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AVIATION SAFETY LETTER

In this Issue...

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

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

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GUEST EDITORIAL

I am pleased to inform you about the roles and responsibilities of the General Aviation Branch—supporting the delivery of a high level of aviation safety in Canada, as well as a high level of confidence in our Civil Aviation Program. General Aviation has adopted the motto "**Flying Safely Begins With Us!**" to reflect the basic role of the Branch—to establish a solid foundation of flight safety by developing safe pilot training and airmanship requirements and ensuring aircraft are registered only when they are safe.

The general aviation sector of the aviation industry includes 24 360 of the nation's 30 954 aircraft (November 2006 data), which is 78 percent of the aircraft in Canada. General aviation also includes over two-thirds of Canada's pilots—well over 39 000 of 62 211 valid Canadian licences, of which over 4 600 were issued in the last year.

To ensure Canadian aviation licences are secure, and to avoid their fraudulent use, the Personnel Licensing and Aircraft Registration Division is undertaking a project to adopt a new licence format for pilots and air traffic controllers. The new licence will provide for positive identification of the owner and consolidate all licence information, including medical certification, in one document.

Furthermore, this Division is also implementing Amendment 164 to the International Civil Aviation Organization (ICAO) Annex 1, regarding language proficiency requirements to ensure pilots and ground controllers can understand each other's communication to operate safely. The proposed new licence format will also allow for the pilot licence to capture the language proficiency rating of the licence holder.

The Fight Training and Examinations Division was instrumental in leading an ICAO initiative, the Flight Training and Licensing Panel, examining the future pilot qualification and training requirements of the aviation industry. Consequently, a new licence, the multi-crew pilot licence (MPL), and the requirements of a new approved training organization (ATO), based on a quality system, were created. The implementation of these two ICAO provisions is going to be a major task for this Division in the coming year.

General Aviation is responsible for personal aviation, which includes private aircraft flown for personal transportation and recreation, and where aircraft operation does not require a commercial or higher pilot licence for personal travel and other leisure flying activities. At the other end, the Branch is also responsible for establishing requirements for high-powered rocket launches, including orbital and sub-orbital events within Canada. The Branch also provides safety standards for the approximately 70 air shows conducted annually in Canada. With increasing activity in the area of unmanned air vehicles (UAV), the General Aviation Branch is actively exploring effective and efficient approaches to the safety oversight of this emerging segment of international aviation.

In support of the Branch activities, the General Aviation System Division is responsible for managing various data systems to track and monitor various records for the use of the different functions of the Branch. For example, the Flight Training and Aviation Education (FTAE) database maintains pilot written and practical examination results for issuing pilot licences. The Distributed Air Personnel Licensing System (DAPLS) gathers and stores relevant information regarding individual pilot qualifications such as age, knowledge and skills with regard to licence(s) and ratings held. The Canadian Civil Aircraft Register includes information about over 30 000 aircraft registered in Canada. Through the support of this Division, it is now possible to take all written examinations on-line.

Finally, the Branch has recently successfully concluded an agreement with the U.S. Federal Aviation Administration (FAA) for Implementation Procedures for Licensing (IPL), which provide for mutual conversion of pilot licences (aeroplane)/certificates (airplane). This process came into effect December 1, 2006.

Manzur Huq
Director
General Aviation

Forced landing straight ahead

Dear Editor,

While reading an article in *Aviation Safety Letter* 1/2007, about a small airplane that crashed in Brantford, Ont., I was reminded of one of my own experiences. Here it is in a few words. My intention is to share with other pilots these critical moments that can save lives.

In August 2001, while taking off from a private runway belonging to the *Escapade au Réservoir Gouin* outfitting company, I experienced a loss of power that was significant enough to force me to land in the middle of a forest at the end of the runway.

Several factors are always at play during such an event. First, the aircraft, a Cherokee 6-260, was almost at its maximum load capacity, that is, 3 360 lbs (the maximum allowable take-off weight is 3 400 lbs). In addition, the centre of gravity was near the maximum allowable aft position.

Under normal circumstances, the aircraft would have had enough power and capacity to take off with a similar load. I have actually been able to do it without any trouble under other circumstances.

Nevertheless, even if the limits listed in the aircraft operating manual (AOM) had allowed me to take off, I was confronted with an abnormal situation following a loss of power, which prevented the aircraft from recovering from ground effect. There was a wall of trees at the end of the sand and dirt runway.

Since the loss of power occurred after the wheels had left the ground, I did not have enough distance to interrupt the takeoff without violently crashing into the wall, which was the fast-approaching forest. So, I decided to conduct a forced landing in the forest straight ahead.

Let me assure you that my heart stopped for a second when I realized that there would be nothing left of my aircraft after this event. What saved my life, and the lives of my five passengers, was that I did not attempt any turns or manoeuvres to try to stay in the air. I was content with letting the aircraft glide straight ahead, keeping the wings horizontal and closely monitoring the speed to avoid stalling.

The aircraft landed in a forest of coniferous trees, which probably helped limit the amount of damage, and except for a few scratches and bruises, nobody was injured.

Fortunately, my pre-flight briefing to the passengers allowed for a very quick evacuation of the aircraft. A fire started in the engine bay within seconds after the crash, but everyone on board was safe and sound before the fire reached the cockpit.

I am convinced that keeping the aircraft in horizontal flight during the descent saved all of our lives. A stall at low altitude is fatal most of the time.

According to the observations made on the aircraft debris, the loss of power was apparently caused by a fire that started in the engine bay during the ground roll on takeoff. The aircraft was completely destroyed in the fire, but the six occupants are safe and sound.

Michel Perrier
Montréal, Que.

Small screw, big problem

Dear Editor,

I am a commercial pilot working for a private company on a Cessna 206 (seaplane configuration). I would like to share with your readers an experience I had in the summer of 2006, in order to make pilots and aircraft maintenance engineers (AME) aware of the importance of paying attention to detail.

After having had major changes made to the avionics, the owner of the Cessna 206 returned the aircraft to service. After three months of operation and approximately 100 hr of flight, an annual inspection had to be carried out. During the inspection, it was found that a 1/8-in. stainless steel cable, which was connected to the flight controls and then went through a pulley system under the console and attached to the elevator, had been half-cut at the aforementioned pulley.

The AME investigated further, and found that a small screw had fallen from avionics equipment and became stuck between the pulley and the cable. Since this type of pulley had a “groove” so that the cable did not come out, the screw became trapped, and each time the pilot operated the flight controls, the cable rolled over the screw, which slowly but surely began cutting the cable.

If it weren't for the AME's attention to detail and the short amount of time between the installation of the avionics and the annual inspection, the consequences of this incident could have been drastic.

Moral of the story: it is of the utmost importance to carefully tighten all screws, nuts, bolts, etc., and if a part (screw, nut, or other) accidentally falls while work is being carried out, it is essential to find the part to prevent it from causing damage elsewhere.

Name withheld upon request.

Engine failure

Dear Editor,

After a four-hour wildlife survey mission in a C-337 Skymaster, I was on final approach to land when, to my utter surprise, the front engine suddenly quit even though the fuel gauges were showing plenty of fuel in the tanks. After making a safe landing, I taxied off the runway, shut down the rear engine, and scratched my head, wondering what had just happened.

After having the fuel tanks filled, it was discovered that the main tank for the front engine had run dry. How could this have happened to me? I am the type who always goes the extra mile to ensure I manage my fuel carefully. This is the type of thing that only happens to careless pilots, right? Well, let's take a closer look at some of the factors at play here.

Although I had over 100 hr of experience flying the Skymaster, I had not flown it within the previous six months, and my comfort level was not at its best. It was also my first wildlife survey mission. I was new to the area where we were flying, and I had never before flown with the three crew members on board that day.

Secondly, there was no fuel dipstick available for the aircraft to verify the amount of fuel in the tanks during a pre-flight inspection. I was told that, because of the shape of the fuel tanks on the Skymaster, it was impossible to get a reliable indication of the fuel quantity from a dipstick. Therefore, the company did not use one.

The three-hour wildlife survey actually took closer to four hours. I had not been the last person to fuel the aircraft, and therefore, I was unsure of the total fuel on board. I felt the amount of fuel my employer said I had on board was accurate and sufficient for the four-hour mission. I was also relying too much on the fuel gauges to provide an accurate fuel quantity indication. Accordingly, I was not as concerned about the mission's duration as I should have been.

After landing, it was determined that a ground wire for the electrical fuel gauges was broken, and this made the gauges read substantially higher than they should have. Also, it was noticed that one of the fuel tanks had blue fuel dye streaks streaming back from the fuel cap. It is unknown how much fuel had evaporated during the mission.

My employer had dispatched the aircraft to the operating base without full auxiliary tanks. I was warned that they were not full, but I didn't know they were completely empty, especially when the gauges were showing 3/8 fuel in these tanks. I was told to return the aircraft with full tanks. All the fuel at the operating base was going to be purchased by the client. Sending an aircraft out without full tanks and returning it with full fuel would probably mean that my employer would come out ahead. However, as it would turn out, this practice was a factor that contributed to my engine failure.

Ultimately, as the aircraft's pilot-in-command (PIC), I accept full responsibility for my engine failure and I consider myself very lucky that I did not become another statistic. I learned from my mistake. I learned to never assume anything, and you can never be too careful when it comes to fuel management.

Name withheld upon request.

Lost satellite reception

Dear Editor,

Portable GPS units are wonderful, and they sure make flying and navigating much easier. In fact, numerous general aviation aircraft are now equipped with both panel-mounted and portable GPS units, some even including satellite weather depiction and radio.

I have a top-of-the-line portable GPS unit of a well-known brand mounted on my yoke, and I use it all the time. Like all portable units, it is a VFR-only GPS, but it is wide area augmentation system (WAAS) enabled, has a color moving map and integrated horizontal situation indicator (HSI), and I consider it to be a very useful tool to maintain situational awareness when navigating. It cannot legally be used to fly IFR, but sure can be used as back-up navigational gear in case of electrical failure, as well as to provide you with the big picture of where you are situated in relation to the other NAVAIDs that you are using to legally fly IFR.

Over a year ago, I was flying IFR in actual instrument meteorological conditions (IMC), preparing to shoot an ILS approach at my home base. In such circumstances, I always use the GPS as back-up for situational awareness, load the approach in the active flight plan, and use the vectors /OBS configuration to project an extended runway centreline track inbound to the approach runway. Of course, I use my ADF and localizer / glide path from my navigation (NAV) radios to legally fly the approach, but the moving map will visually show my progression when intercepting the localizer. That day, I started setting up my NAV/COM radios for the approach about 10 mi. out and was happily watching my progression towards the airport on the moving map, when all of a sudden I got the message: "LOST SATELLITE RECEPTION." I kept flying the approach with my NAV radios, and thought to myself, "what bad timing for losing GPS reception." Since I had never lost reception in hundreds of hours of flying with that faithful unit, I wanted to believe the problem was not caused by the portable unit itself, but rather had something to do with the satellites.

A few months later, I was flying VFR, practicing instrument approaches at my home base. After completing one localizer approach to one runway, I started setting up for another localizer approach to an intersecting runway; then all of a sudden: "LOST SATELLITE RECEPTION." I thought it was an interesting coincidence that I lost satellite reception doing exactly the same type of approach, at the same location, as the first time it happened in actual IMC. As a test, I quickly changed one digit on the NAV radio frequency used for the localizer, and the GPS immediately came back to life. The offending frequency in my case was 109.5, and it produced some interference with the GPS.

I called the GPS manufacturer to inquire as to whether they had similar problems reported by other users. They said yes, and that the frequency I mentioned was one of several frequencies that may affect the unit from time to time. They told me to try and change the location of the remote satellite antenna placed on the glareshield to eliminate the problem. I proceeded on a trial and error basis, flying VFR, and finally found a location on the glareshield, far from the other radios, that would not produce any interference on that frequency. The manufacturer also made a point of reminding me clearly that these portable GPS units, although wonderful in providing easy and accurate navigation, are strictly made for VFR use, and this is why they make you agree with this warning by pressing "Enter" when you turn them on.

I have since decided to install a panel-mounted IFR-approved GPS. Of course, these TSO-approved GPS units are not affected by frequency interference and can be used to shoot approaches in IMC, but only when they have the required receiver autonomous integrity monitoring (RAIM). Again, this is to ensure that the satellite reception is acceptable for accurate navigation.

The lesson learned here is that frequency interference does affect portable GPS units; they are wonderful and you can use them for VFR, or as a prudent back-up aid to navigation for IFR, but always be ready to resume navigation with conventional navigation gears at the worst anticipated time.

Franz Reinhardt
Ottawa, Ont.

What Can You Learn from Accident Reports?

by Gerry Binnema, Civil Aviation Safety Inspector, System Safety, Pacific Region, Civil Aviation, Transport Canada

A lot of people who work in aviation like to read accident reports. The reports serve as good reminders that aviation can be dangerous and that we always need to be vigilant. But if we were all being completely honest, sometimes we read them because it makes us feel smugly superior to the people who messed up. So, how much do we really learn from reading accident reports? Surprisingly, there has been very little research to see if accident reports actually have any positive effect on the people reading them. It seems very obvious that accident reports would be helpful, but there are a number of things that interfere with our ability to learn lessons from them.

Our brains process information and organize it before it is presented to our conscious attention. This processing follows certain relatively predictable patterns, which serve to help us understand the world around us. However, this processing can also distort our view of things, as information gets processed in such a way as to protect our self-esteem and our confidence. The patterns of processing that are very relevant to our understanding of accident reports are hindsight bias, attribution error, and invulnerability.

Readers will recall Heather Parker's series of articles on the "new view" in the past three issues of the *Aviation Safety Letter* (ASL). In these articles, she described hindsight bias and attribution error. These concepts also apply when we are reading accident reports. By way of a brief review, hindsight bias refers to our tendency to look back at events and believe the events should have been predictable beforehand. A classic example of hindsight bias is the Monday-morning critique of the weekend's sporting events by armchair athletes. The coach should have anticipated the other team's strategy. They should have known that the goalie would get re-injured if they put him in so soon. In reality, as we try to anticipate what will happen next, there are many different potential outcomes and we make the best decision we can with the information that we have available. As we read an accident report, we already know how the flight ends, and so we tend to judge all the decisions that led up to the accident with hindsight bias, believing that the pilot should have known better.

Attribution error refers to our tendency to overestimate the contribution of personal factors when we observe other people's errors. This means that when we see other people making a mistake, we tend to believe that their errors are a result of their own inadequacies (ignorance, incompetence, laziness), rather than a result of situational factors. Even when a situation arises over which the pilot had no control, we still tend to believe that they were at fault for allowing themselves to get into that situation.

Invulnerability refers to our tendency to believe that bad things will not happen to us. Of course, there are hazards all around us, so in order to enjoy life we suppress our fear and deny the possibility that anything will happen. But an unrealistic sense of invulnerability actually places us in danger. Young people, especially males, have higher levels of invulnerability, and this can be observed in the number of accidental injuries and deaths among young males. A strong sense of invulnerability will prevent us from taking the lessons of an accident report to heart.

In combination, these three factors make it easy to read an accident report and learn very little. It would be almost natural to believe that the pilot should have known better, that their errors were caused by their own ignorance or incompetence, and that this kind of thing could never happen to you.

I recently had an opportunity to conduct some research to see if accident reports were having an impact on readers. Eighty-nine college aviation students participated in the study by completing a questionnaire, and then six weeks later reading an accident report and completing another questionnaire. The questionnaire was intended to measure invulnerability and attribution error.

The participants' responses to the questions on invulnerability showed very clearly that they did not believe they could be in an accident. The participants also clearly demonstrated a willingness to place the entire responsibility for an accident on the pilot, even when a number of situational factors contributed to the accident. However, the most interesting finding was that there was a remarkably consistent, but small, decrease in the measures of invulnerability immediately after reading an accident report. This means that reading an accident report does have an impact on the reader and does help to make a pilot think about their vulnerability to an accident.

The participants read one of two accident reports. One was a typical accident report format, while the other was written in a narrative format, describing the unfolding events from the pilot's perspective. Both report formats achieved the same level of change in invulnerability. However, the latter format was able to build sympathy for the pilot so that participants who read this style of report were more likely to believe that they could commit the same errors and be in a similar type of accident.

This is good news for those of us who read a lot of accident reports. It really does give us a more realistic sense of the fact that we could be in an accident if the wrong set of circumstances hit us. In addition, earlier research (see http://psy.otago.ac.nz/cogerg/Remembrance%20of%20Cases%20Past.pdf) conducted in New Zealand, and repeated here in Canada, demonstrates that we do recall lessons from accident reports while in flight. However, in order to make the most of these lessons, we need to keep some things in mind. Here are some practical suggestions for reading accident reports:

- Be aware of the fact that hindsight bias and attribution error do alter your perspective on an accident. As you read a report, think about how the unfolding events might have appeared to the pilot. Think about the decisions the pilot made, and try to ignore the fact that they resulted in an accident. Could you have made the same decisions? What circumstances might have led you to those decisions?
- Be aware of the fact that the majority of people have an unrealistically optimistic belief about the probability that they will be in an accident. Ask yourself if you are really being as cautious as you should be.
- Finally, as you read an accident report, remember that the pilot's actions made sense to them at the time. If you cannot make sense of the actions, you do not understand the situation as the pilot understood it. Try to step into the pilot's shoes and see if you can build sympathy for their predicament. Could you fall into the same trap? Could some external pressures or stresses cause you to behave in this way?

If we all use this kind of strategy as we read accident reports, we are more likely to learn valuable lessons from them, and this may prove to be the critical piece of information in some future decision you need to make. In the next issue, I will look at how to apply these same ideas to the way organizations think. △

NAV CANADA Safety Forums Focus on Sharing Safety-Related Information

by Ann Lindeis, Manager, Planning and Analysis, Safety and System Performance, NAV CANADA

NAV CANADA

The sharing of safety data between organizations is recognized worldwide as a critical component in enhancing safety in the aviation industry. Sharing safety data helps mitigate the problem of "transfer of risk," where one part of the aviation system inadvertently transfers risk to another part. For example, existing air traffic control (ATC) procedures may be less compatible with highly automated aircraft compared to conventional aircraft. Including all the involved parties to discuss common problems, such as missed readbacks/hearbacks, altitude busts, and runway incursions, also helps lead the way to creative solutions that benefit all stakeholders.

In 2006, the Safety and System Performance Group in NAV CANADA's Operations Department initiated a series of safety forums specifically aimed at sharing safety-related data and concerns. The Regional Safety Managers in Vancouver (Lana Graham), Edmonton/Winnipeg (Larry Ellis), Toronto (Jeffrey Wearn), and Montréal/Moncton/Gander (Serge Thibeault) led the forums in their respective regions, inviting local representatives from private, commercial and business aviation; aircraft manufacturers; airports; the Canadian Coast Guard; the Canadian Forces; the Transportation Safety Board of Canada (TSB); and Transport Canada.

Participants were provided an overview of operational safety data collected and analyzed by the Safety and System Performance Group, which focused primarily on events reported by controllers and flight service specialists through the Aviation Occurrence Reporting System (AORS), as well as through the contributing factors identified in operations safety investigations. After the presentation, participants were invited to discuss the various issues from their perspective.

Feedback from participants was very positive, prompting NAV CANADA to plan a similar series of meetings for 2007. In an effort to create a more in-depth exchange of data, the format of the meetings in 2007 will be changed: a few months prior to each meeting, participants will be requested to identify areas for discussion. Based on these suggestions, an agenda will be developed to focus on specific concerns, thereby allowing participants preparation time for gathering data or background information on the issues from their organization's perspective. NAV CANADA is also planning to invite more controllers and flight service specialists to participate in the forum to ensure a front-line operational focus.

If you would like more information on these forums, please contact Larry Lachance, Director, Safety and System Performance, NAV CANADA at lachanl@navanada.ca or 613-563-5426. △

COPA Corner—The Benefits of Flying More Often

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

Does flying more often make you a better pilot? Most people would agree that it does, but where is the evidence?

Our sister organization in the USA, the Aircraft Owners and Pilots Association (AOPA), recently published a report on pilots and aging that looked at accidents in relation to recent flying time, to see if there was any connection to aging. In looking at the accident records, AOPA found that, "time in type or hours in last 90 days by each pilot age group did not reveal any significant difference between groups. The less the time flown, the greater the incidence of accidents in all age groups."

This information is interesting for several reasons. It shows that all pilots can reduce their accident risk by flying more often. It also shows that this effect is the same for pilots of any age—older and more experienced pilots benefit from flying more often as much as younger pilots do.

Flying often means getting into the books, meeting other pilots and discussing issues of common interest—all of which contribute to a safer experience.

Why would flying more often be of benefit in reducing accidents? It is pretty clear from literature on the psychology of learning, that physical skills such as aircraft handling, along with cognitive skills such as making weather decisions, are both subject to deterioration over time. Use of these skills on a regular basis keeps them sharp, and that reduces accident risks. Having more practiced skills allows pilots to devote more attention to changes in flying conditions, such as dealing with deteriorating weather conditions. If pilots are not loaded up with the task of flying, then they can also more quickly detect other outside events that can affect the flight itself, such as the appearance of another aircraft in the circuit. The sooner a pilot can detect changes, the sooner they can *act* rather than *react* to those changes, whether it's turning around because of poor weather or lengthening the downwind leg of the circuit to accommodate another aircraft.

The key question is, "how much more do you have to fly to be safe?" Unfortunately, that depends greatly on the type of flying you do, the type of aircraft you are flying, whether you are part of a crew, and the weather conditions that you fly in. There is no evidence that says that flying fewer than "X" hours every 30 days isn't safe. There is little doubt that flying a single-engine aircraft solo in a night IFR environment in low weather takes more recent flying experience to feel comfortable than day VFR flying when the winds are light and the sun is shining. There is also little doubt that pilots flying single-engine aircraft at night in IFR conditions would need to do it more often in order to keep their skill level high and their accident risk low. Fewer accidents mean fewer insurance claims and fewer reasons to raise premiums. Anything that can help make flying less expensive would be great news for all pilots.

So is this an area that calls for more rules, e.g. if you don't fly "X" hours per year, you are grounded until you do a check ride? Definitely not. The amount of flying you need to do to keep your risks lower varies greatly and there is no good science to indicate how much is enough for all types of flying and for all individuals. This is very definitely an area of aviation where pilots need to look out for themselves. If you haven't flown much recently, if you don't feel up to speed on crosswind landings, then get some instruction and get back to a comfortable level of skill. How much flying do you need to do? Perhaps just a bit more than you did last year. △

A Different Way to Fly

by Garth Wallace

Dieter was a shy but friendly student pilot. Early lessons with him were exciting. The stocky, middle-aged bachelor flew our Cessna like it was the skid-steer loader he drove at the municipal dump. In time, he managed to master the Cessna's controls and passed his flight test. The written exam took longer, but he made it.

"I'm going to buy an airplane!" he declared.

It was the unrealized intention of many new pilots, but I didn't discourage him. "We can help you find the right one when the time comes," I replied.

Dieter was back in the office four days later. "I bought a homebuilt," he announced. "Got it from the builder. He's being flying her from a grass strip on his farm."

"Ah, Dieter, did you have a mechanic check it over first?"

"No, she just had an annual inspection. The owner did it himself. He said everything is good to go."

Dieter described the airplane as a low-wing, open cockpit, single-seater built from plans. "She's mostly wood and fabric," he said. "I can work on her myself."

I cringed. "When do you close the deal?" I asked.

"It's mine now," he answered enthusiastically. "I just need help transferring the ownership."

"Dieter, you're buying a homemade airplane maintained and inspected by the builder. It would be a really good idea to have a mechanic look at it."

The new pilot frowned. "The guy said she was government inspected when she was new, eh," he replied hopefully.

"When was that?"

He smiled nervously, "1978, but he said she's always been kept in a hangar."

"I'll help you with the paperwork, but I'd feel better if our mechanic checked her over. It's the only way to be sure of the condition inside the structure and the engine."

"I'll think about it."

We filled out the application for registration. Dieter told me that he paid $8,000 for the little airplane. "The deal includes the use of the lean-to hangar on the guy's farm for a year," he added. He also mentioned that his purchase had a tail-dragger landing gear.

"Then you need flight instruction in a tail-wheel airplane. They can be difficult on takeoff and landing. We can cover that in the flight school's Super Cub."

"OK."

We flew a lesson in the Cub and used part of it to visit the homebuilt at its airstrip. We landed and parked beside a ramshackle wooden shed. Dieter watched my face as I walked up to the airplane. The faded blue paint looked rolled on. The fabric covering was creased in places. The tires were bald. The engine was small. The four cylinders stuck out of the cowling.

"Well, it's a homebuilt," I declared, searching for something positive to say.

Dieter helped me take the canvas off the cockpit. There wasn't much to see. The control stick was a length of pipe growing out of the floor, topped with a bicycle grip. The number of instruments in the panel could be counted on one hand. There was no electric equipment.

Dieter danced around like a kid with a new bike. "She's kind of neat, eh?" he said.

I moved the stick. Control cables slapped the insides. I checked that the ignition was off and then flipped the wooden propeller. The engine wheezed through two complete rotations.

"Dieter, she's neat, but I don't know about airworthy. I wouldn't fly it without a third party inspection."

I talked him into it. The next week, the flight school mechanic drove to the farm and checked the airplane over. I figured that he'd condemn the old homebuilt. The man's approach to backyard airworthiness caught me off guard.

"It's fine," he declared.

"What!? What about the creases in the fabric?"

"The creases are fine. The fabric is just covering plywood. Creases would be a problem at high Mach, but we don't worry about the sound barrier in airplanes like that."

"What about the engine compression?"

"What compression? It's 65 horsepower, enough to turn the propeller. There is no afterburner."

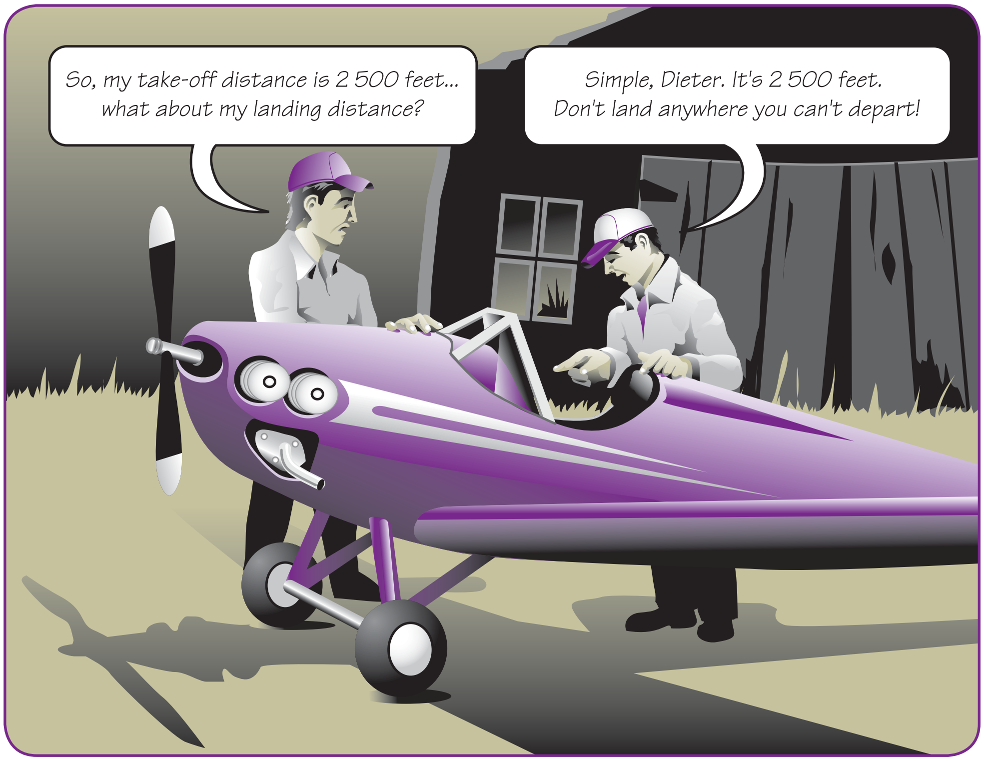
"And the bald tires?"

"If your man stays on grass, he should change them in five years."

"Did you check the slack in the control cables?"

"I tightened them." He was getting impatient with me. "Look, it's not a Cessna, it's a kite, an airplane for floating around on nice days. The finish is not best-of-show but the structure is sound and the engine runs. There is nothing else to check. Your man should have fun with it."

I gave Dieter the good news. "Let's do another lesson in the Super Cub before you try it."



"We have a big problem," he replied. "There is no handbook for the airplane."

"It's a homebuilt, Dieter. Each one is different depending on the engine, materials and construction."

"What about all the numbers and charts you taught me to use in the Cessna manual?"

Now it was my turn to make excuses. His recreational pilot training had emphasized knowledge of the pilot operating handbook and detailed flight planning.

"Did the former owner give you any information?"

"Not much."

"Bring it with you and we'll talk before we fly the Cub."

"OK."

We sat at a table in the office. Dieter read from a scrap of paper. "Climb 60 mph, cruise 80, approach 60 and stall 45. The owner said she burns about four gallons per hour. The tank holds 16. That's it."

"How about take-off and landing distances?"

"The guy said he always clears the trees departing from his strip. It's 2 500 feet long."

"That could be all the information you need," I said.

"What about all the stuff in the Cessna manual; performance versus density altitude, weight and balance, checklists and emergency procedures?"

"They all apply to the homebuilt," I replied, "but they're simplified because the airplane is so basic."

He frowned and waved the piece of paper at me. "This simple?"
"Almost. The owner gave you the worst-case take-off distance. It's 2 500 feet. That's in grass, at gross weight, in the summer, over an obstacle, and sometimes in light wind. Any other conditions will shorten that distance. Don't try to take off in a tail wind, up a slope or from anything less than 2 500 feet long, and you'll never have a problem."

"What about landing distance?"

"Simple. It's 2 500 feet. Don't land anywhere you can't depart."

Dieter scratched his head.

I continued. "All of the speeds are between 45 and 80 mph. Climb is 60 mph. Consider that the best rate of climb speed and best angle, with or without flaps. There are no flaps and the two speeds will be within a couple of miles-per-hour of each other, so stick to 60. Ditto for the approach and glide speeds.

"Cruise at 80 mph. That will come around 2 200 rpm. If the engine will turn the propeller faster, don't bother. It'll only make more noise, not speed. Fly slower if you want, but I don't think you will. With the rpm at 2 200, the fuel consumption will be fixed at four gallons per hour. There is no mixture control."

"What about higher altitudes?"

"Forget them. There's no heater. If that engine could take you over a few thousand feet, you'd freeze to death."

"So the range is fixed at four hours?" Dieter asked.

"Close. The endurance is fixed at three hours, with an hour for reserve. With a 20-mph headwind, ground speed will be 60, so use 180 miles as the range until you know the airplane better. If the wind is over 20 mph, don't fly."

"Weight and balance?"

"There is no place for passengers or baggage. Keep the gas tank topped up, and your weight and balance stays fixed. It would be helpful to know if the empty weight is close to normal for that model."

Dieter's face lit up. "That's no problem. It's a folding wing design. We have a truck scale at the dump. I'll tow her to work. I can show her to the guys."

"Good. Now, everything you learned about pre-flight inspections, checklists and emergency procedures apply, but are simplified. There are no antennae to check or cowlings to open. There is only one fuel drain. There are no doors to latch, no master switch to turn on or radios to set. Use the Cessna handbook as a guide and write your own operating manual."

"OK, I guess."

"Let's fly the Super Cub. We'll use 1 900 rpm for full power, 1 750 for cruise, and we won't extend the flaps."

I showed Dieter how to hand-start the Cub from behind the propeller and had him practise it.

On the runway I said, "take-off power is 1 900 rpm. Climb with the nose in its usual attitude and tell me the resulting airspeed."

The Cub broke ground at 1 000 ft. It climbed to 50 ft in another 1 000 ft at a speed of 65 mph. We departed on a local flight. The 1 750-rpm cruise gave us 70 mph. I had Dieter fly turns, climbs and descents. He flew the Cub better than ever. It handled more like the skid-steer loader at the reduced power and speed.

"OK, back to the airport. Use 65 mph but no flaps on the approach."

We flew a few circuits and then went back to the office.

"I have three more suggestions," I said. "First, hound the previous owner for operating and maintenance information. Second, join the local aircraft amateur-builders chapter, go to their next meeting, plead insanity and tell them what you bought. They'll welcome you like a lost brother."

He smiled. "OK."

"Lastly, plan on taking your first flight when the former owner can be there. I'll come too. We'll make sure you have fun." △

Garth Wallace is a former flying instructor who lives near Ottawa, Ont. He has written 10 aviation books published by Happy Landings (www.happylandings.com). The latest is Wing Nuts. *He can be contacted via e-mail at: garth@happylandings.com.*

Human Factors in Gliding

by Ian Oldaker, Director of Operations, Soaring Association of Canada (SAC)

The study of human factors (HF) is an important part of learning to fly. We know that in almost 80 percent of accidents, pilots contribute most to the problem. In the remaining 20 percent, there is usually an HF component. An example would be pressure to fly when the pilot knows it would be unwise to do so. We may be able to think of typical examples! We can all benefit from a review of HF.

HF is the study of how humans react to, and operate within, their environment in all senses of the word. The environment generally means the air and space in which we live. In aviation, we describe it more broadly to include the cockpit environment where temperature, light conditions and altitude vary; and the human environment of the flying club, the flight line operation, and so on.

HF includes how we respond to operating procedures; system design (especially cockpits); how the body functions and responds to many different stimuli; how we interact or communicate with, and are influenced by, other humans; and how we make decisions.

Ultimately, the safety of our flights comes down to how we, as pilots and equipment operators, relate to our equipment, procedures, other people and the environment.

Accident statistics from many years show that the greatest risks occur during takeoff and landing, when the cockpit workload is high. Add a long flight, and the landing phase is seen to demand the most attention, now from the fatigued pilot.

The top three major areas of concern in gliders worldwide are judgement or decision making, the stall/spin, and mid-air collisions. The first two can arise from problems with circuit planning, especially when flying cross-country, and when trying to make a safe landing after an emergency during the launch. Inattention and becoming distracted, perhaps by the newer in-cockpit electronics, have been implicated in mid-air collisions. How can we avoid these hazards and reduce the risks?

Humans receive many stimuli on which we base our decisions. We receive data, evaluate or process it, make a decision and then act on that decision. Sound familiar, does it? The mnemonic device, SOAR, learned early in your training, is just that: S for see the *situation*, O for what *options* do we have, A for *act* on the best and safest option, and R for *repeat* the sequence.

We assess the *situation* by gathering information that tells us how the flight is progressing; what the situation is *right now*:

- Are other gliders in sight nearby, and do we understand the eye's limitations?
- Does this control movement *feel* and *sound* right?
- What do the aircraft's movements and the G forces tell us? Is our food and water intake okay?
- How do we feel—hot, cold?

Psychological influences are very important:

- Have we just had an argument leading to emotional stress?
- Are we in a good, positive mood, and able to make sound decisions?

How is the glider performing—height, climbing or descending, and location relative to our goal, and the changing weather? We constantly evaluate all inputs so that we can make the best decisions for a safe continuation of the flight.

A negative or indifferent attitude will not support good judgment, and therefore, safety. Self-discipline includes everything from the use of checklists, to following rules and safe practices. It also includes avoiding the temptation to indulge in risky flying behaviour.

Judgment is the ability to identify useable options and make good decisions from experience. What do you know about yourself with respect to HF? For example, how will you perform under low- or high-intensity situations? This can explain our fright-or-flight response and our ability to react to unusual high-risk events. Experience shows some people perform better in emergencies when they have had similar exposures during training. Others may have difficulty thinking, or a tendency to *freeze*.

HF is also about risk management. Develop your own *comfort zone*. This means finding your personal level of satisfaction within the risks in gliding by identifying elements that protect you and make you comfortable. Learn causes of typical accidents and how to recognize departures from your usual routine by knowing your limits. Develop your personal discipline to include items such as checklists, weather minima, personal routines, etc. You need to discipline yourself to take the actions needed to break an accident sequence (the domino effect) or to correct a missed pattern. This is why your instructors will expose you to checklists such as IM-SAFE, SOAR, CISTRSC-O, and will explain what to do when one may be interrupted. The bottom line is to learn proper flying practices, apply consistency, personal discipline, and set and keep high standards in your flying.

For further information about human factors, read Transport Canada's publication: *Human Factors for Aviation—Basic Handbook*, TP 12863 (E) (09/2003). △

Pre-flight

Learning to Fly Takes Hours…
Learning When Not to Fly Takes Years…

Instrument Cross-Check

by John Lorenz. This article is an authorized reprint from the January–February 2005 issue of Southwest Aviator *magazine. For more articles, visit their online site at* www.swaviator.com.

Our IFR training does a good job of teaching the instrument scan for normal flying, as well as the more demanding partial-panel scan. However, most IFR training is seriously deficient when it comes to the important transition step between the two: the instrument cross-check technique that allows a pilot to recognize an instrument failure and thus prompts the change from normal to partial-panel flight.

The cross-check concept is taught—although its importance and application are not always made clear—during ground school, where we learn it as one of the three official "fundamentals" of instrument flying; the other two being instrument interpretation and aircraft control. We are also tested on knowledge of the system of primary vs. supporting instruments for various flight configurations. The system makes sense even though it is non-intuitive, but the important connection between this double-reverse/inverted system and its application as an instrument cross-check is rarely emphasized—and how many of us have actually been taught to regularly cross-check our instruments where it counts, in flight?

In fact, we tend to fly merrily along under the hood or in the clag using the primary instruments without cross-checking, i.e. backing them up. In part, this is because of how we're taught: normal instrument flight runs smoothly enough without an instrument cross-check, so instructors can't tell whether or not students are backing up the primary instruments, and therefore, they tend to gloss over it. Also, cross-checking is added work in what is already a task-saturated environment, so it tends to get dropped, usually without consequences. Yet, the instrument cross-check is an important backup measure that prevents a spatial-disorientation/unusual-attitude disaster by increasing the chance of early recognition of a failed instrument. Its importance only becomes apparent when an instrument actually fails.

The failures that an instrument cross-check is designed to detect cannot be demonstrated in flight. Simulators and computer training devices offer about the only opportunity to realistically train for gradual and/or unexpected instrument failures. Puckering liability issues dictate against installing a valve that can block the vacuum lines to simulate vacuum failure, and usually there are no switches to surreptitiously flick to disable an electric instrument. Yet, the importance of mastering the transition is apparent in several studies that have shown that: 1) it takes a significant amount of time, measured in minutes, for pilots just to recognize an instrument failure, and 2) this is plenty of time to get into real trouble. Coping with a failed instrument by using a partial-panel scan is an entirely different problem from recognizing the failure: the same pilots flew well enough in partial-panel mode when the instrument failure was known, suggesting that it is detection of the failure that is confusing, and that training for it is difficult, deficient, or both.

The flight instruments can be divided by whether they show roll, yaw, and/or pitch information, and theoretically you should cross-check flight indications in all three axes. However, roll and yaw in flight almost always occur together, and so, they can be lumped for simplicity. In order to cross-check roll/yaw indications, compare the attitude indicator/directional gyro (vacuum driven) with the turn coordinator (electrical). The imprecise magnetic compass can also be of some use in that if it is relatively stable, it indicates that the airplane is not turning, even if one of the other instruments shows it is.

Cross-check for pitch between: 1) the attitude indicator (vacuum), 2) the altimeter, airspeed and vertical speed indicators (pitot-static instruments), and 3) the power settings. Beware of the vertical speed indicator: it can wrap around far enough to give an erroneous, and therefore, confusing climb indication at high descent rates, and its indications lag significantly behind the actual conditions when pulling out of a steep dive.

One of the few places where the mechanics of an in-flight instrument cross-check have been described was written by Michael Church in *Private Pilot* magazine. Church suggests that turns, set up as a bank with the attitude indicator, should be backed up by checking to see that the turn coordinator agrees that the aircraft is actually turning, and in the desired direction. Simple enough so far: we do this anyway to establish the turn rate after establishing the bank. The less common flip side of the coin is that when the attitude indicator shows an unwanted turn, the turn coordinator should be checked to see that it corroborates the turn before trying to level the wings and coming back to a heading. Factor the heading indicator into these scenarios carefully, since both it and the attitude indicator are vacuum-driven, and could both be lying if the vacuum system is shot: cross-check to the vacuum gauge. If there is disagreement between instruments, take the time to figure out which one(s) are lying before making drastic moves.

Likewise, if the attitude indicator shows an unwanted descent, double-check with the airspeed indicator, vertical speed indicator, and/or altimeter before hauling back on the yoke. If you want to climb or descend, set it up with power and the attitude indicator, and then make sure the airplane is doing what you've told it to do by cross-checking to the same instruments.

Usually an instructor waves a heavy paw across the panel and slaps a cover on an instrument to simulate failure: there might as well be a red flashing sign: "Go To Partial-Panel, NOW!" It is much more difficult to detect the subtle and confusing indications of a real instrument failure, but it is imperative to do so because the chance to demonstrate dazzling partial-panel skill never occurs if the pilot does not first recognize the opportunity. △

Release of Seat Belts from the Seat Anchoring Point

An Aviation Safety Advisory *from the Transportation Safety Board of Canada (TSB)*

On July 25, 2006, a de Havilland DHC-8-100 departed St. Theresa Point, Man. (CYST), for Winnipeg, Man. (CYWG), with a crew of three and fourteen passengers. While en route at FL 200, the crew noticed a thunderstorm ahead of them, but well below their flight path. The crew turned on the seat belt sign and the flight attendant ensured that all passengers were seated with their seat belts fastened. As the aircraft approached the cloud, the crew noticed it was developing vertically rapidly; they turned westward to skirt around the edge of the disturbance, but encountered an area of turbulence. One large bump was felt that dropped the aircraft and caused loose articles in the cockpit and cabin area to hit the ceiling. Two of the passenger seat belts released, throwing the passengers from their seats. One of the passengers who was released was holding a five-month-old infant. Both hit their heads on the ceiling, causing minor bumps. The other passenger who was released was visibly shaken and could not move. The passenger was later assessed as having minor injuries. Several other passengers received minor flail injuries. The passengers whose seat belts released were moved to other seats, and their injuries were assessed. After landing in Winnipeg, all passengers were taken to hospital, treated, and later released.

The two seats belts that failed were from the aisle seat locations. The seat belts, part number 502745-E-2847, model number 502751, are manufactured by AmSafe Inc. of Phoenix, Ariz. The seat belts are snapped onto the seat attachment point with a hook, which incorporates a spring keeper for quick installation and removal. The seat, ID number 8S0151-1/-2, is manufactured by PTC Aerospace (now owned by B/E Aerospace). The seat incorporates a U-shaped attachment fitting bolted to the seat structure to accommodate the seat belt.

The two seat belts that failed had flipped around the U-shaped attachment fitting, and became lodged under a plastic trim molding on the side of the seat, adjacent to the aisle. A direct pull on the belt bent the spring keeper to the side, allowing the belts to become detached, even though the hook remained undamaged.

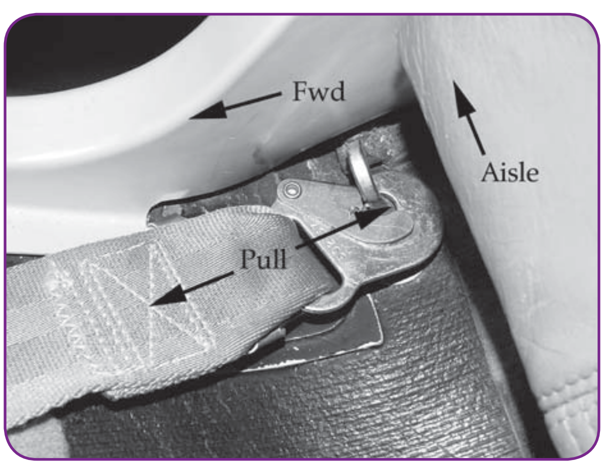


Figure 1: Seat belt hook snapped onto U-shaped fitting—pull is on hook

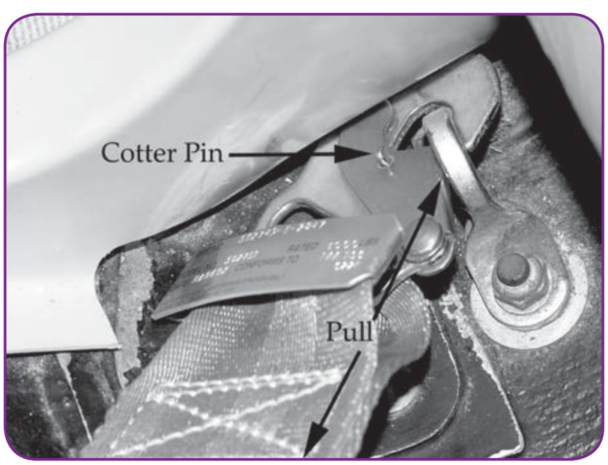


Figure 2: Hook flipped under trim molding —pull is on spring keeper

Flight Operations

Figure 3: Bent spring keeper

Figure 4: Seat belt identification

The seat belt is manufactured with a hole through the spring keeper to accommodate a cotter pin to lock the keeper in place. The locking provision was intended to prevent the unwanted removal of the seat belts. There is no *Technical Standard Order* (TSO) requirement by either the seat or seat belt manufacturer to have the cotter pin installed; the installation of the cotter pin is at the discretion of the operator. Misaligned seat belt clasps, without the cotter pin installed, take less of a pull to detach the seat belt from the seat attachment fitting. With the cotter pin installed, the misaligned belt has a better chance of aligning itself before a detachment occurs. These particular seat belts had the optional cotter pin installed.

Similar types of seat belt failures produced by the same seat belt manufacturer, but without a cotter pin installed in the spring keeper, were reported in two separate accidents referenced in *Special Airworthiness Information Bulletin* (SAIB) NM-04-37, issued on December 22, 2003, by the Federal Aviation Administration (FAA). In NM-04-37, the belts became detached from a Clevis-style attachment fitting, referred to as a "D-ring." Transport Canada issued *Service Difficulty Advisory* (SDA) AV-2004-02 on February 12, 2004, referencing the SAIB. Both SAIB NM-04-37 and SDA AV-2004-02 referenced over 20 aircraft manufacturers with many more aircraft model types having the potential for a similar occurrence.

Although SAIB NM-04-37 did not detail injuries sustained in the release of the seated occupants, both the FAA and the TSB are in agreement that the potential for serious or life-threatening injuries exists if the belts were to release during an aircraft accident, in-flight turbulence, or a hard landing. This occurrence demonstrated the possible alignment/interference problem associated with this particular seat and seat belt arrangement; however, the possibility of similar alignment/interference issues could exist for any seat using this quick-release-style seat belt.

Therefore, Transport Canada may wish to advise other commercial operators of the circumstances of this occurrence. As well, regulators and manufacturers may wish to consider the requirement for a special inspection to ensure that alignment or interference issues with this type of seat belt cannot occur, and that the optional cotter pin is installed as a permanent fixture. △

Be Prepared: What If an Emergency Happened to You? Part I

by Karen Smith, Inspector, Cabin Safety Standards, Civil Aviation, Transport Canada

Emergency! Emergency!

Those are the words you never want to hear when you are sitting in your passenger seat. *Would you be able to switch to emergency mode in seconds?* Flight attendants are trained to react quickly to emergency situations, but it is the preparation before an emergency that helps to ensure a successful outcome. This preparation comes in many forms, from the safety briefing to passengers prior to takeoff, to checking emergency equipment on the aircraft before the flight, to annual training. Flight attendants must balance the use of procedures and equipment on board with the unpredictable reactions from passengers—a daunting task under normal circumstances, much less amid the potential chaos of an evacuation. How do flight attendants—these masters of planning and crowd control—achieve this? *By being prepared.*

A good briefing is worth a thousand words

Good planning for a flight starts with the mandatory crew briefing between pilots and flight attendants. It is an opportunity to ask questions and get a clear picture of the flight ahead. Crew members should take the time to conduct a complete briefing, defining roles and responsibilities, discussing en-route weather, passenger loads and special needs, emergency equipment, safety and emergency procedures and any additional information necessary for the flight. Good communication, as we all know, is essential to an effective and successful flight, but is even more crucial in the event of an evacuation.

The passenger briefing prior to takeoff is an integral part of the preparation of a flight. Regulations ensure that passengers have received a briefing in both official languages at the beginning of the flight, and that all the pertinent information necessary to "survive a crash" is in that briefing and the safety features card found in front of the passengers' seat. All too often, many passengers do not pay sufficient, if any, attention to the safety briefing. Studies show that ill-prepared passengers can be a hindrance in an evacuation. Flight attendants are constantly seeking innovative ways to engage passengers' attention for this vital briefing, as they understand the importance of the information that is being transmitted. Flight attendants also attend to passengers with special needs who may require individual briefings. Every passenger must receive information on the location of exits, the safety features cards and emergency lighting, the fastening of seatbelts, and if applicable, the use and location of oxygen masks or life preservers. The next time you fly, listen to the briefing, look at the safety features card in front of you, take responsibility for your own safety and *be prepared*.

Batten down the hatches

Once the passengers are briefed, the flight attendant(s) will ensure the cabin is prepared for takeoff. This is achieved by visually inspecting the cabin area to verify that all carry-on baggage is safely stowed in overhead bins or under seats, babies are in car seats or lap-held in a safe manner, seatbelts are fastened snugly across passengers' hips, seat backs are in the upright position, cabin doors are armed, and galley equipment and compartments are locked. Bags and articles, if not properly stowed, may become projectiles and obstructions that could injure or hinder passengers and crew. A properly-secured cabin can be evacuated more efficiently than an unsecured cabin. The next time you fly, ensure that you have done your part to help secure the cabin prior to takeoff by following instructions and stowing your items. *Be prepared*.

No, I'm not ignoring you

When the cabin is prepared for takeoff, the flight attendant(s) will advise the captain and take their assigned seat and, as they do for every takeoff and landing, they will conduct a silent review. Have you ever wondered what flight attendants are thinking about while seated on a jumpseat? The silent review is a mental checklist. It is a review of exit locations and operation, evacuation routes out of the aircraft, commands to be used to guide passengers, and identification of passengers who may be selected to assist with an evacuation. Although it might appear that the flight attendant is ignoring you, this technique helps to keep procedures in order for a flight attendant who may fly on numerous aircraft types, where equipment may be different, and the layout of the cabin and functioning of exits or procedures may not be the same. As a passenger, you too can do a mental review, know where your nearest exit is, count the rows to that exit and be familiar with how it operates. *Be prepared*.

Brace yourself: prepared or unprepared evacuation

An emergency can happen upon takeoff or landing. With some emergencies, the crew has prior notice of a problem and time to prepare the passengers. With other situations, there is no prior warning, no time to prepare, flight attendants must use the procedures for which they are trained to control, direct and assist passengers to evacuate. *Would you be able to switch to emergency mode in seconds…?*

Join us in the next issue of the *Aviation Safety Letter*, when we look at the dynamics of an aircraft evacuation from the cabin safety perspective. △

Cross-Country Flying in Short-Legged Aircraft . . . Planning Helps

by Bob Merrick. Bob is a System Safety alumni who promotes aviation safety in all he does. He writes regularly for COPA Flight.

Although it's hard to find accurate statistics, it seems that the practice of using light aircraft for long voyages is increasing. Certainly, *COPA Flight*, the monthly paper published by the Canadian Owners and Pilots Association (COPA) for its 17 000 general aviation readers, often carries accounts of odysseys undertaken by their members; odysseys that take those members far from their starting point, often over some forbidding terrain, or through areas where the climate can be totally unaffected by global warming.

The common thread in such articles is the pre-flight planning required. No, not the kind of planning that says, "we'll fly this heading for a while until we reach East Porcupine Quill, then crank over to about 285°M, which will take us to Grand Central Nowhere." That sort of planning is vital, no doubt about it, and it's particularly vital for the day or days of the excursion, but it's relatively short-range.

Most of those pilots planning extended flights in short-legged aircraft start their planning well before the preferred launch date. Some start by reviewing the pilot's qualifications. How recent is their experience? Is it necessary to apply a new coat of polish to skills (and knowledge) that have become somewhat atrophied since the previous flying season? Local flying schools and their instructors are generally quite happy to remove any rust that might have formed on dormant skills.

Others start with the aircraft. Although modern aircraft are far more reliable than their long-ago ancestors, their engines can still go into auto-rough when flown off the beaten path. Where is your aircraft in its maintenance cycle? "It's good until we get back," you say? Perhaps a check before starting out might not be a bad idea.

Mechanical things have this way of having dizzy spells from time to time. A consultation with your favourite aircraft maintenance engineer (AME) can help uncover incipient problems that, in the general cussedness of things, occur at the worst possible time, in the worst possible place.

Most readers know that we are now getting to the point where there are rules for everything. Just to keep life interesting, those rules keep changing, and the changes are promulgated in various dated publications. Be they electronic, be they paper, or be they chiselled into stone tablets, they are all dated, and woe betides those who take their information from one or two issues ago. Current publications, in whatever form you choose to carry them, are a must. Don't leave home without them, as you might not get back.

Many people will throw in a hand-held GPS, thinking that they will be right on track, all the time. And so they will, at least until the batteries die. Even if the batteries don't die, there is always the risk of doing as one pilot did about a decade ago. He was faithfully following his GPS right up to the point where he flew smack dab into a mountain that had been there, right in the middle of the track, long before GPS. Current charts are essential.

Should your route take you into the United States, a passport is a **necessity**. Since January 23, 2007, all people—pilots and passengers—arriving in the U.S. by air **must** have a valid passport. If your passport is likely to expire during your journey, renew it now. As this is written (February 2007), there is about a 40-day waiting period for a new passport, so don't let this requirement slide. It could spoil your entire holiday.

There are other things that could spoil your holiday; things that you really can't control. A few paragraphs back, we were extolling the virtues of modern aircraft, which seldom break down in mid-flight. Thus, we don't have to worry about that, do we? Sadly, the answer is: "yes." Modern aircraft can, and do, get tired of flying, and head for the nearest patch of ground.

One of the major reasons you sprang for that pilot refresher course was so that you could handle just such an eventuality. After using your newly-enhanced skills to put the aircraft on the ground in one piece (more or less), the question is: "now what?"

The answer depends on the severity of the forced landing. Are you and your passengers prepared to spend a night in the bush, or is everyone attired in a tasteful collection of shorts, T-shirts and sandals? Although David Suzuki might differ, you cannot, for a good many years, rely on global warming to keep you cozy and comfortable during an unplanned overnight stay in the Canadian wilderness. Your pre-odyssey flight planning should encompass such details as care and feeding of your emergency locator transmitter (ELT) and survival gear during impromptu camp-outs.

What else might you think about? Of course, summoning help. How do you do that? With your ELT, that's how. Turn it on and leave it on. Until 2009, COSPAS-SARSAT satellites will hear the plaintive wails, forward them to the search and rescue (SAR) network, and erelong, a SAR aircraft will arrive. After 2009, such satellites will no longer monitor the aviation voice distress frequencies of 121.5/243.0 MHz. Cell or satellite phones can supplement the ELT for reaching out and touching someone.

However, it's not an "instant SAR kit." It can take 90 min or so for the system to localize your position, and, depending on weather, your location and other factors, it can take several hours or more for the SAR aircraft to arrive at the scene.

Such planning is necessary for traversing remote areas. Are you likely to need such plans? Well, no, but if such incidents are not considered in the planning stages, you'll have to deal with them when things go wrong. That is the wrong time to wish that you had brought a jacket, some matches and several quarts of bug repellent.

The continual improvement in aircraft, aero engines, electronics and communication gear has done much to reduce risk in aviation, but it hasn't eliminated it. Thorough pre-flight planning can reduce the risk even further.

And what is the reward for all that work? Well, according to the enthusiastic articles in *COPA Flight*, pilots and their passengers get to view magnificent vistas seldom seen by lesser mortals who are forced to fly with "Air Megaseat" some seven miles above one of the most scenic lands on earth. Not for them the thrill of seeing the mountains, the prairies, the lakes, with the shifting, dancing colours, or to experience the joys of flight as seen from a light aircraft. A light-aircraft odyssey across a wonderful country is something few people get to do. It's a privilege, and like all privileges, it must be earned. Your thorough pre-flight planning is part of the price you must pay for such a remarkable experience. But, it's worth it. Have a wonderful trip! △

REGULATIONS AND YOU

The Applicability of the *Canadian Aviation Regulations* (CARs) Inside and Outside Canadian Airspace

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

The Aviation Enforcement Division regularly receives questions regarding the applicability of the CARs relating to possible or alleged contraventions committed under various circumstances. In order to assist those with similar questions, the following is a brief overview of the CARs applicability in Canada and abroad.

The answers to these questions can be found in the *Aeronautics Act*. Simply stated, the CARs apply not only to all Canadian Aviation Document (CAD) holders in Canada, but to any other person, including foreigners, conducting aviation-related activities here. They also apply to passengers, aeronautical products and other things or activities related to aviation. For instance, the CARs apply not only to Canadian operators, but also to Canadian foreign air operator certificate holders and foreign private aircraft pilots conducting activities in Canadian airspace.

Likewise, the CARs also apply to CAD holders, Canadian aircraft, associated passengers and crew members outside Canadian airspace, except in instances where aviation regulations of the country where operations are being conducted conflict with the Canadian regulations. In all cases, however, operations in foreign airspace must comply with, or be operated in accordance with, the foreign regulations or the CARs, whichever is more restrictive. Therefore, Canadian commercial air operators should not assume that operations specifications issued to them for use in Canada are valid in any foreign country.

Any act or omission committed outside Canadian airspace, where it would be a contravention of a provision under the *Aeronautics Act* if committed in Canada, may be prosecuted under Canadian aviation legislation, unless that act or omission was conducted in order to comply with the aeronautics laws of the State where the event took place.

Although in most cases it is that simple, it should be understood that this very brief overview about the applicability of the CARs inside and outside Canadian airspace might not address all unique circumstances. Further information on the applicability of the CARs may be found in Part 1, Section 4 of the *Aeronautics Act*. You may also contact your Regional Aviation Enforcement Division for additional guidance. △

Evaluation—Single-Engine Turbine Airplanes Transporting Passengers in IFR Flight or Night VFR

by Jim McMenemy, Project Manager, Safety Intelligence, Policy and Regulatory Services, Civil Aviation, Transport Canada

In 1996, the *Canadian Aviation Regulations* (CARs) were changed to allow air operators to carry passengers in approved single-engine instrument flight rules (SEIFR) aircraft. The rule change has never been evaluated to determine whether it has contributed to a reduction of risk for the travelling public. The goals of this paper are to:

a. evaluate the extent to which this rule change achieved its goal of reducing risk to the travelling public; and
b. identify and analyze residual risks that pertain to SEIFR.

For this report, SEIFR refers to single-engine, turbine-powered, commercial aircraft transporting passengers under the authority of Operations Specification (Ops Spec) 001-703. Occurrences to aircraft operating outside of Ops Spec 001-703, such as cargo flights, are cited because the data relate to essentially similar aircraft, and as such, support the evaluation.

Background

In the 1990s, operators and aircraft manufacturers were requesting that Transport Canada (TC) allow turbine-powered single-engine aircraft to conduct passenger-carrying operations. They argued that such a move would enhance safety for the travelling public by addressing three hazards, or sources of risk:

a. allowing SEIFR under controlled conditions would provide pilots with a safe option when encountering marginal or deteriorating conditions, or contemplating flight under such conditions, as opposed to trying to maintain VFR flight in challenging conditions;
b. the higher reliability of the engines in potential SEIFR aircraft would provide a lower level of risk than that associated with reciprocating engines, including most light twin engines; and
c. aircraft capable of SEIFR passenger operations would increase potential fleet utilization, which could influence equipment selection in favour of more reliable, capable, and safer turbine-powered aircraft.

Before changing the regulations, TC evaluated the accident and fatality records, the reliability of potential engines and aircraft, and identified associated risk factors. Controlled flight into terrain (CFIT) was a major concern to the Transportation Safety Board of Canada (TSB) and TC during the 1990s. CFIT accidents kill more people than any other type of aircraft accident. They typically occur in poor visibility conditions and/or at night, when the aircraft can collide with an obstacle before the pilot can react and avoid it. If the SEIFR rule change were to lead to pilots selecting a less risky option than flying VFR in poor conditions, this might, over time, lead to a decrease in the number of air taxi aircraft CFIT accidents with passengers on board.

Pre-implementation accident record

TC staff conducted a retrospective analysis of 129 CFIT[1] and loss-of-control accidents occurring between 1984 and 1995. Accidents were examined and categorized. Two of the categories were VFR flight into instrument meteorological conditions (IMC), and night VFR.

Thirty-seven accidents involved fixed-wing aircraft on VFR flights entering IMC. Fifteen were privately–registered, and are therefore not relevant to the SEIFR rule change. Commercial flights in fixed-wing aircraft had 21 accidents, resulting in 27 fatalities and 10 serious injuries.

There were 27 night VFR accidents, of which 18 were in commercial fixed-wing operations. These commercial aviation accidents claimed 21 lives and resulted in five serious injuries.

The accident and fatality totals represented an unacceptable level of risk, which, with other things being equal, would be reduced significantly—if not eliminated—had IFR been available to the pilots. Risk in aviation, however, is not one-dimensional. Reducing the risk associated with one hazard can create new hazards, or exacerbate those already existing. TC staff examined the issue thoroughly to determine how a rule change might affect the overall risk profile.

[1] *A Study into the Safety of Flight in Marginal Visibility*, Transport Canada, 1997

The Clarenville accident investigation generated six safety recommendations aimed at enhancing SEIFR safety.

System reliability

Supporters of SEIFR claimed that single-engine, turbine-powered aircraft represented a lower level of risk to the travelling public than the bulk of the existing air taxi fleet, reciprocating engines in either a single or light twin configuration [certified under U.S. *Federal Aviation Regulation* (FAR) 23]. All candidate aircraft for SEIFR are powered by Pratt & Whitney Canada PT6 engine variants. The PT6 has earned a reputation for excellent reliability. A TC position paper,[2] entitled *Commercial Passenger Service—Night / Instrument Meteorological Conditions in Single-Engined Aeroplanes*, refers to an optimistic engine failure rate for the Pratt & Whitney PT6 engine of 1/200 000 hr. The source of this data is not cited.

The PT6 is far more reliable than the reciprocating engines that predominated in the air taxi fleet. The PT6 delivers a safety advantage over reciprocating engines in single-engine aircraft.

Fleet composition

Equipment selection is a complex decision, influenced by strategic factors, economic factors (including cost, finance considerations, operating costs, market factors, etc.), and opportunity.

The SEIFR fleet is comprised, almost entirely, of Cessna C208 and Pilatus PC-12 aircraft. In 1995, the year before the SEIFR rule change, there were eight C208 aircraft registered in Canada and no PC-12s.

The regulations

The CARs are organized so that different aspects of an activity, such as carrying passengers, aircraft equipment required, crew qualifications, and maintenance requirements, are dealt with in different sections and subsections. The carriage of passengers in an SEIFR regime requires that an operator obtain approval for an Ops Spec. The Ops Spec is added to the operations manual and thereafter carries the force of law. Approval of the Ops Spec requires the operator to adhere to higher standard requirements for pilot experience, training, aircraft equipment, and maintenance.

Post-implementation evaluation

As noted above, it was postulated that SEIFR would enhance safety of the air taxi sector and the public using air taxi services in three major ways:

a. CFIT accidents (the most severe type of air accident) would be reduced by providing a safe alternative to VFR flight in marginal or deteriorating conditions;
b. the high reliability of turbine engines in SEIFR aircraft would provide a lower level of risk than that associated with reciprocating engines; and
c. SEIFR might encourage operators to replace old aircraft with newer, more reliable and capable equipment.

Post-implementation accident record

<u>Approved SEIFR aircraft occurrences</u>

All accidents and relevant incidents involving aircraft approved for operation under the SEIFR Ops Spec were drawn from the TSB Aviation Safety Information System (ASIS) database. Twenty-one accidents and one incident were identified. There were three fatal accidents accounting for 21 deaths. The TSB is still investigating the C208 accident that occurred near Port Alberni, B.C., in January 2006, which resulted from an engine failure during IFR flight. Factual information released by the TSB on this accident indicates that significant factors, other than the SEIFR rules, likely contributed to this occurrence.

The C208 accident that occurred on Pelee Island, Ont., in 2004, resulted from attempting an overweight takeoff with ice contaminating the wings. The SEIFR issue was not germane to this accident, which claimed 10 lives. The TSB was unable to determine the probable cause(s) of a C208 accident that occurred in Summer Beaver, Ont., in 2003, but there was no evidence of a mechanical or aircraft system failure. The possibility of spatial disorientation during this night VFR flight was not ruled out. There is no evidence to suggest that the number of engines on the aircraft is a factor.

Feature

[2] Position Paper—*Commercial Passenger Service—Night / Instrument Meteorological Conditions in Single-Engined Aeroplanes*

Table 1: SEIFR Aircraft Accidents 1996–2006

TSB Report Number	Aircraft	Location	Number of Passengers and Injuries	Comments
A01W0269	C208	Inuvik, N.W.T.	N/A 1 passenger and 1 pilot: minor injuries	VFR: Encountered IMC. Pilot requested and was issued IFR clearance for approach. Poor execution—flew into terrain.
A03C0302	C208	Brochet, Man.	N/A 1 passenger: minor injuries	VFR: Take-off flap not selected—runway overrun. One passenger: minor injuries.
A98Q0117	C208	Quyon, Que.	N/A	VFR: Landed on water with wheels down.
A05O0131	C208	Lake Joseph, Ont.	0 Pilot, alone on board: no injuries	VFR: Landed on water with wheels down.
A06P0010	C208	Port Alberni, B.C.	7 2 passengers and 1 pilot: fatally injured 5 passengers: injured	IFR: Still under investigation.
A99C0237	C208	Hoar Frost River, N.W.T.	2 No injuries	VFR: Landing on rough water accident.
A98W0014	C208	Edmonton, Alta.	N/A No injuries	VFR: Crash after takeoff. No information from the TSB, but pilot disorientation was likely a central factor according to information supplied by the operator.
A03H0002	C208	Summer Beaver, Ont.	7 7 passengers and 1 pilot: fatally injured	Night VFR: Probable disorientation.
A97O0001	C208	Nakina, Ont.	N/A No injuries	Mis-set rudder trim. Indicator inaccurate—loss of control on takeoff.
A03C0111	C208	Nanuk Camp, Nun.	N/A No injuries	VFR: Unmaintained strip. Soft ground broke nose gear.
A99C0260	C208	Red Lake, Ont.	N/A Pilot: minor injuries	Special VFR: Manoeuvred to avoid birds—struck water.
A98C0068	C208	Pickle Lake, Ont.	0 Pilot, alone on board: no injuries	VFR: Low flying—struck tree tops.
A01C0217	PC-12	Red Lake, Ont.	N/A	Engine anomaly noted prior to takeoff—fuel control unit (FCU) replaced and engine changed later.
A01C0160	PC-12	Sioux Lookout, Ont.	N/A	Engine torque fluctuating on climb out. Aircraft returned to land.
A99C0019	PC-12	Churchill, Man.	N/A No injuries	Aircraft hit building while taxiing.
A00C0170	PC-12	Thunder Bay, Ont.	N/A No injuries	Power anomaly in flight. Suspected FCU fault. Crew used FCU manual override. Landed safely.
A98W0240	PC-12	Yellowknife, N.W.T.	N/A	Power failure shortly after takeoff. Fuel transfer tube failure. Emergency declared. Landed.
A04H0001	C208	Pelee Island, Ont.	9 9 passengers and 1 pilot: fatally injured	Overweight takeoff. Aircraft contaminated with ice.

TSB Report Number	Aircraft	Location	Number of Passengers and Injuries	Comments
A01Q0151	C208	La Grande-4, Que.	0 Pilot, alone on board: minor injuries	VFR: Power loss after changing to left fuel tank.
A98A0067	PC-12	Clarenville, N.L.	8 1 passenger, 1 pilot and 1 other: serious injuries 7 passengers: minor injuries	Engine failure. Led to six TSB aviation safety recommendations.
A05O0131	C208	Lake Joseph, Ont.	0 Pilot, alone on board: no injuries	VFR: Landed on water with amphibious gear extended.
A98O0082	PC-12	Kingston, Ont.	N/A	Fuel cell vents blocked—cells collapsed.

Of the 22 occurrences, three resulted from power failures, including the fatal accident near Port Alberni. A PC-12 power loss near Clarenville, N.L., led to a forced-landing with no fatalities. A PC-12 lost power shortly after takeoff from Yellowknife, N.W.T., and returned to land at the airport. Three others involved engine anomalies. In one case, a fuel control unit (FCU) fault was suspected and the crew maintained power and control by using the manual override, as provided for in the design and required by SEIFR regulations. In another case, the anomaly was noted pre-takeoff, and in the third case, the crew was able to return to the ramp.

The post-implementation occurrence record reveals two accidents where the single-engine and IFR flight is relevant: Port Alberni and Clarenville. In the other two fatal accidents, the single engine was not a contributing factor. Pelee Island was an overweight takeoff with ice on the wings; at Summer Beaver, the aircraft appears to have been operating as designed.

The Clarenville accident investigation generated six safety recommendations aimed at enhancing SEIFR safety. The TSB recommended that:

- the Department of Transport require that pressurized SEIFR aircraft have sufficient supplemental oxygen to allow for an optimal glide profile during an engine-out let-down from the aircraft's maximum operating level until a cabin altitude of 13 000 ft is attained;
- the Department of Transport require that SEIFR aircraft have sufficient emergency electrical supply to power essential electrical systems following engine failure throughout the entirety of a descent, at optimal glide speed and configuration, from the aircraft's maximum operating level to ground level;
- the Department of Transport require that the magnetic chip detecting system on PT6-equipped single-engine aircraft be modified to provide a warning to the pilot of excessive ferrous material in the entire engine oil lubricating system;
- the Department of Transport require that SEIFR operators have in place an automatic system or an approved program that will monitor and record those engine parameters critical to engine performance and condition;
- the Department of Transport review the equipment standard for SEIFR and include equipment technologies that would serve to further minimize the risks associated with SEIFR flight; and
- the Department of Transport improve the quality of pilot decision making in commercial air operations through appropriate training standards for crew members.

TC accepted all of these recommendations, and safety improvements have been introduced. The TSB assessment of TC responses and follow-through on all these recommendations, except the last, is satisfactory and the recommendations are closed. The final item, pilot decision making, is currently rated as satisfactory intent, and the TSB continues to assess TC progress.

Over a period about 10 years, two accidents resulting in three fatalities are attributable to SEIFR operations. Many of the remaining accidents involving approved SEIFR aircraft were in VFR flight, and in others, whether the aircraft had one or multiple engines is irrelevant to VFR into IMC and night VFR accidents.

In order to compare the post-implementation rate of VFR into IMC and night VFR accidents to that reported in the 1997 retrospective study, similar criteria were used to identify accidents in the post-1996 period. The accidents that were identified included single- and multi-engine aircraft. Some were passenger-carrying flights, but cargo flights and flights whose purpose is not identified were included. The inclusive nature of this group of accidents ensures its comparability with the similar accidents analyzed in 1996.

Twenty-two accidents were identified. Four were night VFR accidents and 18 were VFR into IMC. One SEIFR aircraft accident (see Table 1) also qualifies for this group. The Summer Beaver aircraft (A03H0002) was on a night VFR flight. There was a total of 23 VFR into IMC and night VFR accidents involving commercially-registered, fixed-wing aircraft being operated under Part VII of the CARs between 1996 and 2006. There were 44 fatalities.

In the 11 years from 1984 to 1995, there were 48 VFR into IMC and night VFR accidents, an average of 4.3 per year. Since 1996, the rate has been reduced to an average of 2.1 annually.

Not all these flights were carrying passengers. Included in the 22 accidents since 1996 are ferry flights and cargo flights. It should also be noted that, in some cases, the flight crew did not take advantage of the SEIFR option, although it was available. A C208 cargo flight to Victoria, B.C., in 1998, was conducted under VFR at night, although, in retrospect, conditions were such that IFR would have been safer. The crew and aircraft were capable of IFR flight.

Table 2: VFR into IMC/Night VFR Accidents 1996–2006

TSB Report Number	Aircraft	Location	Number of Passengers and Injuries	Comments
A05W0199	C172	Norman Wells, N.W.T.	3	VFR: Weather deteriorated. Had to await SVFR for 20 min—ran out of fuel.
A96P0082	DHC-3	Terrace, B.C.	1 1 passenger and 1 pilot: fatally injured	Apparent CFIT. Aircraft struck mountain 30 mi. from destination. No survivors.
A96P0178	DHC-3	Alliford Bay, B.C.	2 2 passengers and 1 pilot: fatally injured	Float plane. Probable navigation error. Aircraft hit rising terrain after encountering IMC.
A96W0183	DHC-2	Watson Lake, Y.T.	0 Pilot fatally injured	Float plane. Aircraft struck terrain and burned.
A98P0194	DHC-2	Samuel Island, B.C.	4	Float plane. Two aircraft proceeding together in marginal VFR. Started to land—precautionary—visibility improved and stalled in overshoot.
A98Q0154	C172	Mont-Joli, Que.	N/A No fatalities	VFR: Encountered IMC. Tried to turn around—struck mountain.
A98Q0159	DHC-2	Rivière Duhamel, Que.	N/A	Float Plane. Marginal VFR at departure—visibility dropped to ¼ mi.; ceiling 400 ft. Turned and approached stall—lowered nose, struck trees and crashed.
A98P0303	C208	Victoria, B.C.	0 2 pilots: both fatally injured	Night VFR: IFR capability. Lower ceiling than expected. Deviated form intended track navigating by visual references. Struck mountain.
A99O0242	C172	Bancroft, Ont.	2 Minor injuries	Sightseeing flight. Did not obtain all relevant weather. Encountered IMC. Climbed and held. Low on fuel, used local radio station as NAVAID for cloud braking. Struck trees looking for approach.
A00P0092	C285	Moose Lake, B.C.	0	Float plane. Encountered IMC. Precautionary landing at 4 500 ft elevation.

TSB Report Number	Aircraft	Location	Number of Passengers and Injuries	Comments
A01W0304	C172	Fort Good Hope, N.W.T.	3 All passengers and 1 pilot: fatally injured	VFR: Flew into known icing and IMC.
A02C0191	DHC-2	Kashishabog Lake, Ont.	4 1 passenger: fatally injured	Float plane. Encountered IMC. Found destination. On final, struck water with one float. All survived impact—one passenger died from drowning.
A05P0039	DHC-2	Campbell River, B.C.	4 4 passengers and 1 pilot: fatally injured	Float plane. Aircraft went missing en route. Fog noted in area. Wreckage found under water.
A05Q0116	C206	La Tuque, Que.	2	Float plane. Took off into fog. Lost references—struck trees on side of hill.
A06P0157	C185	Mount Downton, B.C.	1 1 passenger and 1 pilot: fatally injured	Float plane. Weather: numerous cells in area. Possible navigational error, flying up wrong valley.
A96Q0076	PA-31	Chubb Crater, Que.	4 4 passengers and 1 pilot: fatally injured	Probable sightseeing detour. Weather deteriorated. GPS mis-programmed. Struck terrain. IFR capable.
A97C0215	PA-34-200T	La Loche, Sask.	5 3 passengers: fatally injured	Night VFR: Aircraft and pilot IFR capable, but due to icing in cloud, aircraft was not equipped to enter cloud on this flight. Struck terrain in wooded area.
A97P0351	C402	Mackenzie, B.C.	2 2 passengers and 1 pilot: fatally injured	Company restricted to VFR. Complex weather—probably encountered IMC and struck water surface.
A99C0266	Beech 58	La Ronge, Sask.	1	Night VFR: Weather deteriorated. Pilot requested SVFR for arrival. Had to wait for IFR traffic. IFR flight did one missed approach before landing. Aircraft struck lake surface.
A00P0019	PA-31-350	Williston Lake, B.C.	0	Only VFR available due to no available IFR approaches in the area. Lost visual reference in snow storm—struck frozen lake.
A03W0202	C414	Calgary, Alta.	0	Night VFR: IFR was available. Struck mountain peak. Started descent early.
A06W0139	C337	Fort Good Hope, N.W.T.	5 5 passengers and 1 pilot: fatally injured	VFR: TSB investigating. Apparent CFIT.

Nine of the accident aircraft were float-equipped. IFR is not appropriate for most float operations, which serve remote areas, under uncontrolled airspace, without the electronic navigational aids familiar to crews flying in more populous areas. Most of the accident aircraft were serving small communities or bush camps. Two exceptions are the C208 near Victoria and the C414 in mountains southwest of Calgary, Alta. Both accidents occurred in mountainous terrain.

Post-implementation system reliability

The PT6 engine has maintained an excellent record and reputation for reliability. Pratt & Whitney data for the PT6A-67B/D recorded 1 275 600 hr in fleet operations in 2005. There were 10 in-flight shutdowns for a rate of 0.008 per 1 000 hr. This is above the estimate presented in the position paper, but well within the internationally-accepted rate for such applications.

Post-implementation fleet composition

Since 1995, Canadian operators have steadily purchased more SEIFR aircraft. Currently there are ninety-six C208 and sixty-four PC-12 aircraft registered. Figure 1 displays the change year-over-year in PC-12 and C208 registration. A third type, the Socata TBM 700 is operated in Canada in much smaller numbers than the C208 and PC-12, as evidenced in Table 3.

Figure 1: SEIFR Aircraft Registered 1994–2006

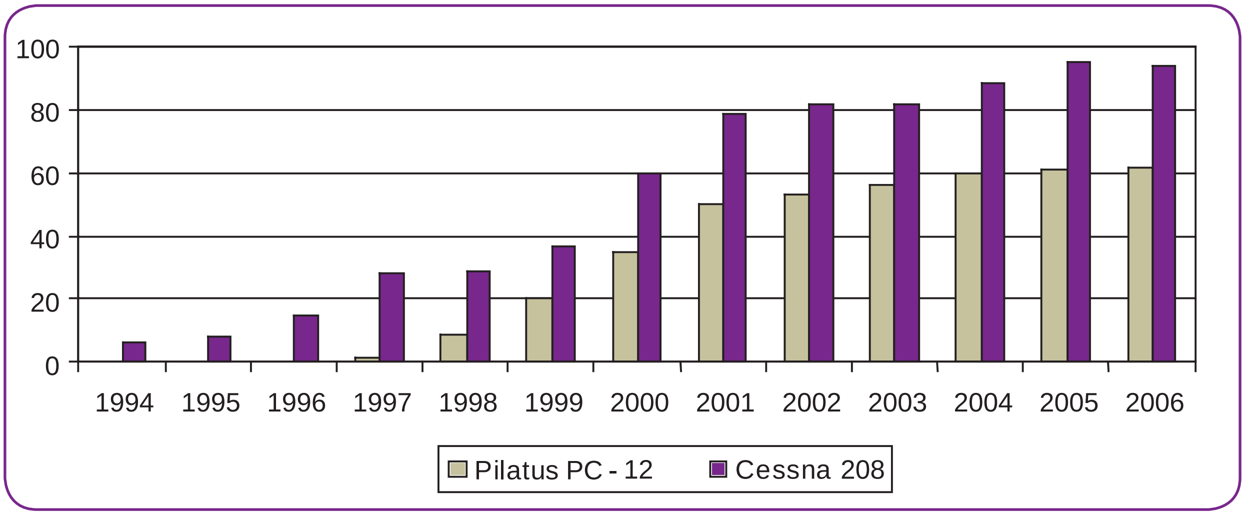


Table 3 shows that, while most of the Cessna and Pilatus aircraft are commercial aircraft, a significant number are in state or private hands. Of the 164 SEIFR aircraft, 127 are registered as commercial aircraft. An additional 17 are owned by government agencies, and 20 are privately-registered. The PC-12 privately-registered aircraft are required to be operated under CAR 604, and oversight authority is delegated to the Canadian Business Aviation Association (CBAA).

Table 3: The Single-Engine Turbine-Powered Fleet[3]

Cessna 208		**Pilatus PC-12**		**Socata TBM 700**	
Private	12	Private	5	Private	3
State	3	State	14	State	0
Commercial	81	Commercial	45	Commercial	1
TOTAL	**96**	TOTAL	**64**	TOTAL	**4**

The number of very reliable turbine-powered single-engine aircraft has increased in absolute terms, but such a change should be interpreted in relation to the entire fleet. In 1995, SEIFR aircraft constituted a negligible percentage (less than 1 percent) of the air taxi fleet. In 2006, SEIFR commercially-registered aircraft approached 10 percent of the air taxi fleet.

Canadian and foreign authorities' regulations

Engine reliability

In addition to Transport Canada, the Australian Civil Aviation Safety Authority (CASA) and the U.S. Federal Aviation Administration (FAA) have approved SEIFR in commercial operations. The European Joint Aviation Authorities (JAA), and now the European Aviation Safety Agency (EASA) have not approved SEIFR.

Commercial Air Service Standard (CASS) 723.22(1)(b) specifies minimum engine reliability rates, "the turbine-engine of the aeroplane type must have a proven mean time between failure (MTBF) of 0.01/1 000 (1/100 000) or less established over 100 000 hours in service."

[3] Excludes amateur-built aircraft

The regulation does not specify basic or non-basic in-flight shutdown (IFSD). Canadian regulations do not specify who will monitor the number "0.01/1 000" or what action must be taken in the event that the MTBF rate of 0.01/1000 is exceeded. In Australia, on the other hand, the engine reliability rate of an approved airplane type is monitored by the CASA Certification Standards Branch, Standards Division. A deterioration of the engine IFSD rate to 0.0125 per 1 000 hr would be cause for a review of the airplane's type approval.

Engine trend monitoring is covered in CASS 726.07(2)—*Quality Assurance Program*, "Where the air operator carries passengers in single-engine aircraft under IFR or VFR at night pursuant to subsection 703.22(2), the program shall include engine trend monitoring or equivalent procedures to identify any deterioration in engine performance and reliability."

CASA requires that, "the aeroplane shall be equipped with an automatically activated electronic engine condition trend monitoring (ECTM) recording system. The system shall record engine parameters referenced in the engine manufacturer's published engine trend monitoring procedures."

Under the *Code of Federal Regulations* (CFR) 135.421(c), the FAA requires that, "for each single-engine aircraft to be used in passenger-carrying IFR operations, each certificate holder must incorporate into its maintenance program either:

(1) The manufacturer's recommended engine trend monitoring program, which includes an oil analysis, if appropriate, or
(2) An FAA approved engine trend monitoring program that includes an oil analysis at each 100-hr interval or at the manufacturer's suggested interval, whichever is more frequent."

<u>Terrain avoidance</u>
Since March 29, 2005, the U.S. FAA has required that a turbine-powered airplane configured with six to nine passenger seats be equipped with an approved terrain awareness and warning system (TAWS) that meets the requirements of *Technical Standard Order* (TSO)–C151. TC has tabled a similar requirement in the following Notices of Proposed Amendment (NPA): NPA 2003-095, NPA 2003-302, and NPA 2003-304. All three NPAs are pending publication in Part I of the *Canada Gazette*.

<u>Additional risk factors</u>
Approval of the SEIFR Ops Spec does not call up a requirement for operators to indicate in their maintenance control manual (MCM) or approved maintenance schedules that they exercise the Ops Spec for single-engine IFR with passengers. There is no standardized, assured means to inform a TC maintenance inspector that the company must comply with CASS 726.07(2). This presents opportunities for TC inspectors conducting inspections and audits to misjudge the extent of an operator's or approved maintenance organization's (AMO) compliance with the regulations and standards associated with the company's operations manual.

Both the FAA and CASA are more specific in defining the engine trend monitoring required for SEIFR aircraft.

Conclusion
This evaluation examined occurrence data and other relevant material to determine the effect that the 1996 changes to CARs—to permit passenger transport in single-engine, turbine-powered aircraft—had on safety. Examination of the pre-implementation documentation indicated three main positive effects were postulated:

- reduction of CFIT/night VFR accidents in air taxi operations;
- higher reliability of turbine-powered aircraft relative to reciprocating engines would constitute a lower level of risk than VFR flight in marginal conditions; and
- approval of SEIFR would influence aircraft purchase decisions in the direction of more reliable, safer turbine-powered aircraft.

There have been only two SEIFR accidents and one fatal night VFR accident involving aircraft being operated under Ops Spec 001-703. In the night VFR accident, the cause was not determined, but there is no evidence that single-engine operation was a factor.

The rate of CFIT and night VFR accidents in commercial fixed-wing air taxi operations has decreased from an average of 4.3 per year between 1984 and 1995, to 2.1 per year between 1996 and 2006. The reliability of the PT6 engine (0.008 IFSD per 100 000 flight hours) is well within the internationally-accepted standard for such applications. It appears that the risk posed by a possible engine failure in IMC is less than the risk presented by VFR flight in marginal visual conditions.

The composition of the air taxi fleet has changed since 1996. Each year, there are more highly-reliable single-engine turbine-powered aircraft on the Canadian civil aircraft register.

The design of this evaluation does not support the inference that the regulatory change to permit SEIFR in 1996 caused all these positive effects. On the other hand, the evidence does not suggest that SEIFR approval should be revoked. The incidence of CFIT accidents has decreased markedly. There are, however, measures that should be considered to further reduce risk.

TC procedures may create an opportunity for maintenance inspectors to be unaware that the SEIFR Ops Spec has been approved. The lack of a mechanism to alert maintenance inspectors to the need for more stringent maintenance procedures required by Ops Spec 001-703 could lead to the maintenance inspectors applying a less demanding criterion when assessing an AMO. Any change in an operations manual that could affect maintenance practice should be communicated to the maintenance inspectors responsible for the AMO.

While the reliability of the PT6 engine is unquestioned, it is possible that aircraft with other engines could be considered for SEIFR operations. To ensure that the Canadian public is assured the same level of safety, regardless of engine and manufacturer, consideration should be given to assigning responsibility for regularly evaluating the reliability of SEIFR engines. If such provisions are warranted, they should include contingencies for dealing with engine types that fall below an acceptable standard.

Both CASA and the FAA specify more stringent engine trend monitoring practices than the CARs. TC should give consideration to a comparative evaluation of the requirements from a risk perspective to determine whether the public interest would be protected by adopting more demanding requirements; perhaps harmonizing with the FAA.

The promulgation of CARs requiring that SEIFR aircraft carrying six or more passengers be equipped with TAWS will further mitigate the risks associated with SEIFR. TAWS helps pilots maintain situational awareness and will warn flight crew that they are approaching a terrain of which, for whatever reason, they are unaware. TAWS will also be helpful to pilots coping with an engine failure, as in the case of the C208 accident near Port Alberni in 2006. △

Bryan Webster Wins the Transport Canada Aviation Safety Award

Mr. Bryan Webster of Victoria, B.C., has received the 2007 Transport Canada Aviation Safety Award for his exceptional commitment to underwater egress training for pilots and passengers. The award was presented to Mr. Webster on May 1, at the 19th annual Canadian Aviation Safety Seminar (CASS) in Gatineau, Que.

Bryan Webster (left) receiving his award from Marc Grégoire, Assistant Deputy Minister, Safety and Security.

Mr. Webster has accumulated over 11 000 hr of flying time in 35 different aircraft types over a 25-year commercial pilot career that includes bush flying, air ambulance, corporate flying and single-pilot IFR cargo flights. Being a ditching survivor himself in 1977, as a passenger in a Cessna 150, Mr. Webster was instrumental in not only saving his own life, but also the life of the unconscious pilot. He understood early the dangers associated with such a life-threatening situation because he had experienced first-hand the cold rush of water, the panic of disorientation, and the extreme difficulty of evacuating a dark, inverted and sinking aircraft.

After reading about a series of ditching fatalities across Canada in the mid-1990s, in which many had survived the initial impact, but later drowned, Mr. Webster took it upon himself to start an inexpensive underwater egress training program to help better prepare pilots and passengers on how to survive such a traumatic event. He designed specialized equipment to be effective and portable, and travelled across Canada to reach those unable to attend his training program locally in Victoria.

Emergency underwater egress training has proven to dramatically improve survival rates, and Mr. Webster's program has been featured in several prominent aviation magazines. With his recent book, *Survival Guide to Ditching an Aircraft*, and his monthly column in *COPA Flight* magazine, he has been able to promote and demystify this field with such impact and effectiveness that other companies have followed his lead to provide this essential training to even more people. He is rewarded by countless letters of testimony from grateful aviation enthusiasts, both from the private and commercial worlds, who all confirm that "*Bry the Dunker Guy*" has made an outstanding impact on Canadian aviation safety. △

Cargo Hook Release Mechanism—Inconsistent Configurations

by Serge Massicotte, Engineering Test Pilot, Flight Test, Aircraft Certification, Civil Aviation, Transport Canada

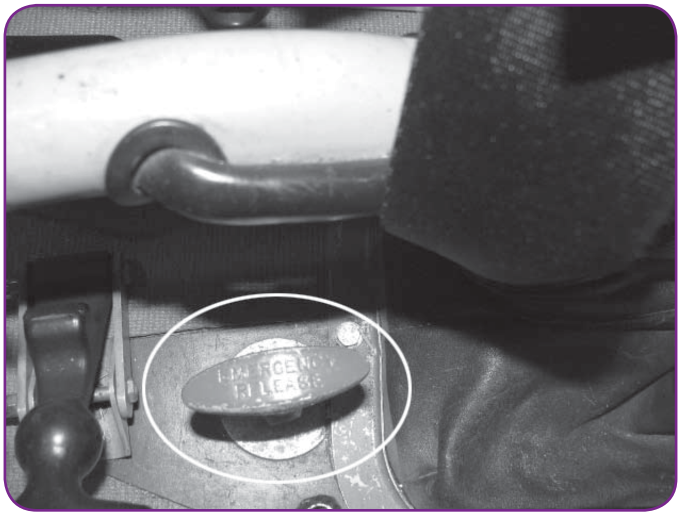
Helicopters have long been recognized for their ability to perform various types of operations throughout the world. The basic design and performance characteristics of this aerial vehicle make it particularly ideal for vertical reference work of all kinds. Vertical referencing, more commonly known as "slinging" or "long lining," involves specific risks due to the very nature of these operations. Unfortunately, the industry has seen a number of slinging accidents and incidents in the past where various causes and contributing factors have been identified. One particular risk factor that keeps resurfacing is the location and/or arrangement of the cargo hook release mechanism, or more specifically, the electrical sling release switch. There is significant variability in the location of this critical switch, not only between different aircraft types, but often within the same operator fleet. The inconsistent location and arrangement of these switch installations may have contributed to a number of inadvertent load release incidents, or even worse, it may have impaired the pilot's ability to quickly release the load in a critical situation. For decades, pilots have dealt with it as best they could. The time has come to re-assess this valid concern.

The Canadian aircraft certification process has been in place for many years to ensure that all new and modified aircraft meet the safety standard. Compliance to federal regulation [the *Canadian Aviation Regulations* (CARs)], application of guidance material [Advisory Circulars (AC)], as well as the experience of certification personnel and common sense, all serve to achieve this very important goal. Since cargo hook systems are normally considered optional equipment, they often get installed and approved under the Supplemental Type Certificate (STC) process after initial certification has been completed. As a result, design options are often limited by existing aircraft configurations and other installed STCs.

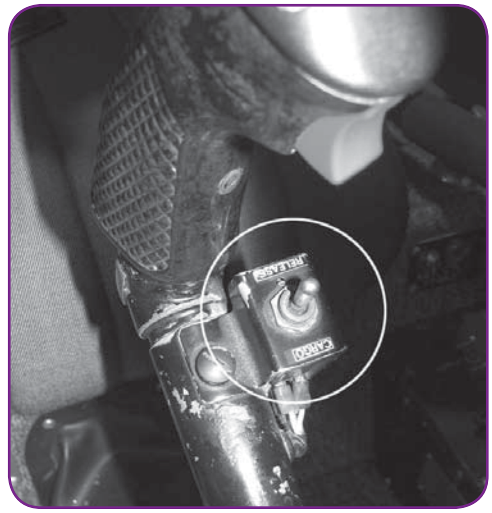
So far, there has been no published standard or guidance specifying that a particular switch must be assigned to the quick-release function for the external cargo hook. This is reflected by the various flight control configurations offered by aircraft manufacturers worldwide. Without a specific standard or guidance to be applied, the certification authority must often approve an "acceptable" design rather than enforce an "ideal" or "standard" configuration.

From a certification point of view, an "acceptable" design is one that meets *Airworthiness Manual* (AWM) 527.865 and 529.865, which requires installation of a primary and back-up quick-release system (more stringent requirements are applicable for human external cargo operations, but that topic will not be addressed in this discussion). AWM 527.777 and 529.777 also states that such cockpit controls must be located to provide convenient operation and to prevent confusion and inadvertent operation. In general, primary quick-release systems that get Transport Canada approval usually consist of a switch that is clearly identified, not easily confused with another switch, and properly located so that it is easily reached and activated by the pilot while maintaining both hands on primary flight controls. These requirements prove to be especially important during degraded flight conditions, such as power-off or hydraulics-off when the need for quick load release may be most critical. With regard to smaller helicopters, they don't always have switches available on primary flight controls to be used to that effect; however, for certification purposes, the same philosophy is generally applied.

From an operational point of view, it is not uncommon for commercial pilots to fly different types or models involving different configurations. Some contracts and some operators are only seasonal, which tends to further reduce pilot exposure (and familiarity) to specific systems. Although operators must ensure that company pilots are current and properly trained on the aircraft they will be flying, different configurations between types, or even between aircraft of the same model in the operator's fleet, may cause confusion during emergencies. According to W. James, author of *Principles of Psychology*, "studies in human behaviour suggest that, amongst other variables, relative and finite amounts of practice influence which automatic behaviour occurs in an emergency situation; the more practiced behaviour will be the default behaviour. The studies conclude that a pilot would require practice with a new switch configuration for 30 days, or 85 hours or 1 000 repetitions or more than with the known configuration, for it to become an automatic behaviour. With less practice, it would be difficult for the pilot to automatically and correctly select the appropriate switch to jettison the external load from the helicopter." [Excerpt



Example of a floor-mounted, mechanical cargo emergency release handle



Example of a cyclic-mounted, electrical cargo release switch

from Transportation Safety Board of Canada (TSB) Report # A03P0247.] Obviously, pilots flying similar aircraft types or similar configurations for extended periods of time are more likely to properly respond to a critical, time-sensitive emergency situation.

As previously discussed, it is obvious that the situation surrounding the arrangement of the primary cargo release switch needs to be addressed carefully. An option would be to amend the current regulation and force all operators to adopt a "new standard." We all agree this is not a viable approach at this time. Another option would be to apply this "new standard" for load release switch position and arrangement to all future Canadian installations; however, this may have very limited impact on the situation, as installations approved by foreign authorities would still not meet this expectation for consistency, and the concern would persist. For the time being, a more practical approach is to strongly encourage operators of diversified fleets to make every effort to standardize their cockpit configurations as much as possible. An excellent proposal for operator consideration is one recently published in an article in the Helicopter Association of Canada (HAC) newsletter that suggested using the "bottom/lowest switch on the cyclic" to release cargo.

It may take some time before the perfect solution is agreed upon and implemented; however, there are steps that can be taken right now to mitigate some of the risks inherent to this business, such as repositioning the release switch to a common location, offering company-conducted awareness training, or modifying company standard operating procedures (SOP) that address this issue. Even a mandatory daily check of the electrical and mechanical releases before the first flight by the pilot, will reinforce the importance of knowing where the switch is found. After all, any confusion or inability to release the load during an emergency may be catastrophic.

Transport Canada, Aircraft Certification is always open to comments and suggestions, and these may be addressed directly to the author, Serge Massicotte, by e-mail (massics@tc.gc.ca), or by phone (613-941-6212).
Fly safe! △

What's an MRB?

by John Tasseron, Civil Aviation Safety Inspector, Aircraft Evaluation, Standards, Civil Aviation, Transport Canada

The acronym "MRB" is one that is widely used in connection with maintenance schedules for transport aircraft, but is often somewhat mysterious to many who come in contact with it. This is partly to do with the fact that, like many acronyms, this one is used (and misused) in conversation and is not frequently explained in maintenance documentation. To make matters even less clear, it is also often used in connection with references made to "Chapter 5" (more on that later). Let's provide some clarification to put this jargon into perspective.

Strictly speaking, the acronym "MRB" stands for Maintenance Review Board. This is actually a clearly understood term, since it concerns a board that reviews maintenance schedules. The board is one made up of regulatory personnel, whose job it is to review an aircraft manufacturer's recommended maintenance schedule and approve it for use by operators. The particular kind of maintenance schedule being reviewed is one that the manufacturer has created by using working groups, who perform an analysis, based on reliability-centered maintenance concepts, to derive a minimum maintenance schedule required to ensure that an aircraft will still be safe to fly. The whole idea behind the exercise is to be able to market a product (aircraft) requiring less maintenance.

Although it is now clear that an MRB is a (regulatory) board, confusion can still creep in when the acronym is used in conversation. This is because it is also used to describe a process, namely that of setting up the previously-mentioned working groups and an industry steering committee, and doing the analysis, compiling the results into a proposal (called an MRB Report) and completing the regulatory review and approval of this report.

Since the major activity within the process is the analysis, let's look at this for a moment. As stated, the analysis is based on the principles of reliability-centered maintenance (RCM). These principles may be applied to almost any kind of complex situation (nuclear plants, hospitals, food processing facilities, etc.), but for aircraft maintenance purposes, they are applied by using a set of rules called MSG-3. This stands for Maintenance Steering Group 3, which has its origins in the Air Transport Association of America (ATA). The analysis typically splits an aircraft up into distinct units, each of which is analyzed according to its own set of rules, and managed by its respective working group, consisting of the aircraft manufacturer, operator and regulatory participants. For a large transport aircraft, this process may take up to two years to complete, and is performed prior to aircraft type certification. The analysis results are given to an Industry Steering Committee who finalizes the proposed MRB Report proposal, which is subsequently approved by the MRB and is then published in the aircraft's maintenance manual.

ATA has also cleverly provided a standard (iSpec 2200) that describes a maintenance manual format including, you guessed it, Chapter 5. The title of this chapter is "Time Limits/Maintenance Checks" and it is the place where an aircraft maintenance schedule (tasks and intervals) fits itself into the maintenance instructions. Currently, for aircraft that have been subjected to an MSG-3 analysis, Chapter 5 frequently contains the entire MRB Report. Note that Chapter 5 may also contain maintenance tasks and intervals that have not been derived from MSG-3 analysis. This occurs because the application of MSG-3 is not mandatory for developing a maintenance schedule, and aircraft maintenance manual formatting likewise does not have to conform to ATA standards. Consequently, there will be variations in what is found in various manuals. Suffice it to say that if there is an MRB Report, it will be in Chapter 5, since it makes sense to use these two ATA standards together.

Once a manufacturer elects to utilize the MRB process to produce a maintenance schedule, there is an automatic obligation to gather in-service information from aircraft operators and analyze that information. This is done in order to determine what adjustments need to be made to inspection tasks and intervals in an MRB Report during the life of the aircraft. The MRB process is therefore described as a "living" process subject to continuous review and change. Note that the content of an MRB Report does not automatically constitute the content of an operator's maintenance program. Operators of a newly acquired aircraft with an MRB Report are only required to incorporate the tasks and intervals in that report into their approved maintenance programs when the new aircraft is first put into service. They may subsequently make changes to their individual maintenance programs, based on substantiation that supports and is approved by their local regulatory authorities. Conversely, changes to an MRB Report are made by the manufacturer, approved by the MRB and published as revisions to the maintenance instructions.

Use of the acronym "MRB" therefore requires some caution in order to avoid misinterpretation and subsequent confusion. Hopefully the above will contribute to providing clarification. △

Were Any Parts Left Over?

by John Tasseron, Civil Aviation Safety Inspector, Aircraft Evaluation, Standards, Civil Aviation, Transport Canada

Yes, occasionally it does happen. A complex aircraft component has been re-assembled, and a part that should have been included in the installation has miraculously appeared on the workbench! Two thoughts immediately come to mind: "now we have to disassemble and re-assemble the entire item again," and "luckily it didn't go flying!"

That's one scenario. Another one is that the part did not get installed, but was not found on the workbench, and the component did go flying! In such cases, this may result in severe damage to the asset, injury or death. In a very few cases, the component will function flawlessly and may continue to do so for an unexpectedly long period of time. But don't bet on it!

Human error is a reality thoroughly embedded in aerospace maintenance activities, with legions of examples of how maintenance mistakes can be made, and an equal number of reasons to remind ourselves, and each other, that the problem continues. The problem is so persistent that there are regulations in place intended to combat it. These regulations address the need to have instructions for continued airworthiness (ICA) that will explain how to avoid maintenance-induced problems. In everyday language, ICAs are quite simply the maintenance instructions that need to be followed to maintain safety.

A recent discovery that a part had mistakenly been left out of a component resulted in an interesting scenario. The maintenance organization that made the discovery reported it to their regulatory authority. The report contained statements that prompted a detailed regulatory review of the maintenance instructions referenced. The regulatory review intended to verify that statements made in the report about deficiencies in the maintenance instructions, were correct.

The maintenance organization reported that they had disassembled the component and subsequently re-assembled it with the parts missing, because the parts were not present prior to disassembly, and the re-assembly instructions made no mention of them. Since no parts were left over after re-assembly, the aircraft went flying. The regulatory review of the maintenance instructions in effect at the time the re-installation was done, revealed three things. First, the missing parts were not illustrated in the diagram showing the make-up of the assembly; second, the missing parts were not identified in the parts listing associated with the diagram; and third, reference was made to the missing parts in the text explaining the re-installation steps! It was also evident that the maintenance instructions in effect at the time of the discovery of the missing parts now illustrated and showed them in a parts listing and identified them more clearly in the re-assembly instructions. Obviously, someone had become aware of the errors and corrected them.

So what was done wrong? The parts that should have been installed by the original equipment manufacturer may or may not have been installed during initial assembly of the component. The parts that should have been installed during re-assembly of the component while at the maintenance organization were not re-installed and may or may not have gone missing. The maintenance organization specialists doing the re-installation **did not follow all of the maintenance instructions provided in the manual**. In this case, they would have become aware of the missing parts from the illustration and from the parts list if they had read the re-assembly instructions carefully, since the proper installation of one of the other parts they did install depended on first confirming the installation of the missing parts. They followed the incorrect illustration and parts listing, but did not read all of the assembly instructions accompanying the illustration!

The message is clear. Treat the text of a maintenance instruction as the principal one to follow. Any illustrations or tables accompanying the text should be referenced in the text, and treated as secondary instructions supporting it. Always be aware of the possibility of errors in the text or in the illustrations or tables (someone discovered the errors in this manual and had them corrected). And finally, double-check the facts supporting any statements made in reports resulting from in-service difficulties that are encountered.

Some good things did come out of this: maintenance specialists made a discovery that avoided a potential accident, the discovery was reported, everyone was reminded of the importance of double-checking, and action was taken to assess the impact on the fleet. △

The following summaries are extracted from Final Reports issued by the Transportation Safety Board of Canada (TSB). They have been de-identified and include the TSB's synopsis and selected findings. Some excerpts from the analysis section may be included, where needed, to better understand the findings. We encourage our readers to read the complete reports on the TSB Web site. For more information, contact the TSB or visit their Web site at www.tsb.gc.ca. *—Ed.*

TSB Final Report A04O0016—Nose Wheel Axle Failure

On January 19, 2004, at approximately 14:10 Eastern Standard Time (EST), an Airbus A321-214 landed on Runway 06L at Lester B. Pearson International Airport, Toronto, Ont., after a flight from Montréal, Que. While taxiing to the terminal, the flight crew heard a noise from the nose landing gear area. As the aircraft turned onto the lead-in line at the gate, the ground marshallers observed that the right-hand nose wheel was missing, and immediately had the aircraft stopped. Maintenance personnel inspected the nose landing gear and determined that it was safe for the aircraft to proceed to the gate. Airport authorities closed Runway 06L to inspect for aircraft components and landing surface damage. The nose wheel was subsequently located on the ramp. There were no injuries and damage to the aircraft was limited to the nose landing gear assembly. The damaged components were removed from the aircraft and shipped to the TSB Engineering Branch for examination.

Aircraft at the gate, shortly after arrival

Findings as to causes and contributing factors

1. The nose wheel right inboard roller bearing failed. It is likely that the lack of lubrication, as a result of the grease dam being dislodged from its normal position, was a contributing factor.

2. The friction temperatures created by the failed roller bearing exceeded the cadmium melting point. Cadmium penetrated and weakened the intergranular structure of the nose landing gear axle, causing it to fail due to liquid metal embrittlement.

Finding as to risk

1. The dislodged inner-bearing grease dam allowed grease to migrate from the inboard roller bearing of the right nose wheel to the inside of the nose wheel assembly. A reduction in lubrication increases the cage loads and may lead to bearing failures.

Safety action taken

The operator has taken steps to have the axles for its nose landing gears coated with SermeTel® to reduce the likelihood of axle failures from cadmium infusion as a result of high friction heat generated from bearing failures. SermeTel® is an anti-corrosive and chemical-resistant base applied as an initial coating prior to decorative coatings of epoxy resin and polyurethane paints. It is an inorganic formula, consisting of an aqueous carrier containing a mixture of magnesium chromate, phosphates and silicates, and aluminum powder.

The operator has also issued a maintenance alert and revised its wheel installation job card to stress the importance of a wheel inspection prior to installation, and to ensure the recommended wheel installation tools and torques are used in accordance with the aircraft maintenance manual (AMM). The operator's wheel shop manuals were revised to raise awareness of the importance of grease dams and seal installations.

In May 2004, Goodrich released Service Letter 1991 that recommends using Mobil SHC-100 grease for the wheel bearings due to its superior adhesion properties, which also increase corrosion protection and bearing lubrication. Goodrich also issued Service Bulletin 3-1531-32-3 in July 2004, with new inspection procedures for bearing grease seals on Airbus A318, A319, A320 and A321 aircraft.

Airbus has designed an integrated retaining ring and seal that is being tested for qualification purposes. Testing includes roll and landing tests under different loads, as well as high-pressure water tests to demonstrate the enhanced performance of the new design in protecting the seal and bearing from external contaminants.

TSB Final Report A05Q0178—Capsizing at Takeoff

On September 29, 2005, a Cessna 185 on floats was to make a scenic flight following visual flight rules (VFR) with a pilot and five passengers on board. The seaplane left the company's wharf at Lac Ouimet, Que., then taxied on the surface of the lake for about 500 m. When it reached the take-off area, the seaplane turned left to face into the wind in preparation for takeoff. At approximately 15:10 Eastern Daylight Time (EDT), as the pilot was applying the throttle, the seaplane tipped to the right, the nose of the right float dug into the water, the propeller hit the surface of the lake, and the aircraft capsized. The pilot and four passengers escaped from the cabin. A seaplane from the company and a neighbouring resident in a boat headed to the survivors right away. The survivors were rescued within seven minutes of the accident. The passenger in the right front seat was unable to escape from the submerged cabin and drowned.

Finding as to causes and contributing factors

1. The combined effects of the wind, centrifugal forces, water resistance, starting the takeoff in a crosswind, and the attempt to regain control by applying full throttle and full rudder, contributed to the capsizing of the seaplane.

Findings as to risk

1. The passengers were not given a safety briefing before the flight. Consequently, they did not know the location of the lifejackets.

2. The instructions printed on the aircraft's safety briefing card about how to open the passenger door were incorrect, which could have compromised the safe egress of occupants.

3. The form for recording the flight times, flight duty times, and rest periods for the pilot had not been updated for almost a month. This did not allow the company manager to monitor the pilot's hours.

4. Neither the pilot nor the front passenger was wearing his shoulder harness, as required by regulations. This could have increased the risk of injury.

Other finding

1. During the investigation, the TSB identified three operational deficiencies that Transport Canada had noted earlier in August 2002, and reported to the company. The deficiencies concerned the monitoring of pilot schedules, the use of shoulder harnesses, and the pre-flight safety briefing.

TSB Final Report A05C0187—Loss of Control and Collision with Terrain

On October 6, 2005, a Cessna 208B Caravan departed from Winnipeg, Man., on a freight flight to Thunder Bay, Ont., with one pilot on board. The aircraft departed at 05:37 Central Daylight Time (CDT). Shortly after takeoff, the flight was cleared to 9 000 ft above sea level (ASL), and direct to Thunder Bay. Several minutes later, the aircraft began a descent and the pilot requested an immediate return to the Winnipeg International Airport. The aircraft turned right to a southwesterly heading, and then the descent continued below radar coverage. After a very steep descent, it crashed on railway tracks in Winnipeg. The pilot suffered fatal injuries, and the aircraft was destroyed by impact forces and an intense post-crash fire.

Findings as to causes and contributing factors

1. The aircraft departed at a weight exceeding the maximum take-off weight and the maximum weight for operation in icing conditions.

2. After departure from Winnipeg, the aircraft encountered in-flight icing conditions in which the aircraft's performance deteriorated until the aircraft was unable to maintain altitude.

3. During the attempt to return to the Winnipeg International Airport, the pilot lost control of the aircraft, likely with little or no warning, at an altitude from which recovery was not possible.

Findings as to risk

1. Aviation weather forecasts incorporate generic icing forecasts that may not accurately predict the effects of icing conditions on particular aircraft. As a result, specific aircraft types may experience more significant detrimental effects from icing than forecasts indicate.

2. Bulk loading prevented determining the cargo weight in each zone, resulting in a risk that the individual zone weight limits could have been exceeded.

3. The aircraft's centre of gravity (CG) could not be accurately determined, and may have been in the extrapolated shaded warning area on the CG limit chart. Although it was determined that the CG was likely forward of the maximum allowable aft CG, bulk loading increased the risk that the CG could have exceeded the maximum allowable aft CG.

4. The incorrect tare weight on the Toronto cargo container presented a risk that other aircraft carrying cargo from that container could have been inadvertently overloaded.

Other findings

1. The pilot's weather information package was incomplete and had to be updated by a telephone briefing.

2. The operator's pilots were not pressured to avoid using aircraft de-icing facilities or to depart with aircraft unserviceabilities.

3. The aircraft departed Winnipeg without significant contamination of its critical surfaces.

4. The biological material on board the aircraft was disposed of after the accident, with no indication that any of the material had been released into the ground or the atmosphere.

5. The fact that the aircraft was not equipped with flight data recorder (FDR) or cockpit voice recorder (CVR) equipment limited the information available for the occurrence investigation and the scope of the investigation.

Safety action taken

The safety actions section of this major investigation report is unfortunately too long to reproduce entirely in the Aviation Safety Letter *(ASL); therefore, our readers are strongly encouraged to read the entire report on the TSB Web site at:* www.tsb.gc.ca/en/reports/air/2005/a05c0187/a05c0187.asp.

Suffice it to say that the focus is largely on flight into icing conditions, on the Cessna 208 in particular, and also on weight and balance issues. Several of the safety actions are also related to the investigation into the Pelee Island, Ont., crash of a Cessna 208 on January 17, 2004 (TSB file A04H0001). This report was summarized in ASL 4/2006. —Ed.

TSB Final Report A05A0155—Collision with Water

On December 7, 2005, a Messerschmitt-Boelkow-Blohm (MBB) BO-105 helicopter was being used for various tasks associated with the upkeep and operation of lighthouse and coastal navigation facilities in the Burin Peninsula area of Newfoundland and Labrador. While returning to Marystown, N.L., in the late afternoon of December 7, 2005, with one pilot and one passenger on board, the helicopter encountered heavy snow showers, and at about 16:28 Newfoundland Standard Time (NST), the helicopter crashed into the water of Mortier Bay, east of Marystown. Both the pilot and the passenger survived the water impact and escaped from the helicopter. However, the pilot perished from hypothermia, and the passenger drowned.

Aircraft during recovery, with cabin largely intact

Findings as to causes and contributing factors

1. The helicopter encountered a heavy snow shower, and while attempting to fly out of the snow, the pilot likely became disoriented.

2. The pilot lost control of the helicopter when the tail broke off after contacting the water during a rapid flare.

3. The survival equipment fitted to the helicopter sank with it, and was not available to aid the survivors after the accident.

4. The occupants of the helicopter were not wearing sufficient personal survival equipment to enhance their potential survival in the frigid water.

Findings as to risk

1. Although the life raft mount had been previously identified as a potential head strike hazard, the passenger was seated in the front seat without head protection.

2. At the time of the occurrence, the operator's management had not taken steps to mitigate the life raft mount head strike hazard.

3. The life raft mount failed, pinning the life raft against the centre rear passenger seat.

4. The emergency locator transmitters (ELT) on board sank to the bottom of the Bay and were not able to signal search and rescue (SAR) of the accident. Therefore, SAR efforts did not begin until one hour after the flight's planned estimated time of arrival (ETA).

5. The pilot's egress was impeded by a direct-to-airframe helmet cord connection.

6. None of those who flew in the helicopter on the day of the accident were provided with immersion suits, nor were such suits required by the regulator or the operator.

7. None of those who flew in the helicopter on the day of the accident had received helicopter emergency egress/water survival training, nor was such training required by the regulator or the operator.

8. At the time of the accident, the operator had not adequately addressed several identified operational shortcomings.

9. The frequency of accidents and serious occurrences, the recurrence of identified operational shortcomings, and the lack of progress in the mitigation of several identified deficiencies are matters of concern that suggest organizational shortcomings with the operator.

Other finding

1. The underwater locator beacon (ULB) did not transmit a detectable acoustic signal.

Safety action taken

Transportation Safety Board of Canada (TSB)
On March 20, 2006, the TSB sent a Safety Information Letter to Transport Canada Civil Aviation (TCCA) and to the operator regarding the signal failure of the ULB.

On March 28, 2006, the TSB sent a Safety Advisory to the operator suggesting that it consider the need to revise its mandatory operations manual requirements for immersion suit use to include the more relevant risk factors related to its helicopters' performance characteristics and operating environment.

Survival equipment on the accident helicopter was installed as required by regulation, yet it was not available to assist the survivors after the accident. On May 9, 2006, the TSB sent a Safety Advisory to the operator suggesting that it consider the adequacy of its helicopter survival equipment installations so as to improve occupant survivability in a capsized helicopter event.

With respect to direct-to-airframe helmet cord connections, other operators may have aircraft with these connection types and may be unaware that these connections can impede egress in an emergency. On May 9, 2006, the TSB sent a Safety Advisory to TCCA suggesting that it advise the aviation community that these connection types may impede egress and that an intermediate cord can help mitigate this hazard. In response to this Safety Advisory, TCCA published an article in the ASL 4/2006, explaining the egress hazard related to direct-to-airframe helmet cord connections and suggesting the use of intermediate cords to mitigate the hazard.

On May 9, 2006, the TSB sent a Safety Advisory to the operator suggesting that, as part of its review of the life raft mounting bracket Limited Supplemental Type Certificate, it may wish to conduct an analysis of the structure so as to improve its ability to withstand survivable impact forces, particularly rearward. Also, the Safety Advisory suggested that the operator may wish to consider steps to prevent the mounting bracket and life raft from jamming against the passenger seat belt mounting bolts, should a failure occur.

On June 2, 2006, the TSB sent a Safety Advisory to the operator suggesting that it re-evaluate all levels of its organization so as to become more proactive in identifying risks and deficiencies, and more responsive in communicating and mitigating already identified risks associated with its operations.

Helicopter Operations Safety Working Group
The operator and the Canadian Coast Guard (CCG) have established a Helicopter Operations Safety Working Group to review safety equipment, training, and procedures, and to make recommendations for improvements. This group has taken action on passenger helmets and survival equipment, and is reviewing the policy on wearing immersion suits as well as helicopter egress training. As a result of the efforts of the joint working group, the following actions have occurred:

- Lifejackets have been standardized for passengers and crews, and reflective tape is to be added to the edging of the cover of the jackets and a large orange patch added to the back.

- Laser flares have been purchased and sent out to the CCG bases to be attached via a cord and rings to each of the standardized high-visibility Switlik lifejackets, model HV-35C, also identified as S7200-2, and inserted in the customized pouch.
- Helmets have been purchased and issued for front seat passengers in all helicopters, and their use is mandatory in CCG helicopters.
- The installation of a fixed intermediate helmet cord for both front seat positions in all BO-105 helicopters is nearing completion.

The operator
The operator is in the process of implementing a safety management system (SMS), adding an assistant chief pilot—helicopter position and a flight operation quality assurance position, all intended to improve, where necessary, existing communication, documentation, and risk assessment practices. Proposals have been generated for modifying the life raft rack to prevent head injuries.

Underwater locator beacon (ULB)
All of the operator's ULBs within the batch of serial numbers affected by the Dukane recall have been replaced. To determine the extent of the delamination problem, the manufacturer cold-tested the 11 beacons returned by the operator. One other beacon was found to have failed in a similar manner. The manufacturer is attempting to determine the cause of the metal delamination and the potential scope of the failure. Once this has been accomplished, the manufacturer will consider a further course of action. △

ACCIDENT SYNOPSES

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, which occurred between November 2006 and January 2007, are all "Class 5," and are unlikely to be followed by a TSB Final Report.

On November 11, 2006, a privately-owned **Robinson R-22B helicopter** was returning to the Boundary Bay, B.C., airport from Harrison Lake. While en route, the pilot decided to practice several manoeuvres (quick stops and descents with reduced power). During one manoeuvre, the main rotor rpm decayed slightly below the green arc, and the warning horn sounded. The pilot flared to increase the rotor rpm and added power. During the flare, the tail rotor struck the ground and the helicopter crashed. Both occupants received serious injuries. The helicopter was destroyed. *TSB File A06P0240.*

On November 12, 2006, a privately-owned **Cessna 150G** was being taxied from a country church yard to the owner's home grass strip. The pilot stopped the aircraft to wait for a vehicle to be moved. The driver of the vehicle was providing traffic control, and was struck by the propeller as he walked in front of the aircraft toward his vehicle. The driver sustained serious injuries to the right side of the body and was transported to hospital by ambulance. *TSB File A06C0183.*

On November 14, 2006, a **Bell 206L helicopter** was going through translation shortly after takeoff, when the engine (Rolls Royce Allison 250 C20R) lost power. The pilot carried out an autorotation. The helicopter sustained substantial damage to the tail rotor driveshaft and vertical winglets during the landing. The pilot was not injured. *TSB File A06C0188.*

On November 18, 2006, a **Hummelbird ultralight** crashed in a field south of Plattsville, Ont. The engine (1/2 VW) reportedly stopped suddenly. The aircraft stalled and impacted the ground, causing substantial damage and seriously injuring the pilot. The pilot was airlifted to the Hamilton, Ont., hospital. *TSB File A06O0290.*

On November 24, 2006, a **Falco F8L amateur-built** was on approach to Runway 06 at the Hamilton, Ont., airport. The landing checks were completed and the landing gear lever was selected down. The aircraft touched down with the landing gear partially extended, and skidded to a stop on the runway. The pilot evacuated the aircraft and received no injuries. The aircraft was substantially damaged. The aircraft was moved to a hangar and placed on jacks. Maintenance found the landing gear circuit breaker popped, and once it was reset, the landing gear operated normally. *TSB File A06O0296.*

On November 24, 2006, a **Spectrum Beaver ultralight**, with two pilots on board, was performing low flying manoeuvres over a farmer's field, when one of the wings struck a fence. Control of the aircraft was lost and it struck the ground, resulting in substantial damage to the aircraft and serious injuries to the occupants. *TSB File A06O0297.*

On November 24, 2006, a **Piper PA-31-350** was on an IFR flight from Edmonton, Alta. (CYXD), to

Valleyview, Alta. (CEL5). After a visual approach to a runway, which was believed to be that of CEL5, the aircraft landed on a snow-covered, abandoned forestry strip about 1.5 NM south of CEL5, which was utilized as a summer helicopter staging area. During the landing roll, the aircraft went through two snow windrows, formed by a ploughed road that crossed the landing area, and came to rest facing 90° to the landing path. The aircraft sustained a collapsed nose gear, damaged propellers, and wrinkled nose structure. There were no serious injuries to the pilot or five passengers, who exited the aircraft and walked to a nearby forestry building. The emergency locator transmitter (ELT) activated automatically during the landing. Flight visibility at Valleyview was estimated at about 4 SM in light snow. The pilot was navigating by GPS and this was his first flight into CEL5. A pre-departure briefing by company operations involved a discussion of minimum IFR altitudes and diversion plans for weather. The company contacted the airport operator to determine runway conditions. Snow clearing was in progress. When the flight was in range of CEL5, the pilot activated the aircraft radio control of aerodrome lighting (ARCAL), and airport maintenance staff confirmed that the lights came on. The abandoned strip was not lit. *TSB File A06W0214.*

On November 27, 2006, a **SOCATA TB 21 Trinidad airplane**, occupied by the pilot alone, took off from Runway 23 at the Brantford, Ont., airport for a local flight. A power loss of the AVCO Lycoming TIO-540-AB1AD engine was experienced when the pilot retarded the throttle at the top of the climb a few miles southwest of the airport. Power was regained when the pilot advanced the throttle. He returned to the airport, joining a high right downwind leg for Runway 23. Again, all power was lost when the throttle was retarded. The pilot landed the airplane on the runway with no engine power. The landing gear was not down at touchdown, resulting in belly and propeller damage, but no injury to the pilot. *TSB File A06O0298.*

On November 20, 2006, a **Schweizer 269C helicopter**, was taking off from a helipad with one pilot and one passenger on board, for a recreational flight. During the transition to hovering, the aircraft started to spin to the right. The pilot tried unsuccessfully to regain control of the aircraft by slamming on the left pedal. The engine power did not decrease, and after several spins, the helicopter crashed on the helipad before coming to a stop on its left side. The tip weights of the three main rotor blades came off during the roll-over. One of them crossed through the cabin of an R22 helicopter parked on the helipad, and became stuck in a plastic container located approximately 100 ft away. Another one went through the wall of the company's hangar. The third was not found. Nobody on the ground was injured, and the two occupants were unharmed in the accident. The examination of the aircraft's controls did not reveal any pre-accident anomalies. The throttle engage switch was in the "HOLD" position, and the belt tensioner, which transmits the engine power to the transmission, was in the semi-stretched position. The aircraft took off even though the throttle engage switch was not in the "ENGAGED" position, and the engagement phase was not complete. While hovering, the revolutions of the main rotor and tail rotor diminished. The decrease in revolutions led to the loss of yaw control. When a loss of yaw control occurs while hovering, it is recommended to cut the throttle and conduct an auto rotation. *TSB File A06Q0187.*

On December 5, 2006, a **Bell 206B helicopter** was working approximately 30 NM southeast of Chetwynd, B.C., in clear and calm weather. The helicopter approached a clearing for landing in an area that had 2–3 ft of snow cover. The pilot compressed the snow several times with the skid gear, and when satisfied that the snow had been compacted, reduced the collective to settle the helicopter for shutdown. When the pilot opened the right door to check tail rotor clearance, the helicopter rolled to the left. The main rotor blades struck the ground and the helicopter came to rest on its left side with substantial damage to the nose, engine deck, tail boom and main rotor blades. There were no injuries to the pilot or two passengers, who were seated in the front and rear left seats. The pilot contacted the company via satellite phone, and when arrangements were made for pick up, the emergency locator transmitter (ELT) was shut off. There was no post-impact fire. *TSB File A06P0265.*

On December 6, 2006, a **Cessna 152** was on a round-robin photography flight from Saskatoon, Sask., to the Candle Lake Airpark, Sask. About 20 NM northeast of Prince Albert, Sask., the aircraft struck high-tension electrical lines running beside a highway. Part of the vertical stabilizer and rudder were torn from the aircraft. The pilot diverted the flight to Prince Albert, where he landed safely with emergency personnel standing by. No injuries were reported. The aircraft sustained substantial damage, and was dismantled for shipment back to its base. *TSB File A06C0195.*

On December 8, 2006, a **Cessna 172N** was on a local student training flight at Steinbach (South), Man. (CKK7). The instructor took control with the intention of demonstrating the recovery from a "balloon" on landing. The aircraft was flared about 15–20 ft above Runway 18. As the instructor applied power to recover, the aircraft stalled, dropping the left wing. The aircraft struck the runway heavily, causing damage to both wings, the nose gear, and propeller. There were no injuries. The flight school reported the wind as 180° at 8 kt. *TSB File A06C0199*.

On December 8, 2006, a **Robinson R44 helicopter** was lifting off from a confined area about 5 NM north of Cranberry Portage, Man. During liftoff, the main rotor contacted a power line, and the helicopter crashed. There were no injuries; however, the helicopter was substantially damaged. The two occupants were able to communicate by radio and satellite phone and walked two miles to a highway where they were met by the Royal Canadian Mounted Police (RCMP). *TSB File A06C0200*.

On December 9, 2006, a **Bell 206L-3 helicopter** was engaged in heli-skiing operations at Trout Lake, B.C., near Revelstoke, B.C., flagging areas for another helicopter to drop off skiers. The helicopter was in a steady hover, landing on a 7 500-ft dome, when it suddenly pitched up and rolled over, sustaining substantial damage. Heavy snow was falling at the time. There was no fire. None of the three occupants was injured. *TSB File A06P0263*.

On December 24, 2006, a **Cessna T182T** was departing Runway 33 at Buttonville, Ont., for a local flight. During takeoff, control of the aircraft was lost; it became airborne momentarily and touched down on the runway with a 30° crab angle. The aircraft exited the runway to the west, the nose wheel dug into the soft grass, and the aircraft overturned. The aircraft sustained substantial damage, but there were no injuries to the three occupants. The aircraft was equipped with airbags, but they did not deploy. *TSB File A06C0321*.

On December 28, 2006, the pilot of a **PA-22-108 Colt** departed Lyncrest, Man., on a local pleasure flight. Upon returning to the airport, the pilot decided to do a touch-and-go landing at a snow-covered grass strip near Oakbank, Man. The pilot was familiar with the strip, having used it in the past for training. The wind was calm and the pilot overflew the strip prior to touchdown. The aircraft touched down main wheels first, and as the nose wheel touched down, the tire broke through the crusted snow, causing the aircraft to nose over. The pilot was uninjured; the aircraft sustained damage to the left wing tip, propeller and windshield. *TSB File A06C0209*.

On January 10, 2007, a **Eurocopter AS 350 B-2 helicopter** was being relocated from a landing pad at the company base in Grande Cache, Alta., to a nearby parking area. Visibility was about 0.7 SM in falling dry snow, and there were approximately 4 in. of dry snow on the ground. After liftoff, the pilot established the helicopter in a hover at 15–20 ft above ground level (AGL). In conditions of blowing snow, the helicopter moved forward and to the right, and then down. The helicopter then struck a 4-ft high snow bank and the main rotor blades struck the ground. The helicopter came to rest upright; however, it was substantially damaged. The pilot sustained minor injury. There was no report of a system malfunction. *TSB File A07W0006*.

On January 10, 2007, a **Bell 47 helicopter**, with an instructor and student on board, encountered heavy snow showers and rapid in-flight rotor blade icing as it entered the Abbotsford, B.C., control zone from the east practice area (Sumas). The instructor elected to land immediately in a clear area near a freeway, but he could not maintain altitude with the available power and rotor rpm. The helicopter touched down on the crest of the median of the divided highway and bounced, touched down again, and turned 180° to the right before coming to rest upright near the highway. The occupants were not injured and there was no fire. Damage occurred to the skids, tail boom, and tail rotor blades; the main rotor did not contact the tail boom and was undamaged. Examination of the helicopter revealed no mechanical anomaly. A review of the local weather at the time of the accident shows that a severe snow squall passed through the area, containing a mixture of rain, wet snow, and possibly freezing rain. *TSB File A07P0018*.

On January 12, 2007, while attempting to start a cold soaked, **ski-equipped Cessna 185F**, the engine was over-primed. The engine subsequently started at an unusually high rpm; the aircraft departed its parking spot and struck a snowbank. The aircraft sustained damage to its right wing, right landing gear leg, and horizontal stabilizer. *TSB File A07C0006*.

On January 24, 2007, a **Cessna 401B** was landing on Runway 22 at Swift Current, Sask. After touchdown, the right main landing gear collapsed. The right wing contacted the runway surface and the aircraft veered to the right off the runway surface. There were no injuries. Information provided indicated that all three wheels showed down and locked prior to touchdown, and that the warning horn did not activate until the right main landing gear began to collapse. Examination by company maintenance found that a double-ended adjusting screw (LH and RH threads) broke at the rod end and allowed the side brace to unlock from its overcenter position. *TSB File A07C0016*.

On January 28, 2007, a **Cessna 172H** was on approach for Runway 33 at the St-Mathieu-de-Beloeil, Que., aerodrome. The aircraft landed approximately 200 ft before the runway threshold, on a snow-covered surface, and turned over onto its back. The pilot was not injured in the accident. *TSB File A07Q0023*. △

"Show and Stall" Usually Fatal

On August 19, 2006, a Cessna 177B Cardinal departed the pilot's farm airstrip, 5 NM east of Manning, Alta., at about 21:25 Mountain Daylight Time (MDT). The flight was a local sightseeing trip with three passengers. At 21:35, the aircraft was observed approaching a community centre 5 NM south of the take-off point, where a sporting event was underway. The aircraft approached from the northeast and made a slow-speed pass at a height estimated at between 150 and 500 ft above ground level (AGL). It then made a steep turn to the left, followed by a steep climbing right turn. The nose then dropped sharply and the aircraft entered a spin of two turns. The rate of spin slowed before the aircraft impacted the ground in a near-vertical, nose-down attitude in light brush. There was no post-impact fire, and all four occupants sustained fatal injuries. The nature of the damage and ground scars indicated a very rapid deceleration and high-impact forces.

On-site inspection of the wreckage by investigators from the Transportation Safety Board of Canada (TSB) revealed no pre-impact malfunction that would have contributed to the accident. The engine was heard to operate all the way to the ground, and examination of the wreckage confirmed that the engine was likely developing power on impact. All flight controls were continuous, and the flaps were in the retracted position. The left-wing tank contained fuel, and the right-wing tank, which was heavily damaged, held no fuel. Fuel was observed leaking from the wreckage shortly after the accident. The aircraft weight and centre of gravity were estimated to be within certified limits.

The aircraft was powered by a four-cylinder Lycoming O-360-A1F6D piston engine. It was manufactured in 1972 and owned by the pilot since 1997. The most recent maintenance recorded in Transport Canada files was in February 2000, when repairs were completed following an accident at the pilot's farm strip in August 1999. No subsequent maintenance activity, including required annual inspections or annual reports to Transport Canada, could be confirmed by documentation or by inquiries made of regional maintenance organizations.

The pilot held a Canadian private pilot licence, issued in 1993. His most recent medical examination was

conducted on May 22, 2003, and his medical certificate was valid until June 1, 2005. The pilot's total flying time declared on his last medical examination form was 218 hr, and his recent experience could not be determined. At the time of the occurrence, the sky was clear, winds were calm, and twilight conditions existed. Weather conditions were not considered to have been a factor in the accident.

The observed behaviour of the aircraft and the impact angle were consistent with those of an aerodynamic stall followed by a spin. If a spin is allowed to develop following a stall, a considerable amount of height can be lost by the aircraft before recovery. Several other accidents have been documented in the 10 years prior to the accident, which had occurred during low-altitude manoeuvring. In these occurrences, the low altitude of the aircraft precluded recovery from a stall/spin before impact with the ground. Due to the forces involved in this type of accident, fatalities are common.

Low-speed handling characteristics are part of the Canadian private pilot training curriculum. Additionally, safety promotion material advising of the hazards of low flying is provided by Transport Canada. The *Canadian Aviation Regulations* (CARs) prohibit the operation of an aircraft at heights less than 1 000 ft over assemblies of people. Publication in the *Aviation Safety Letter* of this factual information gathered by the TSB will hopefully raise awareness of the importance of maintaining effective energy management at low altitudes.

Thank you to the TSB Western Regional Office for providing this account. —Ed. △

Canadian Aviation Safety Seminar (CASS)

Call for Papers—CASS 2008

Abstracts for plenary presentations and workshops are invited for submission for the 20th annual Canadian Aviation Safety Seminar (CASS 2008) on the subject of **Managing Change: The Impact of Strategic Decisions on Personnel and Processes**. CASS 2008 will be held **April 28–30, 2008**, at the **Hyatt Regency** hotel in **Calgary, Alta**.

Canada continues to experience an excellent safety record in commercial aviation. In order to maintain or improve upon this record, the effects of constant organizational change must be anticipated, planned for and managed effectively. To achieve this in a safety management system (SMS) environment, with accelerated attrition rates and increased air traffic demands, the industry must strive to fulfill its needs for key personnel and processes, which should assist in better decision making, both at the strategic and operational levels.

The Canadian civil aviation industry has long recognized the benefits of multi-disciplinary skill sets for its next generation of aviation personnel, and the need for proven organizational processes. CASS 2008 will provide an excellent opportunity to discuss how best to achieve this. Through interactive workshops with colleagues and specialists, followed by presentations in plenary by aviation professionals, delegates will be offered strategies and ideas to bring back to their organization for continued improvements in safety.

Abstracts will be accepted until **September 18, 2007**, and are to be of a maximum of 200 words. They are to be accompanied by the presenter's curriculum vitae and must be submitted by e-mail to **ssinfo@tc.gc.ca** as a text document attachment, or via the online form at **www.tc.gc.ca/CASS**. Please ensure that you also provide us with your full mailing address, phone and fax numbers, and e-mail address for our records and future communications with you. Your submission will be considered based on content and applicability to the aforementioned subject and the aeronautical industry.

All abstracts received will be acknowledged by e-mail within 48 hours of receipt. If you do not receive a response from us, please resubmit your abstract and/or contact us by e-mail (*ssinfo@tc.gc.ca*), phone 613-991-0373, or fax 613-991-4280.

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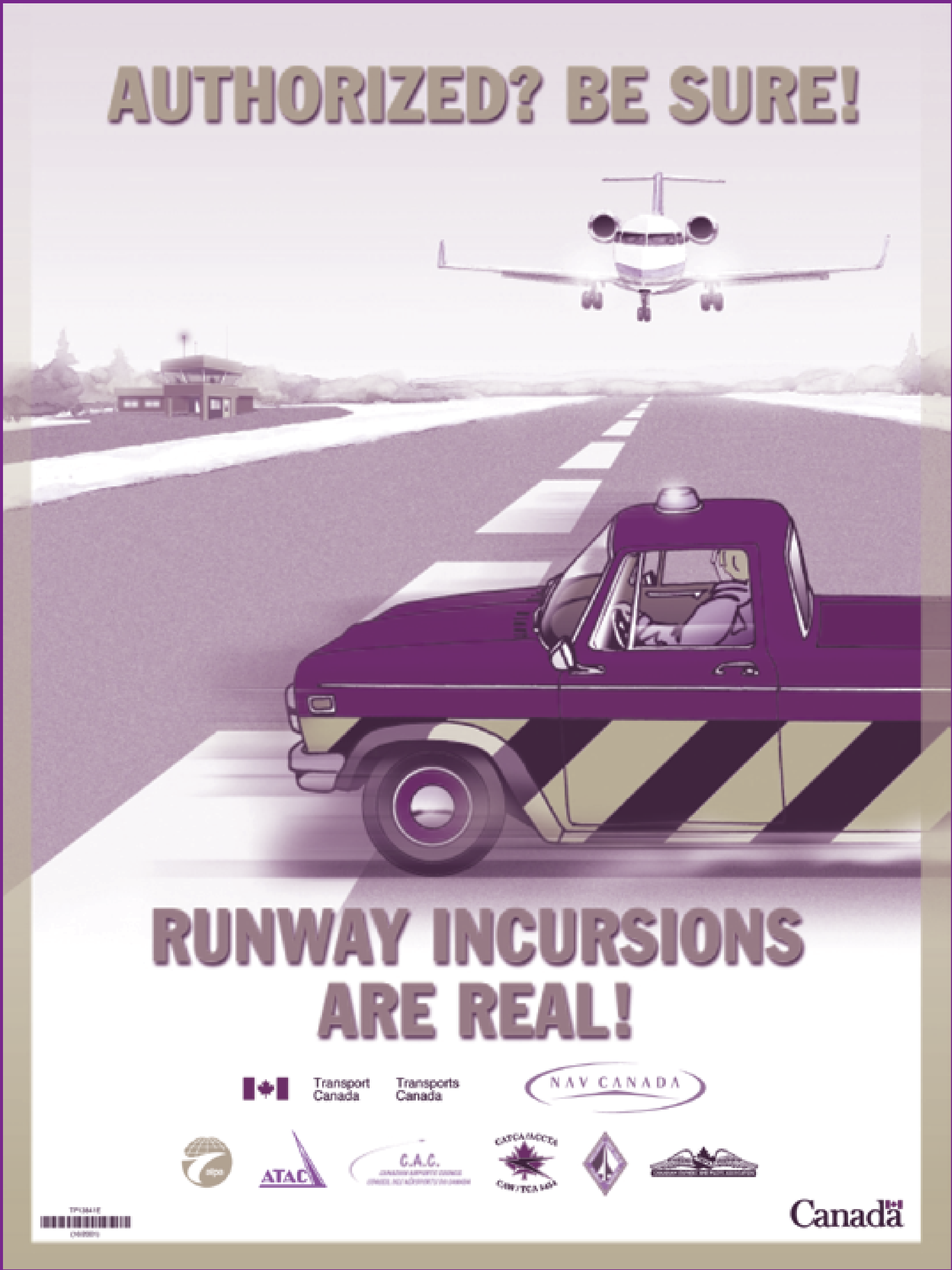
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