National Defence
Défense nationale

Flight Comment

ISSUE 3, 2011

In Memoriam - Colonel R.D. Schultz
1922 - 2011

Canada

Views on Flight Safety

By Chief Warrant Officer Denis Cormier

LEADERSHIP AND FLIGHT SAFETY

As I toured the different wings, bases and organisations during the past year as part of the DFS team promoting flight safety, it reinforces to me that leaders at all levels have the responsibility to enforce the military values, professional ethos and safety culture we expect from them. Leaders have to remain just and equitable in their decisions and actions. These actions must serve the RCAF, the Wing, the organisation or the unit, regardless of the environment. Decisions based on personal interest have no place within our profession; the welfare and safety of others must take precedence.

We as leaders have the ability to turn away taskings when they are at the breaking point, reality is often different. To some, there may be a belief that refusal of a task or mission may jeopardize their chance of advancement or promotion. That concern from some leaders, either real or not, is understandable; however, the fear of professional repercussion for saying "no" has to change. Leaders are chosen for their ability to lead and command; there is no stigma in saying "no" for the right reasons. Honesty, judgement and courage are traits expected from all leaders.

Flight safety is an integral part of our daily business within the RCAF and I believe that we as leaders must understand and accept our responsibilities within flight safety. No task, mission or operation, either at home or abroad, should proceed where a safety concern has not been answered and properly corrected. If someone gains knowledge of an unsafe situation and does not react appropriately, they then become part of the problem and that puts our organisation may be at risk. Needless loss and suffering could eventually be the ultimate outcome.

It might seem easy to manage and direct our people from the relative comfort of our cubicles, however, from this environment it can be difficult to fully grasp the risks, struggles and hardship that our people are facing daily in their job. Fighting a war abroad is very different from conducting operations at home, but one main similarity remains: the constant application of flight safety. Involvement in war is not a permit to disregard flight safety, but is actually the opposite. Rules and regulations have to be enforced to an even greater degree during periods of conflict, otherwise Commanders may find themselves depleted of precious resources and faced with the eventual lost of valuable personnel.

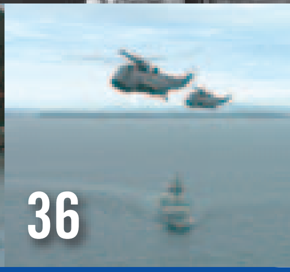
Due to ever increasing commitments, some units "surge" for long periods with no respite in sight. These units are at greater risk and leaders must be astute for critical signs that may go unheeded. Flight safety management is crucial; never let it be said that your airmen or airwomen were injured or killed because you were unaware or chose to ignore the safety measures required on the job. Not only does mishap prevention reduce human suffering and loss, but pragmatically, it's also good business. Flight safety is a leader's prime obligation to its organisation and personnel during the conduct of operations. Our Air Force leaders must look after our people's health and welfare while enforcing a safe and just culture. By leading your personnel into thinking safety day in and day out, you will be guaranteed their unconditional support and cooperation.

Remember: people will do good and safe work for good and safe leaders.

Chief Warrant Officer Denis Cormier was the DFS CWO from 27 Jul 2010 to 02 Aug 2011, he has since retired from the Regular Forces and joined the Primary Reserve. ◆

Cover Page Photo Description:

The *Mosquito* night fighter pictured on the cover is a re-creation of one flown by Colonel Schultz during WWII, while the *Voodoo* is a replica of "his" aircraft when he was setting up the original CF101 OTU. The original oil painting was presented to Colonel Schultz at his retirement mess dinner.



Flight Comment

TABLE OF CONTENTS

Issue 3, 2011

Regular Columns

Dossiers

Lessons Learned

DIRECTORATE OF FLIGHT SAFETY

Director of Flight Safety
Colonel Yvan Choinière

Editor
Captain John Dixon

Graphics and design
d2k Marketing Communications

Imagery Technician
Corporal Alex Paquin

THE CANADIAN FORCES FLIGHT SAFETY MAGAZINE

Flight Comment is produced three times a year by the Directorate of Flight Safety. The contents do not necessarily reflect official policy and, unless otherwise stated, should not be construed as regulations, orders or directives. Contributions, comments and criticism are welcome. Contributions become the property of Flight Comment and may be edited for content, length or format.

Send submissions to:

Editor, Flight Comment
Directorate of Flight Safety
NDHQ/Chief of the Air Staff
MGen George R. Pearkes Building
101 Colonel By Drive
Ottawa, Ontario Canada
K1A 0K2

Telephone: 613-992-0198
FAX: 613-992-5187
Email: dfs.dsv@forces.gc.ca

Subscription orders should be directed to: Publishing and Depository Services, PWGSC CGP/EGC, Ottawa, ON K1A 0S5
Telephone: 1-800-635-7943
Email: publications@pwgsc.gc.ca

Annual subscription rates: for Canada, $19.95, single issue, $7.95; for other countries, $19.95 US, single issue, $7.95 US. Prices do not include GST. Payment should be made to Receiver General for Canada.

To contact DFS personnel on an **URGENT** flight safety issue, please call an investigator who is available 24 hours a day at 1-888-927-6337 (WARN-DFS).

The DFS web page at www.airforce.forces.gc.ca/dfs offers other points of contact in the DFS organization or write to dfs.dsv@forces.gc.ca.

ISSN 0015-3702
A-JS-000-006/JP-000

Good Show

For Excellence in Flight Safety

Captain Antonio Gomez

On the evening of 06 November 2010, Captain Antonio Gomez demonstrated outstanding professionalism and superb control of his crew and aircraft when he successfully dealt with a rare critical electrical malfunction in adverse weather conditions which could easily have resulted in the loss of aircraft and crew.

Captain Gomez was the aircraft captain of the CH124 *Sea King*, call sign Rescue 28, which was dispatched at night to search for a tourist swept off the rocks in stormy weather at Peggy's Cove, Nova Scotia. The crew launched into instrument meteorological conditions (IMC) of 300 foot ceiling and one mile visibility in heavy rain, turbulent winds from a low level jet stream and fog.

In order to complete the mission in these conditions, Captain Gomez and crew had to rely heavily on the helicopter's various electrical navigation and stabilization systems. These systems are crucial during Low Level Over Water (LLOW) flight at night, which is the equivalent of IMC flight due to limited or indiscernible ground references. In effect, this mission was taking place at the limits of the aircraft and crew in the search for the missing tourist.

Soon after the search commenced, while just off the coast and only 250 feet over the water, the *Sea King* pitched up abruptly and the displays inside the aircraft started flashing. Soon afterward, most of the instruments went dark. The helicopter had experienced a failure of both Transformer Rectifiers (TR). This is one of the most insidious emergencies for the *Sea King* because the aircraft immediately loses all of the critical electrical equipment described above. As well, due to a technical oddity of the CH124, when both TRs are lost the aircraft will also lose all remaining electrical systems, including internal communications after the approximate 10 minutes of battery life are expended.

Captain Gomez is currently serving with 12 Wing Headquarters A7 Standards, 12 Wing Shearwater.

Captain Gomez immediately and correctly realized the threat this malfunction presented and, after completing the checklist response for Dual TR Failure, took the controls of the now un-stabilized aircraft in strong, gusty winds. While reading his instruments from the light of his co-pilot's flashlight, with minimal outside visual cues and no electrical navigational equipment, he maneuvered the aircraft away from land, plotted a direct course towards Shearwater and directed the crew to shut down unnecessary electrical systems to conserve the anticipated 10 minutes of battery life for the 20 minute transit to Shearwater. Once he had successfully navigated the helicopter closer to Shearwater Air Traffic Control, they were able to give vectors to assist the struggling aircraft home.

Captain Gomez had to deal with several issues at once during this extremely challenging emergency in very demanding environmental conditions and is to be commended for his outstanding airmanship. Captain Gomez's decisive actions, skill and professionalism make him most deserving of this Good Show award. ◆

Good Show

For Excellence in Flight Safety

Corporal Ian De Ladurantaye

On the morning of 19 December 2010, hover checks were carried out on a *Chinook* aircraft at KAF in order to verify the rigging of the flight control system. Having failed the required checks, the aircraft was taxied back to parking and shutdown in order to allow the maintenance technicians to investigate.

Cpl De Ladurantaye was confused by the results of the hover checks. The swivelling actuator had been replaced the day prior and had been inspected numerous times, and by him as well. Nonetheless, he felt the need to inspect the actuator once more. What he found was alarming, especially considering that the aircraft had already been taken to the hover.

Corporal De Ladurantaye is currently serving with 438 Tactical Helicopter Squadron, St-Hubert.

Cpl De Ladurantaye found that one of the nuts securing the connecting link was missing the required cotter pin. At a quick glance, the bolt appeared to be installed correctly as the safety back-up ring on the bolt held it in the correct position. Upon further inspection, he found that the bolt had only been finger tightened.

The investigation revealed that two different maintenance crews had been involved in the complex task of replacing the actuator. The detailed procedure calls for the removal of the connecting link's top bolt, but never the bottom one. The technician carrying out this portion of the task was confused and began removing the bottom bolt by mistake. Realizing his mistake, the technician finger tightened the bolt and decided he would secure it properly after having removed the top bolt. A secondary report to the initial Aircraft Inspection and Maintenance Record form was never filed and the bottom bolt was forgotten. Upon completion of the work, a level 'A' technician carried out the inspection. Not knowing that the bottom connecting link bolt had been loosened by mistake, the technician could not have known to inspect this area. The bolt was then left unsecured and the aircraft was signed off for flight.

If this aircraft had gone flying while improperly rigged, the result could have been catastrophic mechanical failure. In detecting and correcting this extreme technical hazard, Cpl De Ladurantaye demonstrated dogged perseverance, exemplary attention to detail, a thorough knowledge of the aircraft system and outstanding professionalism. He is truly deserving of this Good Show award. ◆

For Professionalism

For commendable performance in flight safety

Private Jeffery-Scott McCormack

Sea King CH124436 had been recently inducted into 12 Air Maintenance Squadron to complete a Number 2 Periodic Inspection. While assisting in the inspection of the internal structure of the aircraft, Pte McCormack noticed 11 rivets were missing on a structural beam at flight station 357.

Pte McCormack, an apprentice aviation technician, went well beyond his level of training and experience by systematically conducting an extremely thorough inspection of an area which was not required for a Number 2 Periodic.

Recognizing the airworthiness implications of so many rivets missing in a concentrated area and the potential for possible structural failure, he immediately advised both the ACS technicians and his supervisor. During the ensuing investigation, it could not be determined as to when or where the 11 rivets were removed.

Pte McCormack's diligence and keen attention to detail revealed an obscure abnormality that not only exceeded his level of experience but also allowed 12 AMS personnel to resolve a deficiency that may have continued to go undetected. His find clearly eliminated an obvious safety of flight implication and negated the requirement for an ill timed inspection prior to CH124436 being tasked for deployment or operational sortie.

Pte McCormack's high level of professionalism, diligence and attention to detail are well beyond the expectations of a junior apprentice and hence he is most deserving of this For Professionalism award. ◆

Private McCormack is currently serving with 12 Air Maintenance Squadron, 12 Wing Shearwater.

Corporal Shelley McCammon

During Box Top 10/02, the incident aircraft had just returned from a Thule-Alert-Thule run. The plan was to quickly turn the aircraft to try to achieve a third sortie with the Bulk Fuel Delivery System (BFDS). Fuelling of the BFDS was complete and wing fuel was being added to maximize the offload capability in Alert. Servicing personnel were turning the aircraft while the aircrew remained on board. Cpl McCammon was busy supervising a junior servicing crewman on operating the Single Point Refuelling Panel.

Ops tempo was extremely high with considerable pressure on all concerned to turn the aircraft in a timely manner. Environmental conditions were extraordinarily demanding with the ramp being extremely dark, very cold and windy – typical arctic winter ops.

Additionally, external power was supplied through a very noisy ground power unit and vehicle traffic around the aircraft was high.

The ability for anyone to maintain situational awareness (SA) beyond the immediate task at hand would have been severely compromised by the lighting, weather, sound stress, and multi-tasking pressure. Despite all these distractions, Cpl McCammon maintained a superior level of SA. She detected a suspicious sound and immediately moved to investigate, where she observed fuel pouring out of the number three engine after body. She immediately ceased refuelling operations and reported to the flight deck to ensure the Emergency Fire Control Handle had been pulled, to isolate the engine. A materiel failure had occurred inside the engine, permitting an uncontrolled fuel leak. Had the normal start sequence for the *Hercules* been initiated, the potential for a catastrophic fire would have been high.

In difficult circumstances, Cpl McCammon recognized an extremely hazardous situation and took decisive action which prevented the possible loss of aircraft and personnel. Cpl McCammon's attention to detail, quick thinking, and appropriate actions demonstrate a level of professionalism that serves as a model for all personnel. ◆

Corporal McCammon is currently serving with 435 Transport and Rescue Squadron, 17 Wing Winnipeg.

Cadet Warrant Officer (Second Class) Christina Lynch

On 30 July 2009, then Cadet Warrant Officer Lynch, was a student attending the Air Cadet Pilot Power Scholarship at the Region of Waterloo International Airport. Her planned mission was to fly solo out to the practice area to complete some upper air work.

The flight proceeded normally until the return to the airport where Cadet Lynch encountered fluctuating oil temperature and pressure readings. These readings somewhat stabilized back to the normal range. During the pre-landing checks the oil temperature still showed normal but oil pressure was in the lower end of the normal range.

Cadet Lynch was on final to land when airport air traffic control requested an overshoot for traffic separation. All appeared normal on climb out until approximately 400 feet above ground level when the engine began to run rough and the propeller RPM began to fluctuate to limits. Cadet Lynch declared an emergency and was given immediate clearance to land.

During the landing approach the engine failed and Cadet Lynch, who also was a licensed glider pilot, skilfully brought the aircraft to a safe landing and stopped adjacent to the grass on the runway.

Cadet Warrant Officer Lynch's cool head and response to the in-flight emergency ensured an uneventful end to an emergency situation and demonstrated professionalism well

beyond her experience at the time. For this reason, she is indeed deserving of this For Professionalism award. ◆

At the time of the incident, Cadet Warrant Officer Lynch was with 631 Royal Canadian Air Cadet Squadron Centennial out of Scarborough, Ontario.

Private Tyler Douglas

On 19 Jun 2011 while deployed to Sigonella Naval Air Station, Sicily, Pte Douglas of 407 Sqn was tasked to perform a routine post mission flight inspection on a CP140 *Aurora* aircraft. While conducting his checks, he noticed something unusual with the #3 engine left side cowling and conducted an investigation. He realized that the engine driven compressor (EDC) dump door which is normally installed on all CP140 inboard engines had been replaced with a blanking plate.

With a blanking plate installed, if the EDC needed to be dumped due to a blockage, the hot compressed air that is normally dumped into the outside atmosphere would enter the engine compartment. This would significantly increase the back pressure and contribute to higher temperatures in the engine compartment. This could have led to an overheat indication in the engine compartment and a subsequent emergency response by aircrew during flight.

Pte Douglas' keen observation and follow-up was instrumental in facilitating the correction of this configuration error, which had been undetected for several months, and prevented future operational complications. His attention to detail and proactive work ethic speaks to his tremendous ability to operate effectively and clearly demonstrates those characteristics deserving of a For Professionalism award recognition. ◆

Private Douglas is currently serving with 407 Maritime Patrol Squadron, 19 Wing Comox.

For Professionalism

For commendable performance in flight safety

Warrant Officer Fabian Marshall

On 08 March 2011, Warrant Officer Fabian Marshall, a member of the CANR NORAD Inspection Team, was assessing the start up and weapons arming procedures for a CF18 NORAD Alert Force aircraft that was part of a Wing exercise and evaluation. During the launch sequence, he positioned himself in front of the aircraft in order to observe the time-compressed start sequence by an Alert Force two-person team.

The two-person team of maintenance personnel perform distinct but interdependent roles in the CF18 Alert Force start sequence. The primary start person is located at the nose of the aircraft, and serves as a communication conduit with the aircrew and maintains positive control of safety protocols during engine start-up and weapons arming. The second technician is responsible for the application of external ground power and stowing of the internal boarding ladder once aircrew enter the cockpit. In this particular sequence, the boarding ladder would not lock properly in place and the technician was delayed in exiting his position along the left side of the aircraft just in front of the engine intake. The primary start person then left his position and attempted to provide assistance in storing the aircraft ladder. WO Marshall quickly recognised the magnitude of the developing situation and promptly intervened to physically remove the technicians from the left engine intake danger area as the left engine started.

WO Marshall's rapid response prevented the possible ingestion of one or both maintenance personnel into the intake of the CF18. His prompt action reflects a high level of professionalism that serves as an example for his peers, and as such, he is greatly deserving of the For Professionalism award. ◆

WO Marshall is currently serving with 1 Canadian Air Division Headquarters A4 Maintenance, Winnipeg.

Sergeant Serge St-Onge

On 26 May 2011, Sgt St-Onge, a CH146 Flight Engineer employed with Canadian Helicopter Force (Afghanistan) Roto 11, was performing a pre-flight inspection in order to assist a fellow engineer with preparations for a combat mission.

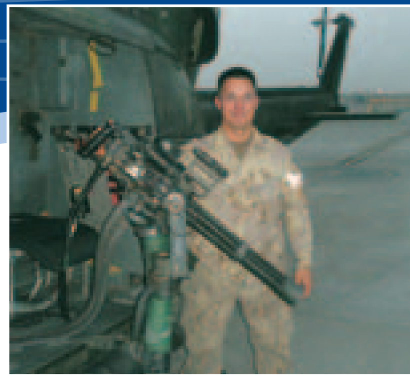
While inspecting the main rotor assembly of aircraft 146401, Sgt St-Onge's intuition told him that something was amiss but he could not conclusively determine the fault. Using his initiative, he proceeded to compare the head assembly to that of another aircraft. This led to the discovery that the damper bolts were installed backwards. This installation is contrary to standard aircraft practices; typically bolts are installed with the head on the inside of rotation which uses rotational forces to keep the bolts in place in the event of a failed retaining nut. Upon further inspection by ground crew, it was discovered that the damper itself was installed backwards. The discovery of an incorrect bolt installation is not easily identified which is evidenced by the fact that the post-installation inspection and numerous pre-flight inspections were carried out without noting the discrepancy.

Sgt St-Onge's attention to detail and proactive response prevented the premature wear and possible failure of the blade dampening system. Had the dampening system failed, the aircrew would have experienced severe main rotor vibrations necessitating a forced landing. The austere conditions present in the Afghanistan theatre of operations increases the potential for a flight crew being placed in a life-threatening situation as the result of an emergency landing. His discovery and follow-on actions played a crucial role in the maintaining of operational safety margins.

Sgt St-Onge is commended for his professionalism and diligence in ensuring that the aircraft was fully mission-capable. His actions serve as an example to follow and the standard to sustain in the conduct of pre-flight inspections. Sgt St-Onge is highly deserving of this For Professionalism award. ◆

Sergeant St-Onge currently serves with 438 Tactical Helicopter Squadron, St-Hubert.

Corporal Eric Lebel



Cpl Lebel was deployed with the Canadian Helicopter Force (Afghanistan) Aviation Battalion as a CH147 *Chinook* AVN Technician from March 2011 through September 2011. On 11 June 2011, Cpl Lebel was being proactive and took the initiative to carry out the monthly inspections on available Dillon Aero M134D machine guns in advance of their due dates. There were three M134s in the ready use weapons lock-up that evening. During the first gun disassembly, Cpl Lebel discovered a round lodged in one of the barrels. He immediately recognized the potential implications and notified his supervisors of the discovery. Upon closer inspection of the barrel, a white powder was observed which is indicative of ballast in dummy ammunition. While another technician was assisting Cpl Lebel in measuring the distance of the round down the barrel with a cleaning rod, the round was dislodged from the barrel. The round was identified to be a dummy round as it was painted black.

Having confirmed the round as dummy ammunition, Cpl Lebel took the initiative and proceeded to investigate how the round became lodged in the barrel. He established that the gun had operated successfully during its last mission and that there was no documentation of dummy ammunition being used on this weapon during any functional testing following that mission. Cpl Lebel suspected that the round had to have been lodged in the barrel during training conducted after its last mission. He raised his suspicions with his supervisor, who in-turn confirmed through Operations that one of the non-flying guns was indeed used for a practical demonstration by the aircrew in the afternoon prior to the start of Cpl Lebel's shift. Cpl Lebel then proceeded to personally verify the remainder of the M134Ds by pulling a cleaning rod through the barrels.

Had Cpl Lebel not taken the initiative to inspect the guns prior to their monthly inspection due dates, taken all the appropriate steps once the round was discovered, and conducted in-depth research, this condition would certainly have gone unchecked until the next firing of the gun. The round in the barrel could have caused catastrophic failure of the M134D. At a minimum, the M134D would have had a gun stoppage and potentially caused a mission abort on a combat mission. The actions completed by Cpl Lebel demonstrated dedication and professionalism and prevented the accidental loss of aviation resources. ◆

Corporal Lebel currently serves with 430 Tactical Helicopter Squadron, Valcartier.

Corporal Bernie Lanteigne

On 28 May 2011, Cpl Lanteigne, a CH146 *Griffon* Flight Engineer employed with Canadian Helicopter Force (Afghanistan) (CHF(A)) Roto 11, was performing a pre-flight in preparation for a combat mission. While inspecting the aft power section compartment, he discovered a discrepancy with the number two engine blower assembly. In order to facilitate a more thorough inspection, Cpl Lanteigne acquired a maintenance stand and improved the light source. Armed with better equipment, he conducted a more detailed inspection of the blower assembly. He discovered that the blower case had critically failed and that the blower assembly itself was on the verge of catastrophic failure.

Cpl Lanteigne promptly brought his findings to the attention of maintenance. Further investigation revealed that the cabin door seal had departed its attachment point in an earlier flight and was ingested through the right hand RAM air cooling duct and through the number two engine blower. The damage to the blower case was so severe that an additional flight would have possibly induced a catastrophic failure of the blower assembly. This would have potential to damage several other critical power-train components nearby including fuel and oil lines. Had the component failed, it could have easily led to a critical power loss and fire. This situation would mandate a forced landing in the hostile and hazardous conditions that are prevalent within the task force Kandahar area of operations. Cpl Lanteigne's exemplary attention to detail and timely actions played a crucial role maintaining combat effectiveness of CHF (A), preventing further damage or possible loss of a vital war-fighting aircraft.

Cpl Lanteigne is commended for his professionalism, perseverance and attention to details. His actions serve as an example for his peers, and as such, he is highly deserving of the "For Professionalism" award. ◆

Corporal Lanteigne currently serves with 400 Tactical Helicopter Squadron, CFB Borden.

The Editor's Corner

Fatigue and Maintenance

One flight safety issue that has emerged, on a global scale, is fatigue management for maintainers. Flight crews have definite crew duty regulations; some might argue that they are not adequate, but at least they exist. Should maintenance personnel have their own mandated set of duty regulations? The question has been asked and studied for years, but progress has been slow. In this issue, Major Helen Wright, our DFS Flight Surgeon, examines this question from a medical perspective, partly in response to a submitted article by MCpl Cedric De Belder entitled "28 Hours Later…". Reading these two articles together gives a meaningful picture of what maintenance crews endure and how performance can degrade during an extended shift.

Foam Earplugs

How many of you have used foam earplugs for hearing protection? I am thinking pretty much everyone. Now, after reading the articles herein, how many have been using foam earplugs correctly? If the statistics from these articles are valid, very few of us! Look for the reprinted article on "Foam Earplugs – Are the instructions falling on deaf ears?" from *Aviation Safety Spotlight* magazine and the accompanying CF slant with "How much protection are YOU getting?"

Air Traffic Control

Some time ago, nearing the end of my first flight as a newly upgraded Airbus Aircraft Commander, I was taxiing the aircraft for parking, feeling very satisfied. I was relaxed, I was confident, and I was in command. I was also turning into the wrong parking spot! Another aircraft was taxiing right behind us and the marshaller was incorrectly guiding us into their spot. A very alert ground controller spotted my error and asked us to confirm parking, saving me from a rather embarrassing situation.

I could cite many more instances where ATC has helped me and my crew towards keeping the flight smooth and safe, and I suspect that many of you can as well. I am looking for input for articles related to ATC and flight safety. Whether you are a controller with something you would like to pass along or flight crew with an ATC story, I would like to hear it. Those published in the March issue will receive our thanks for contributing to the Flight Safety Program and maybe even a little swag!

Colonel (Ret'd) R.D. Schultz (Director of Flight Safety 1967 – 1977)

Colonel Schultz passed away on Remembrance Day, 2011, in his 89th year. Those who knew him might remember him as the "father of flight safety". For those who may not have known him, nor his record and contributions, I would encourage you to read the "Check Six" article in this issue. He was an extraordinary man with a true passion for the RCAF. To him we dedicate this issue.

Best wishes for the year

On behalf of everyone at the Directorate of Flight Safety, may I pass along our best wishes for a safe 2012.

Captain John W. Dixon
Editor, *Flight Comment*

To the Editor

Letter from Sergeant Daryl Rogers

12 Air Maintenance Squadron, 12 Wing Shearwater

One of our guys was looking through *Flight Comment* Issue 1, 2011 and noticed something in the picture on page 23 that caught their eye. Right at the feet of the tech standing on the roof of the helicopter is an unauthorized Leatherman multi-tool. I'm not surprised it was missed when you were picking photos for this issue, as it is pretty subtle. I wonder how many others spotted this? It might be a good idea to have a contest where personnel try to spot the errors or unsafe conditions in photos.

Response

Sergeant Rogers:

Thanks very much for your letter. To answer your question, you were the only one to bring this to my attention. I am therefore sending you and your associate a DFS promotion item of your choice for your keen eye. Thanks also for the contest idea – stay tuned in a future issue.

Editor

From the Flight Surgeon

Fatigue and Maintenance

By Major Helen Wright, Directorate of Flight Safety, Ottawa

Fatigue is a significant problem in aviation operations. Fatigue is a physiological issue associated with a complex interaction of insufficient sleep, long duty periods, shift work, and circadian shifts. The impact of fatigue can be insidious since the extent of performance impairment may not be clear to the individual and there is no method to measure fatigue directly. Fatigued people make more mistakes, experience decreased vigilance, have difficulty sustaining attention, and have memory difficulties compared to people who are well-rested[1]. Fatigue effects have led to maintenance accidents and incidents.

A fatigued maintainer is at increased risk of maintenance errors due to impaired mental functioning. Unlike when driving, falling asleep during work is not a main fatigue hazard; but decreased cognitive function certainly is (cognition is a scientific term for mental processes such as attention, perception, memory and reasoning). There is extensive literature demonstrating the influence of sleep deprivation on cognitive performance[2]. Lack of sleep impairs performance particularly on routine, repetitive tasks requiring vigilance.

Photo: Cpl Jackson Yee

Studies indicate that the average amount of sleep needed in order to sustain optimum alertness is eight hours of sleep per day. There is individual variation and so some people can function well on less sleep than this, but they are few in number[1]. Consider how much sleep you get when on leave or any time when there are fewer constraints on how long you sleep. This will give you an idea of how much sleep you need to be at optimum performance. Track when you naturally go to sleep and wake by keeping a record when on holiday, and then use that amount of sleep time as your target during work weeks (Table 1 is a tool to help keep track of sleep). One study of civilian aircraft maintainers found that people estimated getting more sleep than they actually did; the maintainers self-reported an average of 6 hr 15 min sleep, but measurement of actual sleep time using wrist motion sensors indicated the average amount of sleep before a work shift was only 5 hrs and 7 min[3].

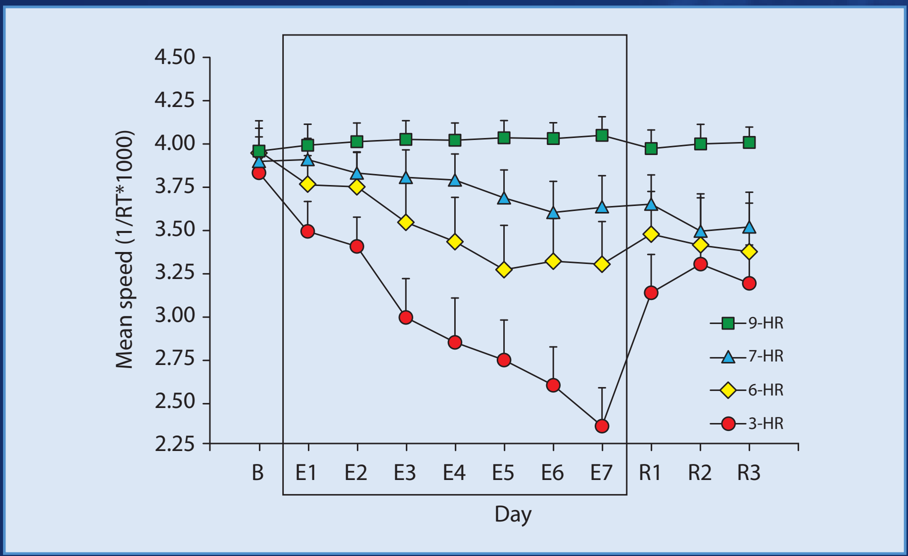


Figure 1. Mean psychomotor vigilance task speed across days as a function of time in bed[4]. Figure 1 demonstrates performance (speed on a vigilance task) over a number of days. At Day B all the subjects had baseline performance testing after a minimum of three nights of 8 hr in bed. E1-E7 are the experimental nights for which each of the respective sleep duration groups were allowed only the designated time of 9 hr, 7 hr, 5 hr or 3 hr per night in bed (see key). R1-R3 are the recovery nights for which all subjects were allowed recovery sleep of 8 hr/night in bed. Notice that the performance speed falls directly with how little sleep each group got. You will also notice that even after three nights of recovery sleep the impaired subjects had not yet reached their baseline performance level.

Sleep restriction (e.g., getting five or six hours of sleep a night rather than eight) will decrease cognitive function[4]. In addition, it takes several nights of full sleep to recover from the sleep debt of a string of nights of poor sleep (see Figure 1). The effect of sleep restriction depends on the amount of sleep you are missing and appears to be cumulative[5]. Chronic restriction of sleep to six hours or less per night produced cognitive performance deficits equivalent to as much as two nights of no sleep at all.

Even relatively moderate sleep restriction can seriously impair waking performance, but self-sleepiness ratings suggest that people are unaware of these increasing cognitive deficits[5].

There are also performance consequences of fatigue for sustained wakefulness (see Figure 2). The performance of a person who wakes at 0700 hours and stays awake for 17 hours until midnight will be as impaired as that of someone with a blood-alcohol concentration (BAC) of 0.05%. (BAC 0.05% is the legal driving limit in many countries; nine of the 13 provinces and territories impose administrative licence suspensions on drinking drivers at 0.05 % or lower). A person who wakes at 0700 hours and then stays awake for 23 hours until 0600 hours the following day will have a performance as impaired as someone with a BAC of 0.10%. BAC of 0.10 % is more than the legal limit of 0.08% in Canada[7]. There are differences between being fatigued and being drunk; response speeds and accuracy on some performance measures indicated fatigue can have an even more pronounced effect than alcohol on some aspects of cognitive performance. This research clearly indicates that one night of sleep deprivation can leave you more impaired than would be acceptable for driving a vehicle[7].

What To Do About Fatigue in Maintenance?

Fatigue in aviation operations is widely recognized as a problem and many agencies and organizations are wrestling with how to manage fatigue (ICAO, TC, FAA, EASA, NASA, etc.).

Goals of a maintenance fatigue risk management program include:

a. reduce fatigue;

b. minimize impact of fatigue-related errors; and

c. circadian management.

Reduce Fatigue

The primary way to reduce fatigue is to get enough sleep.

Measures intended to help maintainers get enough sleep include education, scientific scheduling, napping strategies and, in certain cases, medical treatment. Maintenance duty time regulations are another tool to help ensure crews have the opportunity for rest, but the RCAF does not have any duty time regulations for maintainers.

Folkard[8] investigated work hours for aviation maintenance personnel for the Civil Aviation Authority in the UK. His recommendations are often referenced, and are used by agencies such as ICAO as guidance for maintenance crews.

- There should be a 12-hour limit on shift duration.
- No shift should be extended beyond 13 hours.
- A break of at least 11 hours should occur between shifts.
- There should be a work break every four hours.

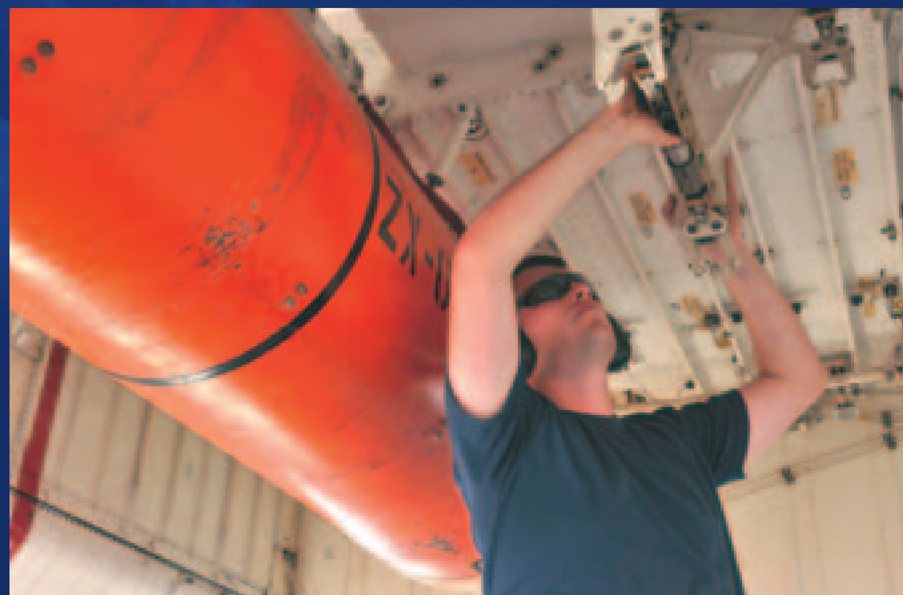


Photo: Cpl Jackson Yee

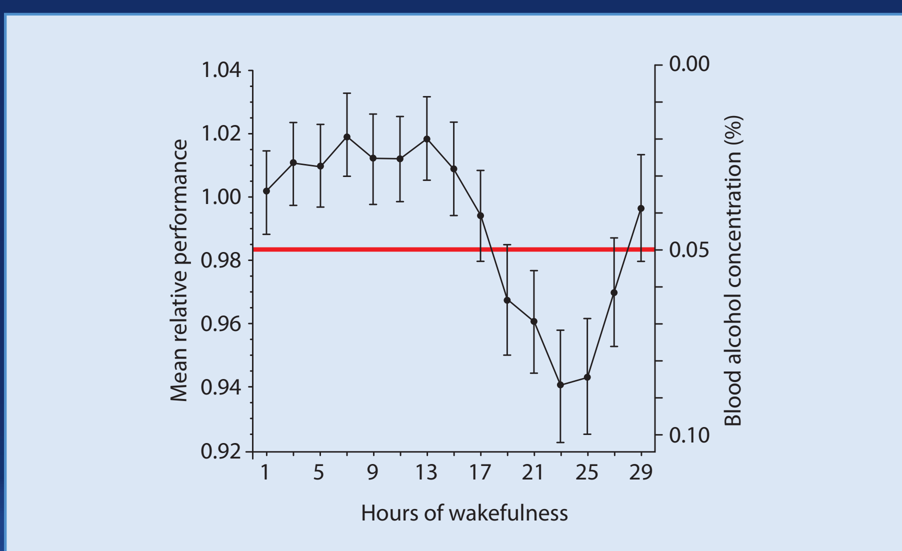


Figure 2. Cognitive performance over hours without sleep relative to blood alcohol concentration[6]. Performance demonstrated in this graph is influenced both by lack of sleep and the circadian rhythm. There is a circadian influenced improvement after the 25th hour of no sleep corresponding to the morning after a missed night of sleep. It is important to note that without sleep this recovery does not return to the person's usual performance level.

Minimize Impact of Fatigue

Maintenance activities are somewhat more self-paced than aircrew tasks. There are still time pressures, of course, but a maintainer who is aware of the potential for impaired performance (increased risk of error) may be able to pause a task, trade speed for accuracy, or repeat a step as necessary[9]. Other fatigue mitigation approaches in maintenance include:

a. maintainers sometimes have the flexibility to choose the time at which certain tasks are performed. In such cases it may be possible to schedule the most safety-critical tasks, or those most susceptible to fatigue, at times when fatigue will have the least impact;

b. adding secondary inspections or functional checks.

Circadian Management

RCAF maintenance crews do travel and are subject to circadian changes. Shift changes can also impose a circadian stress. Supervisors can consult their local flight surgeon and may be able to help crews to shift to the new time zone efficiently and optimize performance when at the new location (see article "Melatonin Influence on Jetlag and Shiftlag" in *Flight Comment*, Issue 2, 2011 on phase shift).

Individual Responsibility

Most believe that fatigue management in maintenance needs cooperation between the individual and the system. While scheduling and operational tempo (and perhaps in the future maintenance duty time regulations) are key to managing fatigue, you, the individual, have an important role to play. Maintainers are responsible for planning and using their rest periods effectively in order to minimize fatigue.

Conclusion

Fatigue is a significant problem in aviation operations but there are ways to assist maintainers and supervisors to manage the risk. Given the nature of military operations there will be occasions when maintainers are required to work long or frequent shifts. It is important that the reduced cognitive function that results from working when fatigued and the implications for flight safety are weighed against the requirement for long working hours.

For More Information

If you are interested in reading more about fatigue, Transport Canada has released educational material as part of its fatigue risk management system toolbox, including two documents providing awareness material, "An Introduction to Managing Fatigue" and "Fatigue Management Strategies for Employees." The first document gives a brief overview of fatigue, while the second contains detail on fatigue, fatigue management strategies, as well as information on nutrition, drugs, alcohol, napping, exercise, and well-being[10]. The FAA also provides maintenance personnel with educational material on fatigue, including a computer-based fatigue countermeasure workshop, a newsletter, video material, and posters[11]. Your local flight surgeon is also a resource, including the potential for briefings by the flight surgeon on fatigue and fatigue management.

Strategies for Optimizing Sleep Opportunities[1]:

- When possible, wake up and go to bed at the same time every day to avoid circadian disruptions.
- Use the sleeping quarters only for sleep and not for work.
- Establish a consistent and relaxing bedtime routine (e.g., reading, taking a hot shower, and then going to bed).
- Perform aerobic exercise every day, but not within two hrs of going to bed.
- Make sure the sleeping quarters are quiet, totally dark, and comfortable. For this to work, day workers should be housed separately from night workers.
- Keep the sleep environment cool.
- Move the alarm clock out of sight so you can't be a clock watcher.
- Avoid caffeine in drinks and other forms during the afternoons/evenings.
- Don't use alcohol as a sleep aid (it may make you sleepy, but you won't sleep well).
- Avoid cigarettes or other sources of nicotine right before bedtime.
- Don't lie in bed awake. If you don't fall asleep within 30 minutes leave the bedroom and do something relaxing and quiet until you are sleepy.

Effects of Fatigue[2]:

- Lapses in attention.
- Loss of vigilance.
- Impaired judgement.
- Impaired reasoning and decision-making.
- Impaired problem solving.
- Delayed reactions.
- Loss of short term memory.

- Reduced situational awareness.
- Diminished crew coordination.
- Tendency to abbreviate or skip routine checks, accepting "short cuts".
- Increasing frequency of errors of omission.
- Low motivation to perform "optional" activities.
- Irritability and impatience.
- Poor assessment of risk.
- Failure to appreciate consequences of action.
- Measurable changes in performance.
- Micro sleep (falling asleep inadvertently in 10 seconds or less). ◆

Table 1. Sleep-time tracking table.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Week 1 Bed							
Wake							
Total sleep							
Week 2 Bed							
Wake							
Total sleep							
Calculate average sleep time _______ (Add amount of sleep each day and divide by number of days)							

References

1. Caldwell JA, Mallis M, Caldwell JL, Paul MA, Miller JC, Neri DF (2009). Fatigue countermeasure in aviation. Aviation, Space and Environmental Medicine;80: 29-59.
2. Cheung B, Vartanian O, Hofer K, Bouak F (2010). General recommendations on fatigue risk management of the Canadian Forces. Defence R&D Canada. DRDC Toronto TR 2010-056.
3. Johnson, W., Mason, F., Hall, S., & Watson, J. (2001) Evaluation of aviation maintenance working environments, fatigue, and human performance. FAA Report. Federal Aviation Administration.
4. Belenky G, Wesensten, NJ, Thorne DR, et al. (2003). Patterns of performance degradation and restoration during sleep restriction and subsequent recovery: a sleep dose-response study. J Sleep Res:2003;12:1–12.
5. Van Dongen HP, Maislin G, Mullington JM, Dinges DF. (2003). The cumulative cost of additional wakefulness: Dose-response effects on neurobehavioral functions and sleep physiology from chronic sleep restriction and total sleep deprivation. Sleep:2003;26:117–26.
6. Dawson D, Ried K (1997). Fatigue, alcohol and performance impairment. Nature;388:235.
7. Williamson AM., & Feyer A-M., (2000). Moderate sleep deprivation produces impairments in cognitive and motor performance equivalent to legally prescribed levels of alcohol intoxication. Occupational and Environmental Medicine. 57(10): 649-655.
8. Folkard S (2003). Work Hours of Maintenance Personnel; UK CAA report 2002/06.
9. Hobbs A, Avers KB, Hiles JJ (2011). Fatigue Risk Management in Aviation Maintenance: Current Best Practices and Potential Future Countermeasures. Report DOT/FAA/AM-11/10 Jun 2011.
10. Transport Canada Website http://www.tc.gc.ca/eng/civilaviation/standards/sms-frms-menu-634.htm.
11. FAA Website https://hfskyway.faa.gov or the shortcut www.mxfatigue.com.

Maintenance IN FOCUS

Aging Wiring

Mr Dale Reid, Directorate of Technical Airworthiness and Engineering Support, Electrical Systems Specialist, Ottawa

Mr Reid joined the CF in 1975 as an Instrument Electrical Technician, having worked on a variety of fixed and rotary wing aircraft, most of which are retired. Departing the CF in 2001, he became a public servant where he is currently employed as an electrical certification systems specialist. He can be reached at Dale.Reid2@forces.gc.ca or 613-991-9758.

Photos are courtesy of Mr Rouleau, (Denis.Rouleau3@forces.gc.ca) the other half of the CF electrical certification systems specialist team. If anyone has any interesting EWIS pictures they would like to share please forward them to Mr Rouleau or Mr Reid.

In general, the RCAF operates aircraft that are typically older than the maintainers servicing them. Wires age in a manner similar to that of people. Both are fighting Father Time as well as the rigours of our environment, and like us, the harsher the environment the shorter the life span.

The CF Airworthiness program was developed to ensure our aircraft are maintained and operated to an acceptable level of safety throughout their service life. The program was developed relying heavily on the regulatory requirements of the Federal Aviation Administration (FAA) and Transport Canada (TC). Regulatory changes can be driven by the introduction of new products and materials or aviation events.

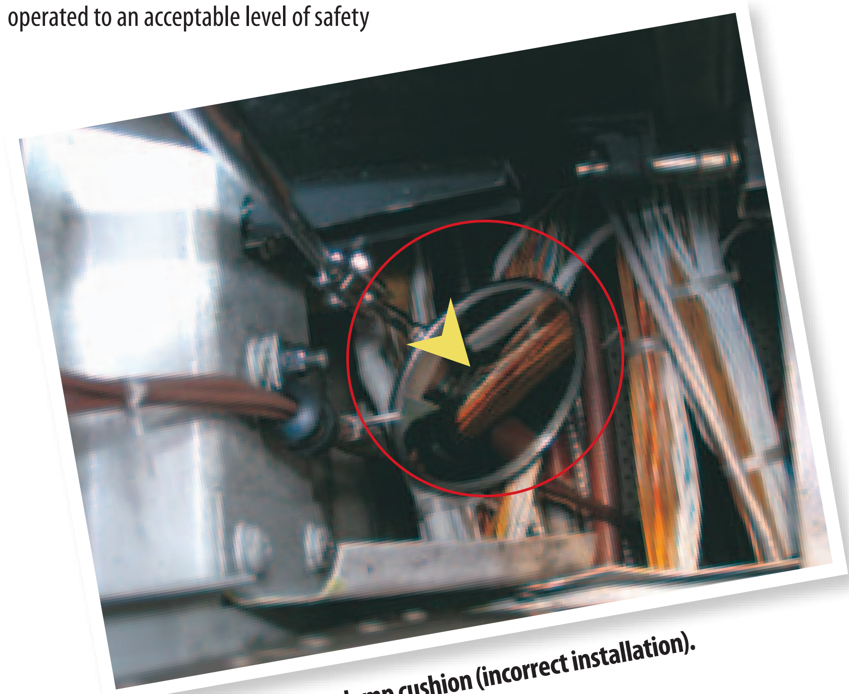


Figure 1. Wire outside clamp cushion (incorrect installation).

Prior to the tragic civil aviation events of TWA Flight 800 and SwissAir 111, little concern was given to wire in aircraft. In response to these events, the Aging Transport Systems Rulemaking Advisory Committee (ATSRAC) was chartered to gather industry leaders and examine the current state of aging aircraft systems. One of the main areas examined was the Electrical Wiring Interconnect System (EWIS). EWIS consists of all wires, cables, and associated support and termination devices.

Nearly all aircraft systems rely heavily on EWIS to operate safely. Like structural components, the health and function of EWIS can be significantly compromised by premature aging, damage and failure of wiring insulation. It is vital from a continuing airworthiness perspective that EWIS, as a system, be given the same level of importance as the aircraft structure and other critical flight control systems. TWA Flight 800 exploded in midair 17 July 1996 killing all 230 souls on board. The TWA 800 crash investigation report concluded that the probable cause of the accident was an

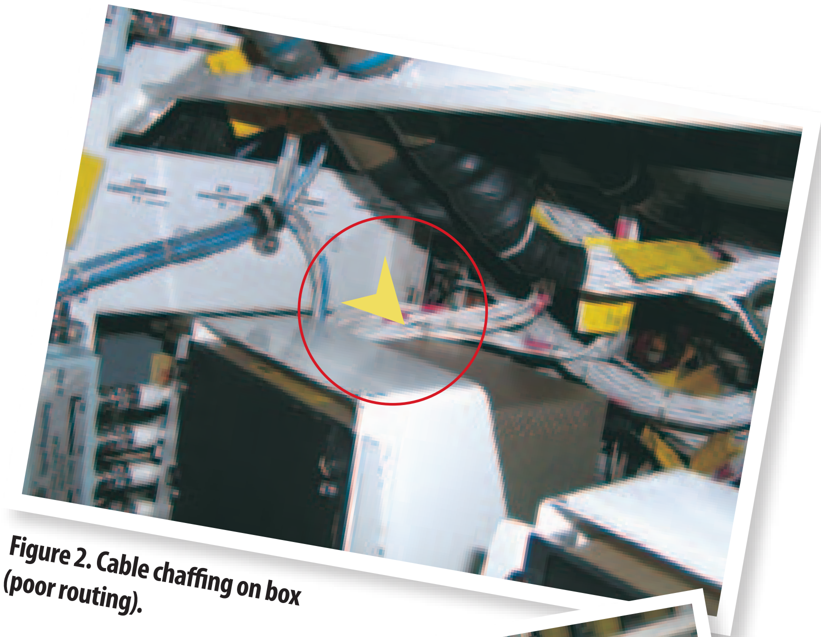


Figure 2. Cable chaffing on box (poor routing).

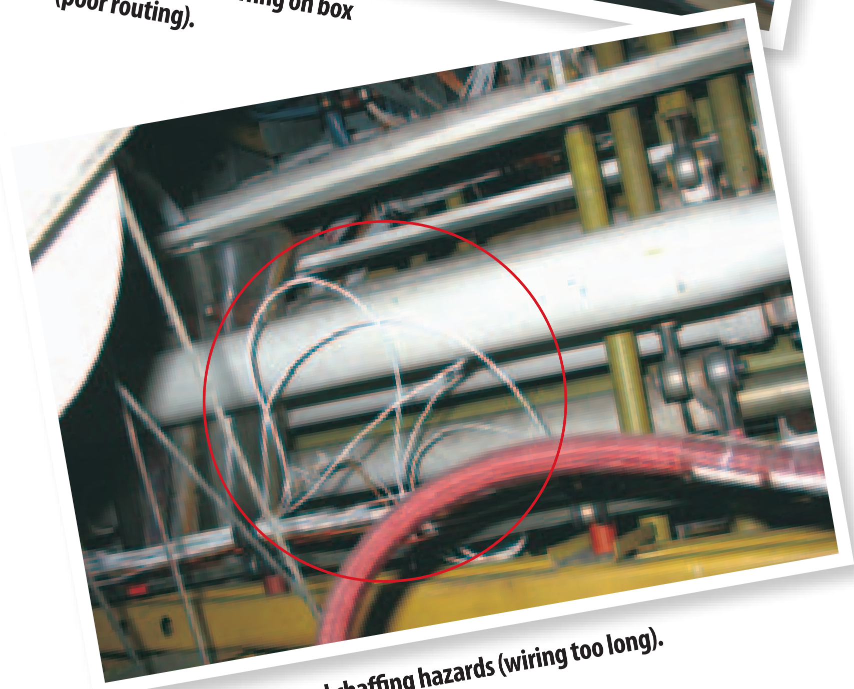


Figure 3. Snagging and chaffing hazards (wiring too long).

explosion in the fuel tank caused by a short circuit. Swissair 111 crashed into the sea 02 September 1998 killing all 229 souls on board. The crash investigation report concluded that the fire started in the entertainment system wiring and spread to ventilation, flight control and autopilot systems. There are no insignificant EWIS systems.

Premature aging is a product of environmental effects and includes but is not limited to: wire bundle location (e.g., Severe Wind and Moisture Problem (SWAMP) areas), temperature cycling, contamination, mishandling, and lack of effective inspection and maintenance training. Premature aging can start before wire is even installed on an aircraft. Damage and failure of wiring insulation can occur from chaffing, contact with cargo, flexing, mishandling or improper installation.

Aircraft are filled with miles of wire that remain in the aircraft undisturbed for decades. Every opportunity should be exploited to examine EWIS, especially if it is in an area not normally accessed. Anyone can conduct these visual inspections with two easily used tools and the correct thought process. The required tools are a flashlight and a mirror.

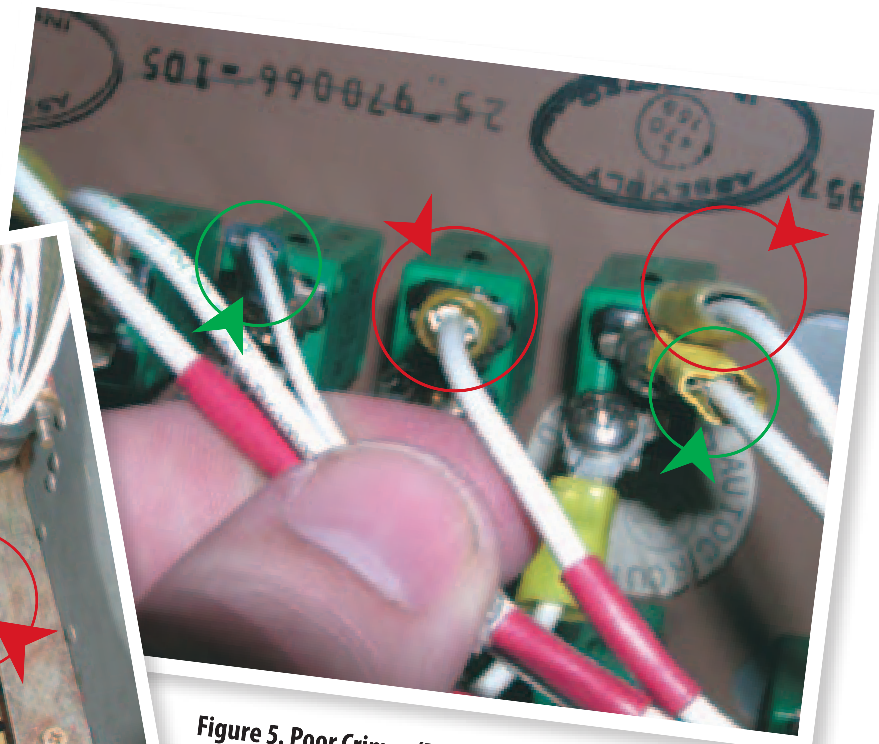


Figure 5. Poor Crimps (Red) Good Crimps (Green).

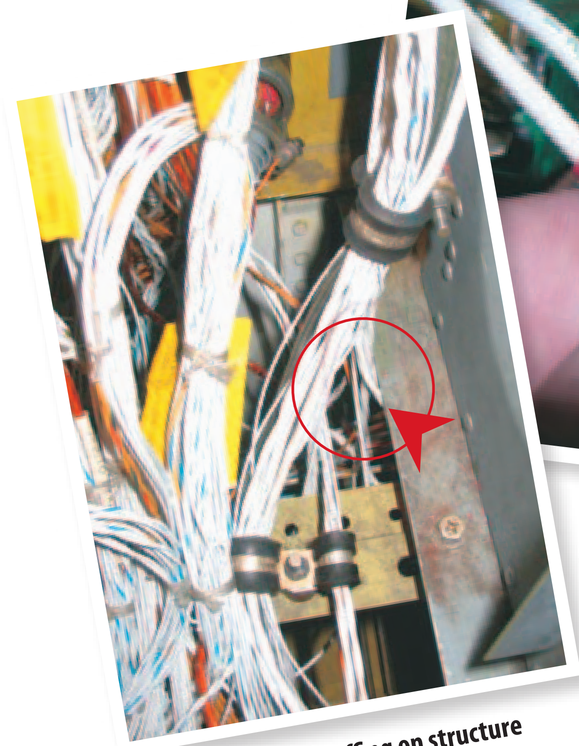
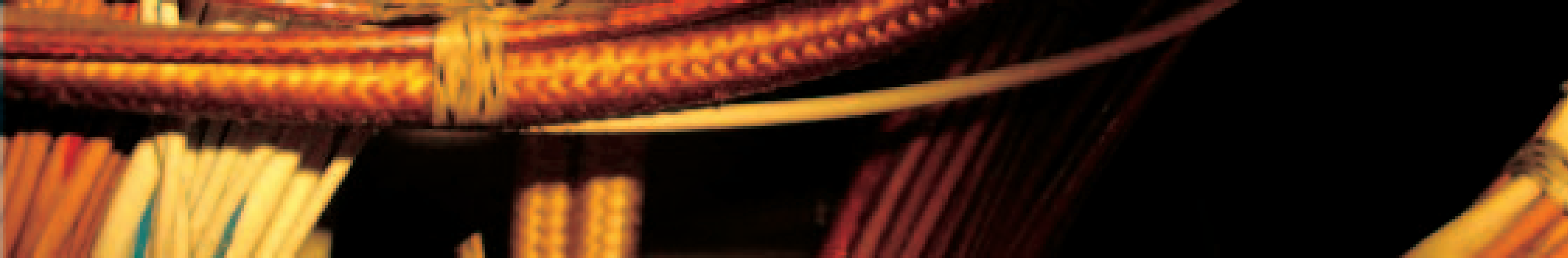


Figure 4. Bundle chaffing on structure (incorrect installation, wires too short).



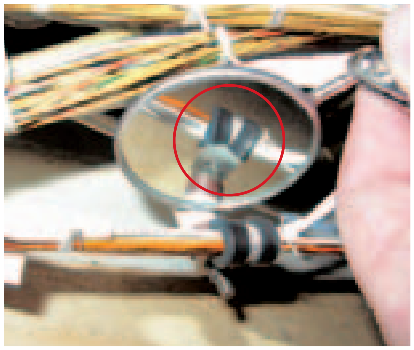


Figure 6. Bottom of cushion clamp not secured (looks good from the front).

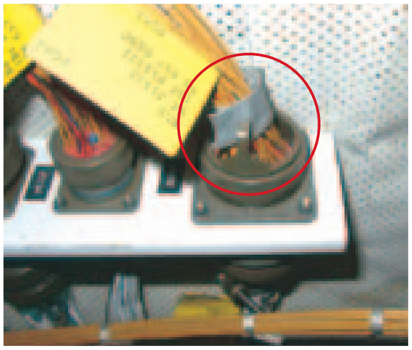


Figure 7. Saddle clamp bars missing (not installed correctly or now a FOD hazard).

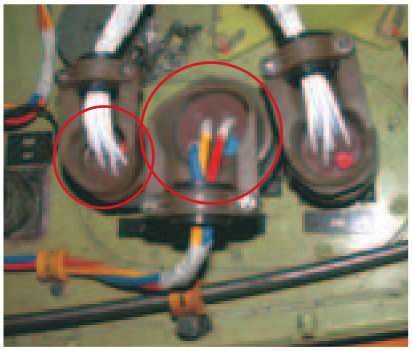


Figure 8. Environmental seal compromised (wires pulled too tight).

The inspection thoughts include:

- If it doesn't look right, it probably isn't. Ask someone who should know.
- Chaffing usually happens above, behind, and below the bundle. Use the mirror to have a look.
- Dirt, in any form, works like sandpaper on wiring. Make sure the wiring is clean.

Other good resources that provide more comprehensive inspection information can be found in C-17-010-002/ME-001 Installation/Assembly Instructions Aircraft Electrical and Electronic Wiring, and Mil-HDBK-522 Guidelines for Inspection of Aircraft Electrical Wiring Interconnect Systems. While these publications provide good information, fleet specific pubs always take precedence.

I would like to take this opportunity to recognize the efforts of all the people who work so hard to keep our aging aircraft flying. ◆

Figure 9. Wire bend radius exceeded (wire too long).

YOUR ATTITUDE > FLIGHT SAFETY > YOUR LIFE

To GO or STOP
Making the Abort Decision

By Captain Steve Roberts, Directorate of Flight Safety, Ottawa

Captain Roberts has completed 16 years with the CF18 including two fighter operational tours, two fighter instructional tours and a long test pilot tour at AETE. He is also an Empire Test Pilot School UK graduate and completed the Cranfield accident investigation course. He has been a DFS investigator since 2009.

For every flight on any given day, it is necessary for the pilot to be prepared for a high speed abort during the takeoff roll. The decision on whether or not to abort the takeoff requires comprehensive pilot awareness of the many risks involved. It's an emergency procedure and the emergency is not necessarily over when the aircraft comes to a stop.

When pilots are faced with unusual, unique, or unpredictable situations, there is the possibility of unduly and/or incorrectly performing a high speed abort. Low speed aborts, normally 100 knots or less, rarely lead to escalating safety issues following the abort. Alternatively, high speed aborts involve manoeuvres associated with higher risk due to the amount of kinetic energy involved and the necessity to effectively control aircraft braking and the aircraft trajectory on the runway. Furthermore, the kinetic energy absorbed by the brake system usually results in very hot brakes which can cause tires to deflate and can potentially result in brake fires, particularly *after* the aircraft has come to rest.

In commercial aviation, more than half of the runway overruns or excursions have occurred when the abort has been initiated at a speed greater than the maximum abort speed. Thus, the STOP or GO decision has to be made no later than when reaching the maximum abort speed or V1. The statistics and experience have also shown that as soon as the aircraft reaches 100 knots, the safest course of action is for the pilots to continue the takeoff, unless a major failure or a very serious emergency occurs.

Many modern, more sophisticated aircraft actually inhibit non-critical warnings during the high speed portion of the takeoff roll and the initial climb. SOPs are often written to include a speed callout in the 80 to 100 knot regime in multicrew aircraft. This callout serves as an airspeed crosscheck, a pilot incapacitation check and as the transition between the low and high speed segments of the takeoff roll.

Common low speed abort situations include:

- System failure;
- Unusual noise or vibration;
- Tire failure;
- Abnormal acceleration;
- Engine failure;
- Engine fire;
- Configuration warning;
- Predictive windshear warning;
- Significant bird hazard;
- Blocked runway;
- Airplane unsafe or unable to fly.

Common high speed abort situations:

- Engine failure;
- Engine fire;
- Airplane unsafe or unable to fly.

Specific fixed wing aircraft have their own abort procedures. It is imperative that pilots understand exactly what their aircraft abort requirements are and how to action them. It is also important to emphasize that aborts should not be initiated above V1 unless the aircraft is incapable of flight.

There are also important considerations following a high speed abort. Normally the pilot will stop the aircraft on the runway and will request the emergency fire vehicles to examine the aircraft prior to further taxi. Depending on the location, there may be a need to clear the runway and the further requirement for remote parking. Any ground crew approaching the aircraft should be advised of the possible hot brake hazard following a high speed abort.

Bottom line: plan ahead, follow your standard operating procedures and understand when a high speed abort should be carried out and the inherent risks involved. ◆

FOAM EARPLUGS

Are the instructions falling on deaf ears?

By Jessica Gehler and Dr Adrian Smith

Jessica Gehlert is a 4th year medical student at Flinders University. She wrote this article under the supervision of Dr Adrian Smith during a clinical rotation at the RAAF Institute of Aviation Medicine. Dr Smith undertook the original research project.

This article was originally printed in the 02/2011 issue of Aviation Safety Spotlight magazine. It is reproduced here with the kind permission of the Australian Directorate of Defence Aviation and Air Force Safety.

Foam earplugs might look simple to use, but the reality is that untrained users often insert them incorrectly, and if not inserted correctly they might provide the wearer with little or no protection from noise.

Do you wear foam earplugs? Have you ever come home from work with ringing in your ears or difficulty hearing? This is a common problem experienced by people who wear earplugs, and may be a result of something as simple as poor fitting.

We all know the aviation environment – whether inside an aircraft, on the tarmac or airfield, or in a hangar or workshop – can be very noisy. (That's why aircrew and aviation maintenance personnel need to wear hearing protection). In many workplaces, foam earplugs are the most common form of hearing protection worn, either by themselves, or inside ear defenders or a flying helmet (so-called double hearing protection). Regrettably, some people might be at risk of developing hearing loss and chronic tinnitus (a ringing in the ears) because they don't insert their foam earplugs the right way.

Noise-induced Hearing Loss

Work-related exposure to hazardous levels of noise is a significant occupational threat around the world. Noise-induced hearing loss is the most common occupational disease in the US, and is the fourth most common occupational disease in Europe. The Australian Safety and Compensation Council estimates that as many as 28 to 32% of Australian workers are exposed to potentially-hazardous levels of noise in the workplace. Occupational hearing loss is a significant condition affecting the Australian workforce, accounting for up to 24% of all disease-related claims over the last 10 years. 'Hearing loss' accounts for 19% of all claims for work-related diseases in Australia.

Occupational hearing loss costs more than AU$41 million each year in compensation. 'Hearing loss' costs the Australian community as much as $6.7 billion a year in lost productivity, a staggering figure when you consider estimates that as many as 37% of hearing loss in Australia can be attributed to excessive noise exposure in the workplace!

In the 2008/9 financial year, occupational noise injuries – hearing loss and tinnitus – were the two conditions most frequently accepted by the Department of Veterans' Affairs, and sensorineural hearing loss was the second most common claim for compensation under the *Australian Military Rehabilitation and Compensation Act*.

Foam Earplugs

The aviation environment is known to pose a high risk for noise-induced hearing loss, and personnel who work in and around ADF aircraft may be required to wear foam earplugs (either by themselves, or together with earmuffs as double hearing protection). Unfortunately, many people think that foam earplugs are easy to use – so easy, that many people are never taught how to use them properly.

Foam earplugs might look simple to use, but the reality is that untrained users often insert them incorrectly, and if not inserted correctly they might provide the wearer with little or no protection from noise. On the other hand, studies have shown that people who are shown how to insert their earplugs correctly get much better protection from noise. Because of this, it is important for aircrew and aviation maintenance personnel – in fact, all ADF personnel who are exposed to noise – to know how to use foam earplugs properly if they want to prevent noise-induced hearing loss.

Photo: LAC Glen McCarthy

AVMED Project 10/2009

The importance of preventing noise-induced hearing loss in aircrew, and the importance of inserting foam earplugs correctly, led the RAAF Institute of Aviation Medicine to evaluate how well aircrew were using foam earplugs. AVMED Report 10/2009: Real-World Attenuation of Foam Earplugs assessed the real-world level of noise protection provided by foam earplugs used by typical aircrew, and compared this to the level of noise protection the earplugs are capable of providing (according to the manufacturer's specifications). The project also looked at the improvement in noise protection after aircrew were shown how to insert their earplugs correctly.

Method

Forty-three aircrew (pilots and non-pilot aircrew) volunteered to participate in the study. Pilots ranged in experienced from a few who had just completed their basic flying training, through to pilots with more than 3,000 flying hours of experience. They were asked to insert foam earplugs as they would normally. The earplugs used were capable of providing 25-32 dB of protection if worn correctly. The study recorded the technique used to insert the earplugs and the level of noise protection they provided – before and after the participants received a brief one-on-one training session to insert the earplugs correctly.

Most of the participants (62%) had taught themselves how to insert the foam earplugs (either by trial and error or by watching how others inserted them), and 7% read the manufacturers instructions. 38% of participants indicated a flying instructor or senior aircrew member in the squadron had shown them how to insert the foam earplugs. These figures are not surprising: typically, Defence members would be given foam earplugs and told to put these in your ears when you are around loud noise, and any other training is more likely to be a soldier's five demonstration rather than a structured training programme. This might explain why 56% of participants reported their earplugs became dislodged when flying, and 19% reported temporary deafness and ringing in their ears after flying (even though they had been wearing foam earplugs at the time).

Results

At the beginning of the study, most participants did not observe the proper technique to insert earplugs. Only 35% rolled the earplugs into a narrow crease-free cylinder, and less than 20% straightened the ear canal, or pushed the earplugs deep into the ear canal, or held it in place while the foam expanded.

The average level of noise protection afforded by the earplugs at the beginning of the study was only 15 dB, with 12% receiving a level of protection less than 10 dB. Of significant concern is that 7% received little or no protection at all. Remember, these earplugs are supposed to provide 25-32 dB of protection.

Further analysis of the results revealed interesting patterns. First, there was no difference between pilots and non-pilot aircrew in terms of the technique used or the level of protection from the earplugs – both groups performed equally poorly. Second, flying experience did not determine who used the correct technique or who achieved good noise protection – experienced aircrew (pilots and non-pilot aircrew) performed just as

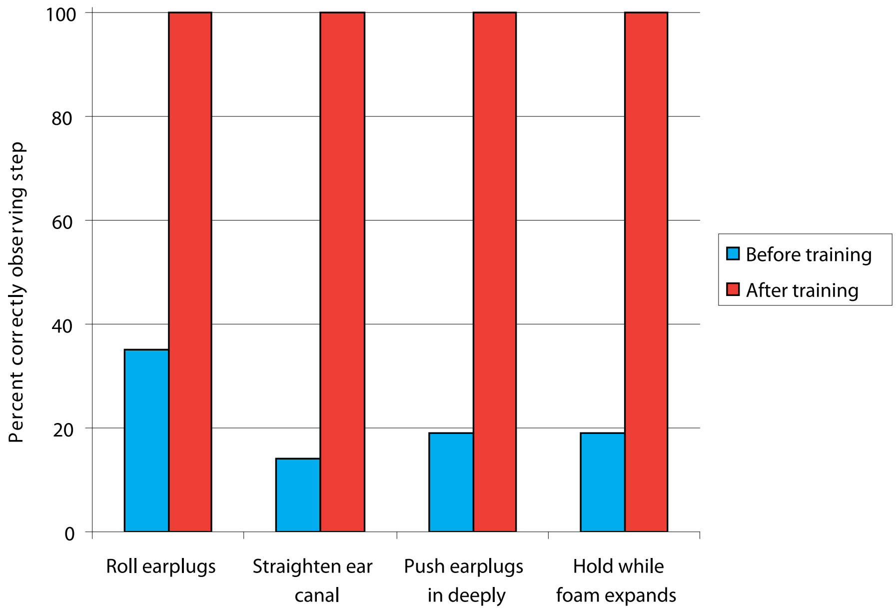


Figure 1. This graph shows the percentage of participants who correctly followed the steps to insert foam earplugs properly, in accordance with the manufacturer's instructions. At the beginning of the study, few people knew how to insert their earplugs correctly.

poorly as newly-qualified pilots and junior aircrew. Finally, compared to those who had taught themselves, aircrew who had been shown how to use earplugs by a flying instructor or senior aircrew member in the squadron were more confident they were using the right technique and more confident they were getting optimum protection. . .but they were no more likely to use the proper technique or obtain a good level of noise protection than those who were self-taught. Not surprisingly, aircrew who read the manufacturer's instructions achieved significantly better noise protection.

After undergoing a brief one-on-one training session, all participants correctly followed the six-step insertion technique, and this was accompanied by a significant improvement in the level of noise protection provided by the foam earplugs. On average, the level of noise protection experienced by the group increased by 11 dB[1] . The average level of noise protection after training was 25 dB, meaning that most of the group were able to achieve a level of noise protection as good as, or better than, the level advertised by the manufacturer of the earplugs. Before training, only 28% of the participants were able to achieve this level of noise protection. The most interesting observation was that the level of hearing protection achieved was directly proportional to how deep the earplugs were pushed into the ear canal – the deeper they were inserted, the more noise they blocked out.

The training given to the participants of this project was simple. Dr Smith, the AVMED researcher who conducted this study, gave each participant a one-on-one briefing and then showed them a series of 30-second video clips supplied by an earplug manufacturer.

Even though the training was simple, it was well-received by the participants of the study. Most of the participants (98%) believed the technique demonstrated to them during the study was better than their current technique, and they intended to adopt and continue to use the newly-taught technique rather than continuing to insert earplugs the way they had done before.

Even though Defence provides foam earplugs to people working in noisy work environments, people might still be at risk of noise-induced hearing loss if they don't use the earplugs correctly.

Conclusion

Even though Defence provides foam earplugs to people working in noisy work environments, people might still be at risk of noise-induced hearing loss if they don't use the earplugs correctly. Foam earplugs that are not inserted correctly can offer little or no protection from noise, and this can increase the risk of developing noise-induced hearing loss later

[1] With noise measurements, a 3 dB change in the noise level is a doubling of the noise energy . . . and it is the overall noise energy that is the risk for noise-induced hearing loss. So, an 11 dB increase in noise protection means that the amount of noise energy the person is exposed has been reduced by a factor of 16!

in life. However, following the basic steps outlined in this article will ensure that ADF personnel are able to insert their earplugs correctly, enabling them to get optimum protection when they are exposed to potentially hazardous levels of noise in their workplace.

Hearing protection and the correct use of foam earplugs is not just about the workplace. Knowing how to insert earplugs correctly is also important for friends and family members who are exposed to noise in other areas of their life – rock concerts, motor sport, or operating power tools or machinery.

Noise-induced hearing loss is often irreversible. Foam earplugs might seem easy to use, but this study has shown that they are easy to use badly. Give yourself the best protection – learn how to use earplugs properly: roll, pull, push, hold, and check. ◆

References

Australian Safety and Compensation Council (ASCC). Work-related noise-induced hearing loss in Australia. Canberra: Australian Safety and Compensation Council; 2006

Australian Safety and Compensation Council (ASCC). National hazard exposure surveillance — noise exposure and provision of noise control measures in Australian workplaces. Canberra: Australian Safety and Compensation Council; 2009

Campbell J. Cost of veterans Military Rehabilitation and Compensation Act rises 280 per cent. The Sunday Mail (Qld), 21 February 2010. Viewed 01 April 2010, http://www.news.com.au/national/cost-of-war-veterans-rises-280-per-cent/story-6frfkw0-1225832611763.

Concha-Barrientos M, Campbell-Lendrum D, Stennland K, editors. Occupational noise–assessing the burden of disease from work-related hearing impairment at national and local levels. Geneva: World Health Organization; 2004

Franks JR, Stephenson MR, Merry CJ, editors. Preventing occupational hearing loss — a practical guide. NIOSH Publication 96-110. Cincinnati, OH: National Institute of Occupational Safety and Health (NIOSH); 1996

National Institute for Occupational Safety and Health (NIOSH). Noise and hearing loss prevention. Viewed 07 April 2010, www.cdc.gov/niosh/topics/noise.

National Institute for Occupational Safety and Health (NIOSH). National Occupational Research Agenda. Disease and injury: hearing loss. View 07 April 2010, www.cdc.gov/noiosh/docs/96-115/disease.html.

Nelson DI, Nelson RY, Concha- Barrientos M, Fingerhut M. The global burden of occupational noise-induced hearing loss. American Journal of Industrial Medicine 2005; 48 (6):446-458

Schneider E, Paoli P, Brun E. Noise in figures. Luxembourg, Belgium: European Agency for Safety at Work; 2005.

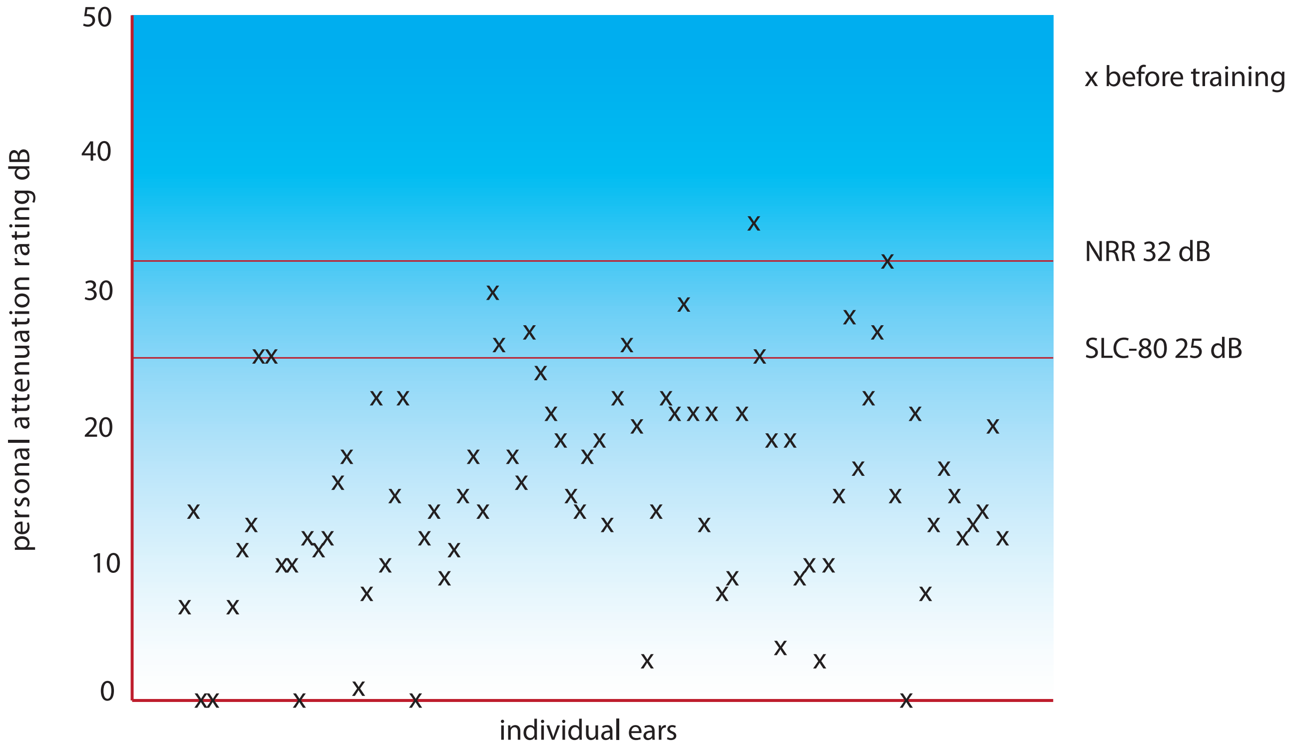


Figure 2. Each 'x' indicates how much noise was being blocked out by the earplugs inserted during this study. Note: earplugs inserted correctly should be able to provide a level of protection of 25–32 dB (indicated by the two horizontal lines across the middle of the graph). At the start of the study, very few people achieve a satisfactory level of hearing protection, with many getting little or no protection from their earplugs.

FOAM EARPLUGS

How much protection are YOU getting?

By Dr Stephen Tsekrekos and Mr Pierre Lamontagne, Directorate of Force Health Protection, Ottawa

Stephen Tsekrekos is a physician who specializes in Occupational Medicine and has been with the Directorate of Force Health Protection since 2004.

Pierre Lamontagne has over 25 years of clinical audiology experience and has been working for the Department of National Defence since 1975. His current role is to oversee the provision of audiology services for all Canadian Forces members and to champion initiatives to effectively protect soldiers from the danger of excessive noise.

The accompanying article by Gehler and Smith[1] shines a spotlight on an important issue regarding the use of earplugs – most people don't know how to use them properly!

Earplug Insertion

Proper insertion of earplugs is critical. If they are not inserted correctly, then they are ineffective. Consider the following example of an earplug that should provide 22 decibels (dB) of protection (in other words, the earplug should be able to reduce the sound energy that reaches your ear by 22 dB). In order for that earplug to work properly, it must be fully inserted into the ear canal[2], such that only the top of the earplug is visible to an outside observer. As shown in Figure 1, the protection provided by the earplug drops off considerably when the earplug is not fully inserted into the ear canal[2]. Note the left-most picture in Figure 1: an individual who only inserts 25% or less of the earplugs into their ear canals may technically be "wearing earplugs", but the earplugs in this circumstance are providing no hearing protection whatsoever.

Fortunately, everyone can learn how to properly insert earplugs; they simply have to be taught how. Many studies have shown that the hearing protection people achieve with earplugs increases substantially when they have been adequately trained on how to wear the earplugs properly[3,4,5,6].

The steps that must be followed to ensure that foam earplugs are inserted properly is shown in Figure 2. In addition to the figure, the National Institute of Occupational Safety and Health (NIOSH) website (http://www.cdc.gov/niosh/mining/topics/hearingloss/earplug.htm) also has a link to an instructional video. As well, NIOSH has a website link that allows individuals to very quickly and easily check the effectiveness of their hearing protection (http://www.cdc.gov/niosh/mining/topics/hearingloss/quickfitweb.htm); all that is required is internet access and a computer with speakers.

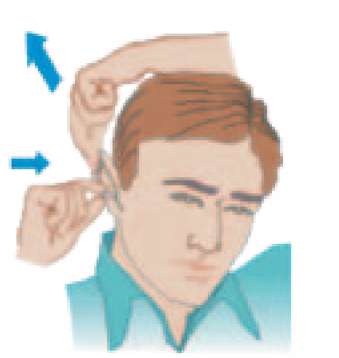
If You Want Them to Work, You Have to Wear Them

In addition to proper earplug insertion, there is one other key factor that must be adhered to in order to ensure that earplugs provide effective hearing protection: they must be worn for the **entire** time that one is in a noisy environment.

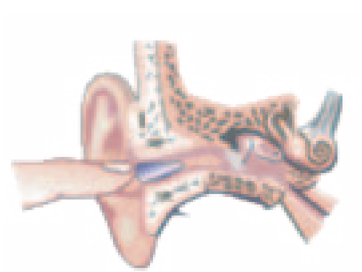
Consider the example of someone who works an 8-hour shift in a noisy environment. This individual uses properly inserted earplugs that provide 22 dB of hearing protection. However, over the course of the work day, the individual removes the earplugs occasionally while exposed to noise, such that by the end of the work day, the individual has worn the earplugs for a total of 7.5 hours out of the 8 hours exposed to noise. The individual has still worn the earplugs for about 94% of the shift, so this shouldn't be a big deal, right? Wrong! By removing the earplugs for just 6% of the total noise exposure time, the earplugs have effectively provided only about **12 dB** of protection over the entire work shift!

Figure 1. Hearing protection (noise reduction) achieved with different degrees of earplug insertion[2].

1. Roll the earplug up into a small, thin "snake" with your fingers. You can use one or both hands.



2. Pull the top of your ear up and back with your opposite hand to straighten out your ear canal. The rolled-up earplug should slide right in.



3. Hold the earplug in with your finger. Count to 20 or 30 out loud while waiting for the plug to expand and fill the ear canal. Your voice will sound muffled when the plug has made a good seal.

Figure 2. Steps required to ensure proper insertion of foam earplugs[7] (Note that for step #3, counting inside your head may be more socially acceptable).

How is this possible? The main reason for this is that the decibel scale is logarithmic (similarly to the Richter scale for earthquakes). The time that the earplugs are out of the ears may not be very long, but the amount of noise reaching the ears during this unprotected time period is much greater than when the earplugs are worn. If the earplugs are worn during the entire 8-hour duration of noise exposure, then they will provide 22 dB of protection. But if you remove the earplugs for just 30 minutes out of an 8-hour exposure period, then you will be exposed to the same amount of noise as someone who uses 12 dB earplugs for the entire 8-hour work shift. If you need 22 dB of protection, for example, then the only way to achieve that is to **always** wear your earplugs when you are exposed to noise.

Summary

There are many different types of hearing protection to choose from. Foam earplugs are a great choice for many situations because they provide excellent protection against many forms of noise, they expand to fit one's ear canals for a "personalized" fit, and they're cheap and readily available, so that you can always grab a clean pair. But like any form of hearing protection, foam earplugs need to be used appropriately. If you and/or your subordinates work in a noisy environment and rely on foam earplugs for hearing protection, then you must ensure that the earplugs are correctly inserted and they are worn when they need to be. Hearing protection only works if it is worn, and worn properly. ◆

References

1. Gehler, J., Smith, A. (2011). Foam earplugs – are the instructions falling on deaf ears? Aviation Safety Spotlight, 02 2011.
2. Bjorn, V.S., et al. U.S. Navy flight deck hearing protection use trends: survey results. Technical Report No. NAWCADPAX/TR-2006/73. Naval Air Warfare Center Aircraft Division. Patuxent River, Maryland. 18 May 2006. (http://www-nmcphc.med.navy.mil/downloads/occmed/toolbox/Flight%20Deck%20HPD%20Use%20Trends.pdf).
3. Toivonen, M., et al. (2002). Noise attenuation and proper insertion of earplugs into ear canals. Annals of Occupational Hygiene; 46(6): 527-530.
4. Joseph, A., et al. (2007). The effects of training on earplug performance. International Journal of Audiology; 46(10): 609-618.
5. Smith, A.M. (2010). Real-world attenuation of foam earplugs. Aviation, Space, and Environmental Medicine; 81(7): 696-697.
6. Murphy, W.J., et al. (2011). Effects of training on hearing protector attenuation. Noise & Health; 13: 132-141.

13TH AIR TO AIR Safety Conference (ATASC)

By Mr Jacques Michaud, Directorate of Flight Safety, Ottawa

Mr Michaud is a former RCAF pilot with close to 6,000 hours on the *Kiowa* and *Griffon* within the tactical helicopter community. He completed three tours with 430 Tactical Helicopter Squadron, his last one as the Commanding Officer from 1993 to 1996 and one tour as an instructor with 403 Operational Training Squadron. He retired from the Canadian Forces in 2002 and moved in his current position of Section Head for Promotion and Information within the Directorate of Flight Safety.

The Directorate of Flight Safety hosted the 13th Air to Air Safety Conference (ATASC) from 20 to 23 Jun 11 at the Hilton Lac-Leamy Hotel in Gatineau, QC. ATASC aims to gather on an 18-month frequency cycle flight safety representatives from Canada, Israel and the United States. The main topic of the conference was "New Technologies Supporting Accident Investigation and Flight Safety."

There were approximately 25 participants that attended the conference representing the Israel Air Force Safety Directorate, the USAF Safety Center, the US Coast Guard, the US Naval Safety Center, and NASA, as well as Canadian government and industry representatives from the Transportation Safety Board, the Quality Engineering and Testing Establishment, NavCanada, CAE and Searidge Technologies. The Directorate invited two experts from the United Kingdom as guest speakers: Miss Sarah Harris, who is employed as a human factor specialist with the Accident Investigation and Human Factors Section of the Royal Air Force, and Dr Matthew Greaves who is a lecturer and researcher at the Safety and Accident Investigation Centre at Cranfield University. He is well versed in the use of United Kingdom Department of Defence's initiatives on the use of commercial satellite imagery for accident investigation and the use of laser scanners for accident site reconstruction

The conference was opened and closed by the Royal Canadian Air Force Commander and Chief of the Air Staff, Lieutenant-General André Deschamps. He described how the aircraft industry is becoming even more global in that more countries operate similar aircraft types, and how complex issues are common across these fleets. He emphasized the importance of sharing information as the most efficient shortcut to safe operations, whether it's communicating the problem or transmitting solutions.

The following provides a synopsis of some of the presentations.

Miss Sarah Harris briefed on the Operational Events Analysis (OEA) she conducts with operational units in theatre. This is a proactive method of Human Factors investigation initiated by operational commanders rather than being triggered by an accident or a serious incident. The OEA involves the analysis of subjective evidence (previous reports and interviews), objective evidence (training and safety analysis), practical observations (mission planning and in-flight assessments), and performance observations (workload analysis and psychological readiness). All the human factor components are then fitted into a timeline construct where serious deficiencies, if any, are identified.

Mr John Britten, a Canadian Transportation Safety Board (TSB) Senior Investigator Engineering Specialist, provided an overview of iZone. iZone is an investigation case management tool used by TSB to collect, share, analyze and track investigation information. The Sharepoint-based tool gives a high level overview of current occurrences and offers collaboration tools for investigators to exchange information directly.

Mr Dan Ouelette is Lead Technologist at the Physical Properties Laboratory in the Quality Engineering Test Establishment. He presented laser scanning and photogrammetric analysis of crash sites with Doctor Matthew Greaves. They described the technology, strengths and weaknesses of laser scanning. He demonstrated several laser projects and summarized the lessons learned. Doctor Greaves showed how photogrammetric analysis could be used for similar purposes and discussed its associated strengths and weaknesses. These technologies offer great capabilities for documenting crash sites, but can be challenging to implement.

Major Adam Cybanski, deputy for Promotion and Prevention at the Directorate of Flight Safety, provided demonstrations of deep surface modelling and video triangulation. He took photos of various objects in the center of the room using a Canon PowerShot 300HS camera. These photos

1st Row Left to Right: Mr. Sullivan (NAVCAN), Maj Laurin (USAF), LCdr Smith (US Coast Guard), Capt(N) Zamesnik (US Navy), Col Chicoyne (DFS), LGen Deschamps (CAS), Col Koren (IAF), Ms. Dillinger (NASA), Maj Shalev (IAF), Mr. Kosta (DFS)

2nd Row Left to Right: Mr. Michaud (DFS), Mr. Cortes (USAF), Maj Roberts (DFS), CWO Western (1 Cdn Air Div), CWO Denis Cormier (DFS), Maj Cybanski (DFS), LCol Brabant (1 Cdn Air Div), Ms. Harris (UK), LCol Ruvio, Ms. Banville (QETE), Capt Maxwell (DFS)

3rd Row Left to Right: MWO Bolduc (DFS), Mr. Joli (NAVCAN), Mr. Armour (DFS), Capt Roberts (DFS), Mr. Sauvé (DFS), Mr. Zdunich (NRC), Mr. Brosseau (DFS), Mr. Greaves (UK), Cmdr Lentz (US Navy), LCdr Atton (US Navy), Maj Golan (IAF), Capt Dixon (DFS)

were assembled first into a point cloud, then into a 3D model by the software Photomodeller. He also demonstrated triangulation methods used to calculate the position of a CF188 *Hornet* accident solely from videos. The videos were tracked using Syntheyes software; relative bearings were then used to derive Lat/Long of the target aircraft. The results were displayed in a simulator to validate the calculated data.

Major Cybanski also provided an overview of occurrence visualization at DFS. He indicated the components required and the steps needed in order to produce an effective visualization. He described the two major types of visualization, investigative and promotional, and demonstrated many of the DFS visualizations produced over the last four years.

Mr. Duff Sullivan, as the Chief of Operational Safety Oversight in the Office of Safety and Quality at Nav Canada, described the capabilities of the Radar Analysis Debriefing System (RADS), an animation system for displaying radar data in an intuitive 3D format on a PC or laptop. He showed how the interface allows creation of an animation with synchronized audio in less than one minute. It can be used for immediate incident level analysis at the ACC or Tower, is an excellent training aid, and can be very useful for senior management briefings and communication to diverse knowledge based audiences.

Mr. Daryl Collins, a Senior Investigator with the Transportation Safety Board, was responsible for the final preparations of the *Cougar* accident report prior to public release and for the sections of the report that pertain to flight crew training including emergency procedures, emergency handling and crew resource management. He provided a detailed account of the *Cougar* Helicopters Sikorsky S-92 accident near St. John's, Newfoundland on March 12, 2009. He also recounted lessons learned during the investigation specifically pertaining to recovery, recorders, emergency flotation systems, certification, public/media, next of kin, survivability and investigation management.

It was agreed by all participants that the Air to Air Safety Conference was very productive, and that another be held in 18 months, to be hosted by the United States Naval Safety Centre. Several of the presenters also contributed articles to the 2011 edition of *On Target* magazine. The Records of Proceedings are available on the DFS Intranet website at http://airforce.mil.ca/fltsafety/index_e.htm. ◆

SCHULTZ, Rayne "Joe" Dennis
Group Captain (Ret'd) DFC, OMM, CD
1922-2011

In MEMORIAM

After a fighter pilot's struggle slipped the surly bonds of earth appropriately on Remembrance Day 2011 in his 89th year. His love of flying carried over a distinguished 37-year career with the RCAF and beyond. A well-documented WWII *Mosquito* night fighter pilot with 410 Squadron he went on to fly over 40 different aircraft including the CF18 twice in his later years. As the Director of Flight Safety for 10 years, he was known as "Mr. Flight Safety". His efforts were recognised internationally by the International Flight safety Foundation in 1977 and he was elected as honorary member of the USAF Aerospace Safety Hall of Fame. In Canada, he was awarded the Trans-Canada McKee trophy in 1978 and was inducted into the Canadian Aviation Hall of Fame in 1997 with the following citation: "Over many years in cooperation with the military and the civilian agencies associated with aviation, his vision, dedication and pursuit of excellence resulted in significant advancement in air operations generally and flight safety accident prevention programs in particular." He will not be forgotten.

The following was originally published as a dedication to Colonel Schultz on his retirement from the CF and is re-printed from Flight Comment, Edition 3 1977.

Colonel R.D. Schultz

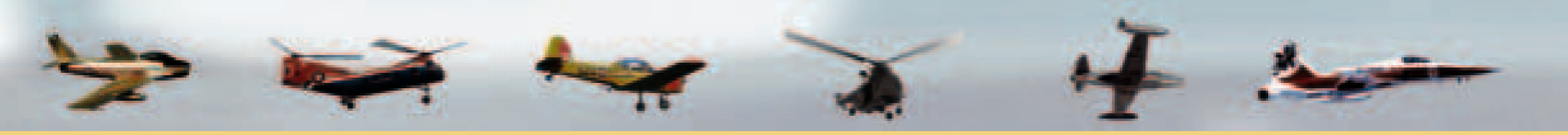
Colonel R.D. Schultz, the Director of Flight Safety of the Canadian Armed Forces and the pilot of the night fighter involved in 1943 in what was later termed "the outstanding night fighter mission of World War Two" will go on retirement leave in late August of this year after 36 years of service.

Colonel Schultz, a native of Bashaw, Alberta, joined the RCAF in July 1941, with the rank of Aircraftsman 2nd Class. After elementary training on *Tiger Moths* at Sea Island and Service Flying Training on Ansons in McLeod, Alberta he was awarded his wings and transferred as a Sergeant Pilot to England. In August 1942, after advanced flying training on Airspeed Oxfords, he was selected for night fighter training and transferred to Charter Hall in Scotland for operational training which was carried out on *Bristol Blenheims*, *Beauforts* and *Beaufighters*.

By December 1942, Sgt Schultz was "combat ready" and was transferred to 410 Squadron RCAF which by then was active in Britain flying *Beaufighters* initially and later *Mosquitoes*. The squadron flew night fighter patrols, night intruder/bomber missions, and carried out its share of training missions as well.

It was as a Pilot Officer that R.D. Schultz and his navigator F/0 V. Williams reported this action in August 1943.

"During a night patrol over France, we bombed a railway bridge near Clermont and attacked and damaged three locomotives and three goods cars. On the return journey we climbed to 6,000 feet and saw an aircraft which began to move into close formation on our right wing. The aircraft, which we recognized as a Do 217 closed into about two wingspans range apparently mistaking us for a friend. Suddenly he recognized his error and broke hard right in



December 2 1942, the morning after the historic three victory mission, Schultz (centre) describes part of the action for his navigator F/O V.A. Williams (left) and Flight Officer Dick Geary USAAF at RAF Hunsdon.

an effort to get out of this ludicrous situation. We broke right and followed him, quickly re-arming our cannon which we had previously safetied. The enemy aircraft opened fire accurately from the under turret. We closed in on him while he took evasive action and eventually we opened fire at 400 yards. The enemy aircraft dived underneath to port and we closed in to 150 yards, the enemy aircraft took further evasive action, carrying out a skidding turn at right angles. A half second burst was fired from 150 yards. Strikes were observed in the cockpit area where fires broke out, and burning pieces were seen to drop off the enemy aircraft. Very inaccurate return fire was observed. Immediately afterwards four of the crew baled out. The enemy aircraft then went into a shallow dive in the direction of the French coast. We closed in to 50 yards and gave Another half second burst. The starboard wing and engine fell off the enemy aircraft. It exploded, was completely enveloped in flames, and went into the sea.

Later, on the night of 10/11 December 1943, Schultz and his navigator took off on what was to prove their most fruitful single mission. An edited transcript of the mission report reads:

"A *Mosquito II* aircraft with F/O R.D. Schultz pilot and F/O V. A. Williams observer – both Canadian, left Hunsdon at 1,800 hours 10th December, 1943, for defensive patrol under Trimley Heath G.C.I. The *Mosquito* patrolled North to South midway across the North Sea at 15,000 feet for about 50 minutes. The pilot was then given a vector of 070 degrees and told to investigate a bogey with caution – three minutes later being told to climb to 20,000 feet. Vector was then changed to 010 degrees and bogey was said to be six miles dead ahead. The observer immediately obtained contact slightly to starboard and well below – range 14,000 feet. The *Mosquito* dived rapidly and overshot. The pilot asked for further help and was given a vector of 240 degrees obtaining contact again at 14,000 feet dead ahead. This range was closed very rapidly and visual contact obtained at 6,000 feet on an aircraft coming head-on at a height of 14,000 feet. The *Mosquito* swung round and got on its tail, momentarily losing visual contact, but the observer held radar contact and visual contact was picked up again at 7,000 feet dead astern. The *Mosquito* closed in and no recognition signs were seen nor was the target showing IFF. Schultz closed in rapidly to 50 yards but the enemy aircraft, by then recognized as a Do 217, fired a long accurate burst before he could open fire. The target peeled off to port. The *Mosquito* followed and got in a short burst which set the starboard engine on fire. The target continued evasive action losing height rapidly and at 9,000 feet a long burst was fired by Schultz which resulted in a large flash and explosion on the starboard side of the 217. All return fire had ceased by now, but the enemy pilot kept up evasion trying to gain cloud cover at 7,000 feet. Unfortunately for him he went straight through it. The *Mosquito* followed and at 1,500 feet the target steadied up, opened its bomb doors and apparently tried unsuccessfully to jettison its bombs. After another long burst from quarter astern the target hit the sea burning furiously. Cine camera shots were taken of wreckage.

The *Mosquito* was then given orders to climb as fast as possible to 15,000 feet. On reaching this altitude it was given a vector of 010 degrees and a distance of three miles. Again the observer got contact at once at 14,000 feet range and the *Mosquito* closed in very rapidly. Visual contact was obtained at 7,000 feet and the target identified as another Do 217. One burst was fired from dead astern opening fire at 300 yards. At 50 feet range the target blew up and the *Mosquito* flew through the debris. No evasive action or return fire was observed and it would appear that the target's bombs blew up as the *Mosquito* crew felt a considerable jar when the Dornier exploded.

F/O R.D. Schultz and F/L V.A. Williams.

Just after passing through the debris, the observer who had been holding another contact during the last engagement, told the pilot to turn starboard 10 degrees 7,000 feet range and pilot obtained visual contact at once at height of 7,000 feet. The *Mosquito* closed in rapidly, identifying another Do 217. Now began a long duel, with the enemy pilot performing exceptionally skillful evasive maneuvers.

Schultz fired two very short bursts from astern, but missed. The enemy aircraft peeled off to port and fired a very accurate burst from its dorsal position. The *Mosquito* followed the target down to 9,000 feet and the pilot fired a long burst which set fire to the enemies starboard engine. Evasive action went on down to sea level and the enemy aircraft turned for home. This was a fatal tactical error for the enemy pilot stopped evasion for this short period enabling Schultz to get in another short burst, causing the starboard engine to blaze. The target put out a defensive barrage from every available gun, the *Mosquito* was hit in the nose, a cannon shell smashing the instrument panel and missing the pilot by three inches. One more burst at the target caused the port engine to catch fire. The enemy pilot kept going with both engines burning but eventually dove into the sea.

The starboard engine of the *Mosquito* started to sputter and the pilot was about to feather it when the port engine caught fire. The starboard engine picked up after the port had been feathered, and the fire extinguished. The pilot gave a preliminary "Mayday" warning which he cancelled and managed to land at Bradwell on one engine at 1945 hours. During the journey to Bradwell he had no temperature gauges to consult as these had been shot away."

During the three combats the *Mosquito* performed extremely well even after being severely damaged, the remaining engine functioned perfectly to get the crew back to Bradwell.

Schultz remained with 410 Squadron for two and one half years and accumulated some 800 hours of flight time, five aircraft destroyed and his first Distinguished Flying Cross before being posted to the Night Fighter OTU at Charter Hall as an instructor. He served there and later at Cranfield as an instructor and test pilot until December 1944 when he rejoined 410 Squadron now flying from Lille, France with 147 Wing of the Second Tactical Air Force.

The war ended for then Flight Lieutenant Joe Schultz with 410 Squadron stationed in Gilze Rijen, still equipped with the *Mosquito*. In late May 1945, F/L Schultz was awarded a bar to his DFC for destroying a further three enemy aircraft in the final stages of the war in Europe.

Deciding to remain in the peacetime RCAF Flight Lieutenant Schultz found himself employed as a test and ferry pilot flying out of St-Hubert, Rockcliffe, Toronto, and Trenton. It was during this period that his log book was certified for no less than thirty-two aircraft including types as diverse as the *Tiger Moth* and *Lancaster*, the *Spitfire* and the *Grumman Goose*. Perhaps this was a portent of what was to come, for Colonel Schultz as of this date had flown most of the aircraft types currently in service.

In December 1948, Flying Officer Schultz (officers reverted in rank after the war) was posted to the *Vampire* OTU and then was posted to none other than 410 Squadron, his wartime unit which had by then become the first jet fighter squadron in the RCAF. He was a member of the RCAF's first jet aerobatic team the Air Defence Group "Blue Devils" and flew in air displays across the North American continent before being posted to the RAF

Central Fighter Establishment on exchange. Here he added to his already impressive credentials by flying *Meteors*, *Venoms* and *Vampires* which prepared him for his return to Canada to the position of Chief Flying Instructor at our newly formed 3 All Weather OTU at North Bay – the training mill for our burgeoning force of CF100 squadrons.

Since that time his responsibilities have grown with each successive appointment, including Staff Officer Air Operations at Air Defence Command Headquarters, Squadron Commander of two CF100 Squadrons, 413 and 432, Squadron Commander of 425 AW(F) Squadron the first Canadian CF101 *Voodoo* Squadron, Chief Operations Officer at No. 4 Wing during the early years of the CF104 operation in Europe, and in 1966, head of the Aircraft Accident Investigation and Prevention section of the Directorate of Flight Safety and eventually his appointment as Director in 1967.

In his position as Squadron Commander of the first Canadian CF101 *Voodoo* Squadron, Col Schultz was responsible for the conversion training of all aircrew who were to man all the other *Voodoo* squadrons. In this appointment he held a key post in the development of our nuclear capable air-to-air interceptor operations. Col Schultz is considered largely responsible for the highly successful introduction of the CF101 *Voodoo* into the RCAF.

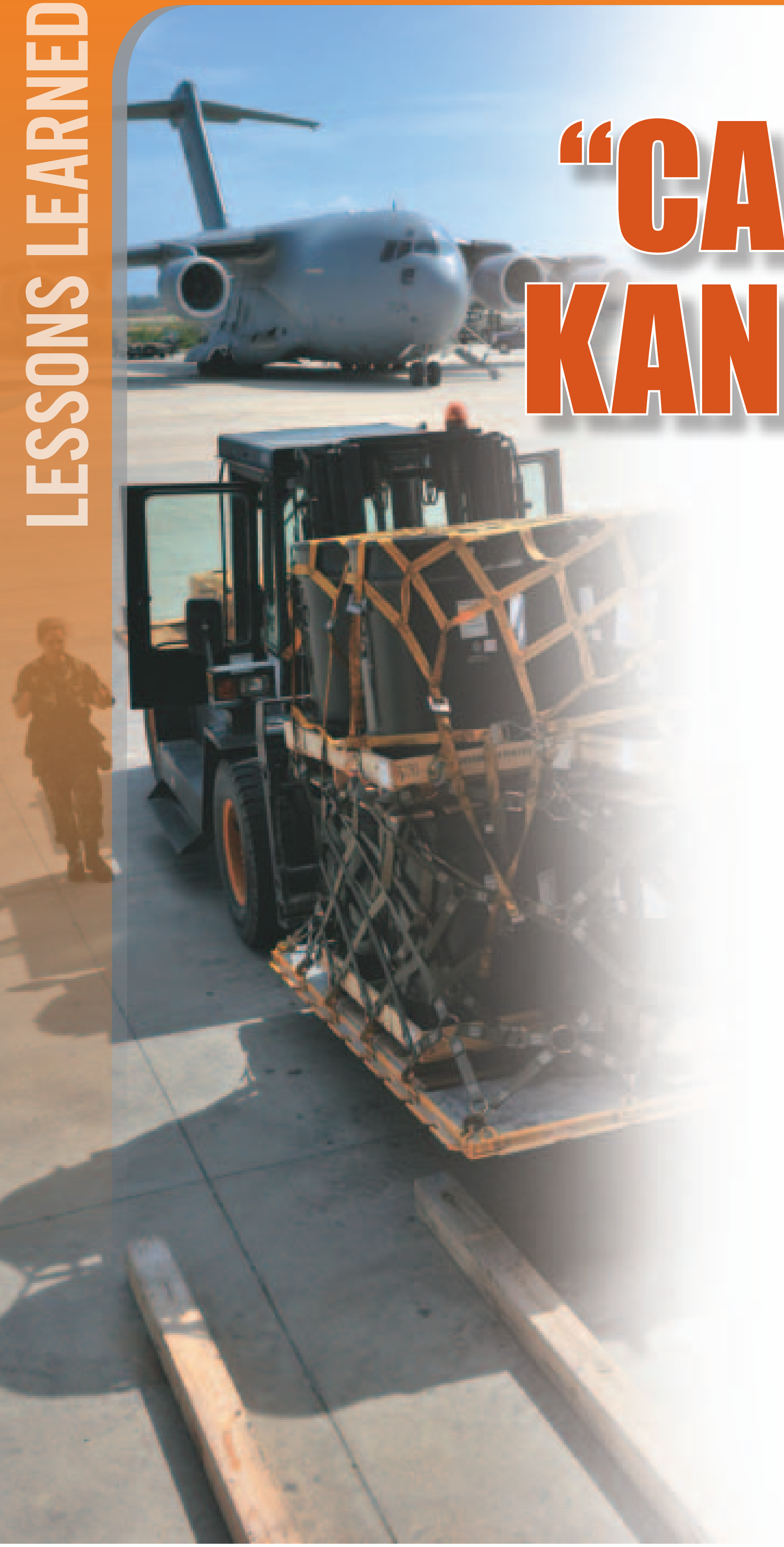
Later, as Chief Operations Officer at No. 4 Wing in Europe Col Schultz's knowledge, dedication and meticulous attention to detail were of inestimable value in establishing a first rate nuclear strike operation. This was evidenced clearly by the unit being given a very high rating on its initial NATO Tactical Evaluation. A unique achievement and one which earned for Canadians the admiration of all their NATO partners.

Col Schultz has been Director of Flight Safety for the Canadian Forces for the past ten years. In this appointment he has been manager of one of the most highly regarded Flight Safety programs in the Western World. During his tenure the accident rate, one important indicator of the effectiveness of any accident prevention program, reached an all time low for the RCAF/CF of less than one per 10,000 flying hours. Much of the credit for this outstanding achievement must he attributed to Col Schultz's unfailing devotion to duty. He has conducted an active accident prevention program based on his firm conviction that operational effectiveness, the primary objective, depends on a sound accident prevention program.

In spite of budget limitations Col Schultz has persevered with such programs as Crash Position Indicators and Flight Data Recorders and "Bird Hazards to Aircraft", to the point where Canada has become a world leader in these fields. His tireless efforts to conserve aviation resources through an effective accident prevention program have won him the respect of subordinates and superiors alike. His infectious and unwavering enthusiasm has been an inspiration to all those tasked with flight safety responsibilities. Many of his former staff officers are now in responsible positions with the Department of Transport Aviation Safety and Aircraft Accident Investigation Divisions.

Col Schultz is highly respected in both Canadian aviation circles and internationally for he has often represented Canada in international seminars dealing with broad concepts of aircraft accident prevention. Although it is impossible to estimate the numbers of aircraft and lives saved by his dedicated efforts, we are convinced that through his devotion to duty, the standards of all these involved in the operation of Canadian military aircraft have been raised substantially.

The Canadian Forces and Canada have every reason to be justifiably proud of Col Schultz. Our flight safety program is primarily the result of his continuing hard work, self-sacrifice and dedication in furthering the cause of military aviation. In recognition of his many postwar contributions to the Canadian Forces Col Schultz was named an Officer of the Order of Military Merit in 1974. ◆



"CAN DO" in KANDAHAR

By Warrant Officer Jordie Larson, Canadian Forces Land Advanced Warfare Centre, 8 Wing Trenton

I think that we have all heard of the "can do" attitude: doing what you can to get the job or mission done. I experienced a similar situation that almost had an embarrassing and undesirable outcome.

I was a Loadmaster on the CC177 *Globemaster III*, and on January 2008 we were on a routine resupply mission to Kandahar and back. As usual, we knew what our inbound load was, but wouldn't know what our outbound load would be until we reached Kandahar. This time, however, when we reached Camp Mirage we were told that part of our outbound load would be a "cherry picker" (service truck with a boom and a bucket).

The CC177 has a loadability checklist for loading vehicles to see if the vehicle can be safely loaded into the aircraft. I asked the MAMS (Mobile Air Movements Section) personnel if this vehicle was checked for loadability on the CC177 as per this checklist. They were told that there was a qualified person in Kandahar who said that this vehicle was "good to go".

Upon arriving in Kandahar, we offloaded our pallets and prepped the aircraft for this vehicle to be loaded. I asked the loading

crew if the vehicle had been checked as per the loadability checklist and they told me that they didn't know and that the "qualified" person who inspected this vehicle wasn't at the airfield. That certainly didn't give me a warm and fuzzy feeling.

I grabbed my checklist and my tape measure, and along with my fellow Loadmaster, we started to check the vehicle dimensions as per the loadability checklist. Among the required measurements are the front and rear overhang (the distance from the front bumper to the center of the front wheel, and the same for the rear) and the ground clearance at the same end of the overhang. These measurements will tell you if the vehicle overhang will contact either the aircraft ramp or the ground while loading. These two checks are for the Ramp Toes Contact Limit and the Ground Contact Limit.

After taking all the measurements and referring to the applicable charts, we discovered that regardless of how the vehicle was driven into the aircraft, the vehicle overhang would contact the aircraft ramp. This led me to believe that either the measurements by this "qualified" person were taken incorrectly or were not taken at all. According to the loading manual we would need to build two ramp extensions, each one being 18 inches wide by 50 inches long and 7.5 inches high, so I asked the loading crew to go get me *at least* twenty 2 x 6 or 2 x 8 wooden boards. What they came back with was just five 4 x 4 pieces of lumber! I knew this wasn't going to be good.

This is when the "can do" attitude came in. I thought that maybe, if we lay the 4 x 4's width ways at the base of the loading ramps, that would reduce the ramp entry level. Well, it did work... at first. The bumper cleared the aircraft ramp and just as the vehicle began to move up the stacked 4 x 4's and into the aircraft, one of the 4 x 4's spun out from under the vehicle tire. The vehicle dropped down and the bumper *just* touched the aircraft ramp – luckily there was no damage. Had the vehicle dropped any further, there was the potential of causing serious damage to the aircraft ramp. Needless to say we left the vehicle behind with strict instructions to the ground crew what was required to safely load this vehicle on the CC177.

Lessoned learned by me: the "can do" attitude is not always a good thing. If there are specific procedures to be followed, follow them and save yourself possible embarrassment... or worse. ◆

ROUTINE FLIGHT? There's No Such Thing!

By Captain Chris Bowers, 423 Maritime and Helicopter Squadron, 12 Wing Shearwater

During the debrief, my co-pilot, a senior officer with over 4,000 hours of flying experience, described it as one of the top five scariest moments in his flying career. How did such a "routine" training flight degenerate into something that potentially could have cost the lives of my crew? As the aircraft captain for the mission, the answer left me with a lesson that will stay with me for the rest of my career – *there are no routine flights*.

When a Navy ship goes through "work ups" it is a trying time for everyone aboard. The ship is continually assessed and critiqued by Sea Training staff, on every imaginable task from the mundane to the catastrophic. It made for very long days and stressed the ship's company. The Air Detachment, having just come from a successful stint on a sister ship was eager to demonstrate to our new ship our "can do" spirit. I was also eager to lead, having spent the past six months working a shore-based operations job. This was my first opportunity to be an aircraft captain at sea.

The sortie was briefed. It would be a simulated search and rescue mission 35 miles from the ship. It was a "work ups" scenario and was originally scheduled to have the aircraft recover prior to sunset. At that time, we would do a crew change with a pilot who held a night deck landing currency.

Our crew had only flown together a couple of times. My co-pilot, though experienced, was new to the rotary world and the Maritime Helicopter community. The Crew Commander Air Combat Systems Officer (ACSO) was also coming from an extended shore-based position. The person with the most recent sea time on the crew was a junior Airborne Electronic Sensor Operator (AESOp).

We launched from the ship and sped towards the search area. Enroute, we noticed intermittent issues with the ship's UHF, but took no heed considering the distances and altitude we were working.

Once on scene, we reported to 'Mom' that we had found the vessel in distress and were about to conduct a rescue. At that time, the ship announced 'FINEX' and we returned to recover as briefed.

Unfortunately, the ship wasn't ready to recover us. It was engaged in a simulated fire on board, and instructed us to continue with our flight training until they were prepared to recover. They were aware of the crew's expired currency in night deck qualifications, yet we devised an impromptu plan to accommodate their training requirements with what we were able to do under our orders and regulations. We would continue with our training, and at the time of recovery we would hoist up a qualified pilot, do an airborne crew change and land.

As night fell over the North Atlantic, we quickly determined that the ship's aircraft controllers (SACs) were not at all standard with what we were accustomed. They

repeatedly tried to place us in approach and wind conditions that were outside the margins of safety. I determined that the current training evolutions with the SAC had no value for our crew and elected to operate independently from the ship.

It seemed that once I communicated my intentions to my crew, the Ship's UHF radios failed completely. After a half hour, we eventually were able to contact her on the stand-by VHF frequency. Unfortunately, the range of the ship's radio reached only 2 miles; anything outside of that range was static. I requested to recover earlier than our land-on time, but was denied by the ship as they were still engaged with their simulated emergency.

Miraculously it seemed that the ship's UHF radio came back online, and I was then happy to do some basic vectoring exercises with the SACs until our scheduled land-on time. Once under the ship's radar control and at 200 feet above the water, the aircraft experienced a failure of its Gyroscopic Heading and Attitude Reference System (GHARS). This system impacts a wide range of other systems on the aircraft from basic aircraft control and handling to navigation and radar. The GHARS is crucial; its failure makes the aircraft restricted from night flying.

We began to deal with the emergency as we have been trained. We attempted to contact the ship and inform them of our status and realized that the radios had failed again. We then began flying timed holds on the standby compass as we waited to establish communications with the ship. Eventually, we were able to re-establish communications with her on the stand-by VHF, and inform her of our situation. We directed her to come to flying stations to recover us.

Unsure about the integrity of our navigation systems, I instructed the ship to take us under positive control for an instrument approach. The quality of the approach reflected what we witnessed prior in the flight and I was forced to overshoot and come up with another plan for recovery. I presented a challenge to the most junior member of my crew: take us back to the ship with a questionable radar and navigation system. He completed the approach flawlessly.

As we descended from 200 feet to 100 feet, I directed my co-pilot to deviate from the standard procedure and instructed him not to make an external lighting change when we were one mile from the ship. I was more concerned with having him back me up during the approach and did not want his attention distracted from monitoring the flight instruments. This important lighting change signals to the Landing Signals Officer (LSO) on the ship, that we are happy with the approach and are preparing to land.

When we arrived at the delta hover astern position of the ship my co-pilot assumed flying duties as per standard procedure. Due to the simulated emergencies aboard and the actual communications failure on the ship, the LSO was unaware of our multiple system degradations and the seriousness of the situation. As we maintained position next to the ship, we attempted to explain the situation to the Sea Training LSO. During this period of confusion, we dipped perilously towards the ocean, and I was forced to take control.

Cross cockpit on a blackened ship, I instructed the LSO to turn on the required recovery lights and then proceeded to put us in a position to recover. In a high hover position over the pitching flight deck, I made an error in judgement and elected to hoist the qualified night landing pilot into the aircraft. During the hoist evolution, the aircraft cargo door came off the rails, and we were unable to close it. Once he was onboard, I realized that a safe crew swap could not be made in the hover and I was unwilling to depart the ship with the numerous systems failures we were experiencing. I informed the ship that although I was not current, that I would land.

An initial attempt to appease the training requirements of a ship's simulated emergency handling, unwittingly placed my crew and my ship in a very real emergency situation. Flexibility is the key to air power and we as aviators often have to deviate from briefed missions to address changing circumstances. These changes present new risks, and flying over the North Atlantic is challenging under the best conditions. There are no 'routine flights.' ◆

Perceived PRESSURE

By Captain Steve Radvak, 429 Transport Squadron, 8 Wing Trenton

Background Information:

December 31 2010 planned departure 0700Z Aircraft 177704

ETAD FZFG VV001 -4/-4 Celsius RVR 0200m

ETAD Closing at 2000Z 31 Dec 10 Opening 02 Jan 11

I never thought this would happen to me, one day in Germany… oops wrong article!

We initially delayed 4 hours as the forecast included a temporary period of mist in the early afternoon. ETAD (Spangdahlem, Germany) servicing only had de-icing fluid which gave a hold- over time of 8 minutes. As conditions were not improving, it was decided we would press and see if we could make the required timings by performing an engines running de-icing. Timing restrictions are based on landing time in Khandahar (OAKN) which can be difficult to modify with only a small window to absorb delays.

During the walk around it was noted that induction ice was forming around the auxiliary power unit (APU) inlet. The APU had been running for approximately 4 hours at this point. After starting the engines and shutting down the APU, we received a warning and annunciation panel (WAP) message "APU DOOR DISAGREE". The loadmaster confirmed that the door was closed, however, the sensor was frozen over. Within a minute of the first warning, a second warning "ICE" asserted itself on the WAP. At this point we elected that we weren't going to make any timings and decided to shut down.

In our haste to shut down, we neglected to complete the ground ice shedding procedures and upon exiting the aircraft, ice was noted on all 4 engines. The spinner plus the first stage fan blades were 80% covered in ice and approximately ¼" thick. All of this icing occurred within 5-10 minutes of engines running at idle! In the end, a Herman Nelson heater was used to defrost the engines and the APU, and approximately 1 litre of water was removed from the APU inlet. We departed 2 hours later as the freezing fog finally turned to mist. ◆

Lessons Learned

1. Prolonged use of APU in these conditions will cause an "APU DOOR DISAGREE" message. We experienced the same conditions in Frankfurt Hahn 3 days later. We elected to keep the APU off until 1 hour from engine start. Because they had Type II anti-ice fluid, the longer hold over times did not restrict our departure.
2. If there is ice forming around the APU door, you can assume more ice is forming within the inlet ducting. Induction ice is a real hazard in these conditions. Although ground shedding ice procedures would have helped, the engines were starting to ice long before the indication. This was not apparent to the crew until we had shut down and realized how bad the conditions really were. If in doubt always perform ground ice shedding procedures.
3. There where a lot of pressures that day, most of them perceived, as this was only the second HLTA mission. If we were not able to leave Spangdahlem that day, the next earliest departure would have been 02 January resulting in all of the HLTA personnel missing their flights.

The best advice I have heard to date is from Joe Reid, a *Twin Otter* Captain with 25,000 hours. He said "the hardest part of flying is learning to say 'no'. When you've figured that out and can sleep at night, you've got flying in the bush figured" (circa 2004).

28 Hours Later…

By Master Corporal Cedric De Belder, Flight Safety Office, 436 Transport Squadron, 8 Wing Trenton

There we were, in our first Middle East tour, fresh and eager! We had a little mishap during a static with the camp firefighters. We ended up showing them what not to do and discharged halon fire extinguishing agent direct into the engine…oops! Either way, here we were early one morning with an engine full on halon residue! It's got to be flushed and it's got to be done now before the residue starts degrading the engine.

Being in the middle east, the temperature is a nice 40 degrees and by noon it will peek to an even better 63! Halon residue is toxic and therefore 2 of our team members volunteer to put on full hazmat suit. They said it would be a good weight loss program, and it was as they both lost about 7 pounds of water weight. So they start flushing the engine with a baking soda/water solution. We had to rob the kitchen of all their baking soda, and because of us, there were no cookies for a week!

We keep on working and the hours pass… we keep drinking water and taking breaks…after a while we all seem to start getting hypnotised by this objective "fix this so we don't have to change the engine." I'll spare you the series of problems we ran into from not having the right equipment, to run-ups not going well, but this day that started out well turned into an absolute nightmare!

28 hours later, the plane is fixed and we look great. We fixed it and turned the plane around so operations could continue. We are all gathered around the table having breakfast for the second time since we woke up and we all hysterically start laughing for no apparent reason. At this point, we all realised that we were so sleep deprived that we were practically drunk! Now I'd love to tell you we all deeply reflected on this and learned valuable lessons and all that jazz, and in a sense we did. We learned that how far our team could go when relying on each other. We also knew that what we did was completely stupid! We were extremely lucky that nothing went wrong as we all understood that lives were at stake.

At the end of the day it's mission first and we soldiered on. We never repeated the experience to this extent, however, there were quite a few long days to follow in the middle east. As far as airworthiness goes we stepped out beyond the boundaries…or did we? I challenge anyone to find a reference on ground crew rest – period. Better people than me have looked for it and came up empty handed. ◆

Comments from DFS

See the article "Fatigue and Maintenance" in the *From the Flight Surgeon* column in this issue for a scientific description of what this crew were going through.

Fatigue and Dehydration:

Current CF heat stress management guidelines do not recommend continuous work in hot environments as described in this story. In particular, this sort of work profile could be dangerous when wearing a full hazmat suit (although the type of suit is not clear in the article). If the 7 lbs of fluid loss reported is accurate, these individuals were likely close to 4% dehydrated, which is a level that would severely compromise physical and cognitive performance. In addition, the duration of work required to lose this amount of fluid suggests that body temperatures would have been high and there is risk of being a heat casualty.

(Comments courtesy of Dr. Tom McLellan, Individual Behaviour and Performance Section, DRDC Toronto)

The Editor's Corner

To the Editor

Letter from Captain Greg Miller

14 Wing Air Traffic Controller, 14 Wing Greenwood (Letter edited for length and content).

The article, "Who's in Charge?" *Flight Comment* Issue 2, 2011, seems to blame ATC for the low fuel predicament. The aircraft was on an IFR round robin flight and cancelled IFR to wait for an aircraft below at Baie Comeau. The pilot then air filed IFR back to Bagotville. The article states that they were cleared back at 5,000 feet but does not state why the low altitude. Was ATC working traffic at 6,000? One would have to think that the same aircraft that forced the original delay may now be forcing the return at 5,000. If so, and especially as ATC is working non-radar below 10,000 feet in that area, the controller would need a lot of airspace to provide separation. Did the pilot request, or was he instructed to, "expect higher enroute"? Did the pilot state that he was unable to accept that altitude and request an altered routing to facilitate a climb for fuel reasons?

Cancellng the IFR flight plan also cancels the priority of the aircraft. From what I am reading here, I am not sure why ATC would be blamed for the low fuel situation.

Response

Captain Miller:

Thank you for your letter. Although the author did not intend to disparage anyone, I understand how some could have interpreted it this way, particularly with reference to the last sentence. It's my job as Editor to ensure that each submission published has a valuable flight safety message and that this message is presented clearly. With the benefit of hindsight, I could have done a better job in this case.

From the limited feedback that I receive, the "Lessons Learned" section of *Flight Comment* might be the most read part of the magazine. I think that it's important for everyone to keep in mind that these submissions come from people just like you – from every military occupation as well as pretty much every rank. In many instances they are sharing on the job experiences with us that may not have gone well, and therefore, may not show themselves in the best possible light – all in the interest of providing you, the reader, with a lesson you don't have to learn the hard way. Sharing these experiences help to make our Flight Safety Program a better one.

In this particular instance, the author of the article did not intend to inflict blame or in any way criticize Air Traffic Control. The intent was to highlight how quickly circumstances of deteriorating weather, unanticipated traffic and an unexpected clearance placed them in a challenging situation. Simply stated, the lesson learned here is for pilots to *coordinate* with ATC to obtain a clearance acceptable to both parties. Also, trying to plan too much on one tank of gas might also be a lesson learned here. Have a look at the excellent article "The Low Fuel Club" in the same issue.

Finally, I would like to thank both the originator of the article for the submission and each of you who provided comments. You have created discussion and increased awareness, thereby contributing to our Flight Safety Program. For my part as Editor, I will continue to do my utmost to provide you with the most relevant, interesting and informative flight safety articles possible. Keep the articles and letters coming!

Editor

Epilogue

TYPE: **CH149 *Cormorant* (149903)**

LOCATION: **14 Wing Greenwood, Nova Scotia**

DATE: **30 August 2007**

On Thursday 30 August 2007, the day prior to the Labour Day long weekend, aircraft CH149903 was in servicing for a 50-hour inspection, a tail rotor inspection and a newly introduced swashplate friction adjustment check. To ensure CH149903 would be available as a back-up for the weekend, more personnel were assigned to the task.

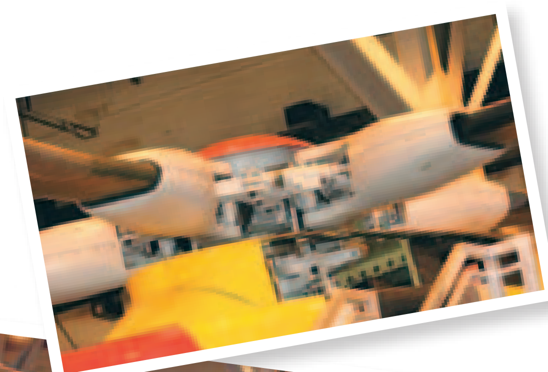
Because work had already begun on the tail rotor, the potential for damage precluded the application of hydraulics on the aircraft to lower the swashplate as called for in the swashplate friction adjustment, however, the time spent waiting for the tail rotor work to be completed effectively nullified any gain made by assigning more personnel.

On their own initiative, the supporting crew altered the work sequence. Planning to use the supplied test harness and turnbuckles rather than hydraulics, they disconnected the pitch links out of sequence before finding out that the swashplate was too high for the turnbuckles to be effective, forcing them to revert to using hydraulics. Upon applying hydraulics, the swashplate unexpectedly moved up, damaging the pitch links, swashplate and main rotor hub.

The investigation determined that the crew elected to alter an approved procedure due to concurrent activities on the aircraft and self-induced time pressure. Additionally, the investigation found that the crew's systems knowledge was deficient due to gaps in training and a lack of warnings within the available maintenance manuals. Together, this led the crew to underestimate the risk involved in altering the sequence of the approved procedure.

The safety investigation recommended that the technical authorities complete a review of the operation of the *Cormorant* Automated Flight Control System with a specific focus on possible un-commanded movement of flight controls upon initial application of electrical power and hydraulic pressure. It was recommended that the findings from this review be captured in the *Cormorant* technical publications and maintenance training package.

The investigation also found inconsistencies with the approved maintenance procedures for the swashplate friction adjustment check. It was recommended that a detailed review and re-write of the Swash Plate Friction Adjustment procedure be carried out to ensure it matches the second line procedure. ◆



Epilogue

TYPE: **CH146425 *Griffon***

LOCATION: **Kandahar Airfield (KAF), Afghanistan**

DATE: **01 August 2010**

Griffon CH146425 was the number two (#2) *Griffon* escorting a *Chinook* conducting battlefield resupply. During a refueling stop, #2 was following the Lead *Griffon* but when Lead initiated an 'S' turn prior to his landing approach, the FP of #2 had to manoeuvre to avoid getting too close. This positioned him directly in line with his spot on a steep approach. Disregarding a suggested option to abort, the FP elected to continue with the approach and descended down to approximately 50' AGL, at which point the aircraft began to sink rapidly. The FP pulled power to cushion the landing and set a level attitude to affect a run-on landing. The aircraft landed with forward speed, bounced twice, and slid to a stop. While rotors were turning, the FE inspected the aircraft observing only a missing skid cap. Based on this information, the AC elected to continue the mission.

The field investigation revealed a seven foot long, four inch deep groove in the crushed rock. Post mission inspections revealed signs of a stinger strike and damage to one tail rotor blade. Evidence and testimony revealed that the final approach was fast, steep and flown in an aggressive manner for the given ambient conditions.

The investigation concluded that that this was a case of power mismanagement. The FP flew an unstable, fast and steep approach for the given environmental conditions and did not use all the power available to arrest the rate of descent. He opted to continue with an aggressive approach even though the option to abort was present. The investigation revealed that the CH146 Standard Manoeuvre Manual did not provide clear guidance or definitions of power management issues such as Power Settling (vortex ring state), Settling with Power, and general power management given environmental conditions (blade loading).

All CH146 aircrew in theatre were reminded of the requirement to apply a greater factor of safety when operating in a power limited environment. This occurrence and others led the Air Wing to modify the Theatre Check-Out policy to include 6 flights.

Additional recommendations include amending the CH146 SMM to include power management issues. The decision to inspect the aircraft with rotors turning and continue with the mission led to recommending that the operators and maintenance manuals clarify the directions given for aircraft inspections after suspected hard landings. ◆

Epilogue

TYPE: Glider Schweizer SGS 2-33 (C-GCSK)

LOCATION: Bromont, Quebec

DATE: 05 August 2009

The accident occurred during a solo flight by an Air Cadet under training as part of an ab initio gliding course conducted by a Regional Gliding School. The student pilot was flying their fourth solo flight for the day, which had been preceded by two dual instruction flights. The take-off, climb out and circuit were uneventful with all required altitudes achieved for each leg. During the turn from base leg to final approach the student significantly overshot the extended runway centerline as the result of a delayed turn. In an attempt to regain the correct final approach the student pilot used steep slipping turns from right to left and left to right but flying through the on course each time. On the last attempt to correct from the right the glider struck trees approximately 340 feet short of the runway threshold and 17 feet above ground. The student was not injured, however, the glider sustained Category "A" damage.

A review of the student pilot's course progress revealed the student was having difficulties with turns, including steep, medium, gentle and slip turns. Problems included over controlling and maintaining proper aircraft attitude. Another area of concern was the tendency to misjudge the turn to final approach. Also, at this particular gliding school, students were only taught to use slip turns to regain or maintain runway centerline, regardless of aircraft position. Supervision was also a factor in this occurrence due to a personality conflict between the Flight Commander and the Deputy. This conflict resulted in poor communication, which in turn, resulted in a failure of this particular student's course progress being closely monitored. Several unsatisfactory instructional flights should have warranted a Progress Review Board (PRB) in accordance with the Air Cadet Gliding Program Manual (ACGPM) before the occurrence happened.

The Flight Safety investigation focussed on training techniques, human factors, and the role that supervision played in the outcome of the occurrence. The decision to teach slip turns as the only option to regain centreline on final approach crept in over time due to previous accidents that happened when turns were done at low altitudes. Also, the ACGPM was very vague in providing guidance on how to fly a final approach or procedures to use if the aircraft fails to achieve the extended centreline when turning from base to final. Although slip turns may serve a purpose on final, coordinated turns are more effective and reduce the risks of increasing the rate of descent on final. In this case, the student was required to attempt a manoeuvre solo despite having demonstrated weakness for that manoeuvre and lacking all of the available tools to correct an alignment problem. Personality conflicts between two key members of the staff, as well, prevented the chain of command from ensuring the progress of the student was properly monitored and actions taken in a timely manner in accordance with directions in the ACGPM.

Recommendations included issuing a reminder to all Regional Gliding Schools to follow the proper processes already in place within the ACGPM with regards to monitoring a student pilot's progress and taking appropriate actions when required. As well, it was recommended that the ACGPM be amended to provide clarification on proper procedures and turns available to use for runway alignment on final approach. This should focus on the advantages, disadvantages or risks associated with coordinated turns, slip turns, crabbing, as well as distances and altitudes where one may be a better option than the others. ◆

Epilogue

TYPE: **CT145 *King Air* (C-FMFR)**

LOCATION: **3 CFFTS Portage la Prairie, Manitoba**

DATE: **08 November 2010**

A CT145 *King Air* operated by 3 CFFTS departed the hard surface of runway 13R at Portage la Prairie as the aircraft was completing a full stop landing. The aircraft was crewed by a Qualified Flight Instructor (QFI) in the right seat and a student pilot in the left seat, under training as part of the Multi-engine Pilot Course. Immediately after touchdown, the right wing began to sink due to failure of the right main landing gear. Attempts to maintain runway centreline proved futile as the aircraft drifted right, departing the hard surface of the runway approximately 600 meters after touching down. The aircraft came to a full stop at the crest of a drainage ditch, 78 meters right of runway 13R centreline. Both pilots were able to safely egress with no injuries. The aircraft sustained "C" category damage.

The investigation revealed that the right main landing gear lower drag brace arm bolt failed due to fatigue prior to achieving the design criteria of six years or 8,000 landings.

Recommendations were therefore made to change the main landing gear lower drag brace arm bolt on *King Air* C90 operated at 3 CFFTS in Portage la Prairie Manitoba after 2,500 landing cycles. Subsequent detailed analysis on other drag brace arm bolts revealed cracks were present at substantially less cycles than the previous design citeria of 8,000 cycles, which supported the decision to replace the bolts at a reduced cycle frequency. ◆

Epilogue

TYPE: Glider Schweizer SGS 2-33 (C-GQYY)

LOCATION: Lachute, Quebec

DATE: 06 September 2008

The accident occurred during a 60 day currency check ride for a basic glider pilot flying as part of the Air Cadet Gliding Program. The aircraft was crewed by a check pilot in the rear seat and a qualified pilot in the front. A 60 day check is composed of two flights, one for aerial manoeuvres and the other for emergency procedures. Prior to the second flight the front seat pilot was briefed to anticipate a rope break scenario sometime during the launch. Climbing through approximately 80 feet above ground (AGL) the front seat pilot thought he heard a metallic clunking noise similar to what may occur during a rope release. Assuming the check pilot had initiated the rope break scenario, the pilot carried out the first actions of the emergency checklist by pulling the release knob twice.

The check pilot in the rear seat, caught unaware, immediately took control of the glider and, after confirming the loss of the tow rope, initiated a steep right turn in an attempt to recover back at the launch area. The right wing tip contacted the ground, cartwheeling the glider, causing Category A damage and seriously injuring both occupants.

The Flight Safety investigation focussed on emergency handling procedures, human factors and safe training practices. Due to the design of the glider it is impossible for the rear seat pilot to prevent the front seat pilot from pulling the release knob. The front seat pilot, having been forewarned, reacted by following the checklist based on the assumption that the emergency scenario had been initiated. The check pilot, whose plan had always been to release the glider at an altitude high enough to conduct a downwind recovery, continued to carry out the pre-formulated plan regardless of the low altitude. Both pilots were anticipating the rope release scenario; however, only one knew when it would happen. This put the pilots in two different mindsets, causing one to overreact without confirmation and the other to react incorrectly based on a preconceived plan. It was also noted in the investigation that the Air Cadet Gliding Program Manual does not provide guidance or safe training practice limitations for emergency scenarios. Emergency training scenarios are also not predicated with the verbal term "simulated" to cue a pilot whether the situation is real or not.

Immediate preventive measures included a review of the emergency response procedures to a rope break or premature rope release scenario highlighting control of the aircraft and selection of a landing area prior to pulling the release knob. Further recommendations included an assessment of rope break emergency training with a view to alternative, safe training methods and procedures. The final recommendation was for the instructing pilot to use the term "simulated" prior to initiating any emergency scenario to cue the trainee that the event is for training and procedures should be conducted accordingly. Anything else encountered in the flight should be handled as a real emergency with appropriate actions and considerations. ◆

From the Investigator

TYPE: **CF188 *Hornet* (188789)**
LOCATION: **Near Cold Lake, Alberta**
DATE: **17 November 2010**

The single seat CF188 was flying as the second aircraft in a two-aircraft formation on a Night Vision Goggles (NVG) training mission. The prevailing weather was instrument meteorological conditions (IMC) and the accident occurred at night. During a radar trail instrument approach to runway 13L at Cold Lake, Lead called for the landing gear to be selected down. Upon selection of the landing gear, the wingman was almost immediately disoriented by the sudden rush of falling snow as it was illuminated by his landing light, which also reflected enough light through his Head Up Display (HUD) to washout the instrument references he used to control the aircraft.

As a result of the visual inputs, the pilot perceived that he had entered a steep descent. In response, the pilot made an aft stick input and pulled the aircraft into a nose-high attitude. Still feeling that he was in a dive and thinking he was rapidly approaching the ground below, but unable to confirm his attitude using outside references or his HUD, the pilot decided to eject.

The ejection was successful and the parachute landing in a forested area was uneventful. The aircraft crashed in a nosedown, near wings level attitude and was destroyed. The uninjured pilot activated his personal locator beacon and used flares to direct the Search and Rescue helicopter to his location. The pilot was transported back to 4 Wing Cold Lake two and one half hours after his ejection.

A review of the recorded flight data and pilot testimony indicated that the aircraft was serviceable and operating normally. A preliminary review of operator practices determined that CF188 aircraft at the time of the accident were routinely operating on NVGs in IMC and at an unlit airfield, however, neither are authorized in accordance with Division Flying Orders.

The pilot was inexperienced in night flying and it had been 224 days since his previous NVG training mission. The investigation is focussing on the human factors surrounding the occurrence. This will include disorientation, organizational pressures and training practices. 1 Canadian Air Division has directed that CF188 NVG training now commence only after a pilot has increased flying experience.

The investigation also found numerous anomalies in the aircraft life support equipment practices and record keeping. Also noted, although not related to the accident, were areas of inconsistency in maintenance practices dealing with CF188 inlet icing cautions and de-icing procedures. ◆

From the Investigator

TYPE: **CT155 *Hawk* (155201)**
LOCATION: **Cold Lake, Alberta**
DATE: **10 June 2011**

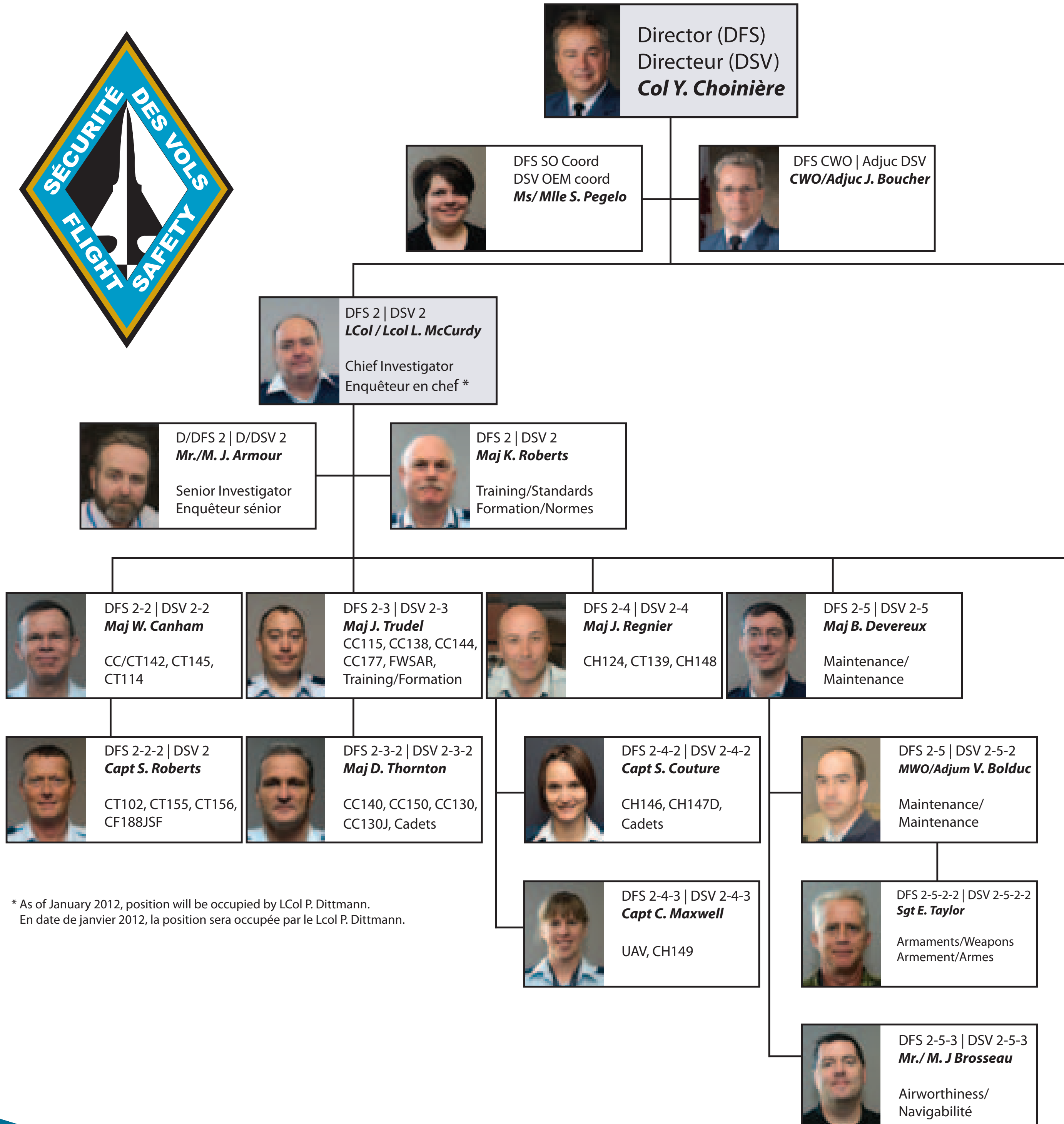
A crew of two qualified instructors was conducting an instructor upgrade sortie and wingman syllabus mission in clear weather in a CT155 *Hawk* aircraft when the pilots noticed a loud bang followed by increasing Turbine Gas Temperature. The aircrew discontinued their training exercise, analysed the aircraft systems and turned the aircraft north towards the Cold Lake Airport. The aircraft throttle was positioned to a medium power setting to commence a shallow climb through 10,000′ above ground level. During the return flight, the wingman reported increasing amounts of smoke coming from the lead aircraft and the aircrew felt increasing engine vibrations. The pilots responded to these indications by shutting down the aircraft's engine. Later, the pilots determined they would not be able to glide to either Cold Lake runway and attempted to restart the engine to gain altitude. During the restart, the wingman reported flames coming from the lead aircraft. The pilots stopped the start and continued to glide towards Cold Lake. Unable to reach any runway, they carried out a controlled ejection initiated by the rear seat pilot. The aircraft crashed and was destroyed, spreading debris over two fields and a road intersection. The pilots descended in their parachutes to land in a shallow swamp. The pilots received minor injuries.

The post-crash field investigation revealed a missing Low Pressure Turbine (LPT) blade from Module 8 in the engine, which is similar to LPT blade failures in four previous CF *Hawk* aircraft occurrences. The engine and other aircraft components have been sent to the Quality Engineering Test Establishment and the National Research Council for further analysis.

The investigation is focussing on the failure of the LPT blade, crew emergency procedures and aviation life support equipment deficiencies. ◆

THE BACK PAGE

DIRECTORATE OF FLIGHT SAFETY
DIRECTION DE LA SÉCURITÉ DES VOLS
(Ottawa)

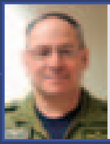


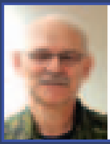
* As of January 2012, position will be occupied by LCol P. Dittmann.
En date de janvier 2012, la position sera occupée par le Lcol P. Dittmann.

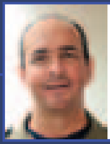
Internet: www.airforce.forces.gc.ca/dfs-dsv

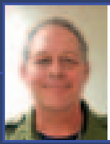
UN DERNIER MOT

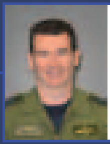
1 CANADIAN AIR DIVISION FLIGHT SAFETY
SÉCURITÉ DES VOLS 1RE DIVISION AÉRIENNE DU CANADA
(Winnipeg)

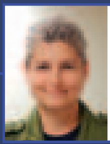

Division FSO |
OSV de division
LCol / Lcol S. Brabant

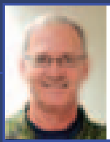

FS UAV/Special Projects
SV UAV/Projets spéciaux
Maj R. Cooney


FS Fighters/Trainers
SV Chasseurs/
avions d'entraînement
Maj D. Girard


FS Multi-Engines
SV multi-moteurs
Maj B. Day

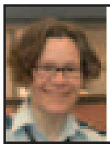

FS Rotary Wing
SV voilures tournantes
Maj P. Harrisson

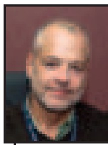

Cadet /Course FS
Cadets/ cours SV
Capt S. Witchel

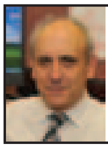

FS / Air Weapons
SV / Armement aérien
CWO/Adjuc R. Western


DFS 3 | DSV 3
Mr. / M. J. Michaud
Chief of Promotion & Information
Chef de promotion & d'information


D/DFS 3 | D/DSV 3
Maj A. Cybanski

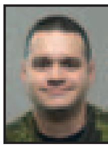

DFS 2-6 | DSV 2-6
Maj H. Wrigtht
Aviation Medecine, Human Factors/
Médecine d'aviation, Facteurs humains


DFS 3-2 | DSV 3-2
Mr./M Pierre Sauvé
FSOMS Manager/
Gestionnaire SGESV


DFS 3-2-2-2 | DSV 3-2-2-2
Mr./M A. Kosta
Statistician/Statisticien


DFS 3-2-2-3 | DSV 3-2-2-3
Sgt L. Calderone
FSOMS/ Internet
SGESV / Internet


DFS 3-3 | DSV 3-3
Capt J. Dixon
FC Editor/
Rédacteur en chef PV


DFS 3-3-2 | DSV 3-3-2
Cpl A. Paquin
Imagery Technician/
Technicien en imagerie

E-mail / courriel: dfs.dsv@forces.gc.ca