National Defence | Défense nationale

Flight Comment

ISSUE 1, 2019

DOSSIER
The Invisible Obstacle

CHECK SIX
1954 Harvard/North Star Collision

ON TRACK
The Challenges of IFR Mountain Flying

Canada

Cover – "Office View" – Photo of a CC115 Buffalo taken by Maj Jean-François Dupont from a CH149 Cormorant on 18 May 2015 during a 442 Squadron simulated plane crash exercise on Mount Waddington in British Columbia. The Buffalo dropped SAR Techs on to a glacier and then the Cormorant picked them up when the simulation was over.

Photo: Maj Jean-François Dupont

Flight Comment

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Photo: DND

Views on Flight Safety

by Colonel John Alexander, Director of Flight Safety

The maturation of the Canadian Armed Forces' Flight Safety (CAF FS) program is one which was born out of the early post Second World War years. At the time, we were losing aircraft and personnel at an unacceptable rate. Our country was no longer engaged in war, yet the RCAF was still losing hundreds of personnel a year.

The early years of the FS program focused predominantly upon finding fault. Following an accident, a FS investigation often resulted in punitive measures against the associated member. We've come a long way since then. Now, we seek to identify the factors leading to an accident or incident with the sole purpose of developing preventative measures. Our program's aim is accident prevention, not discipline.

Experience and research have demonstrated that a system where personnel feel free to report incidents before they become accidents, without fearing retribution, increases our understanding of the risks being taken. From this, preventative measures are developed that decrease risks and thereby enable us to avoid the accidents that stop us from doing the work we need to do. The backbone of this shift, from a punitive to a reporting culture, relies on the trust we have earned from our personnel that the information given to flight safety investigators will be considered privileged and that they will be protected from subsequent disciplinary proceedings. Of course, as military members in a Just Culture, we accept that those personnel who willingly violate rules and regulations may be subject to discipline, but these proceedings should never occur at the cost of compromising flight safety privileged information.

The success of this approach is borne out in our flight safety statistics: our current accident rate is at an unprecedented low level.

In fact, our program is now perhaps one of the most advanced in the world. Legislative amendments passed by parliament in 2014 to the Aeronautics Act of Canada, ensure the confidentiality of the source of statements and the statements made during the course of a flight safety investigation. Video or audio of personnel captured by on board recording devices is also privileged under Canadian law.

However, in a recent challenge before the Military Courts Martial, the arguments presented challenged some aspects of the protection afforded to privileged information. During the Court Martial, both defence and prosecuting attorneys requested access to portions of the privileged information in the form of testimony provided to investigators. They also wanted the whole Flight Safety Incident Report to be admitted into evidence. Justice Department lawyers were provided standing at the Court Martial to argue why the admission of these products were not only arguably contrary to law but would be harmful to the open reporting culture of our FS program.

Canadian case law on these types of challenges to independent investigators supports the principles of privileged information and anonymous reporting. In similar court cases, it has been argued successfully that compromising privilege for the purposes of punishing one individual could cause detrimentally more damage in the long run to the investigative process. In these cases, the courts favoured maintaining the privileged nature of the information to prevent greater harm to society.

In the matter before the Military Courts Martial, a decision was never rendered by the Court since a plea was first accepted by the defence.

The Commander of the Royal Canadian Air Force remains committed to the principles of the protections of privileged information in the CAF FS program. These principles underwrite the open reporting culture which is essential to mitigating incidents before they become accidents. Further efforts will be undertaken in the coming months to educate all levels of the chain of command on FS privileged information. These efforts include the introduction of changes to the Flight Safety Manual for the Canadian Forces as well as amendments to enhance the protection of all Flight Safety Reports.

Many other countries and organizations seek to emulate what has taken the RCAF 70 years to develop. The process to defend this privileged information has been educational and has reinforced why we must continue to guard jealously the advancements we have made in our Flight Safety program for all of aviation to benefit.

The Editor's Corner

Welcome to the first Flight Comment magazine of 2019 whose theme has evolved into the underlying message of "Beware of hidden danger."

This magazine presents an interesting case study by Col (Retd) Chris Shelley which focusses on a collision between a North Star and a Harvard over the skies of Moose Jaw in 1954. Although this collision occurred 65 years ago, the lessons learned are still relevant especially considering the similarities to the enclosed FTI about a near mid-air collision in August 2018 between a civilian and military aircraft in Moose Jaw airspace. The theme of "hidden danger" also applies to the challenges of flying IFR in the mountains as presented by Capt Joël Bouchard and to the informative article written by Capt Paul Spaleta about the compatibility issue between LED lights and night vision goggles masking supposedly lit obstructions.

This magazine also presents several articles on the seemingly simple but often misunderstood topic of deviation. Deviations, especially mission-centric ones, are a growing cause factor of flight safety occurrences. They are symptomatic of a stretched yet creative work force; these are dedicated people who are trying to get their work done the best way they can with limited resources of time, equipment and personnel. Unfortunately unauthorized short cuts taken to increase output mean that the tried and true way of doing things is bypassed. Processes that are not standardized weaken our safety system and removes the reliable defences that protect us from the inevitable error.

On a lighter note, in December 2018, before the retirement of one of our senior DFS investigators, I asked Maj Kevin Roberts to leave us with some parting words of wisdom. His article is a practical guide on the wearing of personal protective equipment...in essence, educate yourself, know the risks and wear what you need to protect yourself. His premise is that there's no need to over protect yourself and make your already difficult job that much more challenging.

I recently received an email from Captain Graham Edwards, the Deputy Wing Flight Safety Officer from 19 Wing Comox, who wanted to know how to ramp up his Wing's flight safety promotion efforts. He stated, "Throughout my excessive number of years in, the FS promotion side of things has remained constant, Bulletin Boards, morning briefs, FS Quarterly meetings etc. That said, do you know of any program/innovative ideas that other agencies/Wings use that may help us get the message out in different ways? Any thoughts or info you might have would be greatly appreciated."

Well Graham, I'm flattered that you asked. Overlooking your reference to "excessive"... which also reflects my time in the RCAF, I'll try to answer your question. Although I've toyed with some novel promotion ideas, I will admit that most of mine haven't left the early concept stage. Plus I'm still licking my wounded ego after my great idea of putting our DFS logo on packages of Band-Aids was rejected. Apparently we are in the business of preventing accidents, not patching them up after they have occurred. Oh well.

This is a great opportunity to broadcast the efforts made by Col (Retd) Steve Charpentier (DFS 3) to stream line and update our internal (http://rcaf.mil.ca/en/dfs/flt-safety/fs-main.page) and external DFS websites (http://www.rcaf-arc.forces.gc.ca/en/flight-safety/index.page). Our newly updated manual, the A-GA-135-001/AA-001, Flight Safety for the Canadian Armed Forces (14 Dec 2018), is now available as are the three DFS Crash Scene Hazard Management videos that focus on how to manage crash scene hazards and the personal equipment one should wear at an accident investigation site. These DFS websites offer clear instruction on how to

nominate someone for a flight safety award and they publish the latest flight safety investigation reports amongst others. Since there is a wealth of information here plus lots of links to other great resources, we invite you to visit the site and explore what we have to offer.

Capt Edwards raises a valid point and he also identifies where the source of his inspiration should come from. YOU. This descriptor isn't isolated to RCAF members, it also includes Air Cadets, internationals, retired military personnel and anyone with an interest in Flight Safety. Are you doing something new that promotes flight safety? Can you share your successes with us? We can discuss these ideas in person during our annual flight safety seminar but in the meantime perhaps you can send me your stories or awesome stereographic poster ideas and I'll share them in the next issue of Flight Comment. Hopefully, by sharing your insights, we can collectively revamp our promotional methods and maybe avoid the unseen pitfalls needing plain old Band-Aids.

Claire Maxwell, Major, DFS 3-3,
***Flight Comment* Editor**

Good Show

For Excellence in Flight Safety

Major Yuri Mokievsky-Zubok

On 19 November 2017, while piloting a CF188 Hornet from Omaha, Nebraska to Calgary, Alberta at a cruising altitude of 28,000 feet, Major Yuri Mokievsky-Zubok noticed a growing discrepancy between the number one and two engine RPM and fuel flow gauges. After making the decision to divert to Regina, the number one engine flamed out. Major Mokievsky-Zubok secured the number one engine and attempted to maintain cruise altitude until a slow descent was eventually implemented to maintain a safe airspeed.

Shortly after passing Moose Jaw, the aircraft speed started to increase and, despite the throttle of the number two engine being at idle, engine RPM was varying between 98% and 101%. Moose Jaw was briefly considered as an option to land, but since their fire services were not available on the weekend, Regina was kept as the destination. Due to the calibrated airspeed being approximately 450 knots, the speed brake was now ineffective. By combining high G and a climb to reduce airspeed, Major Mokievsky-Zubok regained speed brake effectiveness and achieved a continued deceleration.

Once configured and navigating directly to Regina, Major Mokievsky-Zubok was alerted to a flaps-off caution which he subsequently cleared with a reset of the Flight Control System. According to the Critical Emergency Checklist, half flaps is to be selected for a single engine landing. However, to prevent unwanted acceleration, Major Mokievsky-Zubok selected full flaps to mitigate the excessive thrust from the number two engine still at military power. Approximately two nautical miles from touch down the number two engine throttle became responsive and a successful landing was achieved. Had the number two engine not become responsive upon landing, idle cut-off, with a backup of depressing the fire light, was considered for securing the runaway engine. The likelihood of departing the runway as a result of losing main brakes, nose wheel steering, and blown tires was considered very likely and an ejection was considered highly probable.

Photo: Cpl Manuela Berger

When faced with challenging compounding emergencies, Major Mokievsky-Zubok calmly and professionally demonstrated a superior understanding of the CF188 Aircraft Operating Instructions and skillfully executed a safe landing thus directly preventing the loss of an aviation resource. Major Mokievsky-Zubok is most deserving of this Good Show award.

Good Show

For Excellence in Flight Safety

Second Lieutenant Karl Henike

On 15 March 2018, Second Lieutenant (2Lt) Karl Henike, an air traffic controller (ATC) under training, was on shift at 8 Wing Trenton providing air traffic services to a Super King Air that was performing visual approaches. The CT145D Super King Air was piloted by a student pilot under the supervision of an instructor pilot.

After several approaches, the student pilot attempted a flapless landing. As the aircraft neared the runway while on final, 2Lt Henike cleared the Super King Air for the touch and go and then attempted to visually verify that the landing gear was down. Unable to verify its position, he grabbed a pair of binoculars and confirmed his suspicion that the gear was not down. At approximately 200 feet above ground level on final approach, 2Lt Henike radioed the pilots to tell them their gear was up. The crew immediately aborted their approach and completed an overshoot.

To coincide with procedures followed by ATC at civilian airfields, military ATC has dropped the verbal requirement to request that a pilot acknowledge selection of their landing gear. Thus the Manual of Air Traffic Services and the 8 Wing ATC orders do not require that ATC request landing gear checks as part of a landing clearance.

Had 2Lt Henike not remained calm and acted swiftly, it is possible that the Super King Air would have landed with its gear up, resulting in damage to the aircraft and runway. His focus and measured reaction to this event prevented the loss of Canadian Forces assets and potential injury or loss of life. For his actions above and beyond normal duty and his demonstration of exemplary professionalism, especially considering his training status, 2Lt Henike is highly deserving of this Good Show award.

Photo: Cpl Zebulon Salmaniw

For Professionalism

For commendable performance in flight safety

Captain Glenn Scott

On 26 Oct 2017, while leading a two-ship formation mission in the CT155 Hawk over the city of Moose Jaw, SK, Captain Glenn Scott demonstrated outstanding airmanship when his wingman had a significant in-flight collision with multiple flocks of birds. Capt Scott's quick decision-making and superior leadership was responsible for averting what could have been disastrous for his formation and a potential threat to the citizens of Moose Jaw.

Capt Scott was leading his student solo pilot wingman back to base in close formation at 1500ft above ground level. They were in the traffic pattern performing a close formation turn when his wingman announced he had suffered numerous bird impacts. Capt Scott immediately instructed his wingman to move into a loose formation to create a safe maneuvering area. The wingman then said that his forward visibility was severely restricted. Capt Scott quickly instructed the student pilot to move to a position in front, allowing him to do a visual assessment of his aircraft and confirmed that his nose cone was damaged. This damage was causing multiple instrument failures and a continuous beeping sound, preventing the student pilot from using his flight instruments and adding to the excitement. When Capt Scott noticed his wingman was descending, Capt Scott told him to "Climb." Seeing no change to the flight attitude, Capt Scott instructed, "PULL UP," resulting in the student pilot taking corrective action and pulling up in a safe vector away from the ground. Recognizing the requirement to retake lead to guide his wingman back to safety, Capt Scott then lead the formation back for the landing approach; jockeying positions to provide the student flyable references to remain safely on his wing. Understanding the challenging conditions for the solo student, Capt Scott smoothly led him in the descent and onto the runway centerline, advising him to call when visual with the runway. Once comfortable with the student's ability to land safely, Capt Scott separated and safely flew around the pattern to reconnect with his wingman on the ramp.

Capt Scott's ability to quickly recognize the severity of the situation and to remain calm throughout, prevented possible aircraft loss and a possible ejection over the city of Moose Jaw. Capt Scott's display of leadership and airmanship makes him truly deserving of this For Professionalism award.

Captain Adam Rietman and Corporal Gordon Legarie

Photo: Cpl Joey Beaudin

In April 2018, during pre-flight checks on a CC115 Buffalo, the flight engineer, Corporal Gordon Legarie, noticed the weight was almost one thousand pounds lighter than another aircraft he had flown in earlier. Cpl Legarie brought this information to the attention of the aircraft commander, Captain Adam Rietman, and both crew members proceeded to investigate the weight discrepancy. By diligently comparing the weights of other aircraft in the fleet, they identified a 705 pound calculation error which incorrectly decreased the aircrafts actual basic weight. The investigation concluded that the error had remained unnoticed for over two months during which the aircraft had been signed out eighteen times and flew 248 hours.

By identifying the error, Cpl Legarie and Capt Rietman rectified a dangerous situation by preventing overweight takeoffs and landings and possible exceedances of maximum zero fuel and all-up weight limits.

Cpl Legarie and Capt Rietman's dedicated pursuit to determine the cause and correct the weight discrepancy that so many others had missed, makes them deserving of this For Professionalism award.

For Professionalism

For commendable performance in flight safety

Master Corporal Jessie MacIlroy

Photo: DND

Master Corporal Jessie MacIlroy is an Aviation Systems Technician from 400 Tactical Helicopter Squadron in CFB Borden and was deployed to British Columbia from August to September 2017 in support of Operation LENTUS 17-04. When completing a 25 Hour airframe inspection on a Griffon helicopter, MCpl MacIlroy went well beyond the normal scope of his duties to discover the cause of high vibrations that were being reported by aircrew but not considered out of tolerance by the onboard Health Usage Monitoring System. MCpl MacIlroy's attention to detail led him to identify a very small movement taking place on what is supposed to be a static pivot bearing hub on the main rotor head. This undesired movement was magnified under flight load and significantly compromised the airworthiness and safety of flight for Griffon CH146454.

The attention to detail and superior technical acumen displayed by MCpl MacIlroy throughout his time in theatre on Op LENTUS and specifically in relation to this unserviceability, warrants acknowledgement and recognition. New to his rank, he is already demonstrating an outstanding technical aptitude and leadership traits and has played a key role in the success of Op LENTUS by promoting the safety of the aircraft and welfare of the flight crew. It is for these reasons that makes MCpl MacIlroy very deserving of this For Professionalism award.


Photo: Cpl Louis Gagné

Corporal Jason Chiasson

While performing maintenance on aircraft CF188783 (Hornet) during Op REASSURANCE, Corporal Jason Chiasson uncovered an issue with the use of a sealant product for a high-voltage component. Cpl Chiasson noticed that the identification number of the locally available sealant product was not in compliance with the technical publications. The required sealant needed to contain a fire retardant, whereas the one available contained none. His professionalism and attention to detail made it possible to avoid using a product that posed a flight safety hazard. Following his discovery, Cpl Chiasson continued his investigation and checked for other faulty products within our squadrons and in our deployment supplies. Those additional verifications made it possible to eliminate this hazardous situation on the other CF-18 aircraft.

Cpl Chiasson's preventative actions are completely in line with the Technician's Creed and serve as a perfect example of professionalism, thereby earning him the "For Professionalism" award.


Photo: Cpl Trevor Matheson

Corporal Jeffrey Stevens

In June of 2018, Corporal Jeffrey Stevens, an aviation technician with 413 Transport and Rescue Squadron, was tasked on a Mobile Repair Party to change the #2 propeller on Hercules CC130343 in Deer Lake, Newfoundland. While rigging the propeller, he noticed a loose bolt in the engine valve housing. The bolt's nut was barely positioned on the threads and threatened to come loose with the vibrations from the engine. Had the nut come off it would have gone into the valve housing potentially causing serious damage within the propeller controller assembly leading to the loss of propeller control.

Cpl Stevens stopped the work on the propeller, removed the valve housing cover, torqued the loose bolt and verified the torque on the rest of the valve housing bolts. These bolts are not part of the propeller rigging task and all but one of them are obscured by the valve housing cover making them very difficult to see.

Cpl Stevens' keen attention to detail in noticing the loose bolt and his initiative to rectify the issue prevented costly damage and operational delays. Cpl Stevens' meticulous work and his professional attitude towards safety make him highly deserving of this For Professionalism Award.

For Professionalism

For commendable performance in flight safety

Mr. George Giesbrecht

Photo: Capt Corey Csada

On the 21st of August 2018, Mr. George Giesbrecht, a pilot with Provincial Airways in Moose Jaw, Saskatchewan, demonstrated exceptional airmanship when he prevented a potential mid-air collision between his Thrush agricultural applicator aircraft and a CT155 Hawk military training jet that was flying in the vicinity of Moose Jaw.

The weather was VFR, however, smoke from forest fires was causing a reported reduction in visibility of four to six statute miles. Mr. Giesbrecht had just finished an aerial application over some farm fields to the west of Moose Jaw. He was descending from 5,500 through 4,500 feet above sea level (ASL) in an eastbound return to Moose Jaw Municipal Airport when he observed a Hawk jet at 4500 ASL approaching slightly from the right of head-on. Mr. Giesbrecht immediately rolled left while deploying a smoke trail in an effort to make his aircraft more visible. The student pilot in the front seat of the Hawk spotted the smoke trail just right of centre in their windscreen and immediately rolled to the left just prior to the two aircraft crossing paths. Both aircraft returned safely to their respective home airfields without further incident.

Mr. Giesbrecht's ability to recognize that another aircraft was on a collision course with him, partnered with his immediate innovative action to use smoke to draw attention to himself certainly contributed to the collision being avoided. The ability to recognize risk and then skillfully act to avoid it shows Mr. Giesbrecht's proficient knowledge of his aircraft, the environment in which he flew and its associated risks.

The Royal Canadian Air Force Directorate of Flight Safety would like to commend Mr. Giesbrecht for his exceptional airmanship. Mr. Giesbrecht is most deserving of this flight safety For Professionalism award.

DFS

Commendation

The DFS Commendation recognizes outstanding professional long-term performance and dedication in the field of Flight Safety. The DFS Commendation is awarded to the following deserving individuals who, through their actions, have contributed significantly to enhance the capability of the FS Program across the CAF and who emulate the values and ethos promoted by the Program.


Photo: Cpl Vincent Carbonneau

Maj (Retd) Pierre Sauvé


Photo: DND

Maj (Retd) Carl Rioux

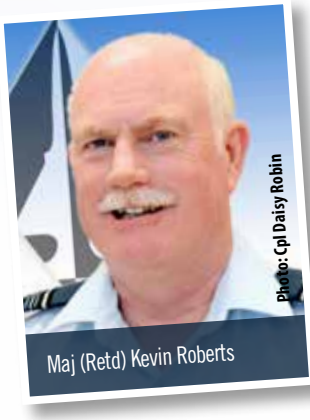


Photo: Cpl Daisy Robin

Maj (Retd) Kevin Roberts


Photo: DND

Capt (Retd) Mike 'Ruggy' Wolter


Photo: Cpl Carbonneau

Maj (Retd) Barry Devereux

From the Flight Surgeon

Docs Corner: The Normalisation of Deviance

by Dr David Stevenson, RAF Centre of Aviation Medicine

I recently read Sqn Ldr Tim Davies' excellent article 'Normalisation of Deviance' in AirClues Issue 20. Then I left for my holiday in the USA. During the six hour drive from my parents' home to Cape Cod, driving at the speed limit of 55 mph with 99% of drivers zipping past me at MACH 0.8, I had an opportunity to reflect on the concept of the 'normalisation of deviance'.

By the way, after an hour or so, I joined the deviants at 65 mph, this after seeing signs in road works stretches stating that, 'Speed Limits Strictly Enforced in Works Areas'. Does this imply, I thought, that the speed limits are not strictly enforced outside of works areas? Is this state sponsored connivance – normalization of deviance?

As I eased my speed up to 65-70 mph, I reflected that I was participating in normalisation of deviance (from the lawful speed limit). In life, there are thousands of 'rules' to which we are exposed on an almost daily basis. To list a very few:

- Keep both hands on the wheel at 2 and 10 o'clock – concentrate entirely on driving for the duration of the trip don't change the radio station, daydream, or play 'I Spy' or attend to the screaming three year old child in the back seat.
- Obey speed limits scrupulously.
- Don't ever eat junk food.
- Don't give dummies to toddlers.
- Always read the terms and conditions before clicking 'Accept' or 'Agree'.
- Wear your seat belt, bicycle helmet, motorcycle helmet at all times.
- Always come to a complete stop at every stop sign and every red light.
- Always eject your USB device before removing it from the computer.
- Don't use Wikipedia or believe news outlets or politicians – only rely on rigorous, scientifically proven fact.
- Don't drink more than twelve units of alcohol per week.
- Don't ever eat junk food (2).
- Eat more fruit and vegetables.
- Exercise half an hour five times a week.
- Don't jump queues.
- Always wash your hands before you eat; brush your teeth after every meal.
- Don't ever eat junk food (3).

It further occurred to me that many of these are 'cover your ass' rules to put the blame on the perpetrator if something bad happens. If I am driving faster than 55 mph, it is my fault if I crash. If I eat junk food and become obese, it is my fault and I deserve whatever bad health outcomes happen to me. If I drink more than twelve units a week, I am an alcoholic, and likewise deserve whatever happens to me – I am an evil person who is a drain on the NHS and the nation.

One way of dealing with the multitude of spoken and unspoken rules of society is simply to ignore them. This becomes 'normalisation of deviance' if lots of people do this. My experience of British drivers (and their mobile phones) and the levels of attendance at pubs, McDonald's and Burger King confirms that this is the course of action which many people take.

The point is that when we routinely ignore rules in everyday life, it is simple to make everyday life work in a semblance of a liveable and efficient way, and we come to accept 'normalisation of deviance' as a normal practice. We become comfortable with it because it becomes so commonplace, even necessary to get on with life. The norm is 'obedience is optional'.

Then we join the military.

In the military, SOPs are not written to cover the authors' asses. They are written because time, expertise and experience have shown that there is a particular, specific, best practice way to get things done properly, and that deviation from those practices can result in real disaster. There is a highly specified way to service a jet engine properly; deviation from procedures is not, in any way, optional.

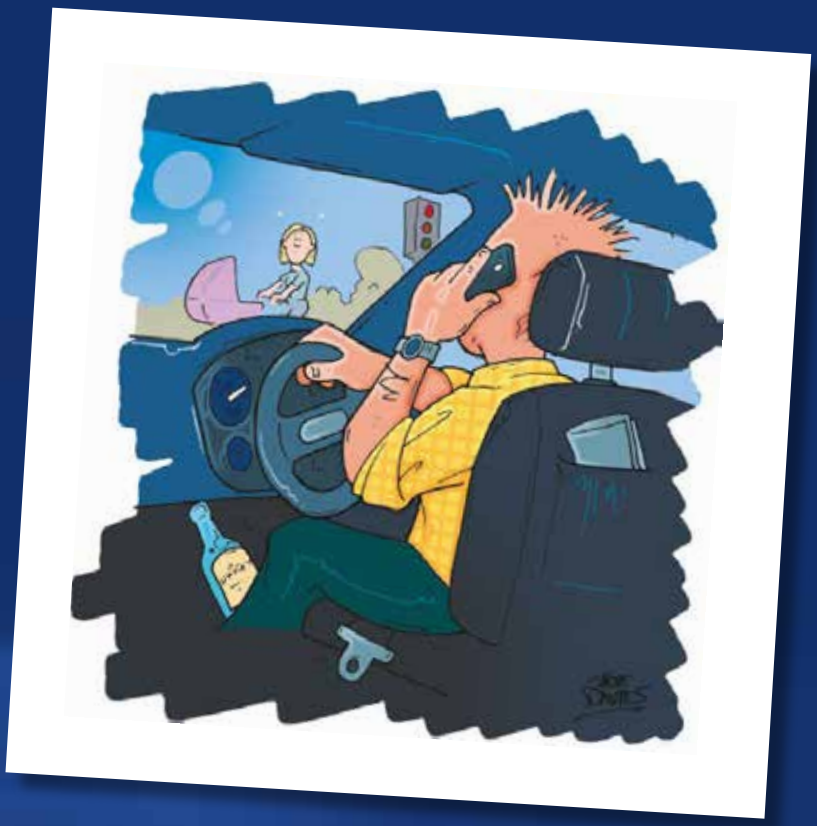
Regulations are likewise written after much expert discussion and consideration, and specify precisely how things are to work in the most efficient way to effectively accomplish a mission. Military people expect other military people to obey procedures and regulations, and thus know what to expect in other people's actions. Obedience is not optional; if you do not want to live under regulations, do not join the military. If the regulation is unfit for purpose, we don't ignore it. We employ institutional methods to change the regulation.

Well, that's the theory.

The real problem is that we become so used to normalizing deviancy in civilian life that it is easy to allow this practice to slip into the way we approach our military duties. We may even consciously or subconsciously justify our behaviour to ourselves: the task is highly demanding, we have too little time to accomplish it, we are fatigued and stressed. However it remains grossly inappropriate. For a whole host of reasons, military activity depends on people following procedures and regulations without deviation.

That said, I recognise that there will be occasions, especially during operations, when reality demands initiative and creativity in order to deal with novel situations, perhaps outside the regulatory framework. This is, however, not normalisation of deviance - it has not become normalised, it is a recognised exception. It is for this reason that we have the Duty Holder system and a hierarchy of Engineering Authorisations which allow decisions to be made and risk to be elevated to the correct levels. Proper use of these systems allows flexibility in dealing effectively with challenging real world situations; they allow us to maintain the 'Box of Standards' principle – our authority has a limit so we may need somebody with a higher level of authority to approve a non-standard course of action.

My closing thought is that, in the military environment, we must be vigilant about being indulgent and allowing ourselves to slip into the normalisation of deviance environment; we must stay within our 'Box of Standards'. When I look back on my 21 year career in US Air Force medicine, I take great pride in the fact that I did my job well working within the regulations. Most of the time.



IMPORTANCE OF AN IMPARTIAL FLIGHT SAFETY INVESTIGATION

by Colonel (Retired) Chris Shelley, C.D.

Chris Shelley joined the Canadian Forces in 1973. After graduation from Royal Military College he trained as a pilot, flying some 3800 hours with 424 Squadron and 408 Squadron on CH135 and CH146 aircraft. He flew on operational deployments in Central America (1990) and Bosnia (2001). He commanded 408 Squadron and 1 Wing before serving as Director of Flight Safety from 2006 to 2008. Retired since 2008, Chris retains a lively interest in aviation history and flight safety.

Fatal accidents were commonplace in the RCAF of the 1950s. Casualties usually numbered in the ones or twos and consequences were limited. Exceptionally, an accident could leap onto the front page, exposing the RCAF to public scrutiny and attacks from other government departments jealous of its voracious appetite for tax dollars. In the realm of flight safety, investigative techniques were well-developed, but there was little support for a systemic analysis of failures and the independence needed for a forthright assessment of an occurrence was tenuous. Boards of Inquiry (BOI) were susceptible to command influence despite the best intentions, and confidence in the outcomes was not always high. A serious accident from April 1954 gives an example of the challenges the RCAF faced in that era.

At 1002 hours, 9 April 1954, an RCAF Harvard collided with a west-bound Trans-Canada Airlines (TCA) North Star at 6000 feet above sea level (ASL) over a golf-course on the north-east corner of Moose Jaw, Saskatchewan. 36 people aboard the two aircraft and one person on the ground died. This aerial collision, the worst Canadian air accident to date, unleashed parallel terrestrial collisions that reverberated within Canada and the RCAF for many years. The RCAF went on the defensive immediately, reeling from attacks in the national media that it cared little for safety and that its aircrew were irresponsible cowboys. RCAF stations across the country received hate mail. In Moose Jaw, citizen support for the newly reactivated air base vanished overnight. Inside government, the Department of Transport (DOT) attacked the RCAF's expansion plans as being ill-considered and reckless. The rapidly growing RCAF, consumer of over 50 percent of the defence budget, was in danger of going from "hero" to "zero" in the public eye. Amid this emotional background investigators struggled to determine the facts and how to prevent a recurrence. The results were far from pretty.

Moose Jaw had been a quiet prairie city until the Second World War, when the establishment of a Royal Air Force (RAF) flying school south of town had brought the growl of the Harvard (Figure 1) to its skies. In 1945 the station closed and lay dormant until 1953 when the rapidly expanding RCAF reactivated the station as a training base for RCAF and NATO pilots. Moose Jaw was one of three Flying Training Schools (FTS) established to push the RCAF to its post-war strength of

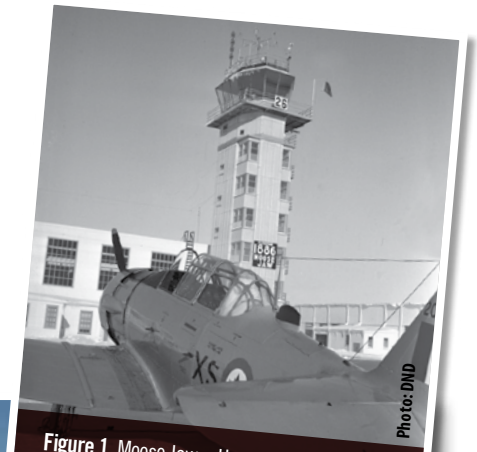


Photo: DND

Figure 1. Moose Jaw – Harvard – 1958

Photo: DND

Figure 2. Moose Jaw – Harvard – 1956

50,000 and to train rapidly expanding NATO air forces. The RCAF spent millions on new barracks, messes and ground training facilities. Designed to graduate 40 NATO pilots every six weeks, the new station was flooded with RCAF and NATO personnel and their families. As new married quarters were not ready, airmen and their families overwhelmed available housing, spilling over into neighbouring towns and Regina, driving up rents and displacing locals. When 2 FTS opened in May 1953 Moose Jaw experienced an economic boom as the skies above filled with yellow Harvards (Figure 2). Yet, the RCAF was not universally welcome; residents complained of the noise, overflights of the city, economic inflation and competition for housing brought on by the arrival of the RCAF. Relationships between the city and the base became tense and conflicted.

Photo: Canadian Aviation and Space Museum

Figure 3. North Star CF-TFC

On 9 April 1954 the two aircraft destined to meet in the skies over Moose Jaw prepared to leave the ground. Harvard Mk II 3309 was a veteran that bore the scars of almost 3900 hours of student instruction. Transferred to Moose Jaw from Gimli in August 1953, 3309 had been damaged seven times in the previous two years by ham-handed students, suffering dinged wing-tips, ground loops, and a wheels-up landing. On 9 April, an RAF student signed out 3309 for a solo Navigation Exercise #9, which required the student to take-off, climb to a safe altitude and then continue climbing north-east to 9000 feet ASL for the first leg. The RAF student had 116 hours in his logbook, and was considered by all to be conscientious, responsible and talented. At 0957 hours, Harvard 3309 took off on runway 13 Left, then turned right to a heading of 138 degrees magnetic to climb on course towards the first turning point at Raymore, Saskatchewan.

CF-TFW was a Canadair North Star (Figure 3) airliner with a crew of four and thirty-one passengers. A Canadian variant of the Douglas DC -4, powered by four Merlin engines, the unpressurized North Star was restricted to low-level air routes as it made its way from Winnipeg to Vancouver. Its captain had been with TCA since 1940, with over 11,000 flying hours and an impeccable reputation. The first officer had over 1700 hours. Following the Green One airway, the North Star flew westbound at 203 knots, level at 6000 feet ASL, aiming to skirt the northern edge of Moose Jaw. Harvard 3309 continued its transit over the city heading northeast, climbing through 6000 feet ASL as it reached the edge of the Green One airway.

At 1002 hours, the climbing Harvard struck the westbound North Star's port outboard engine, tearing open the fuselage and severing the vertical stabilizer. Both aircraft broke apart in the air and fell to earth, scattering debris over a two-mile area. The main wreckage of the Harvard fell on the golf course on the northeast edge of town. The stricken North Star shed large pieces of debris which fell within the built-up areas of the city, some of it narrowly missing a public school. All 36 people onboard both aircraft were killed, and one person on the ground died when debris from the North Star demolished the house where she worked.

The noise of the collision and the falling wreckage caused widespread panic. Citizens rushed into the streets, milling about in clusters around debris and bodies that had spilled out from the North Star. Emergency vehicles found their routes blocked by the crowds, requiring police to restore order before fire trucks could reach the blazing houses. Much evidence was disturbed before it could be secured by the police and by RCAF. The Moose Jaw armouries became a temporary morgue and RCAF personnel relieved the overtaxed police force as guards on the wreckage pending the arrival of the investigation teams.

News of the air disaster spread quickly over the news wire, accompanied by lurid headlines, rampant speculation and fanciful sketches purporting to show the fateful collision (Figure 4). One witness swore that the Harvard had been on fire for at least a mile prior to hitting the North Star. Another claimed that the North Star, "rained bodies like a lawn-sprinkler," as it fell. "37 Deaths Caused by RCAF Ignoring Warning – Moose Jaw," screamed one headline, citing the Mayor of Moose Jaw's complaints to the RCAF about Harvards flying over the city. "Flaming, Sky-borne Disaster Missed 390 Pupils by 100 Yards," blared another, and indeed aircraft wreckage had fallen within 100 yards of the Ross school. As if one tragedy weren't enough, the third mysterious disappearance of a De Havilland Comet jet airliner occurred on the same day, providing more air disaster fodder for the newspapers, and raising public anxiety to even greater levels. But more was to come.

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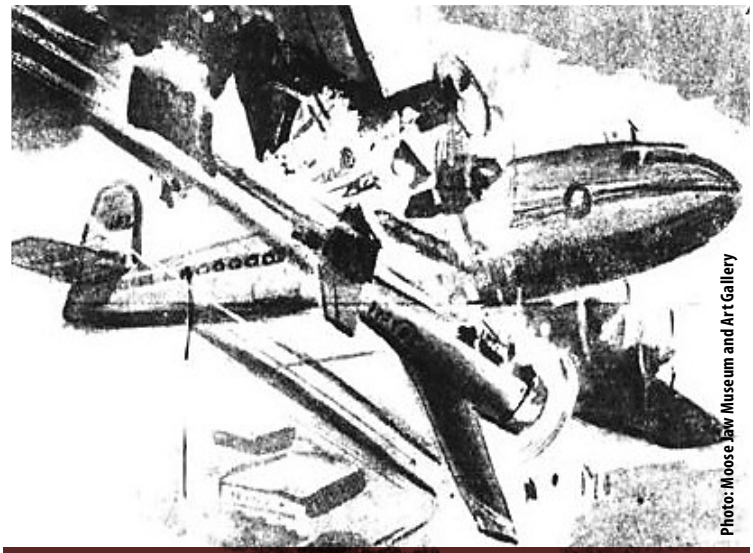

Photo: Moose Jaw Museum and Art Gallery

Figure 4. Sketch – Harvard and North Star Collision

National newspapers gave full voice to accusations painting the RCAF as the villain of the piece. Captain A.R. Eddie, Managing Director of the Canadian Airline Pilots' Association maintained that it was, "a tragic and expensive error to locate military airports on the airways." Eddie urged that RCAF stations be moved to remote areas, since, "there is no question but that ambitious student pilots are subject to the normal tendencies of headstrong carefree youth...after acquiring a mere smattering of elementary flying technique, they are given high-powered toys in which some of them roar about unpredictably in the atmosphere... The fact that they are frequently found on the airways results from the (presumably political) decision to locate military airports on the airways." Numerous others accused RCAF pilots of "buzzing" airliners, claiming that such events were commonplace across the land.

Public furor grew even as the RCAF and the DOT launched separate BOIs to determine the facts. The RCAF and DOT leads arrived in Moose Jaw on 10 April, in time to attend a public meeting held for citizens to voice their concerns. The Mayor, who might have been a voice of calm, instead riled the assembly by accusing the RCAF of ignoring pleas from the city to stop overflights. Citizens present claimed that Harvards flew, "low and noisily and dangerously over the city centre," and a city councillor stated that he had seen planes "stunting" over the centre of the community, "not just singly, but in formation." Others cited frequent appearances of Harvards over the city hospital as another source of danger and annoyance. A less hysterical council member (former RCAF) advised caution. It had yet to be established that the point of contact between the two aircraft had been over the city. While part of the North Star had fallen on a house, most of the wreckage lay scattered over the Willowdale Golf Course.

Amid demands that the RCAF and the DOT "do something to guarantee that such a tragedy should not occur again over the city," a councillor reminded the citizens of their own role in bringing the RCAF to the city. "We brought the RCAF here in the first place, during the war. When it was later taken away, we asked for it back. We got it. When we did it, we took a calculated risk. I do not entirely agree that the RCAF hasn't prevented planes from flying over the city. There are fewer planes over us all the time."

The councillor went further. Moose Jaw citizens, "cruelly curious," had blocked every street in the area. "They did not act as they should. They should be ashamed of themselves because the emergency trucks were blocked."

The lead of the DOT inquiry addressed the meeting, explaining the investigative process and explaining the relevant regulations. While neither RCAF nor DOT representatives speculated about the accident, events would show that public reactions and pressure had set the two government agencies against each other already. The blame game had begun in earnest.

The RCAF and the DOT Boards sat separately but exchanged observers to track the deliberations of the other. TCA supplied each BOI with technical information to establish the sequence of events. The mandate of the RCAF and DOT boards was to establish what had happened, who was responsible and what ought to be done to prevent a recurrence. No mechanism existed to establish a single, unified inquiry short of establishing a Royal Commission. Unfortunately, public furor and the differing missions of each agency virtually guaranteed that each BOI would arrive at different findings and recommendations. The RCAF needed to retain public support for its massive buildup, while DOT aspired to build public and industry confidence in the growing field of commercial air travel. The press looked forward to the BOI reports with anticipation.

The facts seemed straightforward. The RAF student pilot had been flying a serviceable aircraft on an authorized navigation exercise. Numerous witness statements allowed the investigators to dismiss accusations that the Harvard had attempted to "buzz" the North Star. Similarly, the assertion that the Harvard had been on fire prior to the collision had no foundation. TCA's analysis confirmed the Harvard had been in a level climbing attitude, and the North Star in stable level flight in the minutes before the collision, with a relative angle of 45 degrees to each other. The RAF student was given an excellent character by his course mates and instructors, which his course records confirmed. Similarly, the TCA crew had been properly qualified and well-experienced. The North Star had been serviceable. The damage to both aircraft had been catastrophic. Although the collision had happened over the golf course, portions of the North Star's wreckage had fallen south of the impact point, causing damage and one fatality on the ground.

Why had the aircraft collided? Both RCAF and DOT boards agreed that physical evidence and witness statements supported a conclusion that neither pilot had seen the other's aircraft. As the weather had been VMC, each pilot had been responsible to "see and avoid" the other. Clearly, this had not happened. There was no radar advisory, and the North Star had not contacted Moose Jaw tower for traffic information, nor had the crew been required to do so. The Harvard had been climbing with a ground speed of 128 knots and its pilot should have had an adequate field of view. However, the student pilot may have been occupied with a map or aircraft instruments and thus neglected lookout.

"While neither RCAF nor DOT representatives speculated about the accident, events would show that public reactions and pressure had set the two government agencies against each other already. The blame game had begun in earnest."

The North Star crew would have had to look below the horizon on their port side to see the climbing Harvard, which may have been obscured in the city's background and perhaps blocked by the left-hand cockpit window post.

Assigning blame was more contentious. When the tracks of the Harvard and the North Star were mapped, it was clear that the North Star had been to the right of the Harvard as the aircraft converged. Thus, the Harvard was required to avoid the North Star and ought to have altered course to the right. This put the "blame" solely on the RAF trainee pilot, as there was no evidence that he had altered course prior to the collision. The DOT was happy with this conclusion; the RCAF was not. RCAF reviewers pointed out that the North Star had two pilots, the Harvard only one. The North Star had been in level cruising flight, so its pilots would have been free to maintain a sharp lookout. Moreover, the North Star crew had flown the route many times and knew they were approaching a busy RCAF training base. Surely the North Star crew ought to have maintained a more vigilant look out, or at least have contacted Moose Jaw tower for traffic information? (They had not). Surely, the RAF pilot could only be blamed if he had seen the North Star and then failed to alter course to avoid it. The RCAF concluded that the trainee pilot had never seen the North Star, so the issue of altering course was a red-herring. Instead, senior RCAF officers maintained that the North Star crew's actions had been questionable in flying along the airway at a low altitude (4,000 feet AGL) near an RCAF training base.

DOT disagreed. It shared the opinion of the Director of the Canadian Airline Pilots' Association that the RCAF had been reckless to locate a training base close to an airway, giving a sense of inevitability to the accident. DOT concluded the RCAF had wanted to realize "salvage value" by reactivating wartime airfields despite their proximity to existing airways. The DOT recommended that Moose Jaw be closed and that the RCAF not have training bases close to any airway. It considered that the Harvard pilot had been negligent by climbing through the airway at altitudes where there was likely to be traffic and that it had been the Harvard pilot's responsibility to avoid any traffic in the airway.

Public furor continued to build while the inquiries deliberated. Hate mail arrived at RCAF stations across Canada, accusing RCAF aircraft and pilots of gross negligence and a happy-go-lucky disregard for human life. RCAF members in Moose Jaw noted bitterly

Continued on next page

that at a public memorial service the Premier of Saskatchewan had not mentioned the RAF trainee who had lost his life, focusing solely upon the civilian casualties despite the presence of many RCAF personnel. It seemed as if the divide between the RCAF and the city was growing larger, even as across the nation citizens questioned whether the RCAF was worth the tax dollars being lavished upon it.

The results of the investigations were contentious. The RCAF BOI concluded that the accident had occurred because neither the pilot of the Harvard nor the crew of the North Star had seen the other aircraft. It found that the RAF pilot trainee had violated the standing order to not overfly the City of Moose Jaw and had failed to yield right of way to traffic in the airway. The RCAF Board recommended that the Green One airway be moved farther north of Moose Jaw to lessen the chance of a conflict between aircraft from the RCAF station and civilian traffic. The RCAF did not accept DOT's recommendation that RCAF stations be moved; after all, RCAF Stations Rivers, Portage, MacDonald and Moose Jaw were all busy training bases and all located very close to the Green One airway. Air traffic density was increasing across Canada, not just near RCAF bases. Other solutions to congestion ought to be found.

The DOT BOI blamed the collision on the RCAF Harvard, citing the pilot's failure to yield the right of way, while admitting that the pilot had likely never seen the North Star. It recommended that the RCAF station be relocated farther from the Green One airway (or any airway), stating that "the continued use of [wartime] airfields for training constituted a hazard to other traffic." As preventive measures, it proposed that VFR aircraft crossing airways do so at 500 feet above the cruising altitude appropriate for the direction of flight, level and at an angle of 45 degrees to the airway. It also recommended that an onboard device be developed to warn crews of impending conflicts. Neither recommendation was adopted, although VFR cruising altitudes were eventually amended for cruising flight to allow more separation from IFR traffic, and (spurred by numerous mid-air collisions during the 1950s and 60s) Traffic Collision Avoidance Systems (TCAS) technology became widespread on commercial (and some military) aircraft.

In December 1955, DOT gave in to the inevitable. It re-routed the Green One airway farther north, such that its southern edge was now 14 miles away from RCAF Station Moose Jaw. No RCAF stations were closed or moved.

With inquiries concluded and reports submitted, the RCAF and the citizens of Moose Jaw got on with repairing the damaged relationship between base and city. Tempers flared again when government lawyers answered civil lawsuits by claiming the Crown had no liability, but these claims were settled quickly in out of court settlements. Pilot training continued, and hundreds of NATO pilots went on to advanced flying training in Canada and overseas after gaining their wings. Moose Jaw continued to present an unfriendly face to the RCAF, and airmen complained bitterly about high rents, scarce accommodation and closed doors. The RCAF addressed these issues in several ways. It launched a public relations offensive, opening the base to the public for Air Force Days and flying displays. RCAF personnel involved themselves in community life, working with Cubs, Scouts, Brownies and Guides, Rotary, Kinsmen and all manner of service organizations. Members took part in amateur theatre and musicals, and the RCAF Station hosted an annual RCAF Band competition where locals were invited to come and enjoy the music. RCAF Public Relations officers ensured all these activities got full coverage in the press. Still, it wasn't enough. Clearly, some folk wished the RCAF would close-up and go away. Something further was required.

The RCAF unleashed its ultimate weapon: cold, hard cash! In May 1956, the Station Commander had all station personnel paid in two-dollar bills (Figure 5). Cash was king in 1956; suddenly, Moose Jaw was awash with $244,000 worth of orange two-dollar bills. It did not take long for every landlord, every grocery store, every gas station and everyone in the city to realize what it meant to have an active RCAF station on their doorstep. The stunt received wide press coverage and served as a motivator to put the past behind and build a better relationship for the benefit of all. The city grew to appreciate the RCAF, and vice-versa, and the situation has remained harmonious.

Figure 5. 1954 Two Dollar Bill

In retrospect, the RCAF and DOT BOIs were unsatisfactory in terms of process and outcomes. Clearly, each was influenced by negative publicity and departmental politics when framing findings and preventive measures, and the process was distorted further by the need to assign (and avoid) blame. The RCAF BOI tried very hard to protect the reputation of the RCAF and senior reviewers did their best to point the fingers at the crew of the

Photo: DND

Figure 6. Yellow Peril

North Star. In the end, the chickens came home to roost; the Harvard pilot was deemed responsible and the RCAF had to take its lumps. For DOT's part, expecting the RCAF to relocate its stations was unrealistic compared to the alternative of moving the airway. DOT failed to take a systemic view of the mid-air collision threat in a future where air traffic density was certain to increase dramatically, not just near Moose Jaw, but near all major Canadian centres.

What does this accident from 1954 mean today? In Moose Jaw, the crash is well-remembered, but less so elsewhere. Mid-air collisions remain a threat and the proliferation of unmanned aerial vehicles is presenting new challenges in that sphere. The BOI is no longer used for flight safety investigations in the RCAF, replaced by DFS-led investigations that have more independence and credibility. On the civilian side, public perceptions of a lack of transparency in aviation safety investigations led to the creation of the Transportation Safety Board (TSB) in 1990 as an independent investigative authority for civilian transportation. A Memorandum of Understanding between TSB and DFS exists now to enable a unified approach to a civil/military occurrence investigation, hopefully avoiding the kind of frictions that impaired the progress of safety in 1954. The RCAF enjoys an excellent reputation for safety and professionalism with the Canadian public, but that reputation is imperilled by every accident. The experience of 1954 tells us that the press and the public will bring everything into question at such times; one of the many reasons why the maintenance of safe and effective flight operations is critical to the exercise of national airpower. Accidents affect directly not just those involved but also the institution and even the nation. The payoff for remaining vigilant on safety is just as important today as it was in 1954.

ON TRACK

The Challenges of IFR Mountain Flying

This article is the next instalment of a continuous Flight Comment contribution from the Royal Canadian Air Force (RCAF) Instrument Check Pilot (ICP) School. With each 'On Track' article, an ICP School instructor will reply to a question that the school received from students or from other aviation professionals in the RCAF. If you would like your question featured in a future 'On Track' article, please contact the ICP School at : +AF_Stds_APF @AFStds@Winnipeg.

This edition of On Track is written in response to a question raised about the challenges of IFR mountain flying. The answer comes from Captain Joël Bouchard, ICP Instructor.

IFR Mountain Flying

For many general aviation pilots, the only safe option when flying to a mountainous location is to wait until the weather conditions will allow for a visual flight rules (VFR) flight. Military pilots, however, are regularly tasked to support missions that require the use of their instrument flight rules (IFR) skills in mountainous regions and many unique factors must be considered when planning such a mission. These factors include:

- Complex instrument procedures often requiring visual manoeuvring;
- Higher minimum altitudes affected by altimeter error;
- Higher than usual ceiling and visibility requirements at the destination and alternate;
- Surface winds and winds aloft;
- Density altitude and aircraft performance;
- Weather patterns that include mountain waves, winds through passes, orographic lifting, microbursts and temperature inversions;
- Oxygen use.

When it comes to IFR flying in precipitous terrain, aviators often deal with the challenges of manoeuvring visually during a Specified Minimum Take-off Visibility Departure (SPEC VIS) and/or landing after a Circling Approach. The crew faces the compounded difficulty of flying IFR with significant visual manoeuvring requirements in the most difficult terrain possible.

Night Operations

In preparation for a night mission in mountainous terrain, it is absolutely critical to first identify if visual manoeuvring will be required during any phase of the flight. SPEC VIS departure procedures or Circling Approaches (common in the mountains) are published as a result of obstacles impossible to overcome during the design of the instrument procedure because of excessive gradient or major runway alignment issues. It becomes the sole responsibility of the pilot to visually avoid obstacles during these portions of the instrument procedure.

Unless the aircrew is very familiar with the area, it can be very difficult to safely perform a SPEC VIS departure or a Circling Approach at night. Other than published Airport Restrictions limiting operations to daylight hours only[1], many aerodromes will show a Caution Note in the Canada Flight Supplement (DND GPH 205) advising aircrew not to attempt VFR flight during hours of darkness unless they are familiar with the local area. This note may give little to no warning of the under-lying hazards to the unsuspecting pilot about to undertake visual manoeuvring when IFR at night.

[1] CARS 602.96 (3) (d) Operations at or in the Vicinity of an Aerodrome.

When planning a mission requiring a SPEC VIS departure or Circling Approach at night, it is critical to conduct a careful review of all available publications such as Night Circuit Procedures or Visual Navigation Charts (VNC). Some of these charts will require careful comparison with the instrument procedures during the topographical review.

Specified Minimum Take-Off Visibility (SPEC VIS) Departure at Night

Aircrew attempting a SPEC VIS departure shall visually manoeuvre around all obstacles until an altitude is reached where a climb gradient of 200′ /NM will provide the required obstacle clearance[2]. From lift off until the altitude is reached, attempting to visually manoeuver around obstacles at night is a serious undertaking that requires extreme caution, even on a perfectly clear night. Particular attention should be given to plan the lateral and vertical flight path, aircraft configuration and anticipate reduced manoeuvrability in the event of an emergency such as an engine failure or loss of hydraulics (flapless). Also, weather phenomenon such as scattered cloud layers, not normally considered to be a ceiling, will make visual manoeuvring much more challenging and, in some cases, impossible to proceed.

As an example, a crew is planning to depart from Kamloops, BC, using runway 27. In this situation, the following SPEC VIS procedure is provided for use when unable to achieve the climb gradient published in the Standard Instrument Departure (SID):

* DEPARTURE PROCEDURE
(Not For Navigation)

Refer to SID

or

Rwys 09, 27 – SPEC VIS – Climb visual over aprt [airport] to 4600. Continue climb INBD [inbound] track 088º to "YKA" NDB. Then shuttle to 7300 BPOC [before proceeding on course] (max 250 kt [knots]).

To complete a thorough topographical analysis, the crew needs to review all information available to plan this sequence. The best and most up to date charts that can be used are often included with the instrument procedure. In this scenario, the Night Circuit Procedures chart (Figure 1) as well as the LOC C approach (Figure 2) in Kamloops are included for reference.

Caution should be exercised to avoid confusion when using the approach procedure to help with the topographical analysis. In this example, the holding pattern depicted at the YKA NDB for the LOC C Missed Approach procedure is not to be used for the shuttle climb when on departure. Instead, one needs to conduct the published SPEC VIS shuttle climb on an inbound track of 088º using right hand turns[3]. Confusing the two procedures would be like comparing apples to oranges. The Night Circuit Procedures chart and the LOC C approach are used only for locating obstacles and building situational awareness, not to replace the SPEC VIS departure. The crew must also remember to look for close-in obstacles which are sometimes listed[4].

The Night Circuit Procedures chart can be used to help the pilot identify where the hazard beacons are located and the scale at the bottom of this chart can be used to estimate the amount of manoeuvring space available. At this point, aircraft specific factors shall be considered to determine whether the procedure is reasonable. Climb performance, potential for an engine failure (multi-engine aircraft), configuration and manoeuvring speed based on weight and

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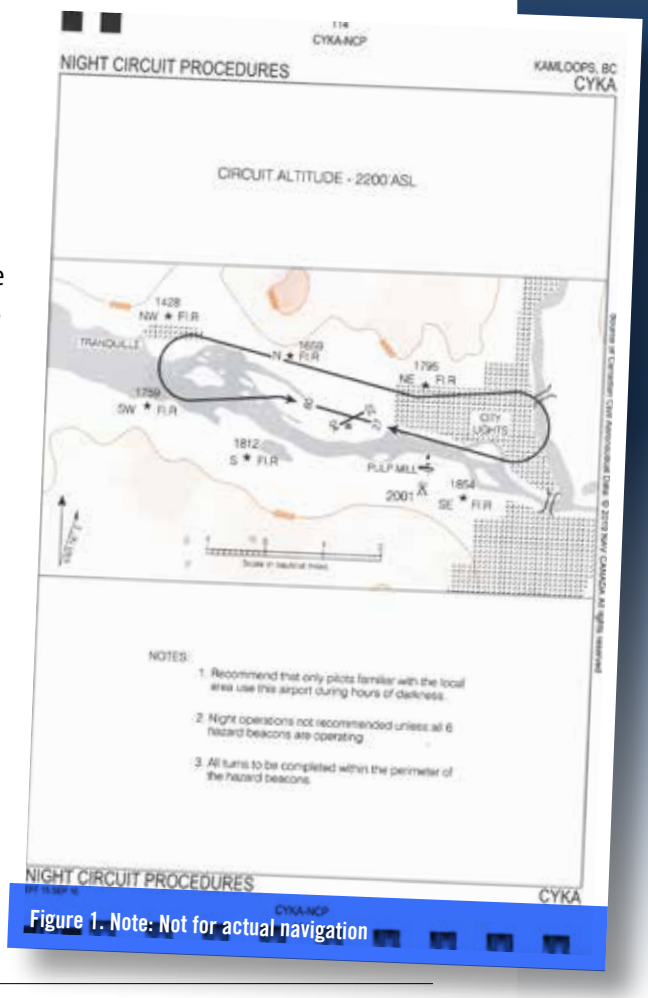

Figure 1. Note: Not for actual navigation

[2] Flight Planning and Procedures Canada and North Atlantic (GPH 204A), Chapter 6, Section 3, Art. 613.

density altitude are only few of the variables that shall be assessed before making the decision to accept the mission.

A common mistake observed during the execution of the SPEC VIS departure includes climbing out straight ahead without using all the available turning room. Climbing at a higher than ideal airspeed is also frequent and causes a larger turn radius and degraded climb performance. These combined mistakes can result in having to use an excessive bank angle in order to avoid Controlled Flight Into Terrain (CFIT).

The Departure Procedure in Kamloops is also a good example of when a turn at Minimum Safe Altitude (MSA) may not be the best course of action despite being safe initially. For this scenario, the departure aircraft is climbing at night over the airport in high ceiling conditions and reaches 8,000 feet (MSA) before entering clouds just 1 nautical mile (NM) west of the threshold of runway 09. Instead of following the remainder of the SPEC VIS procedure and flying the inbound track of 088º to the YKA NDB, having reached MSA the crew decides to continue climbing westbound at 200 feet/ NM. Since the departure procedure was not followed to the YKA NDB fix before proceeding on course, the crew is actually required to be above the 100 NM Safe Altitude of 12,000 feet before reaching the 25 NM radius from the Kamloops' NDB.

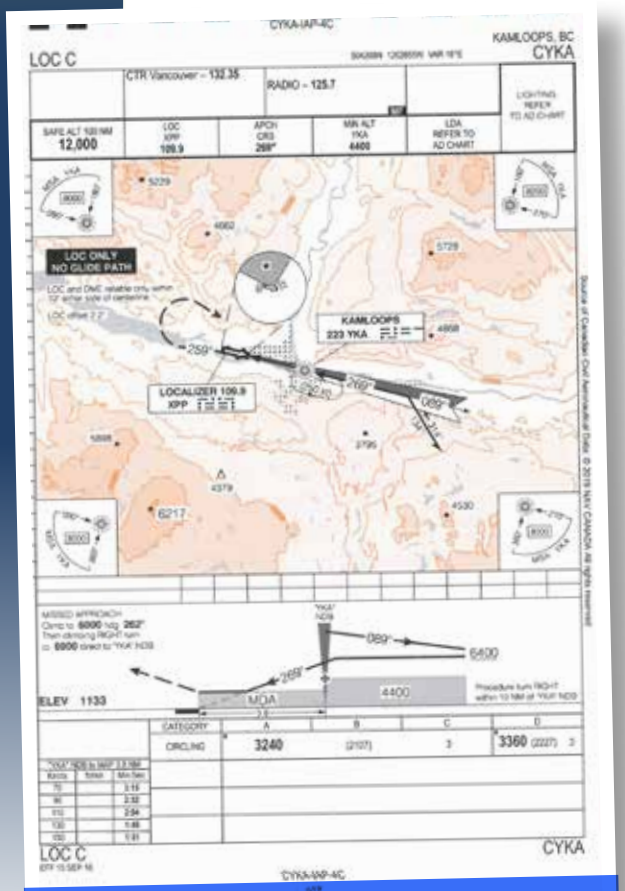

Figure 2. Note: Not for actual navigation

The LOC C approach procedure shows that the aircraft is already 3.8 NM from the NDB when it is over the threshold of runway 27. Adding 1.3 NM for runway length and the 1 NM travelled on the west side shows that the aircraft is now 6.1 NM west of the NDB. If maintaining a climb gradient of 200 feet/ NM, this profile will require 20 NM to gain the required 4000 feet from the MSA to the 100 NM Safe Altitude. The crew has to closely monitor their distance from the NDB to ensure the next safe altitude is reached within 25 NM of the NDB. Indeed, simple math shows that the aircraft will not make the 100 NM Safe Altitude and the pilot will have to turn around to complete the climb inside 25 NM from the YKA NDB.

This example shows that during an IFR departure in mountainous terrain, continuing the climb to the published altitude and the fix Before Proceeding On Course (BPOC) often makes the best sense.

Conclusion

In addition to careful preparation for a night mission in mountainous terrain, another important pre-flight phase is the crew briefing. Anticipation is key to aviation! In other words, if a crew is well prepared and aware of the potential hazards, they will probably succeed in avoiding them. With this knowledge, the crew is prepared to decline or delay a mission if the conditions for a safe and effective flight are not present. Remember, when it comes to managing risk, the perfect answer is not always required to be successful. If one is unsure of how much temperature correction to use? Fly higher! Not confident flying a SPEC VIS departure at night? Take less fuel, add a stop to the itinerary and fly the SID! Unsure if you have the experience and the skills to pull off a Circling Approach at night? Stay put or go somewhere else!

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3. NAV CANADA – Canada Air Pilot, Instruments Procedures, CAP 2: British Columbia

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5. Civil Aviation Organization– Procedures for Air Navigation Services International (ICAO 8168)

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9. NAV CANADA – Canada Flight Supplement (GPH 205)

10. Federal Aviation Administration – Tips on Mountain Flying: FAA Aviation Safety Program

[3] Flight Planning and Procedures Canada and North Atlantic (GPH 204A), Chapter 8, Section 3, Art. 833.

[4] Flight Planning and Procedures Canada and North Atlantic (GPH 204A), Chapter 6, Section 3, Art. 614.

DOSSIER

THE INVISIBLE OBSTACLE

by Captain Paul Spaleta, Directorate of Flight Safety, Ottawa

Flight at night has always presented challenges to manned aviation. Terrain clearance and obstacle avoidance during low level night flying, can be difficult tasks even in visual meteorological conditions. With the rapid construction of new communication towers, power lines and power generation wind turbines (both inland and soon to be off shore), hazards in the low level environment are increasing. Depending on the type of operation being conducted, there may be no choice but to operate where these obstacles exist, and it is vital that aircrew can see and avoid these obstacles. Obstruction lighting was developed for this reason.

In Canada, obstacle lighting is designed so that an aircraft travelling at 165 knots (306 km/hr) or less should be able to see the obstruction lighting in sufficient time to avoid the structure by at least 610 meters horizontally under all conditions of operation, provided the pilot is operating in accordance with the Canadian Aviation Regulations (CARs). In the past, the warning lighting on towers and other obstructions were typically provided by incandescent lamps. As a result of technological advancements in lighting equipment, Light Emitting Diodes (LED) are replacing the older incandescent lamps due to their increased reliability, lower energy requirement and longer service life.

While the LED obstruction lighting systems meet Transport Canada requirements for obstruction lighting as defined by the CARs[1], it has been found that some obstruction lighting systems are not visible under Night Vision Goggles (NVG). NVG have been used for decades in the military aviation community and have proven to be extremely valuable by increasing operational capability and improving safety. They function by amplifying ambient light, providing the pilot with a usable image of the surrounding environment in near total darkness. In 2008, a Royal Canadian Air Force (RCAF) CH146 Griffon crew were night flying near the Shelburne, Ontario, windmills. The crew noticed that the obstruction lighting system used at the site was very visible to the naked eye but could not be seen under NVG.

> *"NVG are force multipliers but are not the panacea for obstacle clearance at night"*

Why couldn't the Griffon crew see the obstruction under NVG when in the past, obstruction lights were blindingly bright? The NVG image intensifier tubes which amplify the ambient light are sensitive to light with wavelengths between approximately 450 nanometers (nm) and 920 nm. This includes most of the visible as well as the near-infrared (Near-IR) spectrum. The current NVG in use in the RCAF however, have Class B filters installed that restrict lighting with wavelengths less than 665 nm. This allows use of blue/green and some red lighting in cockpit displays that would otherwise cause the automatic gain control of the NVG to be activated and potentially reduce visual acuity for the pilot. Because red LED obstruction lights have a narrow emission range (approximately 620 nm to 645 nm), they are very difficult to see using Class B filters. Furthermore, the older incandescent lamps emitted large amounts of IR energy or heat (wavelength 800-900 nm), which NVG were sensitive to and is not restricted by the Class B filter. This radiated energy has been greatly reduced and as a result, obstructions illuminated with LED systems may not be visible. This is why the obstruction lights were visible to the Griffon crew with the naked eye but not under NVG.

Some LED obstruction lighting systems are constructed with integrated IR emitters or can be employed with separate IR emitters that would permit detection by NVG, however this is not mandatory at this point in time. Aviation charts do not differentiate between the two systems so there is no way to tell if you will be able to see a particular obstacle without intimate knowledge of the particular obstacle.

Some steps have been taken to mitigate this problem, but it is limited to little more than aircrew awareness. After the initial discovery by the Griffon crew in 2008, DFS issued a

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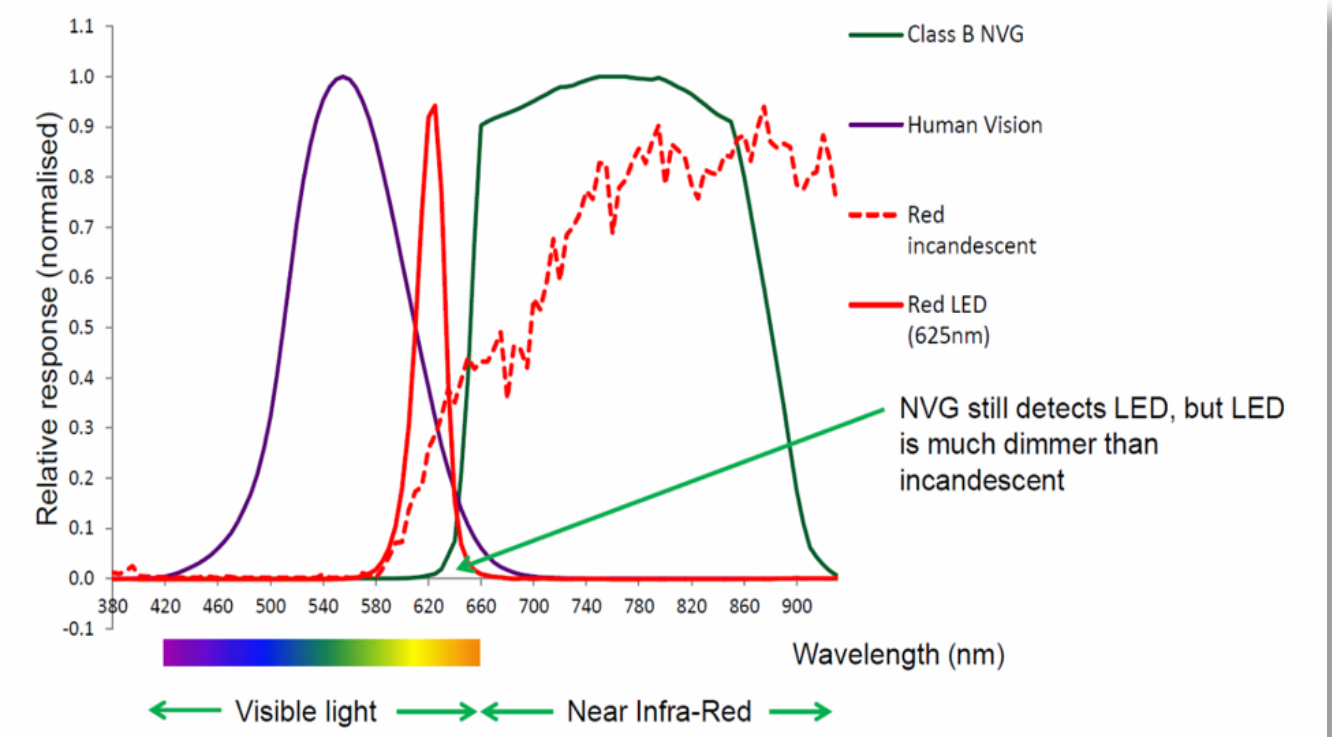

Figure 1.

FLASH to raise awareness. The issue has also been raised by various agencies within the Canadian Armed Forces to Transport Canada and the Ministry of Transportation and a solution is currently being negotiated. This has been a slow process since this only initially affected a small segment of the aviation community however NVG are increasingly being employed by civilian operators and this issue is affecting them as well. They are becoming more vocal and it is hoped that this may help in pushing for change.

Thus far, this article has focused on obstruction lighting however it should be noted that LEDs are also being used in aircraft (both manned and unmanned) external lighting systems as well. How visible are you to other aircraft or how visible are they to you? How will it affect your scan for other aircraft? What can you do to protect yourself? I can't really offer any great solutions but there are some things you can do. First, if you don't have to fly in the low level environment, don't. Remove yourself from the threat. Second, use up to date charts and check your route for obstacles and obstacle heights. Thirdly, if you find any unmapped obstacles, pass the locations on to the appropriate authority so that charts are updated. Inform your operations' office so that local charts can be updated and fellow aircrew at your wing can benefit from your discovery. Lastly, it may be a good idea to periodically take a brief scan under the NVG to look for unseen obstruction lighting or for other aircraft nearby. NVG are force multipliers but not the panacea for obstacle clearance at night. Strange how sometimes technological advances in one area can cause unintended complications in others.

References

1. For more information on what constitutes an obstruction to air navigation and obstruction lighting standards, refer to Canadian Aviation Regulations Part VI paras 601.23 and 621 (http://www.tc.gc.ca/eng/acts-regulations/regulations-sor96-433.htm).

DOSSIER

DEVIATIONS PART 1

by Col (Retd) Steve Charpentier DFS 3 Prevention

Note: *The content of this article is based on A-GA-135-001/AA-001 Flight Safety for the Canadian Armed Forces, chapter 10.*

One thing I have learned over the years is that sometimes one word can convey a different meaning to another person. Have you ever heard the quote, "Between what I think, what I want to say, what I think I am saying, what I say, what you want to hear, what you hear, what you think you understand, what you want to understand and what you understand, there are at least nine possibilities for a misunderstanding!" There are many examples of issues whose root cause involved the misunderstanding of a word cascading into the breakdown of communication, but today I want to clarify the term "deviation" from a flight safety perspective.

There are many meanings associated with the term "deviation." In the aviation maintenance world, approved deviations are procedural changes that have been authorized by engineers or manufacturers and implemented by technicians to solve a technical issue. These are part of the daily maintenance routine and do not pose a concern to a sound airworthiness program.

Deviation has an entirely different connotation for flight safety.

First of all, there is a huge difference between an error and a deviation. The difference lies in the intent of the individual. Errors are unintentional, they happen when a planned action does not go as intended.

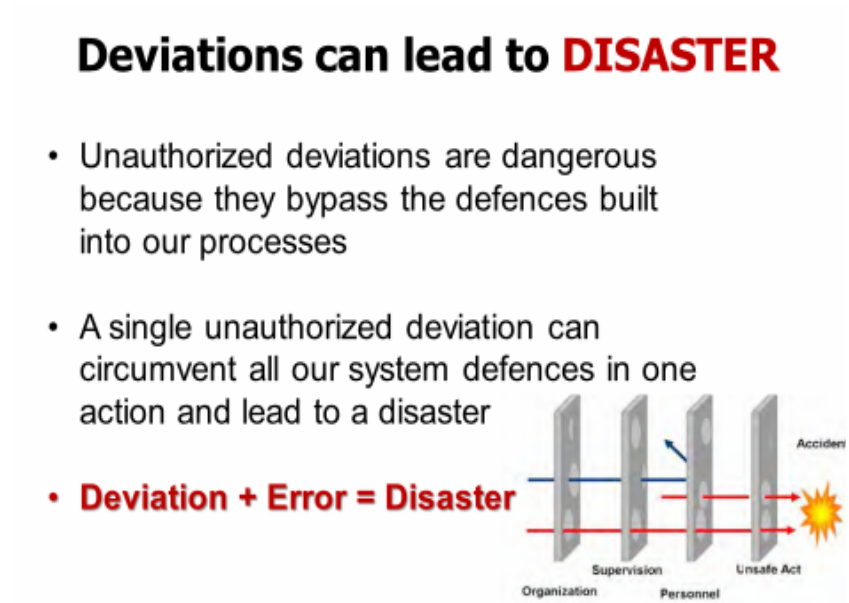

Figure 1.

On the other hand, a deviation is a deliberate action, omission or process when an individual intentionally does not follow a sanctioned procedure or regulation. A flight safety deviation is then considered as an unauthorized action and, in some countries, is referred to as a violation.

Deviations are the main focus of flight safety experts and pose a huge risk to maintenance and flying operations. Deviations can kill and trigger catastrophe. They have harmed maintainers and aircrew and have resulted in accidents causing the unnecessary loss of valuable resources and aircraft. Deviations pose a significant threat because they bypass the safety defences we have built into our systems and processes. A single deviation can circumvent all our system defences in one action and lead to a disaster. You don't believe me? Google it. Air China had a huge fire on the ramp because someone did not follow the procedure to reinstall a bolt in the wings. Inadequate torqueing of a Titanium bolt resulted in a crash with fatalities on the east coast. Were these errors or were they deviations or were they both? Not all deviations result in an accident, but when combined with an error they often lead to disaster. Maybe flight safety specialists are a little alarmist? Perhaps they are better informed! It is when you intentionally cut corners and do not follow authorized

Continued on next page

procedures that you circumvent our defence system. As such, our safety system weakens and can no longer prevent the errors it was designed to capture and safety occurrences arises. This is the classic James Reason Swiss Cheese model (Figure 1).

But why are deviations so dangerous? It is just a matter of time and accumulation of deviation occurrences before a mishap happens. Deviations are like a virus and are highly contagious meaning they quickly go from being an exception to becoming an unauthorized routine practice sometimes involving the tacit approval by supervisors at multiple levels of the organization.

Routine deviations that we learn to accept can go from a good idea to overcome an obstacle to our operations to being the norm in no time at all. This is referred to as a "normalization of deviation." This encourages others to imitate where a gain of time or efficiency is perceived. The problem is that this type of perceived efficiency is often the result of a trade off in some safety defense and one day, will lead to a disaster. The only defence we really have is a ZERO TOLERANCE of DEVIATIONS in any form.

But what should you do if you cannot comply with a procedure? If you cannot comply because you think there's a better way, or if you're unsure how to proceed, you should stop and ask for assistance from your supervisor or manager and use the appropriate review and approval process to implement change. You need to transfer decision and the risk to the appropriate level of authority within the Chain of Command. Improvisation is a gamble with safety. Follow the approved procedures in all cases unless there is a clear direction provided by the right authority to do otherwise.

DEVIATIONS PART 2
JUST CULTURE: MISSION-CENTRIC AND PERSON-CENTRIC DEVIATIONS

Mission-centric deviation

The Directorate of Flight Safety (DFS) classifies deviations into two categories: mission-centric deviations and person-centric deviations. We refer to mission-centric deviation when the overall intent of the individual or group of individuals performing unauthorized deviations is motivated by the desire to complete the task at hand in order to ensure success of the mission. This is often called the "can-do" attitude and is highly driven by our perception that the mission is very important and is a "no-fail mission." As an example, a pilot flies below authorized VFR conditions to avoid cloud in order to complete a transit task or a technician uses non approved procedures in order to expedite the turnaround of an aircraft for a particular mission.

With the exception of the circumstances covered under the National Defence Flying Orders, there are no valid reasons not to follow approved procedures. If a deviation is considered the only way to accomplish a mission, the appropriate chain of command must be informed so that they can determine if the risk is acceptable. The mission can then only proceed when official approval is obtained.

Person-centric deviation

A person-centric deviation relates to a deviation contrary to established procedures based on personal motives, gains or goals. This type of deviation can be said to be in direct conflict with appropriate ethical behaviours and good order and discipline. It involves reckless, wilful, negligent behaviour or misconduct that may be carried out to demonstrate perceived prowess or skills. Examples of this type of action includes: an impromptu unauthorized air show to show off personal flying skills; skipping procedural steps in order to leave work early for a social engagement; and reporting drunk or under the influence of illicit drugs to work or fly an aircraft.

In the interests of aviation safety, when a person-centric deviation occurs, a collateral investigation by the chain of command is often required and supported under the Just Culture approach. While person-centric deviations are quite rare in the Canadian Armed Forces, when one is discovered the Director of Flight Safety as the Airworthiness Investigative Authority (AIA) will notify the chain of command. The AIA's formal letter to the chain of command upholds

the statutes set out in the *Aeronautics Act* and the *Privacy Act* and so will not divulge privileged information.

Guidance to Just Culture

The Just Culture principle is one of the five fundamental principles at the heart of the Canadian Armed Forces flight safety program. This is where we draw the line between a non-punitive culture and one of sanction and punishment where disciplinary action by the chain of command may be required. A reporting culture relies on free and open sharing of critical safety information between managers and operational personnel and this can only occur when the threat of punitive action, fear of sanction or embarrassment is removed. If people feel that they will be blamed for an error, they will be reluctant to voluntarily report. This will result in the loss of learning opportunities and put aviation operations further at risk. However, while a non-punitive environment is fundamental for a good reporting culture, the workforce must know that unacceptable behaviour such as negligence or deviation will not be tolerated by the leadership. Just Culture recognizes that, in certain circumstances, there may be a need for punitive action and ensures that "bad apples" are not able to use the flight safety system to hide from consequence. We all expect fair justice and optimal conditions in the workplace that enable us to be proud of our contributions. When our collective safety and reputation is intentionally put at risk we expect proper consequences to address the issue.

To better comprehend where the line sits when it comes to assessing if an action is considered malevolent, person-centric, mission-centric or an honest mistake, DFS has developed a flowchart to help identify the type of action and recommended outcome that may follow (Figure 2). This product is under development and comments for improvement are always welcome.

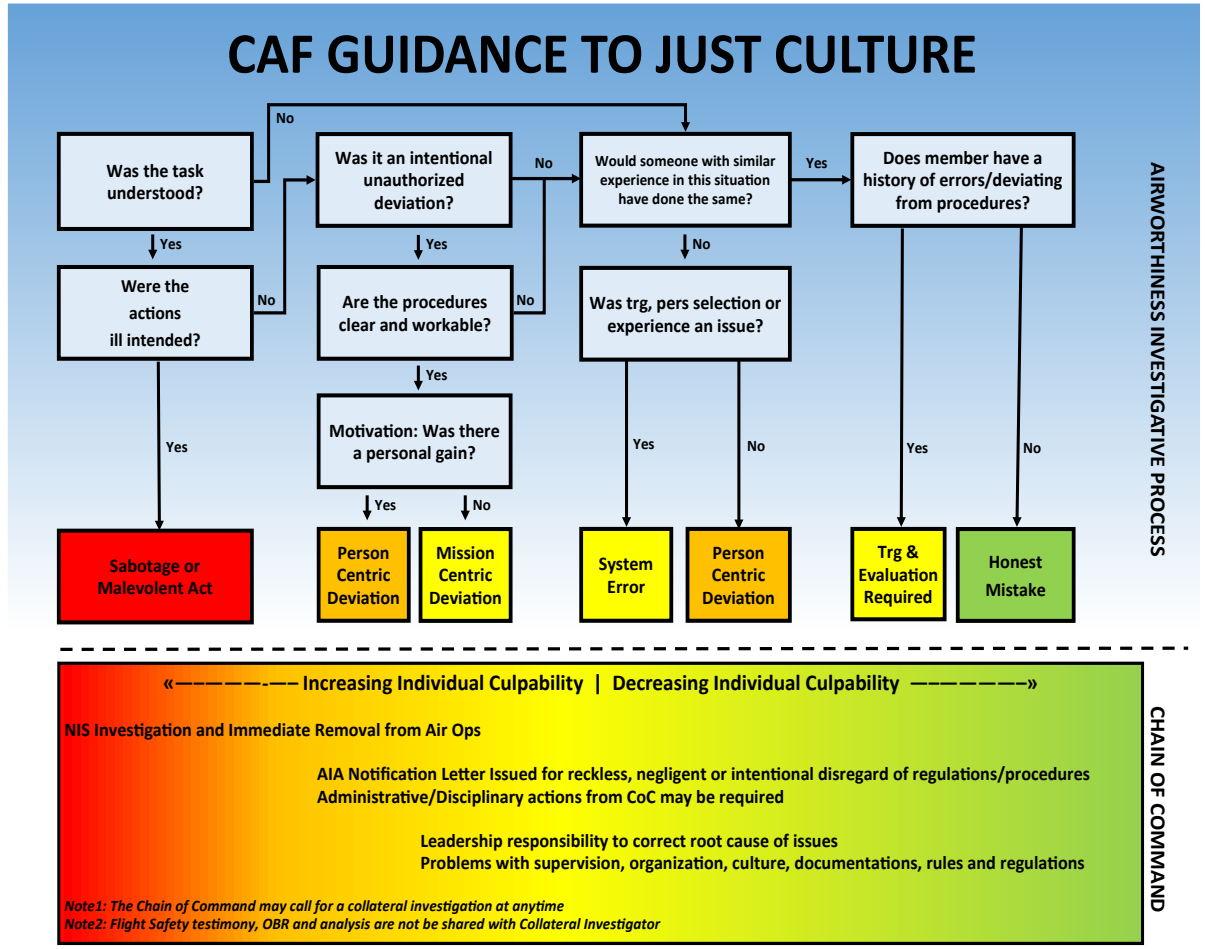

Figure 2.

Photo: Sergeant Halina Folfas

Gotta Love a Good Airshow!

by Major Scott Young, DFS, Ottawa

A few years ago, the Maritime Helicopter (MH) Community was tasked with providing air support for a CC130 deploying SAR Technicians, over water, for the CNE Airshow, and also providing an air demonstration of the CH124 capabilities. Previous to this occasion, Sea Kings were not typically part of the Labour Day Classic air display, so this opportunity was one that the MH Community, in particular 423 Squadron, could not pass up.

I was the lucky Aircraft Captain in charge of getting the airshow asset from Shearwater to Toronto, on target, on time. Festivities were planned starting on the Friday night of the Labour Day long weekend, and with that data point in mind, we began prepping for departure the Monday before. For the journey, we elected to take two Tactical Officers (TACCO), three service technicians, and of course myself and my co-pilot. The TACCOs were very adept individuals, as were the technicians and co-pilot.

As we were planning our mission from the East Coast to Southern Ontario, we began to see a decreasing trend in environmental conditions expected to develop throughout the week. As Tuesday night approached, we realized that we would have to depart IFR, vice a scenic VFR excursion westbound. Sure enough, that Wednesday morning, the morning of our intended departure, we were delayed several hours waiting for the weather to improve in order to start our journey. Initially, we had pre-planned that the aircrew would flight plan as a team while the technicians loaded the airshow swag onto the aircraft, ensuring that our gear and elementary servicing set was complete and ready to go. As we waited that morning for the weather to improve, although unspoken, we all had the heavy feeling that we would not make it in time to part of the airshow experience due to the prevailing, albeit typical, East Coast weather patterns. Morning turned into mid-afternoon and planning – both for the delayed flight and aircraft load – came to an abrupt stop. The mindset changed from excitement in showing off the Sea King capabilities in front of thousands of eager onlookers at the CNE, to shear disappointment with the coastal weather conditions

that had, yet again, placed a damper on the 12 Wing's flight schedule, and mood of its aviators; that would all change late afternoon that fateful Wednesday.

As late afternoon reared its dull, dreary overcast head something magical happened – the forecast improved as did the actual weather conditions, we had our minimums to depart the airfield. As the ceiling lifted, yielding light rain showers, we elected as a team to separate the planning duties to affect a speedy departure – an airshow participation was at stake!

My co-pilot was charged with conducting the flight planning, and I performed the pre-flight while assisting the rest of the crew to load up the airshow gear and swag. This was it, the big show!

Our departure out of Shearwater was as planned and we entered cloud at just over 200 feet AGL with a right turn enroute to our first fuel stop in Fredericton, New Brunswick. If only everything else on this sojourn were 'as planned.'

Upon climbing through 4000 feet Mean Sea Level (MSL), ATC queried us as to where our next destination was. I was operating the radios at the time and found that question quite odd. Did ATC not have our IFR clearance from the handover from Shearwater? Were they not seeing our squawk code? Since I was the non-flying pilot (NFP) I reached over and looked at the flight planning that my co-pilot had calculated. Looking at the tracks on the planning, it became instantly clear that these were not the tracks to get us to Fredericton. I frantically planned new tracks based on where we were currently heading, west not north as we should have been, and informed ATC we were correcting heading to intercept the appropriate northbound track. My co-pilot was a bit confused as to what I was doing, and why I just told ATC that we were correcting track. I took control and had him look at his planning. He had planned the off-airways tracks using True tracks, and not Magnetic tracks. He confessed that he had made the faux pas, and we debriefed it and carried on – keep in mind this all transpired in a matter of 2 mins after departing into cloud north of Shearwater.

As we crossed the Bay of Fundy, the skies opened up. We could see blue skies above, and summer campers on the beaches of the New Brunswick coast – things were looking up, or so we thought.

Five miles into New Brunswick, we entered solid IFR conditions again but knew that we not only had minimums at Fredericton, but also a good alternate in Greenwood, Nova Scotia. As we approached Fredericton for the VOR

"Looking at the tracks on the planning, it became instantly clear that these were not the tracks to get us to Fredericton."

Only approach, it became clear to me that my TACCOs were very silent. Normally jovial gentlemen, they were now sullen, quiet and engaged in conversation and paperwork. I asked what the issue was, as a matter of conversation, and they informed me that if we did not get into Fredericton, we would not have fuel to get back to Greenwood. For the second time on this flight, I grabbed the flight planning and realised that we did not account for the added weight of the aircraft due to the airshow swag, which meant taking on less fuel than we normally would have for a three hour flight. Our only 'out' now, or alternate, just became landing VFR on the beaches of New Brunswick because we did not have the fuel to get anywhere else. I was furious.

I was not upset at my co-pilot, nor at my crew for not informing me earlier. I was upset at myself. I was disappointed in the fact that I had never checked my co-pilot's planning – why would I, he was a seasoned pilot and aircraft captain certified in our community. Fortunately for us that day, we had 'runway environment' on final into Fredericton and landed accordingly. We were all pretty concerned with what had transpired over the last couple of hours and decided to stay the night in Fredericton, get our heads on straight, and thoroughly debrief what had just occurred.

You are likely asking yourself, "So what?" Ever since that afternoon, I habitually do two things before any flight operation. They are:

1) Perform a common sense check on any and all mental math and flight calculations. Even on my own work, I will have another aviator, or honest broker for that matter, check the math. There is no appetite in crewed cockpits or cabins for egos; and

2) I always leave myself an out, an alternate plan – IFR or otherwise – in order to ensure I maintain professionalism and remain legal, but more importantly, to ensure I bring my crew home to their loved ones. I am prepared for conversations in my superior's office regarding the 'hard' talks. I am not prepared, nor should any other aviator for that matter, to talk to a deceased crewmember's family regarding 'hard' conversations based on neglect or ego.

It is interesting to point out that we never participated in that Airshow in 2005. A little storm called Katrina made landfall down south and we were tasked to fly down to assist our American brethren.

Gotta love a good airshow...

Confessions of a (sometimes) Personal Protective Equipment User

by Major (Retired) Kevin Roberts

Maj (Retd) Roberts completed 13 years during three separate tours as a DFS aircraft investigator and was the Investigator-in-Charge for over 15 major accidents. He retired from the RCAF in December 2018.

It was August 1990, I had just finished my aircraft accident investigator training and was three weeks into my first tour of duty at the Directorate of Flight Safety (DFS) when I headed out to my first accident investigation – a fatal CT114 Tutor accident in Moose Jaw, Saskatchewan. My training to that point had primarily consisted of a highly regarded six week course offered as part of a university aviation safety program but I don't recall spending much time talking about crash site hazards. Even in those days, the hazards of carbon fibres were known but they were associated with CF188 Hornet accidents and precautions consisted mostly of wearing a Tyvek© type suit, paper mask and leather gloves. For the remainder of the Royal Canadian Air Force aircraft fleet, a pair of leather work gloves and occasionally a paper mask was about the extent of our personal protective equipment (PPE) use. Blood borne pathogen (BBP) training, or in fact, most other hazard training, had not yet been introduced. Figure 1 shows the notable lack of PPE use with the author (in his green flight suit and ball cap) standing in the middle of the burnt out Tutor alongside technicians dressed in their standard white coveralls.

When I returned to DFS in 2006 for a second tour of duty as an aircraft accident investigator, things had changed for the better with respect to PPE education and use. BBP training was now the big thing and newly minted flight safety investigators were issued a wallet card to indicate they had received the appropriate training. Along with BBP training, the wearing of Tyvek© suits, when deemed required, was now more common.

Figure 1. CT114169, Moose Jaw, Aug 1990

CF188 accident sites involving a post-crash fire were still our largest concern from a hazard perspective with carbon fibres,

Figure 2. CF188738 Wreckage, Lethbridge, July 2010

Figure 3. Waxing the wreck of CF188738, Lethbridge, July 2010

beryllium and cadmium dust, fuel residues and many other nasty hazards present at the site. As shown in figure 2, some of my team worked at the initial impact site of the July 2010 Lethbridge, Alberta, CF188 Hornet air display accident. Although the pilot had ejected and so BBP was not a concern, the airplane had exploded and burnt on impact and the weather was hot (30°C plus) and dry. Although the wreck was sprayed with a one-in-10 wax solution (figure 3) to fix the carbon fibres in place and minimize their movement, the situation called for full PPE use, including goggles and a fitted rubber mask with Organic Vapour/P100 filters. Under these hot and dry conditions, the additional warmth caused by wearing full PPE made work rather uncomfortable and limited the effective working time at the site due to the need to take frequent hydration and rest breaks. In addition, a complete and proper doffing (removal) of the PPE was required after leaving the site and prior to entering the "clean" area to hydrate and rest, further limiting the time investigating on site.

The weather, however, can also be your friend. In November 2010, CF188789 crashed into a frozen slough during a snowstorm north of the Cold Lake, Alberta, airport. The pilot ejected safely. Shortly after the crash, temperatures dropped to the minus 30°C range. Under these conditions a lot of the potential hazards became naturally fixed in place by the frozen precipitation, allowing for a lower level of PPE to be worn by the investigators. In this situation, we wore Tyvek© suits mostly to keep our warm winter clothing clean, used N95 paper masks for respiratory protection and wore no goggles due to icing interference and because they really weren't required (figure 4).

The crash of CF188747 on the range northeast of Cold Lake in November 2016 involving a fatality was yet again a different situation with regards to PPE and hazard assessment. Based on photos of the impact site, it was initially thought that there had been a large post-crash fire and full PPE would be required. However, once we got boots on the ground at the site we realized that there was almost no post-crash fire. What had initially appeared to be a wide scorched and burnt area was in fact mud splatter from the initial impact spread out over the ground. This realization, combined with the cold temperatures and snow, allowed us to modify our initial hazard assessment requiring only a minimum of PPE to be worn such as nitrile gloves and/or leather gloves and, depending on the area the investigator was working in, an N95 paper mask. Nevertheless, it was a difficult site to work and while the physical and chemical hazards were assessed as medium to low, other significant psychological and environmental hazards were present which required their own mitigation strategies.

As you can see, the actual requirement for various levels of PPE can vary greatly for crashes of the same type of aircraft. While it is always safer to err to the conservative side, every accident site does not require

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CONFESSIONS... Continued

that all team members enter wearing full Tyvek© or similar suit, half or full mask with an Organic Vapour/P100 filter, goggles and taped cuffs.

As the Standards officer during my third DFS tour, I regularly instructed on flight safety courses and particularly focused on the aircraft accident response activities expected of an air safety investigator. During their training, students work in groups to do the initial documentation of a crash site involving an actual Bell 206 helicopter wreck with no with post-crash fire but some simulated blood spatter in the cockpit area. To familiarize the students with the available equipment, the students are dressed in full PPE while they measure, photograph and otherwise document the helicopter accident site. Then, as part of their handover to the DFS investigators, they are asked to make a hazard assessment of the site and recommend the level of PPE needed to be worn. Interestingly, many of the students respond that the DFS investigator should wear full PPE for what, in my experience, would require only a pair of leather gloves. This is not altogether surprising, considering the students have limited experience with this type of situation and the fact that they themselves had just worn full PPE while investigating the site.

With experience, however, we have found that referring to the Crash Scene Hazard (CraSH) Matrix (Table 1) helps investigators create a better perspective of the hazards and fosters a better judgement of the anticipated changes. The matrix also helps investigators judge the likelihood of their exposure to the various hazards and gives them a more realistic determination of the PPE recommended to properly protect themselves.

Stay safe out there!

References

1. Crash Scene Hazard (CraSH) Matrix

Photo: Cpl Patrick Dupuin

Figure 4. Winter investigative conditions, CF188789, Cold Lake, Nov 2010

Photo: Sgt Lori Geneau

Figure 5. Debris from the November 2016 CF188747 crash site in Cold Lake. No free carbon fibres but plenty of sharp edges

Crash Scene Hazard (CraSH) Matrix				
	Hazard	**Exposure Route**	**Risk**	**Control**
Physical	• Broken structures • Composite fibres (CF) • Explosives • Radiological[†] • Stored energy	• Cuts • Punctures • Crush • Inhalation/ingestion • Contact/proximity	High Likely Probability Critical Severity • Severe injury and/or • Severely degraded mission capability	• Control access • Avoid/cordon • Disarm • Decontaminate • No eating on site • Wear PPE • Apply Fixant (CF)
Chemical	• Petroleum, Oil, Lubricants/fluids • Metals/oxides • Viton (rubber)	• Inhalation • Ingestion • Contact	Medium Likely Probability Moderate Severity • Minor injury and/or • Degraded mission capability	• Control access • Avoid/cordon • Neutralize • Decontaminate • No eating on site • Wear PPE
Environmental	• Cold/heat • Fatigue • Insects/wildlife • Enemy/Security • Political Situation	Variable	Medium Likely Probability Moderate Severity • Minor injury and/or • Degraded mission capability	• Control access • Implement site security • Apply work/rest cycles • Feeding/hydration • Insect repellent/tick removal • Wear sunscreen • Wear clothing appropriate for the weather • Wear PPE
Psychological	Traumatic exposure[††]	• Direct exposure • Indirect exposure (vicarious trauma, narratives)	Medium Likely Probability Moderate Severity • Minor injury and/or • Degraded mission capability	• Control access • Apply work/rest cycles • Monitoring • Limit exposure and control information release • Wear PPE
Biological	Blood Borne Pathogens • HIV • Hepatitis B/C	• Cuts • Punctures • Via mucous membranes	Low Unlikely Probability Critical Severity • Severe injury	• Control access • Decontaminate • No eating on site • Wear PPE • Vaccinate[†††]

[†] Although the injury sustained from Radiological hazards could be severe, the probability of exposure is considered improbable and therefore the risk is considered LOW.

[††] The potential for severe traumatic exposure may increase the assessed risk level to HIGH in certain circumstances.

[†††] Advance vaccination is encouraged and could be mandatory for all personnel who attend a crash scene.

Photo: Capt Darren Kroeker

Pitch Perfect

by Captain Darren Kroeker, 406 Maritime Operational Training Squadron

Before joining the military I taught people how to fly float planes. Specifically, I taught people how to fly a particularly photogenic blue and white Cessna 180 on old-school Edo floats in the particularly photogenic locale of British Columbia's lower mainland and the mountain lakes to the north. My average monthly income was less than my rent, but it was a good first job for someone with the ink still wet on their commercial licence.

Apart from exploring the mountains, my favourite aspect of the job was the diversity of the students; yes, we had the expected new commercial pilots hoping a float rating might help them snag a job up North, but we also had airline pilots with 25,000 hours looking to shake things up, doctors with private licences contemplating buying a float plane for weekend adventures, and people who just flew for fun that simply wanted to try floats to see what it was like. They all required completely different instruction techniques and I had to be constantly reinventing the syllabus to make sure the student (also customer) got the most value for their expensive training.

Now, taking off and landing on water is not as difficult or as dangerous as one might initially imagine. In terms of hands-and-feet skill required, it's only slightly more difficult than tricycle gear airplanes, much easier than tail-draggers and not even remotely close to small helicopters. Float planes have a high accident rate not because they are hard to fly, but because they take pilots away from the comfort and familiarity of airports with prepared surfaces, ATC, and accurate weather reports (or at least a wind sock) and this leads to misjudged conditions and unfortunate decisions. The other main cause for float accidents is leaving the wheels down when landing on water with amphibious floats. That almost guarantees the plane will rapidly pitch nose down the instant the wheels touch the water and end up inverted. Fortunately, the Edo's on the 180 didn't have wheels for myself or my students to forget about, however, the 180 did have a catch. Those old floats have more drag than the modern ones, enough that if you landed a little nose-low, the plane would pitch down. This pitch down was not nearly as dramatic as the wheels-down-on-amphibians cases, but it was enough that as the plane pitched, the airflow over the tail would push the elevator down, pulling the yoke from the pilot so that the control input would be for even more nose-down. If the pilot allowed this to continue, they could expect to be underwater and up-side-down soon after. This isn't speculation, it had happened three times in this plane's history but luckily none of those instances had led to any injuries. Although it sounds scary, to prevent the problem from appearing, all the pilot has to do to is hang on to the controls and not let them get pulled away, or land a bit more nose-up.

Not being keen on surprise swimming (or watching a hapless solo student flip a plane on a chilly, glacier-fed lake), I always made a point of allowing my students to land a little nose-low and feel the pitch forward. To make it extra memorable for them I wanted it to be a surprise, so my process was to brief them on it at the start of training, then focus on getting them to land in the perfect attitude (making any corrections prior to touchdown), then when their confidence was building, allow them to touchdown slightly nose-low so they felt the pitch down and the controls moving away from them. Of course, I was careful and guarded the controls to prevent things from escalating. Most students handled it adequately, some required a bit of input from me, a few required a lot, but all said they found it dramatic enough to be memorable and afterwards took extra care in getting the attitude perfect before touching down, guarding the controls appropriately in case they were off by a few degrees. Mission accomplished!

Enter the best student I ever had: a tailwheel and aerobatic instructor, bush flying experience on wheels, and an analytical mind with good attention to detail. Too easy. Everything I showed him, he executed flawlessly. I followed my usual process for trying to get him to experience the pitch, but he kept landing with the attitude bang-on so it wasn't happening. I really didn't want to send him for his required five solo circuits before he got caught off guard by the old, draggy Edos, but how do you surprise someone who just keeps doing everything right? Finally, I gave him an extra thorough brief on it and had him intentionally land nose-low so he'd feel it for himself, but it was apparent that this did not have the impact that I was seeking. By all rights, it was time for him to go solo and delaying it would jack up his costs. Do I tell the best student I've ever had that he has to fly extra time at $350/hr so that maybe he can make a mistake that I have no indication he'll ever make? Given how excellent his flying had been, I didn't give it too much thought, briefed him one last time and had him drop me off on a nearby beach so he could do his solo circuits.

"Enter the best student I ever had: a tailwheel and aerobatic instructor, bush flying experience on wheels, and an analytical mind with good attention to detail. Too easy."

The first three circuits were as excellent as expected so I decided to grab my phone and film his next touch-and-go to show new students what it looks like from the outside when done correctly. Looking through the screen on my phone, I watched in quiet awe as he touched the water nose-low for the first time. The plane started to violently rock forward and I could see the point where the water breaks on the floats moving forward to the point of no return. Just as I began to cringe, the nose made a move upwards, the engine wound up, and he was safely back in the air. His final solo landing was as perfect as the first three and we stared at each other wide-eyed as he taxied to the beach to pick me up.


Photo: Stuart Nicklin

The lesson for him was obvious. For me, it wasn't so simple. Delaying a student because they are too good still seems ridiculous to me, but no one is perfect and the mistakes are coming... it's just a matter of time. I was lucky this student was attentive and did what was briefed when things went wrong, but I don't like to rely on luck and there is no substitute for first-hand experience in a situation that fast and dynamic. I changed my personal limits on when I would let a student go solo, came up with new ways to get them to experience the pitch, and kept the video to show anyone who might wonder why I'm delaying their solo despite doing so well. As weird as it may sound, I was relieved to never have another student that strong again.

Editor's Note:

On a somber note, the float plane referred to in this article was involved in a fatal flight safety accident in August 2018. Although unrelated to the occurrence or the personnel described in the 'Pitch Perfect' article, it highlights some of the additional challenges that are faced when operating float planes. For further information, visit the TSB link at http://www.tsb.gc.ca/eng/rapports-reports/aviation/2018/a18p0108/a18p0108.asp.

From the Investigator

TYPE: Hawk (CT155211)
LOCATION: Moose Jaw, SK
DATE: 21 August 2018

The crew of the CT155 *Hawk* had just taken off from the 15 Wing Moose Jaw airport and was heading north to fly an instructional tactical navigation training mission. A near mid-air collision occurred between the CT155 and a *Thrush* aerial application aircraft returning to Moose Jaw Municipal Airport, following an aerial application in some fields located to the west of Moose Jaw.

The *Thrush* was eastbound in descent from 5,500 through 4,500 feet above sea level at the time of the occurrence. The CT155 *Hawk* was westbound at 4,500 feet above sea level when the two aircraft crossed paths. The weather was VFR. Visibility of 4-6 statute miles was reported.

The *Thrush* pilot observed the CT155 *Hawk* approaching slightly from the right of head-on only seconds before crossing paths. The *Thrush* pilot immediately rolled the aircraft left while depressing the button to leave a smoke trail in an effort to make the aircraft more visible. The student pilot in the front seat of the CT155 *Hawk* spotted the plume of smoke just right of centre in the windscreen and immediately rolled the aircraft to the left just prior to the two aircraft crossing paths. Both aircraft returned to their respective home airfields safely and without further incident.

The investigation is focusing on human factors and ways to enhance traffic awareness for crew members.


Photo: Steve Glass


Photo: DND

Photo: DND

Epilogue

TYPE: SGS 2-33A Schweizer Glider
LOCATION: Gimli, MB
DATE: 21 August 2017

The accident took place during the summer Air Cadet Gliding Program at the Gimli Cadet Flying Training Center located at the Gimli Industrial Park Airport in Manitoba. The accident flight was the cadet student pilot's eighth solo air lesson and fourth flight of the day.

The winds were 240 degrees at 8 knots and the operation was conducting right hand circuits to the grass primary landing area adjacent to runway 15. After an uneventful downwind leg, the student pilot turned right onto the base leg and lowered the nose to establish the glider at the pre-calculated final approach speed. At approximately 300 feet above ground level, the student pilot overshot the extended centerline of the primary landing area. The student pilot quickly ruled out a final turn below 300 feet and elected to continue straight ahead on an extended base leg. The intent was to land on the apron and to bring the glider to a stop prior to impacting the parked aircraft and the hangars directly ahead, but not knowing if there was sufficient landing distance available.

To descend quickly, the student pilot maintained a nose low attitude and made use of full spoilers. A forward slip was initiated


Photo: DND

but quickly abandoned as the airspeed increased and the student pilot became distressed. In order to avoid the parked aircraft, the student pilot veered the glider slightly to the right.

The glider landed firmly on the apron in a level attitude and bounced twice. The glider came to an abrupt stop when it impacted the steel bollard surrounding a fire hydrant located 24 feet from one of the hangars.

The student pilot was transported to the local hospital via ambulance, treated for minor injuries and later transferred to a medical facility in Winnipeg. The student pilot was released from the medical facility the following afternoon. The glider sustained very serious damage.

The investigation identified shortcomings in the student pilot's training management and several working and training environment issues including student/instructor ratio, course length and manning of key positions within the Chain of Command. Safety recommendations include the implementation of formal Solo Monitor training, an amendment to the student/instructor ratio, the employment of a single-hatted CFI, an increase to the course length, and amendments to the Air Cadet Gliding Program reference documents.

Photo: DND

DEVIATIONS

What is an Error?

Errors are **unintentional**. Happens when a planned action does not go as intended.

What is a Deviation?

An unauthorized and deliberate action, omission or process. Happens when individuals intentionally do not follow approved procedures and regulations.

Why are Deviations so Dangerous?

- They are contagious.
- They can go from a good idea to being the norm in a short period of time.
- They bypass normal procedures and weaken safety defences.
- They can KILL.

Defence from Deviations?

- The only defence is a ZERO TOLERANCE of unauthorized deviations in any form.

What if you Can't Comply with a Procedure?

If you can't comply, if you think there's a better way or if you are unsure – STOP!

- Talk to your supervisor.
- Use the appropriate review and approval process.
- Transfer decision and risk to the right level.

DÉVIATIONS

Qu'est-ce qu'une erreur?

Les erreurs sont **commises sans le vouloir**. Elles surviennent lorsqu'une action planifiée ne se déroule pas comme prévu.

Qu'est-ce qu'une déviation?

Action, omission ou processus non autorisé et délibéré. Cela se produit lorsque des personnes ne respectent pas intentionnellement les procédures et réglementations.

Pourquoi les déviations sont-elles si dangereuses?

- Elles sont contagieuses.
- Elles peuvent passer d'une bonne idée à devenir la norme en peu de temps.
- Elles contournent les procédures normales et affaiblissent les défenses de sécurité.
- Elles peuvent TUER.

Défense contre les déviations?

- La seule défense est une TOLÉRANCE ZÉRO des déviations non autorisées sous quelque forme que ce soit.

Que faire si vous ne pouvez pas vous conformer à une procédure?

Si vous ne pouvez pas vous y conformer, si vous pensez qu'il existe un meilleur moyen ou si vous n'êtes pas sûr, ARRÊTEZ!

- Parlez à votre superviseur.
- Utilisez le processus de révision et d'approbation approprié.
- Transférer la décision et le risque au bon niveau.