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

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Aging Pilots: Problem or Simply Reality?

Dr. David Salisbury

Canada's pilot population is aging. That is to say, the average age of all the pilots in Canada is older than it was a few years ago. This is due to a number of factors, including the reality that people are living longer and healthier lives. As the baby boom generation ages, the sheer number of older people increases. In addition, economics has slowed the entry of younger pilots into the system. As of June 2010, there are over 5 700 medical certificate holders who are older than 65 in Canada, which is close to 10 percent of the pilot population. We have pilots in their seventies, eighties and even nineties flying in Canada.

What do we know about older pilots? Statistically, they will tend to have more medical conditions of concern to aviation medicine than younger pilots. Most, but not all, will need glasses or other types of corrective lenses. Some will need hearing aids. They will also have slower reaction times, on average, and will be slower to acquire new knowledge and skills. Age is a major factor but it is not the only determinant of cardiovascular disease risk and the risk of sudden heart attack or stroke. Age is also a major risk factor for various chronic medical conditions such as cancer, diabetes, dementia, etc.

In Canada, legislation prohibits discrimination on the basis of age alone. This is one of the reasons that Canada has no upper age limit on having a pilot's licence. Most driver's licence programs in Canada have increased testing requirements in relation to the age of the driver. For example, in Ontario, starting at age 80, drivers must pass vision and written tests every two years and attend a training session to retain their driving privileges. The College of Physicians and Surgeons of Ontario audits every physician's practice starting at age 70 and every two years thereafter.

Transport Canada (TC) mandates an increase in the frequency of medical examinations after age 40 and adds routine electrocardiograms (ECGs) to the testing requirements to maintain a Category 1 medical certificate. The Civil Aviation Medical Examiner (CAME) and/or the Regional Aviation Medical Officer (RAMO) may order additional clinical or laboratory evaluations based on past medical history and physical findings. The standard of care in Canada would suggest that everyone should have their blood lipids tested after the age of 40 to better evaluate their risk for coronary disease. For licensed pilots, fitness assessments are still individualized processes rather than generalized ones based on age.

How do we reconcile the observations of science with the legislation that prohibits discrimination on the basis of age alone? Do we have any evidence that older pilots are less safe or have more accidents than younger pilots? The fact is that we do not. This issue has been explored extensively in the U.S. and other jurisdictions and there is no clear trend in accidents or incidents related solely to pilot age. What we do know is that from time to time, we have accidents associated with older pilots. The question for all of us at that point is always: "Did we miss something?" What can be learned from this accident investigation that could improve our procedures for pilot medical assessment?

Fitness to fly can and does deteriorate with chronic disease onset and age. Some of that deterioration can be overcome with experience and training. Some can be prevented by adopting a healthier lifestyle (i.e. weight control, exercise, not smoking). Medicine can apply technology, procedures and medications to ameliorate some of these conditions. For example, vision defects can be corrected, cataracts can be surgically removed, hearing aids can compensate for hearing loss, etc. However, it is not so easy to detect or compensate for early mental changes or subtle performance deficits. There are currently no quick and easy tests for the early onset of dementia.

Several exciting initiatives, such as the Candrive program (www.candrive.ca), are underway to both detect and hopefully prevent/correct medical problems in aging drivers. The Advance Cognitive Engineering Lab at Carleton University, which is independent of TC, has undertaken simulator studies on aging pilots. TC Civil Aviation is following these developments closely. At the moment though, the decision regarding continued competence is left up to the pilots and their families. Is that enough? As a society we face similar issues in licensing people to drive. When it comes to driving, we mandate some form of retesting with age. Should we do the same for flying? Is there a role for others (family members, friends, flying colleagues) in assessing fitness to fly?

What is the safety message? As pilots, we need to know our abilities and ourselves. We need to know when the time has come to give up the privilege of flying. All doctors, pilots and regulators need to have an ongoing, informed and dispassionate discussion to address this issue and improve the ability to identify those of us, at any age, who can no longer perform at a safe level, for all our sakes.

David Salisbury
Director, Medicine
Transport Canada Civil Aviation

Dr. Salisbury is the Director of Medicine, Civil Aviation, Transport Canada. He is board certified in Community Medicine and Aerospace Medicine as well as being an active aging pilot who holds a commercial pilot's licence, a multi-engine class rating and Category 1 instrument rating.

Air Taxi Floatplane Operations Workshop Brings B.C. Operators Together

Following months of planning, British Columbia-based floatplane operators, other industry representatives, aviation associations, safety advocates, the Transportation Safety Board of Canada and Transport Canada (TC) participated in an air taxi floatplane operations workshop on October 6 and 7, 2010, in Richmond, B.C.

The workshop, hosted by the TC Pacific Region, was created to identify and address safety concerns regarding commercial floatplane operations in the region, and to discuss the results of findings and recommendations from various accident investigations. The main objectives of the workshop were to:

- establish an environment for all commercial floatplane operators in the Pacific Region to openly discuss issues that are important to them as individual operators and as a collective;
- create the opportunity for dialogue on passenger safety and floatplane operations including passenger briefings, emergency egress, personal floatation devices (PFD), aircraft dispatch and flight following; and,
- facilitate the organizing of an association that could provide a venue for promoting sharing of information, resources, best practices and establishing a collective voice to represent commercial floatplane operators in the Pacific Region.

In addition to the issues mentioned above, more key topics were discussed openly and honestly, such as operational challenges, solutions, safety culture, risk management strategies, provision of weather information and several testimonials of real situations experienced in the Pacific Region floatplane environment.

At the end of the two-day event, the following key outcomes were achieved:

- a date was set for the operators to meet and formalize an association;
- a first draft mission statement describing the purpose of the association was created;
- a method of conducting common messaging that better represents the floatplane industry as a group was developed;
- there was a collective recognition of the benefits of working together;
- resources were shared to identify and address safety concerns; and,
- a framework was provided for TC to conduct additional workshops in other regions.

"This workshop was essential to further develop relationships between Transport Canada and air taxi floatplane operators in B.C.," said David Nowzek, Regional Director of Civil Aviation. "I thank the operators for their continued support and cooperation as we combine our efforts to further improve the safety of floatplane operations in Canada." △

False Localizer Course Captures in Autoflight

by Mark Bucken, Specialist, Airspace and Service Requirements, NAV CANADA

"What's it doing now?" More than a few pilots have uttered this phrase while trying to figure out why their autopilot was doing something unexpected. This is why it is of critical importance that cockpit crews maintain situational awareness and monitor what the aircraft is doing at all times, especially when in autoflight.

There have been recent reports of aircraft arriving at Winnipeg, Man., mainly from the east, experiencing false localizer course captures while on autopilot. The problem usually occurs while the aircraft is either on a standard terminal arrival (STAR), or after it has been cleared for the visual approach to Runway 36.

It appears that after the aircraft has been cleared for the approach, the crew, anticipating flying the instrument landing system (ILS) Runway 36 approach, are using either the autopilot NAVIGATION (NAV) on the STAR or HEADING (HDG) mode to position for intercept of the localizer.

On occasion, pilots have then prematurely selected LOCALIZER or APPROACH (APR) mode, anticipating that the flight director will maintain the present heading to intercept and subsequently capture the localizer.

Unfortunately, the early arming of the APPROACH mode allows the autopilot to initiate a turn to track the inbound course when it senses an early fluctuation in the localizer signal. It should be noted that in all of these occurrences, the crews immediately detected the flight deviation and corrective action was taken.

Section COM 3.13 of the *Transport Canada Aeronautical Information Manual* (TC AIM) provides a great deal of guidance on localizer coverage volume, localizer signal limitations, and cautions about their usage.

The coverage and validity of ILS localizer signals is within 35° of either side of a front- or back-course nominal approach path to a distance of 10 NM, and within 10° of either side of a front- or back-course nominal approach path to a distance of 18 NM (see Figure 1). Signal variations outside of these sectors are known to create false capture conditions that satisfy the automatic flight control system's localizer capture logic.

Figure 2 provides an example of what the generic localizer area would look like at Winnipeg for the approach on Runway 36, based on Figure 1.

Through the process of recurrent flight inspections, no problems with front- and back-course (if published) have been observed within the published angles based on the course centreline. The arming of the approach outside

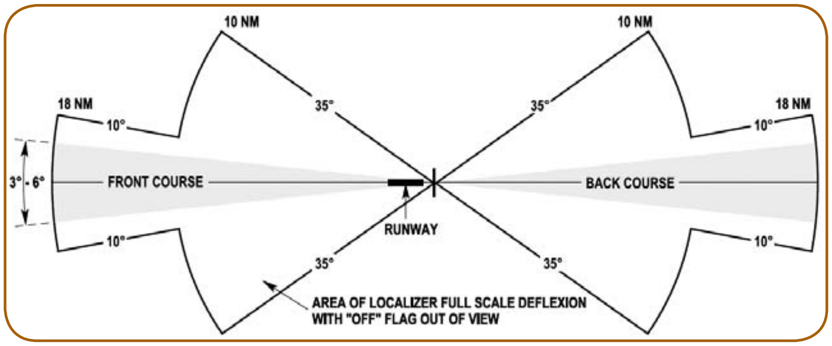

Figure 1

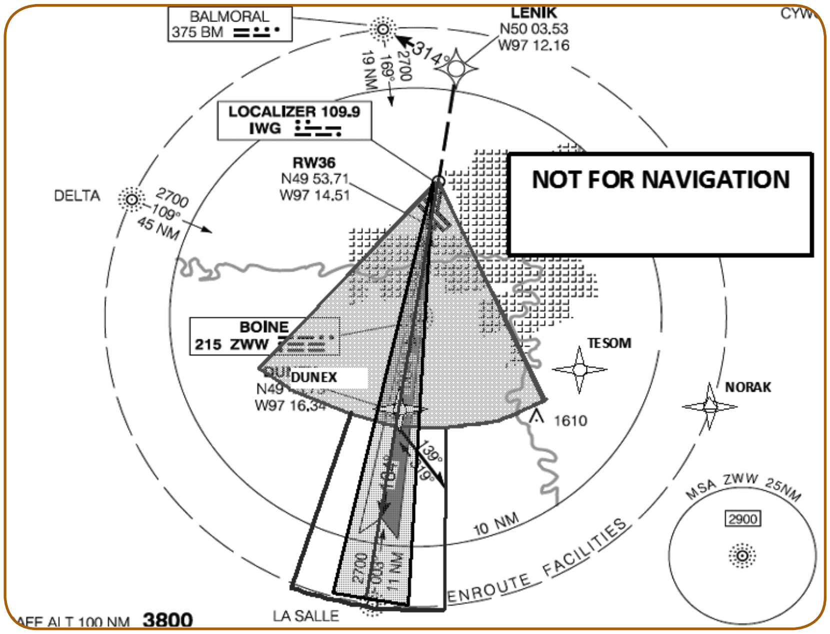

Figure 2: Overlay of the Generic Localizer Coverage on the ILS Runway 36 at Winnipeg airport.

the published sector could result in a premature indication equivalent to an approaching or intercepting on-course centreline. Some flight guidance systems are more sensitive to these fluctuating localizer signals than others and may therefore initiate an early turn in an attempt to intercept the approaching localizer centreline.

With the airplane turning to acquire the "captured" inbound course, just like a normal localizer capture, the first indication of a problem would typically be the localizer deviation displayed on the attitude direction indicator (ADI)/primary flight display (PFD).

Another indication of a problem could occur when the horizontal situation indicator (HSI)/navigation display (ND) ILS becomes erratic or maintains a continuous offset with corresponding unpredictable autopilot control or flight director guidance.

In order to minimize the possibility of a false localizer course capture during an ILS approach, crews should use raw data sources to ensure and verify that the aircraft is on the correct localizer course prior to initiating an auto or coupled approach.

The following cockpit procedures are recommended in the TC AIM (COM 3.13.1 (c)):

(i) APPROACH MODE should not be selected until the aircraft is within 18 NM of the threshold and the aircraft is positioned within 8° of the inbound ILS course; and

(ii) pilots should:

(A) ensure that the ADF bearing (associated with the appropriate NDB site) is monitored for correct runway orientation;

(B) be aware when the raw data indicates that the aircraft is approaching and established on the correct course; and

(C) be aware that, should a false course capture occur, it may be necessary to deselect and re-arm the APPROACH MODE in order to achieve a successful coupled approach on the correct localizer course.

In other words, a coupled approach should be closely monitored, including referring to any other bearing sources, to ensure the aircraft is established on the localizer centerline before commencing final descent.

Whenever flight crews experience false localizer signals, they should report them to ATC for follow-up to determine if the ILS is operating within specifications. △

COPA Corner: The Fix is Only as Good as the Write-up

The following article was published in the April 2009 issue of COPA Flight *under the "Pilot's Primer" column and is reprinted with permission.*

CANADIAN OWNERS AND PILOTS ASSOCIATION

If you fly in an organization with a fleet of aircraft, it's likely that you have a procedure for writing up squawks on them when something goes wrong.

Flying clubs, partnerships, flying schools, and commercial organizations alike find it not only convenient, but also effective to have some sort of system for recording aircraft squawks so that maintenance and the next pilot(s) are aware of the problem.

The squawks are read by each pilot (ideally) prior to flight as part of the pre-flight preparation. A mental note of recent problems that have been repaired and an assessment of deferred squawks are made to determine if the aircraft is sufficiently airworthy for the intended mission.

Sometimes the words "could not duplicate" are written as the mechanic's response to problems that are transient in nature, were simply imagined by the pilot, or so poorly written-up that the mechanic really had no idea what they should be troubleshooting.

Imagined problems do occur, but rarely, and are usually the result of the pilot hearing or seeing something they think they've never heard or seen before. Many times these "problems" are a normal part of everyday operation.

Navigation radio anomalies are frequently written-up like this as a result of pilots being unaware of ground facility anomalies that affect instrumentation. For example, tall corn crops off the end of the runway have been known to wreak havoc with the stability of the VOR [VHF omnidirectional range] signal at my home airport. That particular problem could easily be confused with a bad CDI [course deviation indicator], a problem that the avionics technician will not be able to duplicate in the shop.

In the grand scheme of things, the real problem is poorly written squawks that tell the mechanic virtually nothing about the nature of the problem, or gives them any idea where to begin troubleshooting.

We've all heard of some of the classic examples like, "Squeak in cockpit" to which the mechanic writes: "Cat installed." Or how about this one: "Number three engine missing." Mechanic's corrective action: "Engine found on right wing after brief search."

Regardless of the veracity of these two examples, these types of write-ups are far from adequate and usually result in a less than adequate solution from maintenance. Many times, the mechanic tasked with figuring out what is wrong cannot not properly duplicate the circumstances in order to see or hear what the pilot has written-up.

In other cases, the pilot fails to provide the exact circumstances under which the problem occurred. This is especially important with engine and avionics problems since there are so many possible reasons they could occur.

So how should a pilot write up a problem so that the mechanic has half a chance of finding a solution?

Start by simply indicating what you believe is malfunctioning. Then, indicate how it is malfunctioning. Use your senses for this part. Does it smell? If so, what does it smell like? Did you see something odd happen? Describe it so anyone can visualize it. Did you feel something? Try to describe the sensation, and do so with an explanation that the mechanic might be familiar with. For example, saying that the "Nose gear doors moan like a constipated rhinoceros" may not mean much if the mechanic has no applicable experience with rhinoceroses.

Start by simply indicating what you believe is malfunctioning. Then, indicate how it is malfunctioning.

Finally, describe the circumstances under which the problem occurred: phase of flight, on the ground or in the air, power settings if having engine problems, altitude and distance from NAVAIDs [navigation aids] when experiencing radio problems, etc.

If the problem was radio-related, always inform the mechanic of anything you tried to troubleshoot yourself. Also report any comments made by ATC on radio or transponder problems. Believe it or not, several squawks of the same nature in a short period of time, but on different aircraft, led our avionics technician to suspect a problem with ATC equipment. He was right! Had our people not properly written up those squawks, ATC might have been unaware of their own radio problems for some time.

Sometimes, the pilot can't give enough information about a problem to be of assistance to the mechanic. Engine problems are perhaps one of the most serious problems mechanics deal with, and they may also be one of the hardest for pilots to write-up due to the myriad of things that could actually be wrong.

We once grounded our family airplane for severe engine roughness and vibration just prior to final descent and landing at Moline, Illinois. The mechanics diligently checked the engine and performed a run-up, finding no problems other than some fouled spark plugs.

My father and brother proceeded to test fly the aircraft only to experience the problems again shortly after takeoff. They made a quick return to land and took it back to the shop. This time, the mechanics performed a borescope on the engine and found a cylinder with excessive oil in it. Prognosis: sticking exhaust valve. A new valve and some cylinder reworking and we were set to go.

This example is a case where there is little evidence of the cause of the problem other than the sensation. RPM drop was not significant, likely due to it being a six-cylinder engine. The mechanics probably attacked the problem starting with the most likely sources, like spark plugs, magnetos, etc. Like doctors, mechanics, when dealing with unclear problems, will not automatically assume the rarer problem right from the start. Under circumstances such as these, the more information you can provide, the better.

Many problems have three or four symptoms that are the same but an additional one that distinguishes it from the rest. Having that last symptom in your write-up could be the difference between a solution and "ops chk ok, could not duplicate."

Writing up an aircraft squawk is something of an art; the pilot must be articulate enough to get across the true nature of what went wrong so the mechanic has the right cues in order to proceed with effective troubleshooting.

If you have difficulty putting the experience into words, the best alternative is to seek out a mechanic, or an experienced pilot at the very least, and explain your problem to him or her. For many problems, I follow up the write-up with a call to the maintenance shop when I think that they may have trouble understanding what I was experiencing.

In doing so, you also show the maintenance personnel that you are concerned about the problem and add some ownership to the solution that might not exist from a simple impersonal write-up.

Remember as well that not all mechanics are pilots, so they may not understand a squawk written in pilotese. Get your point across in plain English, but keep it short and simple and you're more likely to see a real corrective action.

This article was written by Donald Anders Talleur, an Assistant Chief Flight Instructor at the University of Illinois, Institute of Aviation. He holds a joint appointment with the Professional Pilot Division and Human Factors Division. He has been flying since 1984 and, in addition to flight instructing since 1990, has worked on numerous research contracts for the Federal Aviation Administration (FAA), Air Force, Navy, National Aeronautics and Space Administration (NASA), and Army. He has authored or co-authored over 180 aviation-related papers and articles and has an M.S. degree in Engineering Psychology, specializing in Aviation Human Factors. △

Search and Rescue Experts Need Your Help… Register Your Beacon

by Major Clarence Rainey, Department of National Defence

The year 2010 has seen a number of arduous searches for missing aircraft lasting many days. This is why we often reiterate the message below. While it may seem repetitive to some, the single life this article may save in the future is certainly worth the half-page it is printed on. —Ed.

Most of us know that since February 1, 2009, emergency transmissions on 121.5 MHz are no longer monitored by the Cospas-Sarsat System. This means that if an aircraft has an accident and a 121.5 MHz emergency locator transmitter (ELT) is activated, search and rescue (SAR) agencies will not be alerted via the satellite network and, as a result, no resources will be launched. With any luck, a high-flyer may pick up the signal and report it; however, this is unreliable and lengthy delays in SAR response may result. A 406 MHz radio beacon signal is very likely to be detected quickly, relayed to the Canadian Mission Control Centre (CMCC) and acted on immediately.

SAR experts agree that 406 MHz beacons are superior to 121.5 MHz models. They affirm that their effectiveness is further enhanced if the 406 MHz ELTs are properly registered with the Canadian Beacon Registry (CBR). When a CMCC operator opens a case on an ELT, the first thing he or she does is verify if the beacon is registered. If it is, the information from the registration form is invaluable to the case. The operator can quickly determine if it is a false alarm or a developing situation. Time is of the essence and an unregistered 406 MHz ELT will delay the investigation phase.

Roughly 18 000 beacons are currently registered; however, this represents only about 55 to 60 percent of the 406 MHz ELTs in use in Canada. Many owners are misinformed with respect to their aircraft registration. They believe if the aircraft is registered with Transport Canada, then so is their 406 MHz beacon. This is not the case. The only way to know if your beacon is registered is to contact the CBR. If you went through the effort of purchasing a 406 MHz ELT, it makes sense to register it. It is also important to re-register your ELT every year and to verify your 15-digit HEX code to ensure it matches your registration. An ELT registered under the wrong HEX code is tantamount to not having it registered at all.

Properly registered beacons improve response time thereby saving lives! In order to register your 406 MHz beacon, please visit www.canadianbeaconregistry.forces.gc.ca/, or call 1-877-406-SOS1 (7671), or e-mail CBR@sarnet.dnd.ca. It is simple and takes only ten minutes. △

Pre-flight

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

As a reminder to all pilots and operators, AIP Canada (ICAO) *supplements and AICs are found online on the NAV CANADA Web site* (www.navcanada.ca). *Pilots and operators are strongly encouraged to stay up to date with these documents by visiting the NAV CANADA Web site, and following the link to "Aeronautical Information Products."*

Unauthorized Low Flight Claims Flying Instructor and Student

The following is a condensed version of Transportation Safety Board of Canada (TSB) Final Report A09Q0065 on the fatal wire strike and crash of a Cessna 150L near Saint-Louis, Que. Readers are encouraged to read the full report on-line at www.tsb.gc.ca.

Summary

On May 4, 2009, a Cessna 150L with an instructor and a student onboard departed Montréal/Saint-Hubert Airport, Que., on a training flight. The aircraft was flying in a north-easterly direction at low altitude over the Yamaska River, Que., when it collided with a telephone cable spanning the river from west to east. The aircraft impacted the surface of the water and sank. The instructor was fatally injured, while the student pilot was able to exit the aircraft but subsequently drowned. The occurrence took place at approximately 16:37 Eastern Daylight Time (EDT).

Factual information

The ab-initio student pilot had started training only a week earlier and had no previous flying experience. In those seven days, the student pilot received three hours of ground instruction, spent 1.6 hours in a simulator, and had 1.8 hours of flying time. The occurrence flight was the student pilot's third planned flight, which was preceded by the relevant ground instruction and pre-flight briefing. This lesson was to cover straight and level flight, climbs and descent exercises as described in the flight training unit's (FTU) training program. Weather conditions were ideal and not considered a factor.

The instructor made a position report once they reached the training area to the north; however, no other radio calls were made. The last valid radar position at 16:33 EDT shows the aircraft at an altitude of 1 340 ft above sea level (ASL) on a true track of 341° with a ground speed of 90 kt. The last coasting target of the aircraft was captured at 16:34 EDT. The radar floor is approximately 1 000 ft ASL in the area of the occurrence. After 16:34 DT, while flying below the radar floor, the aircraft flew at low altitude at approximately 200 ft above ground level (AGL) towards the village of Saint-Louis, heading in a north-westerly direction. The aircraft then headed northeast at low altitude, descending below 100 ft AGL over the Yamaska River. Hundreds of geese on the riverbank took flight as the aircraft passed by at low altitude. While heading northeast in level flight, at tree-top height, and over the river, the aircraft travelled a total distance of approximately 2.4 km before colliding with the unmarked telephone cable. The aircraft struck the cable with a 30° bank angle and then struck the surface of the water in a nose-down attitude and sank quickly.

Wreckage and impact information

The cable consists of a telephone cable covered with black protective sheathing lashed to a steel cable (see Photo 1). The cable did not break on impact.

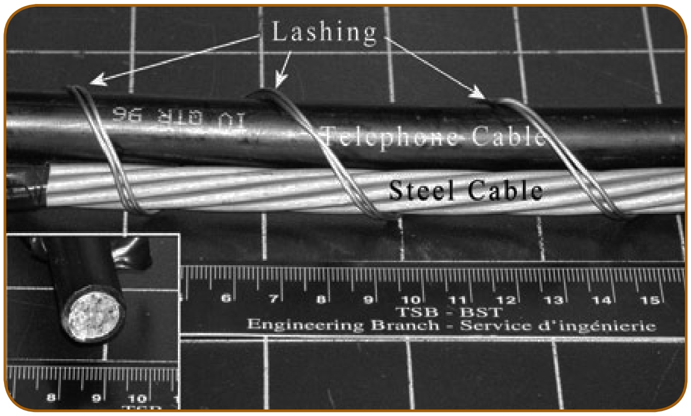

Photo 1: Cable specimen from occurrence site

Examination of the aircraft determined that the propeller was being driven by the engine when the cowlings departed the aircraft and continuity of the flight controls was confirmed. Impact marks and material transfer from the telephone cable were noted on the engine crankcase vent line. The impact marks on the vent line had the same spacing and width as the wires of the steel cable that support the telephone cable (see Photo 2).

Photo 2: Cable markings on crankcase vent tube

Examination of the exhaust stacks, the oil pressure gauge, and the electrically powered turn coordinator further confirmed that the engine was developing power when it struck the telephone cable and electrical power was available. The aircraft was found to be maintained in accordance with the regulations, and the weight and centre of gravity were within prescribed limits.

The training flight was conducted in uncontrolled Class G airspace up to 2 200 ft ASL and where air traffic control (ATC) has no authority or responsibility to control air traffic. The training area is situated over mainly small wooded areas, farm fields, and small towns. Had the flight instructor been managing an emergency requiring a precautionary or an emergency landing, the many surrounding fields available would have been suitable. Examination of the aircraft did not identify any anomalies that would have forced the flight instructor to execute a precautionary or emergency landing, and no emergency radio call was made.

Oblique view of aircraft trajectory

Cable markings

The telephone cable spans the Yamaska River west to east and provides telephone service for residents located on either side of the river. It was installed unmarked in 1975 under the grounds that the cable was not deemed a hazard to small craft navigating the river. The *Canadian Aviation Regulation* (CAR) 621.19–*Standards Obstruction Markings* specifies that an obstruction should be marked or lighted if its height and/or location are deemed to be a threat to aviation safety. As the telephone cable height was approximately 52 ft (16 m) ASL, it would not be deemed a hazard to aviation. Furthermore, the cable is not in proximity to an airport, aerodrome, or water aerodrome.

The unmarked black cable spans from two 40-ft-high telephone poles located on either side of the 300-ft-wide river. Because of the limitations of the human eye, it is difficult to perceive a wire or cable if the background landscape does not provide sufficient contrast. The fact that the cable was not marked likely made it difficult to detect. Pilots are usually taught to look for telephone poles or towers in order to identify the presence of cables or wires. The telephone poles located further inland from the shoreline were not visible while heading northeast along the river; they were hidden amongst brush and tall trees.

Flight training unit

As for all FTUs in Canada, the unit's operations are overseen by Transport Canada. It conducted audits in 2005 and again in 2008; this reflects a normal audit scheduling frequency. The 2008 audit concluded that the operator was able to conduct business safely and professionally while conforming to the regulatory requirements.

The flight instructor was certified and qualified in accordance with existing regulations to conduct the training flight, and he was regarded as a capable, responsible, and professional employee. The investigation into this occurrence did not reveal any previous deviations from planned flight exercises or regulations.

Low flying

Several provisions within the CARs apply to low altitude flight:

> *No person shall operate an aircraft in such a reckless or negligent manner as to endanger or be likely to endanger the life or property of any person.* [CAR 602.01]
>
> *Because the flight took place over a non-built-up area, Except where conducting a take-off, approach or landing or where permitted under section 602.15, no person shall operate an aircraft (...) at a distance less than 500 feet from any person, vessel, vehicle or structure.* [CAR 602.14(2)(*b*)]
>
> *A person may operate an aircraft, to the extent necessary for the purpose of the operation in which the aircraft is engaged, (...) where the aircraft is operated without creating a hazard to persons or property on the surface and the aircraft is operated for the purpose of (...) flight training conducted by or under the supervision of a qualified flight instructor.* [CAR 602.15(2)(*b*)(iv)]

The FTU's operations manual states that visual flight rules (VFR) dual-instruction flight manoeuvres should not be conducted below 500 ft AGL except for the purpose of takeoff, landing, or forced landing. The objectives of the lesson did not require flight below 500 ft AGL. It is not known why the instructor deviated from the training exercise and known regulations, and conducted the last portion of the flight at low altitude over the river.

The *Flight Instructor Guide* covers the subject of flight safety and stresses the need for the instructor to always use correct safety practices because he or she is a role model to others.

Analysis

Given the student pilot's limited aviation knowledge and flying experience, it is assumed that the flight instructor was at the controls at the time the aircraft travelled at low level over the river and collided with the telephone cable.

Because there were no survivors, the reason the instructor deviated from the training exercise and conducted the last portion of the flight at low altitude over the river is unknown. Flight at low altitude was not required for the exercises to be taught nor was it accepted practice as per the CARs or company procedures.

Cables may be unmarked if they are determined to be neither an aeronautical nor a navigable waters hazard. The telephone cable spanning the Yamaska River was not considered a hazard to aviation in that it was approximately 52 ft ASL, at the approximate height of the river banks and was not in the vicinity of an airport, aerodrome, or water aerodrome. The fact that the cable was unmarked made it more difficult to detect. Furthermore, the telephone poles on either side of the river, a primary indicator of the presence of a cable, were hidden by trees and brush. Low flying increases the risk of collision with cables and other structures.

Aircraft electric power, engine power, and flight control continuity were confirmed for the time at which the aircraft collided with the telephone cable; therefore, it is unlikely that the flight instructor was managing an emergency, which would justify low level flight over the river. There were many fields in the area, which would have been suitable had the flight instructor needed to execute an emergency or precautionary landing; the river would not have been a primary choice. The absence of any communication advising of an emergency situation reduces the likelihood that such a situation existed.

Findings as to causes and contributing factors

1. The aircraft was flown at low altitude, causing it to collide with an unmarked telephone cable suspended 60 ft ASL over the Yamaska River.
2. Flying below 500 ft AGL was not required, given the planned exercises to be demonstrated during the training flight; the reason for deviating from the lesson plan and the school's procedures is unknown.

Finding as to risk

1. Low flying poses additional risks to pilots. Cables and other obstacles may be unmarked if they are determined to be neither an aeronautical nor a navigable waters hazard. Unmarked cables are difficult to detect.

Safety action taken

Although not required by regulation, but in light of recently reported low flying over the river since the occurrence, the telephone company has installed red and white markers on the telephone cable spanning the Yamaska River. △

Fuel Gauges: Do they Indicate Properly?

by Tom Bennett, Civil Aviation Safety Inspector, Aircraft Maintenance and Manufacturing, Prairie and Northern Region, Civil Aviation, Transport Canada

There have been multiple incidents of fuel exhaustion over the past few years. In the last issue of the *Aviation Safety Letter* (ASL), you read about fuel starvation due to improper fuel selector condition. In this article, I would like to talk about another common factor in fuel starvation incidents: fuel gauges that do not indicate properly.

Some incidents were very public, whereas most incidents went unnoticed with the exception of being listed in the Civil Aviation Daily Occurrence Reporting System (CADORS). Some incidents were directly related to poor fuel management by the flight crew(s); however a few came as a surprise to the flight crew, as the fuel gauge(s) still indicated there was fuel in the tanks. An accurate reading of the fuel gauge may have prevented many of these occurrences.

There is some confusion about the need for serviceable fuel gauges. This confusion is especially prominent in the general aviation world. As both an aircraft maintenance and manufacturing inspector and an enforcement investigator, I have heard statements like: "The gauges have never worked properly. I just keep track of time in my tanks," many times.

Such a statement is contrary to *Canadian Aviation Regulation* (CAR) 605.14(*j*)(i), which states: "No person shall conduct a take-off in a power-driven aircraft for the purpose of a day VFR flight unless it is equipped with a means for the flight crew, when seated at the flight controls to determine the fuel quantity in each main fuel tank […]". This regulation is then carried through in sections 605.14, 605.15, 605.16 and 605.18 of the CARs, to apply to all power-driven aircraft in all nature of flights (day/night visual flight rules [VFR]/instrument flight rules [IFR]).

Furthermore, many aircraft must have their fuel gauges working as per their type certificates. For larger aircraft, especially transport category aircraft, the fuel gauges can be deferred by means of the minimum equipment list; however, this usually involves using other measuring devices installed on the aircraft and making complex calculations.

Recently, a commercial pilot was fined because one of his fuel gauges was not working while he was operating an aircraft. In this case, as in others, the fuel exhaustion caused substantial damage to the aircraft during the forced landing. The pilot applied to the Transportation Appeal Tribunal of Canada (TATC) to seek relief from the $750. The TATC upheld the Minister's decision.

The Aviation Enforcement Branch has also sanctioned aircraft owners and operators for unserviceable fuel gauges found during Transport Canada's oversight activities. The maximum sanctions for an infraction under CAR 605.14, 605.15, and 605.16 are $3,000 for an individual and $15,000 for a corporation. The maximum sanctions for an infraction under CAR 605.18 (IFR) is $5,000 for an individual and $25,000 for a corporation. Inspection, maintenance and repair of a fuel indication system seem less costly, in my opinion.

A common factor in fuel starvation incidents: fuel gauges that do not indicate properly

Another common excuse I hear is that the gauges have always displayed faulty readings or they are too difficult or expensive to calibrate. As an aircraft owner, if you rely on this flawed thinking you are exposing yourself to numerous risks. First and foremost, you risk running out of fuel. This can lead to personal injury/fatality and damage/loss to the aircraft. Second, you are exposed to regulatory action by enforcement (fine or suspension). I think we can all agree that none of these are pleasant outcomes.

For the aircraft maintenance engineers (AME) in this scenario, I have not yet seen an inspection where the functionality of the fuel quantity indication system is not checked. Be careful what you sign for on the inspection forms and subsequently, the maintenance release. Following manufacturers' instructions for inspection, maintenance and repairs will never lead you astray.

Most pilots and AMEs are aware that any accident or incident results from a series of events; there is never just one cause. Anything we can to do tighten up against the possibility of an error is a step in the right direction. △

Reminder to Always Do a Thorough Preflight Visual Inspection

From time to time, we get excellent photos that need little commentary. Thank you to Neil Ayers and Dan Ferguson, from Northern Ontario, who provided these undisputable proofs that a thorough preflight visual inspection will save the day.

CFIT: Why Are Aircraft Flying at Minimum IFR Altitudes?

More than a decade after the publication of Controlled Flight Into Terrain (CFIT) Education and Training Aid, *produced jointly by the Flight Safety Foundation, Federal Aviation Administration (FAA) and the International Civil Aviation Organization (ICAO), CFIT accidents continue to occur worldwide. The article below, written by Captain Jim Gregory thirteen years ago and published in the* Airspace Newsletter *in 1998, is still pertinent.*

CFIT Prevention Initiatives

I have had the opportunity recently to carefully review the *Controlled Flight Into Terrain Education and Training Aid* material produced and issued jointly by the Flight Safety Foundation, the United States Federal Aviation Administration and the International Civil Aviation Organization (ICAO). The information presented in this material is sobering, to say the least!

The *Flight Into Terrain* document is an extensive compilation of worldwide Transport Category Aircraft Controlled Flight Into Terrain (CFIT) accidents and events where the aircraft was either inadvertently flown into the ground, or nearly flown into the ground. It has detailed accounts of these accidents and incidents that should be required reading for ALL pilots who are currently flying in the world's skies. The report makes one firmly convinced that Ground Proximity Warning Systems (GPWS) are worth their weight in gold (and maybe more) considering the number of times this system has SAVED the passengers, crew and aircraft. Other technical advances, such as enhancing GPWS, excessive bank angle warning devices, head-up displays, enhanced and synthetic vision and Minimum Safe Altitude Warning Systems (MSAW) for use by Air Traffic Control (ATC) to alert aircraft under their control of terrain proximity, are being developed and/or refined to provide that extra "last resort" warning to the flight crew in order to prevent a controlled flight into terrain accident. The *Flight Into Terrain* document also provides a "CFIT Checklist" or a CFIT risk-assessment safety tool as part of an international program to reduce CFIT accidents.

The international CFIT prevention initiatives are laudable and provide the framework for CFIT prevention activities to take hold. However, one aspect of the CFIT prevention initiatives that does not appear to be highlighted is the following question: *Why are transport category aircraft flying at the minimum IFR altitudes on non-precision approaches (NPAs)?*

Most CFIT Occurrences are on NPAs

It is said that transport category aircraft flying non-precision approach procedures account for most of the world's CFIT related accidents. The point of impact of most CFIT accidents is in line with the intended runway for landing anywhere from one to several miles away from the runway. Why would a pilot (or crew) violate a minimum IFR altitude on an approach procedure to the point of colliding with the terrain?

Every IFR-rated pilot knows that a non-precision approach procedure is one where there is no procedure vertical guidance, and that all altitudes associated with the non-precision procedure are minimum IFR altitudes or "DO NOT DESCEND BELOW ALTITUDES". All IFR-rated pilots also know that these minimum IFR altitudes are determined by the instrument procedure design specialist according to established criteria and standards wherein during the initial approach segment of the procedure (from the initial approach fix to the intermediate fix), 1 000 feet of obstacle clearance is provided above the highest obstacle within that segment; 500 feet of obstacle clearance is provided in the intermediate segment (from the intermediate fix to the

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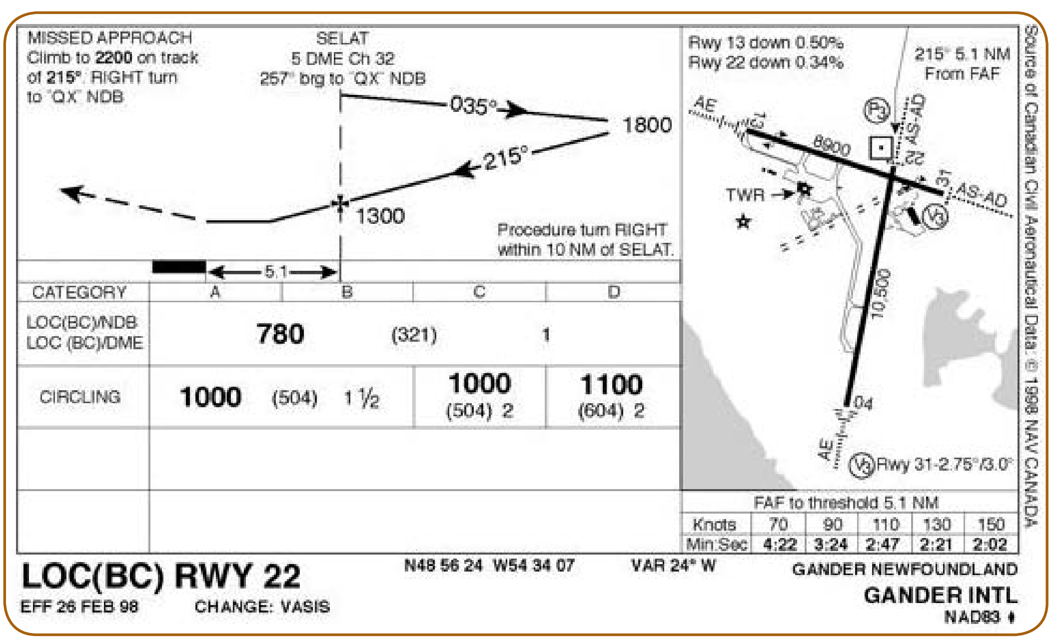

Figure 1

final approach fix [FAF]); and, depending upon the type of facility the procedure is based upon, as low as 250 feet of obstacle clearance is provided in the final segment (from the final approach fix to the missed approach point). Refer to Figure 1.

The procedure turn minimum IFR altitude of 1 800 feet provides 1 000 feet of obstacle clearance within a defined area for the procedure turn initial segment; the FAF minimum IFR altitude of 1 300 provides 500 feet of obstacle clearance in the intermediate segment (in this case, when the aircraft is established inbound on the 215 course within the procedure turn distance of 10 NM), and 250 feet of obstacle clearance in the final segment (from SELAT to the missed approach point, which in this case is the threshold of runway 22). Proponents of stabilized descent techniques, in which the pilot attempts to place the aircraft on a 3° descent path to a 50-foot threshold crossing height on non-precision procedures such as the one above, have argued that the approach slope in the final segment shown in Figure 1 above is very low and unacceptable for stabilized approach techniques. An approach slope may be calculated by taking the FAF minimum IFR altitude (1 300 feet) and subtracting the threshold elevation (459) plus a 50-foot threshold crossing height, and dividing the result by the distance from FAF to threshold (5.1 NM). The result is:

1300 - (459 + 50) = 791 / 5.1 = 155 feet per NM
or (155 / 6076.1 = .0255098 INV TAN) = 1.46°.

A 1.46° descent flight path is certainly not an acceptable way to fly a large aircraft to the runway! Since this is not acceptable, one has to ask the question why is the aircraft crossing the FAF at the MINIMUM IFR altitude of 1 300 feet? In order to have the aircraft established on a stabilized descent that approximates a nominal 3° descent path of a precision approach, the aircraft should be flown to cross the FAF at an altitude of no lower than 1 674 feet plus the elevation of the touchdown zone, or approximately 2 100 feet!

In most, if not all, circumstances an aircraft is probably already cleared for an approach by the time it reaches the FAF. In most, but not all cases, the aircraft is usually above the minimum IFR FAF crossing altitude when cleared for the approach. Why then, would a pilot wish to descend to a minimum IFR altitude at the FAF and expose the aircraft to a 500-foot obstacle clearance as well as expose the aircraft to a very shallow descent profile? Would it not be a better, and safer practice for the pilot to maintain an altitude ABOVE instead of driving the aircraft down to the minimum IFR altitude? If the pilot was to fly the procedure turn on the approach in Figure 1, how many pilots would descent to 1 800 feet within the turn? Why? ATC you say? Remember ATC is just as concerned about CFIT as the flyers therefore ATC will assist in any way that they can to contribute to a safe flight.

Minimum IFR Altitudes on Approach! Why Are You There?

I recall, when I used to instruct instrument procedures to IFR students, one student who was flying a procedure turn and was desperately trying to maintain the procedure turn minimum IFR altitude without much success. The student knew that he must not descend below (let us use our example in Figure 1) 1 800 feet during the conduct of the procedure turn manoeuvre, however, he was struggling to maintain that altitude—so much so that his cross-check suffered to the point that he lost situation awareness and got very confused as to where he was in the procedure turn pattern. We had received our clearance to the airport for an approach when we were about 20 miles inbound to the navaid at 4 000 feet so we had all of the altitudes from our present position at 4 000 feet all the way to the missed approach clearance limit altitude yet the student chose to descend immediately to an appropriate Minimum Sector Altitude (MSA) for the procedure and then immediately descend to the minimum IFR altitude for the procedure turn at the appropriate time.

When the student was questioned as to why he was operating the aircraft at a minimum IFR altitude he could not defend his actions by any reason other than to say, " ...because that's what is published." It appears that many pilots view MINIMUM IFR altitudes on instrument approach procedures in the same way. Since the procedure designer determines these altitudes using established criteria and standards, and because these altitudes are published on the procedure, it seems that some pilots have this unexplainable urge to descend to these altitudes and subject the aircraft (and all who occupy it) to an altitude that is described in all IFR publications as, *"ALTITUDES ARE MINIMUM ALTITUDES AND MEET OBSTACLE CLEARANCE REQUIREMENTS UNDER ISA CONDITIONS."* Not only are pilots forcing aircraft down to the minimum IFR altitudes on approaches, databases on modern aircraft flight management systems (FMS) also drive the aircraft to these minimum IFR altitudes. Instrument approach procedure altitudes are coded in the FMS as "HARD" altitudes thereby driving the aircraft to these altitudes whenever the aircraft is managed vertically by the FMS[1].

[1] These statements reflected reality when this article was written in 1998. Nowadays, while most navigation data providers will code "at or above" altitude, there are still some original equipment manufacturers (OEM) that may code hard altitude. To know exactly what is coded in your box, you have to ask the manufacturer.

Consider the certified maximum operating indicated airspeed on an aircraft. We all know that if we operate the aircraft at this maximum airspeed, it is certainly safe to do so. Some may refer to operating an aircraft to its capability as "operating at the envelope". If we happen to unintentionally exceed this maximum, we also know that the aircraft does not instantaneously disintegrate. We assume that the flight test engineers have provided some margin of safety beyond the placard maximum, however we do not operate the aircraft at this maximum airspeed all the time. If we need it, we know that we can use it—safely. Can not the same logic apply to the minimum IFR altitudes on an approach procedure? If we do not need it, should we not operate the aircraft above the minimum IFR altitude? Really, the only minimum IFR altitude a pilot should operate an aircraft at, in IMC, is the Minimum Descent Altitude (MDA), and only if the weather conditions require it.

Rules of Thumb

There are a couple "rules of thumb" a pilot can use to determine altitudes along a final approach course to approximate a 3° descent flight path. Taking into account a necessary 50-foot threshold crossing height, a 3° descent path at 5 NM from the runway threshold is 1 642 feet above the elevation of the threshold. At 10 NM this same descent path is 3 234 feet above the elevation of the threshold. By adding the threshold elevation to 1 600 (1 642 rounded to 1 600) and 3 200 (3 234 rounded to 3 200), you can determine what the altimeter should read at these points along the final approach course. Applying this rule of thumb to our example in Figure 1, we can quickly determine that we should cross the FAF at approximately 2 100 feet on an altimeter correctly set to the local station altimeter setting. The long calculation is as follows:

- FAF is 5.1 NM from the threshold
- 3° descent (with a 50-foot TCH) crosses 5.1 NM at 1 674 feet
- add 459 (runway elevation) to 1 674 = 2 133 feet at the FAF

A "rule of thumb" application to the same problem follows:

- at 5 NM from threshold, you should be at approximately 1 600 feet
- add threshold elevation (459 feet rounded to 460) to 1 600 = 2 060 at 5 NM
- because the FAF is a little farther than 5 NM (5.1 NM) correct the FAF crossing altitude to 2 100 feet.

The "rule of thumb" can be simplified by saying that to maintain a 3° descent flight path, for every NM along track distance you fly, you need to descend 318 feet. (You may wish to round this value to 300 feet of descent for every NM to help in quick calculations.)

These "rules of thumb" calculations can be accomplished during the flight planning portion of the flight and/or prior to the descent from the en route altitude, and included in the approach briefing. Let us return to the example in Figure 1. If we want to be on a stabilized approach on this procedure, we should cross the FAF at 2 100 feet - not 1 300 feet! There is nothing prohibiting any pilot from conducting a non-precision instrument approach procedure in this fashion. The published 1 300 feet at the FAF is a "DO NOT DESCEND BELOW" altitude and crossing the FAF at 2 100 feet certainly meets this requirement. Extending the rule of thumb to the 10 NM point, the aircraft should be at 3 200 feet + the threshold elevation (460) = 3 660 or rounded to 3 700 feet. Therefore, if cleared to the airport for an approach and you are required to fly a procedure turn, why not maintain 3 700 feet during the procedure turn rather than driving the aircraft down to the MINIMUM IFR altitude of 1 800 feet. The procedure turn must remain within 10 NM of the FAF, in our example, thereby leaving at least 5 NM of level flight at 3 700 feet before intercepting a stabilized 3° descent path. With the knowledge of your groundspeed, you can establish a rate of descent needed to intercept and maintain the 3° descent profile. A 2 NM per minute groundspeed (120 knots) will required a rate of descent of approximately 600 feet per minute.

If ATC should happen to provide vectors to the final approach course and assign an altitude below 3 700 feet, you have a couple of options available:

- maintain the assigned altitude and intercept the 3° descent path closer to the runway threshold; or
- request a higher altitude from ATC. In most cases, they would accommodate such a request.

Low Approach Slopes?

It is apparent that some transport category aircraft pilots may have misunderstood the application of minimum IFR altitudes on non-precision instrument approach procedures for a long time. CFIT initiatives that discuss some non-precision procedures as having very low approach slopes clearly indicate this misunderstanding. There is no such thing as a "very low approach slope" on a non-precision approach procedure. There ARE, however, minimum IFR altitudes that if honoured, will

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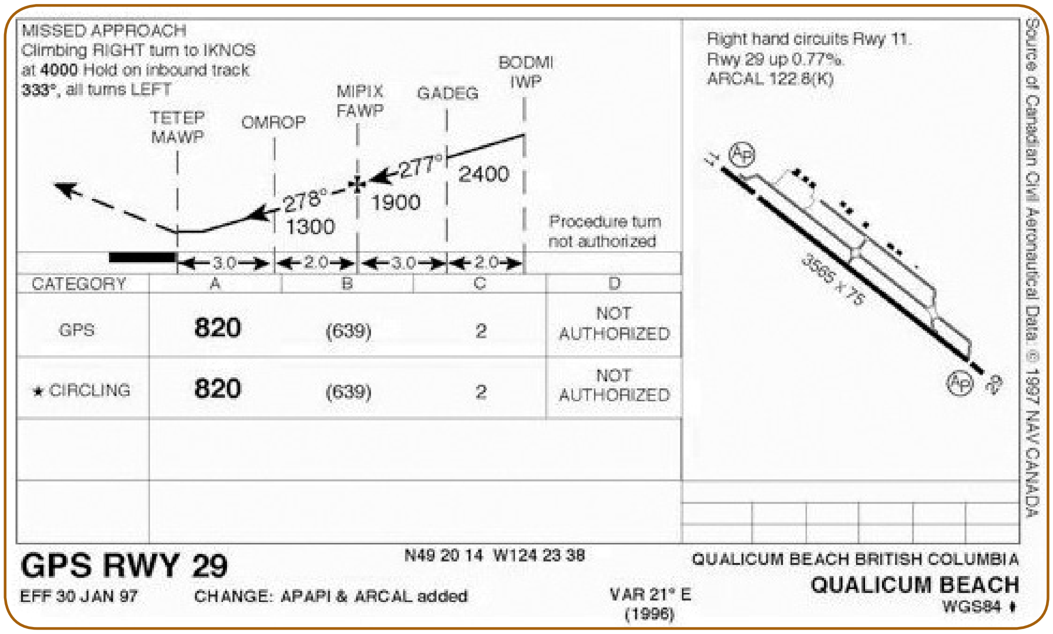


Figure 2

provide the aircraft, under ISA conditions, obstacle clearances determined by recognized criteria and standards. How, and why, pilots got the idea that they must be at the procedure minimum IFR altitude is puzzling.

We need to instill upon IFR pilots that the minimum IFR altitudes of a non-precision approach are just that, MINIMUM, and placing the aircraft at the procedure design minimum IFR altitude or "envelope", while certainly safe to do so, may not be the wisest choice under all circumstances. Modern technology has provided the pilot with useful devices to help make the correct decisions, however, modern technology will never replace good pilot judgment. For those aircraft that have navigation databases wherein the approach procedure is coded into the database and presented to the pilot, the vertical information must be based upon a 3° flight path descent to a 50-foot TCH and not determined by the minimum FAF crossing altitude to ensure the required obstacle clearance which, in most cases, will establish descent angles less than 3°. Rules of thumb to calculate a stabilized descent profile on any non-precision approach procedure should be included in all preflight planning briefings as well as the approach briefing prior to descent. Placing the aircraft at the minimum IFR altitude on an approach should only be accomplished along the final approach segment (i.e., MDA) and only if required by the weather conditions. For example, flying at the minimum IFR altitudes on an instrument approach at night in clear conditions is not good airmanship.

Approaches Steeper than 3°

Most non-precision instrument approach procedures will accommodate a 3° descent profile, however some will not. See Figure 2.

Here is a case where the "rule of thumb" of 1 600 feet above runway threshold elevation (181 feet) at 5 NM quickly shows that a descent profile of something greater than 3° is required for this approach. In fact, looking further along the final approach segment, the step-down waypoint minimum altitude restriction of 1 300 feet at 3 NM requires 373 feet per NM or approximately a 3.5° descent path. On this particular instrument approach procedure, a pilot may not have any choice but to fly at the minimum IFR altitudes on the approach in order to control the rates of descent.

All pilots need to reassess their reasons for operating aircraft at minimum IFR altitudes (procedure envelope) on approach. Is it necessary? Cannot the approach be successfully flown above all of the minimum IFR altitudes, especially if the weather conditions do not require the aircraft to be at MDA to establish the required visual references? Reassessing how pilots fly non-precision approach procedures will go a long way towards preventing CFIT occurrences.

About the author: Captain Jim Gregory was involved in aviation for more than 40 years, first as a military fighter pilot and instrument check pilot and subsequently as a Transport Canada (TC) airspace inspector. He became heavily involved in the development of instrument flight procedures and instrument procedure design standards both domestically and internationally, and he was a long-time member of the ICAO Obstacle Clearance Panel. Jim retired from TC several years ago and went to work for Bombardier Aerospace as a training pilot. Sadly, he passed away in the Spring of 2010 after a long battle with cancer. Per ardua ad astra. —Ed. △

MAINTENANCE AND CERTIFICATION

Used Parts Obtained from Foreign Sources

by K. Bruce Donnelly, Civil Aviation Safety Inspector, Maintenance and Manufacturing Standards, Civil Aviation, Transport Canada

Introduction
This is the latest in a series of interrelated articles addressing the maintenance of Canadian-registered aircraft and parts intended for installation thereon. This article focuses specifically on the use of used, repaired or overhauled aeronautical parts (used parts) that are obtained from foreign sources.

Issue
In recent years, we have seen an emerging trend with respect to the globalization of the aviation industry. Transport Canada has entered into aviation agreements with various States. These high-level agreements are normally complemented by subordinate agreements, such as Maintenance Implementation Procedures (MIP), which specify the requirements that must be met for the mutual and reciprocal acceptance of each party's aircraft and parts maintenance certifications.

Consequently, Canadian operators and maintainers now have improved access to foreign sources of maintenance and used parts; however, more awareness and diligence is required by the industry with respect to verifying the specific certification requirements for used parts. TCCA is aware of circumstances where repaired or overhauled parts and components that did not actually meet the eligibility criteria were inadvertently installed on Canadian-registered aircraft.

Regulatory requirements
Generally, with respect to the installation of used parts, the *Canadian Aviation Regulations* (CAR) prescribe that any part that has undergone maintenance must be accompanied by an Authorized Release Certificate or similar document containing a maintenance release for the work performed on that part. This requirement applies equally to privately and commercially operated aircraft. The person providing the maintenance release must be authorized to sign the release by the holder of an approved maintenance organization (AMO) certificate. When the maintenance is performed outside of Canada, the person must be authorized to sign under the laws of a State that is party to an agreement or a technical arrangement with Canada and *the agreement or technical arrangement must provide for such certification*. This is an important distinction; not all aviation agreements provide for such a recognition.

Responsibility
The installer is responsible for ensuring that a used part is eligible for installation. He or she carries out that responsibility by requesting the appropriate documentation from the supplier, establishing the part traceability to the maintainer of the used part. The installer must also ensure that the maintenance is performed by an appropriately rated AMO or foreign equivalent that is specifically approved by TCCA under the authority of an aviation agreement to certify the maintenance that was performed on the part. The installer must therefore be aware of the specific used part certification requirements that are applicable in the respective circumstances.

Acceptable documentation
Although the documentation may differ in appearance and naming convention, the requirements—in terms

Used, Repaired or Overhauled Part Certification Requirements by Jurisdiction

Canada	United States	European Aviation Safety Agency (EASA)	Brazil	Israel
Completed Form One Authorized Release Certificate with signed CAR 571.10 maintenance release	Completed FAA 8130-3 Authorised Release Certificate or maintenance release document, e.g. FAA form 337, repair station tag or work order or signed maintenance record entry	EASA Form 1 from TCCA-approved and EASA-approved Part 145 Repair Station, with TCCA approval number indicated in block 13	Completed DAC Form SEGVÔO 003 from TCCA recognized DAC Brazil AMO with specific release statement and approval number indicated in block 13	Completed Civil Aviation Administration of Israel 8130-3 form

of the part identification, traceability and certification information, that are to be recorded on the Authorized Release Certificate, which accompanies the used foreign part—are the same as those for an Authorized Release Certificate (also known as Form One and formerly known as form number 24-0078).

Used foreign parts procured from jurisdictions with which Canada does not have an aviation agreement are not eligible for installation on Canadian-registered type-certificated aircraft because these parts do not comply with the applicable regulatory requirements. Installers should first inquire as to whether an agreement exists between Canada and the country of origin. The technical agreements can be viewed on the TC Web site. In addition, installers should not rely on the mere fact that an agreement does exist; the repaired or overhauled part might still be ineligible for installation. The used part certification requirements differ by country of origin due to the differences in the respective bilateral or other technical agreements. The requirements identified in the preceding table are not exhaustive; the table is produced here for convenience to illustrate some of the differences by country of origin.

Airworthiness Notice B-073 is also a useful reference guide and provides more detailed information with respect to part certification requirements for parts obtained from different sources; however, installers should be aware that it also does not cover all of the respective agreements that are in place. Installers should consult the appropriate technical agreement and familiarize themselves with the specific used part certification requirements that are applicable in their circumstances.

Approved organizations

Some agreements, such as the Administrative Arrangement on Maintenance between TCCA and EASA, require the foreign AMO (such as EASA-approved Part 145 repair station) to submit a supplement to their existing approved manual to TCCA for approval. The approval number must appear on the Authorised Release Certificate. If it does not, the part is not eligible for installation. Installers must be vigilant in ensuring that the organization is in fact approved by TCCA and that the approval has not expired, as the approvals must be renewed by TCCA every two years.

Installers are also reminded that where one country has an agreement with another country and one of those countries has an agreement with Canada, the terms of the agreement between Canada and that country are not extendable to the other country. For example, a country in Africa that has an agreement with EASA has the ability to issue an EASA Form 1 Authorised Release Certificate for maintenance performed on a part. The part is not eligible to be installed on a Canadian aircraft despite the fact that Canada has an agreement with EASA, because Canada has no agreement with that specific African country.

It is therefore very important for organizations that procure used parts from foreign jurisdictions to be vigilant in requesting the proper documentation from the part supplier to support the used, repaired or overhauled part installation eligibility. If any doubt exists as to whether a used or repaired part obtained form a foreign jurisdiction is eligible for installation, installers are encouraged to consult with their principle maintenance inspector (PMI) or local Transport Canada Centre (TCC) for advice. △

Compressor Washes—Maintaining Engine Reliability and Performance

by Joe Escobar, Editor, Aircraft Maintenance Technology *(AMT) on-line magazine (*www.amtonline.com*). This article originally appeared in the September 2007 issue of* AMT Magazine *and is reprinted with permission.*

Compressor washes are a routine procedure for those who work on gas turbine engines. Some mechanics might think it is just another mundane task we must do. But why do we do compressor washes? Well, the answer is more than, “because it is written into our operations procedures.” Let’s take a look at compressor washes and how they affect engine performance and life cycles.

Thermal efficiency

Taking a look back at what we learned in A&P [airframe and powerplant] school, we see that thermal efficiency is a prime factor in gas turbine performance. AC 65-12A [*A&P Powerplant Handbook*] tells us that thermal efficiency is the ratio of net work produced by the engine to the chemical energy supplied by the fuel. The three most important factors affecting thermal efficiency are turbine inlet temperature, compression ratio, and the component efficiencies of the compressor and turbine. Other factors that affect thermal efficiency are compressor inlet temperature and burner efficiency.

Contamination to the compressor section affects the thermal efficiency, and therefore the performance of the engine. Not only does it affect performance, but damage to the blades caused by contamination can lead to engine failure.

Contamination

So, what causes contamination? Well, it has to do with the atmospheric environment. The atmosphere, especially near the ground, is filled with contaminants. There are fine particles of dirt, oil, soot, and other foreign matter in the air. Because of the large volume of air introduced into engine compressors, a lot of this contamination is introduced into the engine. The centrifugal forces of the compressor throw this contamination outward so that it builds up to form a coating on the casing, vanes, and the compressor blades.

The accumulation of these contaminants reduces the aerodynamic efficiency of the blades, resulting in deteriorating engine performance. The efficiency of the blades is reduced in a way similar to the way ice buildup reduces the lift efficiency of a wing. This loss of efficiency can lead to unsatisfactory acceleration and high exhaust gas temperature (EGT). Contamination, especially in high-salt operating environments, can also lead to corrosion of the engine components.

In order to maintain engine performance and reduce the corrosive effects on the engine, the debris that builds up in the compressor needs to be removed. We do this through routine compressor washes.

Compressor washes

So, how does a compressor wash remove contaminants from an engine? AMT talked with Bruce Tassone, president of ECT Inc. ECT manufactures R-MC compressor wash. "The chemicals in a compressor wash solution break down the organic bonds of the contaminants," Tassone shares. "This then allows the air stream and/or the fresh water rinse to remove the contaminants out of the engine."

The OEM [original equipment manufacturer] specifies which chemicals can be used to wash the compressor. The approved list can vary from manufacturer to manufacturer. "Some OEMs have a specific list of approved washes," says Tassone. "Others refer to a military specification like MIL-C–85704 or set specific chemical parameters."

Tassone stresses the importance of using proper chemicals like R-MC. "There are different parameters you have to meet with a compressor wash," he shares. "Using unapproved engine washes could cause damage to the engine or airframe such as corrosion, acrylic crazing, hydrogen embrittlement, stress corrosion cracking, and other defects." In order to avoid damaging the engine, be sure to use only authorized chemicals. "You should ask your supplier or overhauler for certification that they meet the engine and airframe OEM specifications," stresses Tassone.

Premix or concentrated?

Compressor wash can come in either premixed or concentrated forms. How do you know what type is right for you? "Some customers buy premixed if they are concerned with either the labour associated with mixing and/or the quality of water they can secure," Tassone tells AMT. "If they have space concerns, such as inventory storage, or they want to be a little more cost-effective in terms of the transportation, and they have the capacity to blend the chemical in regards to labour pool and water quality, they may tend to go with concentrate."

Water quality

Water quality is an important part of effective compressor washes. Whether it is for mixing the concentrate or for the rinse portion of the wash, proper water needs to be used. "We, as well as the OEMs, always recommend de-ionized or de-mineralized water," says Tassone. Don't be tempted to use tap water. Doing so can introduce contamination back into the engine you are trying to clean out.

Establishing a wash schedule

Compressor wash schedules will vary from one operator to the next. The frequency of wash events relates to the amount of contaminants being ingested into the engine.

Operating environment and the types of flight profiles both affect contaminant levels. "High cycles impact the engine," shares Tassone. "But flight patterns also do. If you are dealing with a commuter such as a turboprop, where you are doing shorter runs at lower elevations more closely tied to the city, then your fouling curve is going to increase. If you are looking at trans-Atlantic flights, your fouling curve may not be as steep, but you may have ancillary impacts such as the inorganic and salt buildups. So you have multiple effects with respect to the engine."

Each operator needs to develop a compressor wash schedule that best meets their operating situation. "Most operators set compressor wash schedules with regards to their specific situation," Tassone tells AMT. "They will look at what their degradation curve is. And either individually or with us, they will do an economic analysis of what the breakpoint is for the best wash frequency, and then tie that task in to whatever would be the appropriate checkpoint in their maintenance schedule. In a salt environment, it could be a wash every day because our product has corrosion inhibitors. It could also be on up to a three- to six-month cycle."

Tips for effective washes

Compressor wash procedures vary from manufacturer. A typical compressor wash involves three steps—a chemical wash, a water rinse, and an engine run.

After connecting the appropriate fixtures to the engine, a chemical is injected in the engine while the compressor is turned. Firms like ECT manufacture the wash equipment to conform to the OEM flow rate and pressure recommendations. This allows the chemical to be ingested into the compressor section where it breaks up the molecular bonds of the contaminants. The wash is followed by a fresh water rinse. The rinse ensures that all of the contaminants dislodged by the wash are flushed out of the engine. This is followed up by an engine run. The airflow from the engine run helps further clean out the dislodged contaminants, and dries out the engine.

Tassone shares the following tips for effective washes: "First and foremost, they should always refer to the OEM procedures, because they are engine specific. Second, products that are biodegradable and nontoxic yield high cleaning efficiency while improving personnel safety and lowering disposal costs. If solvents are used, make sure the proper collection, disposal, and government reporting are maintained. Third, we can't emphasize enough that high-quality water, both for mixing and for rinsing, is very important. Finally, they should be using injection hardware and equipment that is approved by the OEMs or their engineering group to ensure they are getting a proper wash and not introducing FOD [foreign object damage] hazards. The mechanics should inspect to ensure all hardware is secure so that foreign objects are not ingested into the engine. Using correct servicing equipment also ensures proper pressure and flow during the compressor wash."

Performing proper compressor washes can result in many benefits. Removing the contaminants restores engine efficiency, resulting in better fuel economy (Tassone says a 1 to 4 percent fuel savings can be realized). It also results in lower EGT, lower corrosion, and restored performance. It's more than just a mundane task after all. △

New! The *Civil Aviation Safety Alert*

Until recently, Transport Canada (TC) was distributing aviation safety information to stakeholders through the use of several types of documents, such as *Service Difficulty Advisories* and *Service Difficulty Alerts*. TC identified a need to consolidate these safety documents into one single document, now entitled the *Civil Aviation Safety Alert* (CASA).

On October 1, 2010, the CASA became the new vehicle for TC to disseminate, in a timely manner, specific safety issues to targeted stakeholders. The new CASA address various subjects such as flight operations and is not restricted to service difficulty topics.

CASAs are non-mandatory notifications used to convey important safety information and recommended action items. The information contained in CASA is critical and recipients are expected to take the CASA recommendations into consideration during ongoing operations and maintenance.

For more information, visit www.tc.gc.ca/civil-aviation-safety-alert.

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 A07A0134—Touchdown Short of Runway

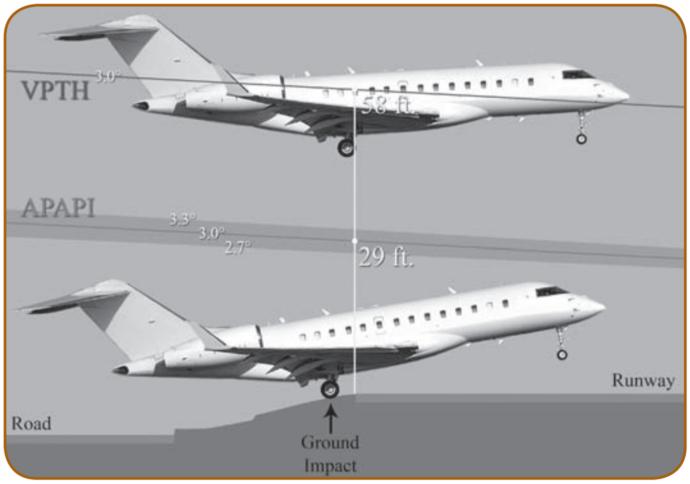
On November 11, 2007, a Bombardier Global 5000 departed Hamilton, Ont., for Fox Harbour, N.S., with two crew members and eight passengers on board. At approximately 14:34 Atlantic Standard Time (AST), the aircraft touched down 7 ft short of Runway 33 at the Fox Harbour aerodrome. The main landing gear was damaged when it struck the edge of the runway, and directional control was lost when the right main landing gear collapsed. The aircraft departed the right side of the runway and came to a stop 1 000 ft from the initial touchdown point. All occupants evacuated the aircraft. One crew member and one passenger suffered serious injuries; the other eight occupants suffered minor injuries. The aircraft sustained major structural damage.

Findings as to causes and contributing factors

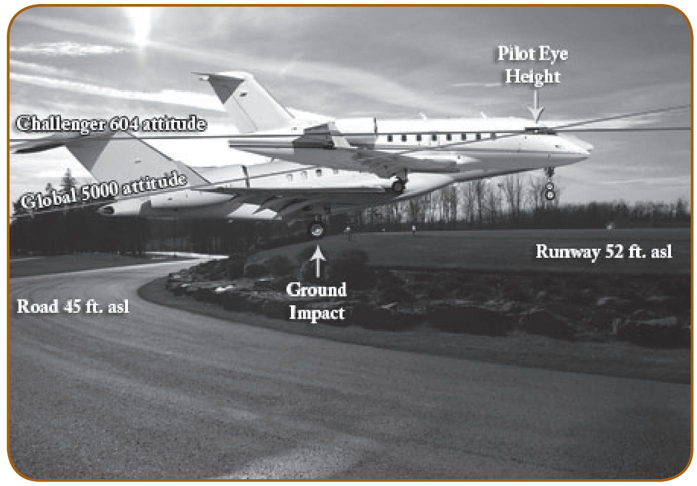
1. The crew planned a touchdown point within the first 500 ft of the runway to maximize the available roll-out. This required crossing the threshold at a height lower than the manufacturer's recommended threshold crossing height (TCH).
2. The flight crew members flew the approach profile as they had done in the past on the smaller Bombardier Challenger 604 (CL604), with no consideration for the Global 5000's greater aircraft eye-to-wheel height (EWH), resulting in a reduced TCH.
3. The abbreviated precision approach path indicator (APAPI) guidance, although not appropriate for this aircraft type, would have assured a reduced main landing gear clearance of 8 ft above threshold. At 0.5 NM, the pilot flying (PF) descended below the APAPI guidance, further reducing the TCH.
4. The pilot used the wing-low crosswind technique, increasing his workload and resulting in pilot-induced oscillations.
5. Both pilots' low experience on the Global 5000, combined with the PF's high workload, affected their ability to recognize the unsafe approach path and take appropriate corrective action.
6. With the aircraft in a low energy state, the pitch up to 10.6° without an associated thrust increase could not correct the flight profile, resulting in the impact with the sloped surface before the runway threshold.
7. The impact with the sloped surface initiated a sequence resulting in the collapse of the right main gear, a loss of directional control, the eventual departure from the runway surface, substantial damage to the aircraft, and some injuries.
8. Contrary to the manufacturer's recommended practices, the operator's standard operating procedures (SOPs) sanctioned descent under electronic or visual glide slope guidance, with a view to extending the landing distance available as acceptable and good airmanship; this contributed to the aircraft landing short of the runway.
9. The lack of an effective transition from traditional safety management to a functional safety management system (SMS) as required by the operator's private operator certificate (POC) prevented an adequate risk assessment of the introduction of the Global 5000 into its operations and contributed to the accident.
10. An inappropriate balance of responsibilities for oversight between the regulator, its delegated agency, and the operator resulted in the operator's inadequate risk assessment not being identified.

Findings as to risk

1. Because aircraft EWH information is not readily available to pilots, crews may continue to conduct approaches with an aircraft mismatched to the visual glide slope indicator (VGSI) system, increasing the risk of a reduced TCH safety margin.
2. Due to limited knowledge of the various VGSI systems in operation and their limitations, flight crews will continue to follow visual guidance that might not provide for safe TCH.



Aircraft in relation to vertical path (VPTH) and APAPI path



Aircraft attitude at threshold

3. The operator did not develop an accurate company risk profile. This precluded identification of systemic safety deficiencies and development of appropriate mitigation strategies.
4. If adequate safety oversight of POC operators is not maintained by the regulator, or the delegated organization, especially during SMS implementation, there is an increased risk that safety deficiencies will not be identified.
5. The fact that the Canadian Business Aviation Association (CBAA) did not insist that milestones for SMS implementation and development be followed may result in some POC operators never reaching full SMS compliance.
6. If Transport Canada does not ensure that the CBAA fulfills its responsibilities for adequate oversight of the *Canadian Aviation Regulations* (CARs) subpart 604 community, safety deficiencies will not be identified and addressed.
7. The audit of the operator's SMS, conducted by the CBAA-accredited auditor, did not identify the deficiencies in the program or make any suggestions for improvement. Without a comprehensive audit of an operator's SMS, deficiencies could exist resulting in the operator's inability to implement an effective mitigation strategy.
8. Contrary to the recommendations made in the Transport Canada/CBAA feasibility studies, the CBAA did not have a quality assurance program for its audit process. As a result, there is a risk that the CBAA will fail to identify weaknesses in the POC audit program.
9. At the time of the accident, no one at Fox Harbour (CFH4) had been assigned responsibility for regular maintenance of the APAPI, therefore preventing timely identification of APAPI equipment misalignment.
10. The operator's risk analysis before the introduction of the Global 5000 did not identify the incompatibility between the EWH of the aircraft and the APAPI at CFH4.
11. Not wearing shoulder harnesses during landings and takeoffs increases the potential risk of passenger injuries.
12. Passengers not wearing footwear could impede evacuation, increase the risk of injury, and reduce post-crash mobility and (potentially) survival.

Note: Due to space consideration we could only reproduce the summary and the main findings. Readers are strongly encouraged to read the complete TSB Final Report A07A0134 on the TSB's Web site at www.tsb.gc.ca. *This comprehensive and significant report explains in detail all of the issues identified in the findings. —Ed.*

TSB Final Report A07O0305—Runway Incursion

On November 15, 2007, a Learjet 35A was taxiing from the north end general aviation ramp for departure on Runway 06L at Toronto/Lester B. Pearson International Airport (LBPIA), Ont., bound for Chicago/Rockford, Ill. The crew of the Learjet was instructed to taxi on Taxiway Juliett, hold short of Taxiway Papa, and subsequently taxi on Taxiway Foxtrot and hold short of Runway 05. At 22:06:34 Eastern Standard Time (EST), the airplane arrived at the hold position for Runway 05, failed to stop, and, at 22:06:43 EST, it entered the runway. At that time, an Israel Aircraft Industries IAI 1124 Westwind airplane was on the landing roll on Runway 05. The crew of the Westwind observed the Learjet in front of them and manoeuvred to pass behind it. The two aircraft came within 60 ft of each other.

Factual information

Departing Toronto/LBPIA, the Learjet's co-pilot obtained a clearance to "taxi right on Juliett and hold short of Papa." The crew understood the clearance, correctly read it back, and made no request or gave any indication that they required progressive taxi instructions. Before reaching Taxiway Papa, air traffic control (ATC) instructed the crew to "taxi onto Foxtrot and hold short of Runway 05." The co-pilot read back the instruction correctly and proceeded to carry out the taxi-before-takeoff checklist. The pilot-in-command (PIC) had an aerodrome chart. He taxied the airplane while looking for the Runway 05 holding point and responding to the co-pilot on checklist items. The PIC saw lights in the distance that he believed to be Runway 05 and crossed what appeared to him to be a taxiway but was, in fact, Runway 05.

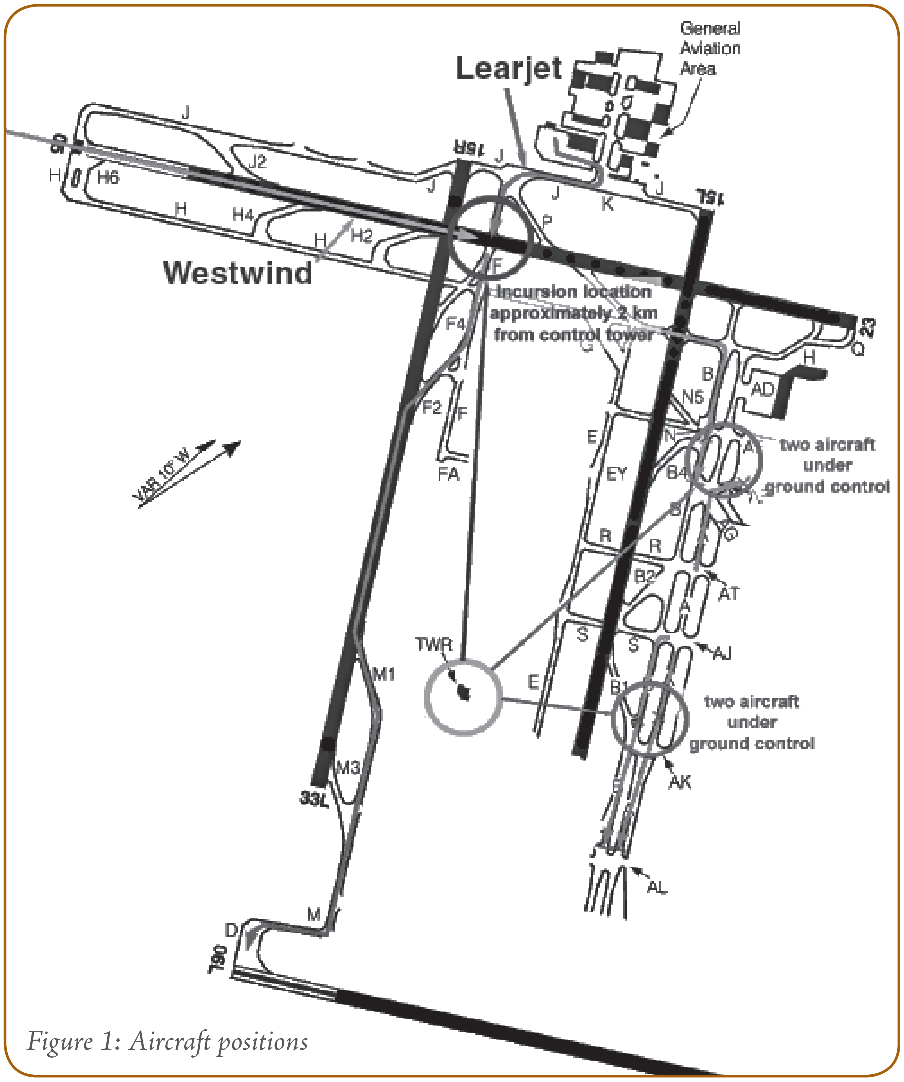


Figure 1: Aircraft positions

Neither pilot was aware that the aircraft was entering Runway 05 and neither saw the Westwind on the runway until after being advised by ATC. The co-pilot's head was down performing the checklist.

The Westwind had been cleared to land on Runway 05. The crew saw the Learjet after it entered the runway and was illuminated by the Westwind's landing lights. The Westwind crew avoided the Learjet by using brakes and steering left to pass behind. It was a clear night with unrestricted visibility. There were no visual obstructions between the two aircraft during the Westwind's approach and landing. At the time of the incident the Toronto/LBPIA control tower was staffed by 10 controllers—7 active and 3 available. Their workload was considered light to moderate. The North Tower, South Tower, North Ground, and South Ground were all staffed.

The North Tower controller was controlling the Westwind on its approach. The runway was clear when the landing clearance was given and was still clear when the Westwind crossed the threshold.

In addition to the Learjet, the North Ground controller was controlling four other aircraft—three taxiing and one under tow—which were on the east side of Runway 15L/33R, in a different direction from the Learjet, as shown in Figure 1. The North Ground controller communicated with three of these aircraft in the 60 s prior to the incursion and was monitoring the fourth as it was reaching its clearance limit. Within 10 s of the incursion, with the Westwind on the landing roll, the North Ground controller scanned back to the Learjet, which was approximately 1 mi. away, travelling directly toward the control tower.

It initially appeared to the North Ground controller that the Learjet would stop short of Runway 05 as instructed. The North Tower controller expressed doubt and the North Ground controller checked the airport surface detection equipment (ASDE) display and determined that the Learjet was entering the runway. At about the same time, an aural conflict alarm sounded.

Analysis

This incident occurred when the Learjet's pilot misidentified Runway 05 as being in the distance and continued to taxi into the path of a landing airplane despite the following passive measures intended to defend against crew deviations:

- airfield markings and signage complied with relevant standards;
- signs and markings were unobstructed and visibility was good; and

- ATC instructions complied with relevant standards, were clearly understood, and were read back correctly.

The crew did not correctly perceive their location on the airfield. None of the indicators of the hold-short point were prominent enough to attract their attention and overcome their perception that they were proceeding correctly. Potential factors contributing to their reduced level of awareness are familiar from previous studies:

- the incursion occurred while taxiing out;
- only one crew member was monitoring the taxi route and compliance with the instruction;
- distraction by the before-takeoff checklists;
- night lighting conditions;
- fatigue associated with the third leg of the day at the 12-hr point of the crew duty day; and
- operational pressure (self-imposed because the crew would be at the limit of their crew day by the time they reached home base).

Findings as to causes and contributing factors

1. Both crew members of the Learjet were unfamiliar with Toronto/LBPIA and did not correctly perceive their position on the airfield. As a result, they did not hold short of the runway as instructed by ATC and unintentionally proceeded onto the runway into the path of a landing airplane.
2. The co-pilot did not assist in monitoring the taxi route or compliance with instructions because he was carrying out checks while the PIC taxied the aircraft.

Findings as to risk

1. A crew's alertness may have been reduced by operational pressures and fatigue associated with a long duty day and multi-leg scheduling.
2. The runway incursion monitoring and conflict alert system (RIMCAS) does not provide sufficient time to prevent incursions, nor does it provide sufficient warning to allow air traffic controllers to avert a collision.
3. There is currently no automated runway incursion warning system to warn flight crews directly of impending incursions or conflicts.

TSB Final Report A07C0225—Double Engine Power Loss

On November 30, 2007, an Aero Commander 500B departed from Dryden, Ont., en route to Geraldton, Ont. The flight was conducted under VFR at 5 500 ft above sea level (ASL) with ambient temperatures aloft of -33°C. Approximately 40 min into the flight, the crew observed an abnormal right engine fuel flow indication. While troubleshooting the right engine, the engine RPM and fuel flow began to decrease and the crew diverted toward Armstrong, Ont. A short time later, the left engine RPM and fuel flow began to decrease and the crew could no longer maintain level flight. At 09:17 Central Standard Time (CST), the crew made a forced landing 20 NM southwest of Armstrong, into a marshy wooded area. The captain sustained serious injuries and the co-pilot and passenger sustained minor injuries. The aircraft was substantially damaged. The crew and passenger were stabilized and transported to Thunder Bay, Ont., for medical assistance.

During examination of the aircraft at the accident site, a restriction or blockage was found in the fuel supply to both Lycoming I0-540-B1A5 engines. The left engine had a partial blockage with no fuel supply to the forward cylinder nozzles; the right engine had a complete blockage with no fuel supply to any of the cylinder nozzles. The blockage was determined to be within the fuel distributor valve(s) because fuel pressure was present upstream of the valves (see Photo 1). The location of the fuel distributor valve on the Lycoming IO-540-B1A5 engine, in conjunction with the Aero Commander 500B engine cowling configuration, exposes the valve directly to the cooling blast of the outside air.

The right engine fuel distributor valve was removed and examined. Ice was found adhering to the internal main metering well surface (see Photo 2). Ice formed from super-cooled water droplets was also found adhering to the servo bleed screen and fully covering and blocking the return-to-tank bleed orifice (see Photos 3 and 4).

Findings as to causes and contributing factors

1. Suspended water in the fuel system precipitated out of solution and froze in the fuel distributor valve. This blocked the fuel supply to the fuel nozzles and led to the loss of engine power.
2. The aircraft was being operated without a fuel additive icing inhibiter. Use of such an additive would have inhibited ice formation in the aircraft's

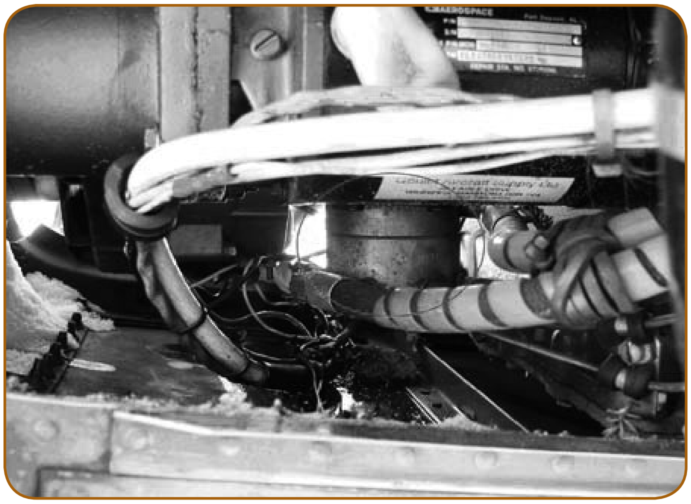


Photo 1: Fuel distributor valve installation in the lower front engine area

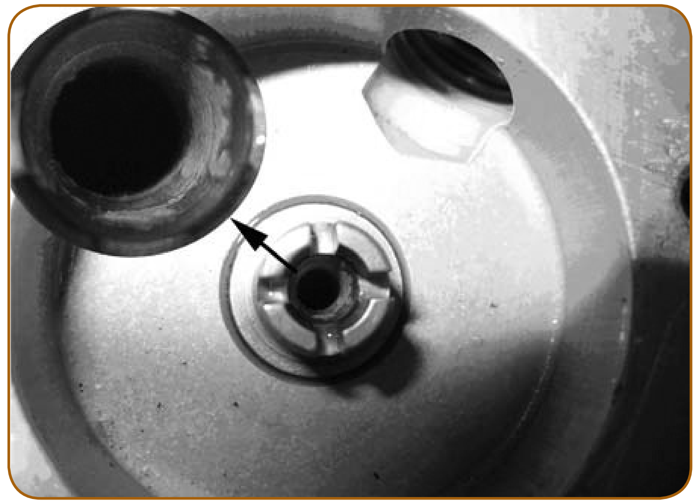


Photo 2: Ice on main metering well

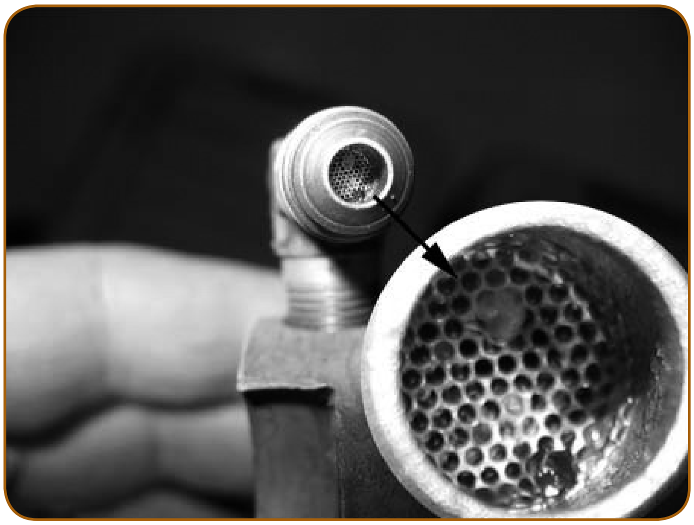


Photo 3: Super-cooled droplet ice formation on the servo bleed screen

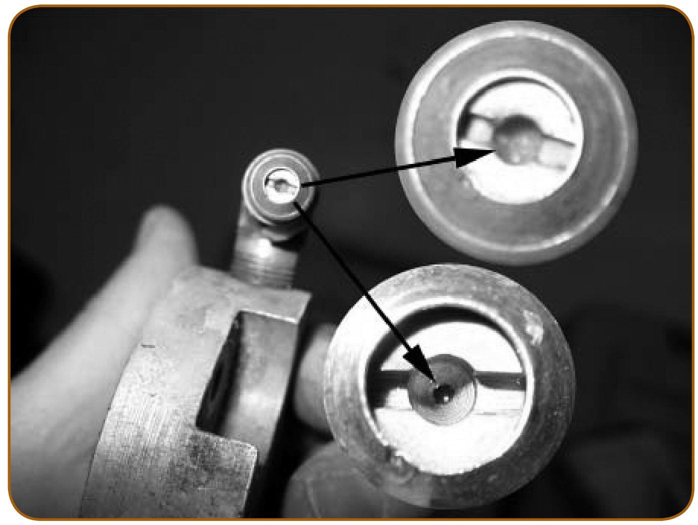


Photo 4: Return-to-tank bleed orifice (shown frozen and thawed for comparison)

fuel system and would likely have prevented the fuel system blockage.

Findings as to risk

1. The fuel distributor valve on the Aero Commander 500B is exposed directly to the cooling blast of the outside air, which, under extremely cold conditions, can lead to the freezing of super-cooled water droplets present in the fuel stream.
2. The operator did not have procedures to describe how fuel additive icing inhibiters should be used during winter operations.

Safety action taken

The operator mandated the use of fuel additive icing inhibitors in conditions where the ambient temperature, either at the surface or at altitude, is less than 0°C. The use of fuel additive icing inhibitors has been incorporated into the company operations manual, sub-section 4.2.2—Fuel Anti-icing Additives. The company planned to introduce mandatory training on the use of fuel additive icing inhibitors in the fall of 2008.

TSB Final Report A08Q0055—Landing with Nose Wheel Retracted

On March 20, 2008, a Challenger CL-600-2A12 was conducting an IFR flight from the Bonaventure Airport, Que., to the Québec/Jean Lesage International Airport, Que. During the approach, the nose gear failed to extend. The flight crew did a low fly-pass, and the tower controller and an aircraft maintenance engineer (AME) confirmed the nose gear anomaly. The flight crew went through the checklist and prepared the six passengers for a landing with the nose gear retracted. At 06:43 Eastern Daylight Time (EDT), the aircraft landed on its nose. Damage was limited to the nose-landing-gear doors and the nose-landing-gear well structure. There were no injuries.

Findings as to causes and contributing factors

1. The oleo pneumatic shock absorber (oleo strut) was found to be compressed due to a loss of nitrogen. As a result, the nose landing gear was released from the landing gear uplock latch, which allowed the wheel assembly to pivot and become jammed in the well.
2. The right deflector remained jammed in the nose landing gear well, preventing extension of the landing gear.

Findings as to risk

1. The design of the landing gear latch and pin allows the landing gear to be released from the landing gear uplock latch and to drop into the well during flight, causing the right gravel deflectors to jam, and preventing extension of the nose landing gear.
2. The clearance between the gravel deflectors and the nose landing gear well structure is very narrow when compared to similar aircraft that are not equipped with gravel deflectors. Another oleo pneumatic shock absorber (oleo strut) compression could result in the same situation occurring again.

TSB Final Report A08C0171—Engine Power Loss and Forced Landing

On August 8, 2008, a Cessna 207A was departing from Winnipeg/St. Andrews Airport, Man., en route to Bloodvein River, Man., with one pilot and three passengers on board. Shortly after takeoff, the aircraft's engine performance deteriorated and several engine backfires were noted. The pilot attempted to return to Winnipeg/St. Andrews Airport but the aircraft could not maintain altitude. The pilot carried out a forced landing on Provincial Highway 8, approximately 2 NM north of the airport at 13:56 Central Daylight Time (CDT). The aircraft was not damaged and none of the aircraft occupants was injured.

The engine magneto timing was checked and both magnetos were found to be incorrectly timed. The required timing is 22° before top dead centre (BTDC) on the compression stroke on the No. 1 cylinder piston. The magnetos were found to be timed to approximately 50 to 60° BTDC. Such an advanced timing of the magnetos leads to pre-ignition or detonation of the combustion gases in the engine and results in high cylinder head temperatures and engine power loss.

A 50-hr inspection of the aircraft was started on July 28, 2008, and completed on the day of the occurrence. In conjunction with this inspection, a 500-hr inspection of the Slick 6310 magnetos was carried out in accordance with Slick Service Bulletins SB2-08 and SB3-08. Though there is no colour vision requirement to hold an aircraft maintenance engineer (AME) licence, the engineer who removed and installed the magnetos had a red/green colour vision deficiency and was incapable of discerning reds or greens.

The Cessna 207 series service manual indicates that the advanced firing position of the No. 1 cylinder may be determined by the use of a timing disc and pointer, Time-Rite piston position indicator, protractor and piston locating gauge, or external engine timing mark reference. The external engine timing marks are located on a bracket attached to the starter adapter, with a timing mark on the alternator drive pulley as the reference point. These marks consist of indented lines on the parts in question.

The engineer chose the external engine timing mark reference as the method of timing because the external magneto timing indicator plate was present on the engine. The external magneto timing indicator plate is located on the rear of the engine, in a dimly lit area of the engine bay. The mark on the alternator drive pulley had been painted red for conspicuity during the last engine overhaul.

The engineer brought the engine around to the compression stroke on the No. 1 cylinder piston and aligned the mark on the alternator drive pulley with the 22° BTDC position on the external engine timing plate. The engineer removed the magnetos and sent them to the engine overhaul facility for the 500-hr inspection compliance.

During the eight-day period in which the magnetos were away for inspection, the engineer completed other maintenance tasks on the aircraft as required by the 50-hr inspection chart. The engine bay was dirty and the engine and belly of the aircraft were washed with solvent. Upon return of the magnetos, the engineer reset the engine timing to the 22° position because the propeller had been turned during the servicing of the aircraft.

As the engineer rotated the propeller to align the timing marks, the first mark that came into view on the alternator drive pulley was a scratch that had snagged debris from the engine washing (see Photo 1). The scratch, with the embedded debris, looked similar in appearance to the correct timing mark (see Photo 2). The engineer was not able to discern the red paint colouring to cross-reference the mark and chose the scratch as the timing mark of reference. The correct timing mark was out of view on the opposite side of the pulley. The engineer installed the magnetos using the scratch with the embedded debris as the reference point.

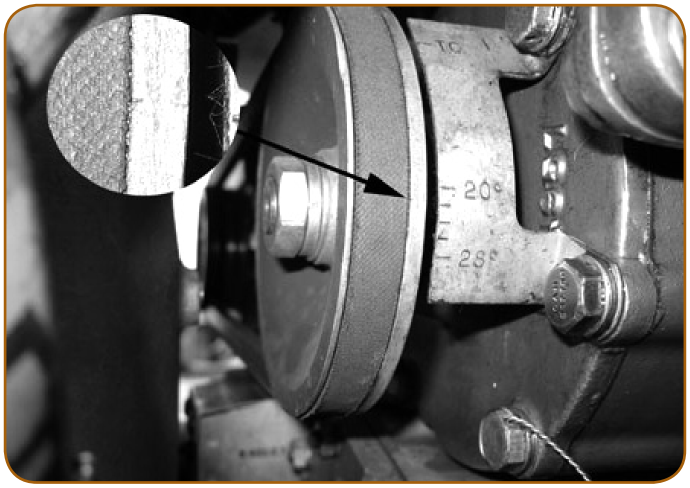


Photo 1: Mistaken timing mark with debris removed

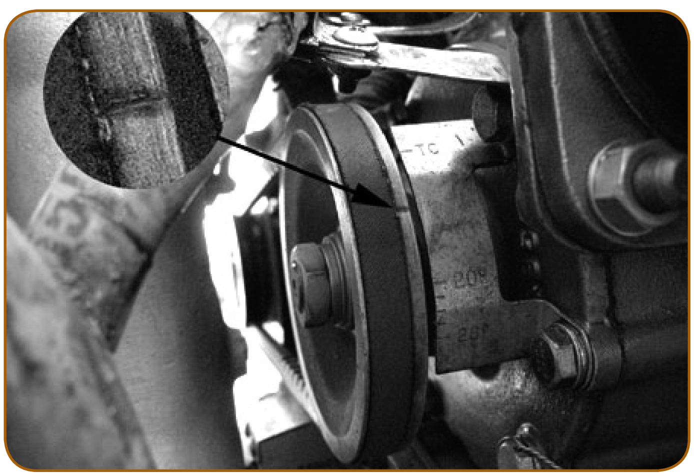


Photo 2: Correct timing mark

Finding as to causes and contributing factors

1. During recent maintenance work, both engine magnetos were incorrectly timed. This condition was not detected during the subsequent engine ground run or before the flight. The incorrect magneto timing led to pre-ignition or detonation of the combustion gases in the engine, which resulted in high cylinder head temperatures and engine power loss after takeoff.

Finding as to risk

1. Service Bulletin M84-8 and Mandatory Service Bulletin (MSB) 94-8C regarding preferred magneto timing methods were evaluated by the operator and not incorporated into its approved Cessna 207 maintenance schedule. The continued use of the external engine timing mark method increased the risk of a magneto timing error.

Other finding

1. A maintenance evaluation sheet addressing the evaluation of MSB 94-8C was not prepared by the company in accordance with its maintenance control manual (MCM).

Safety action taken

Cessna indicated that it will be incorporating information in MSB 94-8C into the next scheduled revision of the Cessna 207 maintenance manual.

The operator indicated that it will be making changes to its policy regarding the implementation of service bulletins.

TSB Final Report A08P0265—Loss of Control—Collision with Terrain

On August 13, 2008, a Bell 206L (LongRanger) helicopter was being operated at Legate Creek, just north of Terrace, B.C. At about 10:30 Pacific Daylight Time (PDT), the pilot started longline operations to move a drill rig at about 4 200 ft above sea level (ASL) on a steep hillside. The first and second lifts were completed uneventfully. Upon lifting the third load, the helicopter descended into the valley before it climbed slowly. It needed two orbits to climb to a sufficient height to make its approach to the landing area. When the load was about 3 ft above the drill deck, the helicopter descended rapidly and the load came down hard. While the ground crew attempted to unhook the load, it popped back into the air. The load slammed onto the deck again and the helicopter fishtailed. The load was abruptly lifted back into the air once again and the helicopter began to spin with its tail bent. The load remained attached to the helicopter and became lodged in trees. Tethered by the longline, the spinning helicopter descended in an arc and crashed into the cliff. It ended up hanging inverted. The pilot was critically injured and died of his injuries the next day. There was no fire. The emergency locator transmitter (ELT) broke out of its mount and was ejected from the helicopter, where it emitted a signal for about 15 hr.

Accident site

Close-up of aircraft at accident site

Analysis

Because there was no evidence of progressive failure or weather-related problems, this analysis will focus on helicopter operations and systems.

The hard landing of the load is consistent with the helicopter sinking rapidly as it slowed and due to limited performance as predicted in the hover out of ground effect (HOGE) chart.

The pilot may have attempted to correct a nose-down pitch if the helicopter was forward of the load when a large collective input was made. This would explain why there were indications that the cyclic was in the full aft position.

The main rotor blades struck the tail boom in a flight regime (hover) where contact is highly unlikely. The deck support did not break as an initiating factor, and because the tail boom did not break before it was hit, there had to be some other abnormal event to bring the main rotor in contact with the tail boom.

There are a limited number of events that can cause a main rotor to strike the tail boom, but only collective bounce is able to generate the divergence necessary to bring this about under the accident circumstances:

- The drop of the load (3 ft) onto the drill deck would initiate a bounce.
- The pilot was leaning out the right door with his left arm extended fully to reach the collective stick (susceptible to an uncommanded movement from a bounce).
- While the lack of built-in friction could have been mitigated by the pilot applying friction, this was not done and the collective did not serve to help dampen the pilot's arm movement after the initiating bounce.
- The longline stretch aggravated vertical movement of the load (bounce).
- The main rotor blade was flexing down when the helicopter was hovering (divergent vertical movement).
- Although the load was very heavy for the helicopter, it dropped and rose quite quickly (disproportionate to the normal collective movement), indicating uncommanded power changes.

Therefore, collective bounce likely caused the main rotor to strike the tail boom, probably in the early stages of the divergent vertical movements.

Findings as to causes and contributing factors

1. The helicopter was operating at a weight that, when forward speed was reduced, caused it to descend rapidly and the load to hit the drill deck hard. The hard landing of the load, combined with the pilot's body position, longline stretch, and low collective friction initiated collective bounce, causing the main rotor blades to strike the tail boom.
2. The tail rotor drive and anti-torque control were lost, causing the helicopter to spin about its yaw axis due to high engine torque; the pilot lost control and the helicopter collided with terrain.

Findings as to risk

1. Longlines that stretch have been known to induce vertical oscillations and there is a risk of these oscillations accelerating to a point beyond the pilot's control.
2. While most helicopter flight manuals contain performance charts, they are often not included in the limitations section and can, therefore, be interpreted as guidance material. There is a risk that not adhering to these performance charts will result in damage to the helicopter, loss of control, or both.

3. Operating with an unrestrained upper body and without a door increases the risk of injury in the event of an accident.

TSB Final Report A08O0233—Uncontrolled Descent into Terrain

On the night of August 31, 2008, a private pilot rented a Cessna 172P. The pilot and two passengers flew from Brampton Airport, Ont., to Toronto/Buttonville Municipal Airport, Ont., then to Barrie-Orillia (Lake Simcoe Regional) Airport, Ont., and Wiarton Airport, Ont., stopping briefly at each of these locations before beginning a return flight to Brampton. At approximately 04:32 Eastern Daylight Time (EDT) on September 1, 2008, the airplane struck the ground at 44°03'N 080°21'W, approximately 7 NM west of Shelburne, Ont., and was destroyed. There was no fire. Impact damage rendered the emergency locator transmitter (ELT) inoperative. The rear-seat passenger notified emergency services of the accident by cellular telephone, but emergency services were unable to locate the accident site until approximately 06:30 EDT when a local resident found and reported it. The rear-seat passenger was taken by ambulance to a local hospital, examined, and released. The pilot and front-seat passenger were airlifted to a Toronto hospital where the front-seat passenger succumbed to his injuries four days later.

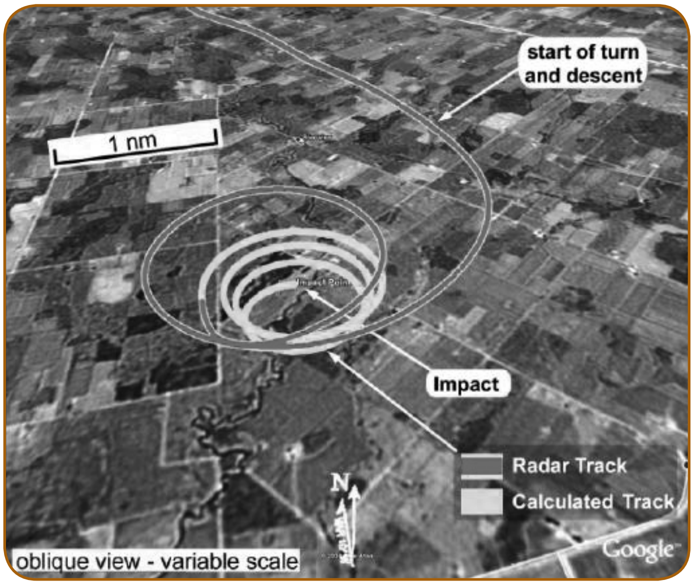
Analysis

In this occurrence, weather was suitable for the flight and was not considered a factor. There was no indication of a mechanical failure of the airplane or of onboard navigation equipment or facilities external to the airplane that may have influenced the events. Therefore, the investigation focused on the pilot and passengers.

The occurrence took place at the lowest point of circadian alertness and after the pilot had likely been awake for 22 consecutive hours. The pilot was therefore at high risk of falling asleep involuntarily: he was very high on the homeostatic scale of propensity for sleep, and he was at the lowest point of the circadian cycle for alertness. The pilot was tasked with maintaining the airplane in a constant direction and altitude at night, a task that is both monotonous and that requires sustained attention. The cockpit environment was one of sustained low-frequency noise and constant consistent vibration.

All on board were accustomed to sleeping at night and were experiencing the lowest point on the circadian rhythm of alertness making them all susceptible to the effects of fatigue. The rear-seat passenger was asleep after leaving Wiarton.

The flight path change that was detected by analysis is consistent with the pilot ceasing to maintain the lateral-directional control input required to maintain the heading of the airplane. As the airplane deviated from its initial azimuth and bank condition, its natural stability would result in a rate of descent that increased as the bank increased, characteristic of spiral mode stability without pilot intervention. The flight path analysis determined that, without any pilot control input, the airplane would continue to fly a descending spiral flight path from the last recorded position on radar to the point where it struck the ground. Furthermore, the analysis predicted accurately the location, heading, and attitude of the airplane at impact.



Final flight path of the C-172

The flight path study cannot prove that the persons on board were all asleep, only that they did not intervene in the flight of the airplane during the last 7 min of flight. However, the investigation concluded that, as a result of fatigue, both passengers were sleeping and the pilot involuntarily fell asleep while performing the monotonous task of maintaining straight-and-level flight, after which the airplane reverted to its trimmed condition and continued to fly until it struck the ground.

In the absence of any direct method of measuring an individual's level of fatigue or propensity for sleep, the defence against fatigue-related accidents is to avoid placing the operation at risk in the first place. In commercial operations, this is accomplished by means of regulatory and operational measures that limit the flight and duty time of flight crews. For individual owners and rental pilots, the sole defence against fatigue is their own judgment, which has been acknowledged to be unreliable since fatigued individuals are typically the poorest judges of their condition. There is no regulatory requirement for flight training units (FTU), flying clubs, or rental operations to exercise the same operational control measures that apply to commercial operations, even though such measures could help reduce risks for affected individuals.

There was a delay in locating the accident site. The pilot did not file a flight plan or flight itinerary; therefore, there was no indication that the airplane was overdue. Although impact forces were of sufficient magnitude, it is possible that the force component along the axis of sensitivity was insufficient to trigger the single-axis inertia switch and activate the ELT. Moreover, the ELT was released from its mounting bracket during impact, and the power source detached, which would have caused the ELT to stop transmitting. As a result, no ELT signals were detected. The physical installation standards for these ELTs do not preclude use of the mechanism by which the retaining strap released the ELT. The design of the over-centre retaining strap for ELTs creates a risk that the ELT will not function in a similar accident.

The airplane's gross take-off weight exceeded the limitations published in the aircraft flight manual (AFM). As a result, the structural integrity of the airplane and its performance capabilities were not reflected in the AFM. Although these elements did not contribute to the accident, operating an airplane outside its certified limitations incurs a risk that the operator cannot assess.

Findings as to causes and contributing factors

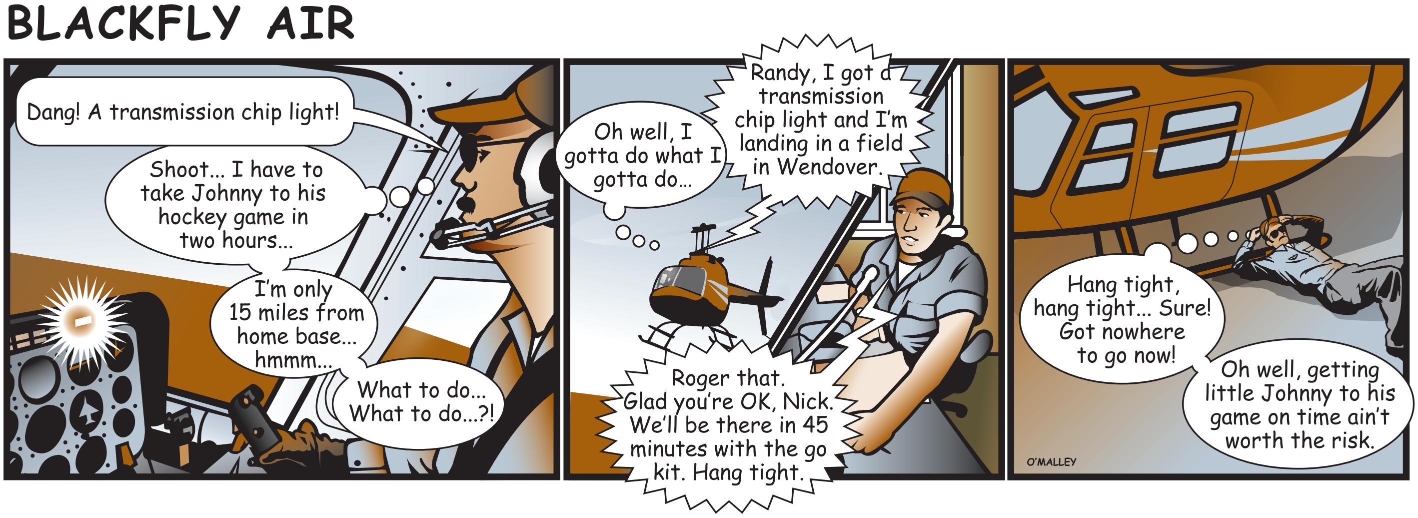
1. Due to fatigue, the pilot involuntarily fell asleep resulting in the airplane continuing to fly in its trimmed condition until it struck the ground.
2. The two passengers, both with flying experience, were asleep and did not identify the developing situation and, therefore, could not alert the pilot.

Aerial view of accident scene

Findings as to risk

1. Reliance on a pilot's own judgment to prevent fatigue-related accidents is an ineffective defence mechanism.
2. The pilot did not file a flight plan or flight itinerary. As a result, there was no alert that the airplane was overdue, which could delay the initiation of search and rescue efforts.
3. The pilot utilized a weight and balance worksheet for a different airplane model. As a result, the flight was flown at a gross weight that exceeded the limitations set out in the AFM.
4. Although it complies with existing standards, the over-centre retaining strap that mounts the ELT to the airplane can release the ELT when subjected to the right combination of impact forces, rendering it inoperable and increasing the risk of delay in locating a crash site.
5. Although it complies with existing standards, an ELT with a single-axis inertia switch may not be triggered by impact forces in some instances, increasing the risk of delay in locating a crash site. △

BLACKFLY AIR



Note: The following accident synopses are Transportation Safety Board of Canada (TSB) Class 5 events, which occurred between May 1, 2010, and July 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 May 1, 2010, a privately owned **Cessna 140A**, took off from Runway 23 at the Trois Rivières Airport, Que., for a local flight. During the initial climb, the pilot heard a drop in engine RPM and decided to abort the flight. During the landing run on Runway 23, the tail wheel-equipped Cessna 140A did a ground loop and came to a stop on its nose. The engine and the left wing were substantially damaged. The pilot was not injured. *TSB File A10Q0067.*

— On May 1, 2010, a **Diamond DA20** with a solo student pilot, was conducting short field/soft field stop-and-go practice on Runway 34 at the Springbank Airport (CYBW) near Calgary, Alta. On the fourth or fifth takeoff, the aircraft was observed over-rotating on liftoff and executing a wing-over type of manoeuvre to the left. The aircraft impacted the ground beside the runway in a vertical nose-down attitude before cartwheeling to an inverted position. The pilot was seriously injured and trapped in the wreckage until released by the emergency response service (ERS) and transported to hospital. *TSB File A10W0063.*

— On May 2, 2010, an unregistered **powered paraglider** crashed near Edgewater, B.C. The pilot had been flying without a licence. He was at low altitude (300 to 400 ft) and his engine was not running. He decided to land and, while turning into wind, caught the wing on the ground. He suffered serious injuries. *TSB File A10P0116.*

— On May 2, 2010, a **Cessna 152** was being ferried from Dryden, Ont., to St. Andrews, Man., when the pilot encountered deteriorating weather conditions. The pilot diverted to Lac du Bonnet (CYAX), but weather conditions deteriorated further. While making a precautionary landing on Provincial Road 214, the aircraft struck an electrical wire. The aircraft sustained substantial damage but the pilot was not injured. *TSB File A10C0054.*

— On May 9, 2010, a **de Havilland DHC-6-300 Twin Otter on skis** was about 90 NM north of Alert, Nun., when a landing spot was found for survey purposes. The pilot performed a ski drag and landed on the second approach. Once the aircraft was stopped, the right landing gear broke through the ice while both engines were running. The right engine hit the ice under power. Both engines were shut down. The captain called for rescue on the HF radio while the first officer initiated the evacuation of the passengers, the recovery of the survival gear and the activation of the 406 MHz emergency locator transmitter (ELT). All the occupants moved away from the broken ice surface. A camp was set up and communication was made via satellite phone. Two hours later, a helicopter arrived to evacuate all the occupants to Alert. There were no injuries. The aircraft fuselage was last seen submerged up to its wings, tail high. *TSB File A10Q0061.*

— On May 11, 2010, a **Robinson R22 Beta helicopter** was on a low speed (12 to 15 kt) night flight at low altitude (between 50 and 75 ft) over fields to prevent the crops from freezing. After making a turn, the pilot felt significant vibrations, and the aircraft went down nose first and made a hard landing. The pilot lowered the collective to stop the aircraft, cut the power and shut off the electrical circuits before evacuating. The aircraft's tail rotor blades were severed. The pilot, who was alone on board, was not injured. An inspection of the aircraft and the rotor drive belt tensioning systems showed that the straps had come off the pulleys while the rotors were engaged. The rotor engagement time substantially exceeded the standards specified in the aircraft's operations manual. The manual indicates that if the rotor engagement time exceeds the 5 s limit (before the rotor turns), it can cause the belts to shift and eventually rupture during flight. *TSB File A10Q0064.*

— On May 13, 2010, a privately owned **PA18A-150** aircraft on wheels took off from the St-Mathias Airport, Que., on a VFR flight bound for Île Bellegarde, Que., with the pilot on board. When it had reached its destination, the aircraft landed on a sandy beach. During the landing run, the aircraft did a ground loop. The left wing and the propeller were substantially damaged. *TSB File A10Q0066.*

— On May 13, 2010, the pilot of a **Cessna C185 on amphibious floats** was on final approach to a private Galiano Island, B.C., airstrip when the main gear struck a berm at the approach end of the strip. The airplane pitched nose down, breaking off the nose gears and veering off to the side of the runway where it flipped on its back. The pilot was not injured and credits wearing a shoulder harness. *TSB File A10P0126.*

— On May 13, 2010, an **Astar AS350-B2 helicopter** was transporting a five-man line crew to a job about 50 mi. south of Dawson City, Y.T. Just prior to touchdown in a mountain saddle, a high rate of descent developed resulting in a hard landing. There were no injuries to the pilot or the passengers but the helicopter had a collapsed right-hand skid and the tail rotor and tail boom were damaged. *TSB File A10W0069.*

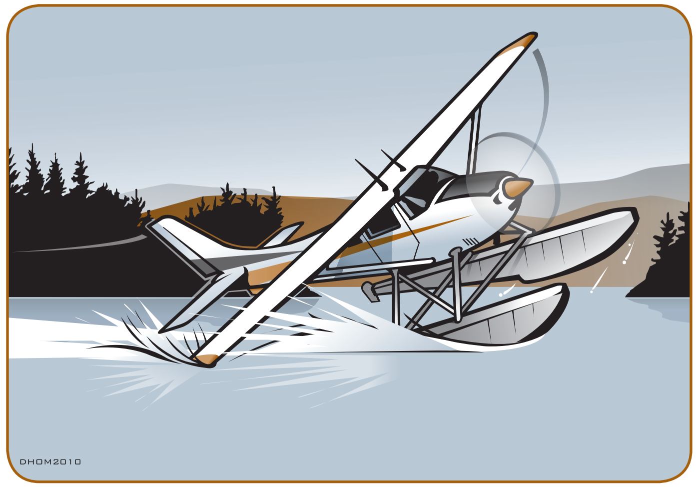
— On May 15, 2010, a **Cessna 172** landed in Kingston, Ont., after a flight from Oshawa, Ont. While taxiing from the runway to a parking position at a fixed-base operator (FBO), the aircraft struck its left wing on a fence post. The collision spun the aircraft to the left and the propeller struck the fence and came to a stop. The collision resulted in significant damage to the aircraft; however, both occupants were uninjured. *TSB File A10O0091.*

— On May 20, 2010, a **float-equipped DHC-2 MK 1** aircraft was landing at Rivers Inlet, B.C., after a flight from Coal Harbour, B.C. When the aircraft was about 5 ft above the water, a gust of wind caused the right wing tip and the right float to touch the water; the aircraft cartwheeled and overturned. The pilot, who was the sole occupant on board the aircraft, was not injured. He exited from the aircraft and remained on a float until rescued. The substantially damaged aircraft was towed towards the River Inlet dock but sank in 160 ft of water. The emergency locator transmitter (ELT) was not activated, but the tracking system alerted the operator's dispatch. The pilot was wearing both a shoulder harness and a life jacket. *TSB File A10P0133.*

— On May 24, 2010, a **Beech V35B** was on a VFR flight from Creston B.C. to Nelson, B.C. In the vicinity of Crescent Bay, on Kootenay Lake, the engine (Continental IO-520) began to run roughly. The pilot heard a bang; oil covered the windshield and the engine emitted black smoke. The pilot ditched the aircraft in the lake, close to shore. The pilot and passenger successfully evacuated the aircraft without injury and were rescued by a nearby boat. The emergency locator transmitter (ELT) was not activated and the substantially damaged aircraft sank in shallow water. *TSB File A10P0143.*

— On May 29, 2010, a **de Havilland DHC6 Twin Otter** aircraft with two pilots on board was conducting a short takeoff and landing (STOL) training flight in a training area 15 NM east-southeast of the Kuujjuaq Airport, Que. During an approach, the right wing struck a tree and the aircraft returned to land at Kuujjuaq without further incident. The wing's leading edge, the aileron and the wingtip sustained substantial damage. Neither of the two pilots was injured. *TSB File A10Q0084.*

— On May 30, 2010, a privately operated **Cessna 182 on floats** with four people on board was on a VFR flight from Lake Témiscouata, Que., in visual meteorological conditions (VMC). During the take-off run in high winds, the right wing struck the surface of the lake and the aircraft nosed over and came to a stop upside down on the lake's surface. The passengers were immediately rescued by shoreline residents, but still suffered moderate hypothermia. There was one minor injury and the aircraft was substantially damaged. *TSB File A10Q0082.*



Artist's impression of event as it occurred

— On May 30, 2010, a privately operated **Piper PA16X (Clipper)** with only the pilot on board was on a VFR flight from the St-Hyacinthe Airport, Que., to the Trois-Rivières Airport, Que. Upon landing in crosswind conditions, the aircraft did a ground loop and went off the runway. The pilot was not injured; however, the aircraft's front right landing gear, propeller and tail wheel were substantially damaged. *TSB File A10Q0081.*

— On May 31, 2010, a **Cub L-4B on floats** was on a VFR flight from lac Miquet, Que., to Petite Décharge River in Alma, Que. During a water landing on glassy water, as the aircraft landed with a high rate of descent, the front float attachment broke and the propeller severed the front section of the float. The aircraft was diverted to lac Sébastien to conduct an emergency water landing. The aircraft landed on its left float, came to a stop near the shore, and the right wing touched the water sustaining no additional damage. No one was injured. *TSB File A10Q0088.*

— On June 4, 2010, a privately operated **Robinson R44 helicopter** was landing in an area next to a cottage on Lac Duval, Que. The grass-covered terrain at the landing spot was uneven. Upon touching down, the pilot put collective down abruptly and sensed the helicopter wanted to tilt backwards. The pilot corrected abruptly with cyclic forward and collective up and the helicopter lifted and tilted forward, striking the main rotor on the ground. The pilot and passenger were not injured. The aircraft was substantially damaged. *TSB File A10Q0086.*

— On June 5, 2010, a privately operated **Piper PA-28-140** was on a local recreational flight in the St. John's Airport, St. John's, N.L., area. During a full flap landing on Runway 02, the aircraft touched down hard and bounced resulting in damage to the nose gear, propeller and left-hand (LH) wing tip. The pilot secured the engine and exited the aircraft uninjured. Rescue personnel responded and the aircraft was towed clear of the runway a short time later. *TSB File A10A0060.*

— On June 8, 2010, a **Midget Mustang MM-1** aircraft was on its maiden flight after extensive refurbishing by the pilot owner. During the climb out from Runway 30 at Orillia, Ont., and after its third circuit, the engine lost power, regained it, and lost it a second time. The aircraft turned to the left and quickly descended striking hydro lines by the side of a road before coming to a rest in a wooded area outside the airport boundary. The pilot was seriously injured and subsequently died of his injuries. The aircraft was substantially damaged. There was no post-crash fire and the 406 MHz emergency locator transmitter (ELT) activated. *TSB File A10O0112.*

— On June 13, 2010, a **Piper PA-25-235** had just taken off from Nipawin, Sask., to conduct aerial spraying when the pilot observed a partial loss of engine power. As the pilot turned the aircraft clear of built-up areas to jettison the chemical load, the engine lost all power. The aircraft descended and collided with trees on the east bank of the Saskatchewan River. The aircraft came to rest, inverted with substantial damage The pilot sustained serious injuries. *TSB File A10C0085.*

— On June 9, 2010, a **Cessna 172M** was landing at a private strip at Somerset, Man., on a flight from Starbuck, Man. During the landing roll, the pilot's headset fell to the cockpit floor and became lodged behind the pilot's rudder/brake pedals. The pilot lost directional control and the aircraft veered off the runway and into an adjacent ditch and overturned. The aircraft sustained substantial damage to its wings and tail; no injuries were reported. *TSB File A10C0091.*

— On June 25, 2010, a **Hughes 369HS (500C) helicopter** was conducting spraying operations 1.6 NM north of Aldergrove, B.C., when the helicopter struck a greenhouse. The skids were torn off the helicopter and the engine was overstressed during the pilot's recovery attempt. The pilot was able to retain control of the helicopter and remained airborne while his ground crew fashioned an improvised landing platform of wood. The pilot then landed the helicopter without further incident. The pilot was not injured but the helicopter was substantially damaged. *TSB File A10P0185.*

— On June 26, 2010, a **Beaver SS basic ultralight** took off from a field near Deep Creek, B.C., for a demonstration flight prior to the aircraft being sold. The aircraft took off, began a right turn and then the nose abruptly rose steeply. The aircraft stalled and impacted the ground. The aircraft was destroyed and the pilot was fatally injured. *TSB File A10P0186.*

— On July 3, 2010, the pilot of a **Found Brothers amphibious floatplane model FBA-2C1** departed from the runway at Pitt Meadows Regional Airport in B.C., to conduct circuits over Pitt Lake, B.C. After picking a spot to land on the water near several boats, he carried out his pre-landing check, observed that the landing gear position annunciator lights were illuminated, heard the audio warning that the wheels were down for a landing on land and continued to land on the water. Upon touchdown, the aircraft pitched down and nosed into the water. Initially, the pilot's door appeared to be jammed but it opened when activated in the opposite direction. The pilot subsequently egressed the submerged cockpit and clung to a float of the overturned aircraft. The pilot released his shoulder harness just prior to exiting the aircraft. He was also wearing a personal floatation device (PFD), which reportedly did not hinder his egress. Since the aircraft was floating close to the surface, the pilot elected not to inflate the PFD. He was rescued shortly thereafter by boaters. *TSB File A10P0195.*

— On July 3, 2010, an **amateur-built PA-18 NG** was on a local flight to the St-Jean Airport (CYJN), Que., with only the pilot on board. During landing on Runway 29, the aircraft bounced twice and went off the runway. The aircraft's right landing gear was substantially damaged. The pilot was not injured. *TSB File A10Q0103.*

— On July 3, 2010, an **amateur-built amphibious Klein KL 1 aircraft** was being prepared for a flight at the Langley Airport in B.C. The pilot started the engine, performed a run-up and cockpit check, and noticed that the battery voltage was below 12 V (normal is 13.9 V). He engaged the auxiliary fuel pump and the engine (Hirth Motoren KG, F30) stopped. The pilot saw flames coming out of the air intake on the left side of the engine cowling. He retrieved the aircraft fire extinguisher and discharged all its contents fighting the fire. He abandoned the aircraft and sought assistance. The fire department arrived and extinguished the fire but the aircraft was destroyed. The pilot was not injured. *TSB File A10P0197.*

— On July 5, 2010, a **Bell 206B helicopter** was engaged in fungicide application near Esterhazy, Sask., when the main rotor mast of the helicopter contacted an overhead wire and control was lost. The aircraft impacted the ground in a nose-low attitude on the left side. The pilot received minor hand injuries and exited the aircraft. There was no post-crash fire. There was a release of chemicals during the crash. No mechanical problems were evident prior to contact with the wire. The seat belt and shoulder harness were in use and the pilot was wearing a helmet, as mandated by company policy. The aircraft was destroyed. *TSB File A10C0107.*

— On July 11, 2010, a **float-equipped Cessna 185** was departing Salerno Lake, near Irondale, Ont. During the take-off run, in a narrow section of the lake, a small boat appeared and was on a head-on collision course with the aircraft. The pilot aborted the takeoff and then shut the engine off; however, the boat continued and impacted the aircraft between the two floats. One occupant of the boat sustained serious injuries; the four occupants of the aircraft were not injured. The boat sustained extensive damage, while the damage to the aircraft was limited to the floats. The aircraft was secured to a large boat to prevent it from sinking and was towed to shore. *TSB File A10O0136.*

— On July 13, 2010, a **Bell 206B helicopter** was working on the east side of Stave Lake near Agassiz, B.C., positioning forest management personnel. While attempting to land with just the pilot on board, a bear paw snagged under a log. The aircraft rolled onto its right-hand side and was a total loss. The pilot was taken to hospital with minor injuries. *TSB File A10P0207.*

— On July 14, 2010, a **AS350BA helicopter** landed in a clearing about 50 NM north of Wabasca, Alta., to pick up a fire crew. After liftoff and acceleration through 30 kt, a main rotor vibration was detected, and the aircraft was landed in a clearing about 800 m away. Two main rotor blades had sustained substantial damage in the trim tab area, likely from contact with a tree. The helicopter was grounded on-site and, due to fading daylight, the pilot and four passengers were extracted the next day. *TSB File A10W0105.*

— On July 16, 2010, a **Cessna T210N Centurian** was landing on Runway 15 at the Saskatoon, Sask., airport after arriving from Regina, Sask. Upon touchdown, the aircraft landed on its belly and scraped along the runway before veering into the infield. There were no injuries but the aircraft was substantially damaged. During recovery, the aircraft was lifted and the landing gear was cycled down. The landing gear came down and locked normally and the aircraft was towed to the ramp. It was not clear whether the landing gear had been selected down prior to landing. *TSB File A10C0124.*

— On July 20, 2010, a **Cessna 172K** was in cruise flight at 6 000 ft, approximately 40 NM east of Senneterre, Que., heading towards Amos, Que., when the engine quit. The pilot applied mixture and carb heat and attempted a restart but was not successful. The pilot conducted a forced landing along a heavily wooded lumber road. The aircraft came to rest after colliding with several large trees. The pilot and passenger were not injured. The aircraft was substantially damaged. The pilot used a SPOT emergency locator transmitter (ELT) to get help. A forestry worker nearby assisted them. Apparently the engine power loss was due to fuel exhaustion. The aircraft had flown 3 hr 55 min since it had last been fuelled. *TSB File A10Q0118.*

— On July 27, 2010, a privately owned **Beech Musketeer Sport (BE-19A)**, with one pilot and one passenger on board, took off for Chicoutimi, Que., from a gravel runway located 1 NM west of lac Portneuf, Que. After takeoff, the aircraft did not have enough climb performance to clear the obstacles on its flight path. The aircraft hit the trees at the end of the runway and crashed 300 m away. Both passengers sustained minor injuries and the aircraft was substantially damaged. *TSB File A10Q0120.* △

Worth Watching—Again! The 11 *Through the Overcast* Video Vignettes

The 11 *Through the Overcast* video vignettes, varying in length between five and six minutes each, were produced in 1997 to promote safe practices for all sectors of the aviation industry, and to prevent accidents and incident. They have been available on the Transport Canada Website in streaming video format for many years now at: www.tc.gc.ca/eng/civilaviation/publications/tp14185-tp14185-2093.htm. Hosted by renowned aviation safety champion Mike Doiron, these excellent vignettes are a must-watch for anyone involved in our industry. Time well spent!

Liability for a Contravention Committed by Another Person

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

The pilot of a light aircraft was on final approach to a runway when he was instructed to expect clearance on short final and to prepare for a possible overshoot due to a vehicle on the runway. The tower controller subsequently cleared the pilot for a low approach only, but the pilot completed the landing while the vehicle was still operating on the far end of the runway.

The *Canadian Aviation Regulations* (CARs) require a pilot-in-command to follow the instructions issued by air traffic control. The evidence demonstrated a contravention of CAR 602.31 by the pilot-in-command; however, further investigation revealed that the pilot was a student on a solo flight and had not received any instruction regarding low approach and overshoot scenarios. The flight school was responsible for the content and quality of the training conducted and, as the owner and operator of the aircraft, was held responsible for this regulatory contravention.

The flight school was held responsible for the actions taken by the pilot-in-command through the use of a regulatory tool known as vicarious liability. While this discussion is not all-encompassing in its scope, vicarious liability can be generally described as a legal concept whereby an individual or organization may be found legally liable for a contravention committed by another person. Section 8.4 of the *Aeronautics Act* incorporates this concept in Canadian aviation legislation.

Section 8.4 of the *Aeronautics Act* specifies which parties can be found liable for a contravention committed by another person. The Act defines these parties as:

- a registered owner of an aircraft;
- an operator of an aircraft;
- a pilot-in-command of an aircraft; or
- an operator of an aerodrome or other aviation facility.

The concept of vicarious liability is important because it helps place responsibility for the a contravention of a regulation on the appropriate party. Where a party has power or influence over another, the party having the influence may be found liable for any contraventions committed by the party over which they exercise that influence and be subject to a penalty for the contravention.

The Aviation Enforcement Division uses several criteria to determine when the use of vicarious liability is appropriate. Some (but not all) of the factors that may be considered are:

- knowledge of the circumstances;
- involvement in the event;
- any benefit gained by the contravention;
- any trends or pattern of occurrences; and
- where the identity of the actual offender cannot be determined.

For example, if you are the owner of an aircraft and you allow someone else to operate it, you will be expected to provide information regarding the details of that arrangement, and depending on the circumstances, you could be held liable for contraventions related to the use of the aircraft.

In a situation where a practice that is not compliant with the CARs is tacitly condoned or even encouraged by an organization, the organization can be found liable for a contravention that would normally be attached to the actions of an individual. If someone works for an air operator and a contravention occurs as a result of that individual's actions, the air operator could be charged with the contravention if such actions were found to be an accepted practice in the workplace. Where proceedings are taken against a corporation, the corporate-level penalty will apply.

Conversely, where an employee of an air operator commits a contravention and the evidence demonstrates that the operator invested considerable effort in their instructions and guidance to employees to ensure that they maintain regulatory compliance, it is unlikely that the Aviation Enforcement Division would assess liability against the air operator.

Section 8.4 of the *Aeronautics Act* is another component in the framework to establish responsibility and accountability for actions, or lack thereof, for all parties that may have contributed to a breach of aviation regulations. There may even be cases where multiple parties could be held liable for a contravention where the evidence demonstrates shared responsibility.

The Aviation Enforcement Division supports Canada's leadership role in aviation safety within the international community by promoting and applying a policy of fairness and firmness when dealing with contraventions of aeronautics legislation. Vicarious liability is one of the tools used to achieve this mandate. △

From the FAA: Loose Equipment in the Flight Compartment and on Glare Shields

The following Federal Aviation Administration (FAA) Special Airworthiness Information Bulletin (SAIB) is a good reminder as to why crews should avoid placing loose items on the glare shield. While not all windshields have electric heating, most aircraft have a compass that can be affected. This is another example of common sense that is not always common. Thank you to our colleague Will Boles, in the Ontario Region, who picked this up for possible use in the Aviation Safety Letter. —Ed.

FEDERAL AVIATION ADMINISTRATION
SPECIAL AIRWORTHINESS INFORMATION BULLETIN CE-10-35
SUBJECT: Loose Equipment in the Flight Compartment and on Glare Shields
Date: May 24, 2010

This is information only; recommendations are not mandatory.

Introduction

This Special Airworthiness Information Bulletin is being issued to remind owners, operators, and installers of potential hazards and airworthiness concerns related to having loose equipment in the flight compartment; particularly items placed on the glare shield. It was prompted by a recent event on a Mitsubishi MU-2B, applies to all aircraft that have a glare shield installed above the instrument panel, and is of particular concern to aircraft with windshield heating systems where the power terminal strips may be exposed and subject to an electrical short from a foreign object placed on the glare shield.

The airworthiness concern does not address an unsafe condition that would warrant airworthiness directive (AD) action under Title 14 of the *Code of Federal Regulations* (14 CFR) Part 39.

Background

During a recent flight on a Mitsubishi MU-2B, thick black smoke filled the cockpit and the crew was forced to make an emergency landing. It was discovered that a hand-held GPS receiver and antenna had been set on the glare shield. A metallic portion of the GPS antenna inadvertently made contact across the windshield heater terminal strips, resulting in an electrical short circuit. The resulting current flow caused the loose equipment to burn, resulting in smoke in the cockpit.

Recommendations

The FAA reminds owners and operators of aircraft that loose equipment on the glare shield or in the cockpit can present a hazard, particularly for aircraft with a windshield heater system installed where electrical terminal strips may be exposed and subject to short circuit. Owners and operators should recognize the potential for exposed terminal strips to be attached to high current windshield heating systems and refrain from placing any loose items on the glare shield that might cause an electrical short and subsequent electrical fire. If possible, these terminal strips should also be insulated or covered to mitigate such an occurrence.

The FAA also reminds owners and operators that loose or portable equipment on the glare shield can obscure the field of view of the crew, can potentially influence the magnetic compass accuracy, and can become a hazard in turbulence. Owners and operators should secure loose or portable items and equipment properly prior to and during the flight they should isolate portable or loose equipment from other equipment installed, and they should ensure the magnetic compass is not affected by any magnetic or electrical influence from portable or loose equipment. △

Invest a few minutes into your safe return home this winter...

...by reviewing section AIR 2.12 of the *Transport Canada Aeronautical Information Manual* (TC AIM), titled "**Flight Operations in Winter**."

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

NOTAMs

Every pilot planning a flight knows that it is necessary to check for aviation weather information. An equally important part of flight planning is to obtain all pertinent NOTAMs. Which NOTAMs should be checked? Is it sufficient to verify only the NOTAMs for the departure and destination aerodromes? Some believe it is; however, it is not.

An example is when the President of the United States visited Ottawa, Ont., from November 30 to December 1, 2004. Pilots planning to depart from or land at the Ottawa/Rockcliffe airport (CYRO) would have been aware of the large areas of restricted airspace in the Ottawa region if they had only checked the NOTAMs for CYRO. The information regarding the restricted airspace was disseminated and stored under the NOTAM files for the Montréal flight information region (FIR) (CZUL), the Toronto FIR (CZYZ) and the Ottawa/MacDonald Cartier Airport (CYOW). A NOTAM issued under NOTAM file CYND—for Ottawa/Rockliffe and other aerodromes in the area—made reference to the Montréal FIR NOTAM.

Canadian Aviation Regulation (CAR) 602.71 requires that “the pilot-in-command of an aircraft shall, before commencing a flight, be familiar with the available information that is appropriate to the intended flight.” Further, the *Transport Canada Aeronautical Information Manual* (TC AIM) section RAC 3.3 indicates there are three categories of NOTAM files: National NOTAMs, FIR NOTAMs and aerodrome NOTAMs. In addition, TC AIM section MAP 5.6.8 describes the type of information disseminated in each category. Before commencing a flight, pilots must ensure that each NOTAM file category has been reviewed in order to be familiar with all NOTAM information appropriate to the intended flight.

So what is the big deal if all pertinent NOTAMs are not checked?

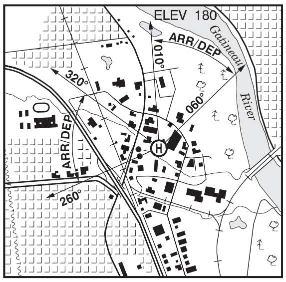
Aside from breaking the law, going against the statements in the TC AIM and poor flight planning practices, in some instances where the restricted airspace is patrolled by armed interceptor aircraft, an unwary pilot who violates the airspace just might experience a “close encounter” of the worst kind. Think about it!

Where can you find out which NOTAM file should be consulted for a specific aerodrome? In the *Canada Flight Supplement* (CFS) Section B, Aerodrome/Facility Directory.

EXAMPLE ONLY - NOT FOR NAVIGATION

OTTAWA / HULL (EXPRESSAIR) QC (Heli) CTH4 ← 1

REF	N45 27 52 W75 44 12 14°W UTC-5(4) Elev 180' A5000 A5002
OPR	102662 Canada Inc (Expressair) 819-778-2112 Cert PPR
PF	B-1 C-2,3,5,6
2 → FLT PLN FIC	(bil) NOTAM FILE CYND ← 3 Québec 866-GOMÉTÉO or 866-WXBRIEF
PAD DATA RCR	65' x 65' 80' x 80' No win maint
COMM ATF	Monitor Gatineau rdo 122.3
PRO	Arr/dep btwn 010°-060° & btwn 260°-320°



1. Aerodrome location indicator 2. Flight planning section 3. NOTAM file

Transport Canada Transports Canada

NATIONAL AVIATION DAY

FEBRUARY 23, 2011

JOIN US AS WE CELEBRATE CANADA'S AVIATION SAFETY, STRENGTH AND SUCCESS

Marking February 23 as National Aviation Day honours the pioneers who opened the skies as a way to connect people and move goods safely and quickly within our large nation and around the world.

We celebrate the aircraft engineers and operators, airport planners and traffic controllers, lawmakers and safety and security experts who share the credit for Canada's aviation safety, strength and success.

For general information, contact the Civil Aviation Communications Centre:

Toll-free: 1-800-305-2059 **Tel.: 613-993-7284**

E-mail: services@tc.gc.ca Website: www.tc.gc.ca/aviation-day

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