

# Flight Comment



ISSUE 1, 2012



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# Views on Flight Safety

*By Colonel Conrad Namiesniowski, Commander 22 Wing, North Bay*

It is often not until crisis strikes that the high level of professionalism, diversity, adaptability, and expertise of the CF's Aerospace Control (AEC) community becomes clearly visible. While Aerospace Control, which includes Air Traffic Control (ATC), Air Defence (AD), and Aerospace Control Operators (ACOp), may not be the default agency that springs to mind when flight safety is the topic, AEC officers and ACOps are undoubtedly key players on the flight safety team. The AEC community enhances flight safety through its close work with aircrew, maintenance crews, meteorology technicians, fire hall and medical staff, and crash response. Hand in hand with effective mission execution, flight safety is the *raison d'être* for Aerospace Control.

As defined in our primary professional publications, ATC and AD personnel exist to ensure mission success and the maintenance of a safe aviation environment. In accordance with ATC's Manual of Operations the object of air traffic control service is to maintain a safe, orderly, and expeditious flow of air traffic. The Scramble Intercept Recovery (SIR) Agreement defines AD procedures to ensure that military operations are conducted with maximum freedom while at the same time maintaining minimum interference and maximum safety for all other air traffic. It is this professional obligation to provide a safe environment for aviation that makes the Aerospace Control community such an integral part of the flight safety team.

As the operational tempo of the CF maintains its hectic pace the Aerospace Control community continues to evolve and expand its role within operations both foreign and domestic. The creation of Expeditionary Air Traffic Management (EATM) capability has enabled the Aerospace Control community to deepen its contributions to operations and strengthen its flight safety presence. Recent examples of this increased level of contribution include: Op HESTIA in Haiti (early 2010), Op PODIUM in support of the 2010 Olympic Games, and Ex MAPLE RESOLVE 1101 in Wainwright, AB.

Op HESTIA was a shining example of what the Aerospace Control community is capable of bringing to the table during international operations. In response to the Haitian humanitarian crisis, 4 AEC officers deployed to Haiti and stood up a fully functioning and efficient ATC unit at Jacmel Airport. These 4 AEC officers liaised with countless agencies and set up a completely operational airfield which included the installation of runway lights and the creation of a crash response section of CF personnel with an aircraft rescue and fire fighting (ARFF) category of 3. The AEC community took an airport that had controlled 7 aircraft per week, on average, and transformed it into a safe and efficient airfield that provided control service to more than 80 aircraft per day.

Op PODIUM highlighted the importance of our AD personnel and their immense contribution to the protection of North American airspace. AD personnel are responsible for keeping our skies, and the ground beneath it, safe. This was

evident during Op PODIUM where the AD contingent created temporary flight restrictions (TFRs) that allowed for the safe transit of military assets from Vancouver to Comox through the restricted airspace created for the Olympic Games. The creation of these TFRs created a safe airspace for, and greatly enhanced the security surrounding, the Olympic Games. All aircraft were required to enter and exit this secure airspace through specific entry points. When aircraft did not possess the necessary authorization they were forced to divert and complete appropriate screening. This sterile and secure airspace was created, monitored, and enforced by the AD component of the Aerospace Control community.

On the domestic front, Ex MAPLE RESOLVE 1101 provided another opportunity for the Aerospace Control community to showcase their abilities and contributions to flight safety. During Ex MAPLE RESOLVE, numerous AEC personnel were deployed under EATM to provide essential support to operations. The AEC team provided excellent air traffic services and proactively coordinated with Transport Canada and NAV Canada to reclassify airspace in the interest of flight safety. One instance of this occurred when the EATM staff, through Transport Canada, was able to reclassify the class "G" airspace surrounding the Wainwright CYR203. The aim of that reclassification was to provide a safe aviation environment for all aircraft.

*(continued on page 7)*



Private Adam McDonald directs traffic from the control tower at 8 Wing Trenton



Photo: MCpl Roy MacLellan

# Flight Comment

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# For Professionalism

For commendable performance in flight safety

## Master Corporal Richard Pilon

**O**n Sep 08 2011, *Tutor* CT114 was scheduled to carry out a flight as part of the Test Pilot Candidate Selection Course conducted semi-annually at Aerospace Engineering Test Establishment (AETE).

Approximately 30 minutes after pre-flight checks and engine start, the aircraft received clearance and began to taxi to the runway for takeoff. MCpl Richard Pilon, presently employed in the Aircraft Maintenance and Control Office (AMCRO) section in AETE, was walking past the flight line windows in the AETE canteen and noticed that the canopy initiator pin safety flag was visible on the left ejection seat. This was an indication that the initiator

pin had not been removed. He immediately alerted AETE Ops to "stop that aircraft". The aircraft was contacted and directed to return and shut down. The aircraft taxied back to the ramp without further incident.

When installed, the canopy initiator pin prevents both the internal and external canopy jettison system from functioning. Although completely separate from the ejection sequence if initiated by pulling the ejection handles on either seat, the installed pin would have deprived the aircrew of the ability to jettison the canopy in an in-flight emergency. Also, in the event of a ground emergency, this would force Fire Rescue personnel to use alternate means to access the cockpit.



MCpl Pilon's years of experience on the CT114 *Tutor*, keen attention to detail and professionalism undoubtedly were instrumental in preventing a potential loss of life or material resource. He is very deserving of this For Professionalism award. ♦

**Master Corporal Pilon currently serves with the Aerospace Engineering Test Establishment, 4 Wing Cold Lake, Alberta.**

## Corporal John Rickert

**W**hile troubleshooting an unserviceable Hands-On Throttle and Stick (HOTAS) on a CF188 aircraft, Cpl Rickert discovered that the Situational Awareness Symbolology (SAS), which provides the pilot with target information, areas of interest and navigation data, would not work. Without this equipment, the aircraft would be ineffective during a tactical mission.

After spending several hours working on this complex snag, he discovered that the installed Control Stick Adapter Assembly (CSAA) was missing a wire on pin #4. He astutely took note of the CSAA part identification and researched the Interactive Electronics Technical Manual (IETM) where he discovered that the CSAA was identified as a non-modified legacy part. A modification had been incorporated back in 2005 which should have removed the part.

This raised questions as to why or how this legacy component had ended up in an upgraded jet. Researching the part number further through the Canadian Government Cataloguing System (CGCS), he discovered the legacy CSAA part shared the same NATO Stock Number (NSN) as the 2005 modified CSAA part.

Cpl Rickert then contacted the Life Cycle Material Manager (LCMM) and informed him of what he had found. As a result of his significant effort to resolve this problem, the LCMM issued a Special Inspection (SI) to check all aircraft and supply to withdraw all non-conforming CSAA's and addressed the CGCS NSN issue.

Cpl Rickert's intuition and perseverance to see a problem through to its successful conclusion represents a perfect example of how to rebuild corporate knowledge in a time of diminished



experience levels. His outstanding attention to detail and application of remarkable technical knowledge makes him truly deserving of this For Professionalism award. ♦

**Corporal Rickert is currently an avionics technician serving with 410 Tactical Fighter (Operational Training) Squadron, 4 Wing Cold Lake, Alberta.**

## Private Michael Burton

On 22 June 2011, Private Michael Burton, an aviation technician with 409 Tactical Fighter Squadron, Sicily Air Wing, deployed with Op Mobile Task Force Libeccio, Sicily Air Wing. While performing a "Daily" and "Before" flight inspection on *Hornet* CF188760 and checking the security of an AIM-120 AMRAAM Air-to-Air guided missile, he observed the lower aft fin did not appear to be fully seated.

Going beyond the requirements of his inspection, he found that the missile fin was loose and had excessive play. He inspected all remaining fins and wings on the missile and found that they were fully seated and secure. He immediately informed his Crew Chief and

Load Crew Chief who inspected the missile fin and elected to have the fin replaced. It became apparent that the fin was not the problem, as two replacement fins also would not fully seat, resulting in the missile being rejected and replaced before the next operational mission.

Further inspection of the missile by second line armament technicians under daylight conditions found that the aft control section had a piece of debris in the fin hub. Removal did not correct the situation and the control section hub was deemed unserviceable and the missile was returned to contractor for repair.

Research revealed that the missile had been installed on two different aircraft since arriving in theatre, totalling 68 flights and 266 hours



of flying and had undergone several uploads, downloads, and inspections without prior detection of this fault.

Private Burton's attention to detail averted the potential for the fin departing in flight and causing damage to the aircraft or an out-of-control missile if fired. He clearly displayed notable airmanship and is to be commended for his superior efforts and is very deserving of this For Professionalism award. ♦

**Private Burton is currently serving with 409 Tactical Fighter Squadron, Cold Lake, Alberta.**

## Captain Keith Hoey

On 9 July 2010, Captain Hoey was the instructor pilot during a local night training mission on the CC130H Search and Rescue OTU at 426 (T) Training Squadron in Trenton.

The lesson plan that evening required the completion of both VFR and IFR manoeuvres, intended to familiarize the student with the various nuances involved with night flying and airfield lighting. The weather was clear but a cloud deck was slowly approaching from the west, which eventually obscured the horizon as viewed in the direction of Lake Ontario.

While conducting local night circuits to runway 24, the student pilot experienced severe spatial disorientation while turning from upwind to crosswind due to a loss of visual references. Immediately following

level-off at circuit altitude the student believed the aircraft to be in a climb and, without available ground references, initiated a gentle descent.

Noticing that the aircraft was 200 feet lower than the prescribed circuit altitude, Captain Hoey advised the student of the altitude deviation and directed that corrective action be taken. He then momentarily re-directed his attention to radio calls and his instructor duties. The student pilot, now disoriented and believing that the aircraft was still in a climb, misread the altimeter and entered a steep dive while applying significant nose down trim. Captain Hoey quickly recognized the seriousness of the situation and immediately took control of the aircraft, rolled the wings level and simultaneously applied back pressure and nose up trim. The aircraft descended within 400 feet of the ground before it was recovered, and a simultaneous climb to a safe altitude was completed.



Captain Hoey's calm and professional reaction to an unusual situation prevented the loss of crew and aircraft. His outstanding professionalism and superior HPM skills during a potentially catastrophic situation makes him fully deserving of this For Professionalism award. ♦

**Captain Hoey currently serves with the Joint Rescue Coordination Center (JRCC), 8 Wing Trenton, Ontario.**



# For Professionalism

For commendable performance in flight safety

## Corporal Alex Williams

While performing a final area closeout inspection following blade fold and driveshaft alignment training on a CH124 *Sea King* helicopter, Cpl Williams, an aviation technician with 443 (MH) Sqn, took advantage of an opportunity to conduct a more encompassing inspection of components not easily accessible while the main transmission fairing is installed.

During this additional inspection, he detected a stainless steel flexible hydraulic line from the primary hydraulic pump to the primary hydraulic panel package making contact with the right lateral primary servo cylinder. The location of the servo is partially obscured and does not present a direct line of sight during routine inspections. Upon closer inspection he discovered that the stainless steel line had worn into the primary servo cylinder in the

area of the fluid return port to a depth of approximately .125". The total thickness of the primary servo wall in this area is .150" leaving only .025" of material to contain 1500 psi of hydraulic pressure.

Based on the extent of damage to the servo, the misrouted line had been compromising the structural integrity of the primary flight control system for a significant period of time. The reduced integrity of this component went unobserved by multiple technicians and aircrew, who previously carried out numerous before and after flight inspections. If not for Cpl Williams' observation, the likelihood of a complete loss of hydraulic pressure to the primary flight controls could have presented a potentially unstable flight regime, compromising the safety and well-being of both the aircrew and the aircraft.



Cpl Williams' attention to detail during the closeout inspection, coupled with his perceptive recognition of the chaffing, resulted in the quick identification and rectification of a possible rupture of the servo cylinder return port housing. His dedication, level of professionalism and initiative to go above and beyond the expected inspection requirement prevented a potentially serious incident or accident and is therefore highly deserving of this For Professionalism award.

**Corporal Williams is currently serving with 443 Maritime Helicopter Squadron, 12 Wing Shearwater, Nova Scotia.**

## Master Warrant Officer Darren Williams

While conducting a supervisory walk around, MWO Darren Williams, the Deputy Aircraft Servicing Officer (D/ASO) in 410 Tactical Fighter Operational Training Squadron, noticed that a key washer on the planing link assembly of aircraft CF188935 looked suspicious and on closer examination discovered the key washer lock-wire hole was pointing at the 1 o'clock position.

Considered a landing gear subject matter expert with over 20 years of maintenance experience on the *Hornet*, he could not recall ever seeing the lock-wire hole pointing in this position. MWO Williams immediately investigated

the matter and after conducting extensive research determined that the planing link assembly had been initially shipped serviceable to Cold Lake via a third-line contractor in this condition. Further investigation revealed that the planing link assembly bolt was a non-conforming part that was not approved for use on the CF188 aircraft.

As a result of this discovery, other 4 Wing aircraft were inspected and one more landing gear set was found with the same type of non-conforming bolt installed. Had it not been for MWO Williams' exceptional observation skills and keen attention to detail, it is likely that the third-line contractor would have continued to provide the CF188 community with non-conforming parts which may have resulted in a catastrophic planing link assembly failure.



MWO Williams use of his extensive technical knowledge and outstanding perseverance in researching the situation, make him truly deserving of this For Professionalism award. ♦

**Master Warrant Officer Williams is currently serving with 410 Tactical Fighter Operational Training Squadron, 4 Wing Cold Lake, Alberta.**

# Views on Flight Safety

(continued from page 2)

On multiple occasions, Wainwright ATC had to notify local civilian aircraft of the airspace designation and provide them with alternate routings. On two of these occasions, ATC proactively contacted 'Rampage' (Div TACP) and had the Forward Air Controllers cease the live artillery fire.

Regardless of the operation at hand, the Aerospace Control community's contributions are essential to overall safety and mission success. A key facet to the community's success comes from the dedication and professionalism of the ACOps. These committed operators are employed as Ground and PAR controllers, Tower and Terminal Assistants, as well as Air Defence Tracking, Identification and Area Surveillance Technicians. In many instances, it is because of an ACOp speaking up when something is not quite right that a runway incursion is prevented, a loss of radar separation is avoided, or a vital track is initialized. It is this second set of eyes that enhances flight safety in all operations involving the Aerospace Control community.

The Aerospace Control team continues to pride itself on its role within the flight safety community. As operations increase and the RCAF evolves, it is important for all personnel to reflect back on the foundation of safe operations. All members of the Aerospace Control team take great pride in the trust that is bestowed upon them by the aviation community. As we continue to earn that trust, we must all remember that flight safety is a shared responsibility. We are one team with one goal – to achieve the mission safely. ♦

# The Editor's Corner

If you haven't yet read it in his issue, I would like to point you toward the "Views on Flight Safety" by Col Namiesniowski, on the CF's Aerospace Control (AEC) community. They include Air Traffic Control (ATC), Air Defence (AD) and Aerospace Control Operators (ACOp) and represent an area where there is little publicity when things go well. When things do not go well, it's a front page story. Fortunately, the former is usually the case. Air traffic controllers have a number of responsibilities, but primarily they ensure the separation of aircraft. Of course they have a number of other responsibilities and can assist in a wide variety of situations. Although it's been around a while, this commentary between a pilot with a dual engine failure and ATC very much brings into perspective how controllers can be faced with extraordinary situations and the positive impact they can have on the result. \*[http://\\*www.youtube.com/watch?v=IAuHpzqM4&feature=related](http://*www.youtube.com/watch?v=IAuHpzqM4&feature=related)

## DFS 2 Chief Investigator

With over 32 years of dedicated service to Queen and country, multiple *Sea King* tours and two tours within DFS, LCol Larry McCurdy decided in December 2011 to retire from the RCAF and his DFS 2 position as Chief Investigator. In his own words, he plans to "hobby farm in Lanark County in Ontario, and to raise chickens, turkeys and horses". We wish him all the best in his new endeavour!

Incoming to the position is LCol Paul Dittman. A CH124 pilot and CH146 QFI with 4000 hours flight time and unit command experience, LCol Dittmann joined DFS in January 2012. Although new to the Chief Investigator/Deputy DFS role, he is well armed with the experience of 18 investigations during his previous DFS tour.

## 14 Wing Greenwood Flight Safety Team Wins 2010 SICOFAA Award

See "The Back Page" of this issue for details of this prestigious award. The 14 WFSO Major Carl Rioux, wished to emphasize that "the recognition of 14 Wing as a leader in FS would have not been possible without the outstanding work of every 14 Wing member. Through their daily accomplishments, both military and civilian personnel have contributed to 14 Wing FS program success and acknowledgment." Well said and congratulations to everyone at 14 Wing.

Finally, I would like to let you know that we are looking for your flight safety ideas articles, pictures, letters and comments. If there is something that you think we should be doing and aren't, let us know.

*Think Safety!*

**Captain John W. Dixon**

Editor, *Flight Comment*



## From the Flight Surgeon

# Are you accident-prone?

By Major Helen Wright, Directorate of Flight Safety, Ottawa

**D**o certain people have more than their “fair share” of adverse events? Are some more likely to be injured: tripping, bumping their head, cutting themselves in the kitchen – or similar sorts of errors? Are some more prone to memory or other cognitive errors? And, importantly for flight safety, are some more likely to be involved in an aviation occurrence?

The belief that some people are prone to error is longstanding, and many of us believe we know such people. The term “accident prone” suggests there is an inherent personal factor predisposing to incidents (rather than context or situational factors). This question of accident proneness is still a subject of debate in the scientific literature<sup>1</sup>. Part of the problem is that there is no agreement as to what “accident prone” actually means.

Early research into industrial accidents focused on individuals (rather than on systems and organisational practices as we do now). Research during World War I found statistically unlikely distributions of accidents that were attributed to individual accident proneness. This idea became accepted in industrial and transportation settings and in the 1920s and 30s there was a

lot of effort to develop tests to identify the accident prone, who would then be transferred or fired. Research in the 1950s started to challenge the accident prone concept; some of the previous work came to be seen as unsophisticated<sup>2</sup>. Many of the more modern studies found that there were indeed accident clusters, but the risk was inherent in the job and circumstances (called latent factors) rather than the person; nevertheless, there were still some excellent studies that seemed to demonstrate accident proneness, and the concept of accident prone remained entrenched in our culture. Movies and cartoons often feature an accident prone character. By the 1960s it became unfashionable to blame the individual and this accident prone concept began to fade from academic literature<sup>3</sup>. It has remained a specialty field of study; for instance, work concerning children and propensity for injury (see Harry Potter sidebar).

Science clearly demonstrates that there are situations in which the likelihood of an error is higher than would be expected by chance. This uneven distribution of accidents has been documented in conditions ranging from death due to horse kicks in the Prussian army in 1898<sup>3</sup>; workers in munitions factories in WWI,



Photo: Cpl Dany Veillette

to contemporary commercial airlines<sup>4</sup>. Given our current understanding of the latent factors that contribute to occurrences, it is very logical that a given set of latent conditions will predispose to occurrences, and it is those background characteristics that influence the occurrence rates – not the people themselves. DFS activities include looking for clusters of disproportionate accident or incidents, and then looking for the cause. The latent conditions of the workplace or organisation are often the root of the problem.



But can we link risk of an accident to a particular personality? Certainly a link can be made for proneness to error for some extreme or pathological personality traits, and mental health conditions such as depression or addiction. For this reason clinical personality disorders and some mental health disorders are not compatible with a pilot's licence.

For those in the "normal" personality range, there is some evidence linking people who are self centred, over confident, aggressive, or impulsive to accident risk; one study found that introverted fire fighters are more likely to be injured on the job, possibly because they were less social and did not rely on teamwork thus putting them at more personal risk<sup>3</sup>. Others have found that motor vehicle and work related accidents are higher in extroverts<sup>1</sup>. A number of studies have shown that personality features in young children predisposes them to household accidents and injury<sup>1</sup>. Stress can influence performance and it is likely that an individual experiencing stress (work or social) is more apt to make an error. Individuals differ in their reactions to stress. Some respond by an increase in risk taking behaviour while others experience suboptimal information processing<sup>2</sup>. Nevertheless, the literature is somewhat contradictory and generally it appears that any link is indirect and influenced by a multitude of other factors<sup>1</sup>.

Studies done in the UK in the 1980s used questionnaires to investigate individual differences in proneness to absent minded slips and memory lapses<sup>6</sup>. This research<sup>4</sup> suggests that people differ widely in their proneness to absent minded errors and that this characteristic was enduring over time. It was not specific to one type of cognitive error (memory, attention, or action). It may be that these people have a chronic difficulty with focusing their attention. There is preliminary evidence that minor error prone people are more vulnerable than average to stress, which



Photo: MCpl Shilo Adamson

### Harry Potter as a Preventive Measure

System or environmental changes are the key to preventing accidents. A study from the UK found that the number of emergency room visits for children aged 7-15 was drastically reduced on the weekends following release of a Harry Potter novel. After release of the 2003 and 2005 books respectively the numbers of weekend emergency room visits for this age group was almost half the average. The lowest attendance over the three years assessed were those two weekends (both mid-summer and good weather). The authors conclude that releasing Harry Potter books seems to reduce the incidence of traumatic injuries in children. With a sense of humour firmly in place, they recommend a committee of safety conscious, talented writers should produce high quality books for the purpose of injury prevention in children<sup>7</sup>.

may interact with their attention baseline and as a result they exhibit a higher than normal rate of minor cognitive failures. It is important to note that there is no evidence that these absent minded slips and lapses translate into a higher susceptibility to accidents.

Interestingly, the self reported slips and lapses decreased with increasing age. . . the authors speculated that more mature individuals rely on memory aids such as electronic calendars, checklists, and address books to keep their slips and lapses under control.

### Conclusion

Objective and statistical analysis does not strongly support "accident proneness" even though the concept is part of our popular culture. Safety is now dominated by a systems approach that looks at contributing circumstances rather than a focus on the individual as the cause. ♦

### References

1. Visser E, et al (2007). Accident proneness, does it exist? A review and meta analysis. *Accident Analysis and Prevention*;39:556 564.
2. Lawton R, Parker D (1998). Individual differences in accident liability: a review and integrative approach. *Human Factors*;40:655 671.
3. Froggatt P, Smiley J (1964). The concept of accident proneness: a review. *Brit. J. industr Med*; 21:1 12.
4. Reason J (2008). *The Human Contribution*. Ashgate, Burlington, VT.
5. Liao et al (2001). Correlates of work injury frequency and duration among firefighters. *Journal of Occupational Health Psychology*;6:229 242.
6. Slips and Lapses are when the action taken is not what was intended.
7. Gwilym S, et al (2005). Harry Potter casts a spell on accident prone children. *BMJ*;331:1505 6.

# Maintenance IN FOCUS

## Mr Murphy and *Swiss Cheese*

By Sergeant Edward Taylor, Directorate of Flight Safety, Ottawa

**W**e have all heard the adage known as “Murphy’s Law” or must have experienced it at least once in our lifetime?

Murphy’s Law states:

*“Anything that can go wrong will go wrong”.*

James Reason’s now familiar “Swiss Cheese Model” has been tossed around the RCAF and Flight Safety for many years. It describes accident causation as a series of events which must occur in a specific order and manner for an accident to occur, which it compares to the holes of several unique pieces of Swiss cheese lining up.

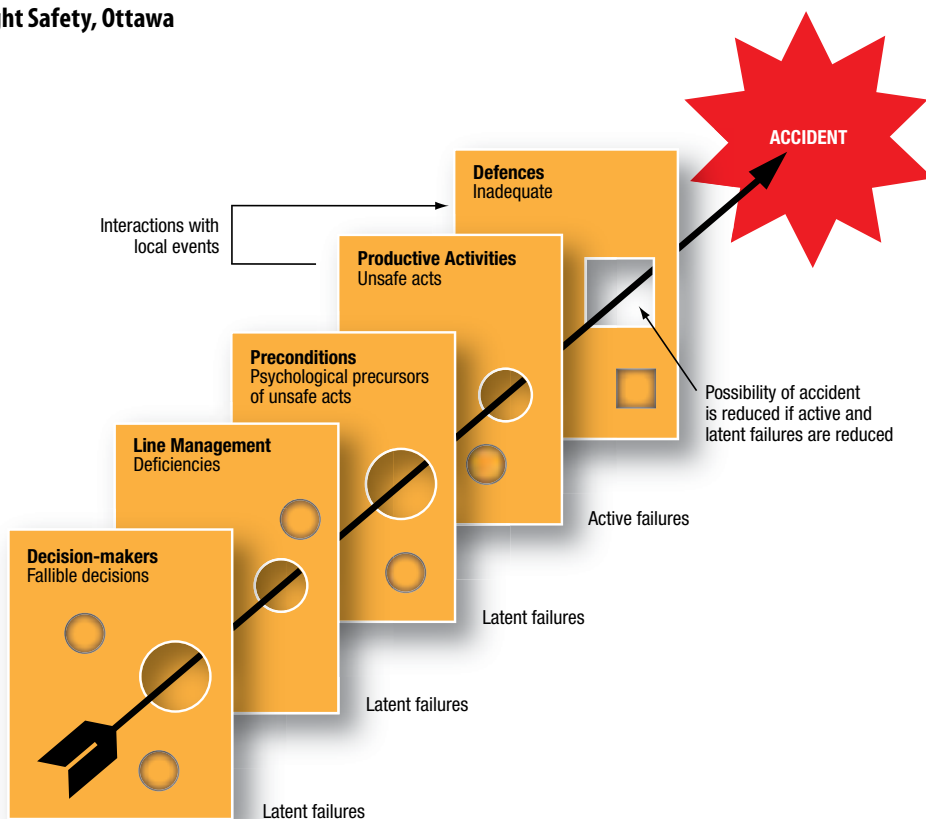
If you haven’t heard or experienced the aforementioned terms or have forgotten about them than let me remind you how they may creep up on you when you least expect it.

It was just another routine day in the CC130 Hercules Air Maintenance Squadron. A long twelve hour shift of servicing aircraft was coming to a close, and of course one more tasking by management came down – tow another aircraft out of the barn to a spot on the ramp.

A typical tow crew consisted of seven personnel: a brake operator, auxiliary pump operator, tow crew supervisor, tow driver and three wing/tail personnel. Towing the aircraft required the tow-bar to be disconnected from the mule so that it could be turned around to push the aircraft to its spot. Brakes were applied and the chocks

were thrown around the nose wheel tire. The mule was turned around and the tow bar was re-attached. Everything was going well until Mr Murphy and Miss Swiss arrived.

A series of events, also known as latent conditions to an unsafe act, were set in motion that could have led to a serious injury.





## Alignment of the Swiss Cheese Holes

**Hole 1.** The aircraft was pushed to its parking spot. The tarmac at this location had a very slight decline for water drainage.

**Hole 2.** The tow crew supervisor signalled for the brake operator to apply the parking brake but the brake operator was unable to set the brakes due to insufficient pressure in the auxiliary hydraulic tank.

**Hole 3.** The supervisor did not wait for the return clenched fist signalling that the brakes were applied and rushed over to bang his fist on the fuselage, indicating for the auxiliary pump operator to exit the aircraft and commence reattachment of the nose wheel scissors.

**Hole 4.** The rope chocks were set around the nose wheel, however, the chocks were too loose.

**Hole 5.** The auxiliary pump operator was now directly behind the nose wheel in confined quarters reattaching the nose wheel scissors.

Mr Murphy and Miss Swiss were now ready for the finale. The tow bar was disconnected from the mule and the wheels were set in motion. The brake operator was heard cursing because he couldn't set the brakes. The man hooking up the scissors screeched in fear as the 40 plus ton aircraft began to roll towards him; fortunately, with "Indiana Jones" alertness, he shimmied out of the way just in time to avoid the fate of wearing the tire tracks of the massive wheels.



The crew sat down afterwards to analyse the occurrence to prevent future towing mishaps.


1. The inexperienced supervisor should have waited for the brake operator to signal that the brakes were set before telling the auxiliary pump man to leave the aircraft.
2. The auxiliary pump man should not have allowed the hydraulic auxiliary tank to depressurize. Also, he should have confirmed with the brake operator that the brakes were set before exiting the aircraft.
3. Finally, the supervisor should have ensured the chocks were positioned correctly around the wheels to prevent the aircraft from moving.

We made one final error that day. Although we discussed it in the crew room, we neglected to report this particular incident in the FSOMS (Flight Safety Occurrence Management System).

Learning from our mistakes can contribute to the prevention of serious incidents and accidents in the future. By reporting the incident in the FSOMS program, preventive measures could have been developed and relayed to other units.

Be careful and conscious of **Murphy** and his law, (*Anything that can go wrong will go wrong*); he lingers over our shoulders every day. We are only human and we do make mistakes. Be alert around aircraft and don't let those nasty **Swiss cheese holes**, (*A series of unsafe acts or events that must occur in order resulting in an accident*), align. ♦





*In the aviation world there is a well known list of human factors related errors which are commonly known as  
“The Dirty Dozen Aviation Errors”.  
In this example, there were numerous errors that took place.  
Which ones can you detect?*

### **“DIRTY DOZEN AVIATION ERRORS”**

**Lack of Communication** A lack of clear direct statements and good, active listening skills

**Complacency** Self-satisfaction accompanied by a loss of awareness of the potential dangers

**Lack of Knowledge** Lack of experience or training in the task at hand

**Distraction** Drawing one’s attention away from a task

**Lack of Teamwork** Lack of working together to achieve a common goal

**Fatigue** Weariness from labour or exertion, nervous exhaustion or the temporary loss of power to respond

**Lack of Resources** Failure to use or acquire the appropriate tools, equipment, information and procedures for the task at hand

**Pressure** Pushing for something in spite of opposing odds, creating a sense of urgency or haste

**Lack of Assertiveness** A lack of positive communication of one’s ideas, wants and needs

**Stress** Mental, emotional or physical tension, strain, or distress

**Lack of Awareness** Failure to be alert or vigilant in ob-serving

**Norms** Commonly accepted practices where assumptions are made that the course of action or procedure is correct based on history without re-validating or verifying the current procedure

**YOUR ATTITUDE > FLIGHT SAFETY > YOUR LIFE**

## RT (Radio Telephony) Communications Discipline

*Do you sound as professional  
as you think you are?*

By Major Bill Lafontaine, Canadian Forces Warfare Centre, Ottawa

**Major Lafontaine is a pilot with over 35 years of flying experience, mostly international. He has logged over 16,000 hours, flown multiple military and commercial aircraft, and has instructed on seven aircraft types.**

I learned in my early days as a pilot the importance of listening to each and every radio call. A good portion of your situational awareness comes from it. Over my flying career, by knowing where others were and what was happening relative to me, I have been able to avoid potential conflicts or close calls on more than one occasion.

By listening so intently to others, I have also learned that there are many pilots whose radio discipline is much less than ideal. There are numerous occasions of unnecessary and non-standard radio terminology. If you are aware of the more common misuses, they will easily stand out.

If the call sign or prefix you use includes a company's or organization's name, then everything that is said reflects upon that company and the individuals who belong to it. If many of the pilots using an "Air Flight" call sign sounded sloppy and unprofessional, then you would probably feel that all pilots with that company were sloppy and unprofessional. This applies to all, whether military, airline, flying club or anyone in between. That's human nature. If your radio conversations were more private, then it wouldn't matter so much, but over the "air waves", everyone is listening. As a result, what you say and how you say it is heard by many who have enough expertise to make a qualitative assessment.



There are many pilots guilty of slang and redundancies. It seems to be the norm to try and sound casual but to me it indicates a lack of that keen edge and attention to detail – characteristics I feel are even more important. The worst violators seem to have only domestic flying experience and have either limited or no exposure to areas where either the quantity of traffic is greatest or the quality of controller language skill is limited. If some of the things I've heard were used in centres around the globe such as Frankfurt, Paris or others, the controllers would not hesitate to sort you out in a less than flattering manner. They do so not to embarrass, but because they understand the hazardous consequences of incorrect or incomplete communication.

Examples of the more common encounters include the use of "oh" for the number zero, such as "flight level two five oh". Phonetically, this would be "two five oscar" which is not a proper altitude reference. You will hardly ever hear an air traffic controller use "oh". Their RT standards and expertise are probably at a higher level than the majority of pilots. Some might think "no big deal", but laxity in this area will probably show up somewhere else as well.

Some of the other common errors include the use of "with ya" or "checking in" such as "with ya at two five oh". Obviously you are with them, or you wouldn't be able to talk to them. If you dropped these redundancies from the radio call, the message would not change at all, so why use them?

The term "looking for" such as "looking for descent" is often heard. I'm sure many controllers would love to come back with "don't be looking under your seat, because you won't find it there". I worked as an Operations Officer for years and would have crews call me on the radio "looking for parking". I would come back with "then you should be using your eyes and not your radio" but few picked up on my subtle attempt at point making. The proper way to ask is with the term "requesting" as in "requesting descent" as we all know but sometimes



Photo: Pre-Pierre Thériault

forget. Another common RT error occurs when pilots are asked to "squawk ident" and the response is "coming down". I can just see the controller ducking under his chair to avoid getting hit!

Most slang or redundancy is inconsequential, other than leaving a bad impression on those who know better. The worst case, although rare, can be potentially hazardous.

When it comes to deleting necessary parts of radio calls, a common problem is when a frequency change occurs. Some pilots simply repeat the frequency and do not include their call sign. For example; "CANFORCE 1234, call Toronto on frequency 128.4" and the response is "Roger, 128.4". What if the call was not meant for you? Now there is a momentary loss of communication and unnecessary radio calls which could have been avoided if the error had been picked up when you used your call sign. Hopefully this doesn't happen in busy airspace or when there's an important piece of time-critical information that needs to be conveyed.

Making an incorrect reference to an altitude is another problem area. One example is 'CANFORCE 1234, fifteen point six for Two

Three Zero". There is never a "POINT" in any reference to altitude. If it is below transition, it should be "one five thousand six hundred". If it is above transition, it should be in reference to a flight level or contain three digits. For example, it is either "one five six" or "flight level one five six". This becomes even more important if operating outside North America where the transition level is lower than we are used to. All flight levels should be referred to with three digits. If you are below ten thousand feet, the first digit should be a "zero", such as "flight level zero niner zero" or at least "zero niner zero". Occasionally controllers will refer to altitudes below ten thousand feet by dropping the initial zero, but in such a case will always use "flight level" such as "flight level niner zero".

Note the difference between these clearances: "descend to seven zero" and "descend two seven zero". The difference is huge and can be deadly if confused. Hopefully controllers have the discipline to watch for and avoid this mistake, but so must you. Throw in an accent and the odds of miscommunication go up exponentially. Anytime you are operating in an area where English is a second language, especially if there is no radar, correct verbal communication is critical. Terminology other



than standard phrases should never be used. The increased odds of misunderstanding communication can be catastrophic.

An example of this happened over India in Nov 96. A Kazakhstan Airlines flight (KZK) collided with a Saudi Airlines flight, killing 349, because the KZK pilots did not understand the controller and descended below their cleared altitude.

During one of my own flights into the Caribbean, I encountered a very near miss with an ATR 72. I was descending into Aruba and the other flight was departing. The controller had a heavy accent and I suspect English was not his first language. We were asked which radial we were tracking inbound and the ATR 72 was directed to fly the outbound radial 10 degrees east of ours. Their read back of the clearance was long and convoluted with excessive extraneous information. It turns out they had misunderstood the clearance and were flying outbound the same radial we were tracking inbound. Although language difficulty was a factor, had they restricted their call to just the pertinent information, with standard phraseology, perhaps either we or the controller

might have picked up the error. The Traffic Collision Avoidance System (TCAS) worked as designed and we were able to manoeuvre and miss each other. I estimate we were as close as 300 feet and would have collided without the TCAS. In spite of the language problem, this close call might have been avoided had the proper radio terminology been used.

I could provide many more examples of some of the things I have seen and heard over the years, but this article would be way too long if I did that. Therefore, I have only touched on some of the things being used over the air waves that shouldn't be there. If any apply to you, hopefully it will be cause for you to tidy up your radio discipline.

Listen carefully to radio calls during your next flight and you'll likely hear many of the RT problems mentioned here. If you listen for them, you will become more aware and less likely to use them yourself. Also, try to be cognizant of your slang and redundancies, which may be difficult if you've been using them without thinking in the past. It may take a bit of time to undo the bad habits, but stay with it.

Radio procedures containing slang, redundancy and omissions are potentially hazardous and, at the very least, reflect poorly on you and others using a similar call sign. But most of all, to be truly professional, you must also sound professional. ♦

### DFS Comment:

Last year, a two plane formation departed from a Canadian Military airfield with the after take off clearance of "SID cancelled, turn left, climb on course to nine thousand". The lead pilot read back the clearance as "left on course **two** nine thousand." As the aircraft passed 9000 feet ATC noticed the altitude "bust" and directed the formation to level at 10,000 feet. The flight continued to destination without further incident.

There were two RT situations which contributed to this potentially hazardous incident. First, if the pilot believed that the cleared altitude was 29,000 feet, the read back should have contained "flight level two niner zero" for confirmation, whereupon ATC would have noticed and corrected the misinterpretation. Second, "The use of 'TO' with CLIMB/DESCENT clearance is not mandatory and may be omitted in cases where it is considered redundant or might be mistaken for the number TWO". Either "cleared to maintain 9000" or simply "cleared 9000", would be less prone to misunderstanding.



# Electronic Flight Bags:

## Technological fad or way of the future?

By Captain Chris Marron

Captain Marron is on exchange from the United States Air Force (USAF) and is currently at the Instrument Check Pilot Flight, 1 Canadian Air Division, Winnipeg. He is a former KC-10 pilot with almost 3,000 flight hours.



At the 2011 NBAA (National Business Aviation Association) conference, there were countless booths setup showing aviation products that spanned from avionics upgrades, to maintenance products, to apps that can be used in our ever more tech portable world. One particular area that was of particular interest to the 25,000 plus attendees was the electronic flight bag (EFB). There was standing room only at the “iPad in the cockpit” seminar, held in the largest conference hall at the Las Vegas Conference Center. Business aviation is taking notice of the advantages that are offered by the EFB.

Some may view EFBs as unnecessary equipment, and can for the foreseeable future manage without. If this thought process prevailed in the past, would we have ever developed the jet engine when we could have stuck with the prop? As with the introduction of the jet engine, the introduction of EFBs bring extraordinary benefits and significant challenges. Both must be identified in order to safely and efficiently use this technology.

With just a couple tablets weighing less than two pounds, the Air Force could eliminate the necessity of having maps, performance logs, operating manuals, flight publications and a myriad of other documents that would be present on any given mission. This can amount to over a 200 lbs reduction in paper weight.



That reduction can eventually translate to millions of dollars in savings across the defence budget. The fuel savings because of the weight reduction as well as savings from printing/distribution costs and personnel costs would rapidly exceed the initial procurement costs. The savings would be only the tip of the iceberg when considering all the future advantages and cockpit efficiencies that could be developed from a one stop tablet solution.

One critical advantage to look at would be the eBook reader aspect that is gained. Having access to one light weight device that replaces many volumes of flight manuals will allow flight crew to study anywhere or look up information quickly with an automated search. Currently we stand straddling the line with the duplication of many of our current publications online, while still maintaining individual or multiple sets of paper publications in the Squadron. Two disadvantages of the current system are having the most current pubs only accessible at our work computer and the time expended keeping paper volumes up to date. With the move to an eBook reader, the loop on the move to electronic flight manuals and other pertinent orders can be closed with a much easier system to access the pubs in short order.

Not only are our counterparts in the civilian industry either looking into, or actually using these EFB's, but so are our closest allies, the USAF. Thus far, the USAF have been testing the *iPad 2* as an eBook reader, and are beginning their testing on the use of electronic Flight Information Publications (FLIP) in flight. By no means is **Apple** the only manufacturer considered able to fill the role of an EFB, but they perhaps have the early advantage. The *iPad* is the only commercial, off-the-shelf device cleared by the FAA and the USAF. Criteria that must be considered when selecting such a device include: reliability, user-friendliness, portability, security, battery life, cockpit ergonomics, multi-tasking capabilities, glare reflection, and pricing to name a few.

Given all the positives that can be addressed by having an EFB become standard issue to our pilots you might think that it is a no brainer. Before we go down that road there are a few concerns that need to be addressed. As you sit down and think of all the wonderful things that a tablet device *could* do for us, the initial procurement must be aimed at the commonalities between fleets and not get too bogged down with individual fleets dream device requests. You could get very excited

thinking about the possibilities of XM weather overlaying your flight plan on a moving map, tactical targeting data being displayed, work email for everyone, night vision goggle compatible, take off and landing computations, and many other unique uses. If we try to come up with a device that tries to "scratch every itch" each fleet has ever had, the procurement process will become overly lengthy, drawing out or perhaps stalling the whole process. Another key concern is security. Many of the current tablet devices on the market do not offer up the necessary level of encryption that might be required for some of our documents that we would like to get loaded on the devices. Other questions that need to be answered are: how do we get the required documents pushed to each device? How do you track that your unit flight crews are keeping their tablets up to date? How do we control those documents once they are out there?

When you talk to a line pilot, the potential of such a device is an exciting thought, but before jumping in headlong we must look at several other aspects before equipping the entire RCAF with an army of *iPads*. ♦



## When is a Clearance not a Clearance?

# Rules of the Road

## for Taxiing Aircraft



By Captain Eric Martinat

**Captain Martinat is a Qualified Flying Instructor (QFI) at 3 CFFTS Portage la Prairie, Manitoba**

As QFI's (Qualified Flying Instructors), our mission is to demonstrate to our students the standard of airmanship and knowledge the Royal Canadian Air Force expects of its pilots. As other QFIs will attest, passing the CF flying instructor's course is no easy task. Once the course is behind you, teaching brings new challenges and each successful student trip increases your confidence. It's a satisfying profession... until something goes wrong.

At the Multi-Engine School at 3CFFTS in Portage la Prairie, students are taken on cross country flights for exposure to high-traffic airports. It's a challenging flight environment for instructors who are required to balance monitoring the student's flying, teaching lessons, complying with clearances from air traffic control and following the myriad "rules of the road" that govern flights. In spite of our best intentions, sometimes things don't work out as planned.



Photo: Pre-Allyssa D. Carter

This past November, I arrived at Calgary International Airport with two students in a twin-engine, *King Air C-90*. As we taxied off the active runway, the ground controller gave us clearance for the long taxi to the Fixed Base Operator (FBO) where we'd put our aircraft to bed for the night.

Most pilots instinctively know they should not move an aircraft on a controlled area of an airport without being cleared; that is according to the orders. Furthermore, if one has to cross a runway, active or otherwise, the controller will issue you specific instructions authorizing you to do so. If the controller doesn't issue that clearance to cross or hold short of the runway, the pilot shall hold short and request

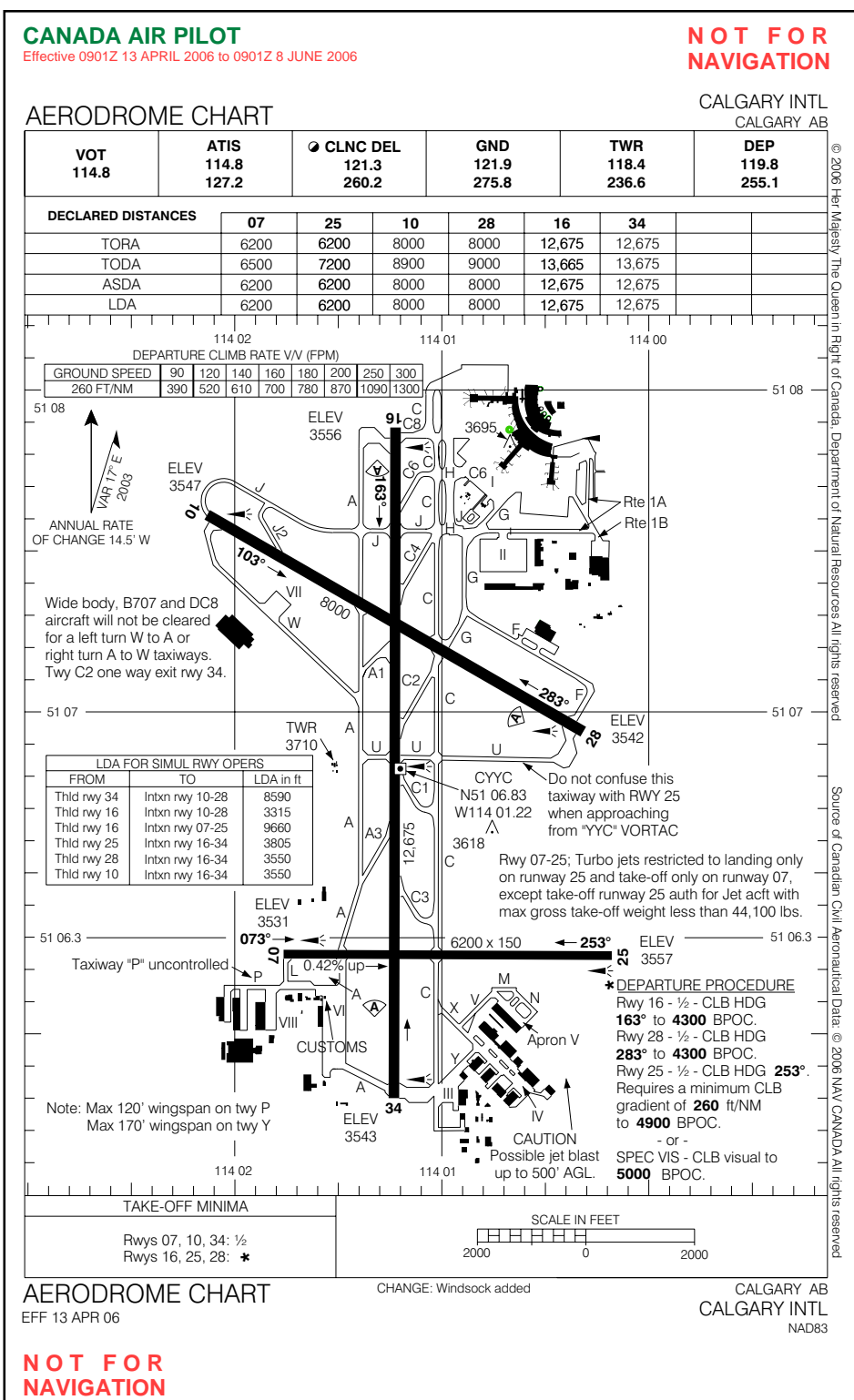
authorization to cross the runway. On my day in Calgary, our clearance from the ground controller stated: "*Taxi to the Shell via taxiway A*". It seemed logical to me, but there was a closed runway between our aircraft and the FBO. Because the runway was closed to air traffic and was NOTAM'd (published) as such, we proceeded happily along and concluded our trip.

The next morning, my students reviewed the NOTAM, saw the runway was still closed and briefed me as such. The ground controller cleared us to "*Taxi via A*" and, as I approached the closed runway, I told my students, "Ok, this runway is still closed so we can continue."

As we continued, I started to feel uncomfortable that our taxi clearance was a bit “loosey-goosey” i.e. no clearance limit, so I had the student stop and call for further taxi clearance. The response we got was “I’m not sure how you got there, but call tower now for departure.” Oh oh! We departed without further incident until a week later when a complaint surfaced that we were observed to be taxiing around Calgary International without clearance.

There are several notations in the GPH 204A and the TC AIM that “emphasize the protection of active runways”...makes sense. We don’t want airplanes taxiing out willy-nilly onto active runways, but what about a closed runway? The rules state: “...to cross any runway while taxiing towards the departure runway...” and this covers my situation. Even when cleared to taxi with no specific clearance to cross a closed runway, pilots are required to hold-short and request permission to cross a closed runway. Even the ICAO Manual on the Prevention of Runway Incursions states: “When a taxi clearance contains a taxi limit beyond a runway, it must contain an explicit clearance to cross that runway, even if the runway is not in use.”

So the moral of my tale is directed to all pilots – beware of taxi clearances that leave something to be desired. Know that even if a runway is closed you require permission to cross it. Follow that advice and you’ll never have an issue. ♦



## *When Lightning Strikes*

Aircraft designs incorporate systems to protect against direct and indirect damage.

By Clarence E. Rash

**Clarence E. Rash is a research physicist with 30 years experience in military aviation research and development. He has authored more than 200 papers on aviation display, human factors and aircraft protection topics.**

**U**nderstanding the mechanisms and consequences of lightning strikes on aircraft has been a decades-long learning experience.

When the first known lightning-caused airplane accident occurred in 1929, scientists and aeronautical engineers initially insisted that lightning played no part in the crash – and that there was “no proved instance of an airplane ever having been struck by lightning.”<sup>1</sup> Over time, the experts of the 1920s were proved incorrect – aircraft lightning strikes occur frequently, although they rarely are associated with accidents.

Lightning is a discharge of electricity that occurs in the atmosphere and can be thought of as a high-current – about 20,000 amperes – electric spark associated with thunderstorms.

Lightning is produced when supercooled liquid and ice particles above the freezing level collide and build up large and separate regions of positive and negative electric charges in the clouds. After these charges become large enough, a giant “spark,” or discharge, occurs between them, lasting less than a tenth of a second. The spark – lightning – can occur between clouds, between sections of a single cloud, between the cloud and air, or between the cloud and the ground – or some object on the ground.

The most common type of lightning discharge is cloud-to-ground, or “negative” lightning, which accounts for 90 percent of all lightning strikes. The discharge usually begins when a significant difference develops between the negative charge in the cloud and the positive charge on the ground – or in another cloud. At this point, the negative charge begins moving toward the ground, forming an invisible conductive path, known as a leader stroke. This leader stroke descends through the air in discrete zigzag steps, or jumps, each approximately 150 ft (46 m) long. Concurrently, a positively charged streamer is sent out from the positively charged ground or other cloud.

When the leader and the streamer meet, an electrical discharge – lightning – takes place along the streamer, up and into the cloud. It is this return stroke that is the most luminous part of the lightning discharge, usually the only part of the lightning process that is actually seen.

Another type of lightning – known as “positive lightning” because there is a net transfer of positive charge from the cloud to the ground – originates in the upper parts of a thunderstorm, where a high positive charge resides. This type of lightning develops almost the same way as negative lightning, except that the descending stepped leader carries a positive charge and the subsequent ground streamer has a negative charge. Positive lightning accounts for less than 5 percent of all lightning but is much more powerful, lasts longer and can discharge at greater distances than the more common negative lightning.

### **Global Pattern**

Lightning is a global phenomenon. Flashes have been seen in volcanic eruptions, intense forest fires, heavy snowstorms and large hurricanes; however, it is most often associated with thunderstorms.<sup>2</sup>



While global in occurrence, lightning is not uniformly distributed geographically. About 70 percent of all lightning flashes occur between 30 degrees N and 30 degrees S latitudes – not surprisingly, in the tropics, where most thunderstorms occur. In addition, lightning over land, or over water that is close to land, is 10 times more frequent than lightning over oceans.<sup>3</sup>

## Every 1,000 Flight Hours

Until the past decade, when information-gathering became more effective, detailed data on lightning strikes to aircraft were difficult to obtain.<sup>4</sup>

However, when the extraordinary frequency of lightning is considered in concert with the frequency of flight – estimated at 77 million aircraft movements worldwide in 2008<sup>5</sup> – it can be no surprise that aircraft lightning strikes occur relatively often. The French Office National d'Études et Recherches Aéropatiales (the national aerospace research center) estimates that an aircraft is struck by lightning on average every 1,000 flight hours – for commercial airlines, the equivalent of one strike per aircraft per year.

While more study is needed, current evidence points to altitude as a factor in lightning strikes. Current data show there are more lightning strikes at intermediate altitudes (8,000–14,000 ft) than at cruise altitudes.<sup>6</sup> Other leading factors in the probability of a lightning strike include being inside a cloud (90 percent) and/or the presence of rain (more than 70 percent).

An aircraft lightning strike is often attributed to “being in the wrong place at the wrong time” – in other words, getting in the way of a lightning discharge. But estimates are that such a scenario accounts for only 10 percent of aircraft lightning strikes. Actually, almost 90 percent of aircraft lightning strikes are self-triggered, as when an aircraft flies through a heavily charged area of clouds – a fact not known until the 1980s.<sup>7</sup>

Fortunately, although aircraft lightning strikes are not uncommon, accidents in which lightning has been identified as a primary or contributing cause are.

Searches of accident databases and historical records maintained by various aviation agencies, historical societies and lightning safety organizations produce a diverse listing and history of incidents and accidents that have been attributed to lightning strikes.

Based on these searches, the first aviation accident attributed directly to a lightning strike occurred Sept. 3, 1915, when a German Zeppelin LZ40 (L10) was destroyed by a lightning strike while venting hydrogen gas off Neuwerk Island, Germany.<sup>8</sup> From 1915 through the early 1920s, a number of airship accidents were attributed to lightning strikes.

The Sept. 3, 1929, crash of a Transcontinental Air Transport Ford Tri-Motor named the “City of San Francisco” usually is cited as the first heavier-than-air aircraft destroyed by a lightning strike. All eight occupants died when the airplane struck the ground near Mt. Taylor, New Mexico, U.S., on the Albuquerque-to-Los Angeles leg of a cross-country journey divided into airplane and train segments.<sup>9</sup>

Over the next few decades, only a dozen or so additional accidents were attributed to lightning strikes; in many of those cases, however, lightning was not firmly established as the cause.

The earliest lightning-related accident for which a detailed description is available involved a U.S. Air Force Curtiss C-46D transport plane en route from Dallas to Jackson, Mississippi, U.S., on June 14, 1945. While at 3,000 ft, one wing was struck by lightning. Unable to maintain altitude, the aircraft crashed into a wooded area.<sup>10</sup>

Nearly two decades later, in what often is cited as the first positive lightning strike-induced accident involving a commercial aircraft, a

Pan American World Airways Boeing 707-121 crashed on Dec. 8, 1963, while in a holding pattern awaiting clearance to land in Philadelphia after a flight from Baltimore. Accident investigators determined that the lightning strike had ignited fuel vapors. As a consequence of the ensuing investigation by the U.S. Federal Aviation Agency – a precursor of the Federal Aviation Administration (FAA) – devices known as lightning discharge wicks were ordered to be installed on all commercial jet airliners.

The U.S. National Transportation Safety Board (NTSB) Accident/Incident Database from Jan. 1, 1962–April 30, 2010, included 58 events in which lightning – but not necessarily a lightning strike – was cited as a major or contributing causal factor. All of the reports involved commercial or private aircraft, with the exception of one accident involving a balloon.<sup>11</sup>

In those 58 reports, the role of lightning is categorized as follows:

- Forty-one events involved actual lightning strikes to an aircraft during flight.
- Two events involved an aircraft while on the ground. One airplane was struck by lightning, and the other was involved in a taxiway accident attributed to a communication breakdown after ground personnel removed their headsets because of lightning in the area.
- Five events involved nearby lightning strikes that impaired either the pilot's vision or ability to control the aircraft.
- Three events involved lightning-related ground equipment failures that led to accidents during landing. Two of these involved the loss of runway lights, and one involved the loss of air traffic control capability.
- Seven accident/incident reports cited lightning as a weather factor contributing to an accident but did not describe its actual influence.

The 58 incidents and accidents resulted in 202 fatalities and 46 injuries, most of which were associated with two accidents:

- The Aug. 2, 1985, crash of a Delta Air Lines Lockheed L-1011-385 in Dallas/Fort Worth, which killed 135 and injured 30 passengers and crew. Lighting was cited as a contributing factor.<sup>12</sup>
- The July 23, 1973, crash of an Ozark Airlines Fairchild FH227B in St. Louis, which killed 38 and injured six passengers and crew. A lightning strike on final approach was cited as a probable cause.<sup>13</sup>

Also among the 202 fatalities was an aircraft marshaller who was wearing a headset connected to a McDonnell Douglas DC-9-31 when it was struck by lightning on Oct. 7, 1989, while being pushed back from a gate in preparation for takeoff from Orlando International Airport.<sup>14</sup>

Of the 41 reports involving a confirmed lightning strike that resulted in an accident or an incident, 28 aircraft – 68 percent – landed safely. All sustained at least minor damage.

## Lightning Effects

Both the occupants of an aircraft and the aircraft itself are subject to the powerful effects of a lightning strike. The inherent structural design of an aircraft provides the occupants almost complete protection despite the massive amount of current involved. This protection is based on the principle known as the Faraday cage, first devised by the physicist Michael Faraday in 1836.

A Faraday cage is a hollow enclosure made of conducting material, such as the hull of an aircraft. In the presence of a strong electric field, any electric charge will be forced to redistribute itself on the outside enclosure, but the space inside the cage remains uncharged. Thus, the metal hull of the aircraft acts as a Faraday cage, protecting the occupants from lightning.

Some aircraft are made of advanced composite materials, which – by themselves – are significantly less conductive than metal. To overcome this resulting safety problem, a layer of conductive fibers or screens is imbedded between layers of the composite material to conduct the lightning current.

Regardless of hull material, the direct effects of lightning on the exterior can also include:<sup>15</sup>

- Burning or melting at lightning strike points;
- Increase in temperature;
- Residual magnetism;
- Acoustic shock effects;
- Arcing at hinges, joints and bonding points; and,
- Ignition of fuel vapors.

Accident data indicate that most of these effects are not serious. However, an estimated one-third to one-half of aircraft lightning strikes result in at least some minor damage.<sup>16</sup> Lightning generally enters an aircraft at one location, usually an extremity, and leaves at another.

Burn marks are found at the entry and exit point(s) of the strike, although exit points are not present if the energy was dissipated via wicks or rods – static dischargers whose primary purpose is to bleed off into the surrounding air the static charge build-up that occurs during normal flight.

Because many aircraft fly a distance equivalent to several times their own lengths during a lightning discharge, the location of the entry point can change as the discharge attaches to additional points aft of the initial entry point. The location of the exit points may also change.

Therefore, for any one strike, there may be several entry or exit points.

Occasionally, in more severe strikes, electrical equipment or avionics may be affected or damaged. This potential problem is addressed in modern aircraft design by redundancy. The functions of most critical systems are duplicated, so a lightning strike is unlikely to compromise safety of flight. In most strike events, pilots report nothing more than a temporary flickering of lights or short-lived interference with instruments.

The exception is the incidence of positive lightning. Positive lightning strikes – because of their greater power – are considerably more dangerous than negative lightning strikes. Few aircraft are designed to withstand such strikes without significant damage.<sup>17</sup>

## Protection Methods

Careful flight planning and the use of weather radar help limit an aircraft's exposure to lightning. It is a good safety practice to avoid by at least 20 nm (37 km) any thunderstorm activity that provides a strong radar echo.

Aviation regulatory agencies worldwide have established certification standards that call for an aircraft to be able to withstand a lightning strike and continue flying to land safely at a suitable airport. In addition, modern aircraft designers employ a number of effective lightning protection systems that address possible direct and indirect damage from lightning strikes. These systems are intended to provide preferred paths for the electric current associated with a lightning discharge to enter and exit the aircraft without causing damage to the aircraft or injury to its occupants.<sup>18</sup> These systems can be divided into three general categories of protection: airframe and structure protection; fuel system protection; and electrical and electronic systems (avionics) protection.

The primary goal of airframe and structure protection is to minimize and control lightning entry and exit points. The first step is to identify locations (or zones) of greatest vulnerability to lightning strikes. For most aircraft,

these zones, in decreasing vulnerability, are the radome and wing tips, the bottom of the fuselage and the area under the wings.

The second step is to ensure that acceptable discharge pathways are available at these potential entry points and that these pathways adjoin preferred exit points on the aircraft. To a great extent, this is achieved via the electrically conductive hull of the aircraft. In the outer hull design, it is important that conductive bonding strips electrically bridge any gaps between sections, thereby reducing potential arcing.

Preferred exit points at the tips of the wings, stabilizers and fins should be equipped with static dischargers – wicks or rods. These static dischargers are not lightning arrestors, however, and they do not reduce the probability of an aircraft being struck by lightning. Nevertheless, if lightning does strike, chances are that the electricity will go through the discharger rather than through the aircraft.

## Fuel System

The primary goal of fuel system protection is to prevent the ignition of fuel vapors.<sup>19</sup> Fuel tanks and associated systems must be free of potential ignition sources, such as electrical arcs and sparks. All the structural joints, hinges and fasteners must be designed to prevent sparks as current from the lightning discharge flows from one section to another. The aircraft

skin near the fuel tanks also must be robust enough to prevent burn-through by a lightning strike.

A second aspect of fuel system protection involves the fuel itself. Advances in fuel development have resulted in fuels that produce less explosive vapors. Fuel additives that reduce vapor formation also are available.

## Avionics

Today's aircraft are equipped with miles of wiring and an abundance of computers and electronic systems, so most lightning protection methods are designed to protect the current-sensitive avionics systems. Flight-critical and essential equipment must be able to function in the aftermath of both the direct and indirect effects of lightning strikes.

As current from a lightning strike travels along the exterior of an aircraft, it can induce transients – temporary current oscillations – into adjacent wires and electronic equipment. Shielding, grounding and surge suppression are the most common techniques used to avoid this problem.<sup>20</sup> Shielded cables are wires enclosed by a common conductive layer (the shield) that acts as a Faraday cage. Shielded cables in aircraft may have two shields – an outer shield for lightning protection and an inner shield that eliminates unwanted electromagnetic interference (EMI).

Surge suppression is used to limit rapid increases in voltage that are significantly above the normal level for an electronic circuit or system. Rapidly increasing voltages can result in electrical arcing that melts one or more components, effectively destroying the circuit. Surge protection works by diverting the increased power to a grounding line.

Every circuit and piece of equipment that is essential to safe flight must be protected against lightning in accordance with regulations established by civil aviation authorities.

Studies have shown that aircraft incorporating lightning and EMI protection have had a significantly lower percentage of electrical failures and interference caused by lightning strikes.<sup>21</sup>

If a lightning strike occurs, a post-lightning inspection of the aircraft is critical. The most important step is to thoroughly inspect the aircraft for burn spots and pitted areas that potentially identify entry and exit points. Evidence of arcing should be investigated, especially near hinges and bonding strips. A thorough check of all critical and essential avionics should be performed. Additional procedures, as listed in the aircraft's maintenance manual, should be followed.





## Notes

1. Parton, Lemuel F. "Records Reveal That No Airplane Hit by Lightning," The Deseret News, Salt Lake City, Utah, U.S. Sept. 7, 1929.
2. U.S. National Weather Service. "Lightning Safety," National Oceanic and Atmospheric Administration. [www.lightningsafety.noaa.gov/science.htm](http://www.lightningsafety.noaa.gov/science.htm).
3. Christian, H.J. et al. "Global Frequency and Distribution of Lightning as Observed From Space by the Optical Transient Detector." Journal of Geophysical Research. 108(D1): 4005 (2003).
4. O'Loughlin, J.B.; Skinner, S.R. "General Aviation Lightning Strike Report and Protection Level Study." U.S. Department of Transportation, FAA. DOT/FAA/AR-04/13. 2004.
5. Airports Council International. "Airports Report Flat Traffic Growth in 2008." [www.aci.aero/cda/aci\\_common/display/main/aci\\_content07\\_c.jsp?zn=aci&cp=1-5-54\\_666\\_2\\_\\_](http://www.aci.aero/cda/aci_common/display/main/aci_content07_c.jsp?zn=aci&cp=1-5-54_666_2__).
6. Rupke, E. Lightning Direct Effects Handbook. Pittsfield, Massachusetts, U.S.: Lightning Technologies. (2002).
7. Radov, V.A.; Uman, M.A. Lightning: Physics and Effects. Cambridge University Press: New York. (2002).
8. Century of Flight. "Timeline: 1915" [www.century-of-flight.net/Aviation history/aviation timeline/1911\\_to\\_1920.htm](http://www.century-of-flight.net/Aviation%20history/aviation%20timeline/1911_to_1920.htm).
9. Hopkins, George E. "Transcontinental Air Transport Inc." American Heritage Magazine Volume 27 (December 1975).
10. Aviation Safety Network. "Accident Description: 14 Jun 1945." [aviation-safety.net/database/record.php?id=19450614-3](http://aviation-safety.net/database/record.php?id=19450614-3).
11. From a search of the NTSB Accident/ Incident Database. In two accident reports, a lightning strike could not be confirmed but was reported by witnesses.
12. NTSB. Accident report no. DCA85AA031.
13. NTSB. Accident report no. DCA74AZ003.
14. NTSB. Accident report no. MIA90FA008.
15. Rupke.
16. Harrison, H.T. "United Air Lines Turbojet Experience With Electrical Discharges." United Air Lines Meteorological Circular, No. 57. (1965).
17. U.K. Department of Transport. Air Accidents Investigation Branch Bulletin. December 1999: "Schleicher ASK 21 Two Seat Glider." [www.aaib.gov.uk/cms\\_resources.cfm?file=/dft\\_avsafety\\_pdf\\_500699.pdf](http://www.aaib.gov.uk/cms_resources.cfm?file=/dft_avsafety_pdf_500699.pdf). United Kingdom. (2004).
18. FAA. "Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment." Department of Transportation, FAA Standard FAA-STD-019e. (2005).
19. Rupke.
20. Ibid.
21. O'Loughlin, Skinner. ♦

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## Lightning... By the Numbers

1,800 Number of thunderstorms in progress worldwide at any given moment  
 40-100 Average number of lightning flashes each second worldwide  
 20,000 Number of amperes (amps) of current in a typical lightning discharge  
 60 ft (18 m) The distance lightning energy can spread from the strike point  
 1:750,000 Odds of being struck by lightning in a given year  
 1:6,250 Odds of being struck by lightning in a lifetime (80 years)  
 1:28,500 Odds of being killed by lightning  
 24,000 Average number of deaths per year due to lightning worldwide  
 240,000 Average number of injuries per year due to lightning worldwide  
 58 Average number of deaths per year due to lightning in the United States  
 500 Average number of injuries per year due to lightning in the United States  
 90 Percentage of lightning-strike victims who survive

Sources: U.S. National Weather Service "Medical Aspects of Lightning," National Oceanic and Atmospheric Administration. <[www.lightningsafety.noaa.gov/medical.htm](http://www.lightningsafety.noaa.gov/medical.htm)>.  
 National Lightning Safety Institute. "Fast Facts About Lightning." <[www.lightningsafety.com](http://www.lightningsafety.com)>.



# CHECK SIX

## On a nice day... *strange things can happen*

This article was originally printed in *Flight Comment*, May – June, 1970.

*We're grateful to this pilot for his interest in passing along an important lesson. . .*

The search for a missing civilian helicopter with two men on board, was in its second week. I was aircraft commander and our *Albatross* had been airborne for approximately five hours on a beautiful sunny spring day. We were full of certainty that this was the day and the aircraft that would find the survivors.

Our assigned tracks ran in an east-west direction over relatively flat terrain. There was one exception to the general flatness, a long narrow hill, running at 90° to our flight path, that we were gradually approaching with the completion of each track.

The top of the hill was slightly higher than our assigned search altitude so I had to climb momentarily and then ease down the other side. The winds were comparatively light and there was no turbulence. On two occasions I broke off our track to investigate sightings by our spotters; one turned out to be a white wolf on the edge of a cut line and the other a set of elk antlers in the trees. The routine of picking up our track was repeated and the search went on. On one particular track I failed to notice that part of the ridge coming up was higher than the rest; the map did not show a higher spot height. As I approached the hill, I increased power slightly, as on every previous pass, and eased the nose up.

It should be pointed out that although my responsibility consisted of completing each mission in an accurate and safe manner there have been several occasions where pilots, with their better forward view, have sighted survivors.

Therefore, I was only half concentrating on the fast approaching hill and automatically adjusted the attitude to compensate for the apparent slow rate of climb. Since cruise for searching is at a low indicated airspeed, it was only a matter of seconds until I felt the first indications of a stall. Pitch and power were applied with adrenalin reinforced speed and the aircraft cleared the tree tops by about 50 feet. Perhaps that doesn't sound too close, but the dear old *Albert*, loaded to the hilt with spotters, crew, para-rescue gear, droppable stores and bags of fuel isn't known for its aerobatic characteristics. A key factor was that recovery was initiated at the very first indication of an approaching stall. A slightly higher ridge or slower reaction and scratch one *Albatross*.

I had at that time about 5,000 hours on a variety of aircraft. I was in good health and took pride in my responsibilities, and yet I had jeopardized the lives of a dozen people and my aircraft. Subsequently, the crew didn't appear upset, but I was, for months. What had happened? Inattention, complacency, boredom, routine, lack of ability, stupidity?



Perhaps a bit of each, but in addition to the fact that one part of the ridge was higher than the remainder, one other factor was present. As the spotters and crew rotated positions there was a gradual concentration of people in the aft of the aircraft where the biggest search windows are located.

The result was a gradual change of aircraft attitude while maintaining a constant height. Looking forward through the windscreen as we approached the hill it appeared that we would safely clear it as on all previous passes. The added pitch and power, however, was not sufficient as a result of the increased height. Flight and engine instruments had been monitored regularly throughout the trip, but regularly doesn't mean continually. On a nice clear day after five hours airborne, strange things can happen. ♦

# It's Not OVER Till It's OVER

Photo: Cpl Marc-André Gaudreault

*The author of this article requested to remain anonymous.*

It was a beautiful spring morning in Trenton. After a long, but uneventful night shift, I was sitting in the tower as the on-duty VFR controller, waiting for both the coffee to be ready and for the oncoming crew to sign on duty. As many shift workers can probably attest, the first 11 hours of the shift went by in a flash; however, the last hour seemed to drag on and on. I was fatigued and could sense that I was developing symptoms of “get home itis.”

After the daily morning brief, the morning crew made their way up to the tower. This particular morning there were more people present in the tower than normal and the noise level increased as everyone exchanged their morning pleasantries and talked about their previous evening.

I began the handover process with the oncoming Controller. The standard checklist was followed: active runway, weather conditions, equipment serviceability, SNIC operations, miscellaneous items, and followed lastly by the current ground traffic and air traffic. In all of these items there was nothing out of the ordinary, so I went through the list at a fairly rapid pace. At that moment, the only thing

happening on the airfield was a CC150 taxiing IFR for a local departure. It wasn't exactly what you would call a busy morning.

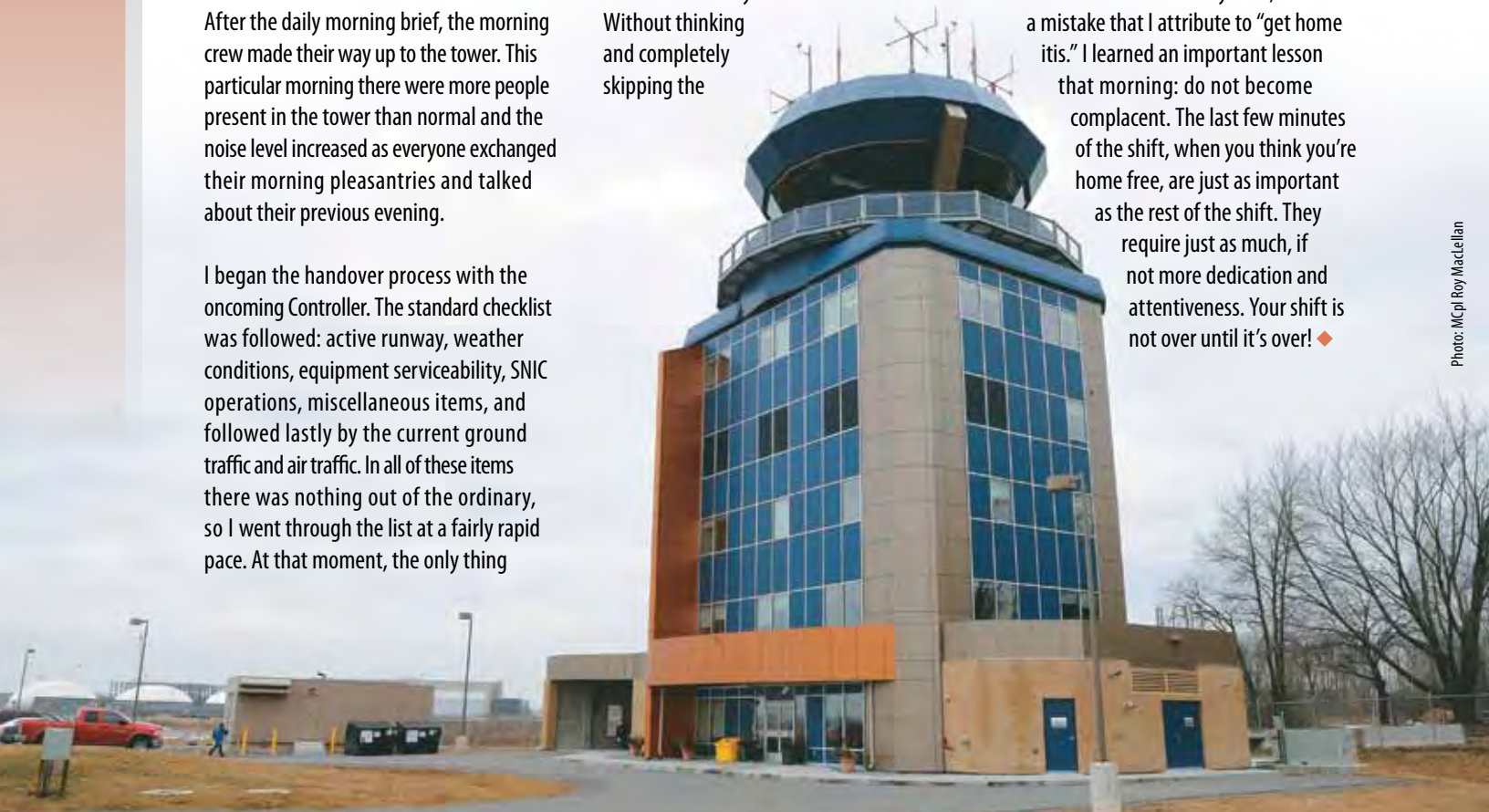
After going through the list, the Airbus pilot called “ready for departure”. The runway was clear and it still belonged to me. I hadn't yet handed over the microphone, and as I mentioned, my thoughts were preoccupied with getting home and the list of things that I had to do that day.

Without thinking and completely skipping the

normal SOP in Trenton for launching an IFR aircraft, I issued a take off-clearance to the pilot without the approval of the IFR Controller. As soon as the words came out of my mouth, I realized what I had done and quickly went to advise the controller of my mistake. Thankfully, the CC150 departed safely and nothing dangerous happened as a result of my inattention.

As an Air Traffic Controller, this experience was humbling and thought-provoking. In the last 30 seconds of my shift, I made a mistake that I attribute to “get home itis.” I learned an important lesson that morning: do not become complacent. The last few minutes of the shift, when you think you're home free, are just as important as the rest of the shift. They require just as much, if not more dedication and attentiveness. Your shift is not over until it's over! ♦

Photo: MCpl Roy MacLellan





# Memories of a YEAR END FLIGHT

Photo: Christian Coulombe

*"Neither my brother nor I have the means  
to support both a wife and a flying machine."*

— Orville Wright

*The author of this article requested to remain anonymous.*

It was the last wave of flying at 2CFFTS with only one day remaining before Christmas Holidays. Ops had extra *Harvard* airplanes available and with night fast approaching, this was a perfect time to reset the currencies for IF, CH, day and night. With all the enthusiasm of a kid about to open the first Christmas present I was quickly off solo to the Walrus high block, practiced some aerobatic's and returned for a HI-ILS/DME 29R "speed pilot's discretion". As the aircraft stabilized at 140kts approaching the FAF, landing gear and flaps were lowered but only two green lights illuminated. A quick check of the annunciator panel, lamps and the hydraulic system showed everything in the green however the Angle Of Attack (AOA) indexer was not operative.

There was sufficient time and daylight to advise ATC of the problem and request they confirm 3 gear were showing down during the low approach. It was nice to hear a positive result from Tower however no Landing/Taxi lights were visible. The yellow page "LANDING GEAR MALFUNCTION" checklist needed to be run so authority from ATC was granted to break out to north of Moose Jaw.

The checklist advised that anytime AOA indexers were operative, Landing/taxi lights were visible or if green lights from

The checklist continued to direct that if gear safe indications cannot be obtained but gear appears visually down:

FUEL .....	REDUCE TO MINIMUM (200lbs)
FLAPS .....	AS REQ'D (LAND)
HARNES .....	LOCK

*When landing is assured be prepared to:*

PCL .....	OFF (as req'd)
Emergency Firewall Shutoff Handle .....	PULL (as req'd)

*After aircraft comes to a stop be prepared to:*

BAT, GEN AUX BAT .....	OFF (as req'd)
Emergency Ground Egress .....	As Required

the rear and front cockpits combined to show 3 green (safe) then the landing gear was considered down and locked and aircrew should land as soon as practical.

Because safe gear indications could not be obtained, an emergency was declared and clearance was given to orbit south while fuel was reduced (approximately 1 hour).

Some of that enthusiasm for my final flight of 2011 diminished as the prospect of:

- 1) a night landing with no landing lights;
- 2) a dead stick landing preceded by a temporary destabilized final approach as the engine was shut down and the blades feathered; and

- 3) right main landing which might not hold on touchdown.

Time was in abundance, so a call to Ops for a review of the checklist and suggestions from Maintenance was requested. One of the recommendations from Maintenance was to employ the emergency gear lowering system. This action resulted in an indication of safe gear and the aircraft was recovered without further incident.

My Lessons Learned/Re-enforced:  
Stay proficient with lights out landings.  
Use all the resources available. ♦

# The **CHEESE WHIZ** Model

By Corporal Bernie Lanteigne, 400 Tactical Helicopter Squadron, Borden

You may be wondering what I'm talking about. On my recent Flight Safety course one of our instructors had a Freudian slip and referred to the Swiss Cheese Model as the *Cheese Whiz* Model. It was hilarious at the time but made me think what that model would be.

It's the opposite of Reason's Swiss Cheese Model when all the holes line up and we get the prime conditions for an occurrence and failure. It's when everything is going well and maintains that gooey cheesy condition where no holes can materialize. What are those conditions we strive to maintain?

In our everyday operations at home and abroad, whether searching and rescuing, moving troops, training, slinging supplies to ships, intercepting aircraft and protecting our sovereignty, cruising up and down our shores, watching high above with UAVs or moving cargo in all parts of the world, we strive to meet the challenge of preventing accidental loss of our resources. This has to be done while accomplishing our missions at an acceptable level of risk.

We are constantly challenged as operators, maintainers and managers to minimize errors, implement preventive measures to eliminate occurrences and facilitate a free and open culture of flight safety. The program has evolved but the more things change, the more they stay the same. Our goal has always been the same and our efforts have not waived. It's a daunting task as the nature of our business is risky.

As an operator and former maintainer, both in the civilian aerospace sector and military, airworthiness is always my



Photo: Cpl Jackson Yee

LCol Steve Brabant presenting the *Cheese Whiz* Trophy to Maj Brent Day.

priority and is at the forefront of the program. How we manage the inherent risk and maintain the program's principles are what determine the success of our business.

My recent participation in combat operations on Roto 11 in Afghanistan had its own challenges. My prime objective was to bring everyone home alive. We were all new to each other as a crew and our gunner had never been exposed to air operations and flying in a helicopter. The "baptism by fire" he and all gunners experienced was a monumental undertaking. Everything they were going to learn was related to flight safety. Airmanship, crew co-op, emergency procedures, aerial marksmanship, air weapon safety and egress and evasion procedures just to name a few. They were fundamental pieces in the *Cheese Whiz* Model, as were all of us. They adopted the safety culture and kept things safe, as we had trained them to do.

In my past experience on search and rescue missions in bad weather at night, rigging *Hercs* for LAPES drops, the countless engine changes and run-ups, fueling CF18s for sweep/escort, combat air patrols or bombing missions in the Persian Gulf, nothing has changed. My focus in preparing for daily operations and dedicating myself to keeping the cheese without holes has remained true to its fundamental principles. Downtown, we used the Transport Canada model referred to as the Safety Management System or SMS. The same principles were in place and flight safety was as much of our business ethos as it is in the military.

The "culture", pun intended, is to identify hazards, implement preventive measures and mitigate risk. It takes a pretty big team to do this and feel privileged you are part of it. No dues to pay, no hazing involved. Welcome aboard. You are part of our Flight Safety Team.

Now spread the *Cheese Whiz*! ♦

# FLIGHT SAFETY

## *More Than a Catch Phrase*

By Warrant Officer Patrick Flaherty, 12 Wing HQ, Shearwater

Flight Safety became more than a catch phrase to me in 1982 when I was a no hook private in Trenton Ontario. This was my first base after my TQ3s in Borden and I was posted to Trenton Boeing Maintenance.

Boeing 707 Periodic Maintenance was like nothing I ever experienced before. A 707 would roll in on a Monday morning and we had only one week to do the inspection, fix what we found wrong and have it out the door by the next Monday. This involved 10 to 15 hour days all week into Saturday, then however long it took to ground run the aircraft serviceable on Sunday. The powers at be would then give us the next couple of days off.

I never gave it much thought to what happens to the aircraft after we towed it into the slot after our final checks on Sunday. I was just a no hook private. I had no real responsibilities and no paperwork to fill out; my biggest concern was when and where the party started.

This all changed after my third periodic. This time we did not get a couple of days off. We had to go into work because of a scheduled "Supp Check" on another aircraft. So on this fine Monday when I walked across the slot to go to work, I was surprised to see the aircraft we just parked the night before being loaded up with people – lots of people.



Photo: MCpl France Morin

When I arrived at my section I asked my MCpl if this was the norm. The reply shocked me. "Yes" was the answer and the usual destination was overseas. I always assumed the aircraft would have a test flight before having passengers being put on board. Didn't they know how much of the aircraft was dismantled and how quick we had to put it back together?

The MCpl then sat down with me and explained why we "earned the big bucks". He explained why we always do the job right the first time, every time, and all about why flight safety is more than just a catch phrase. He explained that flight safety is a way of life in our business and that a chain of events can cause accidents.

He explained how I, as a young technician, am the first link in the chain and as important as any other link. If one simple failure on my part is not found by the checks and balances through the chain, it could have catastrophic results.

From that day forward I always did my job including flight safety as a way of life. Be it one person or 180 flying in the aircraft, I swore to myself that I would never let the flight safety chain down. Flight safety became much more than a catch phrase because now I could put faces to it. ♦





# *A Quiet* but **Dark Night**

By Mr Shawn Coyle

**Mr Coyle is a former CF helicopter engineering test pilot who flew in 427 Sqn and AETE. A graduate of the Empire Test Pilot School, he has been an instructor at 3 schools of flight testing, and held a position at Transport Canada. He currently writes for Vertical magazine, and is the author of 'Cyclic and Collective' as well as being an expert witness on helicopter accidents and the Technical Marketing manager for Marinvent Corporation. He has made many presentations and teaches seminars on helicopter matters. So far, he has survived all his aviation mistakes...**

**I**t was a relatively good time to learn about using the searchlight on the *Twin Huey*. Overcast, big military range area with no lights, not much wind, and a reasonable proficiency at flying the machine during the daytime and IFR. I was just transitioning to the Twin, having completed the basic helicopter course and was about halfway through the *Twin Huey* course.

Tonight, we were going to be training on use of the *Firefly* searchlight system. *Firefly* predates the *Nightsun* by several generations, and was a big cluster of landing lights which could be adjusted in beam width by the operator in the back. One of our trusty (and experienced) flight engineers was the *Firefly* operator. James (we'll call him) was the instructor and I was the student.

We briefed, started up, did the normal checks of the aircraft, checked the *Firefly*, and launched into the Stygian blackness of the Gagetown Training area. Once away from the base complex, it was dark.

Very dark. Up and away, we slowed down, opened the sliding door, positioned the searchlight and started out with line searches and turning around a spot on the ground. I was learning how to cross check between flying the light and flying the instruments, and was having no difficulty. This was fun, and the light appeared to be pretty effective. Communication between student pilot and experienced engineer was going well, and I was comfortable with the way things were developing.

We came back a bit closer to the base area and set up for the next situation, which was to hover while the light was placed and kept on a spot. The target was selected from the dim glow of the reflected lights from the base, and we positioned ourselves for the maximum training benefit. In this case, maximum training benefit would have the helicopter pointing into the black nothing that was over the range area. No lights, no horizon, nothing.

I remember being aware that transitioning to hover in this condition would put us downwind, but we were light in weight, and had plenty of power in hand, so this shouldn't be a problem. I started the transition gingerly, and there were a few vibrations, but that was normal for a downwind type approach. The light was shining on the house, and I was taking my time – not much to look at straight ahead, and I was aware one could get sucked in by just looking at the house. The instructor who was watching the target, I seem to remember thought that the transition was taking a bit too long, and he said – “Raise the nose just a bit more, and lower the collective just a bit.” Being a dutiful student, I did as requested, not by looking at the target (which was off to one side by now), but by a quick glance at the attitude indicator. I don't recall any other indications of impending doom. There were vibrations, but nothing unusual – the target seemed to be in about the right place, power seemed to be OK, when suddenly the engineer yells– pull UP pull UP *PULL UP!*

The next few seconds were pretty confused. The instructor immediately yanked on the collective and then took control (in that order). We started to climb, or at least, it felt like a climb to me. I do remember the low rotor warning horn coming on and going quiet at least a couple of times. The torque was pretty high (about 110% or so) and we were going up like an elevator. At least the engineer stopped yelling and as we were within spitting distance of the heliport, we entered a tight circuit and landed. I don't remember if we declared an emergency or not, but within a few moments we were on the ground and walking into the maintenance office.

Only 110% torque? The maintenance people said, “Hmm, tricky.” A lot of digging through maintenance manuals, and several cups of coffee later it was decided that only a visual inspection was needed if the torque was less than 113%. I'd just had my first encounter with the torque limiter on the Twin Huey. (I later discovered exactly how this piece of equipment worked, and it became a personal vendetta to make sure nothing like this work of the devil ever

got installed on any helicopter I certified. For those Twins that I did post-maintenance flight checks on, I made sure it didn't come on until at least 105%) By the way, it worked by actively reducing fuel flow any time the torque was above the torque limiter setting – so if you hit the limiter and really needed the power, you were on a very short road to no-where.

For those who are interested in what really happened, all I can surmise is that since we were downwind, and got into a bit of descent, we entered vortex ring state without knowing it. Only the quick response of the engineer saved us. We didn't recognize it because we had no visual references and no experience of what the symptoms of vortex ring state might be. ♦

#### DFS Comment:

This crew was fortunate to have more power than normally available. By regulation, aircrew shall review the torque and other operating limitations of their own aircraft type for the mission planned. Moreover, any aircraft rigging shall be done as per the technical orders applicable for the aircraft type.

▶ *Vortex Ring State is a helicopter-only condition that happens when the downwash velocity from the rotor approximately equals the rate of descent. In this condition, the two competing air masses get pretty confused and the rotor starts to eat it's own downwash. This can very quickly develop into a rapid rate of descent, and it's necessary to get forward airspeed to fly out of it. In many ways, it's similar to a stall in a fixed wing airplane– the symptoms are broadly the same– low frequency airframe buffeting, relatively unresponsive controls and a sinking feeling. The recovery is almost the same– lower the nose positively and then apply power. I've only ever been able to demonstrate the effect by decelerating at a low power condition while downwind (at a safe altitude, of course).*



# TRUST YOUR GUT

By Captain Gregory Miller,  
WOps ATC, 14 Wing Greenwood

One calm summer night in the Goose Bay tower I had an L1011 *Tri-Star* handed off to me by Moncton Center. I cleared him into the left hand circuit for an approach to runway 34, as our main runway was closed for repairs. About the same time I had a medevac *Twin Otter* cleared in for the right hand circuit, also for runway 34.

Nice story ATC guy, but what's your point? The point is that my gut didn't feel right about the situation as it developed. On sequencing, I felt fine as the *Twin Otter* was closer, was a medevac, the heavy was following the light, and the L1011 reported his traffic in sight, but by the time the L1011 rolled final my stomach had the same type of butterflies that your first shot of tequila generates. The radar looked like it was close, but I wasn't positive as we

didn't use this runway often and night time causes difficulty in determining distance. So to settle the butterflies I asked the pilot about his traffic, to which he reassured me about seeing the preceding aircraft. Being a "tower weenie", this made me happy.

As the scenario progressed with the *Twin Otter* short final and the L1011 a few miles behind the shot of tequila has turned into a good and solid glass full of that same tequila. The butterflies have now been replaced by two finches and a possibly a cardinal fluttering around in my stomach. The radar still looks close, but not unreasonable, and the night time parallax is making life difficult on me. Thus I pestered the L1011 pilot again and he assured me that he had the traffic in sight. This is what I wanted to hear and life was good.

My stomach, however, didn't seem to agree. With the *Twin Otter* medevac now on the after-landing roll on the runway, the L1011 was told to continue. Now in my stomach, the previous swigs of "diesel with a worm" have been replaced by the unmistakable feeling that I've just finished downing the entire bottle, maggot and all. The little birds have given way to quite a row going on between three sea gulls, two crows, and I believe a turkey buzzard.

Over the din I believe that my gut is telling me "overshoot the *Tri-Star* – overshoot the *Tri-Star*." But being a good trafficker, I had to listen to my brain. Doing that has not always generated good results for me, but this time I believed it would. To calm the cries of discontent from my gut I again asked the pilot if he had the preceding traffic in sight. Again he replied he had the traffic in a calm and soothing tone that let me know that all was right with the world.



So my brain won one of its few arguments and I cleared the L1011 to "land with a *Twin Otter* exiting on runway 26." My brain was in complete satisfaction, but being a fair minded fellow my brain placated the stomach by instructing the *Twin Otter* to "exit the runway, no delay, L1011 landing behind." So with the gathered flock roosting in a gallon of Mexican death wish, I sat up alone in Goose Tower and watch the small *Twin Otter* barely exit the runway as the monstrous L1011 roared by. I'd swear its wing was overtop of the smaller aircraft.

The avian party that had been occurring in my stomach decided that it didn't want to hang around anymore and headed for the door, which unfortunately was the back door. I'm not sure how many people have ever watched two airplanes that should have hit, miss each other, but it causes an incredible feeling. It feels like having your stomach drop straight through your bowels without even the politest stop to say hello before rushing for an exit.

I should stress at this point that my bowels didn't actually drop and Goose Tower did not have to purchase new chairs. However, the feeling that watching a scenario like this causes is unique. Other than a few other close calls or crashes nothing has stuck in my mind with such clarity as this event.

So what happened to cause me to feel like I had been drinking rotgut for the past 48 hours? I had followed all the rules. I sequenced according to MANOPs. The pilot reported the traffic in sight three times and gave no indication of being the least bit worried. When concerned I analyzed the scenario with all available assets (eyes and radar) as best as I could and even sought confirmation from the only other person available, who happened to be sitting in the left seat of the L1011.

What I didn't do was listen to my instincts. If you get the feeling that maybe things aren't right, chances are something is amiss. Listen to what your stomach is telling you.

Don't let that first sip of tequila warning turn into an empty bottle and a gut reaction that is screaming to you not to be ignored. We're in this job not just because we have the capacity to apply the rules and regulations, we're here because we have the ability to combine them with common sense and the requirement to do what is necessary.

I did not want to hear the L1011 pilots whine louder than its engines as they overshot. I did not want to think about a couple hundred passengers getting an unwanted tour of central Labrador on my bequest. I did not want to have the hotline activate as a Moncton Center controller asked me how I could mess up the only two aircraft within a hundred miles. However, I should have listened to my gut. Basic luck prevented me from witnessing a very ugly fireball. So if you face the dilemma of your instincts saying one thing and your brain the other, listen to your instincts. ♦



# AEC – **Then** and *Now*

Lieutenant Colonel Susan Burt, Directorate of Personnel Strategy, Ottawa

**M**y family likes to hear the story of when I initially signed up with the Recruiting Centre as an Air Traffic Control Assistant, and how I thought I would be the one with the flashlights guiding the aircraft onto the ramp. Boy, did I have a lot to learn.

And learn I did; first as an ATCA at Portage la Prairie and Bagotville; then as an Air Traffic Controller in Shearwater, Goose Bay and Greenwood before I retired from the regular force in 1993.

I found the ATC work was exhilarating and very personally satisfying. Unfortunately over the 14 years, I saw many of those around me fall by the wayside because they were unsuccessful in their training, or unable to obtain a qualification in a specific area or place. The reasons varied, sometimes it was due to a second language ability (especially in Bagotville); or at times it was the inability to master the procedural control ability required in the IFR world and, at other times it was the inability to visualize the sequencing required for a mixed VFR arrival.

In the early 1990's, I had an issue of my own. When I went through the school in 1989, we were taught VFR and IFR together over one long 9 month course. After graduation, I worked VFR in the Shearwater tower. A year later, I was posted to work IFR control at Goose Bay. One night, I mixed up the call signs for Air Nova (DH8) and CanForce (CC130) and ended up with a loss of separation. The next few weeks were spent justifying my abilities, going under re-qualification and being closely monitored by the standards personnel. Even though on paper I was "good to go", this is something that stayed with me for a long time after the fact.

In 1992, Captain Wayne Smit and Sergeant Myles Bennett wrote an article "50 Years of ATC Training". The article covers the training challenges from the first school at Pat Bay, BC to the then current training at CFATCTU. It also outlined the historic training improvements during the early years, as well as the struggles in the late 80's in terms of high failure rates on the Officer courses. A change to training philosophy and equipment access was implemented in the early 1990's which led to improved training success.

After many years away from the ATC (now AEC) community, now as a Reservist, I find myself back in the thick of AEC and AC Op issues; this time from a strategic occupational perspective. My current job is with RCAF Occupational Development within Director Air Personnel Strategy (D Air Pers Strat).

The role of D Air Pers Strat is to work with the occupation and Chief Military Personnel (CMP) to produce Military Employment Structure Implementation Plan (MES IP). This is a job-focussed activity designed to produce a structural framework to guide personnel management. The concepts used for the MES IP include the work requirements, duties, tasks, competencies and qualifications. With each RCAF occupation we review, we learn more about what actually is required to ensure that an occupation is effectively structured, established, produced and manned to meet new operational capabilities.

From the production perspective, we are increasingly using research tools to influence selection, conduct assessment and analyse attrition. In response to the unacceptably high training attrition with the AEC occupation in the mid 2000's, D Air Pers Strat commissioned a job analysis study to identify predictors of training

success and recommended an assessment process to better select future AEC candidates. The study identified several competency groupings: cognitive ability, personality, interest in air ops and communication skills.

As a result, in addition to the standard recruiting and selection process at a Canadian Forces Recruiting Centre, all AEC applicants are now required to complete a series of tests at the Canadian Forces Aircrew Selection Centre (CFASC) that measure specific cognitive abilities necessary for successful AEC training and employment. The evaluation features tests developed by the Royal Air Force (RAF). The Royal Air Force Aircrew Aptitude Test (RAFAAT) is utilized for selection purposes by at least ten other Air Forces around the world with very good results. Furthermore, all applicants are provided with a Realistic Job Preview of AEC employment, including briefings which highlight the IFR, VFR, and Weapons streams, as well as a tour of the flight line and tower. This helps alleviate any myths or misperceptions on what the job actually entails and allows for applicants to really know what they're getting into.

While the long term impact of those changes is still to be seen, it is clear we have progressed well beyond the changes in training techniques begun in the 1980's. By applying science, research and analysis at the front end of the selection process, it is anticipated that many of the issues previously experienced in training will be a thing of the past.

Of course it will never be known whether or not these changes could have prevented my own incident. But as I think back to my days in training and in the controlling hot seat, I like to believe that they will. ♦



# From the Investigator

TYPE: SAR Technician – “A” Cat

LOCATION: Near Igloolik, Nunavut

DATE: 27 October 2011

At 0830 hours local, the Rescue Coordination Centre (RCC) tasked a CC130 aircraft from 424 Squadron Trenton (call sign R-323) to fly to the Arctic community of Igloolik. Late in the previous day, a young man and his father became stranded in pack-ice in their small open boat and activated their personal locator beacon. A CC130 aircraft from 435 Squadron, based in Winnipeg, had responded. This CC130 crew had dropped a six man life raft, other supplies and a radio to the boat. R-323 replaced this aircraft on scene at 1505 hours local. The men were unable to operate their boat, which was now in open water.

The crew of R-323 observed the men from the air and communicated with them by radio. The men were distressed and too cold to use the provided supplies. As the day progressed their boat disappeared in increasing wind and sea state. The men moved to the life raft where radio contact was lost and the pair appeared unresponsive. The crew of R-323 believed the men were dehydrated and hypothermic.

The RCC, Aircraft Captain and SAR Technician Team Leader approved a rescue parachute jump to the raft to provide medical assistance. At 1733 hours local, all three SAR Technicians parachuted from 2,000' above their calculated release point, upwind of the raft. The seas were 6-12' with some ice present, the winds were 25-35 knots and the air temperature was -8°C. The sun had set providing 30 minutes until full darkness.

Three good parachutes were observed from the ramp of the CC130 aircraft following the parachutists' static line exit.

One SAR Technician was able to swim to the raft where he provided assistance to the men until recovery by CH149 helicopter, approximately four hours later. The second SAR Technician swam until he realized he could not close the distance to the raft. He deployed his personal one man life raft, stowed his rescue gear and bailed his raft until recovery by the CH149 helicopter.

The SAR Technician Team Leader landed furthest from the raft. The investigation learned he manoeuvred his parachute in descent and after landing he removed his 190C helmet and activated its white strobe light. He also placed his dive hood on his head and made a partial radio transmission

to R-323. Five hours after the jump, the SAR Technician Team Leader was found unresponsive, floating in the sea with his life preserver inflated. He was wearing a dry suit that was not optimized for use on the CC130. Of particular note, the tether designed to hold his one man raft to his life preserver had separated at the threads and this life raft was missing. At recovery, the seas contained 45% slush with some ice pieces up to five feet in diameter. The winds were gusting to 47 knots and the seas were reported as 20 to 30'.

All persons were flown to the Igloolik Health Centre, less than 30 minutes away, where attempts to revive the SAR Technician Team Lead were unsuccessful. The investigation is focussing on SAR Technician personal life support equipment and the regulations governing rescue activities. ♦



# Epilogue

**TYPE: Glider Schweizer SGS 2-33 (C-FNWO)**

**LOCATION: Pineview Airpark, Kakabeka Falls, Ontario**

**DATE: 06 September 2009**

The accident occurred during a Cadet program glider flight which was part of an approved daily flying program to complete currency checks and winch conversion training prior to the fall gliding program. The occurrence aircraft was crewed by a qualified glider instructor pilot in the back seat and a Cadet Instructor Cadre (CIC) Officer, manifested as a passenger, in the front seat. The occurrence happened on the second launch of an authorized familiarization flight for the CIC officer.

The CIC officer was previously a qualified glider familiarization pilot and had given the occurrence pilot a famil flight several years prior; however, it had been two years since the passenger last piloted a glider. The passenger had wanted to re-qualify as a glider pilot in the future and hoped that the famil flights would provide some exposure to glider flying again.

The Flight Safety investigation focussed on training processes, decision making and the influence of the passenger's previous experience on the pilot's assessment of passenger's current abilities. The investigation found that in consideration of the passenger's previous experience and qualifications, the instructor pilot conducted the flights as impromptu training missions, without the appropriate approval or proper pre-flight instructional briefings. However, it was also determined that there was no defined syllabus in place for either a familiarization or demonstration flight with set limitations when a passenger may take control of the glider. The passenger was also allowed to calculate the glider's take-off weight and center of gravity without

confirmation by the pilot. The passenger's calculations were inaccurate and underestimated the glider's weight.

During the first flight, the instructor pilot gave control of the aircraft to the passenger only while at altitude. However, on the second flight, and with strong encouragement from the pilot, the passenger was given control for the take-off, circuit and intended landing. The passenger's technique, combined with the glider's heavier than normal weight and a forward centre of gravity, resulted in a sub-optimal climb and a height of only 850 feet above ground level at rope release. The passenger did not attempt to modify the circuit and no direction was given by the pilot

to do so. The passenger, now feeling uneasy about continuing to fly, relinquished control to the pilot on the base leg. By now the glider was well below the proper final approach altitude. The pilot elected to conduct an off-field landing requiring a turn of 90 degrees to the right at low altitude. During the steep slow-speed turn the wing tip contacted the ground, destroying the glider and seriously injuring both occupants.

The investigation recommended that a formal syllabus for familiarization and demonstration flights with limitations on when a passenger may have control of the aircraft be developed and implemented. ♦



## 2010 SICOFAA Award Winner – 14 Wing Greenwood Flight Safety Team



**Left to right: WO Max Pennell (D/WFSO), Major Carl Rioux (WFSO), LGen André Deschamps (C Air Force), Col James Irvine (WComd), WO Yvan Lévesque (D/WFSO), Major Stéphane Racle (Wing Air Weapons Officer)**

14 Wing Greenwood is one of the highest operational and training tempo Wings in the Canadian Air Force. Flying activities include search and rescue (SAR) and transport CC130 operations, *Cormorant* EH101 SAR and medivac Helicopter and Long Range Maritime Patrol on the CP140 *Aurora*. Supporting those operations are Operational Training Units, an Air Maintenance Squadron, civilian and Military technicians and a myriad of support personnel. The coordination of a Flight Safety Program which encompasses all these activities, all while in a high operational tempo, including overseas deployments, is no easy task. The 14 Wing Flight Safety Team has met and exceeded this challenge resulting in a Flight Safety Program which is considered by the Air Force Operational HQ as the exemplar for all other Air Force Wings to emulate.

The 14 Wing FS Team has excelled in their leadership by their unwavering commitment and determination to foster a FS culture where every Military and civilian personnel in operational

and support facets at 14 Wing is motivated to do their part in Flight Safety. No other CF Air Wing has so successfully influenced Wing personnel so pervasively. Every personnel facet of the Wing, from Flight Feeding to the Aircrew, is clearly committed to their participation in FS and mission accomplishment.

This outstanding Wing FS culture was impressively manifest on Flight Safety and Air Weapons Safety Surveys conducted on behalf of the Air Division Commander. All 14 Wing personnel consider themselves as critical to mission accomplishment through FS practices and leading by example. Personnel discernibly demonstrate both the individual and team collaborative FS approach to every activity and the dividends were obvious from FOD awareness to assertive approaches to identify hazards and risks.

Air Weapons Safety practices are also pivotal to the success of LRP, SAR and ramp safety of personnel. Typifying the Wing FS Team's proactive approach to safety is the provision of Air Weapons Awareness briefings to all personnel on the Wing. The inclusion of support personnel into the FS and Air Weapons Safety program has not only paid dividends on the Air

Canada is a member of an international aviation association called SICOFAA. This is a Spanish acronym for "The System for the Cooperation of the Air Forces of the Americas." This organisation has several sub-committees which meet on an annual basis to discuss aviation related issues (training, SAR, Flight Safety, technology, medicine, etc). Each year SICOFAA provides a deserving unit within their individual air force.

Base, but also in the local community where flares and markers wash up on public beaches. With this knowledge, civilian and military Wing personnel have mitigated numerous dangerous incidents.

The 14 Wing FS Team has distinguished themselves by passionate leadership in transforming 14 Wing into a truly embedded, systematic and integrated FS Culture within mission accomplishment. The FS Team's accomplishment is inspiring for Canadian Forces personnel and epitomizes the achievement of a holistic Flight Safety vision.

In recognition of this outstanding achievement, the Officers and Non-commissioned members of the 14 Wing Greenwood Flight Safety Team are deserving of the 2010 SICOFAA Flight Safety Award. ♦