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AVIATION SAFETY LETTER

In this Issue...

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

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Canada

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GUEST EDITORIAL

Dave Turnbull

As one of the more recent directors appointed to the Civil Aviation Management Executive Board (CAMX), I am pleased to have the opportunity to contribute to this issue of the *Aviation Safety Letter* (ASL). Let me start by explaining the basics of what the National Aircraft Certification Branch (NAC) does. In doing so, I will also capture the main duties of our engineering colleagues in the Aircraft Certification offices in the regions.

Most of the work done by NAC is related to the approval of aeronautical product designs and modifications to those designs, by evaluating them against a set of design standards as required by regulations. Once operating, the continuing airworthiness of those products is overseen, and corrective actions are mandated in cases where design deficiencies that appear in service pose a threat to safety. NAC is also heavily involved in the evolution of appropriate means and methods of compliance with the design standards, and is the core source of the technical input required to develop new and amended versions of the design standards and associated guidance material. NAC is part of an international community and is involved in various working groups and committees that collaborate to continuously adapt and develop design standards and the interpretation of these standards.

Each design project undertaken by an applicant follows a process unique to a company's design methodology. Evaluating a design or design change against the standards is unique each time. It requires many highly subjective technical assessments, and as such, it requires expert flight test and engineering knowledge and skills normally acquired through significant experience in evaluating designs against international standards. NAC and Regional Aircraft Certification personnel, along with the ministerial delegate community across the country, have this expertise, and the ongoing interaction with applicants and delegates on these projects is essential to remaining current with evolving technology and approaches to aircraft design.

Over the past several years, Transport Canada Civil Aviation's (TCCA) oversight of the aviation industry has been gradually moving to a systems-based approach, based on the existence of new regulations requiring certain segments of the industry to have an approved safety management system (SMS). More recently, NAC have been busy working on determining how a company's SMS can include the design process, and how the oversight approach can evolve into a more systems-based approach. This is in line with Transport Canada's (TC) move to strengthen the way it conducts oversight of Canada's entire aviation industry. This gives rigor to the way TC manages safety, as well as to their own surveillance model.

Oversight (in the context of aircraft certification) is defined in TC's Program Activity Architecture (PAA) as, "service to and surveillance of the aeronautical product design industry". The service elements related to aircraft certification (such as establishing appropriate standards, agreeing to acceptable means and methods of compliance, and issuing approvals) are fundamental and will need to remain after the introduction of SMS to the design side of the business. The surveillance elements today consist of a risk-based Level of Involvement (LOI) policy where TCCA engineers interact with ministerial delegates during the certification projects, plus periodic audit activities (outside the context of specific projects) of delegated entities, as well as continuing airworthiness monitoring of the Canadian fleet. When an organization's SMS includes the design piece, it is the audit side of NAC's surveillance model, as well as how the lessons learned from continuing airworthiness surveillance is fed back into the design SMS that will have to evolve. Project-based service and surveillance will need to live on in parallel and in balance with a new oversight model that pertains to the company's new SMS design elements. Current thinking is that neither a purely systems-based nor a purely project-based oversight model will suffice.

To enable this evolution in oversight in the area of aeronautical product design, organizations will need to hold a new type of operational certificate, similar to an air operator certificate (AOC). A company's overall SMS will include a design assurance system that provides a level of certainty that the designs are safe, and that the company will make sound and defendable determinations of compliance. It also means that the design industry will be accountable to TC for the quality of these findings and the continuing airworthiness of approved products.

Issuing this new kind of operational certificate will require NAC and its regional engineering colleagues to provide new and additional services and surveillance related to a company's SMS. Some can be derived from the existing delegation system that has been in place in Canada since 1968. Others will be taken from other operational areas of aviation where SMS is already in place. The systems approach to the design side of the organizations is aimed at promoting a sound safety culture through robust design assurance processes and a positive reporting culture.

Clearly, there are many challenges ahead; however, these are also exciting times and I look forward to working together to improve how we do business. Striking the proper balance between systems-based oversight and certification project-based oversight will be crucial and will require close attention. In the meantime, the NAC continues to carry out its mandate, working directly with industry and international colleagues to support a very strong and ever-demanding Canadian aeronautical design and manufacturing industry. According to the Aerospace Industries Association of Canada, Canada exports over 80 percent of its aeronautical products in an industry sector that makes up nearly 5 percent of our Gross Domestic Product. Getting speedy approvals from our foreign markets depends directly on the quality of our own approval process. Our ultimate goal is to improve safety, which is a goal that we share with the industry.

Dave Turnbull
Director, National Aircraft Certification Branch
Transport Canada Civil Aviation

2010 David Charles Abramson Memorial (DCAM) Flight Instructor Safety Award

The recipient of the 2010 DCAM Flight Instructor Safety Award is Mr. William Sutherland, Manager of Corporate Safety & Quality, Moncton Flight College (MFC), Dieppe, New Brunswick. The award was presented to William on November 8, 2010, by award founders Jane and Rikki Abramson at the Air Transport Association of Canada (ATAC) Annual General Meeting and Tradeshow in Vancouver, British Columbia.

Left to right: Wayne Gouveia, Board of Directors, ATAC; William Sutherland; Jane Abramson.

"It goes this year to a young man whose achievements to date and future potential shine full of promise as a beacon for the future of aviation safety in Canada" said Mrs. Abramson. "His strong leadership, integrity, technical competence and commitment to excellence were instrumental in MFC successfully achieving the performance criteria required for certification as an Approved Training Organization (ATO) authorized to conduct flight training in Canada. The requirement to operate a flight training organization to the exacting ATO standards is an essential pre-requisite for MFC and its partner, CAE, to be able to conduct the first Multi-Crew Pilot License (MPL) training program in North America."

The annual DCAM Award promotes flight safety by recognizing exceptional flight instructors in Canada and has brought much recognition and awareness to the flight instructor community. Recognition of excellence within this segment of our industry upholds a safety consciousness that will hopefully be passed on for many years to come.

The deadline for nominations for the 2011 award is September 13, 2011. For details, please visit www.dcamaward.com.

Reducing the Risk of Landing Accidents and Runway Overruns

by Martin J. Eley, Director General, Civil Aviation, Transport Canada

Day in and day out, week after week, thousands of aircraft land in Canadian aerodromes without incident. Unfortunately, this isn't always the case. Air travel is a complex issue and landing aircraft can be equally difficult. With unpredictable factors such as weather conditions, the surrounding terrain and human error, the fact remains that accidents can and do happen.

On August 2, 2005, an Air France Airbus A340 was unable to stop on runway 24L at Toronto's Pearson International Airport. The flight landed during reports of exceptionally bad weather—severe winds, heavy rain, and localized thunderstorms—and touched down further along the runway than usual. The aircraft came to rest in a nearby shallow ravine and burst into flames approximately 300 m past the end of the runway. There were 309 people on board: 297 passengers (2 of whom were infants) and 9 crew members. Fortunately, everyone survived and successfully evacuated the aircraft, with only 12 passengers sustaining serious injuries.

The Transportation Safety Board (TBS) investigated this accident and on March 16, 2010, they issued a watchlist of items that highlight safety concerns or safety recommendations made to Transport Canada (TC). One of the watchlist items refers to landing accidents and runway overruns. A runway overrun is an occurrence where an aircraft departs from or lands on the end or one side of the runway.

TC has taken a number of actions to reduce the risk of landing accidents and runway overruns and to address the TSB's watchlist.

Regulations and standards

Since 2006, requirements have been in place governing landings in low visibility conditions. These regulations clearly set out the minimum conditions for landings in poor visibility. This prohibits air operators from attempting a landing when visibility is so poor that a successful landing is unlikely.

A regulatory amendment on safe winter runway operations was published in the *Canada Gazette Part I: Notices and Proposed Regulations*. The proposal would require airport operators to develop standardized procedures related to winter runway maintenance. The proposal would also require accurate and timely reporting of surface conditions at airports in winter. These measures will lead to more reliable and safer transportation for those using Canadian airports during the winter.

Additionally, *TP 312 – Aerodrome Standards and Recommended Practices* is being revised in cooperation with industry experts. The updated document will address:

- providing additional visual aids for pilots to help assess landing distances;
- harmonizing Canadian and international runway end safety area (RESA) standards; and
- recognizing the engineered material arresting system (EMAS)[1] as an added measure to increase safety.

TC agrees that RESA is a vital component of its risk reduction plan and is committed to conforming to the International Civil Aviation Organization's (ICAO) 150 m RESA standard, while assessing the potential benefits of extending the RESA to 300 m. TC has therefore tabled Notices of Proposed Amendment (NPA) to the *Canadian Aviation Regulations* to adopt a 150 m total RESA requirement. These NPAs were considered at the Canadian Aviation Regulation Advisory Council (CARAC) Technical Committee meeting, which was held from November 15 to 17, 2010.

International cooperation

TC is an active participant in the ICAO's Air Navigation Commission, Aerodrome Panel and Aerodrome Design Working Group. The purpose of this participation is to develop and harmonize international standards that will reduce runway overrun and undershoot accidents.

At the 2010 ICAO assembly, TC presented a working paper on runway safety that addressed incursions and excursions. At this same assembly, a proposal was made by

1 EMAS is an example of a ground arrestor system. EMAS is located beyond the end of the runway. It is designed to stop an overrunning aircraft by exerting deceleration forces on the aircraft's landing gear. The application of EMAS can mean the difference between an accident and a minor incident. EMAS is a soft ground arrestor. This type of arrestor deforms under the weight of the aircraft tire as it runs over it. As the tires crush the material, the drag forces decelerate the aircraft and bring it to a safe stop. EMAS is popular in the U.S at airports that have difficulties complying with FAA rules on runway safety.

ICAO to establish runway safety programs to prevent and mitigate runway accidents and incidents.

TC agreed with this proposal and noted that the establishment of a runway safety program should strive as much as possible to ensure that runway incursions and runway excursions are studied and defined separately. This would help to develop the best and most appropriate measures for each type of occurrence.

ICAO is also organizing a Global Runway Safety Symposium in 2011, in which TC looks forward to participating.

Landing accidents and runway overruns are an unfortunate reality in aviation. TC is committed to ongoing studies and analyses to identify the hazards and the dynamics that lead to these safety risks, as well as continuing to take action to maintain a high level of safety in the air, and on land. △

Flight Planning: A Critical Layer of Protection from Wake Turbulence

by Dave Rye, Manager, Area Control Centre Operations Moncton, NAV CANADA

NAV CANADA

In recent years, NAV CANADA controllers have noticed a number of discrepancies between the weight categories in flight plans filed by air operators and the expected aircraft weight category. Most of these discrepancies are not errors, but even a small number of errors in filed flight plans should raise vigilance on the part of all pilots, dispatchers and air operators.

Impact of an incorrect weight category

Air traffic controllers depend on accurate weight category information in the flight plan to ensure safe wake turbulence separation. Wake turbulence is turbulent air behind an aircraft caused by any of the following:

(a) wing-tip vortices;
(b) rotor-tip vortices;
(c) jet-engine thrust stream or jet blast;
(d) rotor downwash;
(e) prop wash.

Wake turbulence is usually invisible, leaving pilots with no warning that they are flying into turbulence. This is the reason why, during takeoff and landing, air traffic controllers provide standard separation for all departing aircraft and for IFR traffic on approach.

There are a number of different factors that will affect the strength of the vortex, and how long it persists. The strength of the vortex is governed by the weight, speed, and shape of the wing of the generating aircraft.

The vortex characteristics of any given aircraft can also be changed by extension of flaps or other wing configuring devices as well as by a change in speed. However, as the basic factor is weight, the vortex strength increases proportionately.

In Canada, ICAO (International Civil Aviation Organization) Doc 8643, *Aircraft Type Designators*, is utilized to determine aircraft wake turbulence categories and to apply the appropriate separation standard as detailed in MANOPS (NAV CANADA, Manual of Operations). Turbulence category is determined by the aircraft maximum certificated take-off mass and not by the actual take-off weight of the aircraft.

Sources of discrepancies

ICAO Doc 8643 is very extensive, but within a specific model there can be model variants that have different take-off weights. While most would not be noticeable to air traffic control (ATC), some models can (and do) move from one turbulence category to another, such as the KingAir Model 350 (B350) and the SW4, which are shown as both light and medium (L/M).

Other aircraft may change categories due to certified weight increases for specific mission aircraft (such as AirTractor Model AT8T for agricultural or fire suppression flights) or for temporary certified increases for ferry flights.

One other aircraft of note is the B757, which, while identified as a medium category aircraft, has an increased separation requirement specific to that model due to wake characteristics for following aircraft.

What can you do?

For aircraft types listed in more than one category in ICAO Doc 8643, NAV CANADA controllers are not permitted to modify the weight category unless the pilot-in-command specifically identifies a weight category different than the one filed.

If you are filing a flight plan, double-check the weight category. Be sure that the filed weight category is reflective of the type of flight, flight permit or certificate that you are operating under, not the actual take-off weight of the aircraft. Doing so will ensure that the appropriate turbulence separation criteria is applied to your aircraft. △

Instructor Refresher Courses Improve Flight Safety… and Renew your Rating

by Michael Schuster, Principal Consultant, Aviation Solutions

As of June 2010, there were over 3 000 Canadian flight instructor ratings in force[1]. As with instrument ratings and pilot proficiency checks (PPCs), the instructor rating is not valid forever and must be renewed. The flight instructor rating is based on a class system ranging from Class 4 to Class 1, with additional privileges granted to each successive class as instructors gain more experience and additional qualifications.

Many instructors elect to renew their ratings by undergoing a flight test, but there are, in fact, several different options for renewing an instructor rating. According to CAR 421.66, one way to renew an instructor rating is to attend a Flight Instructor Refresher Course (FIRC). Many instructors are unfamiliar with, or reluctant to use, this method of renewal, so let's take a look at what a FIRC is.

The FIRC originally began in 1951 as a Transport Canada (TC) initiative. Over the years, the program underwent several changes until its conclusion in 2007. TC then granted the flight training industry authority to conduct its own courses under General Aviation Advisory Circular (GAAC) 421-001.

As the GAAC points out, "The safety of flying in Canada depends on the competence of the pilots and the system that supports them. The competence of pilots depends in turn on the quality of the training system that produces them."[2]

The instructor community needs to ask the following question: how well do we continue to develop instructors after their initial training? In many cases, a licensed pilot completes the instructor rating with one or two Class 1 instructors and often works at the same location once rated. This means limited exposure for many flight instructors. In other words, after a year or two of teaching, the rate of acquiring new knowledge and improving instructional skill plateaus; any gaps in knowledge or bad habits that have developed may remain uncorrected for years.

In addition to renewing an instructor rating, the FIRC is an outstanding avenue for professional development, which addresses the above issues. FIRCs bring together instructors from all over the country, with course sizes ranging from six to thirty participants. Throughout the course, every instructor benefits from learning the techniques, ideas, safety systems and operational considerations that are brought by others. The varied backgrounds and experience levels of those in attendance contribute to a sharing of knowledge, and the development of a support network amongst instructors. Instructors can then take what they've learned back to their own Flight Training Units (FTU) to share with colleagues and improve operations.

The theme of best practices is central to the content that is prepared for the refresher courses. Attendees have a chance to participate in lectures, small and large group discussions and exercises, role-playing, scenario analysis, and preparing their own presentations. The courses are quite interactive and not designed to be a one-way flow of information.

Course material focuses on new skills and knowledge. For instance, many instructors have been asked by an aircraft owner to teach them IFR on their private aircraft, only to find out that the aircraft is equipped with an integrated flight deck or "glass cockpit". The instructor may have never been given any guidance during initial training on how to "teach glass". As the National Transportation Safety Board has stated, "single engine aircraft with glass have no better overall safety record than traditional aircraft, but do have a higher fatal accident rate"[3]. The goal of the refresher course is to review to a certain extent, but more so to give instructors new knowledge and skills.

The FIRC modules are led by experienced flight instructors, pilot examiners and industry experts. For instance, during presentations on airspace/ADS-B/RNAV, NAV CANADA may send a controller to participate, TC may provide a presenter to discuss the implementation of SMS at FTUs, and so on.

Every course has its own unique set of topics and more information is available from the course providers' websites. Some common topics include: instructor supervision, operational control, flight-testing weak areas, and scenario-based training. The theme through all of the modules is how instructors can not only improve the quality of their work, but also the level of safety—for their students, themselves, and for the aviation industry as a whole. Applicable real-world content is integrated throughout, to keep the lessons both relevant and current.

The topic of Human Factors, for example, may look at the training of English as a Second Language students. What are the statistics surrounding their safety record? What practices have been shown to improve safety in this environment? What instructional techniques are most effective? Though these topics may sound daunting at

1 www.tc.gc.ca/eng/civilaviation/standards/general-personnel-stats-stats-2300.htm

2 General Aviation Advisory Circular 421-001, June 2010

3 *Aviation International News*, April 2010

Instructors practicing good pre-flight briefing techniques during a role-playing exercise.

first, the courses are designed for all levels of instructors, including Class 4. The courses are also ideal for instructors not actively working in the field who wish to retain their ratings, by keeping up-to-date on the latest changes, trends and innovations in flight training.

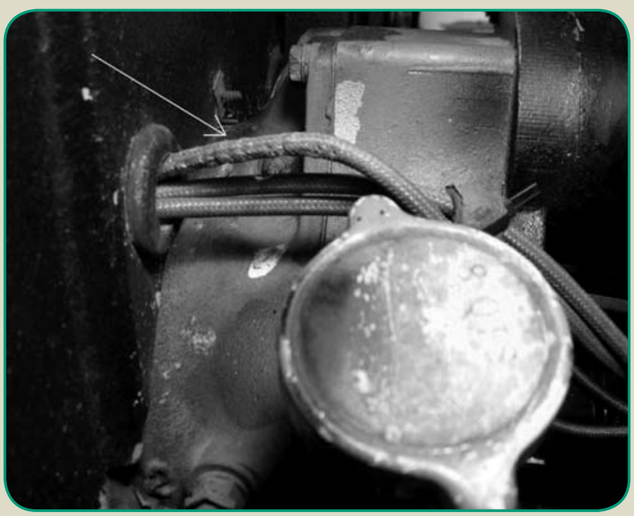
TC has laid out comprehensive guidelines for becoming an authorized FIRC provider. Like all other operators, their documents and training programs are reviewed and courses are audited. There are presently several approved course providers running courses throughout the country.[4]

Flight instruction is an important part of the aviation industry and flight instructors are professionals who should be constantly improving their knowledge and skills. The next time you have a renewal coming up, you may want to consider attending one of these professional development courses. They are one of the best ways to advance both the quality and level of safety in Canadian flight training.

Michael Schuster is an Airline Transport Pilot (ATP) Class 1 Instructor and authorized FIRC course provider. For more information visit www.aviationsolutions.net/instructor.php *or email* mjs@aviationsolutions.net. △

4 www.tc.gc.ca/civilaviation/general/flttrain/irc/menu.htm

If not for ice, watch for mice…



Mr. Paul Harrington of Cottam, Ontario, thought this would be of interest to ASL readers. Just after maintenance on a Cessna 172, he pushed the aircraft out to run it up, and he suddenly had a large drop on the right magneto. He decided to check the spark plugs and ignition wires, so he pushed the aircraft back in the hangar, took the cowls off, and found number 5 magneto wire with the top chewed in half, and other wires with teeth marks. In 36 years of working on aircraft, Mr. Harrington said this was the first time he had ever seen this happening. So, he wanted to share this with pilots and, aircraft maintenance engineers (AME): if you get a magneto drop, you may want to double-check the condition of the ignition wires! He replaced the right magneto harness; for some reason, the mice didn't touch the left one. Be careful out there!

COPA Corner: Practice Precautionary Approaches More Often

by Dale Nielsen. This article was originally published in the "Chock to Chock" column of the July 2010 issue of COPA Flight, *and is reprinted with permission.*

Most of us have never landed at a site other than an airport and probably never will. A precautionary approach is something we don't practice or even think much about because we don't think it applies to us.

When we took our pilot training, we learned precautionary approaches for use at off-airport sites. Most of us did not have instructors who told us precautionary approaches should be performed any time we are not certain about the landing conditions at our point of intended landing, even at an airport. Many of us occasionally go to unfamiliar airports and some of them may have runway surface conditions we are not certain about.

A pilot was intending to land his Piper PA-24-200T Seneca at Mont Laurier. He touched down on Runway 26 but was unable to stop the aircraft on the runway. He eventually came to a stop in the snow, 200 ft off the end of the runway. The runway was 100% ice covered at the time. Fortunately no one was injured and the aircraft received little damage.

A pilot of a Cessna C-180K overflew a 2 400 foot private strip and judged it to be firm and suitable. On landing, the aircraft drifted right. Power was added and the aircraft became airborne for about 100 ft and touched down again with the right wheel on softer ground. The aircraft continued to the right until the right wheel hit a snow drift and the aircraft flipped over. The pilot was not injured.

A Cessna C-172 pilot departed a northern Ontario airport for a short sightseeing flight. He returned for landing 20 minutes later and shortly after touchdown, the right wheel hit some snow that had drifted partially across the runway. The aircraft veered right and impacted the snow bank on the right side of the runway. The pilot was not injured, the aircraft was.

The report about the PA 24-200T accident did not say if the pilot performed a full precautionary approach procedure, just that he overflew the airport. Doing a full precautionary approach procedure may have prevented this accident.

CANADIAN OWNERS AND PILOTS ASSOCIATION

The C-180K pilot did fly over the strip and judged it suitable. It appears that just the centre portion was suitable. He allowed the aircraft to drift to the right away from the suitable landing area and added power to attempt to correct, but the aircraft touched down before the correction took effect. He should have gone around and attempted another landing, or diverted to another landing site.

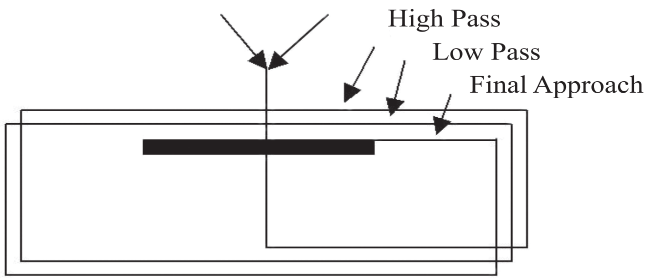
The C-172 pilot did not perform a precautionary approach as he had only been gone 20 minutes. Fresh snow and a crosswind should now be a reminder for the rest of us that it only takes minutes for snow drifts to form across a runway.

We should always be prepared to go around. Too often when we expect or judge a landing site safe, we put ourselves into the mindset that we are going to land.

We do not have reports on runway conditions at airports without an operating control tower, flight service station (FSS) or community aerodrome radio station (CARS). Recent snow, rain or construction can leave unexpected hazards. Local pilots or city crews may clear the runways of snow. Without specific airport training, snow windrows or clumps of hard snow can be left at entrances to taxiways or runway intersections. Winds may blow snow back onto runways in hard drifts. Animals may also create runway hazards at uncontrolled airports, with deer, coyotes, dogs and birds being the most common.

When we are not sure of surface conditions, a landing site, airport or not, should initially be flown over at about 1 000 ft (high pass). An initial assessment can be made of the runway surface and of the wind conditions. When the choice of runway is made, a low pass at 300 to 400 ft can be made along the runway and to the right of the runway to better assess the field conditions. Three hundred to 400 ft should safely clear all nearby obstacles and the surface conditions can be clearly seen. This pass should be made no slower than the flap up final approach speed. Partial flap during this pass will lower the aircraft pitch attitude and help with aircraft stability. The airspeed, altitude, partial flap and trim should all be set before reaching the start of the runway so that all a pilot has to do is look to the left and inspect the runway. If the field is judged suitable, a return for a normal, soft or short field landing can be performed from a normal circuit pattern.

A normal circuit pattern should be performed for the landing whenever possible, because that is what we are used to doing, and there are fewer chances of making errors. Major errors to watch for when performing precautionary approaches are: making the high pass in a dive at high speed; not having the aircraft stabilized at an appropriate airspeed and in an appropriate configuration for the low pass; and abbreviating the circuit and landing hot and long.



Precautionary Approach Procedure

At any airport where you would consider a precautionary approach prior to landing, it may be wise to perform a runway surface check prior to takeoff. Standing on the ramp, or sitting in the aircraft on the ramp, or even on the end of the runway will provide a good view of only a small portion of the runway surface. There could be soft areas, holes, rocks, pools of water, ice patches, clumps of ice dropped from a snow plow, wind drifts of snow, animals or birds out of your line of sight. While checking out the runway surface, check the grass near the runway for animals or birds.

Walk, if it is safe and legal to do so, or taxi the entire runway length to check the surface. An assumption that the rest of the runway is in the same condition as the piece you are sitting on has resulted in more than one aircraft getting bent.

We should not assume that conditions are safe just because we are landing at an airport, or that a strip is safe because someone said so. The few minutes spent doing a precautionary approach may save us a lot of down time.

Dale Nielsen is an ex-Armed Forces pilot and aerial photography pilot. He lives in Abbotsford, B.C., and currently flies MEDEVACs from Victoria in a Lear 25. Nielsen is also the author of seven flight training manuals published by Canuck West Holdings. Dale can be contacted via e-mail: dale@flighttrainingmanuals.com. △

Underwater Egress Testimonials Validate Process

by Bryan Webster, Aviation Egress Systems, Victoria, British Columbia

My passion for underwater egress started—ironically—in 1977 after being initiated to a high-speed water impact as a passenger in a Cessna 150. In spite of that incident, I received a float endorsement the following year, went on to a fulfilling commercial pilot career and a few years later, in 1998, I decided to become an underwater egress and survival skills course provider. Since then, I have observed more than 4 000 egress students and their behaviour while training at aquatic facilities.

Putting into words how disorientation and panic are associated with underwater submersion in an inverted aircraft is very difficult. Following an impact and submersion, the sudden change to cold water and to a dark, foreign environment can often prove overwhelming when time is of the essence; more often than not, survival instincts take control and people tend to panic, limiting their ability to successfully locate the elusive door mechanisms or other emergency exits.

Short of attending a training session in person, real life testimonials offer wonderful educational insights on this topic. A few years ago, I received a call from Brenda Matas, who had been traumatized in a floatplane accident years previous. I explained the program and what it could do for her. She decided to attend one of our classes and try to relive the experience, only this time with a positive outcome.

Brenda had been a passenger sitting beside her husband who was piloting their Super Bushmaster on floats. Shortly after takeoff, the aircraft stalled and impacted the water hard enough to blow out the front window and badly damage the aircraft. She recounted that during the impact, there was intense water pressure violently forcing her backwards, and her only thoughts were not to do anything until it all stopped. Fortunately, the aircraft remained upright but water was rapidly flooding the cabin.

Brenda quickly undid her seat belts and assisted her unconscious husband who had sustained minor head injuries. Once he regained consciousness, they quickly escaped through the side window as the aircraft inverted and began to sink. Soon after, paddles and life vests were collected from the debris floating freely about the downed craft. Fortunately for Brenda and her husband, a pleasure boat appeared shortly after the incident and the pair was rescued and given medical assistance.

Brenda Matas with her Super Bushmaster

For Brenda, this was the end of her flying days but the beginning of a nightmare, which began with agonizing dreams of being trapped under water and searching in vain for non-existent passengers, until she would wake up shaking, sweating and crying. Two years later, once their aircraft had been repaired, she attempted to regain currency by flying with an experienced instructor. However, solo flight brought back the post-crash anxiety, so Brenda and her husband seriously considered giving up flying altogether and selling their aircraft.

This is when Brenda heard about underwater egress training and called me to discuss her options. After a number of discussions, she eventually agreed to attend the course and to face her fears. However, when Brenda arrived at our pool facility, she was physically shaking and had serious doubts about attending the program. We assured her that the training was professionally supervised, safe, and that she could start with the classroom session and see how she felt afterwards. She agreed, and took part in class discussions on how to handle and think about ditching, while sharing her story with her supportive group of classmates.

In the pool, she again showed signs of reluctance and viewed our equipment as terrifying. Only after watching the other students take numerous turns in the simulators did she agree to do it. At the end of the day, Brenda was calm and reacting in the appropriate manner, which helped her overcome her past negative experience.

In Brenda's words:

> *Bryan knew what I did not. He knew I had to go back to that underwater experience again and that was why he was so supportive. I finally worked up the courage to take the course and I am very happy that I did. Huge progress has been made from the gut wrenching apprehension at every landing to now having the confidence that I can think my way through an underwater egress. I now sleep well at night and plan to take the course again in the future.*
>
> *Thank you.*

A second testimonial for the underwater egress training came from a passenger, and stemmed from a more recent occurrence. There was a terrible floatplane accident in the Gulf Islands near Victoria, B.C. a couple years ago. I received a call from a person who requested underwater egress training as she had been in the area when the mishap took place. After the training I received a letter from her describing the event and how it had affected her.

> *Dear Bryan,*
> *I am a frequent floatplane passenger. I used to work on a project that required me to travel by floatplane from Seattle to the San Juan Islands weekly for about 5 years. I have always been concerned with the door operation on floatplanes. The small recessed handles are not easy to operate, even in the best of conditions. I now live on Saturna Island, B.C. Last fall, a floatplane went down just south of our home and I helped friends and neighbours search for survivors. Needless to say, this terrible accident has affected me deeply.*
>
> *After the accident, I contacted a commercial floatplane pilot and he suggested that I consider taking underwater egress training. I came to your class prepared with both a strong desire to learn how to survive a floatplane ditching plus a strong desire to help make floatplane aviation safer. The training was excellent and in fact was a real eye-opener. This experience showed me how challenging it is to get out of an inverted aircraft in the water in the best of conditions.*
>
> *I would recommend this type of training to everyone who flies over water. In fact, it caused me to look at how to get out of any submerged vehicle in a whole new way.*
>
> *Sincerely, Priscilla*

These two stories show how devastating aircraft accidents can be and how they can affect people's lives. Over the last few years there have been many floatplane safety-related initiatives including new promotional campaigns, improvements in aircraft emergency exit doors and windows, enhanced pre-flight safety briefings by operators, industry meetings to discuss floatplane safety, and of course a strong push to encourage licensed personnel—and passengers—to attend underwater egress training. This training not only explains the perils and how to recognize them, but it also provides the knowledge and confidence required to escape a submerged aircraft should the unthinkable happen.

Bryan Webster is a commercial pilot, underwater egress and survival skills course provider, and past recipient of the Transport Canada Aviation Safety Award. He can be reached at info@dunkyou.com. △

Major Accident Report: VFR into IMC Claims Seven

The following article is a condensed version of Transportation Safety Board of Canada (TSB) Final Report A08P0353, a high-profile accident which took seven lives. There is a universal lesson from this extensive report.

Summary

On November 16, 2008, at about 1013 Pacific Standard Time, an amphibious Grumman G-21A departed from the water aerodrome at the south terminal of the Vancouver International Airport (CYVR), B.C., with one pilot and seven passengers for a flight to Powell River (CYPW), B.C. Approximately 19 minutes later, the aircraft crashed in dense fog on South Thormanby Island, about halfway between Vancouver and Powell River. Local searchers located a seriously injured passenger on the eastern shoreline of the island at about 1400. The aircraft was located about 30 minutes later, on a peak near Spyglass Hill, B.C. The pilot and the six other passengers were fatally injured, and the aircraft was destroyed by impact and post-crash fire. The emergency locator transmitter (ELT) was destroyed and did not transmit.

History of the flight

The pilot reviewed and discussed the weather with company dispatch at 0930 and was advised to proceed to Toba Inlet if the weather did not permit landing at Powell River. The aviation routine weather report (METAR) issued at 0900 for Vancouver recorded the wind as 110°T at 10 kts and 2 ½ statute miles (SM) visibility in mist. Cloud cover formed a ceiling at 500 ft above ground level (AGL). The temperature was 10°C, the dewpoint 9°C. Low ceilings and visibility along the coast for the area of the flight route were forecast by Environment Canada. Although the reported weather at the Toba Inlet destination was above VFR limits, weather at CYVR and CYPW was below VFR limits at the scheduled departure time.

Following the weather briefing, the pilot proceeded to the aircraft to load the cargo and board the passengers. During his pre-flight briefing, he advised the passengers that the flight would be conducted at low altitude and that if anyone was concerned, they could deplane. No one deplaned. The aircraft was released by dispatch at 1001.

The automatic terminal information service (ATIS) issued for CYVR at 1009 reported that the wind had decreased to 8 kts and visibility had decreased to 2 SM. The pilot requested and received authorization from Vancouver air traffic control (ATC) to depart under special VFR (SVFR) via the SALMON NORTH departure. This published VFR floatplane route requires aircraft to be equipped with an area navigation system such as a global positioning system (GPS) to identify the SALMON VFR callup/checkpoint, about 6 NM offshore. At approximately 1013, the aircraft departed the water aerodrome westbound towards the SALMON VFR checkpoint. The accident flight was the only fixed-wing VFR departure from the water aerodrome or CYVR before 1049 that day because other operators had cancelled or delayed their flights due to the low visibility.

About three minutes after takeoff, approximately 2 SM east of the SALMON VFR checkpoint, ATC approved a right turn out of the CYVR control zone (a modification to the published SALMON NORTH departure route). At this point, the aircraft turned onto a track of about 308°T. A slight course change to the west was made after which the aircraft resumed the 308°T track until radar coverage ended. About four minutes after takeoff, the pilot reported to CYVR tower that the visibility was about 2 to 2 ½ SM, and that he could probably *climb* to 200 to 300 ft ASL. About six minutes into the flight, and about two minutes before exiting the CYVR control zone, the pilot reported his position as 7 ½ NM from CYVR and noted that visibility had improved to about 4 SM. The majority of the route was greater than 4 NM from land or other discernable features to assist navigation. The last communication from the pilot was at about 1021, when he advised ATC that he was clear of the zone.

The first nine minutes of the flight appeared on CYVR radar, ending about 21 NM northwest of CYVR, about 15 miles southeast of the accident site. Radar returns show that the aircraft's ground speed remained steady around 140 kts, normal cruise speed for this aircraft, allowing for the 8-kt to 15-kt tailwind encountered between CYVR and South Thormanby Island. Although there was no intervening terrain between the radar source and the aircraft, the radar coverage was likely limited because of the low altitude at which the aircraft flew. Of 110 valid radar returns, 10 returns (9 percent) showed the aircraft's altitude as 0 ft ASL, 96 returns (87 percent) showed the altitude as 100 ft ASL, and 4 returns (4 percent) showed the altitude as 200 ft ASL. No radar returns showed the aircraft's altitude higher than 200 ft ASL.

Approximately 12 minutes after departure, the operator dispatch tried unsuccessfully to contact the pilot to advise him that a special weather observation at CYPW indicated that visibility had deteriorated to ⅜ SM in fog and remained below VFR limits. Shortly after 1032, local authorities learned of a probable aircraft crash in dense fog on South Thormanby Island.

At 1110, 15 minutes after the aircraft's estimated time of arrival (ETA) at CYPW, employees from the operator at CYPW called their dispatch centre in Vancouver to say that the aircraft had not arrived. The dispatchers determined that the last recorded position was at 1025 near Sechelt, just over one third of the distance from Vancouver to Powell River. At 1210, dispatch contacted the Victoria Joint Rescue Coordination Centre (JRCC) to report the aircraft overdue. Poor visibility around the island due to fog and cloud prevented airborne search and rescue (SAR) efforts.

Area map with relevant weather information locations available to the pilot

The wreckage was located at about 350 ft ASL on the northeast side of an unnamed 400-ft peak, about one third of a mile south-southeast of Spyglass Hill on South Thormanby Island. The wreckage was examined to the extent possible; no pre-impact mechanical failures were noted.

The pilot was certified and qualified for the flight in accordance with existing regulations. The operator's management had met with the pilot three times to discuss concerns they had with his decision making. The last meeting, about three months before the accident, was held because management was concerned that he was completing trips in what other pilots deemed to be adverse wind and sea conditions. The company believed that this behaviour was causing other pilots to feel pressured to fly in those conditions and was also influencing customer expectations. At least one fishing lodge owner favoured the accident pilot because he flew customers in and out when other company pilots would not because they felt that the conditions were too risky.

The day before the accident, the pilot of a float-equipped aircraft encountered a 400-ft ceiling and estimated 1 SM visibility near Powell River and made a precautionary landing on the water to wait out the conditions. That pilot subsequently observed a Grumman Goose fly by in these conditions. Records showed that the Grumman Goose was piloted by the accident pilot.

Decision making

Pilot decision making (PDM) is critical to flight safety. PDM can be defined as a four-step sequence: the gathering of information, the processing of that information, making a decision based on possible options, and then acting on that decision. Once a decision has been implemented, the process starts over again as the individual now gathers information to monitor the effectiveness of the decision. Based on how that information is processed, the individual then continues through the rest of the process, and so on. Each stage in the four-step PDM process is susceptible to error. During the information-gathering step, misdirected attention can cause critical cues to go undetected. In addition, biases may prevent a pilot from recognizing cues that are different from those expected. The processing of information stage will introduce errors into the PDM process if the information is incorrect, distorted, incomplete, or misinterpreted. The assessment of the available options involves a subjective risk assessment based on experience and knowledge. Pilots usually decide on the option they perceive as most likely to result in the best outcome given their goals. The last step in the process is to implement the option that has been selected as the most appropriate. Errors at this step of the process are typically the result of implementing an inappropriate response or improperly carrying out the correct action.

Pilots' decisions can be influenced by a wide range of factors such as perception of the situation, experience, training, abilities, expectations, goals and objectives, organizational and social pressure, time-criticality and contextual elements. A VFR pilot's decisions are largely influenced by the assessment of existing weather information, the availability of additional navigational aids, and previous experience with a route. Once a decision is made to depart or continue along a route, pilots have a tendency to continue with the selected course of action unless there are compelling reasons not to do so. Additionally, pilots often seek out elements that reinforce, not contradict, the decision made (that is, confirmation bias). Successful experience under similar circumstances can make pilots very reluctant to select a different course of action. If a pilot is suddenly faced with additional unexpected cues from the environment, there is a danger that the relevant cues go unnoticed. This can occur due to mental processing limitations as information competes for a pilot's attention. Relevant cues can also be missed by a pilot if they are deemed less important than others, leading a pilot to focus on cues that may erroneously support the pilot's preferred course of action. In this occurrence, the pilot's safety significant decisions were the decision to take off and the decision to continue the flight into adverse weather conditions.

VFR-into-instrument meteorological conditions accidents

Transportation Safety Board (TSB) data show that continued VFR flight into adverse weather represents a significant threat to aviation safety. While VFR-into-instrument meteorological conditions (IMC) accidents account for a relatively small portion (less than 10 percent) of all reported accidents, approximately 55 percent of those VFR-into-IMC accidents were fatal, compared to 10 percent of all other accidents. An enormous amount of research and many studies have been conducted to identify the causes of continued VFR-into-IMC accidents. Some of the main causes of these accidents are as follows:

- VFR pilots can be overly optimistic on the probability of having to fly from VFR-into-IMC, and on their own abilities to fly out of IMC if encountered (ability bias);
- Incorrect situational assessment can cause pilots to prolong flight into deteriorating weather because they do not realize that they are doing so;
- Decision framing can play a role. If pilots frame their decisions in terms of potential losses (that is, revenue, etc.), they are more likely to prolong flight into deteriorating weather;
- Pilots are motivated to complete their flights; and
- Pilots may exhibit greater risk-taking behaviour as more time and effort is invested in a flight.

Analysis

Given the conditions at takeoff and at the accident site, as well as the forecast and reported conditions for the en route section, it is likely that most of the flight was conducted below the required VFR minima. The conditions present on the day of the occurrence would have resulted in a high likelihood that IMC conditions would be encountered. The visibility portrayed in the photograph as the aircraft taxied into the river at Vancouver (see Photo 1) displays conditions below SVFR minima for fixed-wing aircraft.

A supplementary report from the Merry Island lighthouse indicated marginal visual meteorological conditions (VMC). Lighthouse reports have traditionally provided VFR pilots on the coast with a valuable resource; however, in this case, the report was inaccurate. This may have contributed to the pilot's conclusion that weather along the route was acceptable.

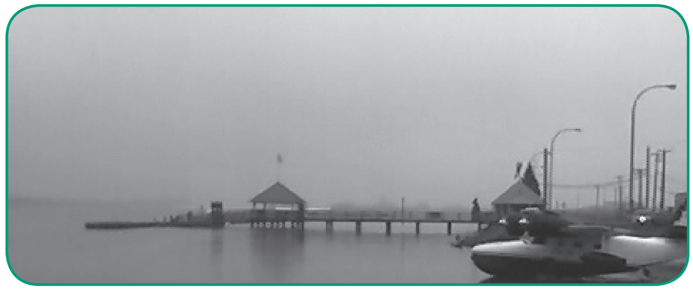


Photo 1. Aircraft entering river for takeoff (accident flight.) Photo courtesy of Mr. Rich Malone, who captured it with his cell phone.

Photo 2. Same location as Photo 1 taken on clear day

During his pre-flight briefing, the pilot advised the passengers that the flight would be conducted at low altitude and that, if they were concerned, they could deplane. This is not a normal part of the pre-flight briefing and indicates that the pilot was aware that the weather along the route was likely to be poor enough that, in order to maintain ground reference, the flight would have to be conducted at a lower altitude. However, the special weather reports (SPECI) issued at 0925 for Powell River showed a marginal improvement that the pilot could have interpreted as the beginning of a trend. This is inherently risky because a single weather report does not confirm that a trend has commenced. Although the large majority of weather information indicated low cloud and poor visibility along the route, the marginal improvement at Powell River and inaccurate information from Merry Island may have contributed to the pilot's decision that weather along the route would be sufficient for a low-level VFR flight.

The pilot's commitment to the decision to depart would have increased after boarding passengers, loading baggage, and starting the engines. Once ATC approved the pilot's request for SVFR, the onus fell on the pilot to ensure that weather outside of the control zone would permit continued flight under VFR. When departing under SVFR, VFR pilots must have an alternate plan if below-VFR weather conditions are encountered when they leave a control zone. The pilot did not request the latest available weather reports (actual weather at 1000) to determine if the weather along the planned flight route was indeed improving. Had this been done, the deteriorating weather in Powell River would have given the pilot the opportunity to reconsider his decision to depart. When the aircraft departed, the visibility on the river was little more than ½ SM.

There are indications that the accident pilot had a tendency to push the weather. For instance, the day prior, the pilot was flying in below-VFR conditions. The pilot's decision to depart was likely affected by confidence gained through previous successes under similar conditions.

Once airborne, the options available to the pilot were to continue on the planned route, alter the route, return to CYVR, divert to another aerodrome, or land on the water. All these options involved risks. Since he had been navigating from SALMON using GPS, he likely relied heavily on the GPS for navigation in the absence of adequate visual cues. As he approached Thormanby Island, it is highly likely that the pilot expected that he would regain adequate visual reference with the ground. However, it is difficult to accurately assess visibility over a featureless water surface, and it likely was not apparent to the pilot that the visibility had become so poor that a change of plan was required. When the pilot finally sighted Thormanby Island, the aircraft was too close for the pilot to be able to avoid colliding with terrain.

Several of the factors that influence a pilot's decision to continue flight from VFR into IMC existed in this accident: previous successes in low visibility, difficulty in assessing actual visibility, commitment to a chosen course of action, the consequences of changing the chosen course of action, and ability bias.

It is likely that one or more of these factors were contributory to this accident.

CFIT

The accident flight was conducted in meteorological conditions below VFR minima. There is no indication that the pilot attempted to land on the water, or to turn around, in the face of extremely low visibility and ceilings. It is highly likely that the pilot was relying on the GPS for navigation and that, as he approached Thormanby Island, his attention shifted from the GPS to looking outside the aircraft. While flying in fog, a controlled flight into terrain (CFIT) occurred during an attempt to avoid terrain. No evidence was found to indicate that the aircraft was out of control before impact.

Wreckage of the Grumman Goose being examined by an accident investigator from the Transportation Safety Board of Canada.

Damage to the aircraft and to the trees at the accident site indicated the aircraft's speed and attitude immediately before impact. The long, straight, rising angle of the swath cut through the trees and the extreme damage to those trees and to the aircraft indicate that the aircraft was flying at relatively high speed and climbing rapidly before collision with terrain. Extreme damage to all the propeller blades indicates that high engine power was being developed. This combination indicates that the pilot reacted to sighting terrain seconds before impact and pulled the aircraft up into a rapid climb. However, the pull-up was initiated too late to out-climb the rising terrain that lay ahead.

The accident aircraft's flight at high speed while at low altitude and in low visibility entailed significant risks. These include: decreasing the available time to plan and react to an emergency, limiting the available options in the event of an emergency, increasing the likelihood of inadvertent descent into water or ground — particularly during a manoeuvre such as turning around — and increasing the likelihood of collision with ground-based obstacles and birds.

Findings as to causes and contributing factors

1. The pilot likely departed and continued flight in conditions that were below VFR weather minima.

2. The pilot continued his VFR flight into IMC, and did not recognize his proximity to terrain until seconds before colliding with Thormanby Island, B.C.

3. The indication of a marginal weather improvement at Powell River, B.C., and incorrect information from Merry Island, B.C., may have contributed to the pilot's conclusion that weather along the route would be sufficient for a low-level flight.

Findings as to risk

1. The reliance on a single VHF-AM radio for commercial operations, particularly in congested airspace, increases the risk that important information is not received.
2. Flights conducted at low altitude greatly decrease VHF radio reception range, making it difficult to obtain route-related information that could affect safety.
3. The lack of PDM training for VFR air taxi operators exposes pilots and passengers to increased risk when faced with adverse weather conditions.
4. Some operators and pilots intentionally skirt VFR weather minima, which increases risk to passengers and pilots travelling on air taxi aircraft in adverse weather conditions.
5. Customers who apply pressure to complete flights despite adverse weather can negatively influence pilot and operator decisions.
6. Incremental growth in the operator's support to the client did not trigger further risk analysis by either company. As a result, pilots and passengers were exposed to increased risks that went undetected.
7. Transport Canada's (TC) guidance on risk assessment does not address incremental growth for air operators. As a result, there is increased risk that operators will not conduct the appropriate risk analysis as their operation grows.
8. Previous discussions between the operator and the pilot about his weather decision making were not documented under the company's safety management system (SMS). If hazards are not documented, a formal risk analysis may not be prompted to define and mitigate the risk.
9. There were no company procedures or decision aids (that is, decision tree, second pilot input, dispatcher co-authority) in place to augment a pilot's decision to depart.
10. Because the aircraft's ELT failed to operate after the crash, determining that a crash had occurred and locating the aircraft were delayed.
11. On a number of flights, pilots on the Vancouver-Toba Inlet route, B.C., departed over maximum gross weight due to incorrectly calculated weight and balances. Risks to pilots and passengers are increased when the aircraft is operating outside approved limits.
12. The over-reliance on GPS in conditions of low visibility and ceilings presents a significant safety risk to pilots and passengers.

Safety action taken

Operator

Immediately following the accident, the operator suspended air taxi operations and implemented several actions to reduce risk before resuming operations. Since then, the company has implemented several other voluntary safety actions that exceed TC's requirements for VFR air taxi operations. These additional safety actions include:

- Raising the minimum departure visibility from the TC-regulated 2 SM to a company limit of 3 SM from a base of operations for VFR aircraft.
- Providing a PDM course, including how GPS affects decision making, to all the VFR floatplane pilots and adding PDM training to the company VFR training syllabus.
- Implementing a dispatch procedure that gives the dispatcher/flight-follower co-authority over the release of the aircraft.
- Conducting risk assessments of VFR routes and operations (including reviewing weather, wind, and water condition limitations) and developing a destination-specific risk rating system.
- Conducting line checks at least three times a year on each VFR pilot.
- Regularly monitoring the stored data of the GPS carried on the aircraft to ensure that pilots are flying within company and *Canadian Aviation Regulations* (CARs) limits.
- Installing aviation-specific satellite tracking systems in all VFR aircraft to replace the satellite messengers previously installed in those aircraft and eliminate the need to monitor GPS data.
- Conducting annual company culture surveys to identify areas needing improvement.
- Providing accident investigation training for key company personnel.
- Revising the company's SMS manual to include revised risk assessment procedures and accident investigation training.

- Having pilots and dispatchers document circumstances where poor weather affects a flight and using those data for track monitoring and to determine risk exposure over an extended period.

Transport Canada

In December 2009, as a follow-up to the *Safety Study on Risk Profiling the Air Taxi Sector in Canada*, TC made available on its Web site the *Pilot Decision Making Simulator*, developed by inspector Gerry Binnema (now retired from TC). This unique tool allows pilots to practice aviation-related decision making in a low-risk environment. The simulator can be found on TC's website at www.tc.gc.ca/eng/civilaviation/regserv/safetyintelligence-airtaxistudy-simulation-menu-1829.htm.

Transportation Safety Board of Canada

On the day this report was publicly released, the TSB issued a communique to the aviation community warning that flying in low visibility is causing too many deaths in Canada. TSB's Bill Yearwood said, "There are some hard lessons that need to be learned and re-learned in aviation and this is one of them."

Yearwood went on to say, "VFR pilots must be able to see the ground below and ahead of them at all times. It's almost impossible to avoid obstacles and rising ground when clouds are low, the visibility is poor and you're flying at twice the speed of cars on the highway."

Aircraft colliding with land or water under crew control are among the deadliest accidents in aviation. They account for 5 percent of accidents but 25 percent of fatalities in Canada. The risk is even greater when aircraft venture into mountainous terrain in poor weather. That is why Collisions with Land and Water is one of the nine critical safety issues on the TSB's highly publicized safety Watchlist.

"Competition is strong and customers can put pressure on companies to complete flights", says Yearwood. "We need to see better decisions from companies and pilots to prevent these kinds of accidents."

To read the complete final report A08P0353 on this occurrence, visit the TSB Web site at www.tsb.gc.ca. △

Optimistic and Ability Biases: "VFR flight into IMC won't happen to me; but if it does I can get out of it!"

by Dale Wilson, Professor, Aviation Department, Central Washington University

The following article is based on research published by the author and his colleague in a paper presented at the 11th International Symposium on Aviation Psychology, *in Columbus, Ohio. It serves as an addendum to the preceding story, which touched on biases, particularly the ability bias.*

Do you think you're less likely than other pilots to experience a VFR-flight-into-instrument meteorological condition (IMC) accident? Do you think you're better at avoiding VFR flight into IMC or successfully flying out of IMC should you inadvertently encounter such conditions? These are questions my colleague and I sought to answer as we reflected on the preponderance of scientific evidence indicating that most people are unrealistically optimistic and are overconfident in their abilities. For example, when university students were asked to rate the likelihood of owning their own home, obtaining a good job after graduation, or living a long life, *almost all of them* believed they had a greater chance than their classmates; when asked to rate their odds of developing a drinking problem, getting divorced soon after marriage, or being fired from a job, *almost all of them* believed they had a lower chance than their classmates. Since it's impossible for the majority of people in a given group to have a greater (or lesser) chance of experiencing a positive (or negative) event than the median of the group, some kind of *optimistic bias* must be at work. This bias is seen in the high majority of cigarette smokers who believe they are at less risk of developing smoking-related health problems than other smokers; in drivers who believe they are less likely than other drivers to be involved in an automobile accident; and, in general aviation (GA) pilots who believe they are less likely than other pilots to experience an aircraft accident.

Most people also believe they are superior to others when it comes to their own skills and abilities. For example, a high majority of managers rate their managerial skills as higher than those of their respective peers; U.S. college professors think they do above average work compared to other professors; Americans believe they are more intelligent than their fellow citizens; and, automobile drivers believe they are better, and are less likely to take risks, than their fellow drivers. Unfortunately, this *above average effect*, or *ability bias*, also seems to be evident in pilots; studies confirm that most pilots think they are safer, are less likely to take risks in flight, and possess greater flying skill than their peers.

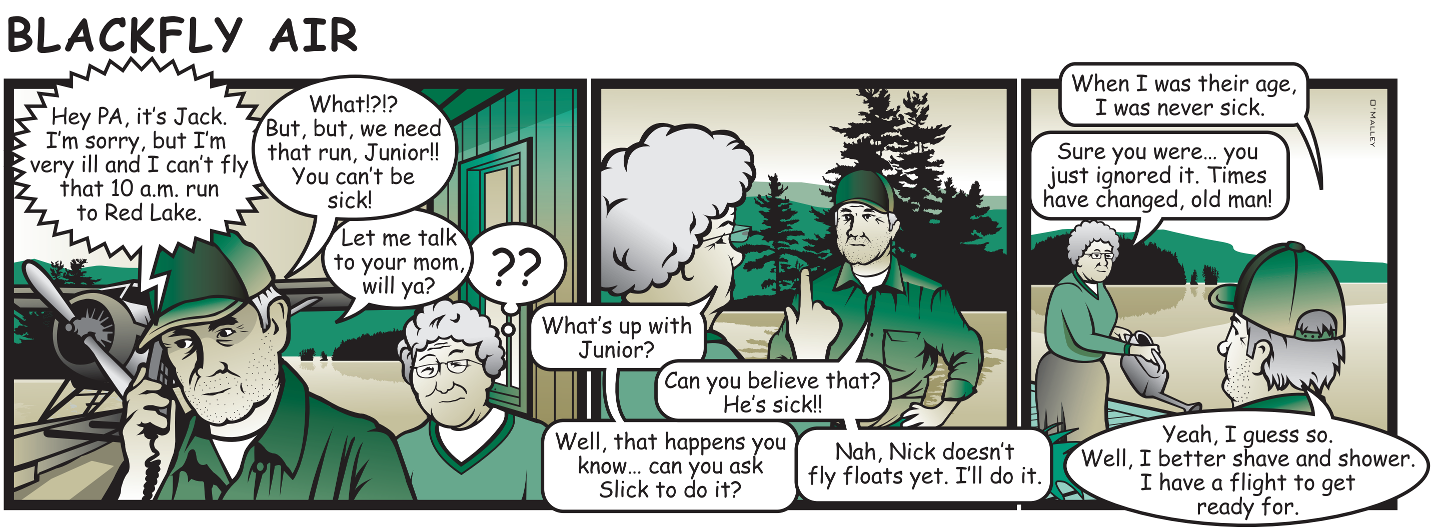
We administered a questionnaire to 160 pilots asking them to compare themselves to other VFR pilots with similar flight background and experience as their own when rating themselves for the following: their *chances of experiencing* an accident due to inadvertent flight into IMC; their *ability to avoid* inadvertent flight into IMC; and, their *ability to successfully fly out of* IMC. The results were unequivocal: participants believed they were less likely than others to experience a VFR-into-IMC accident and believed they were better than average at avoiding inadvertent flight into IMC and successfully flying out of IMC.

Clearly, all of us can't be above average, nor do all of us have a lower-than-average chance of experiencing an aircraft accident, yet that is what most of us believe. Why is that? These biases are part of a family of what are known as *self-serving biases* that serve to protect our ego by painting an unrealistic positive view of ourselves. In fact, the strength of these biases is significantly reduced in mildly depressed people and for those with lower self-esteem; compared to so-called mentally healthy individuals (presumably most pilots), studies indicate that these people actually exhibit more accurate and realistic perceptions of reality! There is also considerable evidence supporting a link between a positive, optimistic approach to life and reduced susceptibility to physical illnesses. The troubling irony is that even though these biases seem to be good for our overall physical and mental health, they can also lead to unsafe behavior.

In spite of a gradual decline in the percentage of weather-related accidents, VFR-into-IMC is still the leading cause of fatal GA weather-related accidents and continues to be a leading cause of all fatal aviation accidents in Canada and the United States. Even though a variety of environmental factors such as mountainous terrain and darkness play a role, investigators consistently cite limitations in planning, judgment, and decision making as reasons pilots initiate or continue VFR flight into unsuitable weather.

The optimistic and ability biases are only two of several complex and often unconscious factors that contribute to what the aviation safety community has historically cited as the major cause of these accidents: *get-home-itis*. Added to this malady is the strong influence other people can have on pilot decision making: compared to other aircraft accidents, a recent study found a significantly higher percentage of VFR-into-IMC accident flights carry passengers on board. Therefore, to protect yourself from the VFR-into-IMC trap, it is vital that you recognize that your decision making is not always rational, and if left unchecked, the biases we all appear to be vulnerable to could prod you into going somewhere you shouldn't.

Dale Wilson teaches aviation safety and human factors courses at Central Washington University in Ellensburg, WA. He has written several articles on night flying, visual illusions, and VFR flight into IMC. Links to his work, including the original research paper this article is based on—"Optimistic and Ability Biases in Pilots' Decisions and Perceptions of Risk Regarding VFR Flight Into IMC"—*can be found at* www.cwu.edu/~aviation/faculty_wilson.html. △



Repair and Modification of Amateur-built Aircraft

by Maurice Simoneau, Civil Aviation Safety Inspector, Aircraft Maintenance and Manufacturing, Standards, Civil Aviation, Transport Canada

Recreational aviation

Owners of recreational aircraft, including amateur-built aircraft, sometimes have the impression that their recreational aviation activities take place outside the mainstream of civil aviation, and therefore that certain requirements of the *Canadian Aviation Regulations* (CARs) do not apply, or have little application, to their aircraft.

In recent years, the regulatory burden applicable to recreational aviation has been made somewhat lighter and clarifications have been made where necessary. For example, with aircraft operating under a special certificate of airworthiness in the amateur-built classification, entries regarding the technical records for the airframe, engine and propeller may be kept in the journey log (see CAR 605.92(3)). In the case of airworthiness directives, a clarification was made about exemption from requirements for owners of aircraft in the amateur-built or owner-maintenance classification (see CAR 605.84(1)*(b)*).

Despite the above, unless the CARs say otherwise, amateur-built aircraft are subject to the same maintenance requirements as aircraft for which the Minister has issued a type certificate.

Maintenance

All maintenance tasks and all elementary work (see Appendix A of CAR standard 625) must be entered in the aircraft's technical record. Aside from elementary work, a maintenance release for all maintenance tasks performed (see CAR 571.10) can be signed by the owner of the aircraft or by an aircraft maintenance engineer (AME) (see CAR 571.11).

This rule also applies to repairs and modifications to amateur-built aircraft, the subject of this article. CAR 571.06 describes the conditions applicable to repairs and modifications to an amateur-built aircraft. Paragraphs 571.06(1) and (2) are of the greatest interest in this case.

CAR 571.06

The first two paragraphs of CAR 571.06 address repairs and modifications. They stipulate the following:

(1) Except as provided in subsection (5) and in the case of aircraft that are operated under a special certificate of airworthiness in the owner-maintenance classification, a person who signs a maintenance release in respect of a major repair or major modification on an aeronautical product shall ensure that the major repair or major modification conforms to the requirements of the relevant technical data

(a) that have been approved or the use of which has been approved within the meaning of the term "approved data" in section 571.06 of the *Airworthiness Manual*; or
(b) that have been established within the meaning of the term "specified data" in section 571.06 of the *Airworthiness Manual*.

(2) Except as provided in subsection (5), a person who signs a maintenance release in respect of a repair or modification, other than a major repair or major modification, shall ensure that the repair or modification conforms to the requirements of the relevant technical data within the meaning of the term "acceptable data" in section 571.06 of the *Airworthiness Manual*.

Admittedly, CAR 571.06 is difficult to understand, and the somewhat convoluted wording does not help. To make it easier to understand, here is a simplified version of these two paragraphs:

a) all repairs and modifications must be performed in accordance with acceptable technical data, within the meaning of the term "acceptable data" in section 571.06 of the *Airworthiness Manual*;
b) all major repairs and major modifications on an aircraft for which a type certificate has been issued or accepted by the Minister for the purposes of issuing a certificate of airworthiness must be performed in accordance with either "approved" technical data, within the meaning of the term "approved data" in section 571.06 of the *Airworthiness Manual*, or "specified" technical data, within the meaning of the term "specified data" in section 571.06 of the *Airworthiness Manual*;

c) aircraft for which a special certificate of airworthiness in the owner-maintenance classification has been issued are exempt from the requirement to perform major repairs and major modifications in accordance with "approved data" or "specified data", within the meaning of the terms "approved data" and "specified data" in section 571.06 of the *Airworthiness Manual*; major repairs and major modifications may be performed in accordance with "acceptable data", i.e. acceptable to the Minister.

The above version makes it clear that only the general rule in a) applies to amateur-built aircraft. Versions b) and c) above are exceptions to the rule; b) is an exception to a), and c) is an exception to b).

General rule

The general rule, as stated in a) – "all repairs and modifications must be performed in accordance with acceptable technical data, within the meaning of the term "acceptable data" in section 571.06 of the *Airworthiness Manual*" – is applicable to all aircraft, whether certified or not, whether used under a certificate of airworthiness or a special certificate of airworthiness, and whether used for commercial or recreational purposes. The same rule applies to all aircraft, including amateur-built aircraft.

The general rule specifies that technical data must be "acceptable" in order to perform any repair or modification. The data include:

a) drawings and methods recommended by the manufacturer of the aircraft, component, or appliance (manufacturer's maintenance manual, structural repair manual, overhaul manual, service bulletins, technical instructions);
b) Transport Canada advisory documents; and
c) advisory documents issued by foreign airworthiness authorities with whom Canada has entered into airworthiness agreements or understandings such as current issues of Advisory Circular (AC) 43.13-1 and -2 issued by the U.S. Federal Aviation Administration (FAA), Civil Aviation Information Publications issued by the Civil Aviation Authority (CAA) of the United Kingdom, or Advisory Circulars - Joint (ACJs) issued by the Joint Aviation Authority (JAA), or Acceptable Means of Compliance issued by the European Aviation Safety Agency (EASA).

FAA Advisory Circulars 43.13-1B and 43.13-2B are recognized as *the* references for all amateur-built aircraft owners and manufacturers. Whether for repairing fabric coverings, refurbishing tubular members, replacing a wooden part or installing a doubler, AC 43.13 is the go-to source of information.

Methods and drawings set out in airworthiness directives may also serve as acceptable data for repairs or modifications. While amateur-built aircraft owners do not have to comply with airworthiness directives, it is highly recommended that they review applicable directives in order to decide whether to comply on a voluntary basis for the purpose of improving the safety of their aircraft.

However, it is possible that AC 43.13-1B and 43.13-2B do not have the answer for a particular repair or modification required. In such cases, aircraft owners could either develop their own data for a repair or modification, or they could show that their data complies with standards recognized in the aviation community or with generally accepted practices. This technical data does not need to be approved by Transport Canada. The owner must ensure that the data is appropriate to the repair or modification in question. It's a matter of common sense!

The general rule that all repairs and modifications must be performed in accordance with "acceptable" technical data is the only rule that applies to amateur-built aircraft (and to aircraft in the owner-maintenance classification), which greatly simplifies things for the owner. However, it must not be forgotten that a modification may have an impact on structural strength, performance, operation of the power unit, or flight characteristics. A modification must not be taken lightly. It is important to think before acting.

Technical records

Details of the repair or modification must be entered in the journey log or in the technical record, and must be accompanied by the maintenance release. It is important to enter data references; without them, the data has little value. For example, the entry might read:

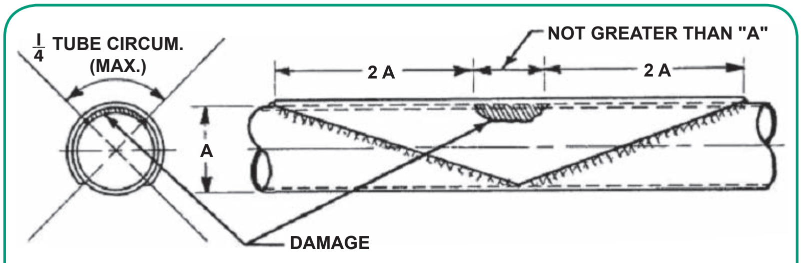


FIGURE 4-36. Welded patch repair.

Lower right fuselage spar, 20 inches from the leading edge of the horizontal stabilizer: repaired by adding doubler, oxy-acetylene weld, repainted. Reference: AC 43.13-1B, chapter 4, section 5, paragraph 4.94 and figure 4-36.

The described maintenance has been performed in accordance with the applicable airworthiness requirements.

[signed] Ty Wright date

Maintenance release

After a repair or modification, owners must not forget the maintenance release, which includes the following statement or similar: "The described maintenance has been performed in accordance with the applicable airworthiness requirements."

Conclusion

Every repair or modification must be performed in accordance with acceptable technical data. This data may include analyses, calculations, references, drawings, or sketches. Every repair or modification must be entered in the appropriate technical record and there must be a maintenance release for it.

If a job needs to be done, it should be done well.

As the owner of an amateur-built aircraft, don't you deserve a job well done? △

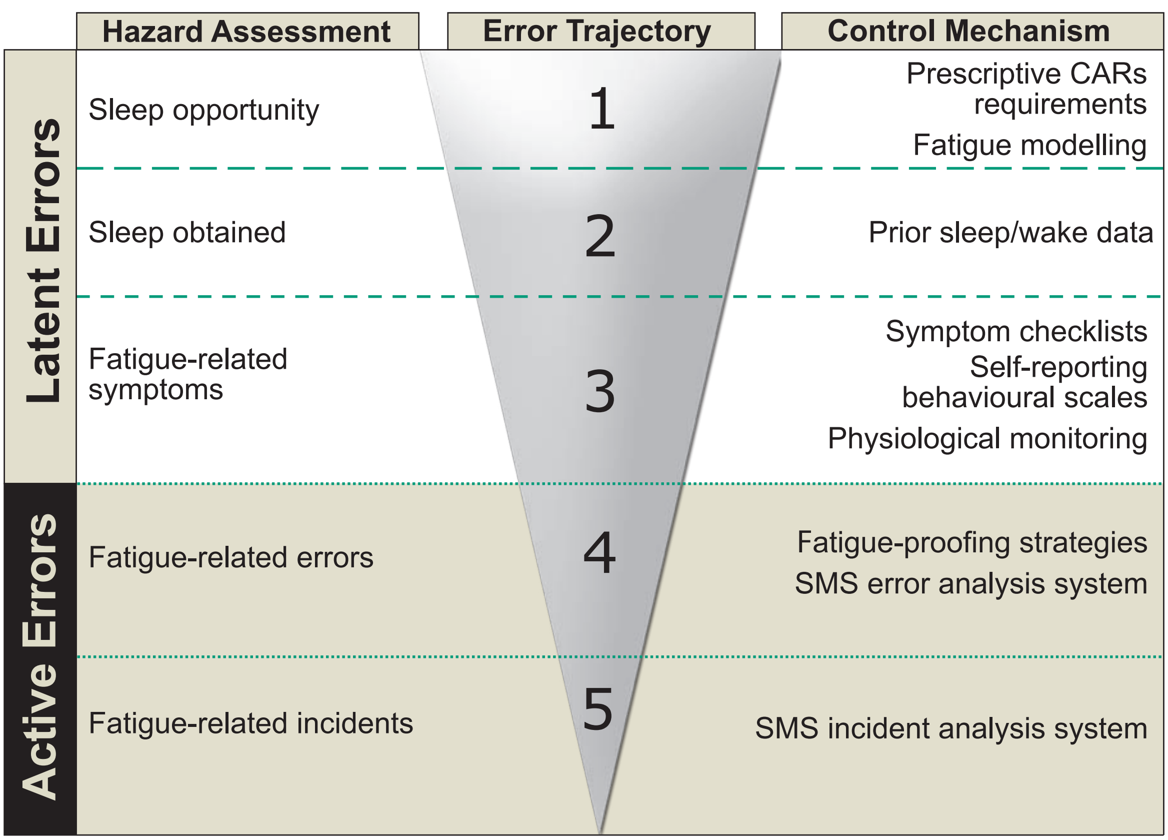
Fatigue Risk Management System for the Canadian Aviation Industry: Introduction to Fatigue Audit Tools (TP 14577E)

This is the sixth of a seven-part series highlighting the work of the Fatigue Risk Management System (FRMS) Working Group and the various components of the FRMS toolbox. This article briefly introduces TP 14577E—Introduction to Fatigue Audit Tools. *Intended for managers, this document provides an overview of tools available to help determine whether scheduling provides employees with adequate opportunities to get sufficient sleep. The complete FRMS toolbox can be found at* www.tc.gc.ca/eng/civilaviation/standards/sms-frms-menu-634.htm. —*Ed.*

Introduction

The purpose of this guide is to provide an overview of various tools and techniques to ensure that work schedules meet the requirements of a Fatigue Risk Management System (FRMS). An effective FRMS consists of several levels of fatigue hazard controls (see *Developing and Implementing a Fatigue Risk Management System* (TP 14575E) for a detailed discussion). One of the first things that companies need to examine is whether the schedule provides employees with an adequate opportunity to get enough sleep to be fit for work (Level 1 control).

Hazard-Control Model for Fatigue Risk Management



Designing a work schedule

In the past, hours-of-service (HOS) rules have been used to ensure that a schedule provides adequate sleep opportunity between shifts and does not result in significant work-related fatigue. In principle, this appears to be a reasonable strategy. However, HOS regulations designed to be applied generically to an entire industry can be inflexible and ineffective for an individual organization. They may not guarantee sufficient sleep opportunity.

In designing an FRMS, it is important to understand that there is no such thing as a perfect schedule. Work schedules need to be structured around competing needs, such as operational safety and employee family and social life. For example, the "family friendliness" of a work schedule is likely to be determined by how much time off it provides during times of high social value (i.e., afternoons, evenings, and weekends). The "sleep friendliness" of a work schedule depends on the breaks it provides during times of high sleep value (i.e., nights between 9 p.m. and 9 a.m.). While sleep should be the primary concern, other factors such as the family and social life of employees should be considered, because they can have a direct effect on whether employees are able to use the time off to sleep. Consulting with employees during the early stages of implementing an FRMS can help find a balance between these competing needs.

Providing adequate sleep opportunity

To determine whether a given schedule may result in work-related fatigue, calculate the sleep opportunity that it provides. There are various ways to do this. This document outlines two methods of managing sleep opportunity:

- *Automated fatigue audit systems*. Biomathematical modelling software has been developed that can predict how much sleep an employee is likely to get in a given schedule. The software is able to calculate a fatigue likelihood score for each employee at any given point in the schedule.
- *Manual fatigue audit systems*. For organizations with relatively simple schedules or that may not want to invest in software, manual calculations can also be performed to generate scores that provide an indication of fatigue likelihood.

We conclude this introduction to TP 14577E by encouraging our readers to view the entire document at www.tc.gc.ca/media/documents/ca-standards/FRMS_14577-eng.pdf. △

TC AIM Snapshot: Shuttle Procedure

A shuttle procedure is defined as a manœuvre involving a descent or climb in a pattern resembling a holding pattern. Shuttles are generally prescribed on instrument procedures located in mountainous areas. In the approach phase, it is normally prescribed where a descent of more than 2 000 feet is required during the initial or intermediate approach segments. It can also be required when flying a missed approach or departure procedure from certain airports. A shuttle procedure shall be executed in the pattern as published unless instructions contained in an ATC clearance direct otherwise.

To ensure that the aircraft does not exceed the obstacle clearance protected airspace during a shuttle descent or climb, the aircraft must not exceed 200 KTIAS while in the shuttle descent or climb, nor exceed one minute outbound still air time. Normal aircraft speed may be flown once the aircraft leaves the shuttle pattern.

(Ref: Transport Canada Aeronautical Information Manual *(TC AIM), Section RAC 10.9)*

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

TSB Final Report A07W0003—Loss of Control—Marginal Weather

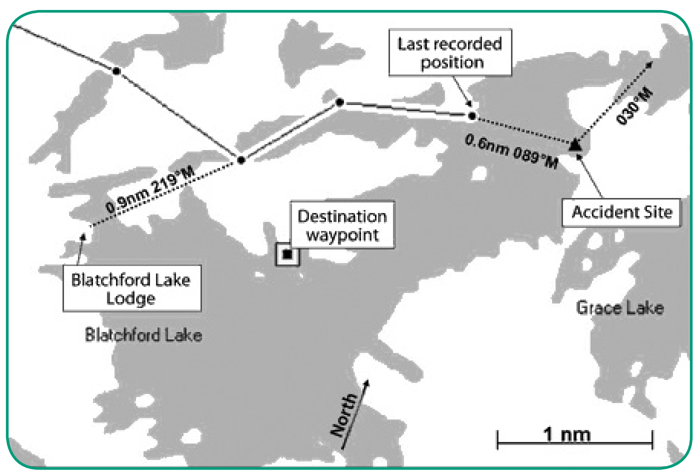
On January 3, 2007, a Cessna A185F departed Yellowknife, N.W.T., at 1019 Mountain Standard Time (MST), with a pilot and three passengers on board, for a round trip flight to Blatchford Lake Lodge, approximately 53 NM southeast. The aircraft was on a company flight itinerary with an estimated time of arrival of 1100. When there was no contact from the pilot by 1300, a communication search and track crawl was conducted by company aircraft, but this was unsuccessful in locating the aircraft. No emergency locator transmitter signal was detected at any time. At 1513, the company reported the aircraft overdue to the flight service station. An active search by the rescue coordination centre was conducted using a number of aircraft. The wreckage of the aircraft was found at 1215, January 4, 2007, on the ice at Blatchford Lake. The pilot and two passengers had sustained fatal injuries, one passenger had sustained serious injuries, and the aircraft was substantially damaged.

Analysis

It was determined that the aircraft stalled while in a left turn at low level. With the forward visibility through the windshield obscured by ice, the pilot was most likely flying with attitude references through his left side window. In a left turn, the descending left wing would have obstructed his visibility, leaving only a view of the snow-covered lake surface below. The conditions would have been conducive to a whiteout situation, whereby the snow-covered lake surface would blend with a snowy, obscured ceiling to disorient the pilot by eliminating all horizon references. The pilot's manoeuvring speed was unknown, but entering a turn would have increased the stall speed, as would the effect of the ice on the wings. The use of flaps would have decreased his stall speed, but the flaps had not been deployed. The stall warning had not activated to warn of the impending stall.

The calculated aircraft weight at impact was just below the maximum gross weight; however, the amount of additional weight of the airframe ice was not quantified. The centre of gravity (CG) was at or slightly aft of the aft limit. This configuration would not have created a problem under normal flight conditions, but the aft CG would have increased the difficulty in recovering from a stall.

Under the operator's Transport Canada exemption for operations below 1 000 ft AGL with less than two miles of flight visibility, the pilot had to be trained in the use of a global positioning system (GPS) receiver. There is no record of his having received the required instruction. The coordinates entered for the lodge were about a mile east of the lodge, and the pilot had turned northeast (away from the lodge) before reaching this waypoint. There is a probability that the pilot abandoned the use of the GPS when he reached the north shore of the lake, and turned left to follow the shore of the lake for navigation, since his visual reference was out his left side window with his windshield obscured by ice. His subsequent flight path continued to track eastward away from the GPS waypoint and away from the lodge, until the aircraft crashed.



Map of area

The pilot was required to have had a minimum of 500 hours in operations under Section 700 of the CARs or equivalent to qualify for low-level/limited visibility flight. He had about 16 hours commercial (Section 700 of the CARs) flying time with about 1500 hours of noncommercial single-engine flying time. He had completed his low-level flying training, but did not adhere to the operations manual requirements that specified that the aircraft was to be operated at 80 knots indicated airspeed (KIAS) with 10° of flap. The aircraft airspeeds varied from 130 KIAS to 77 KIAS, and flaps were not deployed.

The company operations manual specified that the Cessna 185 will not depart into forecast icing conditions. Freezing fog and patchy moderate mixed icing was forecast for the destination area when the aircraft departed, and the pilot report from 0651 reported rime ice upon entering clouds at 1 100 ft ASL. After departure, the pilot had initially climbed to 1 400 ft ASL, then began a continuous descent to about 1 000 ft ASL near his destination. He had encountered icing conditions as forecast and reported, as evidenced by the ice remaining on the airframe after the occurrence. The aircraft was not equipped or approved to operate in icing conditions.

The cargo and baggage was not secured, nor was there any means on board for securing the baggage and cargo to the tie-down rings. Because the primary impact was oriented vertically, the unsecured items probably did not project into the cabin and passengers. It could not be determined whether the baggage carried in the passengers' laps contributed to the severity of their injuries. The survivor was the passenger without baggage in his lap.

Search and rescue (SAR) efforts were delayed for several hours because the emergency locator transmitter (ELT) did not function. The unit was capable of operating, but the impact activation switch (G switch) was oriented to sense a forward impact, not a vertical (downward) impact.

Findings as to causes and contributing factors

1. The aircraft stalled at an altitude too low for the pilot to recover.
2. The aircraft's stall speed and stall recovery characteristics were affected by the left turn, airframe icing, and the aft centre of gravity loading.
3. The pilot's visibility was compromised by the marginal weather conditions and an ice-covered windshield, with a probability that the pilot had entered white-out conditions.

Findings as to risk

1. The pilot self-dispatched on a flight that was not in accordance with the requirements outlined in the company operations manual. He continued the flight after encountering conditions beyond his capabilities in regards to training, equipment, and operating conditions.
2. The baggage and cargo were not secured, and there were no means on board for securing the baggage and cargo to the tie-down rings.
3. Two of the passengers were carrying unsecured baggage in their laps.

Other finding

1. The pilot had not been trained in the use of the GPS as required by regulation for low-level flight/limited visibility flight.

TSB Final Report A07W0099—Load Shift/Loss of Control on Takeoff

On June 2, 2007, a de Havilland DHC-3T Turbo Otter had been loaded with a cargo of lumber at Mayo, Y.T. The aircraft was taxied to the threshold of Runway 06 and the pilot began the take-off roll at 1755 Pacific Daylight Time (PDT). At liftoff, the aircraft entered an extreme nose-up attitude and began to rotate to the right. Shortly thereafter, the aircraft struck the airport ramp. The pilot, who was the sole occupant of the aircraft, was fatally injured. A small post-impact fire was extinguished by first responders.

The aircraft was loaded with a mixture of rough and finished lumber weighing approximately 2 213 lbs. The cargo was composed of six 16-ft rough beams measuring 7 ½ in. by 7 ½ in., a selection of 16-ft rough lumber, and a selection of 10-, 12- and 14-ft finished boards. The lumber was loaded so that all the boards were flush with the front of the cabin. At rest, the aircraft described a 9 degree nose-up attitude, resulting in the cargo being loaded in an "uphill" manner while the aircraft was on the ground (see figure 1). Before the occurrence flight, several loads of lumber had been hauled to the same destination.

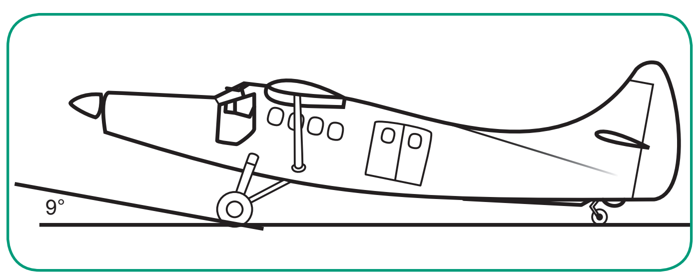


Figure 1: de Havilland DHC-3T Turbo Otter

Recently Released TSB Reports

The load was secured with a single one-inch cargo strap that was placed over the lumber. The strap was fastened to tie-down points located ahead of the rear cargo doors. The floor of the aircraft was plywood. The maximum aft centre of gravity (CG) limit was determined to be 152.2 in. The CG of the occurrence aircraft was calculated to be 154.8 in. aft of the datum, 2.6 in. behind the rearward limit.

There are several documented accidents in the TSB database where the cargo has shifted and resulted in loss of control accidents.

- A85Q0057 – Two fatalities. A float-equipped Cessna 305C stalled with an aft CG and unsecured load.
- A00C0059 – Two fatalities. A DC-3 lost control during a go-around procedure. The aircraft had CG aft of the rear limit, and the cargo was inadequately secured.
- A01W0239 – Three fatalities. A Beech UC45-J lost control after takeoff with an inadequately secured load of moose meat.
- A06P0095 – One serious injury. A Cessna 185B aft CG aggravated by a possible load shift in turbulent conditions led to a loss of control.

Analysis

The aircraft was loaded in a manner that resulted in the CG being aft of the rearward limit. The smooth surface of the finished lumber provided less friction against the plywood cabin floor. The cargo was only secured with one lateral strap and it is likely that the shorter finished boards moved aft during the taxi and take-off roll, which would result in a significant rearward shift of the CG.

The rearward shift of the CG during the taxi and take-off roll resulted in the aircraft pitching nose up, stalling and entering an incipient spin from which the pilot was not able to recover.

Findings as to causes and contributing factors

1. The aircraft was loaded in a manner that resulted in the centre of gravity being aft of the rearward limit.
2. Because the cargo was not properly secured, it shifted towards the rear of the aircraft, resulting in the centre of gravity moving further aft, causing the aircraft to pitch up and stall.

Safety Action

On August 30, 2007, the TSB issued Safety Advisory A07W0099-D1-A1 (*Inadequate Cargo Restraint*) to Transport Canada. The safety advisory suggested that Transport Canada may wish to inform industry of the significance of load shifting on aircraft performance and the need to effectively secure cargo in order to reduce the risk of in-flight load shift. The advisory was published in the *Aviation Safety Letter,* issue 2/2008.

TSB Final Report A07W0150—Power Loss

On August 12, 2007, a Bell 206B Jet Ranger helicopter was over Abraham Lake, Alta., on final approach to the Cline River heliport (CCR5), at approximately 1420 Mountain Daylight Time (MDT) when the engine (Rolls-Royce/Allison 250-C20B) decelerated and flamed out. The pilot entered autorotation and the helicopter descended into the lake, rolled onto the right side, and sank close to shore. The pilot and the passenger in the left cabin seat evacuated the wreckage without assistance. The passenger in the right cabin seat required the pilot's assistance to release the lap belt and exit the wreckage after the cabin became submerged. All three occupants sustained minor injuries. The helicopter was substantially damaged and there was no post-impact fire.

Analysis

The engine lost power and flamed out for undetermined reasons. While no discrepancies that would have prevented normal operation of the engine were identified during bench testing of the Bendix fuel control components, small amounts of unidentified solid contamination were found in several components after disassembly. While small amounts of solid contamination were present, the fuel system components functioned satisfactorily during bench testing; therefore, the possibility that contamination contributed to the loss of power could not be proven or ruled out.

The fuel load on the helicopter at the time of the occurrence could not be determined with certainty, and water contamination was present throughout the engine and airframe fuel systems when the wreckage was recovered. The fuel cell was breached during the accident, which would have allowed water to flow into the fuel cell after the wreckage became submerged. With collective twist grip in the ground idle position and the engine fuel check valve leaking at low pressure, water may have been distributed throughout the fuel system by the boost pumps after the fuel cell filled with water, before the battery became discharged.

Several maintenance-related anomalies were identified during the examination of the engine and airframe. The missing engine data plate, the absence of a current engine log, and the installation of an incorrect power turbine governor (PTG) were indicative of administrative deficiencies, specifically maintenance tracking and record keeping, within the company maintenance program. The leaking compressor discharge pressure (Pc) pneumatic tube, the lack of continuous torque paint on the PTG "B" nuts, the crack in the reducing-tee in the fuel cell, and the internal leak in the check valve assembly in the fuel control unit (FCU) to fuel nozzle fuel line were further indications of weak maintenance practices. While none of these anomalies could be linked directly to the loss of engine power, their presence indicated that maintenance on the helicopter was not being accomplished fully in accordance with the maintenance control manual (MCM) from the contracted Approved Maintenance Organization (AMO), or the operator's MCM.

Findings as to causes and contributing factors

1. The engine lost power and flamed out for undetermined reasons on approach to the Cline River helipad and the helicopter ditched in Abraham Lake.
2. The approach was conducted over water, toward a sloping shoreline that exposed the helicopter to an adverse forced landing environment.

Findings as to risk

1. Small amounts of unidentified solid contamination were found in several engine fuel system components after disassembly, creating the potential for fuel flow anomalies to occur within the engine fuel system.
2. A small air leak was present in the Pc tube, situated between the governor and the FCU, at the "B" nut on the aft side of the governor tee. There was a risk of engine deceleration had the leak rate increased.
3. There was a crack in the end flare on the main fuel line in the fuel cell, where the line attached to the reducer tee-fitting on the aft boost pump. At low fuel levels, the engine-driven fuel pump can draw air into the system if the boost pumps become inoperative.
4. The wrong PTG was installed on the engine, creating a situation of potentially degraded engine performance.
5. The engine check valve assembly, located in the fuel line between the FCU and the fuel nozzle, had a substantial internal leak, increasing the risk of drainage of fuel into the combustion case when the engine was not operating.
6. The torque paint on the PTG "B" nuts was discontinuous, leaving no way to confirm visually any loosening of the "B" nuts.

Other findings

1. The company did not maintain current engine technical records in accordance with the requirements of Section 605 of the *Canadian Aviation Regulations* (CARs).
2. Each parameter of engine data acquisition unit (DAU) data was being averaged and recorded once per minute, which reduced the amount and usefulness of the data for accident investigation purposes.
3. A functioning crash-protected cockpit video digital recorder (CVDR) may have allowed investigators to reconstruct the flight sufficiently to better understand the circumstances that led to the accident.

Safety action taken

Following the accident, Transport Canada completed a limited combined regulatory inspection of the operator's field operation base at the Cline River Heliport. A more in-depth inspection was subsequently carried out by Transport Canada Aircraft Maintenance and Manufacturing (AMM). There were 10 inspection findings in total, most identifying administrative deficiencies. The specialty areas that had findings were quality assurance (QA), technical records, sample aircraft for conformance, maintenance planning, defect recording, rectification, deferral and control procedures, and technical dispatch procedures. The operator responded immediately by implementing a comprehensive corrective action plan (CAP). An aviation consulting company was contracted to assist in dealing with and rectifying the deficiencies.

As a follow-up to this occurrence, the parts supplier who shipped an incorrect PTG to the operator conducted an internal review of the circumstances leading to this incorrect shipment. The review employed a Maintenance Error Decision Aid (MEDA) process. The review resulted in four internal MEDA recommendations for error prevention:

- Encourage the customer to identify the part number required, and provide a purchase order when ordering parts.
- Ensure that parts requests are entered electronically, so as to provide an electronic trail to enable checking of parts prior to shipment.
- Ensure that the parts are correctly identified before removing them from inventory.
- Additional human factors training for the employee involved.

As a follow-up to this occurrence, the contracted AMO provided additional individual staff training, in accordance with the Maintenance Policy Manual (MPM), as necessary to upgrade the knowledge and understanding of the requirements of the MPM with regards to receiving of parts. As well, an MPM amendment was generated to address the use of owner-supplied parts.

TSB Final Report A07P0295—Hot Air Balloon Accident

On August 24, 2007, at about 1900 Pacific Daylight Time (PDT), an Aerostar S77A hot air balloon was being prepared to launch for a sightseeing flight from a field near the Hazelmere trailer park in Surrey, B.C. The balloon was operated under a Special Flight Operating Certificate from Transport Canada (TC) and was loaded with a pilot and 12 passengers in the balloon's basket. It was fastened to its trailer by a strap to prevent the balloon from ascending prematurely.

An intense, uncontrolled, propane-fuelled fire occurred. The pilot ordered the passengers to evacuate the basket and then proceeded to evacuate himself. The balloon rose to the limit of its tethering strap. Some of the passengers still on board jumped from the burning basket as the balloon climbed. The fire affected the tethering strap and it failed from tensile overstress and the balloon climbed without control. The balloon continued to climb until the envelope collapsed and the burning wreckage fell into a nearby trailer park, setting three mobile homes and two vehicles on fire. Two passengers, who did not evacuate the basket, were fatally injured. Several other passengers suffered serious injuries, some with serious burns. The pilot suffered burns. No persons on the ground were injured. Three mobile homes, two vehicles, and the balloon were destroyed.

Balloon lifting trailer

Balloon Information

The balloon was originally manufactured with two burners and three 23-gallon capacity propane cylinders installed in the basket. The pilot/owner had replaced the two burners with a three-burner installation which was approved by the manufacturer as part of the type design of the aircraft. He had also installed a fourth cylinder, of 15-gallon capacity, in the basket. This modification was not approved by the manufacturer as part of the type design, nor was it approved by TC. No documentation was produced by the operator to show that this installation was performed or signed-off by an aircraft maintenance engineer (AME). The pilot had instituted the practice of using an auxiliary 10-gallon portable cylinder for initial filling of the envelope with hot air. It was not installed, but placed in the basket for the hot inflation, and removed when its propane was exhausted. The manufacturer was not aware of this practice.

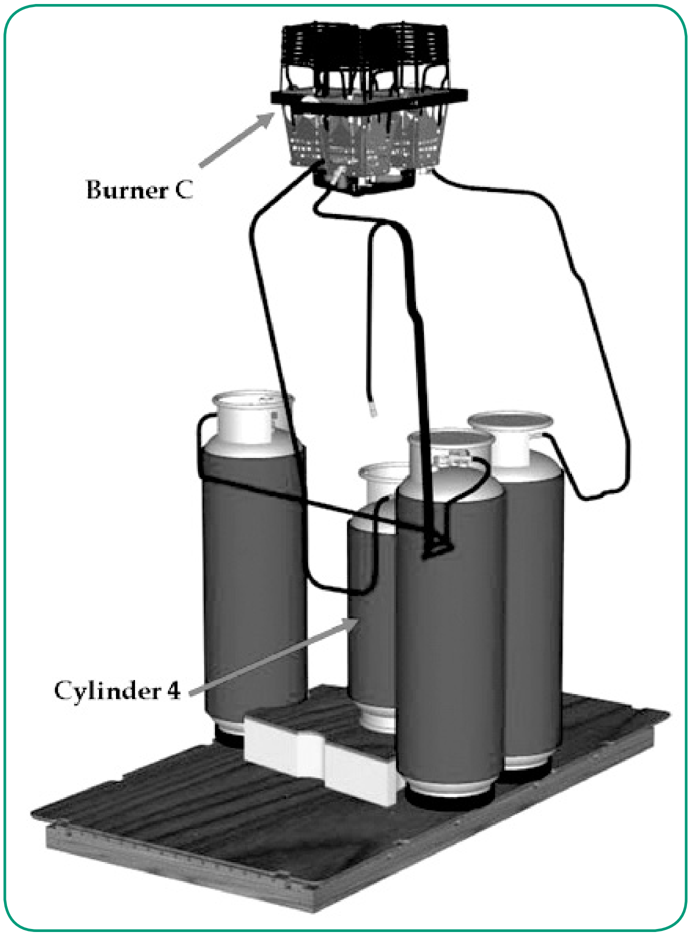
The aircraft journey log indicated that the balloon had flown approximately 1272 hours since manufacture. The balloon was being maintained by an AME who had been performing the 100-hour inspections for the past 14 years. If the balloon required maintenance as a result of these inspections, it was sent to a repair facility. The AME who performed the 100-hour inspections was unable to provide any documentation of work performed during the past 14 years.

Analysis

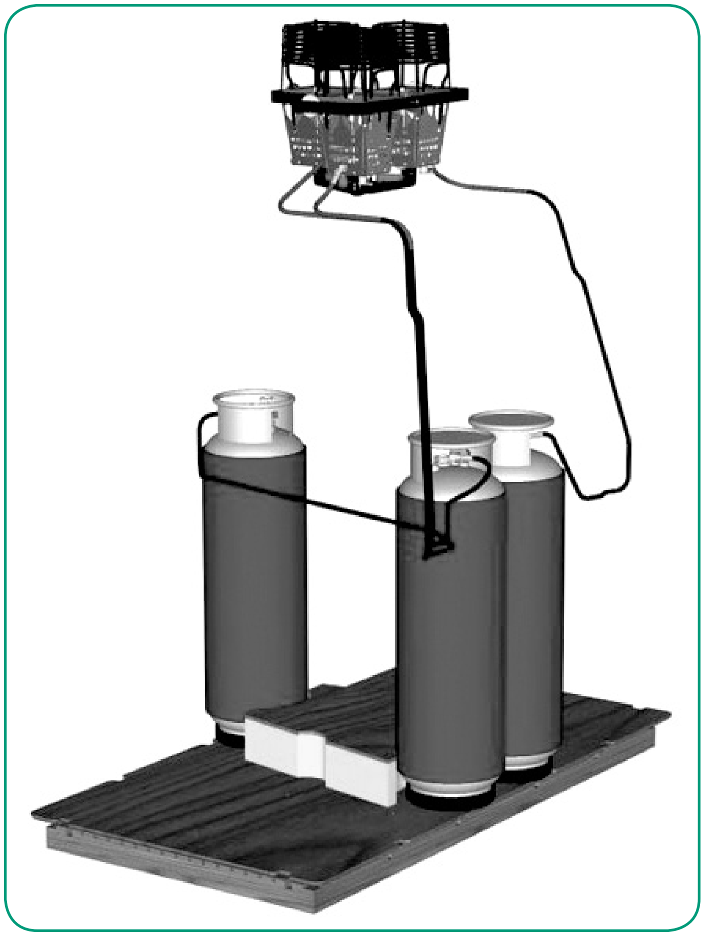
The number 4 cylinder fuel line was not secured, unlike the standard fuel lines which were routed along the basket uprights and placed inside leather sleeves to minimize their exposure and stresses. The tank valve of the number 4 cylinder was the only tank valve determined to be open, therefore the number 4 cylinder was the fuel source for the fire. As burner C had metallic remains of the full length of the number 4 fuel line connected to it, the number 4 fuel line must have become disconnected at the number 4 cylinder tank valve. The pop and hiss sounds heard by both the pilot and ground crewman are explained by the fuel line disconnecting and propane under pressure being expelled. Ignition was probably provided by the test burn which had just been made or by the pilot light, as the loose fuel line whipped around and propane discharged from the number 4 cylinder under pressure.

The pilot's practice was to coil the number 4 cylinder fuel line around the cylinder when not in use. That practice, in addition to the practice of connecting and disconnecting the line during every flight, probably led to more stress on the tank valve/fuel line connection. This extra wear and tear likely led to the hose pulling out of its end fitting.

As the number 4 cylinder was the source of the propane fuelling the fire, closing that cylinder's tank valve would have removed the fuel source and likely extinguished the fire. However, considering the ferocity of the fire, this was not practical. An emergency fuel shut-off, such as is generally provided in other aircraft fuel systems, was not fitted.



S77A modified configuration



S77A manufacturer's three-burner configuration

The basket was the largest available for this balloon and calculations indicate that the gross weight, with twelve passengers on board, was substantially greater than the maximum allowable gross weight. This increased weight meant more lift was required. More fuel would therefore have to be burned to create the hot air for the added lift. The original configuration of the fuel system did not provide sufficient fuel at the increased weight for the average flight duration. The operator had modified the balloon with a fourth fuel cylinder to provide greater lift and flight time.

Contrary to the airworthiness limitation in the manufacturer's *Continued Airworthiness Instructions*, envelope repairs comprised more than 65 per cent of the envelope.

Although the operator was operating under a valid TC special flight operations certificate (SFOC) stating that it was adequately equipped and able to conduct a safe balloon operation carrying fare-paying passengers, no inspection of the company was ever made to support this statement. The SFOC has no expiry date and there are no audits of balloon operators. Had there been periodic inspections by TC, the owner's modifications to the balloon's configuration and variations from the manufacturer's *Continued Airworthiness Instructions* may have been raised as safety concerns.

Findings as to causes and contributing factors

1. The fuel line connecting the number 4 cylinder to burner C became disconnected at the tank valve connection, probably due to a combination of age, wear, handling, and allowing propane under pressure to be expelled. The propane was ignited either by flame from the test burn just made from burner C or from the pilot light.
2. As there was no emergency fuel shut-off and the number 4 tank valve was open, propane continued to be expelled through the number 4 tank valve, thus feeding the fire.
3. Modification of the balloon from the manufacturer's configuration by the addition of cylinder number 4 and the use of an additional auxiliary cylinder (number 5) for initial envelope hot inflation contributed to the likelihood of hose/valve discontinuity because of extra wear and handling.
4. Operation at a weight greater than the maximum gross weight required more fuel which resulted in modifications being made to the balloon's configuration.
5. Lack of oversight by the regulator allowed the modifications to the balloon's configuration and

variations from the manufacturer's continued airworthiness limitations to go unchallenged.

6. The strap securing the balloon to the trailer was made of a synthetic material which was susceptible to heat damage and failed in tensile overstress, releasing the balloon with two passengers still on board.

7. During the initial envelope inflation, the balloon was fastened to its trailer, which was in turn attached to a pick-up truck. When the fire started and people began to evacuate the basket, the balloon began to rise because the emergency deflation system had not been activated. As people continued to evacuate the basket, they had to jump from a considerable height. Some suffered more serious injuries as a result of striking the trailer.

8. The safety briefing given to passengers prior to their boarding the balloon did not adequately explain how they were to exit the balloon basket in the event of an emergency.

Finding as to risk

1. The use of a home-made manifold to refuel all five cylinders at once allowed the escape of a significant amount of propane once the tank valves were closed, after the tanks were filled. This posed a risk of fire at the service station.

Other finding

1. Repairs to the fabric of the balloon envelope were in excess of 65 per cent, contrary to the airworthiness limitation in the manufacturer's *Continued Airworthiness Instructions*.

TSB Final Report A08A0007—Hard Landing—Power Recovery Autorotation

On January 10, 2008, a Eurocopter AS 350 BA helicopter, with two pilots on board, departed the St. John's International Airport, N.L. to conduct annual recurrent training. Upon arriving in the training area at 1433 Newfoundland Standard Time (NST) at approximately 600 ft above ground level, the training pilot retarded the fuel flow control lever to simulate an engine failure. The pilot commenced an autorotation. Nearing the end of the exercise, the fuel flow control lever was advanced to restore power to the engine with a view to executing an overshoot. The engine (a Turbomeca Arriel 1B, serial number 4193) did not spool up as expected. The pilot continued the autorotation, contacting the ground at a high rate of descent. Both pilots sustained serious injuries; the helicopter was destroyed.

Findings as to causes and contributing factors

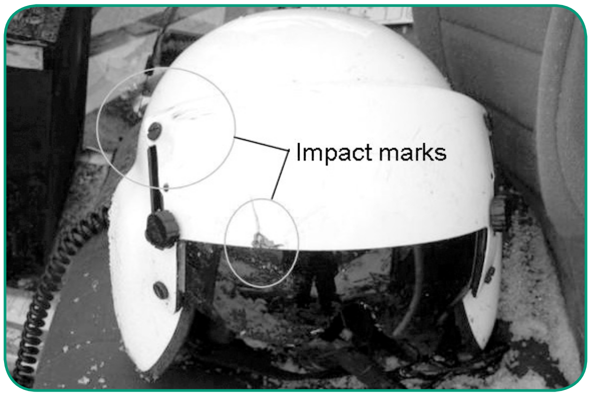
1. The lack of explicit instructions prohibiting power recovery autorotations in the AS 350 rotorcraft flight manual (RFM) resulted in the operator's training pilots adapting a practice of fuel flow control lever (FFCL) operation that was contrary to the manufacturer's intent.

2. The training pilot retarded the FFCL with the intention of executing a power recovery autorotation. The engine did not respond as anticipated when the FFCL was advanced for the overshoot and a high rate of descent ensued.

3. The autorotation was flown at a higher-than-recommended airspeed which, coupled with the steep turn, increased the rate of descent. This high rate of descent could not be arrested prior to contact with the ground because of the low-energy state of the main rotor.

4. Both pilots suffered severe back injuries due to the hard landing. Neither pilot was wearing a shoulder harness; this likely contributed to the severity of their injuries.

5. The training pilot suffered severe facial injuries. He was not wearing a helmet; this likely contributed to the severity of his injuries.



The other pilot was wearing this helmet and did not incur head injuries; scarring on his helmet indicates contact with the helicopter structure during impact sequence.

Finding as to risk

1. Practice autorotations over unsuitable terrain could result in injury and aircraft damage should a forced landing be required.

Other finding

1. While the rotor RPM was within the autorotation range, it was not set at its optimum setting, reducing the energy state of the rotor.

Safety action taken

The operator has issued the following safety memos:

- Shoulder harness—addressed to all pilots, advising that the use of the shoulder harness is mandatory.
- Autorotation in AS 350-series helicopters—addressed to all pilots, advising them that unless intending to do a full-on practice autorotation, manipulation of the throttle in flight is not authorized. This includes power recoveries and surprise autorotations.
- Autorotation RPM verification—addressed to all pilots and maintenance engineers, instructing them to record all required parameters, such as weight, altitude, temperature, speed, and rotor RPM, anytime autorotation RPM verification flights have been conducted.

The company has implemented a policy of cost sharing and interest-free loans to facilitate flight helmet purchase by the company's pilots. Many pilots have taken advantage of this offer and more pilots are now wearing helmets during flight operations.

Eurocopter has developed a proposed supplement for the AS 350 RFM that deals with engine emergencies training procedures. The proposal provides explicit instructions on the procedure to be followed for practice autorotations, for both FFCL and twist grip engine controls. Regulatory approval is pending.

TSB Final Report A08H0002—Runway Incursion

On July 28, 2008, a Boeing 737-700 was on a scheduled flight from Toronto Lester B. Pearson International Airport (LBPIA), Ont., to Vancouver, B.C. At approximately 1141:50 Eastern Standard Time (EST), the north ground controller, believing that Runway 15 right/33 left (15R/33L) was under the control of the north ground position, cleared three emergency services vehicles to enter Runway 15R/33L en route to the fire training area. At 1142:27, the Boeing 737 was cleared for takeoff from Runway 33L. The aircraft was approximately one-third of the way down the runway when the vehicles entered Runway 15R. The flight became airborne approximately 2500 ft from the vehicles.

Toronto LPBIA diagram

Analysis

When a tower controller is about to begin operations on another runway, a request for its ownership and control is made. When a tower controller is finished using a runway, its ownership and control is usually transferred to the ground controller. In this occurrence, the north tower controller needed the ownership and control of Runway 05 to accommodate impending arrivals, but still needed ownership and control of Runway 33L to accommodate the delayed departure of the Boeing 737. Ownership and control of Runway 05 had been transferred to the north tower controller, but ownership and control of Runway 33L had not been relinquished to the north ground position.

The north ground controller expected ownership and control of Runway 33L to be relinquished to the north ground position when ownership and control of Runway 05 was transferred to the north tower controller. The sighting of Tech 37 on Runway 33L by the north ground controller likely confirmed in the mind of the north ground controller that Runway 33L was no longer in use for aircraft departures and was indeed under north ground control. Moreover, the location of the north ground controller position in the tower made surveillance of the south end of Runway 33L problematic and likely prevented the north ground controller from seeing the Boeing 737 near the threshold.

Runway ownership and control transfer is accomplished verbally. There is no visual indication or process to inform controllers of runway ownership, nor is there any physical act performed to confirm controller ownership of runways when changing runway operations.

Convinced that the north ground position had ownership and control of Runway 33L, the north ground controller cleared the aircraft rescue and firefighting (ARFF) vehicles onto the runway, leading to the conflict with the Boeing 737.

The north service road provides access from the north fire hall to the fire training area as well as to many other areas around the airport without the need for vehicles to traverse airport manoeuvring areas utilised by aircraft. There was no operational need, in this instance, for the ARFF vehicles to be present on the airport manoeuvring area en route to the fire training area.

Finding as to causes and contributing factors

1. Believing Runway 33L to be under the control of the north ground position, the north ground controller cleared the ARFF vehicles onto that runway, leading to a conflict with the departing Boeing 737.

Findings as to risk

1. The absence of an effective method for indicating runway ownership and control increases the likelihood of incursions.
2. Where ARFF vehicles do not need to use the runways, their unnecessary presence on a runway increases the risk of incursions, especially during a runway change.

Safety action taken

NAV CANADA reviewed its procedures involving runway ownership. As a result, a new runway surface indicator (RSI) was designed and implemented in early September 2008. This system operates within EXCDS (extended computer display system), allowing visibility at all positions within Toronto tower, as well as a recording of all actions associated with the application. Both the EXCDS and phraseology manuals have been updated to reflect the current standard of operation.

The Greater Toronto Airports Authority (GTAA) initiated a communication process to assist in mitigating risk, which requires emergency services to notify NAV CANADA prior to conducting training exercises that involve crossing the airfield. The GTAA will monitor this process to ensure ongoing effectiveness. These on-field training exercises are deemed to be essential for vehicle operators to ensure that they maintain a level of proficiency to minimize the risk of an incursion.

The GTAA reiterated that airport traffic directives and the associated airport vehicle operator's permit (AVOP) training program indicate and inform AVOP applicants that the service roads should be used whenever possible and that an operational need is required to be present in the manoeuvring area.

TSB Final Report A08P0242—Uncontrolled Descent into Terrain

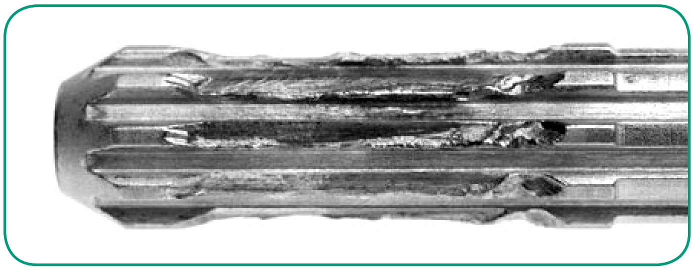
On August 3, 2008, a U.S.-registered Beech 65-A90 King Air took off from Pitt Meadows Airport, B.C., with the pilot and seven parachutists for a local sky diving flight. At 1521 Pacific Daylight Time (PDT), as the aircraft was climbing through 3 900 ft above sea level, the pilot reported an engine failure and turned back towards Pitt Meadows Airport for a landing on Runway 08R. The airport could not be reached and a forced landing was carried out in a cranberry field, 400 m west of the airport. On touchdown, the aircraft struck an earthen berm, bounced, and struck the terrain again. On its second impact, the left wing dug into the soft peat, spinning the aircraft 180 degrees. Four of the parachutists received serious injuries and the aircraft was substantially damaged. There was no fire and the occupants were evacuated. The emergency locator transmitter functioned at impact and was turned off by first responders.

Accident site

Aircraft Information and Operation Approval

The aircraft was heavily modified, in accordance with a Federal Aviation Administration (FAA) approval, to enable parachuting operations. Since February 2003, the aircraft had been registered in the United States and was being operated seasonally in Canada under the Free Trade Agreement (FTA) with a Canadian Foreign Air Operator Certificate-FTA (CFAOC-FTA). The CFAOC-FTA was issued annually by Transport Canada (TC) for parachute jumping operations, recognizing the certificate of authorization issued by the FAA to the operator. At the time of the accident, the parachuting company was using the aircraft for revenue parachute jumping activities.

Left engine drive splines and coupling



Close-up of external spline wear

Analysis

It was concluded that mechanical failure of the left-hand engine fuel pump drive splines resulted in the loss of power from that engine. The bang, the shuddering, and the yaw to the right that was experienced may have been caused by the left-hand engine fuel pump drive splines disengaging momentarily and then re-engaging. This disengagement would have caused the engine to flameout, and the re-engagement would have caused a relight with a corresponding bang. This would have been accompanied by a surge of power which could have caused the aircraft to yaw to the right.

A sudden yaw to the right is normally associated with a right-engine power loss. Although the pilot verified the engines' instruments, he did not correctly identify the left engine as the failed engine. This was likely due in part to the horizontal layout of engine instrumentation that makes timely engine malfunction identification difficult. Moreover, the pilot had not received any training on the King Air for over two years, decreasing his ability to react appropriately. This resulted in the pilot erroneously shutting down the operating engine.

Because the engines were being operated "on condition," the left engine was operated more than 800 hours past the time before overhaul (TBO) required by the engine manufacturer. Had the 3600-hour overhaul been accomplished, or the phase inspection completed as required in the maintenance instructions, the spline wear and corrosion should have been detected.

The general condition of the aircraft, the condition of the fuel systems, the engine TBO over-run, and the missed inspection items demonstrated inadequate maintenance. The regulatory oversight in place was inadequate because the inspection carried out by the FAA in April 2008 did not identify any of these issues. Furthermore, TC did not carry out any inspections of this operation.

Findings as to causes and contributing factors

1. The general condition of the aircraft, the engine TBO over-run and the missed inspection items demonstrated inadequate maintenance that was not detected by regulatory oversight.
2. The TBO over-run and missed inspections resulted in excessive spline wear in the left engine-driven fuel pump going undetected.
3. The left engine lost power due to mechanical failure of the engine fuel pump drive splines.
4. The horizontal engine instrument arrangement and the lack of recent emergency training made quick engine malfunction identification difficult. This resulted in the pilot shutting down the wrong engine, causing a dual-engine power loss and a forced landing.
5. Not using the restraint devices contributed to the seriousness of injuries to some passengers.

Finding as to risk

1. There is a risk to passengers if TC does not verify that holders of CFAOC-FTA meet airworthiness and operational requirements.

Safety action taken

Aircraft Owner

After the accident, the aircraft owner requested that a sister aircraft have its fuel system inspected while undergoing maintenance at an approved maintenance organization in Calgary, Alta. Those inspections revealed numerous heavily corroded components and jelly formed by microbial growth. The fuel drained from the tanks and system was described as milky and was disposed of.

Transport Canada

The Foreign Inspection Division has taken steps to ensure that the regions are notified of foreign air operators that have been issued a CFAOC-FTA for operations in Canada. Procedures will be documented in its staff instruction handbook indicating that the regions are to be notified by e-mail of a CFAOC-FTA operation with the location and dates. △

Note: The following accident synopses are Transportation Safety Board of Canada (TSB) Class 5 events, which occurred between August 1, 2010, and October 31, 2010. These occurrences do not meet the criteria of classes 1 through 4, and are recorded by the TSB for possible safety analysis, statistical reporting, or archival purposes. The narratives may have been updated by the TSB since publication. For more information on any individual event, please contact the TSB.

— On August 2, 2010, a privately operated **Cessna A185E on amphibious floats** was taking off from Lake Couchiching, near Orillia, Ont., on a VFR flight to the Orillia/Lake St. John water aerodrome. After getting on the step during the take-off run, the aircraft struck a boat's wake and nosed over. The landing gear structure was damaged and the propeller struck one of the floats. The aircraft remained upright and was towed to a dock without further damage. *TSB File A10O0160.*

— On August 6, 2010, a privately operated **Cessna 177B** was on the landing roll on a gravel road approximately 10 NM west of Shellbrook, Sask., when the left wingtip contacted tree branches to the left of the road. The pilot lost directional control and the aircraft swerved left into a ditch adjacent to the road. The nose landing gear collapsed and the aircraft was substantially damaged. The pilot was uninjured. *TSB File A10C0137.*

— On August 13, 2010, an **Air Creation MILD GTE 582S basic ultralight** took off from Chambly Airport, Que., with the pilot on board. Soon after takeoff, for an unknown reason, the pilot attempted an emergency landing on Highway 10. On final, the aircraft struck high voltage lines and then crashed on Highway 10. The aircraft was significantly damaged and the pilot was seriously injured. *TSB File A10Q0131.*

— On August 14, 2010, a **Wag-Aero Cuby on floats** took off from Lake Témiscouata, Que., with a pilot and one passenger on board. Some 50 ft above the surface of the water, the floatplane began an uncommanded turn to the left, which the pilot was unable to control. In the next few moments, the aircraft nosed down and hit the lake's surface where it came to a standstill on its floats. The aircraft was significantly damaged. The two occupants were both wearing life jackets when they took off. They were rescued by some recreational boaters who were on the lake. *TSB File A10Q0130.*

— On August 15, 2010, a **Dassault Falcon 900 EX** was on the ramp at Medicine Hat, Alta. The aircraft began taxiing to the runway and struck a fence post with the left wing tip. The aircraft was subsequently grounded and is awaiting replacement parts. *TSB File A10W0135.*

— On August 18, 2010, a **Bell 206B helicopter** was inbound to Bischoff Lake, B.C., with three people on board. The pilot chose a landing area on the southwest side of the lake. Bischoff Lake's elevation is 6 500 ft ASL and the ambient temperature was 25°C. As the aircraft approached the selected landing area, the pilot judged that the aircraft was moving too fast. The landing was rejected and a go-around was initiated. Power was increased to climb but the helicopter began to descend, even though torque was at 100 percent. The pilot pulled up on the collective but the helicopter continued to descend and began to yaw to the right. The helicopter continued to descend and rotate faster; the low rotor RPM horn sounded. Rotor RPM was at 90 percent. The pilot steered the helicopter to an area that was largely free of rocks. The helicopter hit the ground and rolled to the right. The pilot turned off the fuel and battery, and helped the passengers evacuate. The helicopter was substantially damaged; there were no injuries. *TSB File A10P0273.*

— On August 19, 2010, a **Cessna U206G** was on a VFR flight from Fort McMurray, Alta. to Fort Chipewyan, Alta. While en route, the pilot noted that the oil pressure was low. After contacting company aircraft in the area, it was decided to divert to the nearest aerodrome in Embarras, Alta. The oil pressure continued to fall, the propeller RPM surged, and the manifold pressure dropped. At 1 000 ft AGL, oil began to spray from beneath the engine cowling because the No. 6 cylinder connecting rod had penetrated the crankcase. The engine (Teledyne Continental IO-520-F) was shut down and a forced approach into a wooded area was executed. The aircraft was substantially damaged. The pilot and four passengers were not seriously injured and were taken to Fort McMurray by helicopter later that evening. *TSB File A10W0136.*

— On August 29, 2010, a **Wag-Aero Sportsman 2+2**, with a pilot and one passenger on board, left on a fishing trip from Lac Sébastien, Que., without a flight plan and without informing anyone of their destination. The aircraft and its occupants were reported missing on Sunday, August 29, and were found on the evening of August 31, some 78 NM northeast of Lac Sébastien near the Pipmuacan Reservoir and Lac du Fakir. *TSB File A10Q0146.*

— On August 31, 2010, the owner of an **Aeronca 7EC** wanted to ground-test the engine but the aircraft took off and crashed about half a mile from the runway. The aircraft was significantly damaged. The pilot-in-command was seriously injured. He had reconstructed the aircraft and it seems that the control cables were reversed. He did not have a pilot's licence. *TSB File A10Q0149*.

— On August 31, 2010, an **Aerospatiale AS350 BA helicopter** was dropping off two surveyors in the Namur Lake area, Alta. The landing site was in a confined area. The initial touchdown was successful; however, the pilot repositioned the helicopter a short distance to facilitate an easier exit for the surveyors. During this manoeuvering, the main rotor blades contacted a sapling 2 in. in diameter, which resulted in major damage to all three blades. *TSB File A10W0143*.

Artist's impression of rotor strike

— On September 5, 2010, an **amateur-built Christavia Mark 1** took off from a private strip near Lumby, B.C. in gusty wind conditions. Shortly after takeoff, the aircraft appeared to experience control difficulties and stalled. The aircraft impacted the ground in a field near the strip. There was a post-impact fire. The pilot and passenger did not survive. *TSB File A10P0288*.

— On September 6, 2010, a **Schweizer G-164A Ag-Cat** was on a VFR ferry flight from Kapuskasing, Ont. to Elliot Lake, Ont. Weather began to deteriorate about 20 NM north of Elliot Lake and the aircraft descended to maintain visual contact. While attempting to cross over a ridge about 3 NM north of the airport, visual contact was lost and the aircraft struck a tree with one wing, swiveled around and went nose-down towards the ground, coming to rest intact, supported mainly by trees and shrubs. After evacuating the aircraft, the pilot determined that there was no fire, returned to the aircraft, turned on the electrics, and contacted an overflying commercial flight on 121.5 MHz. The emergency locator transmitter (ELT) was not activated. The site was later located by a police helicopter. The pilot was uninjured and the wings of the aircraft were substantially damaged. It was noted that weather reports were not available for Elliot Lake at the time of the flight nor during preflight preparation. *TSB File A10O0194*.

— On September 12, 2010, a **Piper PA-36** was applying a herbicide in the vicinity of Milden, Sask. The landing gear caught in an electrical line at the end of the field and the aircraft crashed. The pilot was seriously injured and the aircraft was substantially damaged. *TSB File A10C0162*.

— On September 12, 2010, a **de Havilland Dash 8-400** had landed and all gates were occupied. The captain taxied to the de-ice bay and shut down both engines. Once a gate became free, the captain elected to start only the No. 2 engine and taxied to the gate. Applying the brakes did not stop the aircraft and the nose cone and nose gear impacted a tug, causing damage and a hydraulic leak. The right propeller struck a ground power unit. The tip of the propeller broke off and damaged two cabin windows. There were no reported injuries. The No. 1 engine contains the engine-driven hydraulic pump and when the No. 2 engine was started, the standby AC hydraulic pump was not selected, so no hydraulic pressure was available for the brakes. The No. 2 engine and propeller will be replaced due to the propeller strike. An SMS evaluation will be conducted by the operator. *TSB File A10A0095*.

— On September 15, 2010, a **Taylorcraft BC12-D** was on final approach to land on the pilot's private strip, approximately 25 NM east of Dorval, Que., when the aircraft struck wires. The aircraft flipped over and came to rest upside down. The passenger was seriously injured. The pilot sustained minor injuries. The aircraft was substantially damaged. The occurrence took place at dusk. *TSB File A10Q0156*.

— On September 19, 2010, an **Explorer advanced ultralight on pneumatic floats** had taken off from the St-François River at water aerodrome CSA7 in Drummondville, Que., for a local flight. During the flight, the pilot suddenly felt a full deflection of the two rudder bar pedals. As a result, the aircraft yawed to the right and, despite application of the left aileron, the aircraft became difficult to control. The pilot made an emergency landing on a stretch of highway that was under construction. On contact with the gravel, the aircraft bounced and turned off toward a ditch. The aircraft was heavily damaged and the right wing was broken. The pilot sustained minor injuries and the passenger was not injured. An examination revealed that the left rudder cable had broken as a result of excessive wear: it had been rubbing against the floor and the steel guard on one of the pulleys. The cable was also corroding at the point of the fracture and the right cable was also showing signs of wear. The diameter of the pulleys (1 in.) and that of the two rudder cables was smaller than what is normally used. As is often the case, the cable tension on the aircraft is provided by return springs. When the left cable broke, the right spring pulled on the right cable, which caused the yawing to the right. *TSB File A10Q0159*.

— On September 22, 2010, a **Cessna 172 on floats** had taken off from Lac du Sapin Croche, Que., for a local flight. Upon its return, it landed on the water and then taxied towards a cottage. When it was about 150 ft from shore, a wind squall lifted the back part of the aircraft and flipped it over. The pilot, who was alone on board, was not injured. He was wearing a Mustang flotation device and was able to swim to shore without difficulty. The aircraft remained above water, suspended by its floats. *TSB File A10Q0161*.

— On September 24, 2010, the crew of a **Cessna C180J** was performing training circuits on glassy water on Little Chippewa Lake approximately 30 NM northwest of South Indian Lake, Man. After several successful circuits, the aircraft swung to the left when power was applied for takeoff. The left float dug in and the aircraft nosed over. The cabin filled quickly through the broken windshield. The aircraft sank in approximately 10 ft of water. The two occupants were uninjured and were able to exit the aircraft safely. The left float was broken and the aircraft was substantially damaged. The pilot-in-command had recently attended an underwater egress training course. *TSB File A10C0171*.

— On September 26, 2010, an **amphibious DHC-2** aircraft took off from Port McNeill aerodrome, B.C., on a VFR flight to Rivers Inlet, B.C. As the weather was marginal, the pilot became preoccupied with receiving weather information on the radio immediately after takeoff and did not retract the landing gear. Upon arrival at Rivers Inlet, the pilot checked the landing gear pressure but did not visually confirm the landing gear position. On touch down, the aircraft overturned and sank and the cabin filled with water. The four occupants evacuated the aircraft successfully but none were wearing a life jacket. As the aircraft was expected, a boat was waiting and picked up all the occupants within five minutes. There were no injuries, but the aircraft was substantially damaged. *TSB File A10P0308*.

— On September 27, 2010, the pilot of a **Cessna 152** was en route from Wawa, Ont. to Sioux Lookout, Ont. The Sioux Lookout flight service station (FSS) received a call from the pilot stating that he was out of fuel. The pilot conducted a forced landing into a tilled field 6 NM east of Sioux Lookout Airport. The aircraft impacted the ground at a high angle and low velocity. The aircraft was substantially damaged and the pilot was seriously injured. Overflying aircraft reported a continuous and strong emergency locator transmitter (ELT) signal. They provided the coordinates of the site and directed emergency personnel. The pilot was extricated from the wreck and transported to hospital. *TSB File A10C0174*.

— On September 30, 2010, while conducting circuits at the Kamloops Airport, B.C., the pilot of a **Piper PA-31T Cheyenne** inadvertently landed on Runway 08 with the landing gear in the retracted position. The pilot and passenger were uninjured but the aircraft was substantially damaged. There was no fire. *TSB File A10P0312*.

— On October 7, 2010, the pilot of a **Schleicher ASW-15B glider** was soaring in mountain waves near Cowley, Alta. He was unable to return to Cowley when he ran out of lift, and landed in rocky terrain about 10 NM southwest of Cowley. The glider was substantially damaged but the pilot was uninjured. *TSB File A10W0163*.

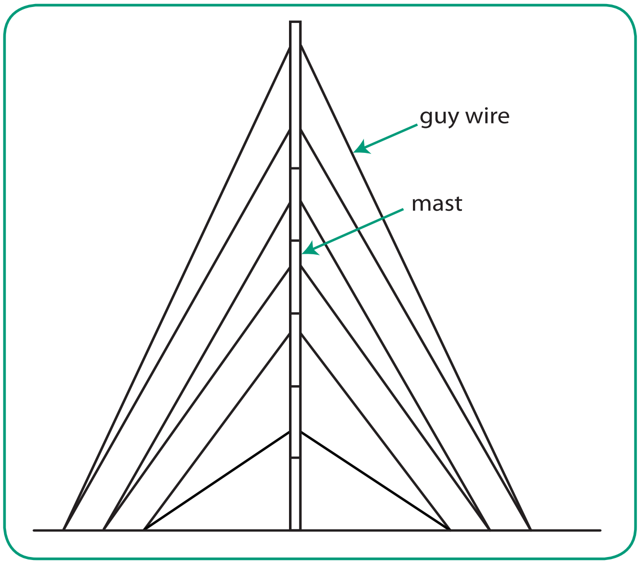
— On October 10, 2010, a **Piper PA28-140** was on a VFR flight near the airport at St-Georges de Beauce, Que. During the landing roll, it seems that a wind squall caused the aircraft to swerve to the left of Runway 24. The pilot, who was alone on board, was unable to bring the aircraft back onto the runway. The main wheel on the left side struck a runway light and the left wing hit a runway sign. The aircraft continued, crossing the ditch at the edge of the runway, and came to a stop about 100 ft later. The pilot was not injured. The left wheel and the propeller were damaged, the nose wheel was torn off, and the root of the left wing was knocked in. Reported winds were 270° at 8 kt. Several witnesses reported a wind squall just before the occurrence. *TSB File A10Q0183*.

— On October 19, 2010, a **Hiller UH-12E helicopter** took off from Chetwynd, B.C. and flew to a job site 20 NM southwest. The job was to seed grass along a pipeline. While seeding at an altitude of about 150 ft, the engine (Lycoming IO-540) stopped. The pilot made an autorotation into a clearing but landed hard and rolled over. The helicopter was substantially damaged and the pilot was uninjured. The 406 emergency locator transmitter (ELT) was activated. *TSB File A10P0337*. △

MET Towers: A Collision Can Happen and it Has Happened…

by Eduard Alf, P.Eng., Visual Aids Technical Unit, Aerodromes and Air Navigation Division, Standards Branch, Civil Aviation, Transport Canada

The spraying of crops by means of a specially adapted aircraft is a common activity in rural areas. In order to obtain the most effective application, the aircraft is often flown at heights in the order of three to four meters off the ground. The field, however, may also have a meteorological (MET) tower, which is used to gather data for analysis of the wind resource prior to the construction of a windfarm. These towers have a tubular steel mast that is held in position by sets of guy wires.



MET towers are not normally at a height or location near an aerodrome or recognized flight route, which would require them to be either marked or lit, as stipulated in Transport Canada CAR 621.19. For the same reason, they would not be identified on navigational charts.

Both the mast and guy wires of a MET tower may be quite difficult to see, depending on the ambient lighting conditions and direction of approach. The photo below illustrates this potential problem well.

The June 2010 occurrence

On June 29, 2010, an Air Tractor 502B was engaged in aerial application near Portage la Prairie, Man., when it collided with an unmarked metal wind power test pole approximately 56 m high. The pilot elected to perform a precautionary landing in a nearby field. Inspection of the aircraft revealed damage to the propeller, right landing gear, flap and wing leading edge, approximately 1.2 m from the fuselage.

The photo of the damage to the leading edge clearly shows how fortunate this pilot was in terms of where the aircraft struck the pole. Had the aircraft hit the pole further out on the leading edge, aircraft control may have been lost. According to the operator, the structural integrity of the Air Tractor wing next to the fuselage is believed to have allowed the aircraft to remain airworthy and retain controllability. The top of the pole was damaged and a galvanized guy wire ⅜ in. thick was severed. The Transportation Safety Board of Canada issued a Class 5 report (*A10C0101*) on this occurrence.

Prior to doing an aerial spraying, the pilot or operator should always contact the field owner directly to find out if there are any objects of concern in the field. If such a tower cannot be readily seen under certain conditions, there is a good chance it will not be detected by an air reconnaissance alone. The pilot or operator should also ask the field owner if there are any MET towers in adjacent fields, over which the spray aircraft might make necessary turns. △

The First Defence
Effective Air Traffic Services - Pilot Communication
Are you sure about that flight level?
If in doubt, ask.
Make sure you get confirmation.
69N
68N
61N
60N
59N
58N
57N
NAV CANADA
Transport Canada
Transports Canada
COPA
CANADIAN OWNERS AND PILOTS ASSOCIATION
FSS
AIR LINE PILOTS ASSOCIATION, INT'L
alpa
SCHEDULE WITH SAFETY
ATAC
CATCA / ACCTA
CAW / TCA 5454
cbaa
PER ARDUA AD ASTRA
jazz
WESTJET
AIR CANADA

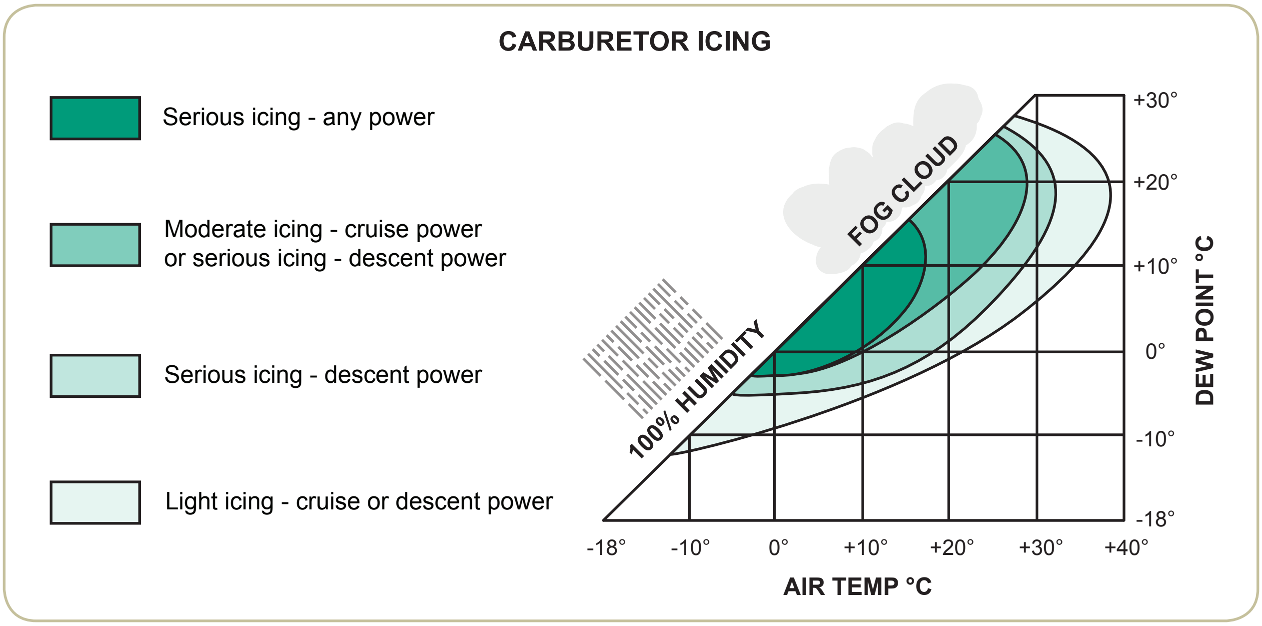
TAKE FIVE...
for safety
Five minutes reading could save a life

Carburetor Icing

Carburetor icing is a common cause of general aviation accidents. Fuel injected engines have very few induction system icing accidents, but otherwise no airplane and engine combination stands out. Most carburetor icing related engine failure happens during normal cruise. Possibly, this is a result of decreased pilot awareness that carburetor icing will occur at high power settings as well as during descents with reduced power.

In most accidents involving carburetor icing, the pilot has not fully understood the carburetor heat system of the aircraft and what occurs when it is selected. Moreover, it is difficult to understand the countermeasures unless the process of ice formation in the carburetor is understood. Detailed descriptions of this process are available in most good aviation reference publications and any AME employed on type can readily explain the carburetor heat system. The latter is especially important because of differences in systems. The pilot must learn to accept a rough-running engine for a minute or so as the heat melts and loosens the ice which is then ingested into the engine.

The following chart provides the range of temperature and relative humidity which could induce carburetor icing.



NOTE: This chart is not valid when operating on automotive gasoline (MOGAS). Due to its higher volatility, MOGAS is more susceptible to the formation of carburetor icing. In severe cases, ice may form at outside air temperatures up to 20°C higher than with aviation gasoline (AVGAS).

(Source: Transport Canada Aeronautical Information Manual *(TC AIM) Section AIR 2.3.)*