Transport Canada Transports Canada

Aviation Safety Letter

Learn from the mistakes of others and avoid making them yourself . . . **Issue 1/2001**

Bad Weather or Pressure? You Be the Judge

In February 1998, an instructor and a student departed Gimli, Manitoba, in a Diamond Katana, on a 118-NM flight to Dauphin. The instructor had filed a visual flight rules (VFR) flight plan with the Winnipeg Flight Service Station (FSS). When the aircraft became overdue, a search was initiated. The aircraft had struck the 12-in.-thick ice surface of Lake Manitoba in a nose-down, slightly right-wing-low attitude, at considerable forward speed and at a high rate of descent. The aircraft had penetrated the ice up to the leading edge of the wing, and the nose, engine and part of the cockpit were submerged. The two occupants sustained fatal injuries. This synopsis is based on Transportation Safety Board of Canada (TSB) Final Report A98C0030.

The instructor was certified and qualified for the flight but did not have an instrument rating. He was described as a careful pilot and a conscientious instructor, and he had completed a Transport Canada pilot decision-making course a few months before the accident. The flight was to complete the cross-country requirements for the issue of a recreational pilot permit for the student.

The weather at Gimli in the early morning on the day of the occurrence was generally cloudy, with visibility reduced by fog. The instructor called the Winnipeg FSS for weather at 08:11, advised the FSS specialist that he was planning a VFR flight to Dauphin, and was provided with a briefing, which included the following:

"VFR not recommended until at least after 1200. Gimli automatic at 0800: wind calm, visibility four miles and ceiling 2200 overcast, altimeter 30.02. Dauphin automatic at 0800: wind 210 at six, visibility nine miles and ceiling 1800 broken, altimeter 29.98. Lots of fog patches around this morning; we're an eighth of a mile here in Winnipeg with a vertical visibility of zero, and that is pretty prevalent over the Red River Valley. I'm surprised Gimli [has] improved to what it is. They, just a little while ago, were down to a half a mile or an eighth of a mile, so they could go down again anytime. And the area forecast for southern Manitoba regions in a light southwesterly flow becoming light southerly during the period, airmass moist in the low levels and stable over western regions, becoming patchy moist over the eastern regions, and for western regions, basically west of the Red River Valley, 2500 overcast occasionally broken, topped at 4000 and visibilities more than six except for scattered stratus ceilings 500 to 1000 and visibilities one to five miles in light drizzle and snow and mist until 1800. The outlook for 1800 to 0600 is for marginal VFR ceilings becoming VFR from the west."

The instructor requested the terminal aerodrome forecast (TAF) for Dauphin and was told "Dauphin TAF valid from 0500 to 1800 [UTC] wind 230° at seven, visibility more than six and ceiling 2000 overcast, and the wind becoming between 1400 and 1600, 180° at 12 kt." There were no TAFs or weather observations available for points between Gimli and Dauphin, and no evidence was found that the instructor or the student obtained weather information for that area from other sources.

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After receiving the weather briefing, the instructor and student decided to wait for conditions to improve. At 09:41, the Gimli automated weather observation system (AWOS) reported that the cloud cover had decreased to scattered cloud at 1900 ft, with a visibility of 2.5 mi. The student filed a VFR flight plan with FSS at 09:54, with a planned altitude of 2500 ft above sea level (ASL). At 10:00, the AWOS reported that the sky was clear and that visibility had improved to six miles. The instructor and student departed shortly after receiving the 10:00 AWOS report.

Several ground observers reported that the weather between Eriksdale, 20 NM east of the accident site, and Vogar, five nautical miles east of the accident site, was low broken to overcast cloud at the time of the flight, with visibility occasionally reduced by fog. Observers also reported that an aircraft that fit the description of the occurrence aircraft flew on the planned route of flight, over Vogar, at an altitude estimated at 200 to 400 ft, shortly before noon on the day of the accident. The aircraft was observed flying above a low cloud layer and was visible only briefly through breaks in the cloud.

Pilots operating in VFR flight require sufficient ceiling and visibility to orient themselves relative to the ground and to navigate to their destinations. Flight in cloud or areas of low visibility reduces the amount of visual reference available to pilots to enable them to maintain control of their aircraft. The terrain from Gimli to Vogar consists largely of crop land and forest, which provides a visual reference even though the ground is snow-covered. The *A.I.P. Canada* states that whiteout occurs over an unbroken snow surface and beneath a uniformly overcast sky, and its effect is that a sense of depth and orientation is lost, and only very dark, nearby objects can be seen. Flight over the white surface of a snow-covered frozen lake greatly reduces the available visual reference and increases the chance that the pilot will be affected by whiteout.

Analysis—The available information indicates that the instructor and the student obtained the area forecast for the proposed route of flight between Gimli and Dauphin, but did not have specific weather information for the Vogar area available to them during their pre-flight planning and were, therefore, probably unaware of the fog that prevailed in the area of Lake Manitoba. However, the area forecast predicted scattered stratus ceilings 500 to 1000 ft, and visibilities as low as one mile, which did not meet the weather requirement of the *Canadian Aviation Regulations* (CARs). The instructor's decision to depart under these conditions left him little margin for any deterioration of the ceilings or visibilities from those mentioned in the forecast.

The flight school's management structure incorporated some supervision of the instructors, but it did not provide for routine monitoring of the flight-planning process, nor did it assist in regularly evaluating the available weather information. When the chief flying instructor (CFI) and the assistant CFI reviewed the area forecast after the accident, they indicated that they did not consider the weather to be suitable for the planned flight. Had their approval been required before departure, the flight would likely not have been dispatched. The fact that the instructor was aware of the area forecast but chose to initiate the flight into an area of predicted adverse weather, and that the CFI reviewed the observed weather but not the area forecast, indicates that the importance of area forecasts in the flight-planning process was not emphasized at the flight school. The flight school's safety precautions policy contained specific weather limits for solo flights by students, but no specific weather limits for instructors.

The student was planning to return home to Ontario on the following day, and the instructor and the student were attempting to complete the flight test before the student's departure. How this may have influenced the decisions made by the student and instructor cannot be ascertained, but it is likely that it would have increased the pressure on the instructor and the student to complete the flight to Dauphin.

Although the weather at Gimli and at Dauphin exceeded the regulatory requirements for VFR flight, the weather that was observed in the area of the accident site was worse than forecast and did not meet the regulatory requirements for either visibility or ceiling. As the aircraft approached Vogar, the cloud thickened and the ceiling lowered. West of Vogar, much of the visual reference with the surface would have been lost as the forested terrain gave way to the frozen lake surface. The low altitude of the aircraft as reported by observers indicates that the aircraft was considerably lower than the planned altitude of 2500 ft ASL.

The white surface of the lake provided little contrast with the broken cloud and probably removed what little visual reference was available to the pilot of the aircraft. The attitude of the aircraft as it struck the ice indicates that the pilots lost control of the aircraft and entered a manoeuvre from which they were unable to recover in the altitude available. The pilots probably lost control of the aircraft as the cloud cover increased, and visual contact with the ground was lost in the near-whiteout and low cloud conditions. Contributing factors were the instructor's

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Address correspondence to:
Editor, Paul Marquis
Aviation Safety Letter
Transport Canada (AARQ)
Ottawa ON K1A 0N8
Tel.: (613) 990-1289
Fax: (613) 991-4280
E-mail: marqupj@tc.gc.ca
Internet: http://www.tc.gc.ca/aviation/syssafe/newsletters/letter/index_e.htm

Paul Marquis

Regional System Safety Offices

Atlantic Box 42
Moncton NB E1C 8K6
(506) 851-7110

Quebec 700 Leigh Capreol
Dorval QC H4Y 1G7
(514) 633-3249

Ontario 4900 Yonge St., Suite 300
Toronto ON M2N 6A5
(416) 952-0175

Prairie & Northern
- Box 8550
  344 Edmonton St.
  Winnipeg MB R3C 0P6
  (204) 983-2926
- 61 Airport Road
  General Aviation Centre
  City Centre Airport
  Edmonton AB T5G 0W6
  (780) 495-3861

Pacific 4160 Cowley Cres., Room 318
Richmond BC V7B 1B8
(604) 666-9517

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decision to continue VFR flight into the deteriorating meteorological conditions west of Eriksdale and a lack of emphasis on area forecasts in the flight-planning process.

Since this accident, the flight school has changed its flight dispatch procedures so that the flight planning for every cross-country flight will be reviewed by the CFI or the assistant CFI to ensure that the forecast weather will be suitable for the flight.

Editorial note on AWOS: AWOS provides observations of meteorological conditions measured directly over or within a specific range of the observing sensors. Unlike a human observer, AWOS cannot report on fog patches or other phenomena that may be prevailing (more than 50%) in the vicinity of the aerodrome. These differences between AWOS and human observations are described in MET 3.15.5 of the A.I.P. Therefore, special attention should be given to obtaining an updated briefing, including the latest area forecast and any available aerodrome forecasts, prior to departing based on a single improved observation from an AWOS. △

CASS 2001—May 14 to 16, 2001—Ottawa, Ontario

Canada's capital city is proud to be hosting Transport Canada's 13th annual Canadian Aviation Safety Seminar (CASS 2001), May 14, 15 and 16 at the Westin Ottawa hotel ((613) 560-7000) in beautiful downtown Ottawa, Ontario. The theme for CASS 2001 is "Making Safety Management Systems Work in the 21st Century—Something for Everyone." The introduction of safety management systems (SMS) into aviation is an integral part of Transport Canada Flight 2005 aviation safety framework. CASS 2001's goal is to provide all participants with specific and usable strategies to guide them in incorporating SMS into their operations. To help achieve this goal, the CASS 2001 Committee has lined up several high-quality speakers, including Professor Patrick Hudson of the University of Leiden, Dr. Barbara Kanki of NASA Ames Research Center, and Jack Enders, formerly of the Flight Safety Foundation and currently running his own consulting firm. The Plenary session is organized into panels to present and discuss safety management topics, such as "Implementing Safety Management," "Return on Investment for Safety Management," and "Error Management and Safety Culture."

In addition to offering delegates informative discussions from keynote speakers, we have scheduled two days of aviation-related workshops, covering practically all aspects of aviation, including operations, human factors, cabin safety, ATS operations, the effective use of data, maintenance, aerodrome safety and more. Some workshops will even be repeated, giving more flexibility for delegates to attend a specific workshop. Space will be limited for Workshop sessions, so please register early!

Ottawa will be in all its glory as the seminar takes place during the Canadian Tulip Festival. Visit the CASS 2001 Web site for further information, the latest on seminar speakers and workshops or to register: *<http:// www.tc.gc.ca/aviation/cass2001/>*.
CASS registration fee: C$400 + 7% GST = $428.

For further information or to register contact Transport Canada, Safety Services at (613) 990-5448 or send a fax to (613) 991-4280. △

A Short Lesson in Hydroplaning

In February 1998, a Dassault/Sud Fan Jet Falcon aircraft was on a night instrument flight rules flight to the Peterborough, Ont., airport. The crew of two carried out a non-directional beacon (NDB) straight-in approach to Runway 09. The aircraft touched down within the runway touchdown zone but overran the 5000-ft runway by 236 ft. The nose landing gear collapsed, and the aircraft came to rest on the main landing gear and nose. The accident occurred during night hours in instrument meteorological conditions. The crew members were not injured. This synopsis is based on Transportation Safety Board of Canada (TSB) Final Report A98O0034.

The flight crew did not report any difficulty receiving and tracking the Peterborough NDB. Runway 09 lighting consisted of high intensity runway threshold, runway end, and runway edge lighting. A precision approach path indicator system is installed for Runway 09. All available runway lighting was reported "on" and set at strength five for the approach.

Runway conditions prior to the approach were reported as bare and wet with braking action reported as good by a Learjet aircraft flight crew that had landed on Runway 09 a short time earlier. The airport runway maintenance crew reported sanding the runway, and they considered braking action to be good just prior to the Falcon's landing. All of the above runway information was passed to and acknowledged by the flight crew.

The aircraft landed within the touchdown zone with full trailing edge flap extended, and the speed brakes were extended immediately after touchdown. The crew reported that the anti-skid braking action was fair for the initial portion of the landing roll but decreased to near nil as the aircraft decelerated from a touchdown speed of 125 kt. The captain selected the anti-skid brake system "off" and deployed the aircraft drag chute when it became apparent that he might not be able to stop the aircraft before the end of the runway. He continued to apply maximum brakes but was not successful in stopping on the runway. For undetermined reasons, the drag chute did not remain attached to the aircraft.

Light rain was reported falling throughout the night and early morning hours with the temperature at one to two degrees above freezing. The visibility deteriorated to three-eighths of a mile in moderate snow, and wet snow accumulated on the runway surface immediately after the occurrence. The flight crew did not observe snow on the approach until after they had descended below the cloud base just inside the final approach fix, and it did not appear to them that there was any build-up of snow on the runway during the approach.

All four tires showed evidence of hydroplaning. When hydroplaning occurs, the tires of the aircraft are completely separated from the actual runway surface and will continue to hydroplane until a reduction in speed permits the tire to regain contact with the runway surface.

During total *dynamic hydroplaning*, the tire lifts off the runway and rides on the wedge of the water, causing such a complete loss of tire friction that wheel spin-up will not occur. On wet runways, where there is not enough water to cause dynamic hydroplaning, *viscous hydroplaning* can occur. This term describes the normal slipperiness or lubricating action of water. Viscous hydroplaning does not reduce the friction to such a low level that wheel spin-up will not occur. On the other hand, *reverted rubber hydroplaning* can occur when a locked tire is skidded along a very slippery water- or slush-contaminated runway at any speed above about 20 kt, where the heat generated by friction produces steam and begins to revert the rubber, on a portion of the tire, back to its uncured state.

The increase in stopping distance as a result of hydroplaning is impossible to predict accurately, but it has been estimated to increase by as much as 700%. Performance graphs for the aircraft indicate that a landing distance of 4400 ft was required for the aircraft at the calculated landing weight of 22,198 lb. Landing distance was calculated for a bare, dry runway condition.

Analysis—Based on reports received en route and prior to their approach, the flight crew anticipated and planned for a landing on a bare, wet runway. This runway condition would not likely have significantly increased the aircraft landing distance from that of a landing on a bare, dry runway, and the crew would have had sufficient runway to land the aircraft and successfully stop on the runway. The precipitation changed to light snow and rain at about the time the flight crew commenced the approach. A film of slush and water that accumulated on the runway was sufficient to cause hydroplaning but not of sufficient depth to be visible to the crew on approach.

The reduced braking action on the wet runway prevented the aircraft from decelerating normally with the anti-skid brake system activated. Despite the fact that an anti-skid brake system would provide a better braking action than a conventional braking system, the captain decided to switch off the anti-skid braking system. When the anti-skid system was deactivated, the wheels locked in a skid, the hydroplaning reduced the braking action to near nil, and the aircraft travelled off the end of the runway. △

* * * Happy New Year * * *

Avoiding Birds—the BAM/AHAS Program

Ongoing efforts to manage the risk associated with collisions between aircraft and bird species that are rapidly adapting to the human landscape have produced some exciting developments. One such development that offers valuable assistance for flight planning in the U.S. and southern regions of Canada is the BAM/AHAS program first developed for the U.S. Air Force (USAF). This initiative has reduced the number of bird strikes on some military routes by as much as 60%.

BAM and AHAS

Over the past 20 years, bird strikes to USAF aircraft have resulted in more than 30 aircrew fatalities, 20 destroyed aircraft and hundreds of millions of dollars in property damage. Many of these strikes have occurred on low-level and range missions where there is no possibility of controlling low-flying birds. Under these circumstances, the only option for reducing bird strikes is to avoid the birds. But how do you determine which birds are where, especially when they are so dynamic and varied in behaviour?

To address this problem, a Bird Avoidance Model (BAM) was conceived by the USAF in the early 1980s. By compiling historical data on large bird populations and their movements, BAM gave pilots and mission planners a basis for taking evasive action. However, this original version was not user-friendly and gave only a crude indication of where birds might be encountered.

The current BAM was introduced in the summer of 1996 and, according to Lt. Curtis Burney, USAF Bird Avoidance Strike Hazard (BASH) team, it is a major evolution in bird modelling. The new BAM provides a representation of bird density overlaid on a standard map. Each square kilometre of the U.S. can now be assigned a unique risk value for bird strikes. BAM now provides data on 60 species of birds most hazardous to aircraft flying at low levels. To make things simpler, these 60 species are grouped into 16 composite types according to behaviour. Also, BAM can now be accessed through a simple, menu-driven, PC-based program, allowing users (anyone with access to a PC Internet connection) to assess potential bird hazards by geographic locations, time of year, time of day, and for selected routes. By comparing the relative risk of different flight plans, users are able to select the safest times and locations to fly.

BAM has proven to be an extremely useful tool. In addition to it being used in military operations, BAM can provide information on where birds are likely to be, based on where they have been in the past. Flight planners and pilots can use this information for planning periods in advance of 24 hr.

However, there was a need to account for real-time bird concentrations and behaviours. BAM does not

a) provide specific information on hazardous species such as turkey vultures and red-tailed hawks; these birds accounted for 27% of identified strikes and 53% of the risk (probability of damage) to aircraft flying low-level missions;
b) bring together data on the dynamic conditions that bring soaring birds into contact with aircraft, e.g., information on weather conditions is needed because weather is one of the key factors that creates the circumstances for strikes—the depth of thermals used by soaring vultures;
c) account for the fact that at any given time during the day or night and at all times throughout the year some species of bird is active. As a result, it is not possible to avoid all birds; the key is to be able to avoid the most hazardous species.

To address this need, the Avian Hazard Advisory System (AHAS) was developed to extend the capacity of BAM. AHAS is designed to link (i) BAM's historical data on bird activity; (ii) weather conditions and their relationships to bird activity; and (iii) strike rates for specific bird species. In addition, AHAS now incorporates data on bird activity gathered by the Next Generation Weather Radar (NEXRAD) system, making it possible to provide information on bird strike risk levels that can be updated every 20 to 35 min. Currently AHAS covers two-thirds of the lower 48 states.

"Today, we can monitor bird migration in near-real time and predict bird behaviour. With AHAS (and BAM), we can synthesize the information to effectively manage the bird strike risk and help relieve aircrews, SOFs [special operations forces], aircraft schedulers and commanders from becoming bird experts." *<http://www-afsc.saia.af.mil/magazine/htdocs/afcs2.htm>*

Together BAM and AHAS focus on bird movements and behaviours for both long- and short-term flight planning. For more information on BAM and AHAS, visit *<http://www.ahas.com>*.

For more information contact:
Bruce MacKinnon
Wildlife Control Specialist
Transport Canada, Safety and Security (AARMB)
Aerodrome Safety Branch
18C, Place de Ville, Twr C
Ottawa ON K1A 0N8
mackinb@tc.gc.ca

Unauthorized IFR Flight Proves Fatal

On May 24, 1999, with one pilot and one passenger on board, a Mitsubishi MU-2B-40 Solitaire aircraft departed on a night instrument flight rules (IFR) flight from Parry Sound/ Georgian Bay Airport (CNK4), Ontario, destined for Lester B. Pearson International Airport (LBPIA) in Toronto. Prior to departure, the pilot received his IFR clearance via telephone from the Sault Ste. Marie Flight Service Station (FSS) with a clearance valid time of 21:18 Eastern Daylight Saving Time from the Toronto Area Control Centre (ACC) and a clearance cancel time of 21:35.

When the pilot did not establish communication with the Toronto ACC within the clearance valid time, a search was initiated. The aircraft was located three days later one nautical mile west of the airport. Both occupants were fatally injured. The aircraft disintegrated as it cut a 306-ft swath through the poplar forest. The accident occurred at night in instrument meteorological conditions (IMC). This synopsis is based on Transportation Safety Board of Canada (TSB) Final Report A99O0126.

The pilot flew the aircraft to CNK4 on Friday, May 21, to spend the weekend with other family members. On Monday, the pilot and his son debated throughout the day whether to fly to Toronto that evening or delay the departure until the next morning. The pilot was planning to fly the aircraft to a business meeting scheduled the next morning in Baltimore. The son was scheduled to work at the family company office on Tuesday, May 25. At 15:47, the son telephoned the Sault Ste. Marie FSS, obtained a weather briefing, and advised the FSS of a tentative departure time of 19:00 or 20:00. The FSS specialist advised of definite IMC weather for the area because of a low pressure system located near Manitoulin Island, Ontario.

A flying instructor based at CNK4 at the time of the occurrence reported the weather to be as follows: southwest winds at 5 to 10 kt, ceiling 500 ft overcast, visibility 3 to 4 SM, and rain. A weather forecast for Baltimore and Toronto for the next day, indicating probable visual meteorological conditions (VMC), was also provided.

Later that day, the pilot announced that he was going to fly to LBPIA that evening, and an IFR flight plan was filed via telephone at 20:19 with a proposed departure time of 21:00. The pilot and his son then drove to CNK4, but because of heavy holiday weekend traffic, they did not arrive at the airport until after 21:00. The pilot telephoned the Sault Ste. Marie FSS and obtained the IFR clearance for departure at 21:22. The pilot taxied onto Runway 35, which was 4000 ft long, and took off downwind. It was not determined whether the flaps were extended during the takeoff; however, it was the pilot's practice to select 20° of flap for takeoff, as trained. The pilot was seated in the left seat.

The aircraft turned left after departure and, while turning through a heading of 130°M and in a shallow descent, it struck trees. Following the initial tree strike, the aircraft continued to turn left to a heading of 115°M, rolled inverted, and struck the ground. The initial tree strike area was determined to be located one nautical mile west of the airport.

At the time of impact, the landing gear was retracted and the flaps were found to be extended between zero and five degrees. Many of the avionics components and instruments did not reveal conclusive information. One of the airspeed indicators revealed a pointer imprint at 190 kt. The impact sustained during the crash damaged the emergency locator transmitter (ELT) antenna, battery pack, and circuit board, and sheared off the gravity (G) switch. The ELT would not have functioned under these conditions.

The engine examination revealed no pre-impact failures of any component parts or accessories that would have precluded normal engine operation. The propeller examination revealed that both propellers were rotating with power. Although precise blade angles could not be established, they were in a normal operating range, and neither propeller was in the feathered position or in beta range.

The pilot had accumulated approximately 5500 flying hours, including 407 hr. on the MU-2, about 332 of which were flown as pilot-in-command. There was no record of an application having been made for the endorsement for the Mitsubishi MU-2 aircraft type or for the Cessna 414 aircraft type, which was previously owned and flown by the pilot. The pilot provided the training provider with licensing documentation that indicated that he held an instrument rating when, in fact, he did not hold this rating.

The pilot's latest aviation medical examination was performed in April 1999, and he was issued a Category 3 medical certificate. Records dating back to 1989 indicated that he had been diagnosed with non-insulin-dependent (diet-controlled) diabetes. Medications were scattered throughout the occurrence site. It was learned that the pilot had suffered Type II diabetes (requiring insulin in addition to dietary management) and hypertension for more than five years. It was also learned that the pilot suffered from asthma. The pilot

did not report his asthma and hypertension medical conditions to his civil aviation medical examiner, nor did he declare that he required oral hypoglycemics to control his diabetes.

All pilots are vulnerable to the effects of spatial disorientation while flying in IMC conditions. The degree to which a pilot may be affected by this phenomenon depends on many factors, including the performance of the aircraft, and the pilot's experience and medical condition.

Analysis—The *Canadian Aviation Regulations* (CARs) require pilots flying this model of aircraft to have their pilot's licence endorsed for high-performance aircraft. Similarly, a valid instrument rating is required by any pilot filing a flight plan and flying under IFR. The pilot's private pilot licence was not endorsed with an instrument rating, nor did he have an aircraft high-performance type rating.

There are numerous indicators that the departure may have been rushed. The pilot and passenger arrived late at the airport because of busy highway traffic during the holiday weekend. The takeoff was conducted downwind. Since the pilot was trained, and it was his practice, to conduct all takeoffs using 20° of trailing edge flap extended, and the flaps were found in the zero to five degrees range, the pilot most likely made a left turn shortly after takeoff and raised the flaps in the turn. Finally, the occurrence site is only one nautical mile west of the airport, and the aircraft had turned through more than 180° prior to striking the first trees, which are also indicators that the departure may have been rushed.

After becoming airborne at night, in rain, with little outside visual reference, the pilot would have been required to rapidly shift his scan from outside the aircraft to the flight instruments in the cockpit. This transition is a critical stage of flight and demands positive, deliberate action and the pilot's full attention. While the aircraft was at low altitude, the landing gear was retracted.

Moments after landing gear retraction, the pilot turned the aircraft left for the on-course track and raised the flaps. The tasks of moving the gear selector and raising the flaps, although not demanding, would divert some of the pilot's attention away from monitoring the flight instruments. This diversion during the transition from visual flight to instrument flight may have caused the pilot to become disoriented and to misinterpret or improperly scan the flight instruments.

The pilot may have also been subjected to somatogravic illusion. The overall result was that the pilot allowed the aircraft to commence a shallow descent until it struck trees. The airspeed indicator imprint and the length of the wreckage trail through the heavily wooded area indicate that the aircraft entered the impact zone at high speed.

Among its findings, the TSB determined that the pilot was not certified for the IFR flight, he did not completely report his medical conditions to the civil aviation medical examiner, and his private pilot licence was not endorsed with the appropriate high-performance aircraft rating. He may also have been subjected to somatogravic illusion and allowed the aircraft to descend into terrain after a night takeoff in IMC.

As a result of this accident, TC has initiated a project to cross-check a sampling of IFR flight plans against instrument qualifications of the pilot filing the flight plan in order to determine if there are systemic irregularities that would warrant highlighting that area of flight operations. △

True Underwater Egress Story

Dear Editor:

In March 1999 I was piloting a float-equipped C-185, carrying two scuba divers and gear. The divers were performing maintenance checks of mooring buoys at various isolated places in the Queen Charlotte Islands. At about 2:30 pm we had just completed our second-last inspection of the buoys at a place called Murchison Island when we were involved in an accident.

The aircraft was just becoming airborne after a normal take-off run when it began to roll to the right. I was unable to counteract the roll, and the right wing tip struck the water, causing us to strike the water nose-first and eventually come to rest in an inverted floating position. I was amazed how quickly I found myself underwater struggling to escape. There was absolutely no time to snatch even a breath of air. The impact must have caved-in the windshield, allowing the cabin to fill rapidly with sea water, immersing our heads and upper bodies first as the plane settled onto its back. I was able to release my seat belt and shoulder harness, then the door latch without difficulty. However, it was some time (it seemed like forever) before the door would open and I was able to escape to the surface. Happily, both passengers appeared at the same time, and we climbed onto the float bottoms.

Both divers were wearing dry suits, so they were well protected from the very cold water. Although, I was out of the water, I quickly began to shiver in the cool air (5–8°C). We were too far from shore to attempt to swim, so we were forced to wait for about 45 min as we drifted toward a rocky beach. It became apparent, though, as we neared the beach, that the aircraft was in a gentle tidal current that would carry us out towards the Hecate Strait where our chances for survival would be very limited. Therefore, we decided to swim for the beach. Although only about 75 m, it was the most difficult swim of my life because of the cold water. I was very fortunate to have two dry-suited companions because I doubt that I could have made it ashore without their help. One of them gave me his dry-suit liner to wear instead of my wet clothing, so I was spared the effects of hypothermia. Fortunately the weather remained clear and dry.

We were located at about 10:00 pm by the search and rescue (SAR) aircraft from Comox, British Columbia. They were able to detect the flash from a waterproof camera that we had recovered from the plane. Incredibly, it floated to the surface after we had climbed onto the floats, and it proved to be our salvation! A coast guard ship happened to be about one hour from our position and was directed to us by the aircraft crew. We were safely aboard by about 11:30 pm. I have some reflections upon my experience that I hope could prevent other seaplane pilots from having a similar adventure. Although the aircraft was never recovered for mechanical investigation, I think the likely reason for the unexpected roll into the water was a strong gust of wind. What seemed like a routine takeoff surprised me by ending in an inverted landing. We are reminded that one of the most critical phases of flight is during takeoff, and you can never be too attentive to factors influencing your aircraft during this period.

I'm convinced that the use of my shoulder harness prevented my demise. My right shoulder was dislocated by transfer of impact forces through the throttle control. Had I not been wearing the harness, I would certainly have struck the panel head-first, been knocked unconscious and drowned.

A quick-release door jettison would have been useful. The time required for the water pressure to equalize in the cabin seemed interminable, and we were fortunate that the doors were not jammed by the crash.

The appearance of the waterproof camera was pure luck. I would not fly a seaplane again without carrying certain items on my person. They would include a small water-proof flashlight and lighter at minimum. Trying to swim back into the cabin to retrieve items would have been suicide.

I'm not sure whether a lifejacket would have helped or hindered exiting the cabin. It certainly would have helped during the swim ashore. Perhaps an inflatable, fishing-type vest would be a viable alternative for float pilots.

An accurate flight plan in such a sparsely settled area is critical to successful SAR operation. If you go down, stay put and try to make yourself as conspicuous as possible. Luckily, we were spared a cold night in the bush, but we were prepared had we not been located at night.

If possible, get yourself some underwater egress simulation time. Some locations for this practice simulation have been described in past issues of the ASL. It is remarkable how difficult simple manoeuvres like opening doors can be when you're inverted and underwater!

Mark Batten
Queen Charlotte City,
British Columbia

Upcoming Regional Events.

The following schedule for upcoming courses and/or workshops is tentative. Please contact your regional office for exact location and cost.

Crew Resource Management (CRM). This course is designed to provide knowledge and skills by using all available resources to achieve safe, efficient flight. The course covers the topics for initial training as identified in paragraph 725.124(39)(*a*) of the *Commercial Air Service Standards*.

Company Aviation Safety Officer (CASO). This program is designed to provide both the theory and practical application of topics such as incident reporting, tracking and analysis; the company safety survey; risk management concepts; accident prevention; the safety committee; and emergency response planning. This course covers the topics as identified in subsection 725.07(3) of the *Commercial Air Service Standards* (Air Operator Flight Safety Program). System Safety offers one free seat to each CEO, Operations Manager, Chief Pilot, Chief of Maintenance or Chief Flight Attendant for every company employee that attends.

Pilot Decision Making (PDM). This course covers the decision-making process, hazardous attitudes and behaviour, judgment, risk management and communication skills. It satisfies the requirement of section 723.28 of the *Commercial Air Service Standards*, VFR Flight Minima—Uncontrolled Airspace for a "recognized Pilot Decision Making course".

Human Performance in Aviation Maintenance (HPIAM). The concept of HPIAM is to provide awareness to the maintenance personnel and management in order to reduce an accident or incident.

Atlantic Region

Courses and workshops are available on demand. For further information, please contact Rosemary Landry at (506) 851-7110.

Quebec Region

Skills Review Seminars Flying: *Risk factors and decision making* (in French)

January 16—Chibougamau
January 17—Rouyn
February 21—Quebec City
February 22—Chicoutimi
March 2—Les Cèdres (in English)
March 7—Lachute
March 8—Valcourt
March 13—Drummondville
March 17—Gatineau
March 31—Rimouski
April 1—St-Georges-de-Beauce
April 7—Amos
April 8—Mont-Laurier
April 11—St-Hubert
April 18—Sept-Îles
April 26—Dolbeau
April 27—Trois-Rivières
May 9—Mascouche
May 23—Dorval

CRM—January 24–25 Quebec City March 14–15 Montreal **CASO**—March 21–22 Quebec City
PDM—January 23 Montreal (Helicopter) February 22—Quebec City (Aeroplane)
March 7—Quebec City (Helicopter) March 28—Montreal (Aeroplane)
For more information or to register, please call (514) 633-3249 or send an e-mail to <lanoixs@tc.gc.ca>.

Ontario Region

CRM—January 29–30, 2001 Toronto March 28–29—Sudbury May 17–18—Ottawa
CASO—May 3–4—Toronto March 14–15—Sault Ste. Marie
PDM—January 25—North Bay
HPIAM—February 6–7—Ottawa March 6–7—Toronto
For information or to register for the above courses, please call (416) 952-0175 or fax (416) 952-0179 or send an e-mail to <neln@tc.gc.ca>.

Prairie & Northern Region (PNR)

Quarterly Regional Aviation Safety Council Meeting February 21—Whitehorse, Yukon
For information on courses and workshops in PNR, contact Carol Beauchamp at (780) 495-2258 or send an e-mail to beaucca@tc.gc.ca; fax: (780) 495-7355.

Pacific Region

CASO—January 30–31—Richmond
PDM—Third Thursday of every month–Richmond. January 18—Abbotsford
HPIAM—February 21–22—Kelowna March 7–8—Langley March 28–29—Prince George
For information on courses and workshops in Pacific Region, please contact Lisa Pike at (604) 666-9517, toll-free at 1-877-640-2233 or send an e-mail to pikel@tc.gc.ca; fax: (604) 666-9507.

Erratum—Self-paced Study Program

A couple errors slipped into questions 1 and 14 of the Transport Canada Self Paced Study Program, published in the *Aviation Safety Letter*, Issue 4/2000. Question 1 should have read "Using the *A.I.P. Canada* GEN 1.6.2 charts, find the end of Evening Civil Twilight on...." The answer to question 1 should be changed to 18:35 local. Also, in answer to question 14, the increase in take-off distance should be 80% instead of 90%. Thank you to the readers who brought those to our attention. —Ed.

To Err is Human

by Gerry Binnema, Regional Aviation Safety Officer, Pacific Region

As a Safety Officer, I encourage people to talk about the errors they have made and the lessons they have learned. But I can't convince others to be more open if I won't lead the way. So let me tell you about some lessons I learned while I was working as an aircraft maintenance engineer (AME) and part-time pilot for a small outfit that owned two Piper Navajos. We received a charter for a cargo flight to Ottawa, Ontario. My boss, Jim, told me to plan the flight, though he would be the pilot-in-command.

My fuel planning indicated that the total fuel burn for the flight was exactly equal to the capacity of the main tanks. The auxiliary tanks indicated 40 gal., giving us over an hour of reserve fuel, so I just filled the main tanks. I couldn't visually check the fuel level in the auxiliary tanks, but that didn't seem to matter since it was only reserve fuel. Besides, I needed to change the O-rings in the fuel selectors, and this was a great opportunity to bring the fuel level down to ease the job of draining the tanks. Oops, was that my AME hat slipping out?

Prior to start-up, Jim asked me a couple of questions about my planning, and he asked me three times if I was sure we had enough fuel. Jim was a quick, aggressive, and task-oriented man. If he offered an opinion, there was little point in arguing, and if he asked a question, you better have the answer. Frankly, he intimidated me. He said I could fly the first leg, and during the flight, two significant things happened. First, Jim had me lean to a certain exhaust gas temperature (EGT) reading, giving us a fuel burn of 18 gph, not the 16 gph I had planned. I knew this airplane's EGT read hotter than the other's, but you don't argue with Jim. Second, the heater stopped working, and the cabin temperature plunged to -20°C. I suggested that we turn the heater switch off, but Jim thought the heater was doing something. It turned out he was right.

On the return flight, after we reached cruise altitude, Jim switched to the auxiliary tanks, something I had forgotten to do on the way up. Thirty minutes later the right engine quit! The auxiliary tank was already empty. This was not the best way to identify an inaccurate fuel gauge! We switched back to the main tanks, and the engine came back to life.

As the flight continued and the fuel gauges marched toward empty, I started to be more assertive, suggesting that we lean the engines a little more. We leaned according to the manual and got 16 gph. I turned off the heater, which was blowing cold air onto my frozen feet. The main tanks were getting low, so we ran the left engine on the auxiliary tank to drain the little bit of fuel remaining in that tank. My eyes were glued on the left engine fuel flow gauge, watching for a flicker, when the right engine quit. This was not good. Now there was no fuel in the right wing at all.

I switched both engines to the left main tank, which was reading under an eighth of a tank. Things were now very tense, but we were on radar vectors for the approach with lots of work to keep our minds off of the fuel situation. The controller gave us a short gate for the approach; we landed and taxied in. Whew!

By the next morning I had convinced myself that there was probably still some fuel in the left auxiliary tank and some more in the main tank. I started to drain the tanks for that O-ring change. I went numb with shock when I found a total of only two gallons of gas. We had been only four minutes from total fuel exhaustion.

It turned out that we actually had only 20 gal. reserve when we departed. Running richer than originally planned had burned 12 gal. The heater had failed, but it had continued to pump two gallons per hour out of the right wing and into the air. A combination of poor planning, trusting a fuel gauge, a lack of assertiveness, and a mechanical failure of the heater led to a very close call.

Lessons learned?

1. Reserve fuel is not *nice-to-have*. You need it in order to cope with all the things that could possibly go wrong on any given flight.

2. Flying with someone who intimidates you is a significant risk factor.

3. Any change to the plan requires attention. What impact will it have? Can I correct for it? What are the unknowns?

4. This was one more chink in the armour for me. Like many people, I started my career in aviation believing that accidents only happen to stupid people and that I wasn't stupid. Perhaps accidents do only happen to stupid people. The problem is, from time to time, we all get stupid, don't we? △

Please . . . have you closed your flight plan?

En route NOTAMs and Flight Information Regions

by Jim F. Pengelly, Aircraft Licensing Officer, Transport Canada Ontario Region

While most pilots take the time to check the NOTAMs for their departure, destination and alternate aerodromes, it appears some may be forgetting to check their en route NOTAMs in the flight information region (FIR) summary. Below is an example of what happened when a pilot neglected to check the FIR summary.

In late September 2000, a Transport Canada inspector was monitoring a high-powered rocket launch in Southern Ontario when an aircraft flew through the launch area (about two square nautical miles). Transport Canada had redesignated the Class F advisory airspace (CYA) as Class F restricted airspace (CYR) to permit high-powered rocket launches. The *Designated Airspace Handbook* was amended by a NOTAM that was issued for the FIR 48 hr. ahead of the activation time specified by the user.

NOTAMs are the means by which changes to information on aeronautical charts or aeronautical information publications are disseminated. They are a pilot's source of relevant information pertaining to flight operations! (Ref.: MAP 5-1 of the A.I.P.) As the change in airspace designation is considered en route information, the Toronto Flight Service Station (FSS) placed the NOTAM in the CZYZ FIR summary relating to CYA and not specific to the local airport or FSS station.

The aircraft that flew through the restricted area, which is used by two operators in the area, was familiar to the Transport Canada inspector. One of the operators stated that there had been no information about the rocket launch on the airport automatic terminal information service (ATIS) that day, but it was later discovered that it had been published in the general summary of the CZYZ FIR, as mentioned previously.

According to the pilot, the NOTAMs were checked for local VFR operations, but he had not checked the FIR summary. Many pilots not heading in Toronto's direction do not check the FIR summary, even though it contains crucial information, because they feel it isn't relevant. This oversight put both the pilot and his passenger at greater risk.

Neglecting the tools and resources present can lead to a dangerous situation with potentially disastrous consequences. Section 602.71 of the *Canadian Aviation Regulations* (CARs) states that the pilot-in-command of an aircraft shall, before commencing a flight, be familiar with the available information that is appropriate for the intended flight. This includes the NOTAMs, and all facility-specific and en route information. Consider the consequences of what would happen to an aircraft that catches a four-foot rocket or if a descending rocket with its parachute deployed goes through a propeller or gets caught across the windshield. When checking the NOTAMs, don't stop at your destination and alternate aerodromes, check your en route information as well. △

The Deliberately Weak Link in the Electrical Chain *cont. from p. 12*

never intended (e.g., as a switch) and to reset them when they should not be reset.

The electro-mechanical construction of a circuit breaker was not designed for use as a switch and using it for this purpose causes premature wear and the risk of failure. When a circuit breaker fails, it will take down a system that may be needed for the safe operation of the aircraft or it will leave a circuit that should be de-energized on-line. Both alternatives are unattractive, and both are capable of inflicting catastrophic consequences.

It is wise to think twice before resetting any circuit breaker in flight. It is telling you that something is wrong—that there has been a serious electrical event. This danger signal must be interpreted with extreme caution. The old rule of thumb to automatically allow one reset is not prudent. Safety-conscious airlines are now telling their crews not to reset any breakers unless they are essential to safety and then to do so only once. Wherever possible, this should be done only after consulting the relevant resources (e.g., the quick reference handbook, the minimum equipment list (MEL), the aircraft flight manual, the company operations manual, and/or maintenance). This approach might suggest that the reset be delayed until the service is needed. There is no need to reset a landing gear circuit breaker that trips after takeoff until you are committed to landing.

Unless your organization already has a comprehensive policy on circuit breakers, it is time that flight operations and engineering/maintenance personnel develop one. Even if you have one, don't assume that everyone is aware of it, understands it and is using it. Better to be surprised by finding out now that they are not than to learn about it after a tragic event. Being at altitude with a deteriorating situation on your hands is no time to develop a good policy. In the meantime, logging any circuit breaker anomalies gives maintenance a much more accurate picture of the nature of the problem.

Circuit breakers: a willing friend, ready to save you from harm's way, provided you understand and respect their limitations.

Mike Murphy thanks Mark van Berkel at Transport Canada, Aircraft Services, for his insights into this important topic; Texas Instruments (Klixon Circuit Breakers) for permission to use the picture; and a group of colleagues for vigorous peer review of this article. △

The Deliberately Weak Link in the Electrical Chain

by Mike Murphy, Chair of the Air Passenger Safety Group

Circuit breakers! They stare at you from panels at your knees, overhead, behind you or perhaps on the console between you and your crewmate. Occasionally, they trip. Just what do these humble yet hardworking devices do? What does it mean when they pop? And, just as importantly, what don't they do?

Circuit breakers probably don't get the attention they deserve. However, several recent high-profile aircraft accidents have reminded us that assumptions, misunderstandings or neglect of critical components, even small ones like circuit breakers, can have tragic consequences. The problem is even more acute as aircraft become increasingly dependent on highly integrated electronic systems for navigation, stability and control. Fly-by-wire aircraft are obviously totally dependent on electricity for safe operations.

Aircraft circuit breakers are designed to interrupt the flow of electrical current when specific conditions of time and current are reached. Those conditions generate heat, and circuit breakers are designed to trip (open the circuit) before this heat damages either wiring or connectors. A specification might be for a breaker to trip under a massive short jolt (e.g., 10 times the rated load of the circuit breaker for between .5 to 1.4 seconds) or a longer, less intense overload (e.g., twice the rated amperage for 3–130 seconds, depending on the type of circuit breaker). If the designed overload conditions are not exceeded, the circuit breaker will not trip.

The very tolerances that must be built into a circuit breaker to prevent nuisance tripping, such as the high transient current that flows when a motor or component is started, mean some glitches may not trip the breaker. Ticking faults and arc-tracking are examples. Ticking faults occur when tiny bolts of electricity intermittently arc from exposed wire conductor. On wires covered with aromatic polyamide, installed in many aircraft built since 1970, this can burn the thin insulation, converting it into carbon, which is an excellent conductor—a nasty case of the insulator becoming the conductor! This can, in turn, lead to very short bursts (micro-seconds) of violent arcing where localized temperatures can reach extremely hot temperatures (well in excess of 1000°C) capable of igniting nearby flammable material. Nevertheless, short, violent bursts of arc-tracking will not necessarily trip breakers, which are comparatively slow-acting devices. Special arc-fault circuit interruption devices, still a few years away from widespread use in aviation, are needed to deal this type of situation. If your aircraft has aromatic polyamide wire, there are very good reasons not to be in a rush to reset any tripped circuit breaker—the results could be catastrophic.

Circuit breakers are not intended to protect the electrical equipment, which may have its own built-in protection or mitigation system, but are intended to protect the wiring and connectors, which would otherwise have no such protection. Aging, vibration, excessive bending, improper installation, heat, moisture, friction, wind blast, and chemicals, such as de-icing fluid, toilet fluid, hydraulic fluid, oil and fuel, can damage the insulation on the wire, if not the conductor itself and any connectors. In addition to disabling the circuit and any associated component, this could also create a fire hazard, possibly in an area where it could be impossible to use extinguishers and that could easily threaten the safety of the flight. With any in-flight fire, especially one in an inaccessible location or close to critical components, an

An aviation circuit breaker.

immediate landing becomes a very high priority. Because such an option may not always be readily available (e.g., in mountainous, arctic or oceanic areas) adequate circuit protection and a good knowledge of what it can and cannot do is essential.

Circuit breakers are thermal-mechanical in nature. Bimetallic elements, with one metal expanding more under heat than the other, pop the breaker open. This also enables them to be reset, albeit only after they have cooled down. However, there are good reasons why it may not be advisable to do so, as we will soon see.

On many light aircraft, the circuit breakers are mounted along the bottom of the instrument panel. Many are flush fit and cannot be manually tripped or pulled. On larger aircraft, they are usually grouped in panels placed around the cockpit in locations where they would not be displacing vital instruments, switches or controls, and most can be manually tripped or pulled. Having them within sight and reach, although a necessity, is both a blessing and a curse. A blessing because they can be seen and, if need be, reset. A curse, because it is tempting to use them for a purpose they were

cont. on p. 11

TAKE FIVE...

for safety

Five minutes reading could save your life !

RCO and DRCO

RCO

Remote communications outlets (RCO) are remote radio transmitters/receivers established as an extended communications capability. They are used to

- receive position reports;
- retransmit ATC clearances; and
- provide remote aerodrome advisory services (RAAS) or flight information services en route (FISE).

It should be noted that flight service stations (FSS) offering these services are not located on-site. RCO frequencies are used like any other frequency.

DRCO

A dial-up remote communications outlet (DRCO) is an RCO that is equipped with a commercial telephone line. The line is only "opened" once the pilot or flight service specialist has made a call, and only the flight service specialist can disconnect the line. DRCOs are used to provide FISE.

Activating the DRCO

- Select the published RCO frequency;
- Push the microphone button four times in no more than four seconds;
- A dial tone will be heard;
- The message "lien établi/link established" indicates that communication has been established;
- Initiate the radio communication as usual.

Difficulties?

- A "call terminated" message indicates that the telephone line has been inadvertently disconnected.
- If the line is not available, a "try again" message will be broadcast.

Reference: A.I.P. Canada, RAC 1.1.4

THE CONFIDENTIAL
TRANSPORTATION SAFETY REPORTING PROGRAM

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Securitas@tsb.gc.ca

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