GUEST EDITORIAL

It is my pleasure to have the opportunity to welcome you to the third edition of Civil Aviation's new-format quarterly *Aviation Safety Letter* (ASL). It is a key initiative in our overall emphasis on communication. In the context of the key results for Civil Aviation—the continued improvement on the high level of aviation safety in Canada and a high level of public confidence in our Civil Aviation Program—the Aircraft Certification Branch needs to be in touch, formally and informally, with both our industry stakeholders and the public.

The Aircraft Certification Branch is responsible for the development and application of the regulations and standards related to aeronautical products and their type certification and, along with the Maintenance and Manufacturing Branch, is responsible for the continuing airworthiness of the products. Each year, more than 1 500 new and modified aeronautical products built or operated in Canada are approved.

In 2003, we embarked on a process of re-examining what the Aircraft Certification Branch does and how we do it. The resulting Business Plan provides our mandate, mission, values, and vision for the future, and describes where Aircraft Certification must be successful and what must be achieved. The plan reaches to 2010 and is a shared headquarters and regional commitment to strategic action that is aligned with Civil Aviation's *Flight 2010*.

The plan includes strategic objectives related to: implementing safety management systems (SMS); enhancing industry relationships; enhancing the certification program; ensuring the adequacy of regulatory materials and policies; enhancing internal management processes and practices; and developing and implementing a new accountability framework. It is a living document and is reviewed each fall, at the Aircraft Certification Management Team Workshop.

By implementing the Plan, we believe that the Aircraft Certification Branch will be well-equipped to respond to the ever-changing civil aviation environment and that we will have enhanced our nationally-recognized reputation as a regulatory organization.

I invite you to take a look at our Business Plan on the Aircraft Certification Branch's Web site at www.tc.gc.ca/CivilAviation/certification/Plan/Menu.htm

Martin Eley
Director
Aircraft Certification

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Aircraft wiring awareness

Dear Editor,

I was very pleased to read the article *Industry Culture Shift Regarding Aircraft Wiring Badly Needed*, by Wilfrid Côté, in ASL 3/2005. I feel the same way about it, and Mr. Côté clearly expressed the urgent need for such a culture shift regarding aircraft wiring installation, repair and maintenance. In 1983, a fire in the aft lavatory of a DC-9 resulted in the deaths of 23 people, after which the operator made a serious effort for a company culture shift about aircraft wiring. As an avionics on-the-job-training (OJT) instructor with that operator at the time, I was tasked to develop a one-day awareness/refresher course that became mandatory to all avionics personnel at all levels within the operation. It also included a practical test for the technicians. Currently, as the training program manager with another employer, I have developed a 5-day practical aircraft-wiring course aimed at General Aviation Line-Maintenance Technicians [airframe and powerplant (A&P), aircraft maintenance engineer—maintenance (AME-M), as well as Avionics, aircraft maintenance engineer—electronics (AME-E)]. This course will contribute greatly to making that culture shift. The aircraft wiring class is very interactive with 60 percent hands-on, and includes case studies of major accidents involving aircraft wiring. Operators, maintenance organizations and individual AMEs may want to know that such courses are available.

Theo Dufresne, AME-E
Montréal, Que.

Airmanship at fly-ins

Dear Editor,

I am writing in response to the article by Michel Treskin on the back page of the *Aviation Safety Letter* 3/2005. I am as displeased as he is about the lack of airmanship displayed at this particular event he attended. I have been flying since 1972 throughout North America and the Caribbean as a private pilot for business and pleasure. I fly a warbird now, mostly for pleasure out of Oliver, B.C. I attended four interior fly-ins/air pageants and one on the coast this year, and I am pleased to say that I did not encounter what Mr. Treskin did—quite the opposite. Most pilots that I observed did complete a walk around and all but possibly one performed a systems check/run-up prior to takeoff. I only hope that what he encountered was not systemic to eastern Canada, but it certainly was not the case here in the west.

Paul Dumoret
Oliver, B.C.

Thank you for writing. My understanding is that the majority of pilots at fly-ins do exercise superior airmanship, across the country. Nevertheless, I believe the article will raise the awareness level even more. —Ed.

IFR from nowhere

Dear Editor,

A few months ago, I flew my Turbo Skylane from Saskatoon, Sask., to our home base in Burlington, Ont., with a stop in Fort Frances, Ont. Even though the weather was quite good, I filed IFR as I always do. Fort Frances is an uncontrolled airport and its airspace is served by Minneapolis Center. I left after a quick turnaround; my IFR flight plan had already been filed before our departure from Saskatoon. Airborne, I contacted Minneapolis Center and found out that my flight plan was not on file. The controller suggested I contact both the American and the Canadian flight service stations (FSS), which I did. Neither was able to let me air-file; the Americans were too busy, and the Canadians told me it had to be filed with the American FSS. In the end, the very helpful Minneapolis Center controller gave me a clearance, without a flight plan, to go directly home. By then, I had flown more than 40 NM. The weather was VFR under a broken 5 000-ft ceiling, so that was not a problem, but what if the weather had been much worse, albeit not bad enough to get the IFR clearance on the ground?

Exactly that happened to me just recently on a flight from St. John's, N.L., to Burlington. We had a stopover in Fredericton, N.B., and continued home. Over the whole Toronto, Ont., area was a long line of severe thunderstorms, so we decided to land at Peterborough, Ont., just east of Toronto, and wait the storms out. After just 1.5 hr, all the bad weather had passed, and a call to London FSS confirmed that there was no convective activity or precipitation between us and our final destination; Burlington. I filed IFR Peterborough to Burlington with the briefer.

When we had landed in Peterborough with an IFR approach, we had talked to Toronto Centre on 134.25 MHz and had cancelled IFR on the ground with that frequency. So, after the run-up, I called 134.25 MHz—nothing. I tried several times without luck. However, the weather looked really VFR; I could see far and the clouds looked high. So I decided to depart VFR and get the IFR clearance once I was airborne. I tried and tried the Centre frequency—nothing again. Also, I tried and could hear Toronto Terminal on 133.4 MHz, but the controller couldn't hear me (I was probably too low). After a couple of minutes of flight, I realized that a continued VFR flight was impossible because of some low stratus clouds that still lingered in the area, combined with not more than 2 mi. visibility. I tried my best to stay VFR, but it was very marginal. Finally, I contacted Oshawa Tower, and within one minute had my IFR clearance. Climbing through the cloud layer, I was able to talk to Toronto Terminal and found out that the Centre frequency 134.25 MHz had been knocked out by a violent thunderstorm!

This situation was probably not dangerous, but could have been if I had not been able to remain VFR, or if I had been forced to fly very low under the clouds in low visibility. The lesson learned is this—if there is even the slightest doubt about continued visual meteorological conditions (VMC) for quite some time after departure from an uncontrolled airport, get your IFR clearance on the ground by calling FSS on the phone!

Gerd Wengler, airline transport pilot licence (ATPL)
Burlington, Ont.

What went wrong? My story

Dear Editor,

My friend (also a pilot) and I were to take a VFR flight in a Piper Archer from Maroochy [in Queensland, Australia] to Kingaroy—a distance of 67 NM directly west through mountainous terrain. We got airborne at 2 p.m. for the 45-min flight. There were lots of bushfires in the area, and although we could see the ground at all times, the forward visibility was limited, there was some turbulence and we had about a 15-kt headwind. Nevertheless, we landed at Kingaroy on schedule and secured the aircraft.

The return trip two days later was a bit more problematic. The meteorological report showed broken cloud at 2 000 ft at our destination, and some cloud en route through the mountains, with a small tailwind. We had just made arrangements to leave the aircraft at Kingaroy and drive back, when a friend who had just flown from Kingaroy to the Sunshine Coast in a Lancair, reported after he landed that everything was clear to the coast, and the clouds were 1 000 ft above the mountain peaks. I was still unhappy about making the flight, but my co-pilot said she was reassured by this, and said she would fly and I could navigate and do the radio work. Since she was a former commercial pilot and had many more hours than I did, I agreed to this. I also phoned a flying school at Maroochy and checked that conditions were clear.

By then my daughter was at the airstrip with her car, ready to drive us home, but we filed a flight plan, taxied out and took off happily. We left about one hour after the Lancair pilot. We could see the mountain ranges in the distance and more mountain ranges beyond this. Cloud was about 4 000 ft so we flew at 3 500 ft. Soon though, the cloud base started coming down and we had to descend. The pilot asked, "Are you happy with this?" and my answer was slow in coming because I was filled with unease. In the minute or so of indecisiveness, we had entered IMC [instrument meteorological conditions]. Now, I have heard the advice of doing a 180° turn and exiting the danger, but we now had cloud and mountains all around us, so it was not as simple as it sounded. I think a 180° turn at low level would have been disastrous.

Both the pilot and I had NVFR [night visual flight rules] ratings that were not recent and had a little instrument training. The highest peaks on the WAC [world aeronautical chart] were at 2 985 ft and we were at 3 000 ft. In addition, we had turned a bit south to fly down a valley to lower ground, so we were unsure of our position, and we were flying in a total whiteout that completely enveloped us.

Being a "junior" pilot, I tentatively said, "I would climb to 3 500 ft and hold the heading and altitude." The pilot replied. "I can't climb into cloud, I'm not an instrument pilot." But then she put the aircraft into a climb and said, "OK, I can do this, but I need you to help me. Tell me whenever the wings are not level or I start to descend. Contact Maroochy Tower and find out what the weather is like there. You'll have to declare an emergency if we're going to get through this."

We were about 20 min into a 40-min flight. The weather was clear at Maroochy, but we were still in trouble; unsure of our position and in a total whiteout. The GPS was telling me we were 4 NM from the airstrip. I guess I didn't do the "logic" check on that one either.

I called Maroochy Tower and explained that I thought we were over the airstrip, had no clearance but were in IMC at 3 500 ft. The tower controller was very calm and asked us to squawk 0100 on the transponder. Apparently, we were not visible on his radar, but Brisbane had us at 10 NM north of Kilcoy, which is about 30 NM southwest of Maroochy. We were told the lowest safe altitude was 4 200 ft and if we were able, we should climb to 4 500 ft and take up a heading of 060. All this time, I was doing the radio calls and keeping an eye on the instruments, signalling when wings were not level, or when we were descending. I remember saying, "We're past the mountains, we have 10 min of flying before we're visual; nothing can hurt us now." I did not like to think of engine failure, radio failure or electrics failure, all of which would have meant certain death. At least I knew we had enough fuel. Our composed controller kept in touch, "You are 6 min from Maroochy airstrip, we should have you visual fairly soon." His voice sounded like God himself.

It seemed like hours went by, but in fact we were in IMC for about 30 min. When we were at Nambour, we were instructed to begin a descent to 3 000 ft. My pilot was as reluctant to descend as she was to climb into cloud. We popped out of cloud and saw the familiar Maroochy River and coastline. I radioed to the tower, "We are visual, we're just going coastal to orient ourselves and settle down." We turned on a left downwind to Runway 36 (with a 15-kt crosswind), made a beautiful landing, and taxied around to the Maroochy Aero Club. The fireies [firefighters] had been listening and came over to welcome us back. The instructor who had checked us out came over to help us open the doors and hangar the aircraft. The controller who had talked us in phoned and joined us at the bar after his shift.

We were amazed to learn that Brisbane and Canberra had been notified, and that commercial aircraft flying above us had offered to help. The controller had cleared our radio frequency and said that many people were happy to hear we were back safely. He told us that the average life span of a VFR pilot who inadvertently enters IMC was less than 3 min.

In retrospect, several mistakes were made. We assumed that the clag in front of us was smoke, as it had been on the trip up, and that it would clear. We placed some reliance on the report of the aircraft that had flown the route less than an hour before, and reported clear conditions. We were reluctant to advise anyone we were in trouble. The GPS was malfunctioning. What saved our lives (besides the calm, cool and collected controller), I think, was the little bit of instrument training we both had. I can recall my instructor saying, "If you get yourself into IMC, climb to lowest safe, keep the wings level, maintain your heading and altitude, and tell someone you're in trouble." Having two pilots in the aircraft, leaving one to concentrate on instrument flying and the other to do the necessary radio work, was a plus. We could easily have been a statistic "Two fatalities: controlled flight into terrain, VFR flight into IMC."

The controller did not bother us with unnecessary requests as to fuel status or ratings. I learned later he had phoned the flying school to inquire if I had an instrument rating. His calm instructions were a major influence on the successful completion of the flight. Thank God that we had an experienced air traffic controller manning the Maroochy Tower at 4 p.m. on a Sunday. And just thank God.

Lessons learned: Don't panic. Keep an accurate time and distance check. Your GPS may be wrong. Don't rely solely on other pilots giving you information. Work together in the cockpit. Don't be afraid to speak up—it might save your life! Also don't be afraid to let ATC know you are in over your head. They are there to help. Clearly with pilots in danger of imminent death, this qualifies as a "Mayday" emergency. (From the French *M'aidez*: "Help me."). I am sure pilots have died because of reluctance to ask for help. This is what you say: "Mayday (three times), [your aircraft's call sign] (three times), I am a visual pilot. I am in IMC and I am unsure of my position." Give your altitude, approximate position, heading and how many persons on board. Say clearly, "I need help" and switch the transponder to 7700.

Dr. Heather Parker
Queensland, Australia

AIM Quick Fix…Stopway and Clearway

A ***Stopway*** is defined as a rectangular area on the ground at the end of the runway, in the direction of takeoff, prepared as a suitable area in which an aeroplane can be stopped in the case of an abandoned takeoff and is marked over the entire length with yellow chevrons as shown in AGA 5.4.2.

A ***Clearway*** is defined as a rectangular area on the ground or water under the control of the appropriate authority, selected or prepared as a suitable area over which an aeroplane may make a portion of its initial climb to a specified height.

References: *Aeronautical Information Manual,* sections AGA 3.6 and AGA 3.7

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The Safety and Efficiency Benefits of the Wide Area Augmentation System (WAAS)

by Ross Bowie, Director, ANS Service Design, NAV CANADA

NAV CANADA

Canadian pilots have been using GPS since the early 1990s as an aid to VFR navigation and for IFR en-route, terminal and non-precision approach operations. For the IFR pilot, the ability to go direct saves time and fuel, and area navigation GPS [RNAV (GPS)] approaches often mean lower minima. These approaches also bring safety benefits by eliminating circling procedures and reducing the need for visual manoeuvring to line up and land, thanks to the accuracy of GPS.

The operational approval to use WAAS in Canada was issued on October 27, 2005. Details can be found in the Transport Canada *Aeronautical Information Manual* (TC AIM) COM 3.16 and RAC 3.14.1, aeronautical information circular (AIC) 27/05 and in a special notice in each *Canada Air Pilot* (CAP) volume.

WAAS builds on the success of GPS and promises even more benefits. The U.S. Federal Aviation Administration (FAA) commissioned WAAS in 2003, and it already serves part of Canada. NAV CANADA has installed two WAAS stations in Goose Bay, N.L., and Gander, N.L., and will install two more in Winnipeg, Man., and Iqaluit, Nu., next year. This expanded network will extend WAAS service to most of southern Canada, as depicted in the map on page 8.

How does WAAS work? A network of reference stations monitors GPS satellite signals and sends data to master stations, which create a message containing corrections and integrity data. The WAAS message is up-linked to geostationary (GEO) satellites orbiting over the equator for rebroadcast over a hemisphere. As an aside, in the mid 1990s NAV CANADA brought the FAA and Telesat Canada together to explore the hosting of a WAAS transponder on one of Telesat's Anik satellites.

On September 9, 2005, the Anik F1R, with an advanced WAAS transponder on board, was launched into an orbital slot at 107.3°W, and from there it will provide WAAS service to all of Canada. Other GEO satellites will ensure redundant coverage.

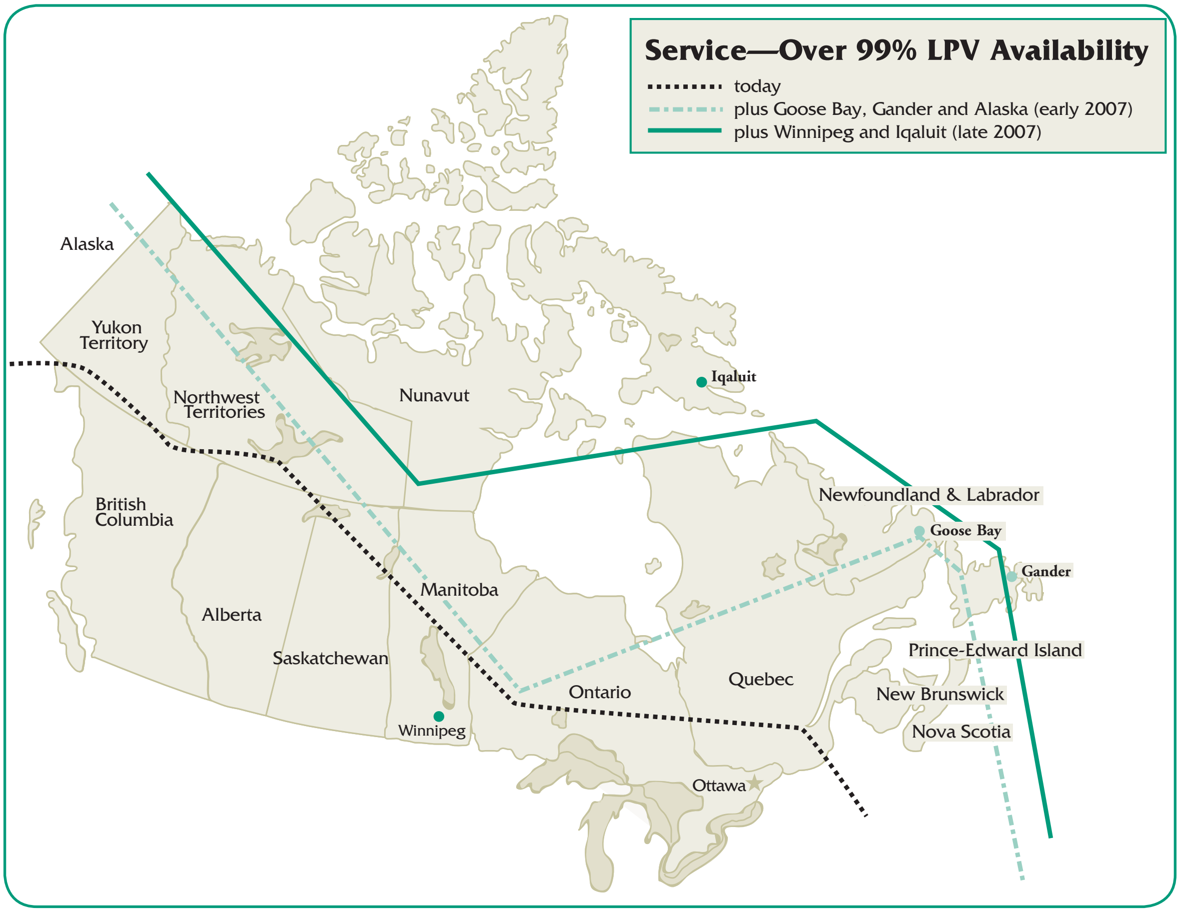
Aircraft WAAS receivers use the WAAS message and the data from GPS satellites to deliver horizontal and vertical accuracy that is better than 2 m. Even more importantly, the integrity portion of the message provides assurance that the aircraft will not be misled by a faulty satellite signal.

WAAS supports instrument landing system (ILS)-like approaches with vertical guidance, termed "LPV" approaches (Localizer Performance, Vertical guidance).[1] The FAA has monitored WAAS performance since 2003, and found that it is even better than predicted, so ILS design criteria can be used for LPV approaches. It is expected that the decision altitude will be at or near 250 ft AGL at over 90 percent of runways meeting instrument runway physical standards. Lower decision altitudes will mean higher airport usability at many sites.

Approach charts with LPV minima are titled RNAV (GNSS) [global navigation satellite system], and there are minima lines for lateral navigation (LNAV) (basic GPS), LNAV/VNAV [for aircraft with basic GPS and barometric vertical navigation (BARO VNAV) capability] and LPV (for WAAS-equipped aircraft). The first chart with LPV minima was published on October 27, 2005, for the Kitchener/Waterloo airport.

Aircraft with WAAS avionics will of course be able to use LNAV minima on existing RNAV (GPS) charts. The plan

[1] The FAA previously defined LPV as "Lateral Precision, Vertical Guidance," as explained in ASL 1/2004. In the summer of 2005, they changed it to "Localizer Performance, Vertical Guidance." This change in definition has no operational significance.



is to convert all the RNAV (GPS) charts to RNAV (GNSS) by adding LNAV/VNAV and LPV minima.

As was the case with GPS, avionics production has lagged behind. There is one panel-mount WAAS unit available in the USA, but it has not yet been approved in Canada. The first flight management system (FMS)-capable system will be available in the fall of 2006.

Since GPS was first approved for IFR flight in 1993, many operators have gained benefits from over 350 RNAV (GPS) approaches. At many small airports previously served by circling non-directional beacon (NDB) approaches, the improvement in both safety and efficiency has been dramatic. WAAS will clearly provide more safety and efficiency benefits, and support the realisation of a long-term goal to provide vertical guidance on all approaches. This not only enhances safety by reducing the probability of controlled flight into terrain (CFIT) accidents, but it also reduces training costs by standardizing on one procedure for all approaches. △

The Canadian Business Aviation Association Column—Attitude and Behaviour

Aviators studying human factors may find the following Merriam-Webster definitions of the word "attitude" very useful:

a. the position of an aircraft determined by the relationship between its axes and a reference datum;
b. a mental position or feeling or emotion with regard to a fact or state;
c. a negative or hostile state of mind;
d. a cocky or arrogant manner.

When discussing attitude in flight training, we learn how "attitude and movements" determine the flight path of an aircraft, and when in trouble, a pilot reverts to these basics. Using our collective knowledge of human behaviour, we could apply a simple rule to create a fall-back position called "attitude and behaviour" to use in making decisions under stressful situations.

Many accident cost factors are attributed to poor human judgement. It is remarkable that under a controlled scenario-based environment, we choose the appropriate action. However, when faced with real situations, our judgement becomes clouded by outside pressures. An example of an outside pressure applicable to many aviators is the perceived need to get the job done at all cost.

Corporate aviation in Canada has evolved into an efficient, global transportation service with well-defined protocols and standard operating procedures (SOP), and can boast one of the safest operational records. There are, however, situations where the system has failed. A safety management system (SMS) is integral to the Private Operator Certificate (POC) Program managed by the CBAA. SMS requires us to be proactive in identifying all hazards and mitigating the ensuing risks to our operation.

Poor judgement is one such hazard that creates risk requiring effective mitigation. The desire to please and to get the job done at all costs creates pressures; the resultant stress can cause a lapse in judgment by otherwise well-trained and experienced aviators, and can lead to accidents.

In one moment of misjudgement, they react contrary to their training, the regulations, and their company SOPs, in favour of a misplaced belief that they could make it and beat the odds. This failure in judgement, or so-called "bad attitude," is not in keeping with the individual's contract, which requires one to be responsible and accountable to comply with well-defined protocols and SOPs. Inherent in the contract is the obligation to make appropriate decisions.

Our collective experience has shown that erring on the side of safety can easily be defended. Bad judgement, where negative indicators were present, cannot be defended.

Being a well-trained professional is important. Exercising good judgment is the minimum standard we must all strive for in order to maintain credibility and service excellence.

Remember the basics of *attitude and behaviour* to stay on the positive side of the definition of attitude. △

COPA Corner—Managing Your Weather Risks

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

CANADIAN OWNERS AND PILOTS ASSOCIATION

On September 7, 2005, the U.S. National Transportation Safety Board (NTSB) issued a study that had some interesting things to say about general aviation (GA) weather accidents and who is most at risk for having them.

The NTSB report stated: "Even though weather-related accidents are not frequent, they account for a large number of aviation fatalities—only 6 percent of GA accidents are weather-related, but they account for more than one in four fatalities that occur in GA annually.

"For the study, NTSB investigators collected data from 72 GA accidents that occurred between August 2003 and April 2004. Information about these accidents was compared to a matching group of 135 non-accident flights operating under the same conditions.

"The study results suggest that a pilot's performance history, including previous aviation accidents or incidents, and Federal Aviation Administration (FAA) knowledge or practical test failures, are associated with an increased risk of being involved in weather-related GA accidents.

"The study also found that pilots who obtain their first pilot certificates earlier in life, or those who obtain higher levels of certifications or instrument ratings, are at reduced risk, compared to other pilots."

Some of the information here will not come as a surprise to many pilots in Canada. Most of us know that flying into bad weather—low ceilings, visibilities and thunderstorms—kills a high proportion of those who do it. While the overall number of accidents is relatively low, the fatality rate in these types of accidents is high. That is usually because the aircraft hits the ground at high speed.

Dealing with the risks of bad weather is the key issue here, and this is where the NTSB report is most interesting—it notes that the pilots who are at an increased risk for weather accidents are those who:

- have had a previous accident or incident;
- have failed written exams or flight tests in the past;
- have learned to fly later in life;
- hold only lower licences (i.e. private pilot);
- do not hold an instrument rating.

So should pilots who meet this profile stop flying? Absolutely not! The key is "risk management"—identifying the risks in your flying and working to reduce them. If that profile describes you—even a little bit—then there are steps you can take. You know you are at an increased risk, so reduce it by doing the following:

- Leave an extra margin when it comes to weather—don't push into marginal weather, or allow anyone else to pressure you into flying in marginal weather. Always leave yourself an "out."
- If you have had previous accidents or incidents, then that is your "wake-up call." Seek out an instructor and get some dual training, focussing on the events and decision making that lead up to the event. Train to prevent a reoccurrence.
- If you have previously failed a written exam or flight test, then you know those are areas of

weakness that you will continuously have to work on. Study those subjects until you become "an expert" in those areas.

- Seek out extra training—upgrade your skills by taking extra ratings (night, instrument) or work on higher licences—the skills and judgement gained will help reduce your risks.

Judgement is a learned skill, just like crosswind landings. And, just like crosswind landings, judgement skills need constant practice if they are to not become rusty. Fly as often as you can. Be current and keep your judgement skills sharp—your life will depend on it.

You can find out more about COPA at www.copanational.org. △

Flying in the Twilight Zone

by Garth Wallace

I watched as a ski-equipped Aeronca Champion, cocked in one almighty sideslip, came out of nowhere and slid down to the snow-covered airport infield. It was early on a Saturday morning. I was sipping coffee and looking out the window while waiting for my first student to arrive.

The Champ taxied over the lumpy, snow-covered grass toward the flying school. It had an original Aeronca paint scheme, cream with a big red teardrop on the bottom of the fuselage. The airplane stopped just short of the snow ridge at the edge of the ramp and shut down.

The arrival of a skiplane was an unusual event at this uncontrolled but medium-busy airport. I continued to watch as the Champ's door flopped forward against the wing strut. A short, stocky pilot climbed out. He was dressed in a black snowmobile suit, big, laced boots and one of those winter hats with earflaps. He was carrying two short pieces of wood in a heavy pair of leather gauntlets. He bent under the right wing strut, used his shoulder to rock the airplane and slid one of the sticks under the right ski. He tramped around to the left side and repeated the procedure. The pilot then scrambled over the low snow bank and waddled across the ramp to the office. I smiled and nodded to him as he came through the door.

"She's nippy out there, eh," he said with a friendly grin. His face was tanned, leathery and peppered with whiskers. As he spoke, the telephone rang.
"Yup, I guess it is," I replied, walking over to the counter. "Good morning, flying school."

It was the local flight service specialist calling. "Let me speak to the pilot of that rag wing that just landed on the infield," he said. The man in question was stamping his feet on the entrance mat and removing his gloves and hat.

"Flight service wants to talk to you," I said, holding the phone out to the newcomer.
"I don't know anyone in flight service," he replied cautiously.
"Maybe he has questions about your arrival," I suggested.

The visitor was not the first older pilot to apply his own interpretation of the airport's mandatory frequency (MF) designation. He ambled to the flight desk, unzipping his well-worn suit, and took the phone.

"'ello?"
I could only hear the pilot's side of the conversation. It was interesting.
"O' course I landed without callin', I got no radio, eh," the pilot said.
He listened patiently for a minute.
"Well, there weren't nothin' like that 'ere last time, eh."
"Eight years? That's what I thought, it's somethin' new, eh."
He listened again for a while.
"Well, why would I be puttin' a radio in an airplane that's got no 'lectrics? It don't make sense, eh."
"Sure, whatever you say." He hung up.
He wrinkled his brow and looked at me. "He sounded a bit excited, eh."
"Did you talk to anyone on your way in?" I asked.
He gave me a questioning look. "Well, I'd be talkin' to myself, wouldn't I? I got no one with me, eh."

My student arrived so I didn't continue the conversation. I mentally named this character Grizzly Adams and went to work. During the pre-flight briefing with my student, I noticed that Grizzly bought a coffee from the machine and wandered around the lounge reading the bulletin board and looking at the pictures.

I was signing out for my flight when the visitor bid us a friendly "goodbye" and headed outside. My student and I followed him to our aircraft. I watched Grizzly pull the sticks out from under the Champ's skis while my student was doing a pre-flight inspection. He leaned into the cockpit and set the controls. Then he hand-propped the engine while standing behind the propeller. Two flips and it settled into an easy idle. With the engine running, he walked behind the tail, picked it up and turned the airplane into the wind. I scanned the sky. There was no traffic. Grizzly climbed into the airplane, closed the door and applied full power. In a hop, skip and a jump, the Champ was airborne.

The next Saturday morning I watched for Grizzly from the office window, my coffee in hand. He didn't disappoint me. The bright little Champ came curving toward the infield from over the hangar row. The pilot had the airplane turned sideways and dropping like a rock. At the last moment, he snapped it straight and raised the nose. It settled onto the snow in a three-point landing, then taxied toward me and stopped beside the ramp.

The telephone rang before Grizzly had cleared our door. It was the same flight service specialist as the previous week. He sounded a bit hot.
"Good morning," I said to my visitor. "The flight service specialist wants to speak to you."
"Boy, she's a bit nippy out there, eh," he said, stamping his feet.
"Yes, I guess it is," I replied.
He took the telephone receiver. "'ello?"
"Well, I didn't call 'cause I got no radio. I told you last week, eh."
"Well, o' course I started 'er by 'and. She's got no 'lectrics, eh. No 'lectrics, no starter."
Grizzly was frowning and shuffling his feet as he spoke.
"Well, how do I start 'er with someone in the front if I'm outside flipping the prop?"
"Whatever you say, lad."
He hung up the phone and scratched his head. "That boy isn't makin' a lot of sense," he said to me.

I had a few minutes before my first student, so I drank my coffee with Grizzly. I found out he was from "up country a piece." He had spent the last 10-odd years rebuilding the Champ after flipping it over in soft snow.
"I re-did the engine while I was at it."

I tried to gently suggest that the flight service station (FSS) helped separate traffic, which made it necessary for pilots to make contact before flying in the area.
Grizzly leaned over to look out the window. At that time on a Saturday morning, there were no airplanes moving.
"'e's got his work cut out for 'im, eh," he chuckled.

I couldn't help thinking that this rough-edged pilot was flying in a time warp. The airspace regulations he was breaking were designed for the orderly flow of high and low speed traffic flying visually or on instruments. Hand-starting the airplane by himself was a well-documented safety issue. Hopping to nearby airports for coffee on a sunny Saturday morning in an old, slow airplane was still an important part of pleasure flying. From across the ramp, Grizzly's Champ looked to be in good shape and he seemed to fly it well. With a little education and expense he could fit into this modern, safer era of recreational aviation, if he wanted to.

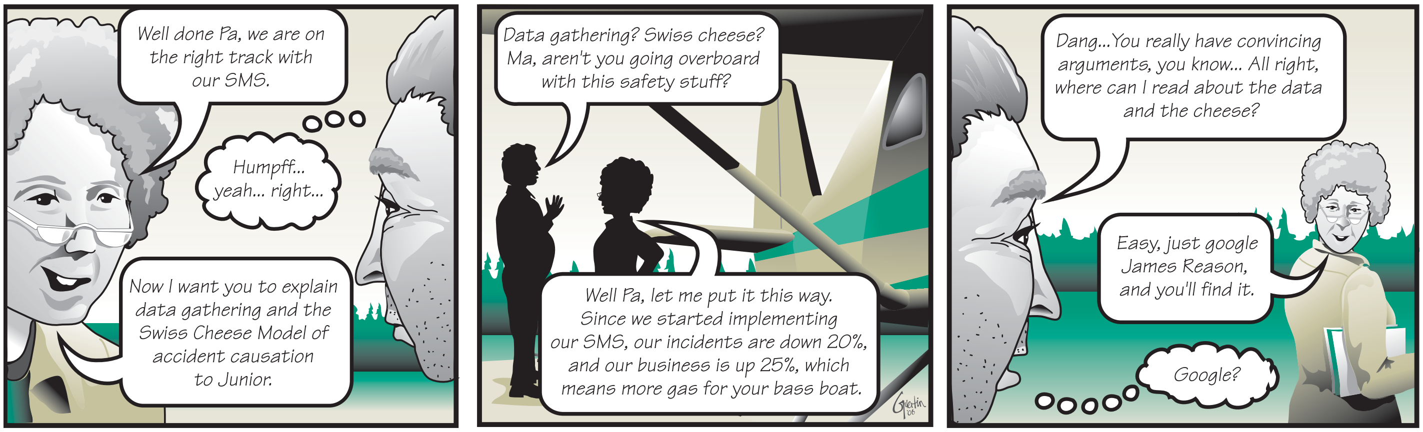
My student arrived and Grizzly left before I could pursue that suggestion. I saw him hand prop the engine, turn the tail, climb in and take off. Our telephone rang. I let someone else answer it.

The next Saturday he was back. This time, when the airplane stopped on the other side of the snow bank, Grizzly left the engine running while he put the sticks under the skis and walked to the office. Our phone was ringing when he was halfway across the ramp.
"Good morning, it's for you, again," I said when he came in the door.
"She's nippy out there, eh," he said.
"You can say that again," I replied.
He took the receiver. "'ello?"
"O' course I left 'er runnin'. Last week, you gave me the devil for 'and proppin' 'er, eh."
"My pilot licence number? I don't have no pilot licence. My dad taught me 'ow to fly. He didn't have one either."
"The airplane registration? I don't know 'bout that but she's all new since the crash, eh."
"Whatever you say."
He hung up and frowned. "'e wants to see some documents but I got not'in' to show, eh."
He scratched his head for a moment. "I t'ink I'll take the coffee to go."
He did.
As he was turning the airplane around by the tail, the telephone rang.
"Good morning, flying school."
"No, I can't see any registration on the airplane, either," I said. It was the truth.
The little airplane accelerated across the infield.
"His name? I think he said that it's Grizzly Adams."

The next Saturday, Grizzly must have flown somewhere else for coffee. △

*Garth Wallace is an aviator, public speaker and freelance writer who lives near Ottawa, Ont. He has written nine aviation books published by Happy Landings (*www.happylandings.com*). The latest is* You'd Fly Laughing Too. *He can be contacted via e-mail:* garth@happylandings.com.

BLACKFLY AIR ON SMS



Blackfly Air on Data Gathering

Blackfly Air managers are relentless in implementing their safety management system (SMS), and this time around they dig deep into data gathering, and are introduced to the *Swiss Cheese Model of Accident Causation*. The Swiss cheese model came from Dr. James Reason, Professor at the University of Manchester, who is internationally known as one of the leading experts on human and organizational factors in safety investigation and accident prevention. As per previous Blackfly Air episodes, we'll briefly discuss these topics here, and in the next article, we'll present a counterpoint on the Swiss cheese model.

Data gathering—the small stuff

Major events such as accidents and significant incidents draw attention in themselves, and certainly will not go unnoticed. However, it is a number of small risks or hazards that, occurring together, cause the series of failures that can lead to an accident. Figure 1 shows how these hazards or latent conditions that exist at the organizational level can contribute to an accident by allowing conditions to exist that make the unsafe acts or active failures possible and dangerous.

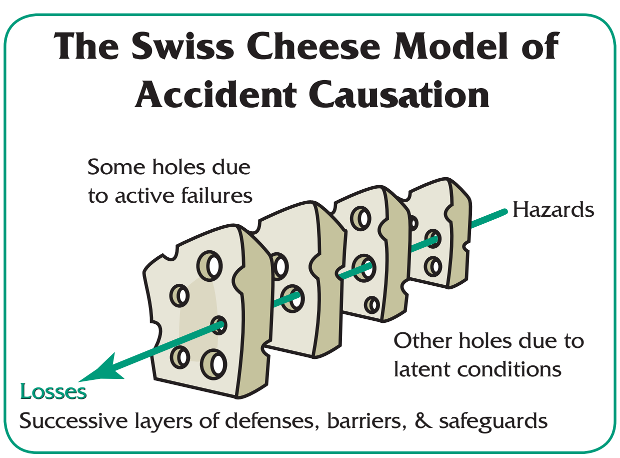


Figure 1: The Swiss Cheese Model—James Reason

The question is, "How do you identify these small risks that often go unreported or even unnoticed?" You need an effective data-gathering process, but most particularly you need a reporting culture within the organization, one in which people are actively looking for current and potential problems. The reporting, then, looks at two things—events that DID occur, and events that MIGHT occur. Gathering data on both is equally important.

A large helicopter operator in the US started a program where employees received a prize for identifying a hazard or developing a safety-related idea that was used in the company. In this case, employees were motivated to look for, and report, hazards. The program was so successful that the accident rate for this company fell to zero during the life of this program.

The secret to long-term success is to develop a simple reporting system appropriate to the size of the company, to encourage the free flow of safety information. This reflects three commitments already made by management in the company safety policy, namely that:

- it supports the open sharing of information on all safety issues;
- it encourages all employees to report significant safety hazards or concerns; and
- it has pledged that no disciplinary action will be taken against any employee for reporting a safety hazard, concern or incident.

Successful reporting programs have these four qualities:

- reports are easy to make;
- no disciplinary action is taken as a result of submitted reports;
- reports can be submitted in confidence and are de-identified; and
- feedback to everyone is rapid, accessible and informative.

The reporting system has to have methods for doing four things:

- reporting hazards, events or safety concerns;
- collecting and storing the data;
- analyzing reports; and
- distributing the information gleaned from the analysis.

There are various options for gathering the data. Here are some:

- confidential report forms deposited in a secure box;
- suggestion box;
- online computer reporting systems;
- confidential staff questionnaires;
- an "open-doorÈ policy for informal communication;
- brainstorming sessions;
- organized study of work practices;
- internal or external company safety assessment; and
- simple forms to be included with regular documentation submitted by crews in the field.

In very small operations, reports can be verbal, but it is essential that the end result be in written format rather than verbal, to preclude any reports from "slipping through the cracks." Make sure that everyone knows exactly where, how and to whom reports are submitted.

Sample reporting forms are included in the toolkit found at www.tc.gc.ca/civilaviation/general/Flttrain/SMS/Toolkit/menu.htm. The simpler it is, the less time-consuming it will be to complete, and the more people will be encouraged to use it. Keep a supply of blank report forms beside the collection box, with aircraft spares packages, or with crew position reports, but also accept simple hand-written notes. After all, this is about looking for safety hazards and fixing them, not creating a bureaucracy.

Should it ***require*** the individual's name? No. The person reporting may add their name, which allows the company to advise promptly that the report has been received and what corrective action is planned, but anonymous reports must be allowed. In a small operation, the level of anonymity will probably be limited, but it then becomes all the more essential that everyone understands the company safety policy's guarantee of no reprisals. Management must make an extra effort to win the trust of employees when the level of anonymity is limited.

You will almost certainly get better response if you post some ideas about the sort of issues to report. In general, you are looking for hazards, risks, incidents and concerns —anything that has the potential to cause injury or damage. A system-wide application of this process will also include reports on recommendations to improve overall efficiency. Here are some examples you can suggest to get people thinking:

- incorrect or inadequate procedures, a setup for error;
- poor communication between different parts of the company;
- out-of-date manuals;
- inadequate training;
- inadequate, incorrect or missing checklists;
- excessively long working days
- missing or unsecured equipment;
- obstacles and limited clearances for manoeuvring;
- refuelling hazards;
- flight preparation;
- unreasonable customer expectations or unplanned requirements; and
- near misses or almost "gotchas."

Encourage your company employees to brainstorm ways in which the system could fail, and to submit these ideas for review and correction. You might consider periodic informal staff discussions focusing on safety improvement, and then document the results. Larger operations may hold monthly safety meetings to review reports and encourage discussion on various safety issues. These meetings should be documented and any action required clearly recorded and followed up.

Whether you are a large or a small operator, you need to keep track of the data in these reports. You want to be able to monitor and analyze trends. Whether your safety database is in written or electronic form, when you receive a report, categorize the type of hazard it identifies, take down the date and any other pertinent facts, then document what gets done to correct the problem, and confirm that feedback was provided to all employees. Ensure that the data does not identify the reporter, and then destroy the original report to protect confidentiality.

Follow-up is vital, both to correct safety problems, and to show people that the program works. There are three parts to this:

- decide who should be involved in ensuring prompt and effective corrective action;
- publicize what has been done to address ***every*** concern raised, including decisions to accept certain risks and why; and
- alert people to the safety issues involved so that everyone can learn from them.

Here are some ways to pass on company actions on safety issues to the staff:

- bulletin board;
- company safety newsletter;
- company Web site;
- e-mail to staff; and
- staff meetings.

Finally, keep in mind that trust is the most important part of the reporting system, because people are being encouraged to describe, not only the hazards they see, but also the mistakes they themselves have committed.

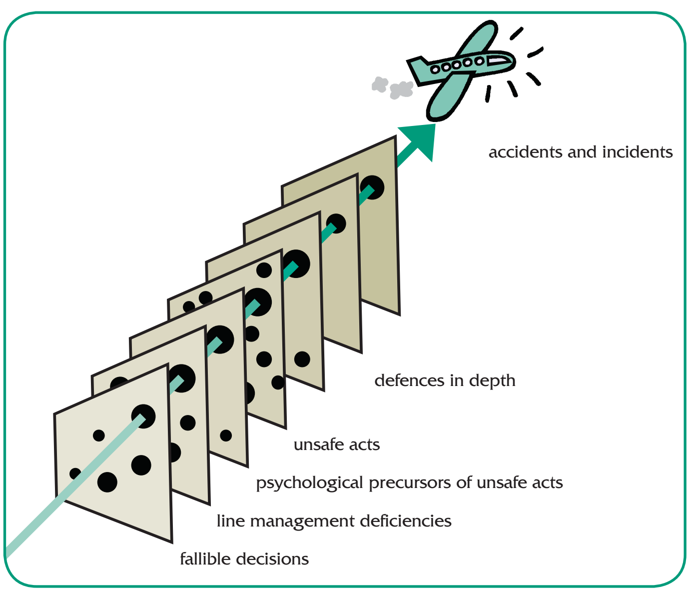
Getting feedback on safety weaknesses in the operation has proven to be far more important than assigning blame. For this reason it is important to have a non-punitive or no-blame policy for reporting safety concerns.

For further information, refer to Chapter 3 of *Safety Management Systems for Small Aviation Operations—A Practical Guide to Implementation* (TP 14135), at www.tc.gc.ca/civilaviation/general/Flttrain/SMS/TP14135-1/menu.htm, and *Safety Management Systems for Flight Operations and Aircraft Maintenance Organizations—A Guide to Implementation* (TP 13881). △

Seeking and Finding Organizational Accident Causes: Comments on the Swiss Cheese Model©

The following is adapted from an online article found on the University of New South Wales's aviation Web site at www.aviation.unsw.edu.au/about/articles/swisscheese.html, *reprinted with permission.*

When it comes to understanding incidents and accidents, James Reason's "Swiss cheese model" has become the de facto template. This has had a positive effect on aviation safety thinking and investigation, shifting the end-points of accident investigations from a "pilot error" explanation to organizational explanations. However, overzealous implementation of a theoretical framework has led to an illusion of management responsibility for all errors. The Swiss cheese model of accident causation is now adopted as the model for investigation in many industries. Indeed, in aviation it has become the accepted standard as endorsed by organizations such as the Australian Transport Safety Bureau (ATSB) and the International Civil Aviation Organization (ICAO). The Swiss cheese model shows several layers between management decision making and accidents and incidents. The layers are shown below:



Variation of Reason's Swiss Cheese Model

An accident or incident occurs where "holes" in these layers align. The holes themselves change over time.

Reason (1990, 1997) made a key distinction between the active, operational errors ("unsafe acts") and the latent (organizational) conditions. Reason (1990) stated that, "systems accidents have their primary origins in the fallible decisions made by designers and high-level (corporate or plant) managerial decision makers" (p. 203). Active errors were therefore seen as symptoms or tokens of a defective system. It became the duty of incident investigators and researchers to examine the psychopathology of organizations in the search for clues.

One implication of the organizational approach has been the tenacious search for latent conditions leading up to an accident. There are serious flaws in such prescriptive implementation. While the importance of analyzing human factors throughout the accident sequence is not in question, the dogmatic insistence on identifying the latent conditions could, and should, be challenged in cases where active errors played a major part.

From human factors to organizational factors, and back again!

Organizational accident theory and the Swiss cheese model occupy a curious position in accident research and commentary, in that they are never challenged. While these developments were clearly landmarks in accident investigation research, this uncritical stance is an unhealthy state of affairs in science. One of the few researchers to question the use of Reason's Swiss cheese model is Reason himself, who warned that, "the pendulum may have swung too far in our present attempts to track down possible errors and accident contributions that are widely separated in both time and place from the events themselves" (1997, p. 234), and that, "maybe we are reaching the point of diminishing returns with regard to prevention" (2003).

The human factors and accident investigation community should encourage a holistic view of errors and accidents, but one that does not necessarily lead deep into the roots of the organization. Here is why.

Issue 1: Active errors may be the dominant factors. The Swiss cheese model can lead to the illusion that the root of all accidents or even errors stems from the organization's management. This is not the case. Many errors are simply a by-product of normal, adaptive cognitive processes. "Inadequate defences" would make the errors more dangerous, but even then some errors would overcome even well-planned and maintained defences.

Issue 2: The causal links between distant latent conditions and accidents are often tenuous. The mapping between organizational factors and errors or outcomes, if any such mapping can be demonstrated with an appropriate degree of certainty, is complex and loosely coupled. However, the Swiss cheese model makes it tempting to draw a line back from an outcome to a set of "latent conditions." This invites "hindsight bias," where we overestimate what we knew or could have known before an event occurred. Many "latent conditions" would seem insignificant in the pre-event scenario.

Issue 3: Latent conditions can always be identified—with or without an accident. An organization can identify its systemic weaknesses with or without an accident. Reason (1997) himself stated that distant factors do not discriminate between normal and abnormal states, "??only proximal events—unsafe acts and local triggers—will determine whether or not an accident occurs" (p. 236). Reason (1997) argued that, "the extent to which they are revealed will depend not so much upon the 'sickness' of the system, but on the resources available to the investigator" (p. 236). It seems that the harder you look, the more latent conditions you'll find.

Issue 4: Some latent conditions may be very difficult to control, or take many years to address. The factors that can be most easily remedied are [those closest] to the task performer—the working environment and supporting processes. Latent or organizational factors are not so amenable to rapid correction. For instance, an organization's "safety culture"—much maligned in the Challenger accident report—cannot be manipulated easily or rapidly. Again, Reason (1997) declared that our main interest must be in the "changeable and controllable."

Issue 5: Misapplication of the model can shift the blame backwards. Just as the focus of accident investigations has changed over the years, the focus of blame has also changed. The "blame-the-pilot" culture swung to a "no-blame" culture. This over-swing was corrected by the concept of a "just" culture. Somewhere in the midst of this, a "blame-the-management" culture blossomed. Paradoxically, the organizational approach has sometimes tended to focus on a single type of causal factor—"management incompetence" or "poor management decisions."

Finding the balance

Reason's Swiss cheese model revolutionised accident investigation worldwide. However, some industries, organizations and professions may have stretched the model too far. The "model" is really a theoretical framework, not a prescriptive investigation technique. And it may not be universally applicable. Investigations can turn into a search for latent offenders when, in some cases, the main contributory factors might well have been active errors with more direct implications for the outcome, and therefore defences should be strengthened to tolerate errors. The search for latent conditions has resulted in recommendations that undoubtedly improve the safety health of the organizations concerned. In some cases, however, these conditions have arguably only tenuous connections to the actual event and should perhaps be reported separately.

Without wanting to return to the dark ages of "human error" being the company scapegoat for all accidents, there is a balance to be redressed in accounting for the role of active errors. △

This article is based on Shorrock, Young and Faulkner (2005) and Young, Shorrock and Faulkner (2005).

Pre-flight

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Shorrock, S., Young, M., Faulkner, J. (2003) "Who moved my (Swiss) cheese?" *Aircraft and Aerospace*, January/February 2005, 31-33.

Young, M.S., Shorrock, S.T., and Faulkner, J.P.E. (2005) "Taste preferences of transport safety investigators: Who doesn't like Swiss cheese?" In P.D. Bust and P.T. McCasbe (Eds.), *Contemporary Ergonomics* 2005, London: Taylor and Francis.

Spring Review: Flying Passengers On Board Seaplanes? Prepare Them!

A review of past seaplane accidents on water indicates that the pilots and passengers in inverted aircraft often survived the impact, but were unable to evacuate under water, and subsequently drowned. In some cases, passengers were unable to release their seat belts, and their bodies were discovered with little or no impact injuries, still strapped to the seats. In other cases, passengers were able to release their seat belts, but were unable to find an exit and/or open it because of impact damage or ambient water pressure. Those who did survive spoke of extreme disorientation and said that they did not exit in what may be considered a normal procedure, i.e. they did whatever they had to in order to get out of the aircraft.

In some of the accidents where pilots survived and passengers did not, investigation revealed that pilots provided a pre-flight safety briefing, but did not discuss underwater egress. There were many accidents where the pilot was injured or killed and could not assist passengers in an underwater evacuation.

Seaplane pilots are therefore urged to include specific procedures for underwater egress as part of their comprehensive pre-flight safety briefing. This could make the difference between a successful evacuation, and being trapped inside a submerged seaplane. A thorough underwater egress briefing will provide critical information to passengers so that they can help themselves.

Situational awareness and exit operation

Prior to takeoff, advise passengers to locate the exit in relation to their left or right knee. If the exit is on their right while upright, then it will still be on their right in the event the seaplane comes to rest inverted. No matter how disorienting an accident, the passenger's relationship to the exit(s) remains the same, provided their seat belt remains fastened. Ensure passengers know the location of, and how to use, all exits. The method of opening an exit may be different from one seaplane to another, and even within the same aircraft. Permit passengers to practice opening the exit(s) before engine start up.

Underwater egress

In water accidents, seaplanes tend to come to rest inverted. The key to survival is to retain situational awareness and to expeditiously exit the aircraft.

The seven actions listed below are those found in the Transport Canada safety brochure for seaplane passengers, entitled *Seaplanes: A Passenger's Guide* (TP 12365). Pilots should read those seven steps out loud to all their passengers during the emergency egress portion of their pre-flight safety briefing, as follows:

If an emergency underwater egress is necessary, the following actions are recommended once the seaplane momentum subsides:

1. **Stay calm**—Think about what you are going to do next. Wait for the significant accident motion to stop.
2. **Grab your life preserver/PFD**—If time permits, put on, or at least, grab your life preserver or PFD. DO NOT INFLATE IT until after exiting. It is impossible to swim underwater with an inflated life preserver. You may get trapped.
3. **Open the exit and grab hold**—If sitting next to an exit, find and grab the exit handle in relation to your left or right knee as previously established. Open the exit. The exit may not open until the cabin is sufficiently flooded and the inside water pressure has equalized. DO NOT release your seat belt and shoulder harness until you are ready to exit. It is easy to become disoriented if you release your seat belt too early. The body's natural buoyancy will cause you to float upwards, making it more difficult to get to the exit.
4. **Release your seat belt/harness**—Once the exit is open, and you know your exit path, keep a hold of a fixed part of the seaplane and release your belt with the other hand.
5. **Exit**—Proceed in the direction of your nearest exit. If this exit is blocked or jammed, immediately go to the nearest alternate exit. Always exit by placing one hand on a fixed part of the aircraft, and **not letting go before grabbing another fixed part** (hand over hand). **Pull yourself through the exit.** Do not let go until you are out. Resist the urge to kick, as you may become entangled in loose wires or debris, or you might kick a person exiting right behind you. If you become stuck, back up to disengage, twist your body 90°, and then exit.
6. **Getting to the surface**—Once you have exited the seaplane, follow the bubbles to the surface. If you cannot do so, as a last resort inflate your life preserver. Exhale slowly as you rise.
7. **Inflate your life preserver**—Only inflate it when you are clear of the wreckage, since life preservers can easily get caught on wreckage, block an exit, or prevent another passenger from exiting.

Transport Canada updated its TP 12365 brochure in 2005, and also developed a bilingual poster for passengers, *Flying On Board Seaplanes* (TP 14346). Copies of those products were sent to all commercial seaplane operators in Canada, in order to put emphasis on this seasonal issue. For information, comments, or to obtain additional copies, please contact the Transport Canada Civil Aviation Communications Centre at 1 800 305-2059 or on the Web site at www.tc.gc.ca/CivilAviation/communications/centre/menu.htm. △

Improving Air Operator and Airport Operations Using a "Code Grey" Fog Forecasting System

by Martin Babakhan, The University of Newcastle (Australia), Newcastle, New South Wales, Australia
and John W. Dutcher, Dutcher Safety and Meteorology Services, Halifax, Nova Scotia, Canada.

Given some recent fog events at the Halifax International Airport, a Transport Canada System Safety Specialist from the Atlantic Region suggested that the work of two researchers to develop a proactive fog forecasting system to improve flight dispatcher planning and flight crew decision making may be of interest to ASL readers. More about this topic can be found at www.johndutcher.com. *—Ed.*

Low ceilings and reduced visibilities impact departures and arrivals at airports worldwide. Besides interruptions to flight schedules and passenger inconvenience, it can be financially costly to both air operators and airports. Therefore, forecasting of short-term variations of airport conditions, such as visibility and cloud base, is important for the safe and economic operation of airlines. Airline dispatchers must account for the possibility of delays due to such impeding weather phenomena and decide whether extra fuel should be loaded onto an aircraft. Of course, this decision on future weather conditions—two hours or more after the flight's departure—must be made one to two hours prior to the plane's departure.

These decisions require accurate and timely forecasts, made using standard aerodrome forecasts (TAF) which have some limitations. There must be at least a probably of 30 percent or more for a significant phenomena (i.e. thunderstorm, fog) before it can be placed in the TAF, and additional restrictions to the use of TEMPO and BECMG in the TAFs. The end result is that TAFs are typically conservative, even though the forecasters may feel that the phenomena could occur within the forecast period. The stated reason is that forecasters must be mindful of the potential impact of their TAFs in driving operational decisions. It is true that TAFs do drive operational decisions in the aviation industry, but one must argue that if there is at least a possibility (under 30 percent) of a significant weather phenomena impacting operators and airport operations, it should be reported to them.

In Australia, the Bureau of Meteorology forecasters are also restricted in notifying the aviation industry as a result of similar restrictions on TAFs. However, internally they use a system called "Code Grey" for significant phenomena having a 10–20 percent probability. This internally signals forecasters to continually monitor conditions to see if they do develop further, warranting an amendment to the TAF—which is typically hours after the original TAF. However, if an air operator or airport developed a similar "Code Grey" system, they could start hours before usual in their strategic operational planning, whilst continually monitoring the situation and updating their plans.

We developed such a system for a large airline based in Australia. With the chief pilot and director of flight operations, a "Code Grey" system for use by their flight dispatchers and flight crews was developed. We also developed a "Fog Model" for Sydney's Kingsford Smith International Airport (YSSY), which determines the probability of fog events for each month under certain temperature conditions and wind profiles. By combining the "Code Grey" system with the Fog Model, flight dispatchers have improved their forecasting and operational performance.

This has also allowed for improved decision making on the flight deck. The flight crews working with the flight dispatchers can continually monitor the weather conditions and make decisions on diverting to alternates, etc. In addition to enhanced decision making and safety, this program yielded significant savings in fuel costs. These systems are meant to supplement the total weather picture for crews and airlines operating in areas prone to fog and other low visibility phenomena. They are not meant to replace the traditional aerodrome forecasts. △

AIRCRAFT SAFETY THROUGH DELEGATION
Regulation • Oversight • Accountability

REMINDER—2006 Delegates Conference

The Aircraft Certification Branch will host the 2006 Delegates Conference at the Ottawa Congress Centre, in Ottawa, Ont., from June 27 to 29. Any delegates who have not yet received an invitation can register electronically at www.tc.gc.ca/aviation/activepages/DC, or by contacting Mr. G. Adams at 613 941-6257, or e-mail ADAMSGL@tc.gc.ca. For more information, visit www.tc.gc.ca/CivilAviation/certification/delegations/2006DelegatesConference.htm.

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 August and October 2005, are all "Class 5," and are unlikely to be followed by a TSB Final Report.

—On August 2, a **float-equipped Maule M5** aircraft was on takeoff from Grazing Lake, Ont. After lift-off, the aircraft did not gain altitude and settled back onto the lake. After the touchdown, the floats struck submerged rocks, and the floats and supporting structure received substantial damage. The pilot was not injured and exited the aircraft without assistance. *TSB File A05O0154.*

—On August 3, the pilot of a **float-equipped Cessna 172** was on final approach to land on Rice Lake, Ont., when, at about 20 ft above the water, the aircraft encountered a downdraft and struck the water hard. The lake surface was choppy and the weather was reported as hazy with thunderstorms building in the vicinity. On contact with the water, the right float broke off at the front, and the windshield was broken as the aircraft rotated forward on its nose; however, the aircraft remained upright. The pilot and passenger were uninjured and were able to egress. *TSB File A05O0158.*

—On August 4, a **de Havilland DHC-3** was transporting eight passengers into Louis Lagoon on the northwest end of Nootka Island, B.C. While on the downwind, left-hand leg of the approach, the engine stopped and the pilot conducted a forced landing into the lagoon. During the after-landing deceleration, the aircraft entered shallows on the east end of the lagoon and flipped over in about 1 ft of water. Only the pilot received minor injuries and everyone aboard escaped. *TSB File A05P0195.*

—On August 5, a **G-BAIR-IV amateur-built** aircraft on floats, took off in a northwesterly direction on Wolverine Lake, near Hearst, Ont. Shortly after takeoff, as the aircraft climbed above tree height, it encountered wind gusts that lead to the aircraft descending near the water edge and landing very hard. The aircraft was destroyed and the pilot and one passenger suffered serious injury. *TSB File A05O0159.*

—On August 6, an **ultralight Tiger Moth Replica** departed Hartney, Man., in the evening on a local day VFR flight. When the aircraft did not return at nightfall, relatives searched local roads in the vicinity. During the search, the aircraft flew overhead and the relatives used car headlights to illuminate a length of grid road for the pilot. The pilot landed across the road, bounced heavily and crashed in the adjacent field. The aircraft was substantially damaged and the seriously-injured pilot was transported to hospital. *TSB File A05C0148.*

—On August 6, a **Cessna 172H** was taking off from a grid road near Canwood, Sask., to return to a farm strip. A wingtip struck willows along the side of the road, and the aircraft veered into a ditch. The pilot was uninjured. The aircraft sustained substantial damage. *TSB File A05C0150.*

—On August 7, a **float-equipped Cessna 185F** was on approach to land at a fishing lodge on Aylmer Lake, Nu. The aircraft was landing with a strong crosswind in heavy rain. The pilot and sole occupant was unable to control bank and caught a wingtip. The aircraft crashed into the water, sustaining substantial damage. The cabin maintained its integrity and the pilot was able to extricate himself from the partially-submerged wreckage. The pilot sustained minor injuries and was assisted ashore by lodge guests. *TSB File A05C0149.*

—On August 7, a private **Enstrom 280FX helicopter** crashed onto Widgeon Lake, B.C., while on approach to the shoreline. The pilot and 2 passengers escaped without injury, and the helicopter sank in 50 ft of water. *TSB File A05P0199.*

—On August 8, a **SBA210 hot-air balloon** was launched in Regina, Sask., for a sightseeing flight. Shortly after takeoff, ATC advised that a weather front with rain was moving in faster than forecast, and suggested a landing as soon as possible. The balloon completed a precautionary landing in the vicinity of the Regina General Hospital, with a reported rate of descent on landing of 300 ft/min. One passenger sustained serious injuries; two sustained minor injuries. The pilot and three other passengers were not injured; no aircraft damage was reported. *TSB File A05C0147.*

—On August 12, a **Beech 19A Musketeer** was landing on a 3 000-ft grass-covered private airstrip near Kildare Capes, P.E.I. The aircraft landed long and bounced on initial touchdown. It then floated until it touched down for a second time approximately 375 ft from the end of the airstrip. Despite heavy braking, it overran the end of the airstrip, entered trees and stopped abruptly. The impact was sufficient to activate the emergency locator transmitter (ELT) and inflict substantial damage on the wings and airframe. The pilot sustained injuries, including lacerations to his head, and a fractured jaw and leg. The passenger sustained lacerations to her head and bruising in the hip area. *TSB File A05A0102*.

—On August 14, a **Bell 206L-1 helicopter** was en route at 700 ft AGL when the low rotor rpm horn sounded. The pilot dropped the collective and observed that the rotor tachometer read zero and the turbine tachometer read 100 percent. A check of the collective produced no response on the rotor rpm; however, a loss of hydraulics was noticed. An autorotation was initiated. On landing, the main rotor blades struck the rear vertical fins and severed the tail rotor drive shaft. A post-occurrence inspection revealed that the spline gear from the transmission to the tach generator had worn, leading to a failure of the hydraulic pump. *TSB File A05W0165*.

—On September 10, a **Cessna 150(J)** was flying low near New Liskeard, Ont., in order to photograph the preparation of a wedding ceremony. During the third pass, the aircraft was observed flying very low and slow. As the aircraft banked to the right, the aircraft stalled and the left wing dropped. The pilot was unable to recover from the stall/spin and the aircraft collided with the ground. The pilot and passenger were fatally injured, and the aircraft was destroyed. The pilot obtained his Private Pilot Licence in 1970; however, he did not have a current medical certificate, and his last medical was in 1994. The pilot had no record of any training since 1973, and there was no evidence that the pilot had exercised any of the recency requirements stated in the *Canadian Aviation Regulations* (CAR 401.05). *TSB File A05O0203*.

—On September 27, the engine magneto of a **Challenger II/A advanced ultralight** was unintentionally turned off momentarily during takeoff and the engine backfired. Subsequently, airspeed was allowed to drop and control of the aircraft was lost. The aircraft descended and struck some trees. The pilot received serious injuries and the aircraft was substantially damaged. This was the second flight for the aircraft after its recent completion, and the first flight in the aircraft for the pilot. *TSB File A05O0217*.

—On October 1, a **Bell 407 helicopter** landed on a makeshift pad at the edge of a lake. The pilot rolled the throttle back to ground idle, the helicopter tilted backwards and the tail rotor entered the water, shearing the short shaft in the engine compartment. The makeshift pad consisted of several logs placed on the boggy ground at the rear of the landing area. The pilot reported that he had landed too far aft on the pad, and that the bear paws were aft of the logs and not on top of them as they should have been. *TSB File A05A0133*.

—On October 2, a **Cessna 172M** was on a pleasure flight from Dawson Settlement, N.B., to Havelock, N.B., with the pilot and one passenger onboard. During landing on Runway 11 (a grass strip) the aircraft overran the end of the runway into a small gully, resulting in damage to the nose gear, the right main gear, and the propeller. The pilot reported that he intentionally landed long to avoid a long taxi. He also reported that the runway was dew-covered and that this may have been a factor in not being able to stop the aircraft. *TSB File A05A0134*.

—On October 15, a **float-equipped Cessna 172N** was en route from Tobin Lake, Sask., to Cooking Lake, Alta., with a fuel stop in Turtle Lake, Sask., 90 NM north of North Battleford, Sask. While landing at Turtle Lake, the aircraft landed long and ran up on a rocky beach. The aircraft sustained substantial damage to the floats, propeller, and forward fuselage. The pilot and passenger were not injured. *TSB File A05C0190*.

—On October 19, a **Lindstrand Balloon model LBL 310A** departed New Hamburg, Ont., with the intention of landing in Fergus, Ont. While en route, the pilot experienced deteriorating weather and therefore elected to land in a field 3 NM southeast of Orangeville, Ont. During the approach, the basket collided with a tree and rotated 180°, causing the passengers to be in an incorrect position for landing. There were 4 minor injuries and 1 serious injury. The balloon was not damaged. *TSB File A05O0238*. △

Forest Fire Season Reminder!

Forest fire season is once again upon us, and each year there are aircraft that violate the airspace in and around forest fires. These include private, commercial and military aircraft. Section 601.15 of the *Canadian Aviation Regulations* (CARs) provides that no unauthorized person shall operate an aircraft over a forest fire area, or over any area that is located within 5 NM of one, at an altitude of less than 3 000 ft AGL. Refer to the "Take Five" published in ASL 3/99, which can also be found at www.tc.gc.ca/civilaviation/systemsafety/pubs/tp2228/forestfire.htm.

Civil Aviation's Business Model: the way we deliver and manage our program

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

Transport Canada Civil Aviation (TCCA) has adopted a business model to deliver and manage its program. It applies equally to safety as to other, broader management issues.

The business model is based on risk management. Its application will help the organization make better decisions in an environment that is forever beleaguered by competing demands for limited resources.

This article provides an overview of how this model applies to aviation safety. While regulatory authorities may find this approach worthy of closer examination, aviation companies may as well, as risk management is an integral part of a safety management system (SMS). The tactics and strategies used to mitigate risk may be different, but the processes are the same.

Inasmuch as this article refers to aviation safety, the applicability of the business model is broad: it can apply to security or environmental topics as well. It can also apply to other modes of transport or management issues.

TCCA' s adoption of this business model evolved out of recognition that safety is not an absolute condition, but rather one where risks are managed to acceptable levels. By way of a backgrounder, this article begins with a brief description of how this model came about.

Safety defined

Transport Canada's traditional view was: "We're here for safety." But the word "safety" was not defined in Canadian aviation legislation or departmental policy documents.

The dictionary is equally unhelpful. The *Concise Oxford Dictionary* defines safety as: "freedom from danger or risk; being sure or likely to bring no danger; being safe." The dictionary describes an absolute condition when few, if any, situations are completely "free from danger or risk." Like all human enterprises, aviation is fraught with risk. The absence of an operational definition of safety has been problematic for civil aviation. It is susceptible to wide, subjective interpretation, which can lead to conflicting priorities and the consequent allocation of resources to lesser issues; it hinders consistency in the delivery of regulatory programs and quantitative performance measurement.

Simply put, in the absence of a formal, operational definition of safety, the dictionary's version cannot apply in an aviation context (or any other low-probability, high-consequence industry for that matter). Perhaps it was in a similar light, that William W. Lowrance defined safety as: "a judgement of the acceptability of risk, and risk, in turn, as a measure of the probability and severity of harm to human health."[1] He summarizes by stating: "a thing is safe if its risks are judged to be acceptable."[2]

For the reasons stated above, in *Flight 2010*—TCCA's strategic plan—a working definition of safety is provided: "The condition where risks are managed to acceptable levels."

The new mission

Having defined safety in risk terms, TCCA refined its mission statement, which aligns with the larger departmental mission: "To develop and administer policies and regulations for the safest civil aviation system for Canada and Canadians, using a systems approach to managing risks."

That safety is the condition where risks are managed to acceptable levels is not new. It has been implied in the aviation industry for many years. However, its wider, explicit use is a relatively recent phenomenon. Defining safety in context and expressing the mission in risk terms helps clarify the regulator's role and limitations. This new mission statement provides clarity of purpose: not only does it spell out TCCA's goal, but it also states how and for whom the organization is delivering its program.

The business model

All parties involved in delivering on the mission must be able to see the whole, understand how things should work, and, more importantly, how they contribute to value-creation. The business model was developed to articulate and illustrate how this works.

Some may argue that, as a government entity, TCCA does not need a business model; it is not a business, as it is not involved in value-creation. But Canadians value safety. The Canadian public and consumers of aviation services look to TCCA to act as their safety advocate, ready to intervene in the sector as necessary to ensure appropriate

[1] William W. Lowrance, 1976, *Of Acceptable Risk*, William Kaufmann, Inc., Los Altos, California, p.8, 1976

[2] Ibid.

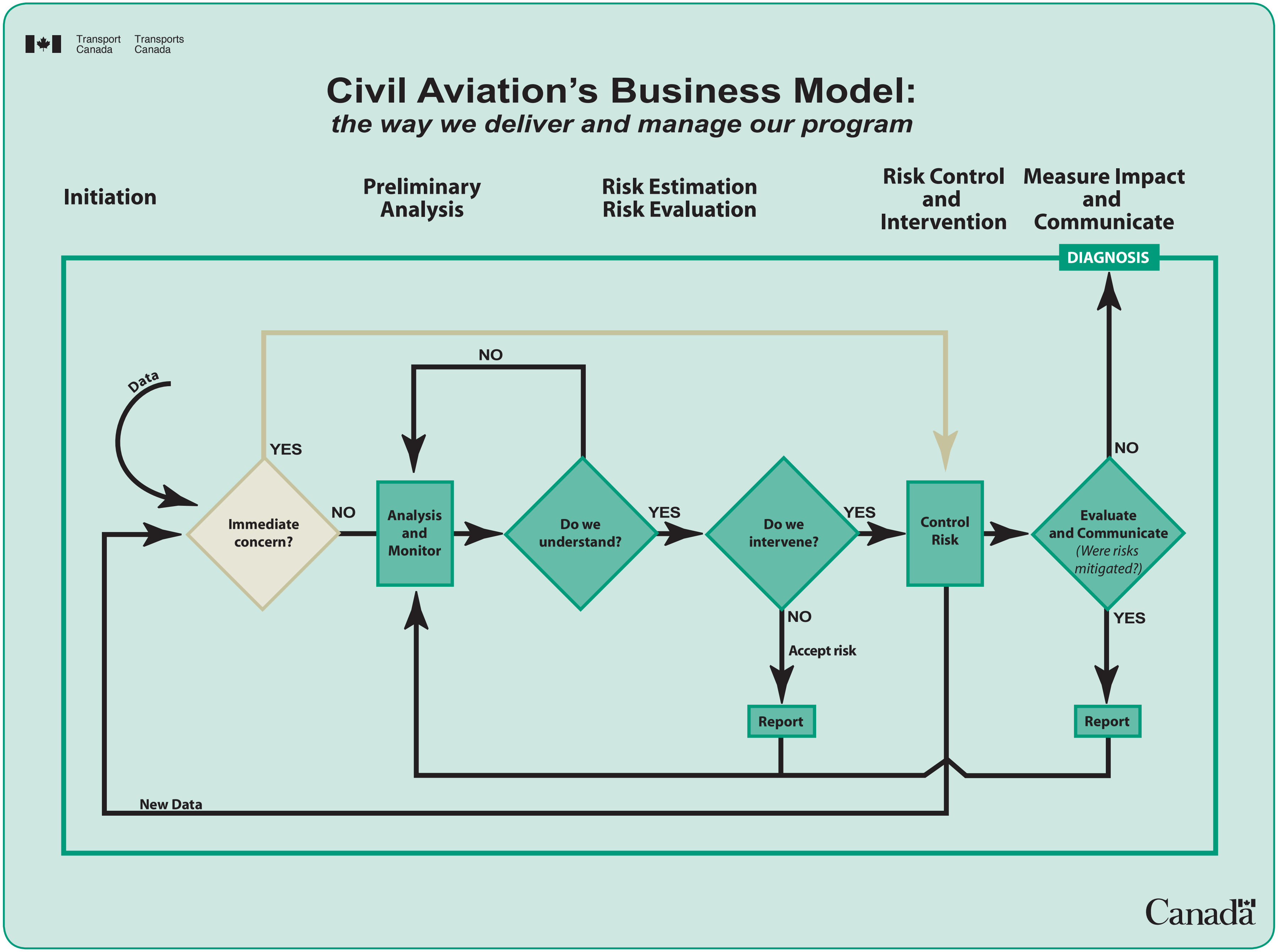

Figure 1: TCCA Business Model

measures are taken to manage aviation risks. This is value-creation and TCCA's new mission statement is its value proposition.
A business model incorporates all critical activities needed to deliver the value proposition. To deliver on its new mission and focus its interventions where they can have the most impact within increasingly limited resources, TCCA has adopted a business model that governs all activities and processes in the delivery and management of its oversight program.

As shown in Figure 1, TCCA's business model incorporates five phases:

- Initiation
- Preliminary Analysis
- Risk Estimation and Risk Evaluation
- Risk Control and Intervention
- Measure Impact and Communicate

Initiation and preliminary analysis

Except for those circumstances requiring the immediate tactical intervention on the part of the regulator (to stop a situation that poses an immediate threat to aviation safety, or respond to an accident or significant incident), the application of the business model requires, first and foremost, the acquisition of safety intelligence before making any decisions.

Safety intelligence is defined as data that are analyzed to produce information necessary to understand the risk. As shown in Figure 2, safety intelligence incorporates data at the bottom, from which information, knowledge and wisdom are derived in hierarchical fashion. Through a process of analysis, data is transformed into information; the synthesis of information leads to knowledge; and over time, this body of knowledge becomes the accepted wisdom.

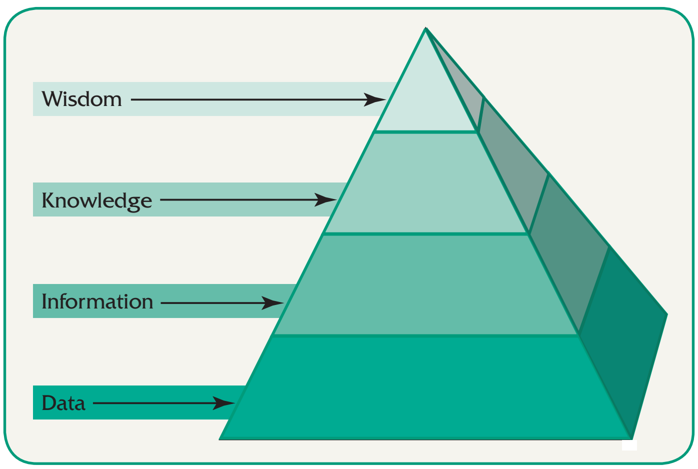

Figure 2: Safety intelligence pyramid[1]

Both reactive (e.g. occurrence) and proactive (e.g. hazard reports) data are collected. These are analyzed to derive meaningful information from which risk decisions can be made.

Ideally, this analysis should address all dimensions that could lead to an individual, organizational (James Reason) or system (Charles Perrow) accident. As shown in Figure 3, these accident dimensions can be broadly categorized as active failures and latent conditions (James Reason). As regulators must take the broadest view, latent conditions transcend the boundaries of a particular aviation company (individual, workplace conditions and organizational factors), and encompass the legislative, socio-economic and political dimensions. As professional, organizational, industry and national cultures may influence the decisions, behaviours and actions of the players involved, culture must also be considered in the analysis. The SMS approach is being implemented to encourage the proactive management of conditions that could lead to accidents. These dimensions can be applied to normal working situations, hazards, incidents or accidents. By analyzing data from each dimension, the output is safety intelligence regarding the actual or emerging hazard expressed in risk terms (probability, severity, and exposure).

Risk estimation and risk evaluation

Once the hazard, the likelihood of its manifestation, and its severity are understood, the question is: "Are the risks tolerable/acceptable or not?" If the answer is yes, the risks are acceptable, then no intervention is required. But, in order for the organization to enhance its monitoring capability and contribute to continuous learning, a report is produced and stored in a safety intelligence repository for future use. If the answer is no, the risks are not acceptable, then a second question must be answered: "How do we intervene to bring the hazardous conditions into the range of acceptability?" The dimension of cost-benefit is examined in the context of risk mitigation. A question that must be answered in the process is: "Will the benefits of any proposed risk mitigation strategy offset the costs of its implementation?"

Risk control and intervention

Generally, there are three strategies for managing risk: eliminate the hazardous condition, mitigate the risks, or transfer the risk. In terms of mitigation, regulators can design and execute intervention strategies that address one or more components of the risk equation (probability, severity or exposure).

Typically, aviation authorities can avail themselves of legislative or policy means to intervene, which can be used to varying degrees to mitigate the risks. Table 1 summarizes some of the more frequently-used tactics under each of these categories, which can be used in whole or in part.

[1] Tom Gorman, The Complete Idiot's Guide to MBA Basics, Alpha Books, New York, NY, p. 281, 1998

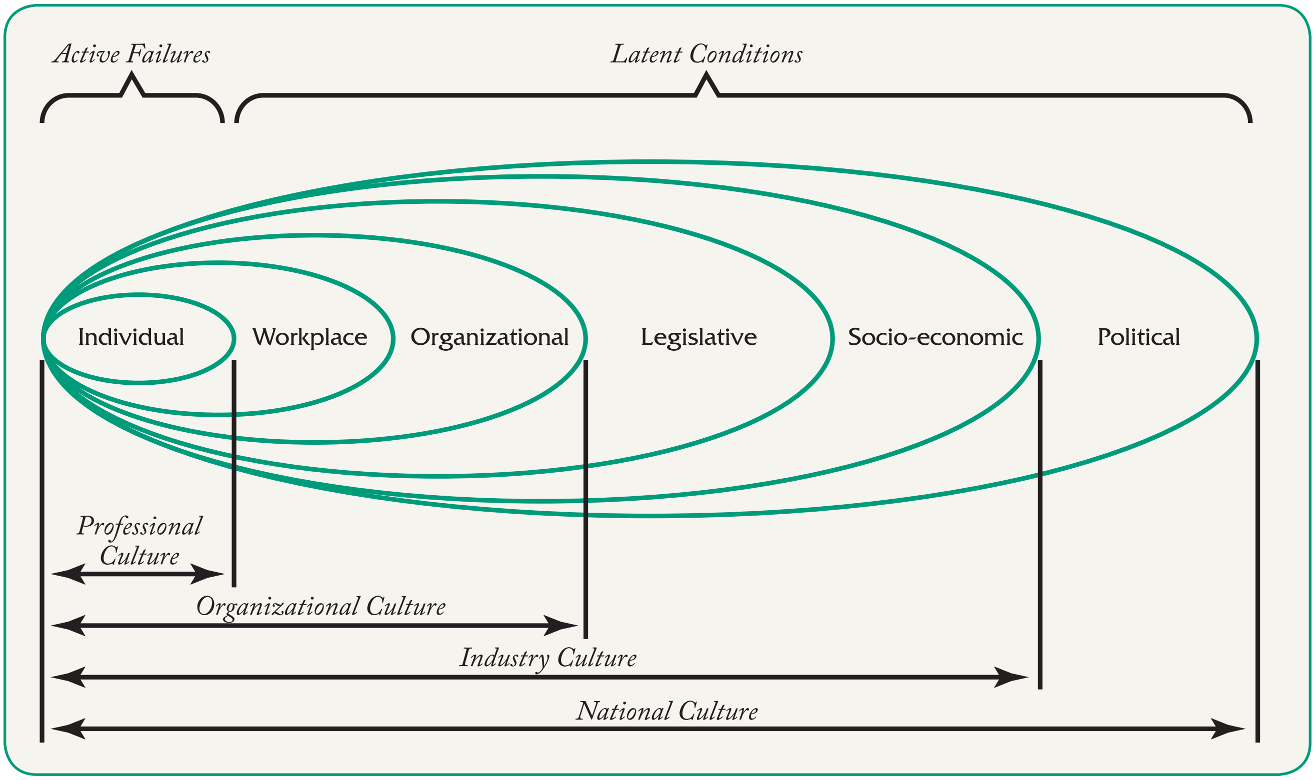

Figure 3: Accident dimensions

Care should be exercised in designing an intervention strategy to mitigate the risk. It should hold promise of mitigating the risks to within acceptable levels (i.e. desired outputs, intermediate and ultimate outcomes that are observable and measurable), and be commensurate to the level of risk in terms of cost-benefit.

The execution of the risk mitigation strategy should be managed as a project with a team and a project plan that includes: project accountability, timelines, resources, and performance measures.

Aviation companies have a myriad of strategies at their disposal to mitigate risk as well. These include engineered systems; organizational, procedural, and behavioural fixes, such as training and education; and/or personal protection from hazards. Safety literature would, however, encourage aviation companies to not rely solely on one strategy, but rather a combination of strategies that achieve defences in depth (James Reason).

Measure impact and communicate

After a time, the results of the risk mitigation strategy should be ascertained. This is done to determine whether the planned interventions are achieving the desired results, whether any adjustments to the original plan need to be made, and to justify current or future resource expenditures.

If the risks are managed to acceptable levels, a report is prepared and stored in the safety intelligence repository. The team may be disbanded, but the issue at hand must be monitored continuously. The lessons learned in the execution of the risk mitigation strategy can provide further intelligence and help identify triggers that would enhance monitoring capability.

If the risk mitigation strategy failed in achieving desired results, one must ask, "why?" This invokes a diagnostic exercise to discover where in the application of the business model the failure occurred. The answer may be in the design or execution of the mitigation strategy phase, the decision-making phase (the misapplication or inappropriateness of risk criteria), or the analysis or data-capturing phases.

Regardless of the outcome, an assessment of what worked, how well it worked, and what did not work should be carried out—if for anything else, to learn from each experience and improve the processes of the business model.

Case study—runway incursions

In 1997, Transport Canada and NAV CANADA (Canada's private air navigation service provider) noticed a significant increase in the number of runway incursions. Runway incursion data was collected, validated and analyzed. The result of this analysis was a better understanding of the active failures and latent conditions behind runway incursions.

The level of risk posed by runway incursions was deemed unacceptable. To mitigate the risk, a number of both short- and long-term risk mitigation tactics were

LEGISLATIVE	POLICY
Rule-making The making, amending, or repealing of: • Laws • Regulations • Standards The issuance/withdrawal of: • Orders • Exemptions • Decrees • Other item	*Promotion and Education* • Conferences, symposia, colloquiums • Newsletters, journals, papers • Briefings • Multi-media safety products
Regulatory Oversight • Educating for compliance • Monitoring • Inspection • Audits • Enforcement	*Strategic Investments/Divestiture* • Privatize • Commercialize • Nationalize • Subsidize
Authorizations (certification) The issuance, or withholding the issuance, of: • Certificates • Licences • Permits, or • Other authorizing documents	*Strategic Leverage* • Public/Private Partnerships • Industry empowerment

Table 1: Regular risk mitigation strategies

initiated, including making regulatory and procedural changes, increasing oversight activities, and embarking on an awareness campaign, to name but a few. A team known as the Incursion Prevention Action Team (IPAT), made up of a cross-section of aviation specialists, was created to manage the risk mitigation project.

After several years, the risk mitigation strategy has proven successful: the number of runway incursions has stabilized, and more importantly, the severity of runway incursions has decreased.

Challenges and benefits

The operational definition of safety and the business model it invokes do, however, raise several broad questions: "What are the risks in aviation?", "Who is at risk?", and if the risks are to be managed to acceptable levels, "What level of risk is acceptable to those at risk?" This is easier said than done; however, Transport Canada is prepared to meet this challenge. Out of necessity, it will perform the required calculations to arrive at a benchmark level of risk (or risk profile) from which it can establish goals, design and execute appropriate mitigation strategies, and measure and report on results.

The rigorous application of the business model will enable TCCA to target its interventions where they can have the most impact for the safety of consumers of aviation services and the Canadian public. It will enable better, more empirical, performance measurement, where Canadians will connect TCCA's actions with visible outcomes. In this way, it will be able to achieve its two key results of improving aviation safety and enhancing confidence in its oversight program. △

Learning how to fly takes approximately 45 hours

...Learning when to fly can take a lifetime.

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The International Context for Aircraft Certification

by Martin Eley, Director, Aircraft Certification, Civil Aviation, Transport Canada

The Aircraft Certification Branch is responsible for the development and implementation of the regulations, standards and guidance for the type certification of aeronautical products, including any mandatory corrective action required during the service life of the products. But what does this mean, and what are the international responsibilities that we have?

The regulatory framework for Aircraft Certification includes the procedures for obtaining the type certification for an aeronautical product (or a change to an aeronautical product), the applicable design standards for the products and the responsibilities for type certificate holders. For the most part, they align very closely with the regulatory framework of the U.S. and Europe. The international responsibilities that we have flow directly from the International Civil Aviation Organization (ICAO) Annexes.

The first of the two main groups of products that we certify are those that originate in Canada. They include the aircraft manufactured by Bombardier, Bell Helicopter, Eurocopter, Diamond Aircraft, Found Aircraft, Zenair, Conair, Convair, Symphony, Fantasy and Sundance, and the engines manufactured by Pratt & Whitney Canada and Orenda. In addition to the basic aircraft and engines, we certify the design changes and repairs made by the operators, maintainers and modifiers, as well as certain equipment installed on aircraft. Many of these certified products, design changes, or repairs are destined for use in other countries, and it is our responsibility to certify them in a manner that will make them readily acceptable to our foreign counterparts. Once the certification work is accepted, we have an ongoing international responsibility to the countries that have accepted our certification work to take corrective action in response to significant in-service difficulties.

The second group of products that we certify are those that originate in foreign countries and are to be operated in Canada. In this case, we rely heavily on our foreign counterparts in the same way that they rely on us for the certification of Canadian products.

Internationally-harmonized standards

Over the years, the international exchange of aeronautical products has driven the need for those products to be certified to common standards. Long before the *Airworthiness Manual* was established, Canada accepted products certified to both the U.K. *British Civil Airworthiness Requirements* (BCARs) and the *U.S. Federal Aviation Regulations* (FARs), to the extent that some aircraft types had two acceptable configurations; one for each set of regulations. The *Airworthiness Manual* introduced the Canadian standards based on the U.S. FARs. The evolution of the Joint Aviation Authorities (JAA) in Europe led to greater efforts to harmonize the European and North American design standards. Transport Canada has played, and continues to play, an active role in the harmonization of many of the design standards. The current differences in the design standards between the U.S., Europe, and Canada are minimal, which, in the majority of instances, allows products to be certified in a common configuration that satisfies the U.S. Federal Aviation Administration (FAA), the European Aviation Safety Agency (EASA), and Transport Canada.

Internationally-aligned type certification procedures

As the degree of harmonization of the design standards increased, so did pressure from the international industry to achieve greater commonality of the certification procedures. Transport Canada has also been actively engaged in the development of internationally-harmonized certification procedures, and although there remain some differences, the degree of commonality is today at a very high level.

International agreements

The effort put into the harmonization activities over the years has formed a good basis for our international agreements. The existing Bilateral Air Safety Agreement (BASA) with the U.S. relies heavily on the mutual acceptance by both countries of the standards and procedures related to type certification. Our past relationship with the JAA in Europe and our evolving relationship with EASA have both been built on a similar basis.

Maintaining and implementing a harmonized regulatory framework

The harmonization of the standards and procedures along with the international agreements are important, and they all need to be maintained to respond to the changes in industry and the aviation environment. The experience of implementing the framework generates a need for dialogue between the authorities to support the smooth flow of products while respecting our safety mandate.

Transport Canada continues to be active in a number of forums to support these international responsibilities.

Harmonization of the standards and procedures

The U.S. and Europe sponsor numerous rule-making activities for which they are committed to consultation and harmonized solutions. Transport Canada certification specialists are involved in many of these activities with the focus being on those areas with the most relevance to Canadian certification projects.

Participation in the Joint FAA/EASA Certification Management Team

The FAA and EASA directors of Aircraft Certification meet twice a year to oversee their mutual acceptance of aeronautical products. Transport Canada is permitted to participate in these meetings, as there are often agenda items of common interest.

Annual meetings with the FAA Aircraft Certification Management Team

Transport Canada, Aircraft Certification managers meet annually with their FAA counterparts to provide update briefings and to discuss current issues. The discussions often lead to enhanced BASA implementation procedures.

Annual meetings with the key FAA certification offices

The flow of Canadian products to the U.S. is primarily through the New York Aircraft Certification Office (ACO), with rotorcraft being handled by the Rotorcraft Directorate in Fort Worth, Texas, and engines and propellers being handled by the Engine and Propeller Directorate in Burlington, Massachusetts. Annual meetings are held with the New York ACO and Rotorcraft Directorate offices to deal with the day-to-day procedures and any issues that may arise.

Annual meetings with the EASA certification office

As we develop a formal relationship with the relatively new EASA organization, we intend to establish annual meetings similar to those in place with the FAA to ensure that our working relationship is effective and relevant.

Contact with other foreign authorities

The export and import of aeronautical products requires that we deal with many authorities worldwide. Although we do not necessarily have the structured agreements with these authorities that are in place with Europe and the U.S., we often conduct business in a similar manner. Where the level of exchange of products is significant, we would, in the long term, expect to develop agreements with those authorities.

Conclusion

Our primary international responsibility is for the basic certification and on-going continued airworthiness support of aeronautical products originating from Canada. Our primary national responsibility is for the safety of the products operating in Canada. Each of these responsibilities requires that we establish and maintain strong relationships with our international counterparts. △

Elevator Trim Rigging Anomalies on Cessna 208

Two Transport Canada Aircraft Maintenance and Manufacturing inspectors carrying out ramp inspections at airfields in the Prairie and Northern Region (PNR) this past fall, came across several Cessna 208 (Caravan) aircraft that had anomalies in the elevator trim rigging.

The aircraft had not all been maintained by the same organization, which led them to believe that the issue they found may be more widespread than just the aircraft they inspected.

The area of concern was the connection of the elevator trim control pushrods to the elevator trim tab horns. It was noticed that in some instances, washers had been added to the bolt/bushing stack-up (highlighted in beige in Figure 1), which removed the required endplay on the assembly.

The lack of endplay bound the pushrods to the trim tab horns, stopping them from pivoting freely, *which could lead to eventual failure of the horns or pushrods.*

Discussion with approved maintenance organization (AMO) personnel on site revealed that adding washers was an attempt to remove the "slop" (side play) in the assembly. *However, some side play is required in this design to prevent binding.*

When properly installed, as per the manufacturer's instructions, each pushrod will have approximately 1/8 in. side play on the trim tab horn.

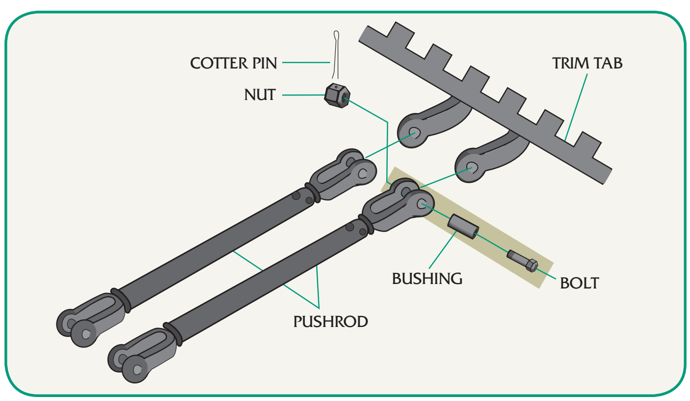

Figure 1: Artist's impression of original technical diagram

In this instance, as elsewhere, the pertinent manufacturer's instructions should always be consulted for the identification of required parts, and their proper assembly. △

A New Accountability Framework for Aeronautical Product Certification

by Gilles Morin, Chief, Regulatory Standards, Aircraft Certification, Civil Aviation, Transport Canada

Over the years, the Aircraft Certification Branch has built a strong partnership with the Canadian aviation industry to effectively make use of Ministerial Delegation of Authority as specified in the *Aeronautics Act*. The development of our delegation framework originated in 1968 with "Notice to Aircraft Maintenance Engineers and Aircraft Owners N-AME-AO 45/68," which introduced the design approval representative (DAR) system. Based on recommendations of the Dubin Commission in the 1980s, the *Aeronautics Act* was amended in 1985 to provide for authorization, by the Minister, of persons engaged in the field of airworthiness. Airworthiness standards were then developed in *Airworthiness Manual* Chapter 505, and the DAR system was expanded to include two new categories of corporate delegate: the airworthiness engineering organization (AEO), and the design approval organization (DAO).

In light of the strategic direction of Transport Canada Civil Aviation (TCCA), as specified in *Flight 2005* and *Flight 2010*, the need to improve the current delegation system within the Aircraft Certification Branch was identified. The current framework confuses the obligations and weakens the accountabilities of the applicants and holders of design approvals by focusing only on the role of the Minister and delegate in the certification process, which leads to the Minister often assuming certain obligations that should be assumed by the applicant or holder.

The Aircraft Certification Branch has taken steps to improve this situation by proposing the new *Civil Aviation Regulation* (CAR), Part V, Subpart 21 (CAR 521), which more clearly delineates the roles and obligations of the applicant and holder. However, CAR 521 is not placing enough emphasis on the obligations of the applicant and the holder. In the course of CAR 521 discussions, industry supported the concept of recognizing a design organization's capability without necessarily granting an organizational delegation. These discussions led to the development of the new accountability framework.

In the new framework, accountability would be clearly placed on the *applicant* of the design approval having an obligation to *develop a safe and compliant design*, and the *holder* having the obligation to *maintain a safe and compliant design*. As a condition of eligibility to apply for, or to hold, a design approval, the applicant and holders would be required to have demonstrated knowledge of the certification process and technical capability, including adequate design assurance system, to design products that comply with the applicable airworthiness and environmental standards. Applicants and holders would demonstrate their knowledge and technical capability by being certified, under the current proposal, as either an approved design organization (ADO) or an approved design individual (ADI).

The Aircraft Certification Branch is moving towards an approach whereby the applicant or holder has to demonstrate the capability of controlling the design and showing compliance with a high degree of assurance. The demonstrated capability would then be backed up by a design validation process, whereby individuals not having been directly involved in the design activities would conduct independent verification of compliance, followed by a declaration of compliance made by the applicant. It is important to note that Transport Canada would continue to maintain an appropriate oversight role through appropriate levels of certification and surveillance activities.

The Minister would continue to delegate specific functions, limited to the issuance of certain types of certificates and approvals after having confirmed compliance with specific elements of the certification process. With a well-structured design assurance process addressing the demonstration, validation, and declaration of compliance, the need for making individual findings of compliance against each applicable airworthiness and environmental standards becomes redundant and, therefore, delegated functions would no longer include making findings of compliance.

Given that certificate holders have an obligation to maintain a safe and compliant design, the recognition of technical capabilities would take considerations beyond the design and certification process by including the need to have appropriate systems in place to support continued operational safety and continued airworthiness throughout the life cycle of the aeronautical product.

In summary, these changes will greatly clarify the roles, obligations, and accountabilities of the various parties involved in the aeronautical product certification process, while providing a better framework that will facilitate the implementation of a proactive approach to aviation safety, including safety management systems (SMS).

The Aircraft Certification Branch will soon commence the development of the required regulatory amendments to introduce the new accountability framework to the Canadian Aviation Regulations Advisory Council (CARAC) Part V (Aircraft Certification) technical committee in 2007, with full implementation scheduled for 2010. △

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Back To Basics: Taking Takeoffs and Landings to the Max

by Cordell Akin
Taken from www.swaviator.com/html/issueON99/backbasics.html

This article is an authorized reprint from the October/November 1999 issue of Southwest Aviator Magazine. *This and many other excellent safety articles can be found on their Web site at* www.swaviator.com.

Just thinking about it is pure enjoyment. You fly into a remote airstrip in the mountains of the Southwest in your own airplane and pitch a tent beside a stream. The trout are hungry. You laze away a few days under a turquoise sky with a warm summer breeze singing through endless stands of pine trees. Or perhaps you'd prefer to pitch that tent in a meadow surrounded by golden aspen trees and set out to track the huge bull elk. Either option appeals to me, but the most interesting part is exercising the skill required to fly into and out of a challenging remote airstrip.

The very geographical nature of the Southwest invites pilots to visit short, high, sloping, dirt or grass airstrips or airports with obstacles in the approach and departure path. Anyone flying their birds to such perches should become well practiced in the area of maximum performance manoeuvres. You remember what they are from training days: short field and soft field takeoffs and landings. If you stay sharp on these manoeuvres, your passengers may not talk about you like they did the pilot in the following story.

After a successful hunting trip, a pilot who was flying passengers for the second year in a row loaded three 200-lbs hunters and the entire elk in a four place airplane and departed from a short airstrip. They all survived the crash right after takeoff, and one hunter said to another, "You know, Zeke, we sure have a skilled pilot. This is only 100 yd from where we crashed last year."

The short field departure with obstacles

Most short, unpaved airstrips will not have a taxiway, so you must back taxi the take-off runway and turn around, wasting as little runway as possible. Be careful when making the turn that your aircraft's tail does not strike something at the end of the runway (e.g. a stump). We're talking real bush here.

Straighten the nose wheel, hold the brakes and apply full power. If the strip is at high altitude, lean the mixture at full power to get maximum performance from the engine. Before releasing the brakes, check all the engine instruments for normal readings and normal power. Be ready to abort the takeoff if anything appears, sounds, or feels abnormal.

Hold the aircraft on the ground until Vx (best angle of climb) speed is reached. Rotate and maintain Vx until the obstacle is cleared, then increase speed to Vy (best rate of climb). As the aircraft leaves ground effect, and induced drag (drag resulting from the production of lift) increases, the initial pitch angle of the nose will need to be lowered slightly to maintain Vx. You must not give in to the urge to lift the nose prematurely when you see trees coming closer at an alarming rate. If the situation is tight, the speed you need is Vx, because it will give you the best climb over obstacles.

So, if you practice short field takeoffs, you can depart from an airstrip whenever you want, right? Wrong. Sometimes the density altitude will not allow the clearance of obstacles no matter how good your technique. It will help to plan your takeoff in the early morning when the temperature and density altitude is lower. If possible, always take off downhill and avoid tailwinds. Ground roll will be increased about 10 percent for each two knots of tailwind.

It is a good idea to increase all pilot operating handbook (POH) figures for 50-ft obstacle clearance by 25 percent in order to take into account engine hours, extra parasite drag from the addition of antennas or the removal of wheel farings, and your own skill level. Keep in mind that published obstacle clearance distances do not take into consideration the real world realities of turbulence and downdrafts. These could place you in the position of looking squarely into the face of a knothole halfway up a tree on takeoff. If the situation is truly marginal, do a pattern with just yourself on board. Then, add passengers one at a time in successive patterns to see how the aircraft performs under the actual conditions.

Aerial view of Hawkesbury East Airfield, a typical short, grass airfield. Photo courtesy of COPA.

Short field arrivals

Clearing the trees on takeoff will be a moot question if you run off the end of the runway on arrival. Of course, it could extend your vacation while you try figuring out a way to get back home.

There is a reason why the practical test standards for private pilot stipulate that the aircraft must touch down within 200 ft of a selected point. On a short field arrival, you want to touch down as close to the beginning of the runway as possible. The key to doing this involves both pitch and power. Once established on final approach with full flaps, pitch the aircraft to achieve the short field airspeed given in the POH. Next, reduce power until the aircraft begins to sink, then increase power just to hold a straight glide path to the beginning of the runway (assuming no obstacles).

With this approach, when power is reduced, the aircraft will sink. When power is added, the sink will stop. This makes possible an accurate straight-line descent to the aiming point in the windscreen. The most common mistake pilots make is to leave in too much power and get high on the approach. Then, even though power is reduced to idle and the proper airspeed maintained, the landing point is exceeded by a good distance.

At the short field approach airspeed and just enough power to hold the glide path, reduce power to idle just before the intended touchdown point and there will be no speed left to cause float down the runway. Allow the main wheels to contact the surface in a modified flare so that maximum braking can begin as soon as possible.

A good short field landing will not be a greaser, but a firm touchdown—the opposite of a soft field landing. It is not necessary to retract the flaps immediately after landing, since the drag they produce is more beneficial than retracting them to put the weight on the wheels. On a rough, short strip, the wheels are going to be bouncing without a lot of braking action initially. The drag of flaps will help slow the aircraft.

Soft field departures

It has been said that if it takes full power to taxi, you have either forgotten to remove the chocks or the tail is still tied down. I would like to add one more situation to that. One time I landed on a dirt airstrip after a heavy rain in a pressurized 210. Slowing to taxi speed occurred very quickly and then it took full power to taxi in the red mud—with about 2 in. of it on all the wheels.

A soft field takeoff starts with the taxi. The control wheel should be full back to allow the propeller slipstream to increase down pressure on the elevator and lighten the nose wheel. During taxi and takeoff in soft conditions, the nose wheel must be protected. If the nose wheel happens to be on the rear of the plane, the soft field task is easier.

Refer to the POH for your aircraft regarding flap setting for a soft field takeoff. It will be 10 degrees on some light aircraft. This flap setting allows enough lift in relation to drag to get the aircraft in the air in ground effect as quickly as possible, allowing the weight to be shifted from the wheels to the wings. When full power is applied with the control wheel full back, the nose will initially rise higher than needed. At that point, reduce the back pressure just enough to keep the nose wheel off the muddy surface. With the wings in this high angle of attack position, the aircraft will lift off into ground effect at an airspeed too slow to sustain flight above ground effect. Therefore, once lift-off occurs, a slow but positive forward pressure must be applied to the control wheel in order for the aircraft to level out in ground effect and accelerate to Vx before trying to climb. The flaps can be retracted once the aircraft is climbing.

Ground effect occurs within one wingspan of the runway, increasing closer to the runway. It is the result of the runway surface interfering with the wingtip vortices and the average relative wind around the aircraft that produces induced drag. The reduction of drag in ground effect is quite pronounced, being about 25 percent at one-forth of the wingspan above the runway.

Soft field arrivals

If the airstrip is soft, touchdown must be made softly on the main wheels and the control wheel held full back to protect the nose wheel. I once landed on a soft grass strip and held the nose off as long as possible as the aircraft rapidly slowed. When the nose wheel finally touched down at a slow speed, it sank into the soft dirt halfway up the tire. There was no damage, but the aircraft had to be pushed by hand to firmer ground.

Assuming there are no obstacles in the approach path, a soft field landing is normally made with half flaps and a normal approach speed. Half flaps work better than full flaps in most cases due to the fact that the pitch change in the flare is less pronounced because the approach angle is not as steep. The most consistently soft landings can be made if the power is reduced to slightly more than idle on short final and left there until the wheels touch. The throttle may then be reduced to idle. In an actual soft field situation, the power may be increased after touchdown to keep the nose wheel elevated until firmer ground is reached.

It is important to keep raising the nose in the flare to hold the wheels off the runway as long as possible with the stall warning horn activated. Once the main wheels touch, maintain full back pressure to keep the nose wheel off the surface until it falls by itself, then continue the back pressure until the taxi is completed.

Whether or not you ever fly into a remote airstrip in the Southwest with that fishing rod or hunting rifle, staying proficient in maximum performance takeoffs and landings will make you a better pilot. Besides, the airplane tires, landing gear and airframe will benefit from constant softer field landings, even those you make with full flaps. And, by the way, your self esteem will also benefit when your passengers tell you what a great pilot you are. △

Cordell Akin is a certified flight instructor—instrument (CFII), multi-engine instructor (MEI) with a total of 10 000 hr and 3 000 hr as a flight instructor. He spent 15 years in East Africa flying a C-185 and a P-210. He is the owner of Akin Air at Coronado Airport in Albuquerque, New Mexico.

Flight Training—Could You or Your Students Run Out of Fuel?

by Brian Bayne, Civil Aviation Safety Inspector, Flight Training, General Aviation, Atlantic Region, Transport Canada

How could it happen? It couldn't possibly happen to one of my students. No way it could ever happen to me…or could it?

Why do pilots of various experience levels, including instructors, run out of fuel?

We've learned some things from following up on fuel starvation occurrences that are worth sharing. There is a common thread—well, more like a rope—it's a lack of understanding.

This makes sense when you think about it. Obviously, if someone planned a trip properly and determined they were going to run out of fuel, they'd make a change, right? Perhaps take more fuel or make an intermediate stop, something, anything. The more likely explanation is that errors are made. Errors in planning, errors in judgment, pilots unknowingly make changes en route that result in higher fuel consumption rates than planned, or sometimes they don't plan at all. Also, it's difficult to pin down exactly how much fuel will be consumed on a training flight. There's no accurate information to rely on, making it guesswork at best.

It is interesting to note that pilots often don't see it coming, right to the end. One pilot told us he thought he had carb ice or some other engine problem when it happened to him. He didn't even suspect fuel starvation as the cause of his engine failure.

Another interesting point is that in some cases, pilots didn't take much or any extra fuel. Why not? Maybe it's because some call it "granny" fuel. One pilot told us he was late leaving on his cross-country and wanted to save some time, so he didn't add fuel. In his case, he already had pretty much the exact amount of fuel he calculated he would need on board. His calculations were off, and yes he crashed. Fuel planning is far from an exact science. As pilots advance and fly things around like people or freight, the luxury of taking extra fuel is pretty much history. It's hard to tell your boss you're leaving a few passengers or some freight behind so you can take some fuel you probably won't need. Why not enjoy that luxury now? Sometimes things are just plain missed. We know trainees can make mistakes, that's the business we're in. Why not teach them to have some extra "go" juice in their back pocket if they can take it?

The truth is, it could happen to your trainee. It could happen to you. It could happen to anybody, and it has. This may be another part of the problem. It just seems like such an unlikely thing that some pilots may not take it seriously enough. Vigilance is a factor. Never assume anything. Remember, in aviation, assumption is the mother of emergency.

Let's take a closer look at some of the seemingly minor common errors that stack up to steal fuel from us.

How much fuel do we need to make the trip?
Did we include fuel to start, taxi, run-up, take off and climb? Some pilot operating handbooks (POH) give us some of this information, some don't. It should be considered.

Are we going to get the consumption rate the POH says we will?
I think pretty much everybody will agree that we won't. Remember, the POH values are for a new airplane, at a specific altitude, at a constant power setting, with a certain mixture leaning procedure and a specific fuel grade. The rate is low even for those parameters because low fuel consumption is a selling point for manufacturers. They're going to print the lowest values they got in testing. If you're conducting a training flight, you really don't know what your consumption rate will be. It could be considerably higher than the POH values. Values up to 170 percent of the POH cross-country consumption rates are possible, depending on what you're doing with the airplane. That means if you calculate 5.0 gallons per hour (gph), you might actually be up around 8.5 gph on a training flight.

How much fuel was on board when we left?
Who checked the fuel quantity—you or your trainee? Was it an accurate measurement? Do you occasionally confirm what they tell you? Was the aircraft on level ground? Are the dipsticks properly calibrated against a meter and for that specific aircraft? Was the quantity rounded up to half-tanks or three-quarter-tanks? It's better to work with the number of gallons instead.

Is our cross-country en-route time accurate?
Maybe not. Forecasting of upper winds has become fairly accurate but you may get there sooner or later than planned. The key is to get there. Fuel must be closely monitored en route; not on gauges alone, but based on how many gallons you had on departure, your consumption rate, and your actual time en route. You know, some of the other not-so-accurate stuff we've already talked about!

Have you discussed fuel consumption performance penalties with your trainee?
Does your trainee understand the increase in fuel consumption rates encountered with changes in altitude, mixture-rich instead of lean, making a diversion to look at something, doing some practice precautionary procedures or forced approaches?

Let's review.
The amount of fuel we think we need when we plan the flight may not be accurate. The amount of fuel we have on board for the flight may not have been measured accurately. The amount of fuel we're consuming en route is difficult to calculate accurately. The amount of fuel remaining is tough to figure out, too. We all know fuel gauges are not incredibly accurate. If all of these things conspire against us, we may be in trouble.

What if a trainee decides on a lower altitude or leaning the mixture has always been kind of scary, so they don't? What if they want to take a look at something, or fly over a friend's place? How about throwing in a practice precautionary, forced approach or diversion, wouldn't that make my instructor happy? What if they get lost for a little while? Do they really understand the fuel consumption penalties they would suffer? It's difficult to know even for experienced pilots.

What's the answer?
The answer is knowledge. The answer is vigilance. And, oh yeah, since things are not accurate, take more fuel than you think you need. Remember, you can take more fuel than you need, what a luxury! What an example to set for your students. Ever notice that experienced pilots seem to do things that give them a large margin of safety whenever they can? There's no shame in it, nobody can plan for every possible scenario, but you can set yourself up so you have options and see things coming. Teach that attitude to your students, and remember—grannies live for a long time. △

Timely Selection of Pneumatic De-icing Equipment and Inadvertent Selection of Inappropriate Automatic Flight Control System (AFCS) Climb Mode

This article is in response to two recent Aviation Safety Advisories from the Transportation Safety Board of Canada (TSB).

On May 27, 2005, a de Havilland DHC-8-100 (Dash 8) was on a flight from St. John's, N.L., to Deer Lake, N.L., with 36 passengers and 3 crew on board. During the climb out from St. John's, the indicated airspeed began a gradual and undetected decrease to the point that the aircraft departed controlled flight. The aircraft descended rapidly, out of control, losing 4 400 ft before recovery was effected, approximately 41 seconds later. The aircraft was operating in icing conditions [1] when the loss of control occurred; however, the extent to which airframe icing contributed to this occurrence has not yet been established. The TSB investigation into the causes and contributing factors of this occurrence is on-going (*TSB file A05A0059*).

[1] According to the aircraft flight manual (AFM) and company standard operating procedures (SOP), icing conditions exist when the aircraft is flying in visible moisture below 5°C.

Dash 8 operating instructions state that, when operating in icing conditions, engine intake by-pass doors must be open, engine ignition switches must be set at manual, and airframe de-ice must be set to slow or fast. The crew was aware of the possibility of ice, was watching for its formation, and had selected the engine by-pass doors to open. The anti-ice system was on, with the ignition switches set to manual. The airframe de-ice system remained off.

For many years, the accepted practice in the aviation community was to wait until a significant amount of ice built up prior to activating airframe de-icing equipment to prevent "ice bridging." The Dash 8 aircraft flight manual (AFM) reflects current norms of selecting all anti-ice systems "on" immediately when entering icing conditions. In the course of the investigation, it became apparent that a number of pilots may still cling to the traditional practice of waiting, despite contrary instructions in the AFM. When contacted, FlightSafety Canada estimated that 50 percent of pilots, both Canadian and international, who attend their training sessions, still wait for ice to build up despite directions that may exist in AFMs to select de-icing equipment "on" immediately upon entering icing conditions.

Small amounts of ice may have unpredictable adverse effects, particularly if the aircraft is already operating near the stall speed. Since the occurrence, the operator has taken steps to ensure that pilots conform to published procedures for activation of pneumatic boots. Pilots are required by regulations to complete annual ice contamination training, and the occurrence crew had completed airborne icing training in March of 2005. However, it is apparent that old beliefs on the use of pneumatic boots are still prevalent. The TSB suggested that Transport Canada (TC) take additional action to ensure that pilots are informed and conform to published de-icing procedures, and dispel old beliefs about the use of pneumatic de-icing equipment.

TC agreed with the suggestion, and we therefore invite all pilots to read Commercial and Business Aviation Advisory Circular (CBAAC) 0147, issued on November 2, 1998, which can be found at www.tc.gc.ca/civilaviation/commerce/circulars/AC0147.htm. This circular addresses airborne icing and the operational use of pneumatic de-icing boots. It also addresses the issue of "ice bridging" and recommends the procedure proposed in the TSB advisory unless specifically prohibited by the AFM.

For the benefit of our readers, here is the excerpt on "ice bridging" as found in CBAAC 0147:

"ICE BRIDGING
Several generations of pilots operating aeroplanes with pneumatic de-icing boots have been cautioned against the dangers of ice bridging. Pilots were—and are—advised against activation of the pneumatic de-icing boots before sufficient ice has built up on the leading edge—generally between 1/4 and 1 inch—out of concern that the ice would form the shape of the inflated boot, resulting in the boot inflating and deflating under a shell of ice, making de-icing impossible. Despite the widespread belief in this phenomenon within the pilot community and its coverage in numerous technical publications, its existence cannot be substantiated, either technically or anecdotally. At a recent conference held in Cleveland [Ohio] to investigate ice bridging, the major manufacturers of pneumatic de-icing boots reported that they had been unable to reproduce ice bridging under any laboratory/wind tunnel conditions, and that any operational report of ice bridging investigated by them had been determined to be a report of residual ice."

Finally, CBAAC 130R, *Revised Airborne Icing Training Guidance Material*, directs operators to revise their training programs to incorporate the revised information on airborne icing issues.

Inadvertent selection of inappropriate automatic flight control system (AFCS) climb mode

In the same occurrence described above, the aircraft used a Sperry SPZ-8000 digital AFCS. A single flight guidance controller is used to select flight director modes of operation, and to engage/disengage the autopilot. Most of the controls on the AFCS controller are alternate-action pushbutton (push on, push off). There are two vertical modes available; when the "IAS" button is selected, the AFCS will command the aircraft's indicated airspeed at the time of selection, and when the "VS" button is selected, the aircraft's vertical speed at the time of selection. The selection of either of these two modes will remove the other one, if it was previously selected and active. The "IAS" and "VS" selection buttons are located next to each other on the flight guidance control panel. When the autopilot is engaged, it is driven by the flight director commands selected on the flight guidance controller panel.

The crew had engaged the autopilot during the initial stages of the climb. Normally, the aircraft is climbed using "IAS" mode. Flight data recorder information for the flight shows that, during the climb, the rate of climb remained constant at 1 190 ft/min, while the airspeed varied. This indicates that the AFCS was operating in the "VS" mode. Information gathered to date indicates that the crew had meant to select "IAS" mode, and were unaware that "VS" had been selected. The inadvertent selection of "VS" and the subsequent loss of airspeed was not detected by the crew.

The crew had recently completed DHC-8-100 conversion training at FlightSafety Canada. FlightSafety Canada's standard operating procedures (SOP) for the DHC-8-100 (page 10.4) for the climb state:

"The vertical speed (VS) mode should not be used for climb, since airspeed may decrease below that desired, as the FD (flight director) increases pitch attitude to maintain climb rate to compensate for decreasing engine power at higher altitudes."

To help guard against inadvertent selection of "VS" mode and subsequent low airspeed, FlightSafety Canada SOPs require a verbal challenge and response when the AFCS is engaged. Upon engaging the AFCS, the pilot flying calls out, "set IAS," along with the captured airspeed. The pilot monitoring confirms the selection of "IAS," and reads back the captured "IAS" value.

At the time of the occurrence, the operator's SOP for the climb phase did not restrict climbs in "VS" mode; however, it was common knowledge amongst company crews that "VS" mode was not to be used. The operator's SOPs also did not require a verbal challenge and response between crew members to ensure correct AFCS mode engagement. Since the occurrence, the operator has taken steps to modify their SOPs to ensure that the correct selection of AFCS mode is made. There are other AFCSs that operate in a manner similar to the Sperry SPZ-8000. Selection of "VS" modes during climbs in these other systems could also have adverse effects.

At present, there is no requirement for operators to have an SOP detailing specific AFCS engagement procedures. Defences need to be put in place to prevent inadvertent or inappropriate selection of AFCS vertical and other commands by aircrew. As evidenced by this serious incident, an inadvertent selection of "VS" mode during climb could lead to an airspeed deterioration which, if not detected and corrected in time, could lead to a loss of control. Therefore, operators are strongly advised to incorporate appropriate measures into their SOPs to ensure the correct selection and monitoring of the AFCS modes of operation. △

"Labrador Tea-Brush" Punctures Bell 212 Belly, Fuel Cell

Tree stump with vegetation removed

Helicopter operations in the field often involve landing in remote, confined and obstructed areas. Pilots who land in totally unprepared areas have a certain routine about inspecting the intended site, and as such, will usually exercise a level of diligence appropriate to the situation. At other times, ground support personnel may have prepared a remote or improvised landing area, which can influence the level of diligence used by pilots when approaching the site.

An example of such a situation occurred on August 16, 2005, when a Bell 212 helicopter was landing on an improvised pad at Bonnie Lake, Ont., on a flight from a firefighting camp. The landing site had been prepared by trained ground personnel. As the aircraft was landing, it struck a tree stump, described as "Labrador tea-brush," which punctured the belly of the aircraft and the right main fuel cell. About 300 lbs of fuel was lost.

The stump should have been removed by the ground crew, but was not easily seen because of the vegetation. Since the site had been prepared by trained personnel, the pilot likely assumed that the landing site was free of hazards. As a result, the operator is reviewing its helipad construction training for ground personnel. △

View of punctured helicopter fuselage

Collision Avoidance Tip: Use of landing lights. *Pilots have confirmed that the use of landing lights when flying at the lower altitudes and within terminal areas, both during daylight hours and at night, greatly enhances the probablility of the aircraft being seen. A side benefit for improved safety is that birds seem to see aircraft showing lights in time to take avoidance action. Therefore, it is recommended that all aircraft show a landing light(s) during the take-off and landing phases, and when flying below 2 000 ft AGL within terminal areas and aerodrome traffic zones. (Ref.: TC AIM AIR 4.5)*

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

TSB Final Report A03P0332—Maintenance Error—In-flight Fuel Leak

On November 6, 2003, an Airbus A330-300 departed Vancouver International Airport, B.C., at 14:23 Pacific Standard Time (PST) on a scheduled flight to Calgary, Alta., with 6 crew members and 92 passengers on board. Shortly after takeoff, the Vancouver tower informed the pilots that a substantial amount of smoke or vapour was coming from the No. 2 engine. Although the pilots did not receive any abnormal engine indications or cockpit warnings, they declared an emergency and advised that they were returning to Vancouver. After an uneventful landing, the pilots shut down the No. 2 engine. Aircraft rescue and firefighting (ARFF) services, following the aircraft, advised the pilots that fuel was leaking from the engine but there was no sign of fire. Eventually, the aircraft was towed back to the terminal where the passengers were deplaned. There were no injuries or damage to the aircraft.

Visible fuel leak from the Airbus A330

Findings as to causes and contributing factors

1. Because of an incorrect entry on the maintenance office duty board, and because technicians did not follow the troubleshooting manual (TSM), they unnecessarily removed the low-pressure (LP) fuel line from the fuel/oil heat exchanger.

2. Because the technicians were unfamiliar with the coupling, because the retainer was hidden from view, and because they did not refer to the aircraft maintenance manual (AMM), the technicians did not properly reconnect the LP fuel line.

3. Upon the application of take-off power, the fuel pressure, the fuel flow rate, and engine vibration caused the fuel/oil heat exchanger LP fuel line to detach, causing a substantial fuel leak from the No. 2 engine.

Findings as to risk

1. A high-power engine run was not performed by the operator (nor was one required by the engine manufacturer), which would have produced conditions similar to those that caused the LP fuel line to detach from the fuel/oil heat exchanger on takeoff. A high-powered engine run could decrease the risk that a leak or mis-installed component would go undetected.

2. Correct inspection of the fuel/oil heat exchanger would require the use of an elevated platform both prior to and after the actual engine run-up. A proper inspection of the LP fuel line connection was not accomplished after the engine run-up, increasing the risk that a leak or mis-installed component would go undetected.

3. The operator had not implemented Airbus Service Bulletin (SB) A330-28-3080. Implementing this SB would reduce the risk that a fuel leak could go undetected, leading to fuel exhaustion, engine failure, or fire.

Other finding

1. The removal and re-installation of the fuel/oil heat exchanger LP fuel line was not documented, as required by the operator's maintenance policy manual and Transport Canada regulation.

TSB Final Report A04P0057—In-flight Collision

On March 12, 2004, two float-equipped Cessna 185 aircraft were conducting independent herring patrols on the northeast side of Vancouver Island, B.C. The pilot of the first C-185 was on a private business flight in support of his company's fishing vessels, located in the vicinity of Nanoose Bay, B.C.; he was monitoring radio frequencies 126.7 MHz and 122.9 MHz. The pilot of the second C-185 was on a charter flight in support of the Department of Fisheries and Oceans Canada (DFO). The crew of this flight was to observe herring spawn size and location, and to conduct gear counts. This flight had originated at Comox, B.C., and had proceeded southeast along the shoreline toward Nanoose Bay, where the pilot was to land and pick up a second DFO officer from a boat that was regulating the fishing activity. The pilot of the second C-185 was monitoring frequency 123.2 MHz.

The second C-185 concluded the spawn count adjacent to the government wharf in Nanoose Bay, and the pilot began a left turn to land near the DFO boat. At the same time, the first C-185 was exiting Nanoose Bay, in level flight, at about 400 ft above ground level (AGL). The two aircraft collided in flight at approximately 09:48 PST. The pilot of the second C-185 had not seen the other aircraft. The pilot of the first C-185 did see the opposing aircraft, but had insufficient response time to avoid the collision. After the collision, both pilots were able to maintain control. They established radio contact and then inspected and assessed each other's damage. The first C-185 returned to and landed at Vancouver, B.C. The second C-185 flew back to Campbell River, B.C., and landed without further incident. The first C-185 received damage to the vertical fin and rudder while the second C-185 received damage to the forward compartment of the left float. There were no injuries.

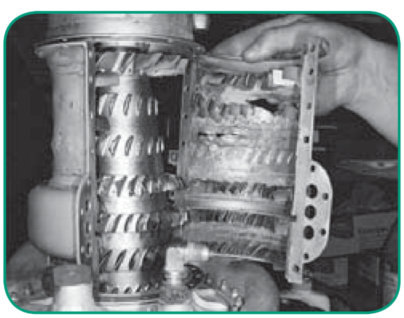
Findings as to causes and contributing factors

1. Both pilots were monitoring one or more radio frequencies that they considered appropriate for their location and intentions; however, neither pilot was on the same frequency, so any calls made were not heard by the other pilot.

2. Neither pilot saw the other aircraft in time to avoid the collision and the two planes collided in flight.

TSB Final Report A04P0206— Engine Power Loss

On June 11, 2004, an MD Helicopter (Hughes) 369D was lifting a 900-lb sling load when there was a loud bang accompanied by a partial engine power loss. The pilot performed a forced landing, and the aircraft hit the ground and rolled onto its right side with the main rotor blades still turning. The engine continued to operate on the ground and was shut down by the pilot. There was no post-impact fire. The pilot experienced accident-related health issues some time after the occurrence.



Compressor case half removed exposing damage to blades and vanes leading and trailing edges

Finding as to causes and contributing factors

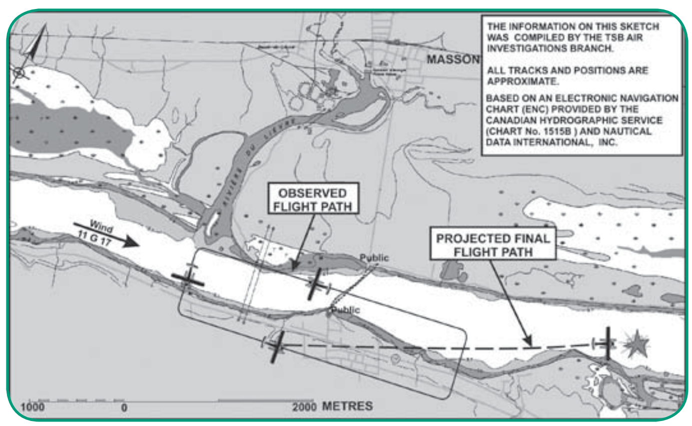
1. The compressor failure resulted from the separation of a second stage rotor blade due to high cycle fatigue, which had initiated at or near the leading edge of the blade. Post-fracture mechanical damage in the origin area prevented determination of the cause of fatigue initiation.

Other finding

1. Indications of foreign object damage (FOD) were observed, but the significance of FOD as a precursor to the second stage compressor rotor blade fracture initiation was inconclusive.

TSB Final Report A04H0002— Collision with Water

On June 14, 2004, the pilot and sole occupant of the DHC-2 seaplane was on his first flight of the season on the Ottawa River at Gatineau, Que. This training flight, conducted according to visual flight rules (VFR), was to consist of about 12 touch-and-go landings. The aircraft took off at approximately 13:00 Eastern Daylight Time (EDT), and made several upwind touch-and-go landings in a westerly direction. At approximately 13:40 EDT, the aircraft was seen about 50 ft above the surface of the water proceeding downwind in an easterly direction, in a nose-down attitude of over 20°. The right float then struck the water and the aircraft tumbled several times, breaking up on impact. Despite the waves and gusting wind on the river, some riverside residents who witnessed the accident attempted a rescue, but the aircraft sank before they could reach it. Even though the pilot was wearing a seat belt, he sustained head injuries at impact and drowned.



Aircraft flight path

Finding as to causes and contributing factors

1. The aircraft struck the water for undetermined reasons.

Findings as to risk

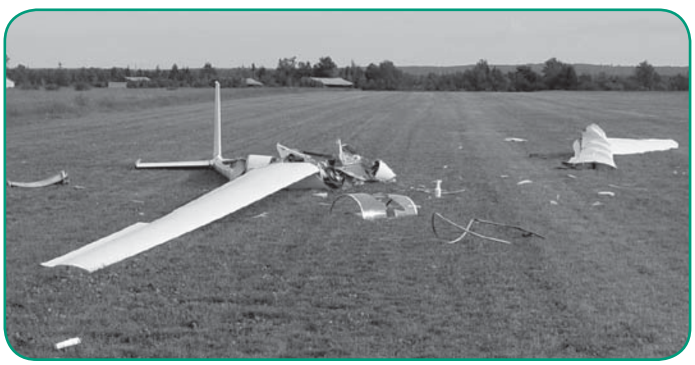
1. The certificate of airworthiness was not in effect at the time of the accident because of airworthiness directives that had not been completed.

2. The distress signal emitted by the fixed, automatic emergency locator transmitter (ELT) was not received because of the reduced range of the signal once the ELT was submerged, which could have increased the response time of search and rescue units if there had been no witnesses to the accident.

3. The pilot had not made a training flight with an instructor for more than 19 months, which could have resulted in a degradation of his skills and decision-making process.

TSB Final Report A04A0079—Aerodynamic Stall and Loss of Control

On July 18, 2004, the pilot of an amateur-built Schreder HP 18 glider was prepared for a winch-assisted takeoff from the grass adjacent to Runway 02 at Stanley Airport, N.S. The wind was from the northwest at approximately 4 kt. At approximately 14:45 Atlantic Daylight Time (ADT), the pilot gave the signal to commence the launch. The winch was activated, and after a normal ground roll, the glider lifted off the surface. The glider then pitched up to an estimated angle of 45° and climbed steeply to about 100 ft AGL. The aircraft then rolled to the right, pitched nose-down, and completed one or two rolls before it struck the runway in a left-wing-low, nose-down attitude. The pilot was fatally injured and the glider was destroyed.



Finding as to causes and contributing factors

1. Shortly after lifting off, the aircraft entered a steep climbing attitude and a wing stall ensued; there was insufficient altitude for the pilot to effect recovery.

Finding as to risk

1. The shoulder harness straps were not latched prior to takeoff; however, it is unlikely that their use would have lessened injuries in this accident.

TSB Final Report A04Q0124—Risk of Collision

On August 5, 2004 a Cessna 172 was returning to Québec, Que., following a VFR cross-country flight. The pilot contacted the Québec terminal control unit 28 NM west of the Québec/Jean Lesage International Airport while flying at approximately 3 000 ft above sea level (ASL). A Cessna 208 Caravan was on an instrument flight rules (IFR) flight from the Québec airport to Mirabel, Que., at a flight-planned altitude of 8 000 ft. The two aircraft passed within 200 ft vertically and 500 ft laterally of one another as the Cessna 208 was climbing through 3 000 ft ASL on departure from the Québec airport.

Findings as to causes and contributing factors

1. The student pilot did not complete the entire "Line-up" portion of the aircraft checklist and omitted to turn the transponder to the altitude encoding position "ALT." Under these conditions, the transponder did not transmit information to the radar system, making the aircraft much less visible on the controller's radar situation display (RSiT).

2. The Québec terminal controller did not radar-identify the Cessna 172 after issuing the transponder code, or request other information to determine the aircraft's position or altitude. As a result, the Cessna 172 was allowed to penetrate Class D airspace without the required level of radar service being provided. This placed the Cessna 172 at a risk of collision with the Cessna 208.
3. The Québec terminal controller's attention was directed to controlling his IFR traffic inbound to the Québec airport and to coordinating the arrival sequence with the tower. He forgot about the Cessna 172 and did not notice the developing conflict between this aircraft and the Cessna 208.

Findings as to risk

1. The RSiT software programming caused the flight plan data entry window to automatically close 30 seconds after the last keystroke. Once the window closed, it could no longer serve as a reminder to the Québec terminal controller that he still had some further action pending.

2. In a radar environment, while in contact with air traffic services (ATS), pilots may expect to receive information on all aircraft in their vicinity and, when operating in visual meteorological conditions (VMC), may not search for conflicting traffic and take action to avoid a collision.

TSB Final Report A04A0111—Loss of control—Collision with Terrain

On August 31, 2004, an AS-350D Astar helicopter was being operated in support of a geological survey crew, 45 NM northwest of Nain, N.L. At approximately 16:00 ADT, the pilot of the occurrence helicopter picked up a team of geologists and proceeded to reposition them 1.5 km further along the ridge line they had been sampling. While on short final for the landing site, the helicopter's rate of descent increased, and the pilot was unable to arrest the descent. The helicopter struck the ground in a gully, just left of the intended touchdown point. The helicopter came to rest on its right side, facing the direction of approach. The pilot and two passengers escaped with only minor injuries. The helicopter was substantially damaged, but there was no post-crash fire.

Finding as to causes and contributing factors

1. The reason for the sudden descent of the helicopter could not be determined.

Findings as to risk

1. Some company helicopter pilots are operating in the mountainous terrain of northern Labrador without the benefit of mountain flying training.

2. The pilot did not fly a reconnaissance of the intended landing site before attempting a landing.

Other finding

1. Using a satellite phone to speedily notify company operations greatly improved the survival scenario.

TSB Final Report A04C0190— Collision with Terrain

On October 30, 2004, a Bell 212 helicopter with two pilots and three passengers on board, departed from the radar facility at Shepherd Bay, N.U., at approximately 11:10 Mountain Daylight Time (MDT) on a day, defence VFR flight to another radar facility at Gjoa Haven, N.U. During takeoff from Shepherd Bay, the helicopter descended and crashed, in a nose-low, left-banked attitude, into the snow-covered terrain about 250 m from the departure helicopter pad. The captain and the three passengers were seriously injured, and the first officer died on impact. The survivors were able to return to the facility and alert search and rescue (SAR). The helicopter sustained substantial damage; there was no fire.

Findings as to causes and contributing factors

1. The helicopter departed into environmental conditions conducive to white-out and loss of micro texture for attitude reference.

2. The potential for entering white-out conditions was masked by the visibility of objects in the vicinity of the departure point.

3. The crew did not maintain the priority of rate-of-climb during the rotation to forward flight, did not maintain an adequate instrument scan, and were not able to overcome the white-out conditions and establish a positive rate-of-climb.

Findings as to risk

1. The helicopter was not equipped with an instantaneous vertical speed indicator, nor was one required. Transitory false indications of a climb were possible from the vertical speed indicator installed in the helicopter.

2. The crew's training was conducted in a setting that did not demonstrate the effects of lack of micro texture, and the crew did not anticipate white-out other than the effects of re-circulating snow.

3. The crew's training did not develop the rapid instrument scan required to compensate for the pilot flying's minimal experience on type and in arctic conditions.

Other finding

1. The ELT was damaged and rendered inoperative when the main rotor struck the cockpit area.

TSB Final Report A04O0336— Rejected Landing—Collision with Terrain

On December 16, 2004, a Short Brothers SD3-60 aircraft was on a charter cargo flight from Toledo, Ohio, USA, to Oshawa, Ont., with two pilots on board. The crew conducted an IFR approach to Oshawa Municipal Airport in night instrument meteorological conditions (IMC). At approximately 20:00 Eastern Standard Time (EST), the aircraft landed on Runway 30, which was snow-covered. During the landing roll, the pilot flying noted poor braking action and observed the runway end lights approaching. He rejected the landing and conducted a go-around procedure. The aircraft became airborne, but it started to descend as it flew over lower terrain, striking an airport boundary fence. It continued until it struck rising terrain and then a line of forestation, where it came to an abrupt stop. The flight crew exited the aircraft and waited for rescue personnel to render assistance. The aircraft was substantially damaged, and both pilots sustained serious injuries. There was no post-crash fire.

Findings as to causes and contributing factors

1. The crew planned and executed a landing on a runway that did not provide the required landing distance.

2. The flight crew most likely did not reference the aircraft flight manual (AFM) performance chart "Effect of a Slippery Surface on Landing Distance Required" to determine that landing the aircraft on the 4 000-ft, snow-covered runway with flap-15 was inappropriate.

3. After landing long on the snow-covered runway and applying full reverse thrust, the captain attempted a go-around. He rotated the aircraft to a take-off attitude and the aircraft became airborne in ground effect at a slower-than-normal speed.

4. The aircraft had insufficient power and airspeed to climb and remained in ground effect until striking the airport perimeter fence, rising terrain, and a line of large cedar trees.

5. The flight crew conducted a flap-15 approach, based on company advice in accordance with an All Operator Message (AOM) issued by the aircraft manufacturer to not use flap-30. This AOM was superseded on October 20, 2004, by AOM No. SD006/04, which cancelled any potential flap-setting prohibition.

Other finding

1. The flight crew members were not advised that the potential Airworthiness Directive (AD) announced in the original AOM was not going into effect and that the use of flap-30 was acceptable, as relayed in the follow-up AOM.

TSB Final Report A05P0154—Power Loss

On June 24, 2005, the pilot of a Robinson R22 Beta helicopter was operating in an area about 10 NM north of Courtenay, B.C., giving rides to volunteer interns at a local avian rescue society. He had completed four trips, then shut down and readied the helicopter for a flight to Courtenay Airpark, where he would refuel before returning to his home base at Boundary Bay Airport, B.C. On start-up, he ran the helicopter on the ground for about two minutes after re-engaging the clutch. At approximately 16:30 Pacific Daylight Time (PDT), the pilot lifted off, turned the helicopter 180° to point toward his departure path, and raised collective to perform a confined-space takeoff. The helicopter climbed to a height of about 60 ft AGL when there were abnormal engine sounds and an apparent detonation. The engine became quiet, and the main rotor blades were almost stopped. The helicopter rotated about 270° to the left in a rapid descent and struck the ground heavily with little or no forward speed. The pilot was severely injured. The helicopter was substantially damaged, but there was no post-crash fire.

Findings as to causes and contributing factors

1. The pilot did not recall applying carburetor heat prior to departure or during takeoff. It is likely that carburetor ice adversely affected engine performance and caused the engine to stop operating.

2. Following the loss of engine power, the main rotor RPM decayed rapidly to an unrecoverable speed and the pilot was unable to arrest the helicopter's descent.

Findings as to risk

1. When replaced, the push-pull tube was found to have worn excessively. Failure of this primary flight control would render a helicopter uncontrollable.

2. Incorrect over-current fuse protection of the belt tension actuator may lead to overloading of the drive belts.

3. A global positioning system (GPS) unit was secured with clecos* onto the side of the instrument console. Failure of the temporary fastening could lead to an electrical fire. (*A "cleco" is a spring-loaded clamp used to temporarily hold parts together prior to the installation of rivets. Special pliers are used to insert clecos into holes.) △