The joint efforts by industry and regulators will thus ensure the enhancement of aviation safety. △

Engineering Test Pilots at Transport Canada: How Does Their Work Impact You?

by Dick Walker, Engineer Test Pilot, Flight Test Division, Aircraft Certification, Civil Aviation, Transport Canada

During the take-off roll, the right in-board flight spoiler inadvertently deployed. The captain made a small lateral control input to counter the roll tendency, and the takeoff was continued with no further comment by either pilot. During the after-takeoff check, the first officer noticed on the flight control indicator that the right in-board spoiler was deployed. The captain had already trimmed the airplane to counter the deflection, but otherwise had not noticed the failure. A return to land was commenced and completed without further incident.

Who assesses an aircraft's handling qualities and decides if such a failure is acceptable? In aircraft certification, it is the job of the engineering test pilot.

In the world of new or modified aircraft, there are two kinds of test pilots—development and certification. Here on the third floor of Tower C in Ottawa, there are eight "certification" test pilots (five fixed wing, two rotary wing and the Chief, who flies both) who are responsible for supporting the program of aircraft certification. That program includes certifying new aircraft manufactured in Canada, aircraft imported into Canada, and aircraft modifications. For example, we get involved in the certification of Bombardier and Bell products, new Boeing or Airbus products for the airlines, and regional modification activities such as float installations, new engines, search lights, and avionics, just to mention a few. There are delegate test pilots in the industry, both private and working for manufacturers, who can also make findings of compliance on behalf of the Minister. These test pilots do not only do certification flying, but are also often involved in "developmental" test flying. Although all flying has associated risks, developmental test flying requires the most vigilance and the smallest steps.

Understanding the part that we play, and how it affects the operational line pilots who fly in the industry, requires a brief discussion of the certification standards. The *Canadian Aviation Regulations* (CARs) call up the certification design standards contained in the *Airworthiness Manual* chapters 523, 525, 527 and 529, which are the design requirements for small and large fixed-wing and rotary-wing aircraft. Each of the chapters address: structure; design and construction; powerplants; equipment; and operating limitations and information, but most relevant to the pilot community, is the flight subchapter, containing flying qualities and performance requirements. Of the approximately 400 paragraphs and sub-paragraphs in each chapter, there are some 140 items that require a test pilot qualitative evaluation. These items contain words such as "procedures consistently executed in service by crews of average skill," "time delays reasonably expected in service," "not require exceptional pilot skill, alertness or strength," "consistent results can be expected," "not cause undue difficulty in maintaining control," "safely controllable and manoeuvrable," "no excessive demands on the pilot when manoeuvring," "cannot be overstressed inadvertently," "stick forces within satisfactory limits," "suitable stability and control feel," "gradual, easily recognized, and easily controlled," "distinctive to the pilot," "prevent inadvertent stalling," and more. Although the test pilots are required to fly the aircraft to collect data for subsequent engineering analysis, it is the qualitative evaluations that perhaps have the most impact on line pilots.

RJ 900 water ingestion test

One example, for which there is no universally accepted solution, is the workload associated with flight management systems (FMS). Over the years, navigation has progressed from single-source aids, such as non-directional beacons (NDB) or VHF omni-directional ranges (VOR), to multi-sensor FMSs with inputs from ground- and space-based equipment. These FMSs reduce the pilot workload in terms of being able to navigate, but increase pilot workload in the management of the system. Some of the earlier, less sophisticated, systems were so cumbersome to input data that they were not certifiable, in our opinion. Even the systems that have been certified require the line pilots to be knowledgeable about the system and, perhaps more importantly, to have good cockpit discipline in terms of work sharing and standard operating procedures (SOP). So, even though we, the certification test pilot, might say something is certifiable, you, the operational pilot, have an essential part to play in using the equipment properly and safely. With new aircraft certification programs, it is routine to involve operational pilots with certification test pilots in a joint activity to better ensure operational suitability in the real world.

In addition to certification test flying, the Chief, Flight Test, Aircraft Certification, is responsible for approving aircraft flight manuals (AFM) and master minimum equipment lists (MMEL). Post-certification activities require each of the individuals in the Flight Test Division to be responsible for several AFMs and associated MMELs.

AFMs contain the limitations, emergency procedures, normal and abnormal procedures, and aircraft performance. AFMs can contain both approved and unapproved data, which is clearly identified as such, and provides the procedures to be followed in the day-to-day operation of the aircraft and its equipment. In some cases, particularly for large aircraft, an associated operating manual (not a certification document) is provided by the manufacturer, and contains more detail to assist each operator in developing SOPs. Although not mandatory, operators for the most part adhere closely to manufacturer-recommended procedures for obvious reasons; that is, the manufacturer is most knowledgeable about the aircraft. Notwithstanding this flexibility, the AFM limitations are considered mandatory. Finally, the AFM is a certification document and the test pilots, both regulatory and manufacturer, play a key role in its evolution throughout the certification program.

The individuals in the Flight Test Division (test pilots and flight test engineers) are responsible for chairing MMEL Review Groups that have regulatory, operational and manufacturer representation. These groups decide what equipment may be inoperative for flight dispatch. This relief is for a defined, short period of time with associated provisos. The relief is based on operational and certification considerations to include redundancy, next failure assessment, and qualitative (test pilot) and quantitative (engineering) evaluation. All this requires extensive communication with manufacturers and operators to ensure safety, and recognize the need to be able to fly with inoperative equipment.

I have just touched the surface of what we do from day to day. The variety in terms of flying different types of aircraft, travel, technical understanding, and associated office administration (did I say that?) makes this a tremendously interesting and challenging job. We like to think we make a valuable contribution, but are only one part of the "system" which makes flying safe. △

Carrying External Loads on Airplanes

by John Ereaux, Regional Manager, Aircraft Certification, Atlantic Region, Civil Aviation, Transport Canada

Canada's aviation history includes many examples of operations that exploited the unique capabilities of aircraft. Carrying external loads, such as canoes, boats, lumber and antlers, on float-equipped aircraft is one example of how operators have utilized aircraft in innovative ways.

The need for a considered and cautious approach to carrying external loads should be self-evident. As early as 1935, the National Research Council of Canada studied the practice of carrying canoes on float-equipped aircraft. Over the years, preferred methods of attachment, location and orientation of external loads have been established. For example, square back aluminium boats should be mounted with the stern facing forward to reduce adverse wake effects over the airplane tail. In addition, many canoe/boat/airplane combinations have been shown by experience to be airworthy, while other combinations are not considered safe.

Float plane carrying an external load

Unfortunately, accidents and incidents continue to occur with airplanes carrying external loads. In October 2003, a fatal loss-of-control accident involving a Piper PA-18-150 occurred while carrying moose antlers attached to the aircraft floats. The Transportation Safety Board report (TSB Report A03W0210) for the PA-18-150 accident cites more than 17 accidents that have occurred since 1976, involving external load operations with airplanes. Nine of these accidents involved fatalities.

Although many operators have obtained formal design approval for their external load installations, the current regulations are somewhat ambiguous on this subject, which has led to inconsistent interpretation and application of the rules related to the carriage of external loads.

Transport Canada is taking steps to amend the regulations and guidance material to clearly mandate that operators wishing to carry external loads must first get formal Transport Canada design approval for the installation. This requirement would apply to all external load operations for airplanes that are considered major design changes. Examples of external loads that are considered major design changes would include canoes and boats being carried on float-equipped aircraft.

The formal design approval process is carried out to verify that an airplane with an external load attached continues to meet the airworthiness safety standards. Typically, the design approval process for external loads includes, among other things, examination of the following items:

- Means of securing the load to the aircraft. The means should be safe and repeatable.
- Location of external load. The load should not interfere with the propeller, wing lift struts, emergency egress for the pilot and passengers, or pitot-static ports. The location of the load should not permit the retention of water spray.
- Flight characteristics and performance. Usually, a flight test is required to verify adequate stability and control, engine cooling, climb performance and the absence of wake effects from the external load on the airplane empennage.
- Provision of operating and maintenance information applicable to the external load operation. This would normally include load attachment information as well as operating limitations and procedures. Often external load operations include a reduction in maximum take-off weight to cater for the reduced aircraft performance as a result of the aerodynamic drag of the loads.

Transport Canada records indicate that more than 150 different approvals for external loads have been issued over the years. Transport Canada Regional Aircraft Certification offices maintain a listing of all previously issued approvals. Many of the existing design approvals are available for purchase or use by airplane operators.

Applications for new design approvals of an external load should be made to the Transport Canada Aircraft Certification office located in the operator's region. Consult the Transport Canada Web site for contact details (www.tc.gc.ca/air/offices.htm). Operators are encouraged to utilize the services of Transport Canada Aircraft Certification delegates, such as design approval representatives (DAR) and design approval organizations (DAO), when seeking design approvals. △

Continuing Airworthiness Division Reporting Systems

by Léo N.J. Maisonneuve, Manager, Information Programs, Continuing Airworthiness, Aircraft Certification, Civil Aviation, Transport Canada

The Continuing Airworthiness Division of the Aircraft Certification Branch of Transport Canada Civil Aviation oversees the continuing airworthiness (CAW) of approximately 30 000 Canadian-registered civil aircraft, as well as countless Canadian-designed and -manufactured aeronautical products operated worldwide.

Successful execution of the regulatory component of the CAW activity is highly dependent on the efficient management and ready access by Transport Canada personnel to vast amounts of aircraft-specific data, documents, reports, and other information.

Two of the most significant and enduring of the early "legacy" systems developed by the Continuing Airworthiness Division to support their activities are the Service Difficulty Reporting System (SDRS) and the Computerized Airworthiness Information System (CAIS); both having been implemented in the late 1980s.

These two systems have been subject to capital investments in the past years in order to alleviate the workload to both external and internal stakeholders by allowing for enhanced reporting using state-of-the-art technology.

Web Service Difficulty Reporting System (WSDRS)

SDRS, which was the first to be converted to an enhanced Web-based application, facilitates the collection and retrieval of service problems encountered in the field. The information collected provides data to support the investigation and the development of corrective actions, where necessary.

Canadian Aviation Regulation (CAR) 591 requires that air operators, aircraft maintenance organizations (AMO), type certificate holders (including special type certificate holders), manufacturers, flight training units (FTU), distributors, and CAR 604 private operators submit service difficulty reports (SDR). Aircraft maintenance engineers (AME) working on private aircraft, or any small privately-operated aircraft, are also encouraged to submit SDRs.

Transport Canada receives approximately 2 200 SDRs annually. The Transport Canada WSDRS was developed as a result of requests from the Canadian aviation industry for a Web-based, fast, convenient and confidential SDRS.

Registered users can utilize this site to: submit SDRs as required by the CARs; query the SDR database; track and store submitted SDRs; update previously submitted SDRs; and check for Transport Canada action (status updates) on Canadian SDRs.

As of 2005, there are approximately 1 600 registered users of the WSDRS, representing 95 percent of large organizations (greater than 15 employees). Although the hardcopy form 24-0038 is still available, WSDRS has largely replaced its use for the reporting of service difficulties by Canadian industry.

Non-registered visitors to this site can search the SDR database using the "Quick Queries" buttons found on the side menu of the WSDRS homepage.

For more information on the WSDRS, visit the following Web site: www.tc.gc.ca/wsdrs/default.asp?Lang=E.

Continuing Airworthiness Web Information System (CAWIS)

CAIS performed a number of essential functions, including: recording airworthiness and owner information for approximately 30 000 Canadian-registered aircraft; collecting and disseminating aircraft utilization data (hours flown) through the CAR-enabled Annual Airworthiness Information Report (AAIR); storing, indexing and facilitating public on-line access to all 40 000 airworthiness directives (AD); facilitating selective distribution of corrective action notifications (such as ADs) to the affected parties; and other miscellaneous functions.

Requests from both registered aircraft owners and Transport Canada personnel for a Web-based airworthiness information system have resulted in the development of the CAWIS Web site.

CAWIS is primarily used by registered owners, operators, maintainers and manufacturers of Canadian-registered aeronautical products or products for which Canada is the country of type design responsibility, as well as Transport Canada personnel.

Registered aircraft owners log on to CAWIS using an AAIR access code that is indicated directly on the top right corner of the AAIR form, which is mailed to them by Transport Canada. Registered users can also utilize this site to query the AD database (for both foreign and domestic ADs) and review data pertaining to their own aircraft.

Visitors of CAWIS can search the AD database by selecting the Airworthiness Directives link located on the side menu (just below the login button) of the main page.

For more information on CAWIS, visit the following Web site: www.tc.gc.ca/cawis-swimn/. △

Aircraft Certification Hosts 4th Delegates Conference in June 2006

"Aircraft Safety Through Delegation"

by the Delegates Conference Organizing Committee

The Aircraft Certification Branch is again hosting a delegates conference. The 2006 conference will be held at the Ottawa Congress Centre, June 27–29, 2006. The previous conference, held in 2003, attracted over 500 participants, and a similar turnout is predicted. All Aircraft Certification Delegates are invited to attend. Registration to date has been very positive; the conference is over 75% sold out.

The theme for the conference is "Aircraft Safety Through Delegation." In addition to the plenary session, specialist streams have been set up to cover the areas of flight test; avionics/electrical software; aircraft structures; powerplants and emissions; fuel and hydro mechanical control systems; and occupant safety and environmental systems. Program information can be found on the Web site indicated below.

The conference program has been developed by an organizing committee made up of representatives from Industry and Transport Canada, and has been designed to appeal to all delegates.

The objective of the conference is twofold. The first and foremost objective is to educate delegates and Transport Canada personnel on regulatory developments, policy initiatives, and new technology. The second objective is to strengthen the combined Industry and Transport Canada Aircraft Certification Team, which is essential to meet the challenges facing the Industry and to maintain Canada's leading role in aviation.

We encourage you to take advantage of this opportunity to strengthen your working relationship with the combined Transport Canada / Delegates Team.

Invitations to the conference have been sent to all delegates; if you did not receive one, please register. This can be done electronically, at https://www.tc.gc.ca/aviation/activepages/DC, or by contacting Mr. G. Adams at 613 941-6257, or e-mail ADAMSGL@tc.gc.ca. The organizing committee will confirm your registration by separate correspondence. The organizing committee finalized the conference program in December 2005, and will publish it on the Web site in early 2006.

To find out more about the conference, please visit the following Web site: www.tc.gc.ca/CivilAviation/certification/delegations/2006DelegatesConference.htm. △

The *System Safety Summer Briefing Kit* is Now Available for Purchase!

This six CD-ROM collection contains various promotional products produced by System Safety headquarters and regional offices. This package was originally designed to provide the regional System Safety Specialists with a central bank of materials for the regional safety briefings. However, this collection could well serve Industry in setting up their own safety briefings, in the same way we announced the availability of the *System Safety Winter Briefing Kit* in ASL 3/2005. The cost for the summer briefing kit is $25, and its contents can be viewed at: www.tc.gc.ca/civilaviation/systemsafety/pubs/tp14112/menu.htm.

It includes, among others:

- **CD 1: Runway Incursion Prevention Tools**; this CD has the video "Danger on the Runway," the six runway incursion prevention posters, past newsletters articles on runway incursions and more.
- **CD 2: Night VFR (NVFR) Prevention Tools**; this CD includes our NVFR PowerPoint presentation and quiz, the poster depicted on page 26 of this issue of the ASL, the night VFR video called "*Black Holes and Little Grey Cells—Spatial Disorientation During NVFR,*" past newsletters articles and more.
- **CD 3: Airspace & GPS Awareness Tools**; this CD includes the video "*A Simple Mistake: At An Uncontrolled Aerodrome, You Are in Control,*" posters on uncontrolled aerodrome VFR and IFR procedures, past newsletters articles and more.
- **CD 4: Various Topics**; this CD includes our family of *Take Five…for safety* pamphlets, material for safety in float operations, PowerPoint presentations on subjects such as fatigue, pilot decision-making and survival, past newsletters articles and more.
- **CDs 5 and 6: Weather to Fly CDs**; these two CDs contain 26 two-minute video vignettes aimed at general aviation pilots and the general public. The aim of these vignettes is to promote safe flying and how weather affects flight conditions and is a factor in every flight.

The *System Safety Summer Briefing Kit* (TP 14112E) can be purchased from the new Transport Canada Transact Web site at www.tc.gc.ca/transact, or by calling the Civil Aviation Communications Centre at 1 800 305-2059. △

Aviation Enforcement and Punitive Action

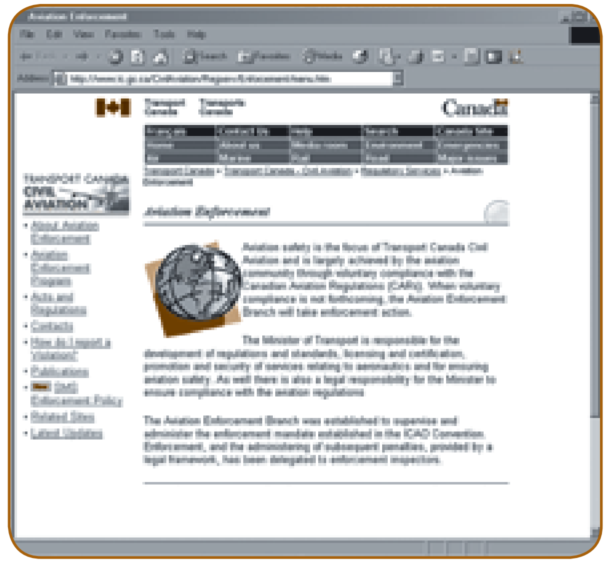
by Jean-François Mathieu, LL.B., Chief, Aviation Enforcement, Regulatory Services, Civil Aviation, Transport Canada

The Minister of Transport is responsible for taking disciplinary action against all those who violate the *Aeronautics Act* or *Canadian Aviation Regulations* (CARs). At Transport Canada, the Aviation Enforcement Division is specialized in conducting regulatory investigations of all alleged violations of the aviation regulations.

Transport Canada's Aviation Enforcement Policy recognizes the fact that "voluntary compliance" with the regulations is the most progressive and effective approach to achieving aviation safety. However, punitive action may prove to be necessary when there is a violation of the Canadian regulations. This punitive action is applied with fairness and firmness, taking into account the public's safety and economic consequences.

If the Minister has reasonable grounds to believe that a person has contravened a designated provision, he may impose a monetary penalty, and determine the amount of the penalty pursuant to Schedule II of CAR 103.08. If it turns out that voluntary compliance will not occur after imposing a monetary penalty, or if the nature of the alleged offence is such that it requires more severe punitive action, the Minister may suspend the Canadian aviation document (licence or permit) for a specific amount of time, in accordance with section 6.9 of the Act.

Recent amendments to the *Aeronautics Act* will allow the Minister to use new punitive action. For example, if the Minister has reasonable grounds to believe that a person contravened a designated provision, he could issue a "notice of a violation without a monetary penalty" or obtain a "compliance undertaking" from the offender.



www.tc.gc.ca/CivilAviation/Regserv/Enforcement/menu.htm

Furthermore, the implementation of the regulation regarding safety management systems (SMS) and the policy published by Aviation Enforcement will allow the organizations that are subject to this regulation to submit corrective actions without imposing enforcement action. This policy allows certificate holders governed by an SMS, the opportunity to determine, by themselves, proposed corrective measures to prevent recurrence of a contravention, as well as the best course of action to help foster future compliance. We invite you to take a look at this policy on the following Web site: www.tc.gc.ca/CivilAviation/SMS/policy.htm △

The Transportation Appeal Tribunal of Canada (TATC)

The TATC replaced the Civil Aviation Tribunal (CAT) that was established under Part IV of the *Aeronautics Act* in 1986. The Act establishing the TATC came into force on June 30, 2003. The TATC is a multi-modal tribunal that is available to the air and rail sectors. It will be available to the marine sector at a later date. The Tribunal was established to provide the transportation community with the opportunity to have enforcement and licensing decisions taken by the Minister of Transport reviewed by an independent body. The Minister's enforcement and licensing decisions may include the imposition of monetary penalties or the suspension and cancellation of a Canadian aviation document. Additional information on the TATC is available on their Web site at: www.cat-tac.gc.ca.

In future editions we will discuss recent cases decided by the TATC, which may be of interest to the aviation community. △

DEBRIEF

Ending Your Flight Right—IFR Visual-Reference Approach Refresher

by Tony Pringle. Tony has worked as an aviation safety officer for several Canadian carriers. He is a current airline transport pilot, safety consultant and writer, based in Hong Kong.

Ending an IFR flight with a declared visual reference can often result in a quicker, more efficient flight. Below are some items to keep in mind when ending your next IFR flight in visual conditions. Make sure you get the right type of approach for the airport and current meteorological conditions.

Remember that while ATC is responsible for providing adequate separation from other IFR traffic, it is the pilot who is responsible for ensuring adequate separation from terrain (except, of course, when on radar vectors). [Transport Canada *Aeronautical Information Manual* (TC AIM) RAC 1.5.5]

- Cancelling IFR can safely expedite the arrival at an uncontrolled aerodrome where there is other IFR traffic. For example, if you are arriving at an aerodrome and you do not cancel IFR, you may need to enter a hold while an outbound IFR aircraft departs, or conversely, an aircraft expecting an IFR clearance on the ground may be delayed while an inbound IFR aircraft arrives.
- When cancelling IFR, the flight plan remains in effect. All that has been cancelled is the provision of IFR control service by ATC. After landing, the pilot must close the flight plan with ATC or a flight service station (FSS) (TC AIM RAC 3.12.2).
- At some airports, ATC may give a non-specific approach clearance, i.e. "cleared for an approach." This clearance authorizes the pilot to perform an IFR approach, and the controller will provide IFR separation from other traffic based on the assumption that the pilot will proceed to the airport via a published approach. This clearance does not give the pilot authority to conduct a contact or visual approach. Should the pilot wish to conduct a visual or contact approach, this must be specifically requested. (TC AIM RAC 9.3) △

TYPE OF APPROACH	REQUIRED VISUAL REFERENCE	WEATHER REQUIRED	TRAFFIC SEPARATION	MISSED APPROACH	TC AIM REFERENCES
CONTACT	-pilot has visual reference to the surface of the earth -pilot must request contact approach	-pilot operates clear of cloud -minimum 1 mi. visibility -aircraft shall be flown at least 1 000 ft above the highest obstacle in a 5-NM radius	-ATC continues provision of separation from other IFR traffic while in controlled airspace	-IFR missed approach segment protected by ATC	RAC 9.6.1
VISUAL	-pilot reports airport in sight (or traffic to be followed in sight)	-ceiling 500 ft above minimum IFR altitude	-same as above, except the pilot is expected to maintain visual separation from any traffic to be followed	-no IFR missed approach segment -must remain clear of cloud -contact ATC as soon as possible -ATC separation from other IFR traffic will be maintained	RAC 9.6.2 RAC 1.5.5
CANCEL IFR	-visual meteorological conditions (VMC) -flight not expected to return to instrument meteorological conditions (IMC) -operating outside class A or B airspace	-VMC	-ATC discontinues provision of separation from IFR traffic	-no IFR missed approach segment -must remain VFR	RAC 3.12.2 RAC 6.2

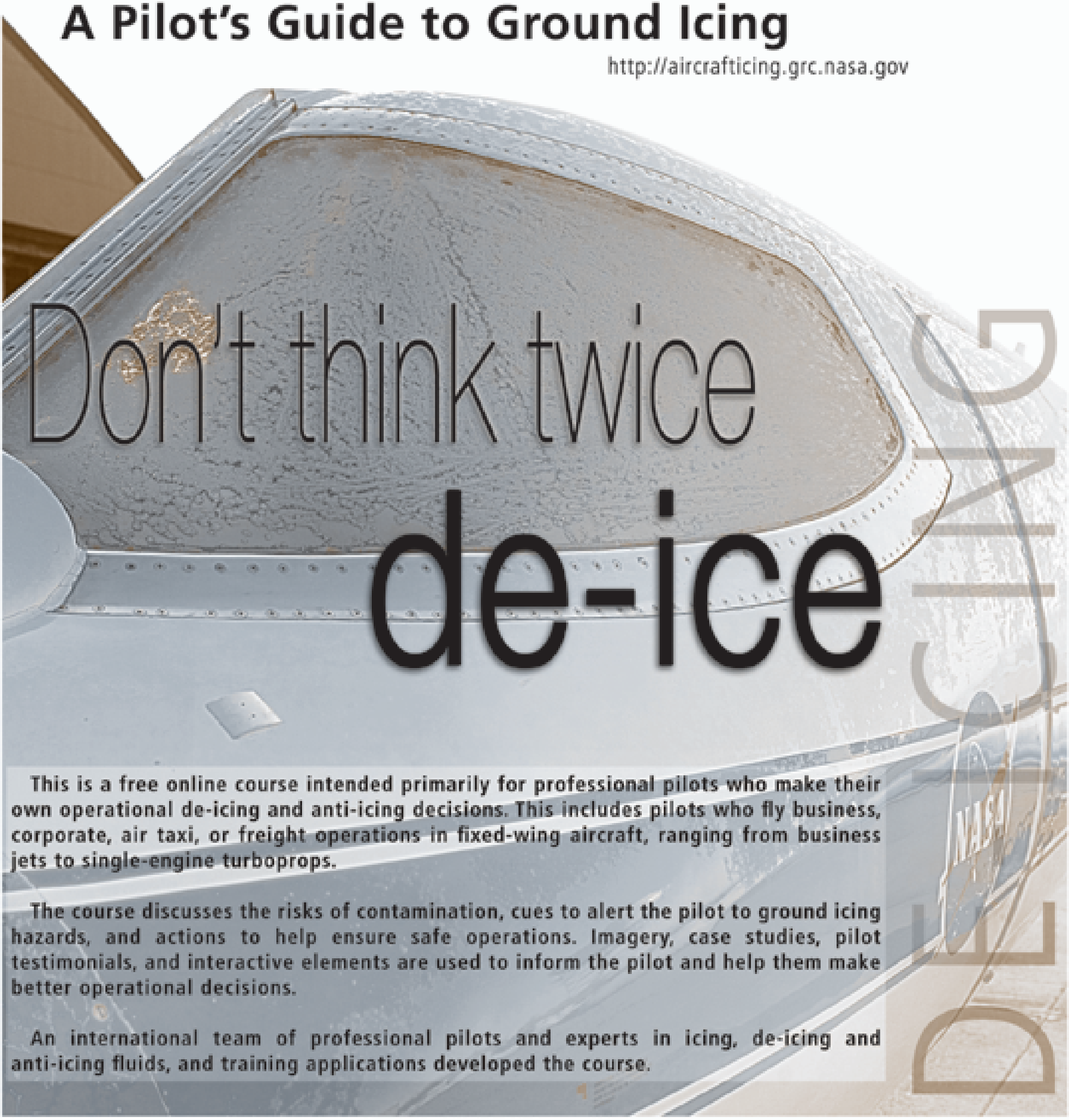
Transport Canada Transports Canada

Canada

Announcing...

A Pilot's Guide to Ground Icing

http://aircrafticing.grc.nasa.gov



This is a free online course intended primarily for professional pilots who make their own operational de-icing and anti-icing decisions. This includes pilots who fly business, corporate, air taxi, or freight operations in fixed-wing aircraft, ranging from business jets to single-engine turboprops.

The course discusses the risks of contamination, cues to alert the pilot to ground icing hazards, and actions to help ensure safe operations. Imagery, case studies, pilot testimonials, and interactive elements are used to inform the pilot and help them make better operational decisions.

An international team of professional pilots and experts in icing, de-icing and anti-icing fluids, and training applications developed the course.

National Aeronautics and Space Administration
www.nasa.gov

TAKE FIVE... for safety

Five minutes reading could save a life

GPS DATABASE ISSUES

One of the facts of current life is that old computers and new software that gobbles up gigabytes of disk space and memory do not mix very well. The same problem exists when large databases are crammed into early-generation GPS receivers that have limited memory space. Navigation databases are continually growing, and in some cases can exceed the storage capacity of certain legacy receivers. This can seriously affect the operation of GPS receivers, and in some instances, it already has. The following three examples show what can happen, usually at a most inconvenient time of the flight.

Spring 2003

In order to fit a new database into the Trimble receiver, the database provider inadvertently created a geographical region, extending from 40°N to 48°N and 65.5°W to 76.5°W, within which the receiver would cease to function, resulting in a loss of GPS guidance.

Summer 2005

Waypoints beginning with the letter “Z” were unintentionally omitted from the database. When one of these was part of an approach procedure, the receiver assigned a position of 0°N and 0°W to the missing waypoint, without any warning to the pilot. Once the issue was brought to the attention of the database provider, an acceptable database was promptly promulgated to the users.

Fall 2005

LPV (WAAS) [lateral precision, vertical guidance (wide area augmentation system)] approaches are now being coded and introduced into navigation databases. In one case, there were two area navigation (RNAV) approaches published to a single runway end—one lateral navigation (LNAV), the other LPV. To conserve memory, only the LPV procedure was coded, and this was the only approach offered. Unfortunately, the receiver had not been upgraded to WAAS, so the only approach that was available to the pilot was the one that he could not legally fly.

The relationship and compatibility of the avionics and its database is checked during initial certification; however, there is relatively little regulatory oversight of database updates. Pre-flight verification of all required procedures (and those that can be employed legally) for the flight is the only certain way to avoid being “trapped” by a database error during a critical stage of the flight. Pilots can minimize the risk of a database error during a critical stage of a flight by a pre-flight verification that all approaches that could conceivably be required are in the database, can be loaded successfully, and are correct. The correctness of the data may be checked by loading the approach and comparing the track and distance of each leg with the paper chart.

This may increase the time required to prepare for a flight, but if it prevents just one nasty surprise, it will be worth it.