



National
Defence

Défense
nationale

Flight Comment



ISSUE 3, 2022

**SPECIAL SERIES:
NECK AND BACK PAIN**

CHECK SIX

FDM and Flight Safety in WW2

DOSSIER

Surviving Canadian Winters

Canada



Neck and Back Pain

6



It's that Time of Year Again

26



Was that Briefed?

31



Eyes Wide Shut

33



Winter Icing

35



Bellanca Scout (C-GBAZ)

37

Photo: Cpl Rachael Allen

TABLE OF CONTENTS

Issue 3, 2022

Regular Columns

Views on Flight Safety	2
The Editor's Corner	3
Special Series – Seat Ergonomics	6
From the Flight Surgeon	11
Check Six	13
On Track	
5G Network and Aviation	20
Dossiers	
It's that Time of Year Again	26
Lessons Learned	
Was that Briefed?	31
Eyes Wide Shut	33
Winter Icing	35
From the Investigator	36
Epilogue	39
The Back Page	40

Awards

Mr. Richard Steeves (AVN Tech)	4
SICOFAA Award	5
Lieutenant Alex Cloutier (IFE) and Captain Adrian Rizzuto (PLT)	9
Corporal Benjamin Arbuckle (ACS tech)	10
Master Corporal Dima Kyshynskyy and Corporal Peter O'Brian (AVN Techs)	12
Master Corporal Gary Cousins (FE)	19
Captain Thomas Garbe (PLT)	24
Master Corporal Jonathan Hudson (AESOP)	25
Corporal Phillip Molter (AVN tech)	30
Corporal Tyler Palman (AWST)	32
Corporal Gabriel Papakonstantinou (AVS Tech)	34

DIRECTORATE OF FLIGHT SAFETY

Director of Flight Safety
Col Jean-François Gauvin

Editor
Maj Jillian Sicard

Imagery Technician
Cpl Kyle Morris

Graphics and design
d2k Graphic Design & Web

THE CANADIAN ARMED FORCES FLIGHT SAFETY MAGAZINE

Flight Comment is produced up to four 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 feedback are welcome. Contributions become the property of *Flight Comment* and may be edited for content, length or format.

Send submissions to:

Directorate of Flight Safety
Attn: Editor – Flight Comment
60 Moodie Drive
Carling Campus CFB O-G
Building 7N.2.C19.21
Ottawa, ON, Canada K1A 0K2

Telephone: 613-901-7698
Email: dfs.dsv@forces.gc.ca

This publication or its contents may not be reproduced without the editor's approval.

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).

Visit the DFS web page at
<http://rcf.mil.ca/en/dfs/flight-safety/fs-main.page> (DWAN)
<https://www.canada.ca/en/air-force/programs/flight-safety.html> (Internet)

Flight Comment magazines and Flight Safety posters are available on the flightcomment.ca website.





Views on Flight Safety

by LGen Kenny

LGen Kenny joined the Canadian Armed Forces in 1989. After training, instructing and deploying as a fighter pilot on the CF-188 Hornet, he became Commander of 4 Wing Cold Lake in 2014 and was deployed as Commander of the Air Task Force—Iraq in Kuwait between October 2014 and April 2015. He went on to be Deputy Commander Force Generation at 1 Canadian Air Division in Winnipeg in 2016, Director General of Air Readiness at Headquarters Royal Canadian Air Force in Ottawa in 2018, and Commander of 1 Canadian Air Division/Canadian NORAD Region in July 2020. On 12 August 2022, he became the Commander of the Royal Canadian Air Force.

The responsibility for Flight Safety rests with those who supervise and manage our aviation resources, fly and maintain our aircraft, logistically support flying operations, provide administration, feed people and control air traffic. Clearly, everyone involved in flying operations has a role to play in preventing accidents.

Over the last 40+ years, the RCAF accident rate has been steadily reducing for many reasons, but without a doubt thanks to our collective commitment to the Flight Safety Program and through a Just Culture. However, striving for zero accidents is a challenge that needs our constant daily attention and dedication. It may not always be obvious, but keep in mind that most accidents are often the result of cascading human factors that take root in small errors and deviations.

The RCAF is made up of a very capable and proud team of experts that are mission focused and results oriented. It is important to understand how this can lead to real or perceived pressures at all levels. No one wants to fail at a mission, but sometimes this pressure can lead to unforeseen short cuts and nonconformity.

"No task, mission or operation, either at home or abroad, should proceed where a safety concern has not been evaluated and properly assessed. Our Flight Safety program is at the heart of our mission success, and an operational enabler."

As Commander of the RCAF, I expect that all personnel are following procedures, but I also trust that anyone can come forward without fear of retribution to identify issues related to Flight Safety to their chain of command.

As such, "no fail missions" do not exist. No task, mission or operation, either at home or abroad, should proceed where a safety concern has not been evaluated and properly assessed. Our Flight Safety Program is at the heart of our mission success, and an operational enabler.

I expect leaders at all levels to ensure that Flight Safety is more than a slogan. I trust them to ensure it is part of daily actions, discussions and their decision-making process.

Flight Safety is a critical component of RCAF operations that has proven most effective in safeguarding our personnel and assets. I fully support the Flight Safety Program and equally count on everyone's support to take full ownership of their Flight Safety Program. 🇨🇦



The Editor's Corner

by Maj Jill Sicard, DFS 3-3

Ahhh... Can you smell that in the air? Fall has quickly come upon us, and for some, winter has already slipped in! A new season brings all sorts of new beginnings and perhaps old endings.

As much as I wanted to produce four issues this year, due to global paper shortages, it was just not feasible, so we had to pack in what we could for our last issue of 2022.

Before I get into the goods, I would first like to start off by thanking everyone who contributed to our great magazine, without you, we would not have an international sought-after Flight Safety product. It goes without saying that we are nothing without your words of wisdom so please keep the good stuff coming in!

There are endless concepts to discuss when it comes to Flight Safety. Thanks to new technological advances, we can read and learn in our *On Track* article about 5G networks and how it affects the aviation world.

Every day progress is made in the medical field that has interesting connections to aviation. Our Special Series this issue talks about the importance and discovery of Seat Ergonomics and its relation to neck and back pain. We also have a piece from the DFS Flight Surgeon introducing us to a new cognitive interview system that has unlocked the potential to remember more than the old system could accomplish, which in turn helps occurrence and accident investigations.

The beauty of "new" also brings in the importance of the "old" and for us in Flight Safety, history is so essential, it gives us the capability to learn lessons, and pick up new things from others' experiences. For example, our *Lessons Learned* stories will surely make you think about the value of situational awareness and remaining diligent. We also have a fantastic read from Mr. Chris Shelly on how FDM was used as far back as WW2, and how it helped 6 RCAF Group with bombing campaigns in our *Check Six* section. Another important and reoccurring theme in the *Dossier* section is the reminder to be prepared for seasonal changes, especially "Winter Operations" which come with cold weather surprises.

Finally, spread throughout, we are chock full of awards this issue. Each one showing a great attention for detail and professionalism that the military is known for, congrats to all the recipients!

I want to wish everyone a restful and safe holiday season, I can't wait to see what articles and stories will come our way in the New Year! Keep in mind, if there is something you would like to read about in particular feel free to send us an email with your request or better yet, send us an article on something Flight Safety related and we can publish it for everyone to read, as an added bonus you will receive some Flight Safety memorabilia! 📄

"Calling all CARTOONISTS!"

We are currently looking for someone with drawing skills to add a new style to the magazine. If you think you have what it takes, please contact us through the Flight Safety email with a demo of some drawings!"

Photo: Cpl Matthieu Racette

For Professionalism

For commendable performance in flight safety

Mr. Richard Steeves (AVN Tech)



While replacing the Center Diamond Detonation Cord (CDDC) on the aft transparency of a CT-156 Harvard II canopy, Mr. Steeves noticed that something was not quite right about this particular canopy's detonation cord arrangement (that had been in place since 2006). He had a sense

that the aft-end attachment of the detonation cord was located on the wrong side of the canopy. He asked an assisting technician if the attachment looked correct and the more senior technician noticed that under close scrutiny, the attachment appeared to be facing the wrong way. Upon checking the configuration

against the template from the canopy maintenance manual, it was confirmed that the detonation cord was indeed reversed.

Had an airborne ejection occurred with the detonation cord in the incorrect configuration, the Peripheral Edge Detonation Cord would have fired instead of the CDDC. This would have potentially injured the pilot or interfered with the ejection sequence, having unknown but potentially dire consequences. This subtle error was repeated and undetected by experienced technicians despite numerous previous detonation cord removals, installations, and canopy repairs over a 15 year period.

Mr. Steeves' professionalism and attention to detail is exceptional for a new technician. His actions corrected a serious error, averting potential pilot injury during an ejection. Mr. Steeves is an example of the "see something/say something" attitude that the Flight Safety Program instills, making him highly deserving of this *For Professionalism Award*. 🏆

SICOFAA Award

Canada is a member of the International Aviation Association called Sistema de Cooperación entre las Fuerzas Aéreas Americanas. This Spanish designation means System for the Cooperation of the Air Forces in the Americas (SICOFAA). Each year SICOFAA provides member countries with an opportunity to nominate a deserving unit within their individual air force. This unit must have demonstrated the highest level of dedication to the furtherance of Flight Safety and, by their actions, been an exceptional example to others. The 2021 SICOFAA Award recipient is 437 Squadron (Huskies) from 8 Wing Trenton.

437 Transport Squadron has proven a crucial role in the CAF and an exemplary model for the Flight Safety (FS) Program. In particular, their support in long range, strategic passenger airlift and Air to Air Refuelling (AAR) capabilities have demonstrated their high readiness in domestic and foreign operations such as Op IMPACT, Op REASSURANCE, Op PRESENCE and Op UNIFIER. In addition, 437 Squadron is entrusted with the only strategic VVIP airlift capability. They remain on the forefront of innovation in the FS Program by initiating a fully electronic reporting system in order to collect, process and redistribute information no matter where their members are located geographically allowing for a continued healthy reporting system with very low occurrence rates. DFS would like to congratulate 437 Sqn on this highly deserved award. 🏆



Picture: LCol Eric Willrich (right), departing CO of 437 Sqn is receiving the SICOFAA Award on behalf of 437 Sqn from 8 Wing Commander, Col Leif Dahl, 9 August 2022.

Photos: McpJ Marc-Andre Gaudreault



SPECIAL SERIES on Seat Ergonomics

ADDRESSING NECK AND BACK PAIN THROUGH IMPROVED SEAT ERGONOMICS

by Mr. Patrick Bickerton

Patrick Bickerton is a human factors specialist in the DTAES and is the DND Project Officer overseeing various research and development projects with the NRC-FRL pertaining to human factors, whole body vibration, hearing protection, and speech intelligibility.

BACKGROUND

Rotary wing aircrew work in demanding environments, not just cognitively demanding but physically demanding as well. In fact, approximately three out of every four RCAF rotary wing aircrew have, or will experience neck and/or back pain at some point in their career as a result of their flying duties. Effects of flight induced neck pain can have serious implications on an individual's performance and career. Effects can range from minor annoyances to major distraction and discomfort, which can impair aircrew performance and even result in grounding the aircrew.

Beginning in 2012, DRDC-Toronto oversaw research initiatives to better understand the neck and back pain problem and recommended several mitigating solutions that could be adopted by the rotary-wing operational community. The results of this work have culminated in a significantly improved understanding of the physiology of neck and back pain and has identified a number of causal factors. One important note is that there is no one single causal factor. Indeed, the physiology of neck and back pain is caused by a multitude of factors including aircrew



Photo: NRC

behaviours (task sequences and postures), workstation design (seat ergonomics and control and display arrangement), equipment selection (helmet design and other body-borne equipment), organizational factors (work-rest schedules or operational tempo) and other human factor considerations.

Given the various causal factors, there is no "silver bullet" solution to the problem. Successful mitigation of neck and back pain will require the aggregate of various strategies.

This article, focusing on the importance of seat ergonomics, is the second in a series related to the implementation of neck and back pain mitigating solutions for RCAF personnel who

regularly fly on aircraft. The previous article published in *Flight Comment* 2022, Issue 1, discussed the importance of proper helmet fit.

WHATS IN A SEAT

A seat is an incredibly important piece of equipment for aircrew. Besides obvious performance criteria, such as sufficient strength to support a seated occupant during regular flight, aircraft seats must also absorb impact loads during hard landings and crash loads. An effective seat must also have sufficient adjustability to put the occupant in the right position(s) to accomplish their duties, support sedentary and dynamic postures (twisting, leaning, reaching etc.), and comply with

body-borne equipment (e.g., body armour, immersion suits, life preservers, survival equipment). On top of all of this, seats must be comfortable. If a seat is not comfortable, the discomfort distracts the occupant from their primary duties and leads to negative health outcomes over time.

One of the ways that proper seat ergonomics can mitigate neck and back pain is to reduce the amount of vibration transmitted to the occupant from the aircraft's transmission. In fact, reducing exposure to whole-body vibration is one of the recommended neck and back pain mitigation strategies from DRDC scientific research.

Aircraft vibrations are transmitted through the floor and seat into the occupant's body and propagate through the bones and tissues. Just like a guitar string has a natural frequency at which it will vibrate, so too does the human body. The natural frequency of human spines, for example, ranges between 4-6 Hz. Typically, dominant vibration frequencies of helicopters tend to be around 5.4 Hz (1/rev). Aircraft frequencies that closely match the natural resonance of the human spine are more concerning from a health perspective as they cause "whole-body" vibration of the occupant.

One of the most interesting findings is that the effects of whole-body vibration can be magnified at the head and neck. This effect is believed to be a contributing factor in neck pain prevalence among rotary aircrew. The idea is that because the whole body is vibrating, the neck muscles are constantly stabilising the visual system, which fatigues the neck muscles and leaves them susceptible to injury. Coupled with the added weight of helmets, night vision goggles, battery pack, and counterbalances, the demands imposed on the neck muscles to counteract this whole-body vibration may result in pre-mature muscle fatigue and an increased potential for

injury. Research has shown that neck muscle activity is reduced when main rotor track-and-balance are properly tuned and when vibration mitigating seat cushions are used.

With the support of the Directorate of Technical Airworthiness and Engineering Support (DTAES), scientists at the National Research Council – Flight Research Laboratory (NRC-FRL) in Ottawa, Ontario have studied the effects of whole-body vibration on aircrew comfort, cognition and fatigue. Presently, NRC-FRL are developing active and passive vibration dampening seats and cushions to minimize the exposure of whole-body vibration to aircrew.

Similar to the way modern headphones cancel external noise by producing a sound wave in opposite phase, NRC's *active* vibration reduction seat moves the seat in the exact opposite direction and phase as the aircraft vibration, thereby cancelling the vibration transmitted to the occupant. NRC has developed a prototype active vibration reduction seat that is designed to structural airworthiness requirements and has demonstrated promising performance in

laboratory settings, reducing transmitted vibration levels of the Bell 412 (civilian version of the RCAF CH146 Griffon) by 75%.

For laboratory testing, NRC uses a human-rated shaker facility of their own design to accurately reproduce vibrating environments. Using data collected on previous research efforts, NRC can reproduce the vibration environment of the Bell 412, CH147 Chinook and CH149 Cormorant in various phases of flight and aircraft configurations.

"Our human-rated shaker table is a very useful tool for studying the effects of vibration on occupants. Basically, the shaker table is a platform that can vibrate precisely in the primary direction of vibration, which is up and down, to simulate what you feel in the helicopter" says Dr. Viresh Wickramasinghe, Team Leader of NRC-FRL. "Because we have precise measurements of vibration across various RCAF aircraft, with a click of a button, we can make the occupant feel like they are



Continued on next page

sitting in the Chinook on the ramp, or flying at maximum speed, as well as feel like they are sitting in the side-facing seat of a Griffon during a transition to the hover. We can then instrument the occupant with various sensors including accelerometers to measure vibration transmission through the body, electromyography (EMG) to measure muscle activity on the back and neck, pressure plates to measure “hot-spots” on the thigh and buttocks, and motion tracking to track dynamic postures. It’s a wonderful engineering tool.”

The intent is to complete laboratory testing and to conduct flight testing on the active vibration reduction seat using NRC’s Bell 412 helicopter over the next year.

NRC’s *passive* vibration dampening technology consists of improved seat cushions designed to target the most dominant vibration frequencies of the CH146. The present effort is to provide seat cushions for non-pilot aircrew who typically sit on cloth seats, often referred to as “rag-and-tube” seats. These rag-and-tube seats offer little in the way of back support and lumbar support to Flight Engineers, Door Gunners, and Aeromedical Personnel. Additionally, rag-and-tube seats have an unfortunate crossbar under the thigh and is uncomfortable after prolonged sitting.

As a means to improve seat ergonomics to non-pilot aircrew, NRC-FRL partnered with a local Canadian manufacturer RAMM Aerospace to develop a set of seat cushions that can be installed over the rag-and-tube seats on the CH146 Griffon. The seats meet civilian airworthiness requirements for flammability and were

verified in NRC’s shaker table to significantly reduce whole body vibration of seated occupants. The seat cushions were recently submitted to an Initial Operational Assessment (IOA) by the Land Aviation Test and Evaluation Forces (LATEF) to assess how the seats could integrate with existing Tactical Aviation and Search and Rescue/Combat Support Squadron (SAR/CSS) missions and aircraft configurations and provide improved comfort to non-pilot aircrew. The results of the assessment showed that the seat cushions were comfortable, however, several deficiencies were identified related to material selection, craftsmanship and compatibility with other mission kits that are being assessed by DTAES and NRC-FRL. The intent is to address the deficiencies through design changes and resubmit the article to IOA.

“The performance of the CH146 seat cushions during initial operational assessment testing was encouraging. We are confident that we hit the mark with regards to seat comfort and are looking forward to working with DTAES and RAMM to improve other aspects of the design so that this much needed capability can be delivered to the CH146 community.” says Dr. Wickramasinghe.

DTAES and NRC-FRL will continue developing new and improved solutions for aircraft seats. Improved seat ergonomics are an important mitigating factor against the risk of neck and back pain among RCAF aircrew. These research and development projects will continue over the next year. 🙌



Good Show

For Excellence in Flight Safety

Lieutenant Alex Cloutier (IFE) and Captain Adrian Rizzuto (PLT)



On 24 May 2022, the CC-130H Hercules crew was holding short of Runway 06 at 8 Wing Trenton. There were multiple aircraft in the pattern and the Hercules crew was working through their pre-take off checks while a King Air was given a clearance for a touch-and-go on Runway 06.

While monitoring the Flight Engineer Under Training (FEUT) and working through the checklist, the Instructor Flight Engineer (IFE), Lt Alex Cloutier, went "eyes out" to assess traffic before being cleared onto the runway. He immediately noticed the King Air on approach still had its landing gear fully retracted. Over the intercom, he informed the Aircraft Captain (AC), Capt Adrian Rizzuto, who looked up from his checklist to confirm the King Air was indeed

about to land with its gear up. Capt Rizzuto swiftly reacted to an imminent accident and immediately called tower frequency to warn the aircraft about to land of the situation. The King Air had initiated a flare and dipped to about 10 ft above ground level. The King Air then reacted to the radio call, initiated a Go-Around and re-joined the pattern without further incident.

Lt Alex Cloutier and Capt Adrian Rizzuto are being commended for their exceptional situational awareness, the rapid assessment of the dangerous gear-up approach on the King Air and also for their immediate communication and team work, thus avoiding a very serious incident. They are most deserving of the Flight Safety *Good Show* Award. 🏆

For Professionalism

For commendable performance in flight safety

Corporal Benjamin Arbuckle (ACS tech)



Cpl Arbuckle was tasked to assist a Level A technician with the inspection of a temporary repair on a CH-147 Chinook on 20 Jan 2022. While performing this task, FOD was discovered on the ramp of the aircraft. A FOD check was initiated and during the search, Cpl Arbuckle detected a loose nut and washer on a flight control which is not something that would usually be observed during a FOD check. Cpl Arbuckle informed the Level A and a further inspection of the area as well as review of the maintenance publications identified that a cotter pin was missing from the assembly.

It was determined that through the vibrations experienced during aircraft operations, and the lack of a cotter pin, the hardware became loose and was close to falling off. Had the nut come off, loss of flight control input could have resulted in a catastrophic failure leading to potential loss of life and aircraft.

Cpl Arbuckle had only recently completed his A/C Tech Common Core training and had begun gaining experience working on the CH-147 Chinook, conducting servicing and elementary tasks. His attention to detail and

thoroughness allowed him to identify an issue where the location is obscured from sight and not something that would usually be found during a FOD check. It is commendable for a new technician to recognize and report a shortcoming of this magnitude. This speaks volumes to Cpl Arbuckle's dedication and his understanding of Airworthiness and the Flight Safety Culture of the RCAF. He is well deserving of this *For Professionalism* Award. 🦋



SAI IN FLIGHT SAFETY

by LCdr Ajiri Ikede CD, MD, RAM, ABPM (Aerospace)

The timely collection and analysis of information remains the cornerstone of all Flight Safety investigations. Prior to 2020, DFS used generalized witness statements (GWS) and in-person witness interviews to gather pertinent information required to piece together the details surrounding an incident or accident. Although in-person interviews continue to be a vital component of an investigation, they are not without limitations – perhaps the most obvious being the inevitable delay from the time of the accident to the time of the interview.

It has been well established that as the time increases from when people witness an event, their ability to accurately remember details decreases. Put simply, people tend to forget more details as time passes. This is known as the Forgetting Curve and the effects can be quite dramatic, especially within the first 24 to 48 hours (see figure 1).

In an effort to capture as much detail as possible, DFS had been employing the GWS and requesting that witnesses complete these statements as soon as possible. However, when witnesses were providing statements, they were not given much in the way of direction or structure. In most cases, they were simply told to “give us a written statement”. This led to a wide variation in both the quality and quantity of the GWS that were received and reviewed by DFS.

The Self-Administered Interview (SAI) is a validated investigative tool that was developed in an effort to bridge the time gap between a witness experiencing an event and

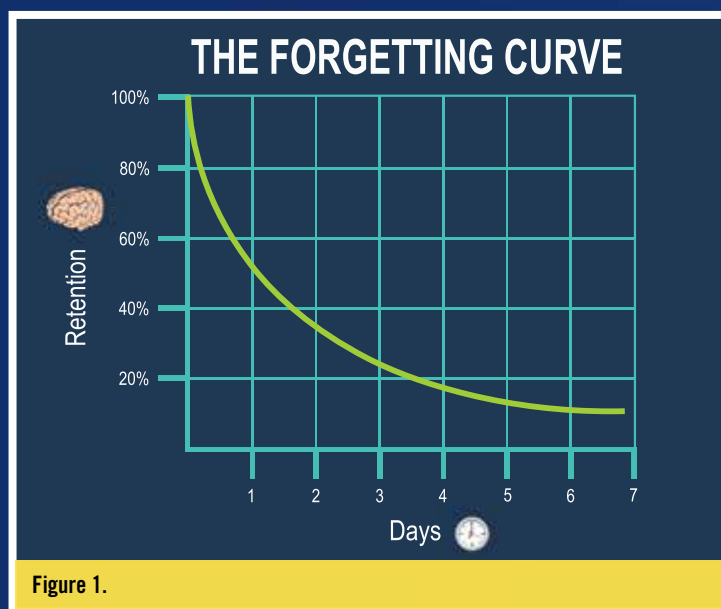


Figure 1.

that witness being interviewed in person by a trained investigator. The SAI incorporates principles of a cognitive interview, guiding the witness through steps to facilitate recall of as many details as possible. Although the SAI has been used effectively in law enforcement investigations, it required an adaptation to the aviation environment in order to be used by aircraft accident investigators. This adaptation occurred in early 2020 and was a collaborative effort between members of the DFS in Ottawa, and the original author of the SAI, Dr. Ronald Fisher.

The SAI was first used for an investigation in April 2020 and was administered about 24 hours after witnesses had already completed the standard GWS. Based on the forgetting curve,

it would not have been completely unexpected to discover fewer details in the tool that was used much later. However, this was not the case. The SAI successfully captured about 75% more details in both quantity and quality as compared to the GWS! In addition, the SAI provided instructions and a space for witnesses to draw sketches which proved to be very helpful to investigators. As a result of the demonstrated advantages over the GWS, DFS has adopted the SAI as the new standard for collection of witness statements.

The SAI is available for download on the DFS website under the administration tab at: <http://rcaf.mil.ca/en/dfs/flt-safety/administration.page> 🔥

For Professionalism

For commendable performance in flight safety

Master Corporal Dima Kyshynskyy and Corporal Peter O'Brian (AVN Techs)



In the early hours of 24 Feb 2022, MCpl Dima Kyshynskyy and Cpl Peter O'Brian were preparing a CC-130 Hercules, for the maintenance "C" release to complete a mission later that morning.

They discovered the #3 propeller was missing the information that indicates the torque values for the balance weights used in the balance process. MCpl Kyshynskyy and Cpl O'Brian printed off the prop balance solution allowing

them to confirm the correct weight placement, then they confirmed the torques that should have been applied to the balance weights. During the verification and inspection of the propeller, it was discovered that the weights had been installed in the incorrect positions. If the aircraft had flown without this unserviceability rectified, the aircrew would have experienced a serious imbalance and vibration, which could have led to catastrophic failure of the propeller and significant damage to the engine.

Both MCpl Kyshynskyy and Cpl O'Brian displayed superb technical abilities by identifying the missed torque, and a thorough investigation of all the completed work. MCpl Kyshynskyy and Cpl O'Brian's professionalism and attention to detail potentially avoided a serious incident/accident from occurring. They are both highly deserving of the *For Professionalism* Award. 🇨🇦



CHECK SIX



Flight Data Monitoring (FDM) and Flight Safety in WW2

by Col (retd) Chris Shelley

Chris Shelley joined the Canadian Forces in 1973. After graduation from Royal Military College he trained as a pilot, flying some 3800 hours with 424 Squadron and 408 Squadron on CH-135 and CH-146 aircraft. He flew on operational deployments in Central America (1990) and Bosnia (2001). He commanded 408 Squadron and 1 Wing before serving as Director of Flight Safety from 2006 to 2008. Retired since 2008, Chris retains a lively interest in aviation history and flight safety.

As the RCAF acquires newer and more sophisticated aircraft, the implementation of RCAF-wide FDM becomes ever more possible. Defined by the FAA as the “routine collection and analysis of flight operational data to provide more information about, and greater insight into, the total flight operations environment,” FDM would assist the RCAF in increasing flight safety and operational effectiveness. There are challenges to be met: collecting and managing data; balancing FDM’s intrusion into every aspect of aircrew operations and maintaining trust in the integrity of flight safety when all data are open to scrutiny. While FDM is a modern concept, it may be surprising to learn that the RCAF has grappled with these challenges before. By taking a brief look at how 6 (RCAF) Group managed FDM as part of RAF Bomber Command’s operational research and analysis regime during the Second World War and how it affected operations and flight safety, we can gain some insight into the potential of FDM for today’s RCAF.

Of course, “Flight Data Monitoring” and “Flight Safety” were not in the lexicon of the wartime RCAF. Nonetheless, 6 (RCAF) Group collected massive data on aircraft and aircrew performance

and used them to create processes that improved operational performance and reduced accidental losses. So, for the purposes of this article the terms FDM and Flight Safety will be used. After a condensed look at the problems facing 6 (RCAF) Group bombing operations, it will be shown how FDM helped solve them. The relationship between 6 (RCAF) group FDM and Flight Safety will also be discussed including how FDM activities influenced aircrew morale. It will be suggested that FDM gave 6 (RCAF) Group an important combat edge, but there were consequences that should be remembered in the design of future FDM programs.

In the early years of the Second World War, strategic bombing was the only way the Allies could strike deeply into the heart of occupied Europe and the Axis homelands. The Royal Air Force (RAF) had designed Bomber Command during the 1930s to carry out long-range precision strikes, but the early years of the war produced many failures and few successes. The strength of German defences forced allied bombers to fly at night, preferably in periods of low illumination and poor weather, to keep losses at an acceptable level. By late 1941, it became painfully obvious that even the

best-trained and equipped crews failed to find their assigned targets and in fact, very few bombs fell within five miles of the target. The enormous expense and effort being poured into Bomber Command was an utter waste. Something had to change.

Scientists of Bomber Command’s Operational Research Section (ORS) began to look for solutions. They realized quickly that they needed masses of data if they were going to analyze problems deeply enough to find solutions that could increase the accuracy of the raids. Bomber Command aircrew were well trained, well-equipped, and highly motivated, yet they could not hit their targets. To define the challenges facing Bomber Command, scientists decided to track every aspect of aircraft and aircrew performance. Only by clearly defining the problems of bombing could they hope to effectively employ new technologies in navigation, target marking, gunnery and bomb aiming. Bomber Command ORS started its program to collect data, define problems, test solutions, reassess and revise in a continuous cycle that would last until war’s end.

Continued on next page





CHECK SIX

ORS scientists needed sources of on-board data, but where to find them? Unlike today, in 1942 aircraft did not record, store, or transmit any flight or performance data. Instead, researchers had to analyze the navigator's log, the flight engineer's log, air gunner combat reports and crew debriefings to derive a history of any mission. Raids were not flown in formation, so a 500-bomber raid consisted of 500 individual crews navigating their bomber along a defined route to meet a prescribed time-on-target that varied for each aircraft. To create a history of a raid, ORS scientists analyzed the logs of every single returning bomber. ORS scientists used the data drawn from the logs and other reports to develop histograms of the raids, plotting the whereabouts of each individual bomber at specific times (Figure 1). Even combat losses contributed to the data, as the location of each known loss was plotted to determine how close the bomber had been to track, timing and assigned altitude at the time of loss. The huge effort needed to develop raid plots paid off in identifying the challenges faced by aircrew in navigating to and finding the target. Yet, the log sheets could not assist with the most important assessment of all, whether bombs had hit the target. More information was needed!

This last, most crucial, piece of data was obtained by installing cameras on the bombers to record the period leading up to and including bomb release. Photo-flash cartridges illuminated the terrain as the camera took photos during the bomb release sequence. By analyzing several raids and thousands of photos, experts devised interpretation techniques that allowed ORS to determine the precise position of an aircraft at bomb release. Later, colour photography recorded aiming points and onboard cameras captured critical navigation and other flight instruments to give even more precise information. These studies gave hard evidence that aircrew, despite their best efforts, were not finding the targets, but also pointed to a solution.

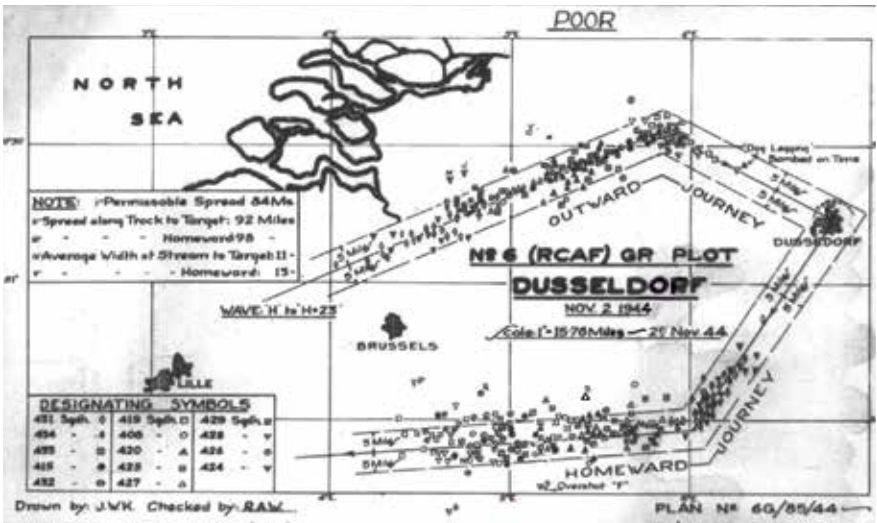


Figure 1. Concentration Dusseldorf

Squadron	Percentage of aircraft bombing within correct T.O.T. per wave	Percentage of aircraft bombing after Time off Target per wave	Average minutes late of aircraft bombing after Time Off Target	Percentage of aircraft bombing before T.O.T. for wave	Average minutes early of aircraft bombing before T.O.T. for wave
408	37.0	30.0	4.9	33.3	5.0
426	45.0	42.0	6.2	13.0	2.9
432	34.0	37.0	4.2	29.0	3.9
Lancaster	38.7	36.5	5.2	24.6	4.2
419	34.2	22.5	5.4	22.9	5.5
427	41.0	27.2	4.2	31.8	3.4
428	28.1	46.9	5.4	25.0	4.3
429	56.2	18.8	6.8	25.0	4.3
431	40.0	44.0	5.3	16.0	2.8
433	38.7	51.6	6.4	9.7	2.3
434	70.0	5.0	4.0	25.0	2.0
Halifax	46.2	32.0	5.4	21.8	4.3
6 Gp	41.0	34.6	5.3	23.6	4.2

Figure 2. 6 (RCAF) Group Bombing Times Analysis, January 1945



That solution was to improve the accuracy of navigation to the target area and then have the bombers release their bombs at a specified time on a visible aiming point. ORS persuaded Bomber Command that a special target marking force equipped with the latest navigational aids and brightly coloured pyrotechnics could mark the desired aiming point for the target well enough that the main force bomb aimers drop their bombs accurately. This force became known as the Pathfinder Force, and from 1943 on it would find and mark targets for the main force bombers. Timings were planned so that hundreds of bombers would pass through the aiming point in quick succession, overwhelming the defences. Navigation accuracy was vital and could only be improved by standardizing navigation procedures and log-keeping, and by using ground-based long-range aids to navigation (GEE, OBOE, and later H2S ground-mapping radar). These improvements helped guide the bombers to the target. However, it was the development of target marking that increased the percentage of bombs falling on or near it. Published analysis of raids gave feedback to commanders and crews. For example, the 6 (RCAF) Group raid plot for Dusseldorf at Figure 1 is assessed as "Poor," meaning there was room for improvement! Bombing analyses showed whether squadrons were proficient or not (Figure 2). No excuses were accepted, as per this comment from August 1944: "415 Squadron has dropped from a 100% score on German targets to 54.9%. They have also entered the French target records, second to last at 85.9%. Possibly the loss of the Squadron Commander and Navigation Officer is the explanation for this. We are looking for a great improvement in T.O.T. during September." Sympathy could wait until after victory!

The road to success was long; nonetheless, the cycle of data collection, analysis and tactical adaptation led to extremely high levels of effectiveness by war's end. Every innovation was tested, analyzed, and either kept, modified, or discarded depending upon how well it worked

in combat. The constant collection and analysis of data created a revision cycle of weeks, not months, providing Bomber Command with the tactical agility it needed to beat the Germans. Tactical agility was vital, because every new item of airborne equipment installed on a bomber, be it tail warning radars, navigation receivers, jamming equipment or cameras, literally fell into German hands within weeks of its debut. The Germans worked feverishly to develop countermeasures to every innovation, so it was essential to continue the cycle of data collection and review to ensure that Bomber Command could stay one step ahead of the enemy. The result was that by 1945 Bomber Command could be confident of destroying any target within its reach.

What did this approach to data collection mean for aircrew? Systemic collection and analysis of flight data from bombers and crews was underway when 6 (RCAF) Group was formed with eight squadrons in October 1942 and firmly established by the time it matured to full strength of 15 squadrons in late 1943. 6 (RCAF) Group faced the challenge of constantly integrating inexperienced crews into operational squadrons, bringing them rapidly to a peak of combat efficiency, maintaining that peak for a few months and then "screening" the surviving crews into non-combat roles (ground jobs or training positions in Canada or at an Operational Training Unit). This cycle could last

from six months to a year, depending upon the tempo of operations. Crews formed themselves by a process of mutual consent at the Heavy Conversion Units (HCU) and became a tight-knit, interdependent group that completed its tour of duty together. Frivolous or solo flying was a thing of the past, for by the time crews arrived at operational squadrons every aspect of their performance was recorded and analyzed and consequences (apart from those imposed by the

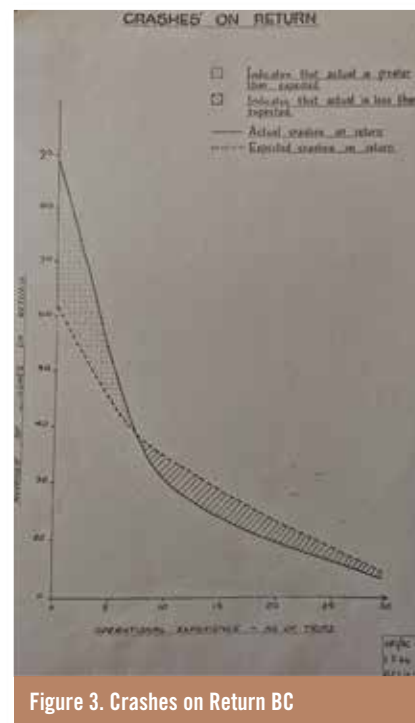


Figure 3. Crashes on Return BC

Time spent forward					Fuel Time		Miles	
Date	Event	Target Type and No.	Pilot	Day	Duration (hours of fueling, power, engine, etc.)	Time	Miles	
24. 1	100%	100%	100%	100%	Cpt. Hogan	4.00	7.30	
24. 2	100%	100%	100%	100%	Cpt. Kurland	2.00	6.15	
24. 3	100%	100%	100%	100%	Cpt. Jones	2.00	6.15	
24. 4	100%	100%	100%	100%	Cpt. Conner	2.00	6.15	
24. 5	100%	100%	100%	100%	Paula Bennett & X. Survey		3.40	
24. 6	100%	100%	100%	100%	Gaggle & Survey		3.40	
24. 7	100%	100%	100%	100%	Cpt. Dutton	2.00	6.15	
24. 8	100%	100%	100%	100%	100% X. Survey			
24. 9	100%	100%	100%	100%	Cpt. de la Cruz (Survey & Survey)		6.15	
24. 10	100%	100%	100%	100%	Survey & Survey		6.15	
24. 11	100%	100%	100%	100%				
24. 12	100%	100%	100%	100%				
Summary for Dec. 1944. 100%.					100% 100%			
Total 100% 100%.					100% 100%			

Figure 4. FE Log Book

Figure 4. FE Log Book

Continued on next page



CHECK SIX

Classification of Accidents, November 1943

1	Error in pilotage, taking off	3
2	Error in pilotage, landing	1
3	Error in pilotage	0
4	Error in captaincy	2
5	Engine failure (forced landing)	1
6	Airframe failure	1
7	Error in navigation	0
8	Taxying accidents	8
9	Bad aerodrome surface	0
10	W/T failure	0
11	Forced landing, fuel shortage, etc.	0
12	Faulty manipulation of controls	0
13	Collision	2
14	Cause Obscure	3
15	Other	0
TOTAL		21

Figure 5. Classification Accidents Nov 43

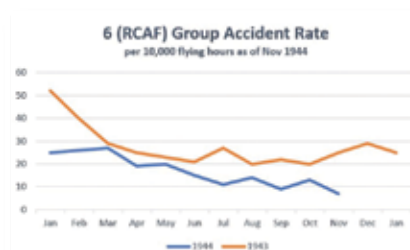


Figure 6. 6 (RCAF) Group Accident Rate 1944

Germans) awaited those who failed to measure up. A crew's arc of experience consisted of 30 or more operational missions, this number being determined by Bomber Command's assessment of the intensity of combat and the availability of replacement crews. Since at the height of the bombing campaign the average life of a heavy bomber was 14 missions, the odds of survival were not great.

The decision to cycle crews out of combat operations for a "rest" was not due to any compassion on the part of Bomber Command. It was instead a result of data analysis that showed that as crews approached their 30th

mission their effectiveness diminished and the risk of casualties through combat loss or accident increased greatly (Figure 3). Bomber Command decided that it was better to "screen" these experienced crews for a rest, that they might later re-enter the fray as supervisory personnel or as pathfinders than to push past 30 missions where crews faced almost inevitable extinction. The 30-mission cap also sustained crew morale by giving personnel a definite horizon for relief from the stress of combat. Aircrew recorded combat missions in green ink (day) or red (night) in their logbooks to make it simpler to keep track and the mounting total could be productive of hope or resignation, depending upon the individual's outlook (Figure 4). However, the constant monitoring of flight data and performance could mean that unsuccessful missions might not count toward the magic "30." Early returns due to aircraft unserviceability, frozen guns or crew incapacitation did not count. Failure to release bombs reasonably close to the aiming point or other navigation failures could also lead to a flight not being

counted depending upon the evidence of the onboard cameras. Crews arrived well trained but inexperienced. Operations gave them experience and increased their efficiency until combat exhaustion and stress began to deprive the survivors of their edge. HQ 6 (RCAF) Group had to know where to draw the line on tour lengths, and it used data analysis to inform that decision.

Performance discrepancies were also detected by the data-gathering process. The constant scrutiny of navigator logs, flight engineer logs, combat reports and target photos by the squadron hierarchy readily identified crews and/or crewmembers who were not maintaining the desired standard. Most cases met with suitable remedial measures and improved, but those who failed to respond could be separated from their crews and sent to an "Aircrew Refresher Training Centre," which for 6 (RCAF) Group was in Sheffield, England. Very little has been written about these centres, and for good reason. Being sent there was nothing less than an extrajudicial punishment. No training of any value occurred; rather, non-commissioned aircrew were subjected to long hours of parade square drill and physical training, combined with a routine that was designed to make life as miserable as possible. Commissioned officers could find themselves stripped of flying status, removed from their units, and made to revert to the ranks if the case was sufficiently serious. These were all administrative actions. Courts martial were rare, reserved for gross violations of flying regulations on non-operational flights or bad behaviour on the ground. Offenders facing court martial would be removed from operational squadrons immediately to await their fate at another base.

FDM also provided insight into accidents and their causes, and 6 (RCAF) Group worked hard to prevent accidental losses during operations or training. In an environment where adherence to altitudes, timings, and bombing procedures meant success and survival, the consistent message from headquarters was that deviation from raid orders or flight procedures led to disaster. The flight safety approach was simplistic; someone was always to blame.



Accident rates were high in 1943 (50 per 10,000 flying hours) but declined steadily throughout the war. 6 (RCAF) Group's main tool for passing information was its monthly Summary of Operations and Training (SOTA), available to all.

The SOTA summarized notable accidents by celebrating heroes and shaming fools. Heroes got a *Good Show*:

"[This] case was a pilot who had to feather his starboard inner engine shortly after taking off for operations. He set course 15 minutes early so as to arrive at the target on time but, on reaching the enemy coast, the starboard outer engine failed, bombs were jettisoned safely and course set for England. The pilot was unable to feather his starboard outer propeller, so he unfeathered the starboard inner, but the engine only gave 1/3 power and was running very roughly. On reaching our coast, the starboard outer seized and the propeller and reduction gear were torn from the engine causing damage to the starboard inner engine. The pilot made a good landing at night on a strange aerodrome with the use only of his port engines." *[The rest of crew did nothing apparently?]*

Fools were branded as *Boob of the Month*:

"... At 5,000 feet the Engineer reported the starboard inner engine oil pressure had dropped to 25 lb per square inch and asked the pilot to feather the propeller. The pilot asked if the coolant and oil temperatures had risen and when he learned they had remained normal he stated that the pressure gauge was probably 'duff' and

instructed the Flight Engineer to keep a close watch on it. After five minutes the Flight Engineer left his panel to disengage the undercarriage up-locks. When he returned, the starboard inner engine was on fire and the crew were preparing to abandon the aircraft. . . There were three survivors [of seven crew]. If the oil pressure on a Merlin engine drops below 30 lbs/square inch the pilot should always feather the propeller. The Flight Engineer should not have left his panel to disengage the up-locks, especially as a second Engineer was in the aircraft."

The SOTA would even state, "The pilot is now at Sheffield," or show an air gunner in a crude cartoon yelling, "Send the bastard (sic) to Sheffield!" ("Sheffield" = the Aircrew Refresher Training Centre, the punishment camp). More commonly, an occurrence could result in a permanent red-ink Logbook endorsement of "Carelessness," or "Negligence," to warn future supervisors that its holder was a dodgy customer. Ground personnel (armourers, air traffic control, etc.) were subjected to similar scrutiny.

While this approach might strike us as counter-productive, it was consistent with Second World War RCAF culture. As AOC 6 (RCAF) Group Air Vice Marshal McEwen stated in October 1944:

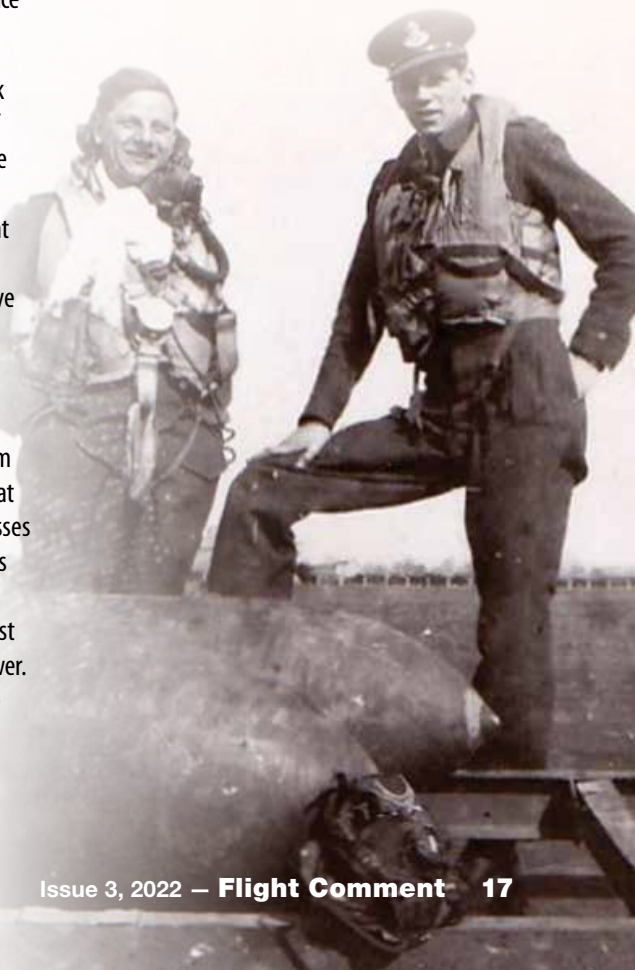
"Every time a pilot takes an unnecessary risk with an aircraft, or is involved in a breach of flying discipline, he should invariably receive exemplary punishment, even though the incident did not actually result in an accident . . . Before the War, any pilot damaging his aircraft in an accident was considered to have let down his Squadron and the other pilots were not slow in rubbing it in!"

Aircraft were precious items of government property, and personnel who damaged them were judged negligent or careless, terms that appeared frequently in accident reports. Losses could be minimized by following regulations and standard procedures; therefore, if a loss occurred then a regulation or procedure must have been violated and someone had to answer. This approach did little other than to increase

the already sky-high stress levels of operational personnel. However, the "culture" of 6 (RCAF) Group embraced a shared belief that mistakes, or deviations jeopardized the Group's mission, increased losses, and justified severe sanctions. This attitude preserved the will to carry on despite significant odds against personal survival. Unfortunately, the worst aspects of this 1940s RCAF culture carried over into the 1950s, until the high losses of peacetime flying resulted in the birth of the flight safety approach we know today.

Nonetheless, 6 (RCAF) Group headquarters recognized that many accidents were caused by deficiencies in equipment and procedures, armament, communications, air traffic control and administration. Each area was subjected to intense study to extract any data that might prevent future occurrences (Figure 5). This led to improvements in airfield lighting and facilities, communications equipment and procedures, and better onboard landing aids for the bombers, the precursor of the Instrument

Continued on next page






CHECK SIX

Landing System (ILS). Every ditching occurrence was examined and changes to procedures, equipment, readiness of response forces, and air search were often the result. These actions bore fruit as the 6 (RCAF) Group accident rate declined steadily, preserving aircraft and crews for combat operations (Figure 6). The combination of pressure to improve operational efficiency and to preserve assets for combat operations combined to create a strong and successful drive to reduce accidental losses in 6 (RCAF) Group throughout the war.

From this brief look at FDM and flight safety in the wartime 6 (RCAF) Group there are a few items worthy of attention by today's RCAF. The first is that FDM, properly executed, can provide data essential to operational success and increased flight safety. As Air Chief Marshal Sir Arthur Harris, commander of Bomber Command stated, "... Bomber Command's Operational Research Section investigations always enabled us to know exactly where we stood." Today's RCAF could have similar knowledge through FDM; however, in 1943 FDM brought an

enormous leap in capability whereas today the improvements, although important, would be more modest. Today's flight safety culture is also vastly different from 1943. Punishment is not an effective tool for accident prevention; rather, active participation in occurrence investigations gives the most benefit. As in 1943 data collection and analysis can assist accident prevention and aircrew have long accepted that cockpit voice recorders and other flight data recorders can be used in confidential flight safety investigations. Whether using them for operational reasons is justifiable, or whether a parallel system of data collection would be necessary has yet to be decided. These cultural and regulatory obstacles will need to be overcome to implement an effective FDM regime. The past also teaches us that any recording device found at a crash site could allow an enemy to exploit our data, more so if the recording device is crashworthy. The value of data collection and analysis must be balanced against the potential harm caused by its compromise, and the RCAF has yet to find the

means to square that circle. All things considered, FDM was a powerful tool for victory for the wartime RCAF and could be so once again. 

A note on sources:

- 6 (RCAF) Group monthly Summary of Operations and Training can be found online at www.bombercommandmuseumarchives.ca.
- Figure 3 is from Operational Research Section/Bomber Command 424J, dated 7 May 1944, copy obtained from Directorate of History and Heritage.
- Figure 4 is from the logbook of Flight Sergeant Dennis Warburton, 424 Squadron, by permission of his daughter, Helen Abraham.
- For an in-depth look at operational research, see Wakelam, Colonel (Retired) Randall T., *The Science of Bombing: Operational Research in RAF Bomber Command*, Toronto: University of Toronto Press, 2009.



For Professionalism

For commendable performance in flight safety

Master Corporal Gary Cousins (FE)



Photo: Cpl Dlugozina

On 13 Apr 2022, MCpl Garry Cousins was carrying out a Flight Engineer walk around on a CH-149 Cormorant and noticed what he thought to be an anomaly with the outboard Breeze Eastern hoist cable where it meets the hook. After comparing it with the inboard cable, he determined the outboard cable was minutely thinner than the inboard cable. He consulted with an experienced technician who referred to the CH-149 first line maintenance manual. With no obvious cable widening or broken/loose strands, the technician indicated to MCpl Cousins that the cable was serviceable.

Not feeling confident about the cable, MCpl Cousins took it upon himself to research this anomaly and discovered an identical scenario in an Australian Flight Safety Report when a Breeze Eastern hoist cable failed and broke right at the hook. The cause was improper parking of the hoist hook which allowed the hook to buffet in the wind, causing internal cable strands to fail. The second line Component Maintenance Manual was reviewed and it was determined the cable was out of limits and therefore, was replaced immediately. Further investigation noted that this issue was not familiar to technicians, so a wider check was

completed. Several other cables in the fleet were noted to be unserviceable as well and therefore were also replaced.

MCpl Cousins' determination and research resulted in existing limits being published in first line manuals and extra training for both aircrew and ground crew regarding hoist "parking" and cable inspection. His attention to detail likely averted a future cable failure which could have resulted in loss of life. MCpl Gary Cousins is very deserving of the *For Professionalism Award*. 🏆

ON TRACK

5G Technology and Aviation

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

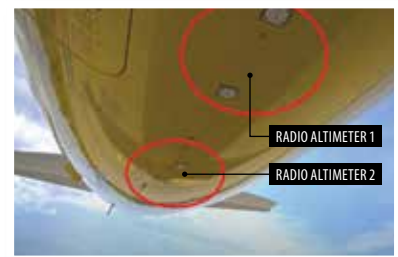
This edition of On Track will explore the implementation of 5G technology and its potential effects on aviation.

by Capt Chris Filiatreault

Over the past year or two, you may have noticed various articles, news releases and reports about 5G technology and its potential effects on aviation. Telecom companies in the United States, Canada, Europe and many other places in the world are rolling out, or have rolled out, 5G services as the next generation of wireless interconnectivity. In the past year, many media outlets, especially in the United States, published articles and broadcast about the serious consequences to commercial aircraft if 5G were implemented without restrictions. Most

international news agencies were discussing the 5G rollout in the U.S. and its effects on aircraft travelling to U.S. airports. In fact, many international airlines cancelled flights into the U.S. in January 2022 over concerns with 5G.¹ Many European and Eastern nations did not have comparable media releases when 5G was implemented in their countries—rather, 5G and its effects on aircraft were nothing to be alarmed about. Why the difference you may ask? It comes down to the proposed broadcast power and frequency proximity of 5G networks in the U.S. to an aircraft system called a Radar Altimeter (a.k.a. RA's, or RADALTs).

Let's back up a little, what is 5G anyway? The term “5G” refers to the “fifth generation” of broadband cellular networks. Just like current networks, 5G is broken up into geographical areas called “cells,” and when a 5G cell is fully functional and implemented it is possible that it can support up to one million devices per square kilometre via three different frequency bands: low, mid and high. The low-band operates between 600 and 900 MHz (just like 4G), mid-band uses 1–6 GHz and the high-band uses 24–47 GHz. The majority of 5G performance will be found in the high-band, but 5G will still depend on the other bands for continuity of service. With the ability to download up to 10 Gigabits per second, 5G represents the latest in connectivity and interconnectivity—in fact, it probably won't be until the



Picture 1 and 2. Location of a RADALT on an airframe: on the top picture it is located near the rear of the tail of a large jet, and on the bottom picture it is located on the underside of the tail boom of a helicopter. (Picture credit: Quora for the Jet, Aero Access for the helicopter)

mid-2020s that we start to see the potential of 5G become more evident. Aside from supporting faster uploads and downloads, 5G networks have greater “bandwidth” and can therefore connect many different devices. Devices can talk with near-zero latency; autonomous cars, industrial applications with robots, critical communications and many more applications will depend on 5G. 4G devices are not compatible with 5G and a hardware upgrade is required.

¹ “Airlines cancel U.S. flights amid 5G concerns despite carriers’ promise to delay rollout”
By Tim Hether and David Shephardson, Reuters, 18 January 2022.



So how is this important to us? The concern with the bands that 5G uses, specifically the mid-band (1–6 GHz), is that the spectrum overlaps the 4.2–4.4 GHz range that radar altimeters use. A radar altimeter is a sensor that is integrated into the underside of the airframe on some fixed-wing and rotary wing aircraft (picture 1 and 2). The radar altimeter (figure 1) projects a beam towards the ground and depending on the time delay in receiving the reflection, the radar altimeter can instantly determine the true height (regardless of temperature) of the aircraft above the ground (usually between 0 ft and 2500 ft). The concern is that modern commercial aircraft systems (both fixed-wing and rotary) are connected to the RADALT, and use its inputs to carry out automatic functions. The systems a RADALT is connected to can include: Terrain Awareness Warning Systems, Traffic Alert and Collision Avoidance Systems, Airborne Collision Avoidance Systems, Wind Shear detection systems, flight control systems, auto-throttle, auto-flare, auto-hover, auto-level off and other critical systems that rely on accurate radar altimeter readings. It is suspected that 5G interference could cause a RADALT to have improper readings, including inaccurate or instantaneous jumps in different readings, affecting either one or potentially both (where equipped) RADALT indications on the instrument panel. At the time of writing this article, there have been no confirmed aircraft accidents or incidents (in the Canadian Forces or civilian world) directly

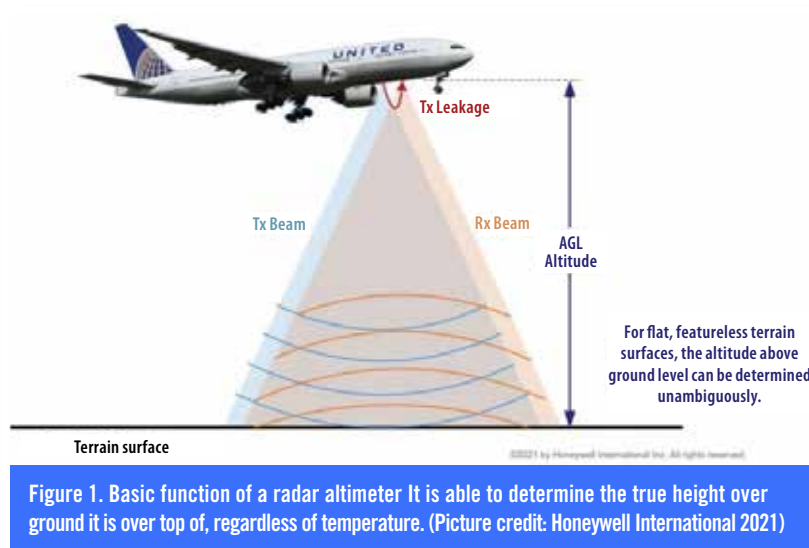


Figure 1. Basic function of a radar altimeter It is able to determine the true height over ground it is over top of, regardless of temperature. (Picture credit: Honeywell International 2021)

attributable to 5G interference. However, within a couple of weeks of 5G being implemented around the U.S. in January 2022, federal regulators received 100+ pilot reports of potential 5G interference; the reports which have been investigated have determined 5G was not a factor.² Nevertheless, the potential consequences of 5G interference with radar altimeters could be quite severe. As an example, if a 5G signal were to interfere with a RADALT while an aircraft was on approach, and make the RADALT think it was at zero feet and cause the auto-throttle to reduce the aircraft's engines to idle before the pilots could react, may result in a crash. This is the main reason, in December 2021, the Federal Aviation Administration (FAA) was so adamant that

more research and testing be done before allowing 5G operations in the vicinity of U.S. airports hosting commercial traffic.

So what has been done to ensure safety? The preparation for 5G integration into various countries has been diverse. In Japan, independent testing was conducted to confirm how 5G would impact RADALTs. Japan implemented certain preventative measures as a result of their findings: 1) Point 5G beams below horizontal, 2) ensure no masts are built under runway approach paths and 3) ensure enough "guard" band (unused spectrum) exists between frequencies.³ Of note, Japan's 5G mid-band is also the closest to the RADALT frequency compared to other countries (Japan's 5G

Continued on next page

² "Pilots Detect Possible Interference Since 5G Rollout — And Regulators Are Investigating", Alan Levin and Todd Shields, Bloomberg Magazine, 2 February 2022.

³ "The compatibility study between 5G base stations and radio altimeters in Japan and update of the result of measurement campaign", Naruto Yonemoto, Akiko Kohmura, Shunichi Futatsumori, and Kazuyuki Morioka, Electronic Navigation Research Institute, National Institute of Maritime, Port and Aviation Technology, (ENRI/MPAT), JAPAN, 1 March 2021. <https://www.icao.int/safety/FSMP/MeetingDocs/FSMP%20WG11/WP/>

mid-band is 3.6–4.1 GHz and 4.5–4.6 GHz), but the power at which the stations broadcast is 4% or less than the power authorized for broadcast in the U.S.⁴ The E.U. (5G mid-band is 3.4–3.8 GHz) has determined that capping the 5G mid-band at 3.8 GHz allows enough guard band to prevent interference from the RADALT's 4.2–4.4 GHz spectrum. Australia follows suit by capping their mid-band 5G at 3.7 GHz. In France it's the height of the tower and the power output that determines how close it's allowed to be to the runway. Also, antennas around 17 major airports are required to be tilted away from flight paths.⁵ At this time there have been no reported 5G and RADALT incidents from any of the above nations.

The release of 5G in the U.S. was a more convoluted matter. In the U.S. the 5G mid-band is 3.7–3.98 GHz, and is planned to be broadcast at much higher power than in other countries. Effectively, where overseas nations and Canada had a more collaborative approach between federal regulators and telecoms to determine how and where 5G might interfere with aviation, the same cooperation was lacking in the U.S.⁴ Due to the uncertainty of how higher powered 5G towers might affect certain RADALTs in vicinity of major airports where pilots are conducting "low-visibility operations", (which require high precision inputs from RADALTs) the FAA issued two airworthiness directives (AD), one fixed-wing and one rotary wing, on the 7th of December 2021, limiting aircraft operations within 5G areas. Canada issued two airworthiness directives (effective 4 January 2022, CF-2021-52) echoing the U.S. ADs for Canadian-registered aircraft operating in U.S. airspace. Unless an aircraft had a certain RADALT that would not be interfered with, or the company could comply in alternate ways (Alternative Means of Compliance, AMOC) the aircraft was barred from entering



that airport under certain conditions. Helicopters required additional equipment or procedures for operation in 5G areas. The FAA issues Notice to Air Missions (NOTAMs) for airports where 5G operations are present and where restrictions are needed. In a letter to AT&T and Verizon dated 31 December 2021, the FAA and Department of Transport (DOT) implored the telecoms to delay the 5G rollout in vicinity of certain airports until more research could be completed. On the 3rd of January 2022, the FAA was able to reach an initial agreement with the telecom companies to delay 5G implementation by two weeks in the vicinity of "priority" airports. By the 7th of January 2022, the FAA and telecom companies agreed to have additional mitigations (buffer zones) in place for 50 select airports for a further 6 months. Since the release of the directives, the FAA has worked with the telecoms, air carriers and RADALT manufacturers to determine which aircraft/RADALTs and airports are

safe. The FAA has a webpage dedicated to the progress they've made with 5G, which also includes an interactive map showing which aircraft are allowed into which airports: <https://www.faa.gov/5g>. Finally, on the 17th of June 2022, the FAA issued a statement defining the way forward with a permanent fix. This phased approach would see aircraft operators with "radio altimeters most susceptible to interference to retrofit them with radio frequency filters by the end of 2022".⁶ The statement also disclosed the telecom companies would keep certain mitigations for another year while airlines completed RADALT upgrades.⁶ The deadline was set for July 2023 for retrofits to be completed and this is also when telecoms will implement full 5G service.⁶

Canada's approach to 5G implementation is a collaborative and phased approach, and includes regulatory oversight as to where and how 5G can be broadcast. To phase in

⁴ "Aviation tackles issues with US 5G rollout", airlines.iata.org, 3 February 2022.

⁵ "Europe rolled out 5G without hurting aviation. Here's how", C. Riley and J. Ataman, CNN Business, 19 January 2022.

⁶ "5G C-Band Update" June 17, 2022 Statement, FAA Website, [faa.gov/5g](https://www.faa.gov/5g).

5G service gradually, Innovation, Science and Economic Development Canada (ISED) completed an auction of the 5G mid-band, specifically 3.45-3.65 GHz⁷, in June 2021. It's expected that in 2023, following further research and data collecting, ISED will allow for 5G operation in the range of 3.65-3.98 GHz. With the initial rollout of 5G in Canada, and monitoring what was happening in the U.S., as well as other nations, ISED implemented "interim technical rules"⁷ on 18 November 2021. The rules included: 1) "exclusion and protection zones to mitigate interference to aircraft around certain airport runways where CATI/II/III automated landing is authorized" and 2) "a national down-tilt requirement to protect aircraft used in low altitude military operations, search and rescue operations and medical evacuations all over the country."⁷ ISED has a webpage that shows where the "exclusion" and "protection" zones (picture 3) are located around 26 airports and you can find it at: <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11726.html>. In an "exclusion" zone, there will be no 5G operation allowed, but in a "protection" zone 5G would be permitted with certain broadcast power restrictions. At this time ISED is also monitoring ongoing

developments as 5G is released to determine interference to aircraft and the need to keep a national tilt-down requirement or lift that requirement should transponders used in Canadian aircraft, specifically helicopters, show that they are not affected by the broadcasts.⁸ Transport Canada issued a number of recommendations to air operators, aside from the requirement that all phones and Personal Electronic Devices (PEDs) need to have transmitting functions disabled for flight. These recommendations included precautions operators can take to ensure that interference, should it occur, does not severely impact their operations.⁷ One precaution that might be of interest to emergency and military responders is that, if a cell phone is needed in flight, to make sure its 5G function is disabled, and then the device would be forced to use 4G or 3G. Transport Canada also reminds air operators that should a pilot suspect 5G interference,

to report it to Air Traffic Services (ATS) as soon as possible. No other restrictions or equipment upgrades have been announced as a requirement to land at Canadian airports up to this point.

5G is an emerging technology that represents the next generation of interconnectedness and shows great technological and economic benefits for society in general. As any new emerging technology, knowing how to incorporate it safely is a priority for many regulators. Fortunately it seems that at this time, no interference has occurred in departing or landing aircraft. As 5G evolves and grows it will be important for continued collaboration between all regulatory agencies of various nations to ensure best practices are implemented to guarantee safety while we harness all the potential 5G can offer.✈



Photo: Sgt Matthew McGregor

⁷ "Potential risk of interference of 5G signals on Radio Altimeter" Civil Aviation Safety Alert (CASA) No. 2021-08, 23 December 2021.

⁸ "Decision on Amendments to SRSP-520, Technical requirement for fixed and/or mobile systems, including flexible use broadband systems, in the band 3450–3650 MHz", ISED Canada, November 2021.

For Professionalism

For commendable performance in flight safety

Captain Thomas Garbe (PLT)



While reading the Flight Comment Magazine, Capt Thomas Garbe took note of the For Professionalism Award given to another member regarding the Zephyr Cable Cutters utilized on the CH-149 Cormorant and the maintenance package that resulted from his discovery.

As 417 Sqn also operates a hoist on the CH-146 Griffon, Capt Garbe spoke to the Maintenance section as to whether the same actions were

required at their unit. Looking through the manuals, no maintenance package was found. A query was sent to the Weapon Systems Manager office, who was not tracking a known serviceability issue with the Zephyr Cable Cutters. They investigated and released a Maintenance Directive for the cable cutters.

Capt Garbe shows a keen interest in all aspects of Flight Safety, was able to connect the dots and began research within his unit for an issue

that was not noted between RCAF communities. Despite the fact that the maintenance of cable cutters are normally outside his normal duties, Capt Garbe showed expert knowledge and initiative which could have avoided a critical fault and closed the loop on a directive that was not properly disseminated. For his actions, Capt Garbe is very deserving of the *For Professionalism Award*. 🏆

For Professionalism

For commendable performance in flight safety

Master Corporal Jonathan Hudson (AESOP)



During a flight from Iceland to 14 Wing Greenwood, MCpl Hudson, an Airborne Electronic Sensor Operator (AESOP) on the CP-140 Aurora, spotted what he thought was oil leaking out of engine #3.

He alerted the flight deck, however there were no symptoms of an issue via the system instruments. The Flt Engineer on board inspected the leak and discovered that it was

not oil, but fuel. Further monitoring found that the fuel leak worsened with time and eventually reached the exhaust. To avoid the engine catching on fire they used the precautionary e-handle to shut down #3 engine.

While air crew personnel are trained to report anomalies during specific duties, MCpl Hudson elected to inspect the engine while in transit, allowing him to identify and report the leak.

This prevented an insidious fuel leak from being unnoticed in the flight deck and a subsequent potential engine fire. MCpl Hudson demonstrated actions well beyond the scope of normal AESOP in-flight duties.

Due to keen attention to detail, exemplary professionalism and work ethic, MCpl Hudson's actions are worthy of this *For Professionalism* Award. 🏆

It's That Time of Year Again

by Col (Retd) Steve Charpentier and Major Jill Sicard, DFS RCAF

This article was initially requested and produced for publication in the RAF Air Clues magazine.

Imagine yourself in this scenario: your helicopter crew is travelling through the far north and are forced to land in the Arctic because of the rapidly degrading visibility. The temperature drops below -10 C and you must spend the night in the cockpit waiting for the weather to clear up. During the night, you experience a visit from a not so friendly polar bear and have to climb on top of your helicopter, throwing things at the bear in hopes it will go away! This is a true story, and fortunately, the bear decided to disappear, but it provides us with a picture of what an unexpected situation could look like in our vast country during cold weather operations. Preparing for winter in the RCAF happens in a variety of ways; if you live in the north, winter has already started (did it ever end?), central Canada basically skips Autumn temperatures and goes from +30 to -30 in the span of a week. Followed by the coasts, who have two completely unique set of rules for winter operations.

Meteorological changes start happening at different rates around Canada and with climate change, it's never consistent but here are a few things that the RCAF looks out for when it comes to cold weather phenomena. Firstly, make sure you always have the current weather and suitable gear. Things change so

quickly and options to land or divert may be quite limited for IFR aircraft or even unavailable for VFR aircraft.

Every year when autumn arrives, we re-educate aircrew and ground crew on cold weather procedures. They receive various briefings and lectures such as wind-chill factor, low visibility, icing, first aid, and more. We also offer advanced Arctic survival training, and every aircrew must learn the basic survival skills. The training and briefings are critical for aircrew that are exposed to the elements while transiting over our massive unfriendly frozen lakes and lands and for ground crew deployed in a harsh environment supporting air operations.

Each Squadron develops their own "Cold Weather Brief" package to prepare everyone for the diverse weather conditions they may encounter based on their Squadrons location and aircraft type. There are normally four parts to those briefings: Weather phenomena, aircraft-specific limitations, survival skills and equipment which lead to medical issues and cold injuries. Below we will cover the basics of each section.

Weather phenomena: During winter Ops the conditions experienced include the following; various icing, turbulence, ice fog, and rapidly moving blizzards.

Icing is something everyone has experienced during the winter months no matter where you are located within Canada. Be aware that when it comes to icing conditions, it can change

your normal expectations with regard to aircraft weight and it also disrupts the airflow, creating drag and decreasing lift. Icing is classified in four different stages of intensity: trace, light, moderate and severe. Trace is when it is first noticed and does not pose hazards if occurring for less than 60 minutes. Light icing conditions are when accumulation begins. Moderate icing happens when accumulation is greater and can be hazardous if you do not use de-icing equipment. Once the rate of accumulation reaches a point that the use of de-icing equipment is no longer effective, it is considered severe. If you are airborne when this happens, you should divert immediately!

In a past Sea King flight this phenomena happened, the crew were flying at high altitude and started experiencing icing and before they had a chance to turn around the aircraft started buffeting indicating an imminent stall condition, luckily they were able to descend quickly and the icing started to melt—remaining vigilant and being able to act swiftly is key.

Normally cold weather brings nice stable air, especially over Central and Northern Canada; however, there is still plenty of terrain that will generate turbulence. For example, when the sun is shining—particularly for prairie type locations, thermal turbulence occurs. This is when the surface heats up from the sun and then the warm air rises. Uneven surface heating and cooling of the air above cause updrafts and downdrafts. Mechanical turbulence is caused by wind shear, both horizontal and vertical. The most common causes are pressure gradient, terrain, and frontal zones. Winds are lighter in areas of high pressure and are stronger in low-pressure systems. Mechanical turbulence is increased around mountains and varying terrain heights where wind is funnelled through passages. The types of Turbulence include: light, moderate, severe and extreme.

One such incident occurred not too long ago with a CP-140 flight in December on the west coast where the turbulence was so fierce, it shook the headsets off the pilots strapped in and one of the crew members in the back was lifted off the ground and violently tossed, resulting in a broken arm.

Fog can be tricky, because during the winter in Canada only certain areas develop it regularly, so it is an important one to know if you are newly posted to a new geographical location. There are several different types of fog, but for Winter you want to be aware of; freezing fog, which is like freezing rain, is super-cooled water droplets that remain in a liquid state until encountering a freezing surface. When that occurs, the fog freezes, thus the name. Ice fog normally occurs in very cold temperatures. It is composed of tiny ice crystals that are suspended in the air. Finally, advection fog, which is common along coastal areas, it forms when moist air moves over colder ground or water. It can persist for days if there is little wind to disperse it. Freezing fog or sometimes freezing mist can also happen in the springtime, recalling another story where the crew was flying a chopper along the Mackenzie River at low level in light mist or haze when suddenly the windscreen turned into an opaque Popsicle forcing them to stop and turn around using only lateral visibility.

Rapidly moving blizzards can cause a lot of problems in a short amount of time which can include icing, turbulence and fog along with whiteout or poor visibility. Most helicopters

cannot revert to IFR flying because of icing conditions, and IFR aircraft may find their airport suddenly unavailable and will need to revert to their alternate. Therefore, it is imperative to remain alert for changing surroundings and be prepared with a backup plan if required. Especially under NVGs (Night Vision Goggles), it can be challenging to detect changes—such is the case in this next story of getting caught at night under NVGs in a rapidly moving blizzard north of Québec City. The pilot was forced to land on a frozen lake and revert to survival mode with the limited survival equipment available on board of a Kiowa helicopter. Although only 50NM north of Québec, they had no means of direct communication with the Squadron. The Squadron attempted to launch a rescue team on snowmobile but had to turn around because of the intense blizzard. The following morning the weather cleared up and thankfully everyone was OK, however without the survival tent and some decent gear, the story could have been tragic.

Continued on next page



Aircraft Specific Limitations: obviously we cannot go through every limitation and requirement for each aircraft but there are some universal recommendations that are important to know. Each aircraft has a temperature operation limitation, a de-icing protocol and fuel additive requirement. Furthermore, each aircraft has their own little quirks or possible equipment errors in cold temperatures, make sure you know what those are and what you can expect flying in colder temps, for example, a fouled hoist, or pitot static system. Below is a list of reminders.

- IFR should plan to fly 1000 above MEA/MOCA.
- Approach minimums shall be corrected when temp is below 0 degrees.
- Hangar storage avoids most winter pre-flight problems.
- Additional personnel may be required depending on the mission i.e. taking shifts to avoid cold injuries, preparation takes longer, etc.
- Maintenance may have issues as well in cold weather i.e. APU starts.
- Whiteout is very common on snow-covered ground during landing/taking off.
- Be sure to check the freedom of movement in controls while on the ground.
- Battery removal may be required if temperatures are sub-zero.
- For helicopters, use caution with rotor brake on ice and oleos may compress in cold weather.
- For fixed-wing aircraft, de-icing and anti-icing requirements add both extra steps and time, be aware of flap positions while parked, taxiing and after landing.

Survival Skills and Equipment: During the walk around, ensure you are not getting cold, if you are, you are underdressed. Make sure your survival kit is serviceable. Be knowledgeable about what is inside the kit, and how to use it. There is a tendency to under dress in the aircraft for most people including passengers and aircrew. It is nice and

toasty in the aircraft with the heat on until you are forced to land in the middle of nowhere. Or God forbid, your fixed-wing aircraft must complete a forced or crash landing in Arctic-like conditions. It is important to have your gear readily available for the slim chance you might need it.

The disaster of BOXTOP 22 in 1991 sums up exactly what we are trying to convey when it comes to survival, equipment and overall, the importance of winter operational knowledge. In October of that year, a Hercules crashed after losing sight of the runway (CFIT) in the . Four passengers died because of injuries suffered in the crash. Thirty-two hours passed before rescue crews were able to arrive at the site. The aircraft commander succumbed to hypothermia before rescue personnel could arrive on scene. The survivors, some soaked in diesel fuel, endured high winds and temperatures between -20 C and -30 C. Many sheltered in the tail section of the downed aircraft but others were more exposed to the elements, all of them suffered from hypothermia. Repeated attempts by the surviving crew and passengers of BOXTOP 22 to recover all possible clothing and emergency supplies were ineffective due to the combination of crash damage, poor weather and arctic winter darkness, i.e. poor visibility. The standard issue kit bag and the designated survival kit bags were almost identical in appearance, particularly in the dark. The crew made several forage trips through the wreckage in search of survival gear or supplies, but the majority of the equipment found was from the sea survival equipment and several personal kit bags which proved to be of little value.



Photo: P02 Belinda Groves

Regulations are in place for your safety. In some cases, you may not be able to readily access your luggage because of injuries. If you are flying in and out of cold weather wear your gear or have it right beside you.

Medical Issues and Cold Injuries: If you are ground crew working outside, you should know how to recognize the onset of cold injuries to both yourself and your partners. Use the buddy check system. Take frequent breaks to warm up, keep hydrated and dress properly. When asked to deploy somewhere consider the worst and make sure you are kitted appropriately for it. Injury caused by exposure to cold can lead to permanent injury, loss of body parts and even death. Hypothermia, frost bite, chilblains and immersion foot are just a few.

Our enemies in this cold environment are water and wind. Water on the skin causes you to feel colder and lose heat faster, wet skin freezes faster than dry skin. Wet hands and feet can even have damage at above freezing levels. Cold water immersion cools the body 25 times faster than cold air. So, the takeaway is to keep dry if at all possible!

When the wind blows, it takes away that boundary layer which is a thin layer of warmth created by our skin, it also takes more energy to re-create that boundary layer, so each time the wind removes it, we get colder trying to re-create it. Thus, why wearing appropriate layering is very important as well as seeking shelter from the elements. Develop a plan for cold weather work, proper clothing is the single most important resource to keep you warm. A water wicking material base layer followed by loose-fitting layers will trap heat inside.

If we are exposed to the cold for an extended period, injuries such as frost bite, hypothermia and carbon monoxide poisoning can occur. Hypothermia and frost bite are the most common cold weather injuries, especially in prolonged exposure. The symptoms for hypothermia are: shivering, lack of coordination, impaired judgment, confusion and slurred speech. Frost bite causes redness in the skin followed by numbness, after this, the colour changes to a waxy-looking white that is hard to the touch. Finally, ending in deep frostbite which is blueish (muscles in that area will not work properly). In all cases of the above injury, you want to prevent further injury immediately

by keeping the area dry and preventing more “cold exposure”. Warm up gradually, especially important for frost bite. Carbon monoxide poisoning can happen with heaters and heat sources, for example, trying to warm up inside an enclosed space like a tent or aircraft and can occur without the victim even knowing. Symptoms are tiredness, headache, yawning, dizziness, nausea, chest pain and confusion, followed by unconsciousness, causing death. Always ensure adequate ventilation, ensure heaters are regularly serviced.

Although we could talk about winter operations for an eternity, we have summarized some very important aspects of winter prep for Canadians and Flight Safety operations. Every year, we are reminded of the importance to be prepared and we hear so many stories that provide a Lessons Learned aspect that brings that importance so much closer to home in order to avoid the thought of “that will never happen to me”. In such a diverse and challenging geographical nation, we in the RCAF require those reminders to remain vigilant and safe. When it comes to winter, always expect the worst-case scenario and be prepared to survive it. 4



Photo: WO Jerry Kean

For Professionalism

For commendable performance in flight safety

Corporal Phillip Molter (AVN tech)



On 1 Mar 2022, Cpl Phillip Molter was carrying out a 280 day corrosion control inspection on a CH-148 Cyclone helicopter. During his inspection of the aft disconnect coupling spring, Cpl Molter noticed that the grease around the aft bearing, which was black and gritty, appeared to be incorrect.

He confirmed his suspicions by reviewing the maintenance manual and determined that the correct grease should have been orange in color with a smooth viscosity. He proceeded to sign out the correct grease required and subsequently serviced the bearing in order to

push the old grease out. It was confirmed that the grease escaping from inside the bearing was in fact black graphite grease. Cpl Molter immediately informed his Chain of Command of the situation and raised a Flight Safety on the aircraft as well as a Technical Problem Report. Ultimately, the engineering disposition rendered the bearing unserviceable and therefore it had to be replaced.

Flying with an unserviceable driveshaft bearing has the potential for catastrophic damage. Furthermore, the aft disconnect bearing is not listed as an item to be lubricated

or inspected during a 280 day inspection. However, due to Cpl Molter's incredible attention to detail, this error was found and resolved before any further damage could be caused to the aircraft or personnel during flight. It is for these reasons that Cpl Molter's professionalism exemplifies the Flight Safety program and he is most deserving of the *For Professionalism Award*. 🏆



Was That Briefed?

by Anonymous

My first trip as a technician was in a CT-114 Tutor two-ship, flying a round robin from Moose Jaw to Toronto in the early 1990s.

The two pilots were instructors from 2CFFTS, each pilot had a technician with them for the experience and exposure. The pilots carried out flight planning, the techs prepared the aircraft, and were ready to takeoff. Preflight brief was given, the first leg of the return trip was to depart Toronto and climb to 10,000ft, followed by a formation flight to Sault Ste. Marie.

My pilot had the number 2 aircraft. Part way through the trip he decided to describe formation flight principles. He explained how lead is responsible for the safety of the formation of airplanes and those onboard; and expected to be a smooth, consistent platform for the wingmen to reference. He went on to explain what the wingmen would need for a successful flight. He then proceeded to demonstrate close formation flight and how close the Snowbird Air Demonstration Team

flies to each other. To give me a better view since I was sitting in the right seat, he passed under lead and pulled in close on lead's left with wings overlapped. Unlike the Snowbirds, whose lead communicates each planned formation maneuver, our Lead with no warning decided he would show his passenger a barrel roll to the left.

The last we saw of the lead aircraft during that leg of the trip was the roundel on his wing coming over our cockpit before my pilot performed evasive maneuvers and our aircraft lost 800ft to regain level flight attitude. Our formation flight reconnected about 20 minutes later as we approached and landed in Sault-Sainte-Marie.

The post-flight brief had the two pilots stepping aside for a discussion in private. Lead was unaware of the near miss. Aircrew

communication during flight had broken down as both pilots deviated from the discussed flight plan and neither spoke to the other aircraft in formation.

Communications are extremely important to safely conduct a formation flight and intent must be clearly understood by all crew members. This could apply for all aviation and safety in general, how many times have we heard "Communication is Key"? In this case, we were very lucky, but a short look through history will tell you that many accidents happen due to lack of communication.

Always ask yourself, does your team understand your intentions?



For Professionalism

For commendable performance in flight safety

Corporal Tyler Palman (AWST)



On 23 Jun 2021, then Avr Tyler Palman was conducting aircraft start-up procedures on a CF-188 Hornet at CFB Cold Lake. Upon completion of the aircraft start-up, Cpl Palman was returning from the flight line when he observed an excessive leak from the R/H main landing gear (MLG) of the aircraft.

Cpl Palman promptly obtained the attention of the pilot, as well as the line supervisor to confirm the aircraft's serviceability. Upon closer inspection it was discovered that the R/H MLG Side Brace Hydraulic Swivel had failed internally, resulting in a substantial hydraulic leak. If it had gone unnoticed, it is possible that the aircraft may have lost the entire contents of the #2 hydraulic system, affecting a myriad of controls, including nose wheel steering and brakes. The loss of such systems during take-off may have resulted in the pilot aborting their take-off, or could have potentially developed into a significant airborne emergency.

Cpl Palman's outstanding situational awareness and decisiveness prevented a CF-188 Hornet from attempting flight in an unserviceable condition. His diligence and high level of professionalism directly reduced the severity of a significant hazard. Cpl Palman is most deserving of this *For Professionalism* Award. 🏆

Photo: Cpl Avery Philpott

A photograph of a military aircraft, likely a CP-140, on a tarmac. A ground crew member in a camouflage uniform and a high-visibility vest is standing in the foreground, gesturing towards the aircraft. The aircraft has large propellers and a complex fuselage. The background shows a clear sky and some airport infrastructure.

Eyes Wide Shut

by Sgt Mycael McGraw

It was an early winter morning at 14 Wing Greenwood and I was appointed to be the aircraft marshaller by servicing. The Aircraft Captain (AC) was in servicing to accept the aircraft and give thumbs up to the towing and start crews.

After the AC took responsibility and we all walked out, we proceeded to open the hangar doors and got the towing mule hooked up to the aircraft. On command, the tow driver proceeded to push the aircraft outside.

Once the aircraft was positioned, I placed myself directly in front of the CP-140 and was maintaining visual contact with the AC. Within two to three minutes, they asked me to give the signal for chocks out, this is the last step before the engines start.

"Chocks out" signal was given back to the pilot and we were ready to start engines, the pilot asked permission to start #2 engine, followed by #1 engine. We were now focusing on #3 engine when a technician was walking toward the engines that were already started. He was in my peripheral vision and I was confused why he was headed to the aircraft while holding a coffee jug and a food container. In that moment, I knew we did not have a lot of time to stop him. I started to run toward him and waving my hands trying to get his attention and at the same moment the AC in conjunction with the Flight Engineer pulled both emergency shutdown handles. The technician was so surprised to see both engines coming to a dead

stop, he dropped both containers on the ground and you saw the fear in his eyes and the realization of what he had just done.

Sometimes technicians (and anyone for that matter) can get into a routine and although you may think their eyes are open and they are aware, they may be distracted! Complacency can kill so it is vital to ensure that everyone's situational awareness is in the present. This lesson could have cost the life of a member. For supervisors, if you are in control or in command, make sure people around you are alert and focused even for the simplest task. ⚠️

For Professionalism

For commendable performance in flight safety

Corporal Gabriel Papakonstantinou (AVS Tech)



During Ex Tipic Sauvage at Luke AFB, Arizona on 1 Nov 2021, Cpl Gabriel Papakonstantinou was assisting a colleague with a Daily Inspection and Before flight check on A/C 782. During the inspection of the right-hand pylon on station 7, he opened a panel to ensure the Command Signal Encoder-Decoder (CSED) was firmly seated. When he lightly shook the CSED it revealed an abnormal movement, but the latches were properly set.

Piquing his curiosity, Cpl Papakonstantinou checked the underside of the pylon. Looking up from the underside, a crack approximately 80% the length of the pylon was discovered. He alerted the proper technicians which lead to a Flight Safety investigation. This discovery prompted a local survey revealing 7 other pylons with the same cracked underside. Had it not been for this discovery, the 8 aircraft could

still be flying with unserviceable pylons and could have resulted in panel failure or potential loss of components during flight.

Cpl Papakonstantinou has shown a high level of professionalism and superb intuition. He is more than deserving of this *For Professionalism Award*. 🇨🇦

Winter Icing

by Capt Gary Bishop

Last winter I flew a medevac training mission that proved to be a lesson in some of the hazards of winter operations. In particular, the importance of situational awareness during taxi procedures especially whenever other vehicles or crew are working around the aircraft.

Upon landing in Trenton, the runway conditions were bare and dry. While waiting for the medevac crew to arrive, precipitation began in the form of rain and lasted about 30 minutes. The temperature hovered around freezing that morning and after the rain stopped, we found that the water was beginning to freeze to the wings and the apron had become slippery.

After the medevac crew was onboard, we de-iced and began to taxi for takeoff. Before our taxi, we received a Canadian Runway Friction Index (CRFI) reading that was reporting good braking action. Though the taxiway only appeared to be damp, we quickly realized they were very slippery. No other aircraft had arrived or departed during this time, so we had no Pilot Report of the surface conditions. Our taxi included a backtrack of the runway so we decided to check the condition through some low speed brake applications. We found our braking action to be poor and received a new CRFI that confirmed what we had found. The conditions were deteriorating and we made the decision to cancel the mission. As we taxied off the runway, the aircraft began to slide on ice with almost no braking action and the use of thrust reversers were required in order to stop. At this point even taxiing was hazardous.

We shut down the aircraft and called for a tow back to the ramp. The tow was going to take some time, so the crew bus was also called in order to take the medevac team home. As the bus arrived, its brakes locked up and it began to slide on the ice. It finally came to a stop, short of the nose of the aircraft and our engineer who had been outside installing the tow bar. The bus was able to stop without incident, however, slid uncomfortably close to the jet and our engineer. The medevac team departed on the bus and we were towed back to the ramp without issue.

This experience has taught me that it's important to consider all hazards around the aircraft during ground ops. In the future I will have more situational awareness on the people and vehicles operating near the aircraft and will be able to better manage the increased risk in poor weather conditions. ❄️



Photo: Sgt Matthew McGregor

From the Investigator

TYPE: Bellanca Scout (C-GBAZ)
LOCATION: Brandon, MB
DATE: 20 June 2022

The accident involved a Bellanca Scout from the Northwest Cadet Region. The flight was part of the Air Cadet Gliding Program and in support of the summer glider pilot training. The Bellanca Scout aircraft is used to tow gliders to altitude where the glider would release from the tow plane and conduct their training mission.

The aircraft launched from the Brandon Airport Runway 26 with two Cadet Instructor Cadre Officers on board. The intent was to survey the approach paths and landing strips for use

during the upcoming summer glider pilot training camp. During the initial landing attempt on the planned Tow Plane Landing Strip the aircraft encountered a significant amount of standing water. The aircraft rotated forward, allowing the propeller to contact the ground, then continue past vertical and coming to rest on its back.

The aircraft sustained very serious damage. Both the pilot and the passenger were not injured.

The investigation did not reveal any evidence of technical issues with the aircraft and is now focusing on procedures and human factors. ✈



Photo: NCdt RJ Neufeld – RCAC, NW Region,
Brandon Camp PAffO photographer



Photo: NCdt RJ Neufeld – RCAC, NW Region,
Brandon Camp PAffO photographer

From the Investigator

TYPE: Globemaster III –
(CC177704)

LOCATION: Trenton, ON

DATE: 15 May 2022

The incident occurred during the pre-flight inspection of the aircraft in preparation for a multi-leg air mobility flight transporting cargo to Greenwood, NS and then onward to the United Kingdom.

At the time of the incident, the pilots were conducting their pre-flight activities on the flight deck, while the Loadmaster and personnel from the Air Movement Team were completing their loading operations inside the aircraft cargo hold. As part of the pre-flight inspection, a maintenance crew was sent to the aircraft to perform a birds nest check using an articulating boom lift. While the technician in

the articulating boom lift was removing a bird's nest from the elevator area, the #2 hydraulic system was powered up by a member of the Air Movement Team with the intent of opening the cargo ramp and door. This hydraulic system activation startled the technician high up in the articulating boom lift, however no movement of the flight control surfaces occurred, which could have resulted in serious injury. The technician briefly paused their work while the hydraulics were shut off and then proceeded to complete the birds nest check without further incident.

The aircraft sustained no damage and no injuries occurred as a result.

The investigation did not reveal any evidence of technical issues with the aircraft and is focusing on human factors. 🔍



From the Investigator

TYPE: CH-146 Griffon
(CH146495)

LOCATION: Edmonton, AB

DATE: 20 July 2022

The incident flight was a tactical navigation training flight to exfil troops from the Edmonton Tactical Low Flying Area (TLFA). The aircraft was part of a formation of two CH-146 Griffon helicopters and the flight was conducted at tactical altitudes, as low as 15 feet above ground level.

After conducting circuit and nap-of-the-earth handling practice, the formation departed the base northbound for the TLFA, where a tactical navigation route to the exfiltration location was initiated. In the later portion of the route with the aircraft heading southbound in the lead position, they approached a group of trees

along a east/west roadway. The crew identified a pole left of the aircraft's nose, however no wires were observed running to the right of the pole and their altitude remained unchanged. The aircraft struck a wire a few seconds later. Following the wire strike a decision was made to split the formation, with the incident aircraft returning to base single-ship.

The aircraft sustained very serious damage and the crew sustained no injuries.

The investigation did not reveal any evidence of technical issues with the aircraft and is now focusing on human factors. 🔥



Photo: Sgt Desfossees



Photo: Sgt Desfossees

Epilogue

TYPE: Hornet (CF188762)
LOCATION: Bagotville Airport
(CYBG), QC
DATE: 9 November 2020

On 9 November 2020, CF188762, an aircraft assigned to the Quick Reaction Alert at 3 Wing Bagotville, was scrambled to launch as part of an active air defense mission. Upon commencing strap-in procedures, the occurrence pilot noticed their leg restraint lines were not connected to the ejection seat.

In an effort to enable the pilot to effectively deploy the aircraft and complete the mission, a technician possessing no Aircraft Life Support Equipment authorizations attempted to re-attach the leg restraint lines to the ejection seat. The initial attempt at reconnecting was unsuccessful. The second attempt required the activation of the Manual Override Release handle in order to properly reroute a D-ring which had been missed during the initial re-attach attempt. Personnel involved did not realize that pulling the handle would also

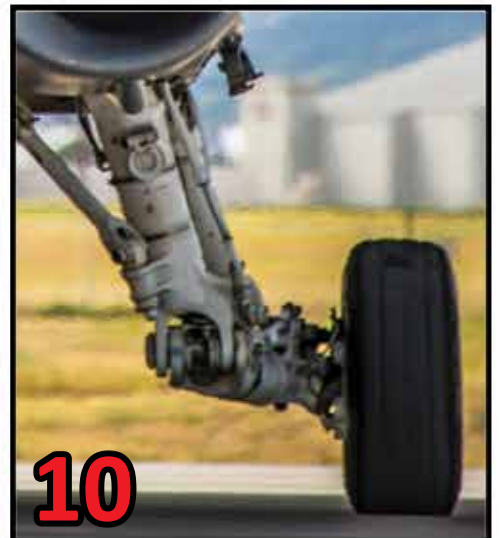
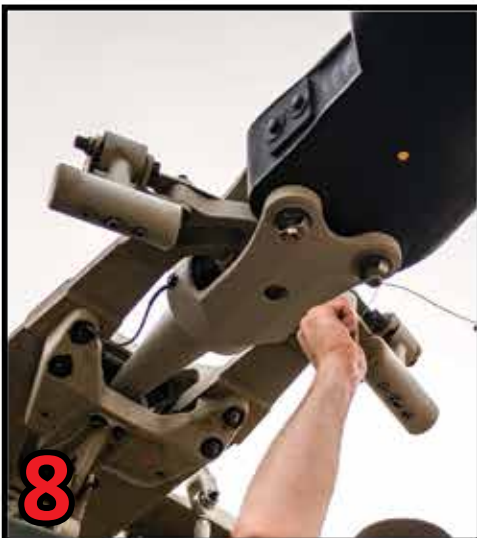
release the lap belt at the quick disconnect end. The pilot taxied to the active runway for take-off, but luckily the active air defense was cancelled prior to the aircraft launching. No damage or injury resulted from this occurrence.

The investigation could not conclusively determine the reason for the original disconnect of the leg restraint lines. The high desire to accomplish the mission, emphasized by Canada's defense policy, was the main reason a non-authorized technician in Aircraft Life Support Equipment tried to re-attach the leg restraint lines.

The preventive measures focus on elevating risk assessments to higher operational authority, emphasizing ejection seat components training for technicians as well as during egress training for pilots. Additionally, they focus on expanding procedures that pertain to aircraft and operations at the Quick Reaction Alert.



CAN YOU GUESS THE AIRCRAFT?



Send your answer at dfs.dsv@forces.gc.ca