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Flight Comment

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Canada

Photo: Cpl William White

Views on Flight Safety

By Colonel Steve Charpentier, Director of Flight Safety

Since taking over as the Director of Flight Safety this July, I have learned a lot from the Flight Safety team. I am currently on the road conducting the annual DFS briefing and will use the opportunity to meet the airmen/airwomen and others that support RCAF operations everyday. Thus far, let me say that I am amazed by the dedication and commitment of everyone I have talked to. It is a pleasure and a privilege to be the Director of Flight Safety and to lead this group of passionate individuals that are driven to prevent aviation related occurrences in the RCAF.

DFS has two important functions as represented by the black and white of our well known Flight Safety Crest: Aircraft accident prevention (white) and accident investigation (black). The two functions interrelate and overlap to prevent loss of aviation resources while accomplishing the mission at an acceptable level of risk. Obviously, the main reason we investigate is to understand the cause factors of an accident in order to prevent future occurrences. But how do we determine whether or not our preventative measures have been successful?

The challenge we face as a flight safety culutre is that there is that there is not always an immediate way to ascertain the results of your preventive actions. This can be partially assessed through speculation, deduction and statistics but nothing is absolute. Working to prevent an accident that has not yet happened is often a thankless job. I recognize the difficulties you all face in attempting to prevent the "accident that has never happened." After all, there are no tangible consequences, and it is all supposition. You have the unenviable task of convincing people to take action based the "potential" consequences. Some may say that you are too cautious, while others will agree with you, but will not necessary feel any urgency to fix the problems. After all, *"We have been doing it that way for many years and never had an accident!"*

In contrast, when there is an aircraft accident; it's investigated, cause factors are determined and preventive measures are developed. These resulting preventative measures are normally an easier "sell" because there is pressure to ensure it won't happen again. When you work in prevention you don't get the attention and limelight of an investigator. You receive little recognition for your preventive work and sometimes you may even be seen as to be hindering operations. The fact is, when you prevent safety occurrences, your efforts often go unnoticed. Ironically, it's more than likely that you may not even notice when one of your actions interrupts a chain of events that would have led to an accident.

So, with all of that being said, I would like to use this opportunity to recognize the many unsung heroes out in the wings who deserve recognition for their daily actions in support of accident prevention. Those who of you that work in the shadows and continuously pay attention to detail. You are the real enablers of safe aviation, and should be credited with mission accomplishment and saving lives. I want to personally thank you and give you all a big "pat on the back", you most definitely deserve it! Feel confident that your contribution prevents aircraft accidents and loss of life.

BRAVO ZULU! ◆

The photo on the cover was taken by Captain Zacharie Charbonneau, 429 (T) Sqn, while serving in Moose Jaw on an Flying Instructor tour. The photo shows a formation of three CT-156 Harvard II completing a 120°/3g turn over Southern Saskatchewan landscape.

Flight Comment

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Good Show

For Excellence in Flight Safety

WO James MacDougall

On 21 October, 2012, while serving as a Flight Engineer on board a CH149 *Cormorant* helicopter conducting maritime Search and Rescue (SAR) training, Warrant Officer (WO) James MacDougall demonstrated phenomenal situational awareness, decision making skills and an extraordinary regard for the well being of others. As a result of his actions, he prevented a Search and Rescue Technician (SAR Tech) from receiving severe injuries or possibly perishing.

The training event started with a plan to carry out a series of standard SAR Tech insertion/retrieval events onto a small coast guard vessel using the helicopter's hoist. The weather on scene at the time was acceptable for the exercise; however, the winds and sea state were elevated. The ship had a pronounced pitch and roll which made for a realistic and dynamic rescue training sequence. The briefed plan was to insert two SAR Techs followed by a rescue basket onto the bow of the vessel. The first SAR Tech insertion to the designated area was carried out without incident, despite the challenging conditions caused by the wind and sea state acting on the vessel. The second SAR Tech was then successfully lowered onto the vessel and he began to detach himself from the aircraft. While disconnecting from the hoist cable hook from the SAR Tech harness, the hoist cable became wrapped around the right hand of the SAR Tech just as the vessel pitched down. The result was the second SAR Tech being held up off the deck and then deposited violently over the starboard side of the railing of the bow as the vessel pitched back up.

When WO MacDougall received the "cut cable" signal from SAR Tech, he opted to disregard the signal reasoning that by cutting the cable the entangled SAR Tech would fall over the side of the vessel with a seriously injured arm and 50 feet of cable coming down on top of him. With only fractions of a second to analyze, he reacted expertly to the unfolding incident for which there was no established procedure. WO MacDougall used his unparalleled hoist operator skills to swiftly adjust the hoist cable length, relieving

Photo: Cpl Jennifer Chasson

Warrant Officer MacDougall currently serves at 442 Transport and Rescue Squadron in Comox

tension on the SAR Tech's arm, and preventing the SAR Tech from sustaining further injuries. This action also allowed the loop in the cable to be released and the hook to swing free of the SAR Tech enabling him to roll under the railing and back into position.

With both SAR Techs out of immediate danger, the second SAR tech was assessed as being fit enough to be hoisted back into the helicopter. Once the entire crew was safely onboard the aircraft, the remainder of the training exercise was cancelled and it returned to base without further incident.

For his exemplary actions and extraordinary situational awareness, WO MacDougall is a deserving recipient of a Good Show Award. ◆

Photo: DND

Good Show

For Excellence in Flight Safety

Cpl Ramanjit Bhachu

On 8 March 2013, while carrying out a routine maintenance inspection of a CC130J *Hercules*, Corporal (Cpl) Ramanjit Bhachu, an avionics technician at 8 Wing Trenton, noticed burn marks on the left hand electroluminescence formation light.

On her own initiative Cpl Bhachu promptly conducted an investigation to determine the cause, going above and beyond the inspection requirements and performing a thorough electrical and avionics inspection.

Although several technicians expressed the belief that the burn marks were as a result of lightning strikes, Cpl Bhachu was not willing to accept this theory without evidence. Her determination to dig deeper led her to perform a functional test on aircraft CC130606, during which, arcing was observed. Realising the fire hazard due to the proximity of the fuel dump masts, she immediately advised the Flight Safety office, her supervisor and followed-up by drafting a Technical Problem Report (TPR). In conjunction with the TPR, she researched the external lighting snag history on the CC130J fleet and found a definite pattern of failures on 436 Sqn aircraft. Cpl Bhachu also visually inspected other CC130J aircraft and confirmed similar burn marks.

Photo: WO Carole Morissette

Photo: DND

Corporal Bhachu currently serves with 8 Air Maintenance Squadron in Trenton

A special inspection was initiated on the remainder of the fleet and it was discovered that the existing seal was not adequate and water was penetrating the area causing delamination and damage to the lighting system.

Lockheed Martin sent an advisory bulletin to our international allies flying CC130J *Hercules* to bring attention to this potentially hazardous situation and it was later found that New Zealand had similar problems.

Cpl Bhachu's discovery and subsequent actions prevented a potentially serious aircraft incident for the CC130J fleet world wide. Her professionalism, diligence and attention to detail make her a very deserving recipient of the Good Show award. ◆

For *Professionalism*

For commendable performance in flight safety

WO Ryan, Sgt Parsons, MCpl Wilkins, and MCpl Melanson

On February 28, 2013, Loadmasters (LM) Warrant Officer (WO) Kenneth Ryan, Sergeant (Sgt) Terry Parsons, Master Corporal (MCpl) Charles Wilkins and MCpl Anatalie Melanson, were crew members on a 436 Transport (T) Squadron aircraft, tasked to conduct a night airdrop formation on the Joint Operational Access Exercise (JOAX) at Pope AFB, NC.

In the cargo compartment of the CC130J *Hercules* aircraft were 75 fully loaded US Army paratroopers waiting in anticipation of the planned jump. Approximately 1.5 hours into the flight, many of the jumpers began to yell for a LM and signalled that they needed assistance. Sgt Parsons made his way forward through the right side of the packed cargo compartment and observed that the left emergency exit door had been unlocked and was now inside the aircraft. Sgt Parsons immediately reacted by returning to his position; connecting to the intercom and informing the crew of the emergency. WO Ryan and MCpl Wilkins raced from the back of the aircraft, climbing over paratroopers and stanchions to reach the exit. As they arrived they discovered a paratrooper lying across other jumpers; his static line now dangling out the open exit. Sgt Parsons and MCpl Melanson cleared passengers from the vicinity, secured the door and relayed the developments to the rest of the crew. The aircraft continued to the drop zone without further incident.

Photo: Cpl Adam Baraniuk

Sergeant Parsons (left) currently serves at 426 Transport Training Sqn and Master Corporal Wilkins (right) currently serves at 436 Transport Squadron in Trenton

The follow-on investigation revealed that while transiting to the drop, enough slack had developed in the seat back to allow a paratroopers pack to inadvertently contact and intertwine with the emergency exit handle. When the command to stand-up was given, the tangled static line released the door locks, and the door suddenly entered the aircraft. It was only through the timely reaction and follow on coordination of the LM team that this occurrence did not result in loss of life or assets.

WO Ryan, Sgt Parsons, MCpl Wilkins and MCpl Melanson are to be commended for their outstanding level of crew coordination and professionalism demonstrated under extremely demanding conditions. Their stellar performance and competence in the face of a potentially life threatening situation make them fully deserving of this For Professionalism award. ◆

Photo: Cpl Adam Baraniuk

Warrant Officer Ryan (left) and Master Corporal Melanson (right) currently serve at 436 Transport Squadron in Trenton

The Editor's Corner

Welcome to the Editor's corner,

For those of you who don't know me I am Lt Thomas Baker (T.J. for short), I have taken the reins from **Capt John Dixon** as the editor of the *Flight Comment*. As this is my first issue officially "at the helm", I thought it would be appropriate to provide some background on myself and share my vision for the *Flight Comment* of the future.

The original "Crash Comment" cover

As I come from predominatly Army background, I think I still see the RCAF from "the ground looking up". Although I am a multi-engine pilot by trade, when I "think RCAF", my first thoughts are still of the sights and sounds associated with a CH146 *Griffon* coming over the tree line to reposition me somewhere I would have otherwise had to walk. Throughout my 18 years in the Canadian Armed Forces, I've had the opportunity to work in the tactical, operational and strategic levels of our C2. What I have gained from this exposure is an appreciation of what it takes to get an aircraft (or any asset) to the troops on the ground. The planning, maintenance, training and support etc. all must come together like a touchdown play at the end of the super bowl. I have a great deal of respect for all of the moving parts in this "play" and plan on continuing the great work of my predecessors by highlighting all of the facets of RCAF operations in support of our missions.

The *Flight Comment,* above all other magazines, has the greatest potential impact on operations in the CAF. This is mainly due to our Flight Safety culture being one of openness and participation. Right now as you hold your copy of the *Flight Comment* you are participating in the prevention of future flight safety occurrences. As an old Army Sergeants Major of mine used to say, "People will do what they know to do; when they know better, they do better." As a brand new editor, I must point out the grammatical nightmare of his wisdom, however the message was very clear; train your people, when things go off the rails, make sure you understand the "why" of the issue and communicate it to the largest audience possible. This holds true in the RCAF and is in line with the spirit of the original (then called) "Crash Comment", first published in 1949. In fact, the motto printed on the inside cover of the first issue read, *"Learn by the mistakes of others • the easiest way to gain experience."* The terminology (and name) have changed in the last 64 years but the essence remains. It is my intent to continue to use the Flight Comment as a conduit to educate and communicate to the aviation community; not only within the RCAF but anyone that would benefit from our experiences and preventative actions.

As for the future, I plan on taking the *Flight Comment* into the digital realm; meaning as of the time you are reading this, you are able to download and read this magazine (free of charge of course) via Newsstand for Apple devices or Google Magazines for Android devices. This does not mean that the printed version of the magazine will be discontinued; there is immeasurable value in having this magazine laying around in waiting rooms, lounges and break areas. Rather we will use this new capability to expand our audience beyond the boundaries of our current print budget.

Also, even if you're reading the print version right now, I invite you to download and take a look at the digital version anyway. There are inherent limitations with the printed medium (space and number of pages) that we are able to overcome in the digital version. For example, a printed article may only have one or two pictures included on the page, we can include a slide-show in the digital version. Interactive content like maps, approach plates, audio and video can also be inserted. Of course there is a disclaimer: this is a new initiative and I fully expect the current issue to pale in comparison with what we will be producing in a year from now.

In conclusion, I am excited to fill this position and look forward to hearing any and all feedback you may have about the product. Lastly, if you have a Flight Safety article burning inside you, put it on paper and send it to me. You don't need to be a writer to convey a great idea, we can help you get your message across. I will always have room to publish a good article should you have an idea or experience you would like to share with the readership.

Fly Well!
Lt Baker

From the Flight Surgeon

How to Safely Enhance Your Performance

By Major Stephen Cooper, Directorate of Flight Safety Medical Advisor, Ottawa

My first two articles: "Who is your Doctor" and "Access to care anywhere" explain how to get the care you need. My next articles: "Fatigue: a treacherous and Deceitful Enemy" and "Human Factors" explain how easily your performance can degrade and contribute to an accident that will kill or injure you. In this article I would like to address the positive ways in which you can safely enhance your performance without endangering yourself or the safety of flight.

The most effective and safest ways to enhance your performance are within your control. Most of them simply require developing good habits and resisting the "easy way out" when the opportunity arises. If you are unable to maintain these lifestyle habits or you do but still suffer from degradation in your human performance, this may be an indication of a larger issue. In this case, I would advise you to share your story with a health care professional and consider their advice, It may be life changing.

Today I will elaborate on what is already in your personal tool kit to maximize your performance…remember it takes two weeks to develop a good habit…so make small changes and be willing to experience a few days of discomfort as your mind, body, and spirit adapt to your new choices.

Sleep

Your grandmother was right: a good night sleep and a regular bedtime are important. Sleep allows the brain and body to heal and rebuild from the daily wear and tear. Inadequate sleep kills people…there is a 7% increase in traffic fatalities after we "lose" an hour of sleep in the fall and a 7% decrease in the spring when we "gain" an hour of sleep as a result of daylight savings time. (reference)

Try going to bed 15 minutes earlier and wake up at the same time in the morning; your performance may improve significantly just by gaining that 15 minutes on a regular basis. Also, take a look at your sleeping area; it must have no electronics, (if you have an alarm clock, turn it away from you). For further information trying searching "Sleep Hygiene" on the internet more ideas to enhance your sleep. Improving the duration and quality of your bodies "downtime" is something ease to achieve and will harvest tremendous gains both professionally and physiologically.

Nutrition

Pick a weight that you would like to be; whether it's a goal or your current weight, being conscious of your "ideal weight will provide you with a benchmark of which you can measure your performance.

Eat breakfast, lunch, and supper at a table with friends and family. People that sit down and "make time" for meals tend to make healthier choices over a longer period of time about what goes into their bodies.

Slightly increase your fruits and vegetables and slightly decrease your meat, dairy and high calorie foods like butter, oils, dressing, and restaurant food.

Eliminate the calories from liquids by drinking water, tea, coffee or "0" calorie drinks. What we drink is often overlooked when observing our in-take; if your not already doing so, take a look at the calories associated with your next couple beverages. For example, did you know that a bottle of orange juice has roughly the same amount of calories as the equivalent amount of Coke? Obviously there are advantages of consuming O.J. over soft drinks, but in the management of consumption it is important

Photo : Sgt Frank Hudec

…did you know that a bottle of orange juice has roughly the same amount of calories as the equivalent amount of Coke?

to take into account everything that goes into your body.

Reduce portions sizes to "shrink" your stomach; this is a change that will take effect over time but will pay huge dividends.

As you begin to make these small changes in your intake you will feel hungry between meals…however when you you do, don't eat… or if you do eat, have fruit, vegetables, popcorn etc. Choosing an appropriate "snack" will make the difference in your performance. After two weeks, you will adapt to these new feelings and new habits.

Exercise

You cannot control time…you can only control how you spend it.

Try decreaseing your "screen" time by 30-60 minutes daily; substitute something active into that timeslot. This doesn't require you to trade your favourite show for "windsprints" between your streetlights. Infact the first time you do this, use the time for self reflection and planning how you will fill this "gap" with a new activity (playing with your children, participating in domestic chores, walking, exercising, team sports etc).

Choose activities that you can repeatedly do for months and years. This will allow you time to develop a habit and stick with it. Regular activity, especially when done outside and with other people, will improve your health, provide you with an increased sense of well being and improve your performance in all areas.

Addictions

Tobacco, alcohol and other chemicals alter our normal feelings for a short, and sometimes intense, period. They decrease your human performance immediately upon ingestion and for hours and days after during the "hangover" and withdrawal period. Sleep, exercise, family time and money are also sacrificed before, during and after consumption of these chemicals.

Avoidance of these chemicals and treatment for addictions by your health care team will improve your performance in all spheres of life.

Social wellness

Our social support network changes throughout our life and can also be highly variable between individuals. Social media can also overwhelm us with the 7/24 ability to interact with hundreds of people. Ironically there are loved ones in your home just a few steps away from you craving your attention.

Cultivating health and meaningful relationships is a skill that must be learned overtime and practiced. These relationships often motivate us to perform at a higher level, and also prevent us from doing unhealthy things that can decrease our performance.

Spirituality

For some people, spirituality is a part of every action and thought, where as others are not sure of the meaning. The discovery and journey of spirituality is tied very closely to the personal journey through life as we experience the world around us. A spiritual crisis can be as debilitating as a mental or physical illness or injury. Likewise, spirituality can motivate and direct people to perform activities that would otherwise not be imagined or accomplished.

Conclusion

Our thoughts, dreams, actions and habits help to create the person we are. Altering our daily habits and how we allocate time during the day can change who we are and how we perform. This includes the decisions we make about the amount of sleep, food, electronic media, personal relationships and physical activity we consume. Altering our daily routines and habits, even just by a bit, and sticking to new behaviours during the difficult two week transition can dramatically and safely increase your performance. The Canadian Armed Forces provides you abundant health services to assist you in altering your daily behaviour in order to improve your human performance, maximize your use of these programs and services to keep you performing at your best. ◆

Photo: MCpl Frank Hudec

Maintenance IN FOCUS

Loose Rivets to Cracked Formers

By MCpl Rick Kanaar, 424 Transport and Rescue Sqn, Trenton

It had to be one of the first nicer days of spring in Trenton; I was working the day shift at 436 T & R Squadron and all went well. In fact, I was sitting at home that night when I got a phone call from one of my fellow ACS techs working the evening shift.

As it turned out it was a very interesting conversation. One of our CC130 *Hercules* Aircraft (AC) had landed a few hours earlier that day and since it was so nice out it was decided that a Post-flight Inspections (PI) would be carried out on the ramp. As it happened, another tech conducting his portion of the inspection had noticed a couple of loose rivets on the trailing edge of the L/H outer wing and notified the ACS tech.

The ACS tech climbed the ladder set up at the location and, to stabilize, grabbed on to the former at the location of the loose rivets. To his surprise, not only were the rivets loose but so was the rest of the former. Upon further investigation he noticed that the former had a crack in it about nineteen inches long along a row of rivets attached to the wing skin.

This is when I was called.

Photo: Cpl Levarre McDonald

Rather than trying to assess the situation over the phone I decided to come in and have a look myself. This way I would better be prepared to answer all the questions that would no doubt come in the morning.

When I arrived at the squadron to check the AC over more and more issues started to arise. We had called in the Wing image techs to take pictures for the flight safety report, but in preparation of the pictures I wanted to clean the area to make the damaged former more visible. In doing that I noticed another former had a crack in it in almost the same location and almost as long. After the pictures were taken and the report was well on its way, I went to go back to work on another AC in the hangar.

Photo: Cpl Levarre McDonald

Photo: Cpl Levarre McDonald

The contractor for the Legacy fleet, wanted to know if the parts received for the other AC were the correct parts and at the same time wanted an inspection of the outer wing formers done on that AC as well. So I carried out an inspection of both wings, center and outer. To my surprise I discovered two cracked formers on this AC as well and multiple loose or missing rivets in various locations in the flapwell.

In the end, the first AC was sent to third line contractor for repairs and the aircarft in the hangar, since it had open fuel tanks, it was decided that we would carry out the repairs ourselves. Not long after we finished our repairs it was ordered that an inspection of the remaining AC be carried out. Of the four AC in service, three of them had cracked formers and almost all in the same location.

To summarize, now when I go to inspect any part of an AC, I make sure I am more thorough and remember that just because it "looks fine" it might actually have more wrong with it than can be seen. Two loose rivets turned out to be multiple broken formers and even more loose rivets on three AC in a squadron of four! ◆

DFS Comment:

Good find and excellent lesson. Defects such as loose fastners and cracks are often indicative of further, hidden problems. Care should be taken to ensure that all related or supporting structures are also inspected in these situations.

THE SIXTH SENSE

Photo: Cpl Roxanne Shewchuk

Courtesy of the *MAC Flyer* – *reprinted in Flight Comment*, issue 1, 1978

There may be those who will dispute the hypothesis, but it has been said that seasoned helicopter pilots possess keener flying instincts than other fliers. There may be a case for disagreement. But record books bulge with accounts of daring missions, performed under seemingly non-survivable circumstances, in which the chopper pilot and his crew returned unscathed.

Low level missions with minimum navigation equipment, pick-ups in pitch black jungles, shattering ground fire these are a few of the obstacles surmounted by helicopter pilots in South East Asia alone. There are many cases – unchronicled for obvious reasons – in which reckless pilots on routine training mission pushed themselves and their fragile machines to the limit – and somehow lived to brag about it.

Instinct? Just plain luck? Or is there more to it than either of these obscure terms imply? A noted reporter once observed that helicopter pilots seem different from their fixed wing counterparts. He characterized them as introverts – whereas other pilots are extroverts brooding, while their fixed wing buddies brandish smiles of confidence. The reason, he surmised, is that chopper pilots are conditioned by their environment to assume that if something critical hasn't already happened during their flight, it soon will. This reporter was implying, possibly without realizing it, that helicopter pilots have a kind of 'sixth sense' which often alerts them to impending danger. Identifying this sixth sense as the sign of an introvert might be a little rash, however, since many helicopter pilots are rather famous for their extroverted antics.

An old wives' tale? Like the hunter who claims the ability to think like his prey, or the fisherman who `reads' the water to find the big ones, few veteran helicopter pilots are likely to malign the existence of such a phenomenon. Participants who survive any type of potentially hazardous endeavour seem to develop such instincts – the high wire performer, the professional automobile racer, the bullfighter. The amount of danger involved very often helps determine the degree of such an instinct. Certainly all pilots not just helicopter pilots are imbued with the sixth sense potential.

But it may he more visible in helicopter pilots simply because their flying environment requires constant vigilance and split-second decisions at low levels. In this respect, helicopter flying probably relates closer to the old 'seat of the pants' flying than anything the Air Force offers. And this presents challenges and temptations – low altitude, low air speed, and a machine which its pilot may feel a part of – similar to those facing pilots of the open cockpit era.

While it is not difficult to imagine that a 'sixth sense' does exist, the prospect of explaining how it is attained is another matter. What are the ingredients of this unusual quality'? Do helicopter students who have passed their first check ride suddenly find themselves ordained with such powers'? No one has yet ventured to define all of its ingredients. However, there is little doubt that experience plays a great part in it. Natural powers of observation, deductive powers, common sense, and judgement are all involved in this phenomenon. And certainly a most essential ingredient is knowledge of the aircraft's limitations and the operating procedures required to fly it effectively. Without this knowledge, there would be no pre-determined point at which a sixth sense could be triggered.

How many times have helicopter pilots broken off a routine manoeuvre simply because 'it didn't feel right', and subsequently discovered that their bird had developed a serious malfunction? How many others have ignored the warning signs during urgent missions and averted tragedy by the skin of-the-teeth? How many more who 'had that feeling' didn't make it back?

Sounds, vibrations, handling characteristics – all of these have a special meaning to the helicopter pilot who has the experience, knowledge, and proficiency to detect their meaning. These factors seem to be part of the sixth sense and may be decisive during critical low level missions.

First indications that this instinctive warning system is about to trigger may be a feeling of uneasiness in the pit of the stomach, a cool sensation down the spine, or a tug of conscience that says 'don't do it'. Most often the sensation passes quickly and, sometimes, is overlooked until too late. The sensation doesn't always indicate impending disaster. It may simply he an indicator that something unusual is happening or about to happen.

How long does it take to gain the 'experience' necessary for this instinct'? Many pilots never attain it. Some violate its effectiveness by disregarding the warning signals it emits. Pilots who are fortunate enough to develop this feeling, whether it's called 'sixth sense', 'common sense', or 'flying sense', are a step ahead of their machine to start with. Used effectively, this phenomenon can be a life-saver. Disregarded in favour of barnstorming tactics or other personal whims, and it becomes as impotent as a flaunted safety rule.

Combined with self-discipline, proficiency, and a sense of personal responsibility, this 'sixth sense' could be your guardian angel. ◆

Photo: DND

A New Capability for Crash Site Documentation

By Major Adam Cybanski, Directorate of Flight Safety, Ottawa

Major Adam Cybanski is the officer responsible for helicopter investigation (DFS 2-4) at the Canadian Forces Directorate of Flight Safety in Ottawa, Canada. He is a tactical helicopter pilot with over 20 years and 2500 hours on fixed and rotary wing aircraft including the CT114 *Tutor*, CH139 *Jet Ranger*, CH135 *Twin Huey* and CH146 *Griffon*. He completed a tour in Haiti as Night Vision Goggle Specialist and Maintenance Test Pilot, and has managed the CH146 *Griffon* Full Flight Simulator. He is a graduate of the Aerospace Systems Course and holds a BSc in Computer Mathematics from Carleton University.

Technology has changed dramatically in the last 25 years. The memory storage capacity and speed of seventies era supercomputers like the Control Data 6600 and Cray have been surpassed by the modern cellular telephone. A Samsung *Galaxy 2* or *iPhone 4* has 2000 times the memory and approximately four times the speed of the Cray 1. In addition, the current generation of mobile devices also provide the added capabilities of audio recording, photography, video recording, mobile communications, GPS navigation, and inertial navigation.

The methodology for documenting a crash site has changed little since the seventies. New flight safety investigators are still taught to take many photos, draw a crash site diagram, and measure everything possible using a ruler and tape measure. One of the reasons this has changed so little over previous decades is because it is effective and fulfills the requirement. The incredible capabilities of consumer technology provide an opportunity to re-examine how we capture a crash site. This is exactly what was done in November 2012.

Crash Exercise

A crash site exercise was conducted by DFS in Ottawa, Canada. Wreckage and miscellaneous objects were documented using total station survey equipment, GPS survey equipment, laser scanner, and a phone. A modern cell phone was used to capture high resolution video, GPS-stamped photographs, and to conduct a GPS survey. During the survey, over 400 high resolution photos were taken, and more than 10,000 frames of video were captured by the phone. The data was analyzed in photogrammetry software and integrated into a single 3D site model, which could be examined in *Google Earth*.

Photo: DND

Crash Exercise

Data Presentation

In the *Google Earth* site model, the simulated radar flight path was added. Representative photos of the site from different viewpoints could be seen by clicking on camera icons dispersed among the site. A 3D model of the crashed aircraft was placed at the correct location, and could be examined from any perspective. Approximate distances could be measured using the ruler tool.

To illustrate the fine 3D imaging capability for components and remains, several photos of a skeleton were stitched into a 3D point cloud, which could also be examined from any angle. With the addition of a single scale measurement, the measurement between any of the points could be obtained.

Cell Phone Capabilities

A cell phone has many advantages over other methods of crash site capture. It is relatively inexpensive ($500), while surveying equipment or laser scanners can cost up to $85,000. It is available at any electronics store, and there is a very good chance that other people on the investigation will also have similar cell phones, if the investigator's does not work. These phones can be used for taking notes, accessing checklists, sending emails, accessing maps, and many other things. A phone has a fixed focal length lens, which is important. Any time a camera lens is zoomed in or out, it must be recalibrated for photogrammetry. Using a fixed lens, such as in a cell phone, makes measurements from photographs easier and quicker. The resolution of a cell phone (8 Mega pixel) is sufficient for photogrammetry, and 1080p video is more than sufficient for video analysis. By default, most phones stamp their photographs with the time and GPS location. This makes subsequent analysis much easier. Finally, the size of a cell phone is small and portable, which makes it easy to bring to any crash site.

To capture a site, two free *Android* applications were used. Similar programs for the *iPhone* exist. Tina Time-Lapse is a program that automatically takes photos at a predetermined interval. The application was set to take GPS-stamped photos in high resolution every 2 seconds. This meant that a large amount of photos (up to 800 in a 30 minute period) could be taken quickly; simply by pointing the phone in different directions around the crash site. The volume of the phone was increased so that an audible "click" could be heard as each photo was taken. The other application used was Easy Voice Recorder Free. This application was initiated before any pictures were taken which made it easy to produce a running commentary of what was being photographed. This provided easy investigator notes that could be synchronized to each photo taken.

Photogrammetry Overview

Photos were taken at three distinct distances, for three purposes. Close-up photos were taken to capture surfaces and crushed areas, and employed in deep surface analysis to make 3D point clouds of small areas, such as bodies, ground scars, crushed and burnt areas, etc. Medium distance photos were stitched together to make a 3D model of the wreckage. Distant photos were taken that included prominent land features in order to locate the wreckage pieces on the crash site. In addition to the photographs, video was taken of every surface so that nothing would be missed. Capturing the information with the phone was extremely quick, on average 10 photographs per minute.

3D Point Cloud

To capture surfaces in 3D, two overlapping photos are required. The camera must be moved laterally, and not turned between the photographs. If the photos are of a quality that shows sufficient texture, a 3D model can be stitched together in about 30 minutes, once back at the lab. This model is comprised of thousands of measurable points in three dimensions and is the best way to investigate any deformations in the object.

3D Surface Photographs

Photo: DND

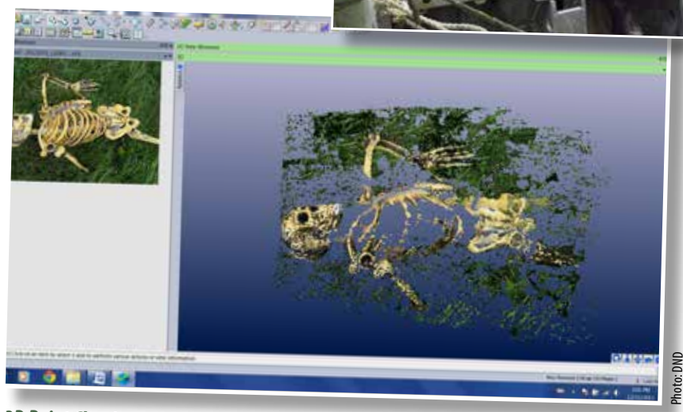

Photo: DND

3D Point Cloud

Wreckage Model

For creating a large 3D wreckage model, many overlapping photos are required as well. The object should be circled from left to right, and the top must be captured. Creating a traditional 3D model is labour intensive and can take several days back at the lab. Identifiable features are marked in overlapping photos. These features (minimum of six on each photograph), allow the software to determine the orientation and location of the camera for each shot, and then calculate the relative location of each feature in space. Joining these points can produce 3D surfaces, which form the basis of the 3D model.

Photo: DND

Wreckage Model Photographs

Photogrammetric Survey

To locate the wreckage pieces at the crash site, long-range photos are needed.

Photos should include distant objects that can be seen from *Google Earth*, such as large trees, road intersections, towers, etc. Again, identifiable features are marked in each overlapping photograph (minimum of six), both in the foreground and in the background. These features determine the relative camera positions and orientations, and the points can be examined in an application such as Autocad to reveal the relative position of objects.

In order to easily identify the location of crash components, an *Android* app called *GPS Survey* was used. This provided the position of the principal items, as well as documenting identifiable control features such as a large tower, prominent tree, road intersection and other landmarks. The phone was able to determine the position within a few metres. If extra accuracy was needed, the methodology for differential GPS could be emulated. Continuous logging of GPS signals at one of the identifiable landmarks with a second phone, while conducting the GPS survey, might have further increased measurement accuracy.

Panoramic View

Panoramic views from inside the cockpit, and between the crash components were also captured and incorporated into the final *Google Earth* project. Double clicking on the aircraft within *Google Earth* takes you inside for panoramic viewing of the controls and cockpit interior. The viewpoint can be slewed left or right, up or down. Overlapping photographs are stitched together and joined at the ends to produce a continuous 360 degree strip. This image can then be formatted so that it can be viewed in a panoramic perspective.

It is critical to capture an overhead view of the components for situational awareness. This is typically done using aerial photography, but in some cases alternatives may be needed due to aircraft availability, weather, or other factors. An inexpensive UAV (Parrot Drone 2.0) was used along with a rugged camera (GoPro Silver) to capture an overhead view of the wreckage. The relatively small UAV has comprehensive integrated stabilization, and was controlled by the cell phone.

In addition, the UAV transmitted live HD video to the cell phone, which was recorded for later analysis. The live video also aided in effectively positioning the UAV for aerial photos, and could be employed for other purposes, such as aerial search for wreckage.

Camera Calibration

A camera used by an investigator should be calibrated to improve the accuracy of photogrammetric measurements. This could be done before or after visiting the crash site. A pdf calibration image (showing dots in rows) may be emailed to the investigator. They would print the image onto 8.5 x 11 paper, and then take 8 photos of the paper from different angles. These photos would be sent back to the photogrammetrist, who could use them to improve the precision of crash site measurements. This calibration is not absolutely required for crash site photogrammetry, but improves the accuracy of the resulting calculations.

The final 3D models must be scaled. Without a good scaler, you cannot determine if an object is metres or millimetres across. Ideally, a tape measure should be included in most photos. An investigator can also be photographed for this purpose (if his height is known or subsequently measured), or GPS coordinates from the camera can be employed as a last resort.

There are several applications available, such as *PhotoModeler* and *iWitness* that can be used to conduct photogrammetric triangulation (surveying). *PhotoModeler* can also create 3D Dense Surface models and 3D wreckage models. The models and photographs were

Survey Photograph

Photo: DND

Panoramic Photograph

integrated into *Google Earth*, for intuitive analysis by the investigators. There is a free open source application called insight 3D that can be used to learn how to make 3D models from photographs.

Tips for Investigators

The following tips should be considered when preparing to document a crash site:

- Take advantage of the high capacity of memory cards by taking hundreds of GPS-stamped high resolution photos.
- Ensure that prominent features that could be seen in *Google Earth*, are visible in photos when possible.
- Scalers such as a tape measure or measurable objects should be visible in most photos.
- Video record the components so that they are covered from all angles.
- Conduct a GPS survey of the principle components.

Final Thoughts

Photography has been utilized for crash investigation since the dawn of flight safety and will continue to contribute in that vein for the foreseeable future. Photogrammetric analysis may be needed in an investigation, but should not be construed as a routine procedure. It is important that every Flight Safety Officer understand how to capture crash site photos that will yield good results for photogrammetry. This will ensure that photogrammetry will be possible, if needed, and can serve as an excellent back-up to other methods of site capture such as surveys and laser scanning. If done correctly, a modern cell phone can capture an amazing amount of information at a crash site, and should become a critical tool for the modern investigator for years to come.

Afterword

After this paper was written, the author was called out on a helicopter crash investigation. A Smartphone was employed for many purposes, including photographing and videotaping the wreckage and debris fields, making investigation notes, recording witness re-enactment of the event on a tabletop model and in an aircraft cockpit, and for video playback. The utility of this portable and flexible tool will undoubtedly continue to increase with experience and time. ◆

Photo: DND

Aerial View from UAV

Photo: DND

ON TRACK

We can learn about flying from that or lookout – IFR in VMC

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

This quarter's topic was written in 1990 and it discusses IFR Flight in VFR Conditions. Recently, there was a near miss in Regina between two RCAF Harvard II's and an inbound civilian passenger aircraft. As this Flight Safety was still being investigated at the time of print, we chose to re-visit a similar scenario from 1990. We are re-printing this article as a reminder that, 23 years later, close calls are still a hazard.

By LCol T.A. Bailey, Former DFS 2

An aviation occurrence investigated by both CF Flight Safety personnel and the Canadian Aviation safety board concerned a near-miss between a military aircraft operating on an IFR clearance and a civilian aircraft practicing holding procedures at a VOR on a VFR flight. The weather was visual meteorological conditions (VMC) with 15 miles visibility. The military aircraft had departed its nearby base, climbed and levelled at an assigned altitude of 5000 feet (ASL) and crossed the VOR in question enroute. It was transponder equipped, had been identified on radar and was being monitored by air traffic control center.

The civilian aircraft, Piloted by an instructor and student, reported to the control tower that is would be holding on the VOR, which was 8 NM SE of the airport, at 5000 feet ASL (The airport control zone extends upwards to 3500 feet ASL). Although outside the tower's control zone, the civilian aircraft was monitoring tower frequency. It was transponder equipped, squawking 1200, but was not picked up by the IFR controller in the control center.

The two aircraft passed on crossing tracks near the VOR at the same altitude and had about 1000 feet of lateral separation. Neither crew saw the other aircraft until the moment they were passing. No evasive action was taken by either aircraft.

The incident took place in class D airspace. This is controlled airspace within which both IFR and VFR flights are permitted. VFR does not require a clearance to enter. The center had a responsibility for maintaining separation between the military aircraft and other known IFR traffic; however, the IFR controller did not have the civilian aircraft on radar screen and consequently didn't know it was in the area.

The civilian aircraft was practising holding patterns over the airways navigation fix at an assignable IFR altitude. It would have been more appropriate to hold at the VFR 500 foot altitude offset or at any altitude below the IFR minimum obstruction clearance altitude (MOCA) at that location. A Better alternative would have been to request from the center a block of airspace in VMC at the VOR for holding practice.

The incident took place in class D airspace, which is airspace where both IFR and VFR flights are permitted.

Regardless, in class D airspace in VMC conditions, the responsibility to ensure adequate spacing between IFR and VFR aircraft rests with the flight crews of both aircraft, in accordance with "seen-and-be-seen-rules". In this case, neither flight crew was conducting lookout procedures adequate to detect the other aircraft before there was a risk of collision.

This situation and the appropriate responsibilities are fully covered in the A.I.P Canada, RAC 6-2 IFR Flights in VFR weather. This states: "an IFR clearance provides separation between IFR aircraft only. Pilots operating IFR must be aware of the need to provide their own separation visually from VFR aircraft when operating in VFR weather conditions." GPH 204 does not make such an unequivocal statement and this is being addressed.

Meanwhile, it behoves all of us to "lookout or luck out" as the Flight Safety video says and hopefully learn a little more about flying from an incident. ◆

DFS Comment:

Some of the references in this article have been updated since its original printing. For example, the A.I.P. was replaced by the A.I.M. and the GPH204 has since been modified.

Photo: DND

The Air Image Tech

By Cpl Daisy Hiebert, DFS 3-3-2, Ottawa

So you're an Image Tech tasked to create imagery in flight or maybe you're a passenger with a camera in an aircraft. As the newly posted in Image Tech for the Directorate of Flight Safety, I thought I would take some time to review some of the considerations when operating photographic equipment in the air environment. Flight Safety is everyone's responsibility; even the Image Tech embedded into the aircrew or the person tasked to take pictures.

Photo: Cpl Daisy Hiebert

As an Image Tech in an air crew position you have many responsibilities to your equipment and fellow aviators. First and foremost, you need to know what you're doing, which sounds simple however ask yourself these questions before every flight: is your air imagining ground training current? Do you know the general safety within the aircraft you're tasked to? There are distinct differences with regard to operating a camera in the aviation environment based on the airframe your in (i.e. backseat of a CF188 vs. the back of a CH146) You'll also need to have proper knowledge of strap in procedures, Ground Emergency signals, Airborne NORDO signals, Safety zones around the aircraft and about the seat and canopy pins. These may seem like small details however I advise on leaving nothing to chance when it comes to Flight Safety.

Another great strategy for an airborne photo mission is to cover as much of your plan on the ground with the pilot before even climbing in. It is very important for the pilot and the Image Tech to know what the photo requirements are for the mission before heading out. In this type of tasking, the pilot is responsible for providing a smooth, stable platform in which we can obtain the best possible images. The Tech's responsibility is to direct the pilot to the desirable position before the image is required. The difference between a good image and a great image could only be a couple of feet. While the Image Tech is providing direction to the Pilot during the flight, the Image Tech needs to be aware of when the appropriate time to talk on the intercoms. In the critical phases of flight (i.e. takeoffs and landings) the Image Tech should strive to not be a distraction in the aircraft.

The Image Tech equipment is also a primary concern for Flight Safety and can be easily overlooked if the crew is not diligent. Before the camera can be taken onto an aircraft it needs to be EMC tested and cleared for flight. Once it has passed the camera needs to go through pre-flight preparation. This is what you need to do before every flight:

- Removal of the camera strap (all cameras)
- Removal of the lens cap (all cameras)
- Removal of the lens hood (still cameras)
- Preparation of video tapes for flight and removal of CF Card cases/video tape cases.
- Ensure UV filters/other filters are secure
- Permission for use of flash lighting, **absolutely no flash lighting allowed in jet aircraft.**
- All loose items and all straps deemed non essential for camera operation shall be removed prior to flight.

The Image Tech should be aware of the location of the camera when G's are pulled in an aircraft. Do not attempt to take pictures in high G turns or sharp manoeuvres; you will be fighting a losing battle and more than likely damage your equipment or the aircraft in the process. Before takeoff or landing, you should stow the camera away, lose objects have a way of finding themselves in the worst places when left to their own devices. In summary, an Air Imagery Technician is not a passenger but rather an active aircrew member and this function requires a high level of professionalism and diligence. ◆

Photo: Cpl Kate Suppa

It Could Have Been a Lot Worse

By Sgt Daniel Roberts, 4th Air Defence Regiment, CFB Gagetown

On the evening of 6 March 2008, I was in Kandahar as an Air Vehicle Operator (AVO) for the CU161 *Sperwer* TUAV. Essentially I was the ground-based pilot and was responsible for flying the UAV and monitoring its systems.

As our crew prepared for the mission, we noticed that both the density altitude and winds were borderline for launch but we decided to proceed with the pre-launch checklist.

Our site was located on the perimeter of the base and there were U.S. Army Engineers working to expand our borders approximately 500 metres away with heavy equipment.

Up until this point in the tour, I must admit we had a somewhat cavalier attitude about Flight Safety because we were on operation and because there was no one actually in the aircraft.

As we approached launch, the winds were light but varying between a crosswind and a slight tailwind and so the decision was made to launch.

The *Sperwer* is completely autonomous during its initial climb-out to altitude and as a default it's programmed to essentially sacrifice altitude to maintain airspeed, which is exactly what happened that night. In the moments after the launch, I remember watching the height above ground from inside the control center hold at 15 feet for several seconds. Then the screen froze, which was an indication that we had lost downlink with the aircraft. A moment later, a frantic call came over the radio from the ground crew saying the aircraft had slammed into the side of a backhoe and exploded in a fireball. The combination of launching with a tailwind, the high density altitude and aircraft "full-up" weight hindered its ability to climb and forced the programming into attempting to gain airspeed to prevent a stall. What I learned later was that a U.S. Army Sergeant was working away and was raising the arm of her backhoe when the *Sperwer* struck it.

Thankfully, other than being extremely shaken up, she was unhurt. As I stood on a sea-can and surveyed the site I realized that if the aircraft had been 6 feet to the left she would likely have been killed by the *Sperwer* (weighed over 300 lbs) with a full tank of fuel. This occurance served as a very scary reminder that unmanned flight poses its own dangers and must be taken seriously. ◆

Photo: Sgt Carole Morissette

Photo: Cpl Doug Farmer

Shifting Cultures

By Capt Eric Pootmans, DFS 2-2-2 , Ottawa

THE GOOD OL' DAYS???

After 18 years as a pilot in both the Reserves and Regular Force, and after having just recently re-enrolled after an almost 12 year sabbatical from the RCAF to teach military pilots in the Middle East; it is both impressive and eye-opening to reflect back on the changes I have been witness to in the Flight Safety culture.

While my personal experiences in military aviation date back to the early 1980s, my initiation included a number of 'old time fly boys' whose military flying experiences stretched back to the early days of F101 *Voodoos* and F104 *Starfighters*. These seemingly legendary individuals were extremely confident and operationally minded. Their vast knowledge and experience was evident not only in the lines on their faces and determined expressions, but also in the manner in which they approached the task of preparing for missions and the skills they displayed in the air. They knew how to get the job done and prided themselves on mission accomplishment. Failure to complete a mission was not a popular option. These were tough, driven individuals – the product of their upbringing in the earlier days of fighter operations. Now retired from the Regular Forces, they had transitioned into commercial pilots who were keeping their hand in military aviation by flying CH136 *Kiowa* helicopters in the Air Force Reserves.

I have to say that I felt extremely privileged to be mentored by these great men and I got to enjoy multitudes of war stories throughout my time with them. The many tales of near-death experiences made them appear even tougher than their gruff exteriors. One such tale involved a pair of *Voodoos*. The pilot rejoining pulled up while looking up as he overshot the lead aircraft from below. The two *Voodoos* collided multiple times killing the #2 pilot and both Wing Safety Officers (WSOs). The lead pilot found himself in an uncontrolled roll and pulled the ejection seat handle when he saw blue. Unfortunately, due to the quick roll rate, he was inverted at low level when he exited the aircraft. His parachute didn't have time to open, however it was his lucky day in a twisted kind of way. As fate would have it, he landed on the only tree within miles, his body breaking 6 inch branches as he made his way through the tree. The unopened parachute caught the upper branches and he came to a stop, hanging in his harness just a few feet off the ground! He spent the following year recovering from his injuries, but he lived to fly again.

Maybe it's experiences such as this that made the lucky ones tough, capable men, having survived the adversity and challenges they had faced in those early days with little direction or rules. They had proven themselves as having the right stuff in doing so.

It is rather amusing how they used to talk of the "good ol' days" even way back then, telling stories of times with few rules and boundaries. They had to rely mostly on seat-of-the-pants instincts, natural flying skills and good fortune to assure a safe landing at the end of each mission, with good fortune being the key player in the equation. "Better to be lucky than good" they would often say. It all seemed so cool at the time, encompassing unparalleled romance, adventure, excitement and camaraderie, combined with so much freedom to do as they wished.

That said. . .what was likely not so cool back in those days was attending the funerals of their mates who were perhaps missing one of the attributes I mentioned above, or perhaps not as lucky. There were many such funerals – about one every other month. Natural selection was in full force and there was no forgiveness for those who didn't make the cut.

Photo: DND

CHANGING TIDES

While it's impossible not to acknowledge the romance of piloting back in the earlier days of aviation, I for one am happy for the changes that have taken place. I probably wouldn't have thought so when I was initially enrolled – full of piss & vinegar and having more vector than brains, not to mention these mentors who had significant influence on my thoughts and behaviour. The ol' fly boys didn't appear all that impressed by the changes that were occurring and the growing number of rules which were ever expanding. They didn't lack an appreciation for safety, but had survived some challenging times and become experienced masters at managing risk, each within their own limitations, through experience and backed by good luck. These pilots had acquired a vast amount of experience and knew they could rely on it to get them home safely at the end of the day. It had worked for them, however many of their colleagues were not as fortunate.

What they perhaps failed to express appreciation for at the time was how the ever increasing number of rules and regulations – many of which having the name of one of our fallen comrades attached to it – would safeguard those less experienced or perhaps the less talented and reduce the overall risk for all stakeholders. I've developed a big appreciation for the kind of attitude which places safety at the forefront of every mission objective. Looking back, these experienced pilots would on occasion assume more risk than necessary to get the job done. Their skills allowed them to get away with it.

The change in culture towards more safety – conscious behaviour has become universal. It affects all our lives on a daily basis. Seemingly everyone in today's society understands the basic concept that any initiatives one can take to minimize risk and enhance safety while still getting the job done is a good thing. That way of thinking is largely embraced by all corporate industries and militaries around the world, which in turn gets funnelled down to each individual. The aviation community was a key player in developing these safety cultures and it's good to see how it has spread to all facets of life in modern times. The world has become a safer place due to the resultant shifts in attitudes.

I still hold a great fondness for those talented aviators who initiated me into the Air Force and retain many wonderful memories of great times spent with them both in the air and on the ground. I also appreciate the many lessons they taught me. They were smart guys, however it seems evident that young people today are considerably smarter than my generation was and those who preceded me when it comes to safety and risk management.

Kids today continue to push the envelope in so many areas, however most are doing it with a smarter, more calculated approach. They seem to have benefitted from this growing wave of safety consciousness that has encompassed the globe. The military aviation community is now benefiting from these young people joining our team. I sense that there are fewer and fewer people with cowboy attitudes within our ranks. That means a safer work environment with better assurances that we'll always get back home to our families at the end of the work day. It is my hope that everyone embraces this safety conscious attitude. While our predecessors were great men, we've come a long way since then and we should be proud of the innovations in Flight Safety. ◆

Photo: DND

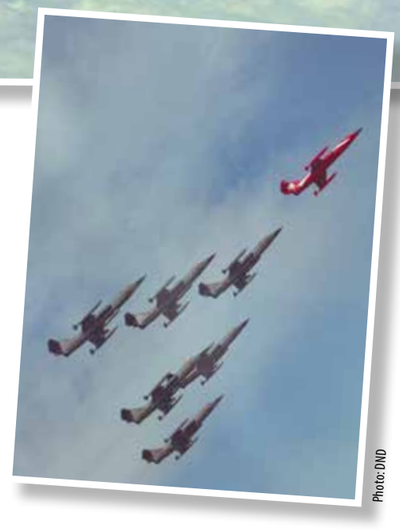

Photo: DND

"I Have Control" – "You have Control", The Perfect Twins

By Lisa Klassen, Contractor Flight Safety Officer, Allied Wings, Portage la Prairie

"I have control"; familiar words to all pilots. The phrase is commonplace in aviation and the training environment is no exception. As instructors, we use the phrase on every flight. Our students expect to hear it, except, perhaps, on a flight test. The phrase is effective in prompting a quick reaction from the student, a relinquishing of the controls to the instructor. There are no arguments or protests or any reluctance on the student's part, provided the student hears and comprehends/processes the phrase correctly. Control is to be immediately passed over to the instructor. As control is relinquished to the instructor, the student confirms the handover with the phrase "you have control". It is simple and effective.

A clear-cut method of transfer of control of the aircraft is absolutely essential. It prevents confusion and allows for a quick reaction and intervention when required by the instructor. Proper use of the phrase should ensure that at least one, and only one, person is flying the aircraft at any given time. It is a powerful phrase. The frequency of its use varies depending on the situation. For example, a newer student may expect to hear it more often as the instructor provides demonstrations of exercises that they have not yet learned or are just beginning to practice. Additionally, the phrase may be heard more frequently as time critical exercises, such as approaches and landings, are being learned. In these situations, there may be little room for error and the instructor may need to intervene sooner or more quickly to prevent a bad situation near the ground. In some instances, there is not even time to utter the phrase, the instructor must take control first and explain during or after taking control.

Another factor that affects when the instructor takes control or offers physical or verbal assistance is experience. With experience, whether it is the experience of the student or the instructor, personal limits fluctuate. In some cases, personal limits tighten as the instructor learns through experience to expect the unexpected or to anticipate the requirement to intervene.

This experience and shift in personal limits is useful to prevent an undesirable situation. More often than not, however, as the instructor gains experience, he becomes more comfortable and confident in his abilities as an instructor and his personal limits expand. This can be beneficial to the student, as he is afforded more time to identify and correct errors before assistance is offered.

The more dangerous shift in personal limits, where judgement errors may become particularly prevalent, occurs when the instructor becomes overconfident with his experience level or that of his student. In this type of situation, the layer of defence, in the form of experience can, in fact, work against the instructor. When this happens, the layer of defence begins to reveal some holes; the increased level of experience, which should be protecting the instructor, may actually be causal to errors.

Working with a new student or a student learning a new skill, the instructor may be more alert to the possibility of errors and may be more prepared to jump in when required. When a student has already learned and mastered an item, or is required to complete the exercise without assistance, the instructor may be more reluctant to offer assistance and perhaps even less prepared to offer assistance if required. Similarly, a more seasoned instructor may become overconfident in his own skills and ability to salvage situations and thus might let the student go too far before jumping in.

Every step taken in aviation comes with new challenges and new risks. Regardless of our experience level, we as humans will never be above the possibility of making errors, nor should we ever make assumptions about those with whom we are flying.

"I have control." – "You have control." Words that are frequently used, occasionally abused, and, at times, underused. Especially amidst shifting personal limits, this phrase needs to be at the tip of our tongues, ready to be spoken the moment it becomes necessary. Even more importantly, we need to maintain and foster the ability to discern when it is necessary to speak it. There is no room for complacency or overconfidence when a student is counting on us to ensure the safety of the trip. ◆

Photo: DND

TRUST YOUR INSTINCT

By Capt Marc-André Martin, D/DFS 3, Ottawa

My Harvard II Flying Instructor Course was nearing completion and it seemed I could finally see the light at the end of the Moose Jaw tunnel. On this day of January, things were looking up with a straightforward mission profile and excellent weather. The FIS instructor would be in the back, pretending to be a Phase IIA student on an early IF trip. Our only concern was the reported CRFI, which at 0.35, was right on the limit. There was a 5 kts crosswind and all pilots scheduled to fly on that wave were monitoring closely the wind indicator at the operations desk, watching for any trend that would prevent us from flying. Wind speed and direction had been consistent with the TAF for an extended period of time and we, like everyone else, elected to go fly. As a Lieutenant, this would be the first time I would get to fly with such a low CRFI and, frankly, I was eager to explore this edge of the operational envelope.

Start-up and taxi were uneventful and we got clearance to takeoff. I lined up the aircraft, pushed up the PCL to 30% torque and completed the take-off check. As I released the brakes, the aircraft immediately commenced drifting left, despite proper crosswind technique and full right rudder application. As we were accelerating, it became clear I was lacking any meaningful directional control on the aircraft due to low CRFI. Gone was the warm-and-fuzzy feeling and I strongly felt like I should reject the takeoff as the situation was about to snowball beyond the boundaries of my own personal limits. Nonetheless, as the QFI in the backseat was remaining quiet, I second guessed myself and rather decided to disregard my initial thoughts and continue with the takeoff roll. By this point, I was committed to takeoff: a late decision to abort would have most likely resulted in a runway excursion, based on the runway edge closure rate. Through 70 knots the instructor took over control and we rotated soon after, just as the runway edge was starting to disappear under the left wing. A flight of two *Harvard II* right behind us aborted their take-off. Those who were holding short waiting to takeoff took the smart[er] decision to taxi back to the ramp after witnessing what had just happened. The tower frequency was oddly quiet for such a nice weather day and we started feeling lonely up there.

Our confidence was shaken. We established ourselves on a long downwind where the instructor and I weighed different options for recovery. The discussion revolved around the actual CRFI and whether or not the reported figure of 0.35 was representative of the entire runway surface. Reported CRFI being the average of multiple lectures taken across the runway, we concluded that thresholds, surfaced in concrete, could have been worse than the asphalt portion of the runway. I wondered why this thought did not occur to us before we strapped in the aircraft. Keeping ample fuel to divert, the instructor elected to attempt landing by moving the touchdown point beyond the concrete portion, which would still leave us with sufficient room to stop despite the poor runway condition. He executed a flawless approach and landed as planned, 1000' down the runway and primed to overshoot if the aircraft would drift as previously seen. The landing roll was cautiously executed we were both relieved as we turned on the taxiway at a crawling pace. The taxi back and shutdown where uneventful.

The ensuing debriefing was lengthy to say the least, but was not the one-way conversation I was expecting after displaying this level of decision making. We rather had a productive discussion on the importance of respecting our own Personal Limits, both from a newly winged pilot and an experienced instructor perspective. The rate at which a poor decision can evolve into a dangerous situation is exponential and it behoves us to know where exactly the limits of our personal envelope lay. Such boundaries inevitably expand with increased experience and so does the ability to recognize when they are about to be exceeded. Nevertheless, the dire consequences of operating outside this envelope remain the same and every effort should be made to prevent a situation from developing into one we can no longer control.

This training mission turned out was an eye opener on how one should always cautiously deal with conditions near to aircraft limitations. It also made me realize how the reported CRFI is not an absolute value and that runway condition should be treated carefully, as most other things in aviation.

Now, I am certainly not the first nor the last to find out about these concepts, but the basic lessons I learnt through this humbling yet fruitful experience have served me well thus far. First, we must trust our self preservation instinct, which usually manifest itself when personal limits have been overstepped. Putting in practice my initial thoughts about an early abort would have stopped an already dangerous situation from developing further. Second, the silence of others is not a stamp of approval. I interpreted my instructor's silence as implicit guidance to press despite an obviously dangerous situation. Perceived expectations of others should not influence our decision making process and respecting our personal limits despite self-inflicted pressures is a critical step towards flying safely. ◆

Photo: MCpl Pierre Thériault

Photo: Cp Rick Ayer

Friday Afternoon in Sunny Victoria

By Capt Chris Horn, Rotary Wing QFI, 3 CFFTS – Portage la Prairie

It was a warm, sunny afternoon in Victoria, BC, the *Sea King* crew where briefed and heading out to conduct a COREX (Crew Operational Readiness Exercise) off the southern coast of Victoria.

One hour into what was a very routine trip, with work successfully completed on a local land mass called Discovery Island. I, as the AC (Aircraft Captain) and acting CC (Crew Commander) elected to transit the aircraft to the next working area to finish the remainder of the training as planned.

In the Maritime community flight in DAY VMC conditions may be conducted over water down to 40ft AGL. The left seat pilot was on the controls for the transit and requested a decent to 40ft AGL. I acknowledged the request but asked that the height above the water be no lower than 60ft. I monitored the decent and the level off, and noted that the transit would take about 5 min on the current heading. Feeling sufficiently satisfied that everything was proceeding "normally", I brought my head inside the cockpit to verify the radio frequency prior to making a call to advise the local traffic of our intentions. For those unfamiliar with the airspace in and around Victoria, there is extensive float plane and helicopter traffic, especially when the weather is nice.

While making the radio call, I was looking at the notes on my knee pad to verify that the mission was on time for our eventual return to the squadron for a shut down and start of the weekend. I felt a collective pull and roll of the aircraft to the left. As I brought my eyes upward to the horizon I saw that the RadAlt was showing 35ft AGL, with an increasing trend, and that the aircraft attitude was returning back to wings level. Determining that we were now heading back into a safe regime of flight, I took stock of the situation and requested a further climb back to 200ft AGL.

I queried the other pilot as to why we departed the planned flight parameters and determined that this was not an aircraft control malfunction but a pilot induced departure from controlled flight. I advised the crew and confirmed that everyone was ready and willing to continue the mission. The remainder of the COREX and transit back to the base was flown without further instance.

Some lessons to be learned. Even though I expected the other pilot to take a direct route to the new training area, this was not verbalized but assumed. The pilot obviously had a different plan that involved some maneuvering in the low level environment. As per SOP, all turns shall be cleared prior to commencement, such that the crew can clear the intended flight path. Secondly knowing that this is a busy area and that my attention would be diverted at times during the transit, I should have played it safe and denied the request down into the low level environment. Thirdly just because a crew member has shown strong proficiency does not exclude the possibility of deviations from the ideal occurring, after all flying is a very dynamic and at times unpredictable environment.

This experience was a learning one, and the crew and I hope that some of you reading this can now further appreciate the potential consequences of channelized attention, or assumptions of what the crew is or will be doing. ◆

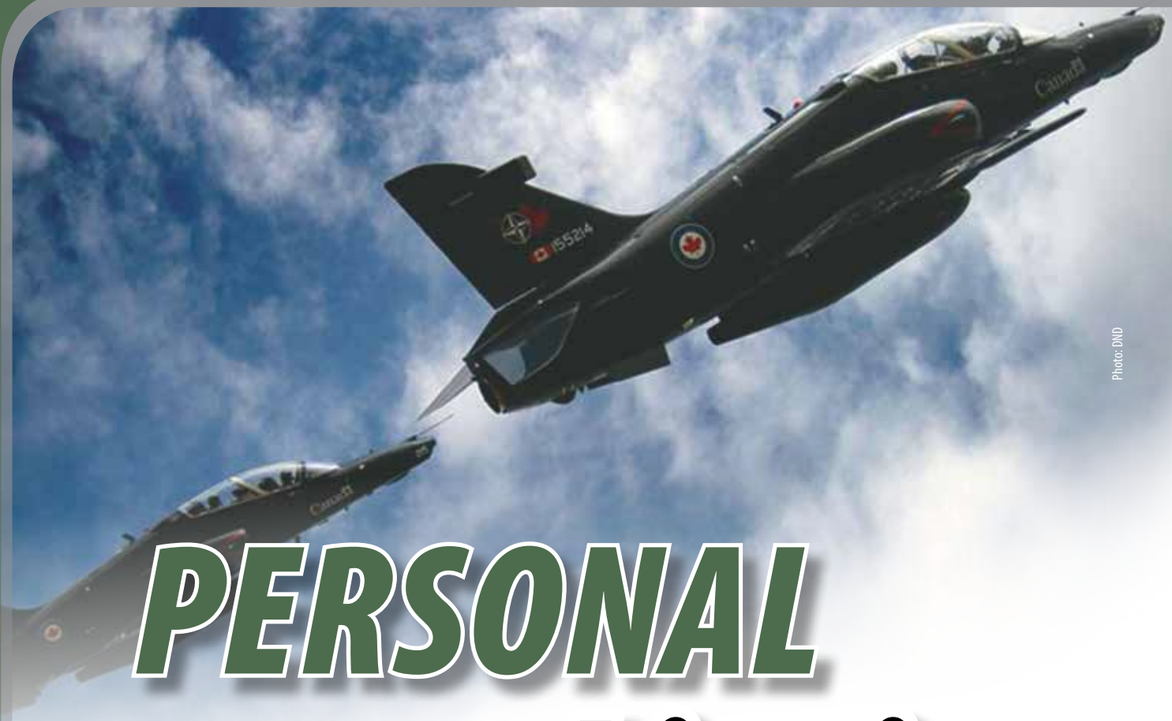

Photo: DND

PERSONAL Limits

By Maj Julian Daintree, OC CFS Det, 15 Wing Moose Jaw

Maj Julian Daintree has a total of 5,600 hrs with over 2'500 hrs of instructional time. He flew operationally on the CC-138 and instructed on the CT-114 *Tutor*, CT-155 *Hawk*, CT-156 *Harvard II*, T-37 *Tweet* on exchange with the USAF and also flew the Pilatus PC-9 at the King Faisal Air Academy in Saudi Arabia. He is currently the Central Flying School Det Commander in Moose Jaw and has an A1 Instructional Category.

The term Personal Limits (PLs) refers to your ability to anticipate deviations leading to unsafe situations; with either aircraft or personal performance limits. Normally this anticipation should include a suitable buffer allowing for action to be taken prior to reaching those limits.

This skill set, from a Qualified Flying Instructor (QFI) point of view, relies on employing certain Tools of Instruction (TOIs) namely "reverse follow through" and "guidance". A QFI requires the ability to recognize and avoid approaching limits while not being physically in control of the aircraft. However, while this article focuses on instructing, it should be said that everyone, not just QFIs, need to know, understand and recognise their personal limits.

Here was my excursion into reacquainting myself with my personal limits and why we have them: I was conducting a Clearhood Extra Dual mission with a basic student pilot (SP) flying the CT156 *Harvard II*. He had been having problems with his Practice Forced Landings (PFLs) and was on the cusp of being Cease Trained (CT'd) if he was not able to complete them to a satisfactory level on this mission. I was very keen for this student to succeed as he had a great attitude towards his training and took responsibility for his shortcomings. We briefed and went airborne to conduct his mission. For the most part his flying was good and the mission progressed until the time came for us to complete the PFLs. The students first PFL started off fine

but ended up unsuccessful as he did not anticipate the headwind, selected full flap too early and had to execute a go-around. We discussed the issues which lead up to the go-around and set up for the last attempt at the PFL. I was very aware that if he did not make this PFL he most likely would be CT'd. The PFL started off in the same manner as before, we came around through final key and the full flaps were selected but again too early. I was straining to look over his shoulder at the runway and the sight picture was not ideal "I would normally go-around from here" I thought. I was "willing" the aircraft towards the runway. We barely crossed the threshold and I thought "ok he should flare right about now"……Nothing. I immediately took control, slammed the throttle forward and moved the stick aft……Nothing. I was out of airspeed, altitude and the aircraft slammed into the runway……Hard. So hard in fact, that I wasn't convinced, after we bounced back into the air and the *Harvard* started flying again, that I still had serviceable gear or tires. I had another aircraft join on me to do a Battle Damage Assessment check and we recovered safely. However, the aircraft was damaged to the point that it took over 6 weeks to get it back into the flying schedule.

The root cause of this incident was that I wanted the student to succeed and in that, I had completely blown my personal limits. It wasn't the student's fault it was mine. I had become distracted looking at the runway, dropped the airspeed out of my cross check and violated my own personal limits to the point that I also exceeded the aircraft performance limits.

Here are a few thoughts and key factors which will help you to know, understand and recognise your own Personal Limits. These key factors are focused on instruction but can be adjusted to fit all aspects of flying.

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There can be many discussions (and I highly encourage them) on factors affecting PLs and you will see many of the following factors linking to my example. Factors affecting personal limits are but not limited to the items listed:

Experience – Both new and experienced QFIs/IPs can easily exceed their PLs. The new instructor may not see a situation developing in time to recognise that their PLs are about to be reached. New QFIs may have PLs that are too restrictive to the student, so care must be taken not to be over compensating or over bearing with guidance and/or physical assistance. An experienced QFI may suffer the same fortune due to being complacent or a willingness to let things develop so that the student may learn but the situation gets out of control too quickly to react. The solution to the experience issue would be vigilance. Be vigilant regardless of your experience level should preclude you from making major PL errors.

Distraction – A QFI can become distracted due to a variety of tasks in flight; writing notes, listening to R/T or looking out for traffic. In doing so, they fail to notice an upcoming event. Distraction almost always results from improperly prioritizing of your follow through and focusing on a non essential aspect rather than the task at hand. Maintain a constant scan of your situation both in and outside the cockpit.

Lack of Reverse Follow Through – RFT is physical, visual and mental. It is a key factor to identifying root cause for many of a student's error. RFT is also a key factor to preventing a violation of PLs in that when the QFI is aware of all of the inputs, he/she is thinking ahead of the aircraft and can ID an adverse situation early before it gets to the instructors PL's. If guidance doesn't work- take control. Good RFT is the key factor in the avoidance of exceeding aircraft limits such as gear/flap over speeds, over "G's" etc.

Sequence being Taught – Some sequences raise awareness levels and others don't. For instance, a close formation mission naturally tends gravitate very close to a QFI's PL's for the duration of the flight. So a QFI will be very aware and vigilant in ensuring that PLs are not exceeded. However it must be stated that the speed at which those restrictive limits are reached, can and will surprise even the most experienced of QFIs. Whereas teaching a less dynamic sequence, such as instrument flight twizzle, can lead to a less attentive/alert state of mind and therefore are just as susceptive to a PL violation. Familiarity (experience) with the sequence being taught is also a factor, having taught a certain sequence or manoeuvre a number of times, the inherent risk may start to fade from the QFI's mind until he/she exceeds their PLs.

> everyone has personal limits. The key is to be aware of our personal limits each and every time we step to an aircraft and take action when you recognise that those limits may be exceeded.

Student type – Weaker students, based on performance alone, will be prone to pushing a QFIs PLs. However, the danger of the weaker student is dampened somewhat due to QFIs paying more attention. The strong student is the one to worry about, as the QFI may tend to let his/her vigilance slack. Be aware of SP's common errors (strong and weak) and be prepared for them by always having a way out, especially on the extreme ends of the flying envelope and when close to the ground. Good procedural knowledge combined with the awareness of the aircraft performance are necessary to avoid making major errors that could lead to a hazardous situation and a PL violation.

Decision Making/judgement – Many incursions to QFI personal limits occur with a snap judgement/decision prior to an incident. Usually, the instructor has the idea that the student will benefit in seeing a "further" continuation of a procedure which is not planned and is now going outside of the usual boundaries or complexities of the intended manoeuvre. If not properly controlled the continuation could proceed to the point which inadvertently exceeds the QFIs PLs.

Law of Intensity – The Law of Intensity can be a very useful tool for the instructor to impart information or a lesson to a student. However, it is very easy to exceed the intended level of "intensity" leading to a PL violation. In addition, once the intended level of intensity is exceeded you must deal with the fact that your student has had a negative learning experience.

In conclusion, everyone has personal limits. The key is to be aware of our personal limits each and every time we step to an aircraft and take action when you recognise that those limits may be exceeded. For the instructor, the student must never be allowed to reach or exceed your personal limits. Once the personal limits of the instructor have been reached or exceeded, the training value of the manoeuvre has probably been lost. Timely use of guidance is the preferred method to prevent the student from exceeding the instructor's personal limits and reverse follow through the key factor to recognising those limits are approaching. Finally, during rapidly deteriorating situations where guidance is not possible, physical intervention by the instructor will be required to avoid an PL violation.

We have mentioned reverse follow through a number of times in the article and how important it is with regard to avoiding a violation of PLs. Here is a brief description of Reverse Follow Through.

Reverse Follow Through comes in three main forms and are the one of the most important skills a QFI can develop. The three forms of follow through are: Physical, Visual and Mental. RFT is critical to properly analysing your student's performance and identifying the root cause of errors.

- **Physical Follow-Through** relates to your ability to have your hands and feet lightly on the controls/ancillaries so that you can feel the small pressures induced by the SP but the SP is unable to feel that you are on the controls. PF-T is critical to analyse your student's performance and identify root cause of errors.
- **Visual Follow-Through** relates to your ability to complete your own work cycle while also paying attention to the SP's work cycle. For instance, you must still look out and monitor aircraft performance while watching your student complete his manoeuvre. Remember the airspeed from my PL violation?
- **Mental Follow-Through** relates to your ability to mentally fly the manoeuvre while your student physically flies it. You should be thinking about all the factors that you would normally take into account if you were in control of the aircraft. Physical and Visual follow through aid Mental follow through to provide the complete picture. By having the complete picture you are able to identify and correct student errors while maintaining SA to know, understand and recognise your personal limits.

The Law of Intensity is one of the seven laws of learning contained in the Flight Instructors Handbook. It states basically that a vivid or dramatic experience has an increased chance of being retained over a routine experience. ◆

Photo: DND

From the Investigator

TYPE: CH149 *Cormorant*
LOCATION: Kamloops Airport, BC
DATE: 16 July 2013

Helicopter CH149906 was conducting a normal take off to a 10 foot hover. Three seconds into the take off, at approximately three to four feet above ground, the crew heard a clunk followed by "Master Warning" and "Engine Fail" tones. As the helicopter yawed slightly, the Flying Pilot briefly paused his application of power before slowly reducing it as the aircraft settled back onto the runway. The #2 engine torque indicated "0" while turbine inlet temperature increased to 1116° Celsius (°C), which is above the maximum transient temperature of 992 °C. A #2 engine emergency shutdown was then immediately conducted. Once the crew confirmed that no further dangerous indications existed, the helicopter was taxied back to the ramp and a normal shut down was completed.

A boroscope inspection confirmed foreign object debris damage to the engine after the second stage compressor. The engine was then routed to the third line contractor for a comprehensive teardown inspection with oversight from the engine original equipment manufacturer (OEM). The teardown found two consecutive airfoils that separated from the second stage compressor bladed disk, which caused secondary engine object damage to components downstream in the gas path. The airfoils were not recovered, but the bladed disk fracture surfaces clearly indicated signs of fatigue.

The Cormorant fleet experienced a similar failure one year earlier, though it was considered an isolated incident. The engine OEM is gathering data in an attempt to explain the failures and to develop preventive measures. ◆

Photo: Cpl Daisy Hiebert

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Left: Engine compressor

Above: Stage-2 bladed disk with missing airfoils

From the Investigator

TYPE: CH124 *Sea King*
LOCATION: 12 Wing Shearwater, NS
DATE: 16 July 2013

The accident crew planned a night trainer in the local area. The crew change was completed during a hot refuel with engines running and rotors turning. The aircraft had ground taxied to take off pad 3 when it was recalled back to the inner ramp so that the aircraft captain could sign additional electronic aircraft records required prior to this flight. The helicopter came to a complete stop on the inner ramp, and while the co-pilot completed the parking sequence, the aircraft captain began to remove his safety harness. The crew then felt the aircraft pitch forward rapidly.

Sea King CH12435's tail rose, the Main Landing Gear (MLG) oleos extended and the aircraft subsequently rotated forward, pivoting on the MLG. The aircraft lifted off the ground. The main rotor disk then moved backward and impacted the tail pylon causing it to separate from the fuselage. The aircraft fell back to the ground and yawed to the right. The aircraft then rolled left as the left sponson collapsed and the main rotor blades struck the ground at the pilot's 11 o'clock position. The aircraft yawed 120 degrees to the right before coming to rest on its left side. Flying debris damaged the surrounding hangars. The crew conducted an emergency shutdown and egressed through the personnel door. There were no injuries or post-accident fire.

Preliminary findings indicate that the aircraft was serviceable. Post-accident maintenance inspections revealed no technical faults. The investigation is focussing on human factors during the parking and crew change sequence. ◆

Photo: Cpl David Randell

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