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ISSUE 1, 2018

Flight Comment

CHECK SIX

Cause Obscure

FROM THE FLIGHT SURGEON

Crash Scene Hazard Management

VIEWS ON FLIGHT SAFETY

Commander of the Royal Canadian Air Force

Canada

Cover – Investigating the wreckage of CF188738 that crashed while conducting an air show practice on 23 July 2010 at Lethbridge County Airport, Alberta.

Photo: Cpl Raulley Parks



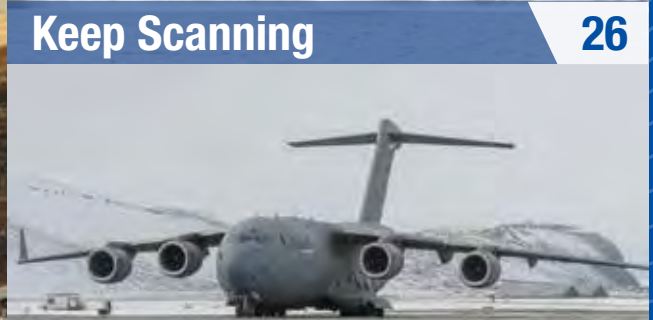
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Flight Comment



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Views on Flight Safety

by LGen A.D. Meinzinger, Commander of the Royal Canadian Air Force

I recently read an interesting article on the Royal Canadian Air Force (RCAF) Aerospace Warfare Centre's online forum that discussed the challenge of creating, implementing and following policy. As many of the people in the subsequent discussion stated, rigidly adhering to policy without taking context into consideration can create friction and may lead to unwanted results. In the Flight operations domain that could result in a catastrophic accident.

It's important to note that many of our RCAF policies, especially flight and maintenance procedures, were adopted to make our day to day practices safer. Checklists were created so that important steps would not be overlooked. Tool control practices were implemented to avoid leaving items in critical aircraft spaces. Air traffic control procedures were created to prevent two aircraft from occupying the same space at a given time. In short, following policies and procedures has greatly reduced our human propensity to put ourselves in danger and makes our Air Force operations much safer.

Sometimes, however, policies and procedures fail to meet their purpose. They can become cumbersome, dated and cause frustration. Procedures that were originally developed

to make something safer can lose their relevance over time or come into conflict as technology and capability advances. It is possible therefore that the intended procedural safety net may then become a hazard. It is for this reason that the leadership of the RCAF relies heavily on its members to identify procedural shortfalls for revision and refinement. Observations need to be communicated to unit leadership so that solutions can be adopted or, at the very least, the related risks can be better understood and assumed by the appropriate level of command.

The success of the Canadian Armed Forces Flight Safety Program, first and foremost, relies on support from its leadership and the complete buy in from its membership. As Commander of the RCAF, I expect that RCAF personnel are following defined policies and procedures but I also trust that anyone can come forward, without fear of retribution, to identify issues to their leadership. This is how we collectively strengthen our Air Force.

Another critical aspect of our Flight Safety Program is the independence of our Flight Safety specialists. It is essential that anyone can engage members of our Flight Safety team without the need to consult the chain

of command. This essential attribute of our Flight Safety program helps to ensure a robust safety culture and allows for self-reporting and openness. As the Commander RCAF, I recognize the importance of a strong Just Culture within our Flight Safety Program, as it enables free and open reporting from all members of our team, military and civilian. RCAF leadership at all levels must continue to lead by example and openly promote the key principles of our Flight Safety Program. 🔥

The Editor's Corner

In addition to our regular columns, this issue of Flight Comment will focus on ways that accident investigators can reduce risk and mitigate hazards at an aircraft accident site. Over the years, investigators from the Directorate of Flight Safety (DFS) have learned many valuable lessons on how best to respond to an accident. We have refined our information gathering process and conducted post-occurrence action reports to try and identify potential short falls in our response. We have accident "Go Kits" that contain equipment and clothing to address a wide variety of conditions. However each occurrence can be quite unique and it is not unusual for an accident scene to introduce something unexpected. Curve balls include rapidly changing weather, remote accident sites, challenging terrain and visits from curious wildlife. How does one prepare for these unknowns?

Much like dressing up to protect ourselves from the cold, the best type of protection is the adaptable, layered kind. Protecting ourselves can begin well ahead of time and is accomplished by first aid training, having up to date vaccinations and being physically and mentally fit. Having a seasonal "Go Kit" packed with appropriate clothing and following a detailed kit check list goes a long way to speeding up the pack before departure process and helps ensure important items are not left behind. Bringing and having access to appropriate Personal Protective Equipment (PPE) that is designed to protect investigators from the anticipated hazards such as burnt carbon fibres, sharp objects, and fuel and oil contaminated surfaces is important and is

addressed in the PPE article. After the call is received, a critical step in protecting ourselves is anticipating, recognizing and properly reacting to the actual hazards that are present at the crash scene. This aspect is discussed more fully in this issue's "Crash Scene Hazard Management" article.



Photo: Alexandra Baillie-David, DND

Our centre-fold poster portrays the Crash Scene Hazard Matrix, a valuable tool used based on the Risk Management process that is modifiable to suit the needs of any safety organisation. The poster also includes images of two levels of PPE available in both military and commercial off-the-shelf products. This poster can be used as a visual tool to provide guidance on the assessment of hazards, mitigation of risk and the type of protective equipment to be worn at a crash site.

This issue also includes an informative and relevant account written by Col (Retd) Chris Shelley of an aircraft accident that occurred on the outskirts of Ottawa, Ontario, in 1956. There is a plaque located behind the Bruyère Village senior's residence on Hiawatha Park Road in Ottawa that commemorates the lives lost in this accident (see photo insert). Studies of these past accidents serve to remind us of the challenges encountered in the flight safety investigation process, that we must be prepared to react to a tragedy and how unanswered questions can linger on for decades after an accident.

As usual, you will find a very useful article written by the Instrument Check Pilot School on Human Performance in Military Aviation (HPMA) that highlights the various tools we have at our disposal to recognize and address human factor errors.

Looking for flight safety posters? They are now available on the flightcomment.ca website.

Lastly, I would like to take this opportunity to say a fond farewell to a stalwart member of our Flight Safety organisation. Sergeant Lucille (Lucy) Calderone has been a quiet voice of wisdom, counselling many of us through FSIMS woes and other flight safety matters within DFS for 20 years! We are going to sorely miss her when she hangs up her uniform on May 5th. She is leaving behind very huge boots to fill...although she may decide to keep her boots as hiking shoes for the many adventures she is about to embark upon. Safe travels Lucy! 🍀

Major Claire Maxwell

Good Show

For Excellence in Flight Safety

Captain Daniel Schade

During a night flight on 2 June 2017, Captain Daniel Schade, a Sea King helicopter co-pilot, was taking off from the deck of HMCS ST JOHN'S to continue a high-value operation. Mid take-off, a rare failure of the tail probe system caused the tail probe to extend and become locked in the fantail of the flight deck. Capt Schade's quick recognition of the problem and expert handling of the aircraft prevented a catastrophic accident at sea.

The crew had just returned from a mission for a hot-refuel, with much real operational pressure to return on station as quickly as possible. Once ready for take-off, they conducted a Silent Launch Recovery (ZIPLIP), where the clearance for takeoff was given through the use of light signals rather than voice communications. At the exact moment the helicopter began to lift, the tail probe system failed, causing the probe to extend down and engage in the fantail. The main landing gear raised approximately five feet off the deck while the tail probe remained locked in the rails. The critical condition developed rapidly, leaving minimal time for others to react other than the pilot at the controls. Without verbal prompting from the LSO or a change in trafficator signals from FLYCO and as the helicopter was reaching an estimated ten degrees nose up, Capt Schade expertly recognized there was an irregularity with the take-off and elected to promptly abort the take-off by safely lowering the helicopter back on the flight deck. From the critically nose-high attitude and in night conditions, he skillfully set the helicopter back on the deck with the main probe in the trap.

Capt Schade's actions were exceptional for a first tour maritime helicopter co-pilot (MHCP) who had not attained deck landing qualification. The common procedure for shipborne take-offs is to initiate a sharp, but controlled, collective pull once the aircraft is light on oleos. This technique creates quick separation between



Photo: WO Chris Hawkins

the helicopter and the flight deck, which is particularly important when sea state is high. Capt Schade's immediate recognition on the initial collective pull coupled with his smooth handling of the aircraft in a critical phase of flight averted the possibility of striking the tail rotor blades on the quarter-deck or inducing a dynamic rollover. Either scenario could have resulted in catastrophic damage to the aircraft, serious injury to personnel, or loss of life.

As inputs to tail rotor pedals would have had no effect on heading, an over controlling situation of the pedals could have created a catastrophic and sudden failure of the tail probe.

Capt Schade displayed situational awareness, decisiveness, and aircraft handling skills far above what is expected of a MHCP; his actions would be considered exemplary for even the most experienced pilots. For his outstanding reactions in preventing a devastating outcome, Capt Schade is highly deserving of this Good Show award. 🏆

Good Show

For Excellence in Flight Safety

Corporal Devin Berube



On 4 May 2017, aircraft CF188746 was going through its start sequence to return to 4 Wing Cold Lake from Inuvik and two ground crew members were involved in the start-up. The first member's role was to oversee the start while remaining in full view of the pilot and Cpl Berube's role involved arming the weapons and checking for leaks and hydraulic levels.

Cpl Berube had just armed the weapons on the right side of the aircraft when he noticed that the hydraulics were low. He relayed the low hydraulic signal to the other technician, who in turn signaled to the pilot. While waiting for the hydraulic unit to arrive,

the pilot wrote a note to the technicians indicating that the aircraft had a left wing tank unlock advisory. While walking toward the left wing tip to check the cause of the advisory, Cpl Berube noticed that the other member was walking towards the left wing external fuel tank and was within the nine foot danger area of the left engine intake. Cpl Berube grabbed the other member and pulled him out of danger. Had Cpl Berube not reacted quickly, the other member may have been sucked into the left engine.

Cpl Berube's quick thinking and decisive action potentially prevented the loss of life. He is highly deserving of this Good Show award. 🇨🇦

Good Show

For Excellence in Flight Safety

Corporal Zachary McNaughton



Cpl Zachary McNaughton, an Aviation Technician, was deployed to the west coast with 427 Special Operation Aviation Squadron. On the night of the 2nd of November 2015, Cpl McNaughton was tasked to support a dual point Hot Closed Circuit Refueling (HCCR) operation. During night HCCR, for both operational reasons and to prevent blinding aircrew who are using Night Vision Goggles, all lights are extinguished or limited to red. The weather conditions that evening were light rain and low visibility.

The day prior to the mission, the dual point HCCR site was repositioned to an unused parking lot that was adjacent to the pick-up zone. For reasons unknown, the decision to use the parking lot was never communicated to the bus drivers who, throughout the operation, had been using the parking lot as a turnaround point when dropping off troops at the pick-up zone.

While two running helicopters were conducting HCCR operations, a transport bus entered the HCCR site at a high rate of speed, oblivious to the ongoing refuelling activity. Seeing this incursion,

Cpl McNaughton quickly assessed that the bus was not slowing down and immediately ran in front of the bus, frantically waving his arms to signal the bus driver to stop. When the bus finally stopped, the vehicle's front tires were millimetres away from the pressurized fuel hose and a few meters from the helicopter rotor arc. If a collision had occurred between the bus and the rotating main rotor blade, compounded by a potential break and leak in the pressurized fuel hose, the impact and damage would have been devastating.

Cpl McNaughton's exceptional situational awareness and quick response unquestionably prevented the loss of numerous lives and preserved Royal Canadian Air Force assets. He is truly deserving of this Good Show award. 🇨🇦

For Professionalism

For commendable performance in flight safety

Master Corporal Steve Atchison



Photo: OS Paul Green

On 30 March 2017, MCpl Atchison, an Aviation Systems Technician at 8 Air Maintenance Squadron Trenton, discovered a CC130J fleet-wide issue while conducting Auxiliary Power Unit/Engine Emergency Shutoff Valves and Fire Extinguishing Systems checks after an avionics modification. MCpl Atchison discovered that pulling an engine's "Fire Handle Fuel" Electronic Circuit Breakers (ECBs), as per the Job Guide sequence, would override the Engine Oil Sump Shutoff Valve to an open position and inadvertently cause the engine compressor to be flooded with oil. Indeed, this condition was

retroactively attributed as the likely cause of two previous CC130J oil flooding flight safety occurrences. MCpl Atchison's discovery of this incorrect sequence in the Job Guide was confirmed by on-site Lockheed Martin (LM) engineers and a High Priority alert was sent to LM headquarters to amend the Job Guide. MCpl Atchison then conducted extensive research into other CC130J publications and discovered two additional Job Guides that contained the same erroneous sequence. He promptly brought this new discovery to the Lead LM Field Service Rep, and the additional info was forwarded to LM headquarters for

immediate revision of the applicable publications. MCpl Atchison then helped LM write a Technical Awareness Bulletin to prevent future engine oil flooding occurrences.

MCpl Atchison's superior attention to detail detected a latent condition that had gone undetected by 8 AMS and 436 Squadron personnel, as well as by LM engineers, and directly resulted in the issuance of high priority amendments to several technical orders. MCpl Atchison's diligence, professionalism and tenacity is highly commendable and well deserving of this For Professionalism award. 🏆

For Professionalism

For commendable performance in flight safety

Master Corporal Sean Côté and Corporal Stefan Van Chesteing



On 2 June 2017, MCpl Côté and Cpl Van Chesteing were tasked to rectify a reoccurring Propeller Reset Caution Light fault on CC138 Twin Otter aircraft 803. Upon illumination of the caution light, the normal course of action is to adjust or replace the micro switch that triggers the light. In the two weeks prior to their tasking, three faults had been signed off as serviceable by adjusting the micro switch twice and once by finding 'no fault' in the system. After ground runs were carried out and the system was again deemed serviceable in accordance with technical references, MCpl Côté and Cpl Van Chesteing became unsatisfied and continued to troubleshoot the issue.

While tracing the engine cable path further back on the propeller reset caution cable slide assembly they discovered that a jam nut was missing at the aft end of the distance rod on the right hand power cable. The missing jam nut allowed the cable slide to move and periodically bind in its mount causing a caution light to illuminate intermittently. Thus the normal action of adjusting or replacing the micro switch was inappropriate for the root cause of the problem caused by the missing jam nut.

Had the missing jam nut continued to have gone unnoticed, the power lever cable could have bound sufficiently on the mount to

prevent the pilot from reducing engine speed and potentially forcing an inflight engine shut down. By persevering in their efforts to identify and rectify the fault, MCpl Côté and Cpl Van Chesteing went well beyond normal procedures and demonstrated a level of expertise and competency well above expectations. Their superior professional attitude may well have prevented a significant hazard to flight safety and so they are most deserving of this For Professionalism award. 🏆

Corporal Francis Séguin



On 24 July 2017, upon returning from a long range trainer, Flight Engineer Cpl Séguin was conducting a post flight inspection on the control column and flight controls of the CC138 Twin Otter when he heard a very faint binding sound when operating the ailerons at full aft elevator deflection. The noise was barely audible and co-workers did not see this as an issue; nevertheless Cpl Séguin was convinced something was not right. To confirm his suspicions, Cpl Séguin conducted similar

inspections on other aircraft in the hangar and determined that the sound was absent on the other airframes.

The issue was brought to the attention of the squadron maintenance section who inspected the cables under the control column and revealed that the aileron cables had been incorrectly installed around the pulleys. Furthermore, it was discovered that in certain control configurations the rigging error was causing one cable to rub on the nose wheel steering column. If the aircraft had continued

to operate with improperly rigged cables, chafing could have occurred potentially resulting in the cables severing in flight and leading to catastrophic results.

Cpl Séguin consistently displays remarkable attention to detail and professionalism while carrying out his duties as a 440 Squadron flight engineer and this case is no exception. Cpl Séguin's tenacity in conducting a thorough investigation resulted in the identification and rectification of a potentially critical hazard. Cpl Séguin is truly deserving of this Good Show. 🏆



From the Flight Surgeon

Crash Scene Hazard Management: An Updated Approach

by Major Tyler Brooks, Diploma in Aviation Medicine, Medical Investigator;

Major Claire Maxwell, Editor of *Flight Comment* magazine / Formerly – Rotary-wing Investigator and Personal Protective Equipment (PPE) Coordinator;

Master Warrant Officer Gary Lacoursière, Technical Investigator.

DFS has developed an updated approach to crash scene hazard management and welcomes the opportunity to collaborate with other organizations to share best practices and lessons learned.

On 21 January 2016, an updated approach to crash scene hazard management was presented to representatives of the major air investigator communities in Canada: the Canadian Society of Air Safety Investigators (CSASI), Transport Canada (TC), the Transportation Safety Board (TSB), and DFS. The updated approach is rooted in the risk management process recommended by the International Civil Aviation Organization (ICAO) and is designed as a comprehensive yet straight-forward evidence-based approach to managing crash scene hazards.

Background

From the early 2000's, crash scene hazard management in Canada focused largely on biohazard protection. This was the logical consequence of changes in the late 1990's to workplace health and safety guidelines aimed at protecting the worker from exposure to



infectious diseases such as Human Immunodeficiency Virus (HIV), Hepatitis B, and Hepatitis C. To emphasize the perceived risk, the annual "Personal Protection" training for aviation accident investigators was specifically called "Blood Borne Pathogen (BBP) training."

Unfortunately, the emphasis on biohazard protection sometimes overshadowed other potential hazards at aviation crash scenes.

Anecdotally, there was concern at DFS (the independent investigator of CAF aircraft accidents), that some CAF flight safety personnel were emerging from training with the impression that infectious diseases were the primary hazards at a crash scene. Over time, DFS attempted to supplement BBP training with instruction on other hazards – such as chemical, explosive and radiological

hazards – but this led to ever-growing “shopping lists” of specific hazards, which were difficult to remember and not contextualized in terms of the actual risks they posed.

In 2015, DFS began a review of its crash scene hazard training package, ultimately leading to this updated approach that is believed to benefit not only Canadian air investigators but also international air investigators.

Method

DFS reviewed the ICAO guidance provided in Circular 315 “Hazards at Aircraft Accident Sites,” which discusses specific crash scene hazards and groups them into categories. DFS adopted this consolidated hazard categorical approach, but made slight modifications to the individual ICAO categories after broad consultation with DFS accident investigators, and CAF aviation medicine and occupational medicine experts. Thus, the previous “shopping lists” of hazards were reorganized into five easy-to-remember categories: 1) Physical, 2) Chemical, 3) Environmental, 4) Psychological, and 5) Biological.

DFS then conducted a risk analysis of the five hazard categories using a Risk Management (RM) process. ICAO Circular 315 recommends applying a RM process to crash scene hazards involving the cycle of: 1) identifying hazards, 2) identifying exposure routes, 3) assessing risk, 4) introducing controls, and 5) reviewing and revising the risk assessment. Rather than applying RM at the time of a crash, DFS decided to take the ICAO recommendations one step further and *pre-assess* the likely hazards. With primary focus on CAF aircraft fleets, DFS gathered evidence from scientific



and medical literature, hazardous material safety data, and expert consensus to assess the overall risk of each hazard category. The pre-assessment was intended to give investigators a “head-start” when confronting a crash scene, allowing faster and more accurate risk assessment, safer scene hand-over, and improved safety measures.

Applying this RM process, DFS ultimately assessed that there was a low risk associated with biohazards (i.e. Human Immunodeficiency Virus (HIV), Hepatitis B, and Hepatitis C) at a crash site. This assessment was based on reassuring information from the US Centers for

Disease Control, the Public Health Agency of Canada, and a thorough literature search for documented cases of disease transmission from aircraft accident sites. Moreover, consideration was given to advances in medical science since the creation of health and safety guidelines in the 1990’s. For instance, Hep B transmission can be prevented with vaccination, HIV transmission can be prevented with post-exposure prophylactic treatment, and Hepatitis C can now be medically cured. Thus, the relatively low risk of biohazards can be put in proper context for accident investigators.

Continued on next page

Crash Scene Hazard (CraSH) Matrix

Hazard		Exposure Route	Risk	Control
Physical	<ul style="list-style-type: none"> • Broken structures • Composite fibres (CF) • Explosives • Radiological[†] • Stored energy 	<ul style="list-style-type: none"> • Cuts • Punctures • Crush • Inhalation/ingestion • Contact/proximity 	High Likely Probability Critical Severity <ul style="list-style-type: none"> • Severe injury and/or • Severely degraded mission capability 	<ul style="list-style-type: none"> • Control access • Avoid/cordon • Disarm • Decontaminate • No eating on site • Wear PPE • Apply Fixant (CF)
Chemical	<ul style="list-style-type: none"> • Petroleum, Oil, Lubricants/ fluids • Metals/oxides • Viton (rubber) 	<ul style="list-style-type: none"> • Inhalation • Ingestion • Contact 	Medium Likely Probability Moderate Severity <ul style="list-style-type: none"> • Minor injury and/or • Degraded mission capability 	<ul style="list-style-type: none"> • Control access • Avoid/cordon • Neutralize • Decontaminate • No eating on site • Wear PPE
Environmental	<ul style="list-style-type: none"> • Cold/heat • Fatigue • Insects/wildlife • Enemy/Security • Political Situation 	<ul style="list-style-type: none"> • Variable 	Medium Likely Probability Moderate Severity <ul style="list-style-type: none"> • Minor injury and/or • Degraded mission capability 	<ul style="list-style-type: none"> • Control access • Implement site security • Apply work/rest cycles • Feeding/hydration • Insect repellent/tick removal • Wear sunscreen • Wear clothing appropriate for the weather • Wear PPE
Psychological	Traumatic exposure ^{††}	<ul style="list-style-type: none"> • Direct exposure • Indirect exposure (vicarious trauma, narratives) 	Medium Likely Probability Moderate Severity <ul style="list-style-type: none"> • Minor injury and/or • Degraded mission capability 	<ul style="list-style-type: none"> • Control access • Apply work/rest cycles • Monitoring • Limit exposure and control information release • Wear PPE
Biological	Blood Borne Pathogens <ul style="list-style-type: none"> • HIV • Hepatitis B/C 	<ul style="list-style-type: none"> • Cuts • Punctures • Via mucous membranes 	Low Unlikely Probability Critical Severity <ul style="list-style-type: none"> • Severe injury 	<ul style="list-style-type: none"> • Control access • Decontaminate • No eating on site • Wear PPE • Vaccinate^{†††}

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

^{††} The potential for severe traumatic exposure may increase the assessed risk level to HIGH in certain circumstances.

^{†††} Advance vaccination is encouraged and could be mandatory for all personnel who attend a crash scene.



Crash Scene Hazard Matrix (CraSH Matrix)

In the end, DFS produced the following matrix describing the *minimum* expected risk level of each of the five crash scene hazard categories. The CraSH Matrix is intended to serve as a quick-reference and simple starting point for crash scene hazard management. At the same time, investigators remain free to modify the risk levels when necessary based on specific crash site circumstances. DFS has rewritten the chapter on Crash Scene Hazard Management (previously entitled "Blood Borne Pathogens") in its Airworthiness Investigation Manual (the investigation standards manual for the CAF). The new approach is being taught on the CAF Flight Safety course for aircraft accident investigators and the medical course for Aviation Medicine providers.

Practical Application

DFS has now moved beyond the conceptual stage of this initiative and has had opportunities to practically apply the CraSH Matrix in the field.

The first practical application of the CraSH Matrix occurred in November 2016 as a result of a CF188 Hornet crash in an unpopulated area near Cold Lake, Alberta, where the pilot sustained fatal injuries. Based on reported conditions, the accident investigation team used the CraSH Matrix while enroute to the crash scene to pre-assess the hazards. The resulting assessment indicated a probable high risk level due to the type and quantity of physical hazards and required the investigators to adopt the wearing of full PPE. Upon arrival, it was determined that conditions were not as initially reported and the physical risk was downgraded to a medium level. This re-assessment resulted in the investigators having to wear less PPE thereby increasing

their manoeuvrability and efficiency and easing the level of difficulty in conducting their on-scene investigation. As the investigation progressed, the level of risk had to be adjusted due to environmental hazards (e.g. changing weather), physical hazards (e.g. unexploded ordnance), and psychological hazards (e.g. human remains).

Overall, awareness of hazards, their associated risks and the application of control measures was simplified and enhanced by use of the CraSH Matrix. As a practical tool, the CraSH Matrix allowed the team to keep up with changes in risk levels, anticipate and modify plans, and successfully complete the on-scene investigation. In addition, the CraSH Matrix served as a vital tool when handing over responsibility of the crash scene to the Aircraft Recovery and Salvage Team. Crash Scene Hazard Management for this case also included the first-ever follow-up medical screening for all 109 personnel who worked on the crash site, a process that was well-received by personnel and their supervisors. Screening took place for potential injuries from all five hazard categories in the CraSH Matrix, with particular attention to potential psychological injuries.

The second practical application of the CraSH Matrix occurred due to an engine failure of a CT156 Harvard II trainer in January 2017, which forced both occupants to carry out an ejection and caused the aircraft to crash in a farmer's field. Again, the aircraft accident investigators used the CraSH Matrix tool to pre-assess the expected risks and, as a result of the analysis, made the decision to wear minimal PPE. Deteriorating weather forced a re-assessment of the hazards and associated risks, resulting in a change of control measures to enhance PPE, modify the recovery plan and ultimately resulted in the move of the wreckage to an indoor location.

In both cases, the CraSH Matrix allowed the accident investigation teams to pre-brief and safely prepare their crews on the anticipated hazards and associated risks of the crash scenes, then allowed for rapid yet comprehensive re-assessments of the crash scenes upon their arrival. The matrix proved to be an excellent tool for briefing off-site supervisors on local conditions and increased the effectiveness of the crash scene handover to new personnel arriving on-site.


Projected Future Development

DFS will continue to use the CraSH Matrix when investigating accidents; however, its use has highlighted areas that need to be strengthened and updated particularly in the application of controls measures.

The first area that underwent review was the rationalization of appropriate PPE. DFS' current process involves the provision of items to CAF flight safety units located across Canada. The challenge is to align the standardized equipment with the actual requirements of the crash scene and requires an understanding of the environment in which the equipment is to be used and knowledge of the capabilities and limitations of the equipment. This matter is discussed in greater detail in the PPE article found in the Dossier section of this magazine.

The provision of PPE does not mean that every crash site will require the investigator to wear all the items for proper protection. Rather the crash scene investigators need to know and understand the hazards to which they are being exposed and then they need to be able to pick the appropriate protective items from a menu of available resources. Understanding that flight safety investigators have limited time to deal with the intricacies of PPE at

Continued on next page



the time of an accident, DFS personnel have refined the selection of available PPE to better protect against known hazards and have developed a PPE poster to compliment the CraSH Matrix tool.

Another area for review is the need to develop education and training products that complement the updated approach to Crash Scene Hazard Management. For instance, the effective use of a PPE pocket-card relies on flight safety investigators understanding the hazards that they might encounter at a crash scene and knowing the limitations and capabilities of their equipment. To promote this understanding and knowledge, DFS is in the process of developing short training videos that can be accessed via the internet. The intent of these videos is to provide accurate, standardized, current and accessible information to flight safety personnel so that they can easily educate themselves at the time and place that is convenient to them.

Finally, the Canadian Forces Health Services Group (CF H Svcs Gp) has developed a cross-platform mobile application called the “Div Surg App” that features resource material and online tools to meet the needs of the aerospace medicine and flight safety communities. The CraSH Matrix is available for download from this app, both as a read-only “pocket-card” quick-reference and as a modifiable “worksheet” document which can be shared via email. DFS intends to continue to collaborate with CF H Svcs Gp to extend the features within this app to support Crash Scene Hazard Management.

Collaboration

A key factor attributing to the success of this updated approach has been the collaboration between members of the Canadian air

investigative community. Coincidentally, CSASI, TC and the TSB were considering a periodic review of their own crash scene hazard management and BBP training packages and the meeting with DFS in January 2016 identified that there was a great deal of consensus on the suggested way forward. Each group subsequently agreed to collaborate with DFS to further develop the CraSH Matrix and to determine how to best incorporate it as the basis for crash scene hazard management within their respective organizations. This common approach was expected to enhance interoperability and allow collaboration on future work, such as the rationalization of PPE.

After the DFS article on Crash Scene Hazard Management was published in the October-December 2016 *International Society for Air Safety Investigators (ISASI) Forum* magazine, conversation was generated with other air accident investigation agencies, notably the United States National Transportation Safety Board and the United Kingdom Air Accidents Investigation Branch. These conversations are indicative of a growing trend towards supporting this updated approach and demonstrate the importance of collaborating with other organisations to promote a greater understanding of crash scene hazard management.

Conclusion

Hopefully our shared knowledge will give our accident investigators a better idea of the actual hazards and associated risks that may be encountered at a crash scene. This knowledge will result in the application of more effective control measures and will ultimately increase the health protection of our personnel working at a crash site.

We would like to thank the following people for their contributions towards this endeavour:

- Barbara Dunn, CSASI
- Nora Vallée, Occurrence Response Analyst, Flight Operations, TC
- Leo Donati, Director Operational Services, TSB
- Susan Greene, Manager Multi-Modal Training and Standards, TSB
- Beverley Harvey, Senior Investigator International Operations and Major-Investigations – Air, TSB
- Dr. Joan Saary, Occupational Medicine Specialist, Canadian Forces Environmental Medicine Establishment (CFEME)
- Maj (retired) Rachel Morrell, former Head of Military Medicine, CFEME
- LCol Nathan Nugent, former Head of the School of Operational Medicine, CFEME
- Col Pierre Morissette, Royal Canadian Air Force Surgeon, CF H Svcs Gp HQ
- Col Helen Wright, former 1 Canadian Air Division Surgeon, CAF
- Maj (retired) Tarek Sardana, SO Aerospace Medicine, CAF
- LCol Carmen Meakin, Clinical Leader for Mental Health, CAF
- LCol Martin Leblanc, Chief Investigator, DFS, CAF
- Maj Patricia Louttit, former Acting Wing Surgeon CFB Cold Lake, CAF
- Capt Roger Dib, Director Aerospace Equipment Program Management (Fighters and Trainers), CAF
- WO Wil Tyhaar, Director Aerospace Equipment Program Management (Transport and Helicopters), CAF. 🧯



CAUSE OBSCURE!

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

Chris Shelley joined the Canadian Forces in 1973. After graduation from Royal Military College he trained as a pilot, flying some 3,800 hours with 424 Squadron and 408 Squadron on CH135 and CH146 aircraft. He flew on operational deployments in Central America (1990) and Bosnia (2001). He commanded 408 Squadron and 1 Wing before serving as Director of Flight Safety from 2006 to 2008. Retired since 2008, Chris retains a lively interest in aviation history and flight safety.

Late in the evening of 15 May 1956, the Dominion Observatory near Dow's Lake in Ottawa, Ontario, noted a curious seismic event. Its instruments recorded an intense pulse, too short and shallow to be one of the small earthquakes so common to the Ottawa Valley, but clearly significant. Little did the scientists realize that this recording would provide key information for a flight safety investigation.

What the seismographs had measured was the impact of a fully-armed CF-100 Mark 4B interceptor smashing into the ground at 700 miles per hour, just north-west of the small village of Orleans, Ontario, killing the pilot and navigator. Had this been the only consequence, the crash would be little remembered today. Unfortunately, the jet had made a direct hit on the only significant structure for miles around, the Villa St. Louis Convent. The ensuing explosion and fire destroyed the building, killing a Chaplain, 11 nuns, and a kitchen worker. 25 others escaped with their lives.



Photo: DND

Despite a detailed flight safety investigation, the causes of this accident remain a mystery. Flight safety officers, unlike novelists, are no fans of mystery, yet even today, almost sixty years on, the RCAF could encounter similar frustrations to those the investigators faced in 1956.

The first RCAF officer to reach the crash scene found the building on fire from end to end, with great crowds of civilians blocking all the entrances and exits to the property. He enlisted the Ontario Provincial Police to clear the grounds and prevent civilian entry to the scene. As soon as emergency services had dealt with the casualties and brought the fire under control, RCAF crash investigators began their work.

The flight in question had originated as an operational mission to intercept an unknown radar track north of Montreal. Two CF-100s had been scrambled from St Hubert by CRYSTAL control (Radar Station Lac St. Denis), but had washed out after losing a rocket pod. The occurrence CF-100 had been scrambled as part of a replacement section from RCAF Station Uplands at 2129 hours and had contacted CRYSTAL control, but the unknown track was resolved before they could carry out an intercept. CRYSTAL handled both aircraft in a series of practice intercepts on their way back to Uplands and then passed control to Foymount Ground Controlled Intercept (GCI) Radar (ESKIMO) at 2211 hours. One of the

Continued on next page



CHECK SIX

CF-100s landed at Uplands, but the occurrence pilot tarried, asking ESKIMO for a practice intercept on two other inbound CF-100 aircraft. ESKIMO denied the request and monitored as the tracks of the inbound section at 35,000 feet crossed the track of the occurrence aircraft at 33,000 feet. ESKIMO noted nothing unusual. The occurrence CF-100 reported "normal" to ESKIMO at 2214, before disappearing suddenly from the radar screen at 2215. Its last known position was 10 nautical miles north-east of Uplands at 33,000 feet.

Roughly one minute later, the CF-100 struck the convent with such force that its engines slammed through two upper floors, eight inches of concrete and 35 feet of solid clay before coming to a stop. The aircraft's fuel, rockets and ammunition exploded, causing fire, massive destruction and death. Clearly something had gone horribly wrong with incredible swiftness.

RCAF investigators began the grim job of sorting out the aircraft wreckage from the ruin of the convent. It soon became apparent that the CF-100 had suffered no loss of flight control

surfaces or structure prior to impact, and the engines had been developing full power. Given that the pilot had reported no problems to the GCI controller, whatever had happened to put



Photo: DND

the fighter out of control had been sudden and disastrous. Then, as now, there were no crashworthy voice or data recorders on RCAF fighters, so telling the story of this accident would prove to be a tremendous, and ultimately futile, challenge.

Early assistance came from an unlikely source, the Seismological Division of the Dominion Observatory, Ottawa, whose instruments had recorded the impact. Knowing the distance from the crash site to the Observatory and the speed at which shock waves travel through the earth, the scientists were able to provide the investigators a precise time of 2216 hours and 51 seconds for the impact. The recorded pulse correlated to a 15-ton aircraft hitting the ground at 700 miles per hour. As the last transmission from the pilot had taken place at 2214 hours and 45 seconds ("Normal"), the investigators now knew that the aircraft had taken no more than two minutes and 6 seconds to descend from 33,000 feet above sea level and travel 5 kilometres to hit the convent in a near vertical attitude.

Examination of the aircraft wreckage provided few clues. Despite being extremely broken up by the impact with the building, there were no obvious signs of pre-impact problems or failures. Having absolutely no data from the



Photo: DND



aircraft that would illuminate the last two minutes of the flight, the investigators turned their attention toward other factors: the weather and the crew.

Weather at the time of the occurrence was a solid ceiling of cloud at 8,000 feet extending upward to 20,000 feet with better than 15 nautical miles visibility. Normally, this would not have posed a problem for a CF-100 to penetrate safely but combined with other factors could prove significant.

The Board of Inquiry (BOI) began to consider whether the crew had lost control of the aircraft. Looking at the available facts, they came up with three working theories: an upset from jet wash, oxygen starvation (anoxia), or loss of control due to Mach tuck.

Upset and subsequent loss of control could have occurred due to the jet wash turbulence of the section that had crossed over the occurrence aircraft, 2,000 feet higher. Although not impossible, the BOI considered the scenario unlikely, given that 2,000 feet was adequate vertical separation and that the occurrence pilot had spoken with GCI after the cross-over and issued no distress call.

Second was the possibility of anoxia. Incapacitation due to oxygen starvation at altitude was a spectre that stalked the RCAF through the 1950s. No fewer than 20 fatalities were attributed to anoxia in that decade. Even today, anoxia is a concern in such advanced aircraft as the F-35 and F-22 and worries about the safety of oxygen systems in many other aircraft persist. In this case, however, the investigators considered it unlikely the pilot had succumbed to anoxia. He had communicated normally with GCI just two minutes prior to the crash, showing no signs of impairment. The investigators also considered that if the pilot had lost consciousness, the navigator would have radioed this information to the GCI or would have tried to bail out at least. Therefore, anoxia was thought to be unlikely.



Photo: DND

This left loss of control due to Mach tuck. "Mach tuck" is a characteristic of all subsonic wings and was a problem with the CF-100. As a subsonic aircraft approaches the speed of sound, a shock wave develops and begins to move aft on the wing, killing lift and causing the nose to drop. The CF-100 would tuck at just over .92 Mach. This was not necessarily disastrous because the aircraft would slow

"The Board of Inquiry (BOI) came up with three working theories: an upset from jet wash, oxygen starvation (anoxia), or loss of control due to Mach tuck."

quickly if power was reduced, and the wings of the Mark 4 could take the stress. However, if unchecked, Mach tuck could lead to loss of control. If the occurrence pilot had inadvertently exceeded the limiting Mach during descent through the clouds, a sudden pull-out might have caused a black-out and loss of control upset.

As investigators focused in on the pilot's history, they found something that made this theory more chillingly plausible.

At first glance the pilot's history was unremarkable. By all accounts, the 25-year-old man had been very conscientious, keen and sober. Despite the presence of a six-week-old infant as well as a one-year-old baby in the family home, the BOI determined that he pilot had gotten adequate rest before the flight. The Flight Surgeon had been concerned when the pilot followed a diet consisting solely of fruit juices, but he had responded to counseling and was eating more conventional meals. Medical evidence showed that the pilot had eaten a proper meal before the flight. Investigators also learned that the issue of Mach tuck in the CF-100 was well-known to the pilot. It had been publicized in a recent Flight Safety "Near Miss" circular and the occurrence pilot had participated in a general discussion of the subject in the squadron, showing excellent awareness of the problem and how to recover. There was no reason why the pilot would not have been able to recover from Mach tuck had it occurred.

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CHECK SIX

Then, buried in the pilot's personal file, came a disturbing find. In early 1953, the Institute of Aviation Medicine at RCAF Station Downsview had sent a letter to the Commanding Officer of RCAF Station Gimli, warning him that the pilot, then undergoing training, had a very low G tolerance. "He registered blackout at 4.5 G, and he is considered to have a very narrow range between blackout and consciousness with

"Although the pilot had certainly been made aware of his low 'G' tolerance, he may not have been aware of the restriction, or he may have considered his posting to fighters as proof that the RCAF was ok with his physiological limitations. Either way, faulty handling of the paperwork had allowed an extremely dangerous situation to develop."

superimposed convulsive episode." Further, "it is strongly recommended that this Flight Cadet be trained as a multi-engine aircraft pilot and that he, under no circumstances, be permitted to fly fighter aircraft."

Incredibly, the letter had been placed on the pilot's file in Gimli and then forgotten. It had not been forwarded to Air Force Headquarters, and no action had been taken to stream the pilot away from employment on fighters. On the contrary, he had been selected for CF-100 interceptors despite the aeromedical assessment that he was dangerously unsuitable. Although the pilot had certainly been made aware of his low 'G' tolerance, he may not have been aware of the restriction, or he may have considered his posting to fighters as proof that the RCAF was ok with his physiological limitations. Either way, faulty handling of the paperwork had allowed an extremely dangerous situation to develop.

Now the scenario of Mach tuck seemed more sinister. If the pilot had inadvertently allowed the CF-100 to exceed limiting Mach and experienced a "tuck," the possibility of black out during an ensuing high G pull-out attempt was very likely, given the pilot's history. The aircraft would have continued then to tuck past the point of recovery, becoming an unguided missile accelerating toward the ground and the convent far below.

Despite the plausibility of the Mach tuck scenario, the BOI failed to arrive at a definitive cause for the accident, citing a lack of solid evidence. Instead, they opted for "Cause Obscure," a common result for BOIs during the 1950s. The BOI did state that there was no "evidence to indicate any carelessness, negligence or disobedience of relevant orders or instructions on the part of the pilot or of the

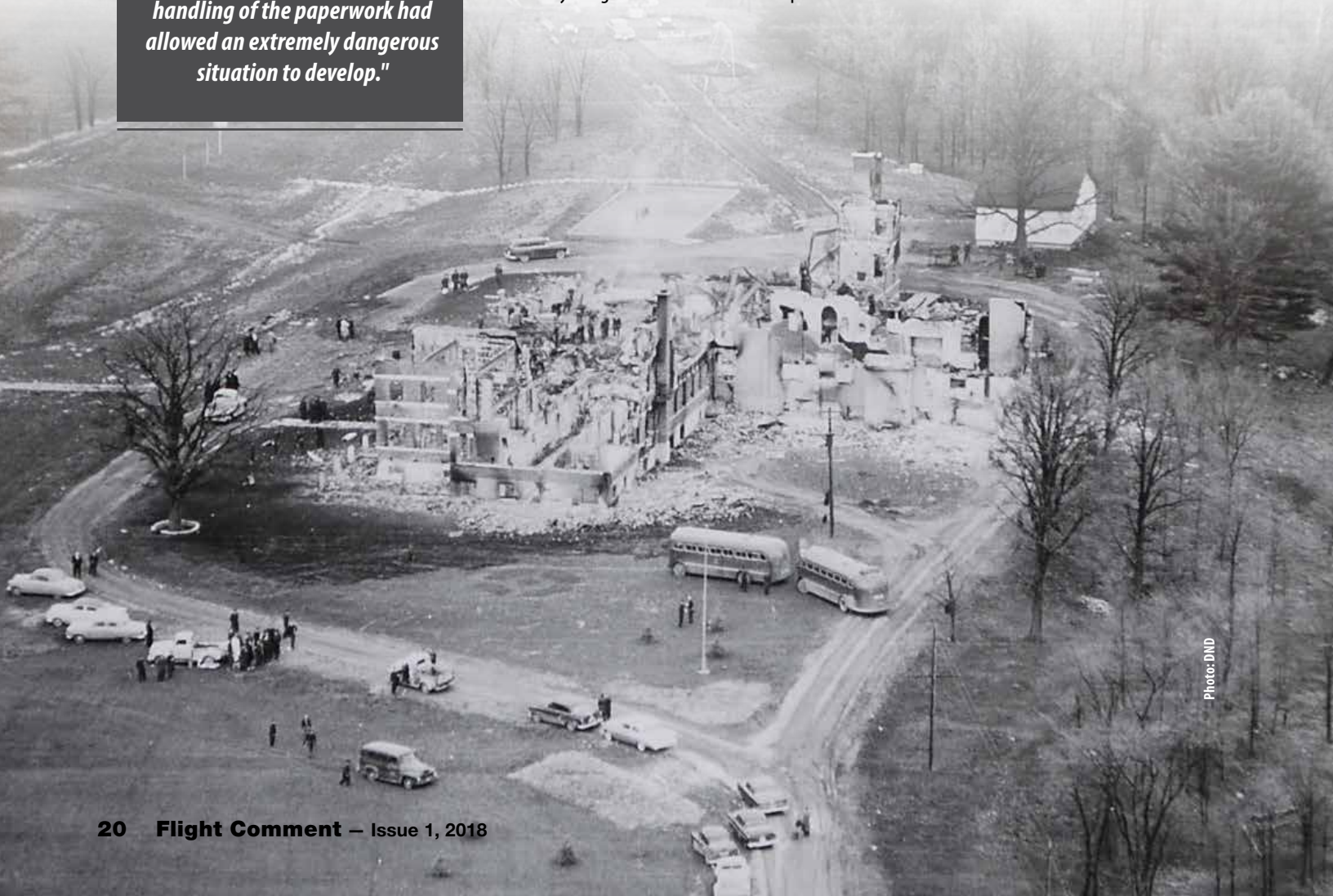


Photo: DND



navigator in relation to this flight which terminated in this accident." Higher level reviewers gave most credence to the scenario of Mach tuck and ensuing black-out by the pilot, given his medical history. Overall, it was a less than satisfactory conclusion for an investigation into such a disastrous and notorious accident and provided little in the way of useful preventive measures. As a result, the RCAF essentially closed the book on this accident and moved on. If this seems harsh, remember that the RCAF experienced 56 fatal accidents that year, as well as hundreds more Category A non-fatal accidents. There was plenty of work to be done correcting known deficiencies and little time left to ponder which systemic failures might have led to this crash.

Many years would pass before the RCAF modified flight safety investigation procedures to provide a more sophisticated approach to "cause factors." In the 1950s, Boards of Inquiry had administrative as well as safety responsibilities, and were instructed to find "the cause" (i.e.: responsibility) for accidents. While their reports produced many valuable recommendations for improving safety, they tended to be quite narrow in scope and had difficulty in tackling systemic issues. Flight safety today has a vastly improved system for identifying and classifying hazards and cause factors, and a much better record of tracking their resolution. As we have seen from this occurrence, the investigators of the 1950s were

also hampered by the absence of any kind of crashworthy on-board recording devices, and often had only extremely scanty evidence on which to base conclusions. Today, most RCAF aircraft carry crashworthy CVR/FDR, with a notable exception being the CF-18 fighter/interceptors. In that respect, not much has

changed in 60 years, as RCAF crash investigators may once again be faced with a smoking hole in the ground and little choice but to conclude, "Cause Obscure!"



Photo: DND



Photo: DND

ON TRACK

HPMA – Past, Present and Future

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

This edition of On Track will discuss HPMA related topics and was written by Captain Braden Buczkowski, HPMA Flight Commander and ICP School Instructor.

Yes, HPMA... you did read that correctly. The following article is a departure from the norm in that, unlike most other On Track articles, this one focuses on HPMA aspects and is not just directed towards pilots... members of every trade within the RCAF should be able to take something away from this.

For those of you who do not know much about Human Performance in Military Aviation (HPMA), it was introduced to

the RCAF in the early 2000s and is the follow-on to the old Crew Resource Management (CRM) program. The aim of the program is “Increased operational effectiveness through individual and team performance training.” We are the H in HPMA, and 70 – 80% of all aviation problems are due to the fact that we (humans) are involved in the process. Until there is a time that humans are no longer involved, there will be problems that we cannot AVOID, and we understand that. We have therefore developed strategies and tools that will help to TRAP and MITIGATE the problems that will inevitably arise, and I will now share some of these with you.

The first example is the AIPA (Awareness, Implications, Plan, Act) model. It is the most recognized symbol of the current HPMA program and describes our decision making process.

The three critical resources affecting any decision are Knowledge (Background or Situational), Attention (Are we lacking any?) and Time (How much is available?). These must be carefully managed in order for the decision to be made effectively. In order to do that, the person(s) involved must maximize awareness, determine the implications, develop a plan and then act accordingly. If we understand the process



by which we make decisions, we should be able to affect the outcome in a positive way.

The PACE model (Probe, Alert, Challenge, Emergency) is another tool we have at our disposal. It is a process for initiating a discussion and can best be described as a gradual escalation of the communication process that helps to prevent conflict. When faced with a non-critical situation, a probing question may be sufficient. An alerting statement would be the next step if the situation becomes more urgent, followed by a direct challenge and finally an emergency command. In some extreme cases, it may be necessary to jump straight to the emergency command, however, ideally the escalation would be gradual and the situation could be resolved early, without the need to progress to the next level.



It is worth noting at this point that Regulations and Orders, along with robust Standard Operating Procedures, well written Standard Manoeuvre Manuals and detailed checklists go a long way towards preventing many situations from even occurring, which is why they must be updated on a regular basis in order to remain effective.


When any program is replaced with a new and improved version, it is inevitable that certain aspects will be overlooked, either intentionally or inadvertently. This holds true to HPMA. The old CRM program included some great tools and techniques which did not necessarily transfer over to the new documents. Fortunately, there are some long-in-the-tooth individuals still around who remember and are willing to share their knowledge with the newbies.

Aircrew (specifically pilots) from communities who fly in formation or close proximity to other aircraft have a simple three word phrase that is universally recognized as a command to put an immediate halt to the current activities... those words are "KNOCK IT OFF." Unsurprisingly, this phrase is not to be used lightly as it will lose its importance rather quickly. There is another, lesser known, three word phrase that should hold the same level of urgency and can be used by anyone (not just aircrew) with the sole intent of raising awareness of a potential problem. That phrase is "THIS IS STUPID." It may sound silly to some, however, if these three words are ever spoken, it should serve as an immediate attention grabber. It is also important to remember, that this phrase should not be used lightly and should be reserved for occasions where the outcome has the potential of going sideways very quickly, lest we end up with a 'boy who cried wolf' situation.

Another trap that people fall into at times is referred to as "STRENGTH OF AN IDEA" which can often be compared to tunnel vision. Many times when a decision must be made, particularly within a short time period, the result can be seen as a straight path forward with no chance of altering course. The individual often affected by this would be the one who is making the final decision (Aircraft Commander, shift supervisor, etc.) and once that individual is moving forward with their thinking, it is difficult to steer them in a different direction if and when things start going poorly. It is then imperative for the remaining team members to be assertive in their statements to 'right the ship' or 'get the train back on the rails.' If anyone has ever experienced 'GET-HOME-ITIS' you know exactly what I am referring to.

Another approach for your HPMA toolbox is called the "MOST CONSERVATIVE RESPONSE." Very simply, when faced with multiple possible options, it is often preferred to choose the answer that will allow for the least amount of contention. This can sometimes be described as the safest course of action. However, if the safest solution is always chosen, it would be difficult to get the job done, due to the fact that there is always some degree of risk in military operations. Choosing the most conservative response is not always easy for the leader or their followers, since many times the decision that needs to be made is difficult and has the potential of frustrating or even alienating certain team members. Indeed, we must not forget that we are all part of a larger team and we may not always have all the information at hand.

Over the next few months, we will be hearing the acronyms FRMS (Fatigue Risk Management System) and MALA (Mission Acceptance – Launch Authority). These tools are being introduced to the RCAF with the intent of enhancing both the current HPMA program and the way we perform as a whole. It is obvious from the FRMS acronym that the focus will be on fatigue, its associated risks and how to manage them. As you will learn, FRMS has the potential to be a game changer to the day to day operations of the RCAF. Surely we can all relate to operating in a fatigued state at some point in our careers, perhaps even on a regular basis. One goal of FRMS is to educate individuals with respect to the numerous physiological aspects of fatigue so that we can all learn the proper countermeasures and mitigation strategies when we are faced with it. Much like all the other concepts discussed in this article, these new tools are intended to increase both the effectiveness and safety of our operations. However, like all tools, they must be used properly and in the recommended manner to work as they were designed to do.

There are many different HPMA strategies and tools that help trap and mitigate problems and new HPMA techniques are still being introduced. It is up to each individual to educate themselves on their options and to then pick and choose the method that works best for them. By strengthening the individual approach, and practicing these methods as a team, operational effectiveness can be greatly enhanced. 

Personal Protective Equipment for **FLIGHT SAFETY INVESTIGATORS**

by Captain Sylvie Couture, Directorate of Flight Safety 2-4-2, Ottawa

The CraSH Matrix, introduced in the “From the Flight Surgeon” article on the management of crash scene hazards, identifies various methods of controlling hazards at an aircraft crash scene including elimination, engineering, administrative measures and the use of personal protective equipment (PPE). For example, a variety of chemical and biological hazards may be eliminated by decontaminating the site with water or a 10% bleach solution. Explosive hazards may be eliminated by the specialized intervention of explosive ordnance disposal teams. Burned carbon fibres may be stabilized by applying a fixant or soil tackifier such as water, ice, firefighting foam or a 10% acrylic floor wax solution. Additionally, exposure to all categories of hazards may be reduced by strictly limiting and controlling access to the site.

While PPE is considered the last line of defence and the least effective method, it remains an essential tool for flight safety personnel. When used properly, PPE protects individuals from all categories of crash scene hazards by preventing:

- a. Direct skin contact;
- b. Ingestion or inhalation;
- c. Absorption through mucous membranes; and,
- d. Injury due to sharp, penetrating, or crushing hazards.

PPE may also offer psychological protection by providing physical separation from the crash scene and reducing exposure to distressing stimuli, such as smells. However, PPE is not a suit of armor. It can be damaged or fail and a decontamination process should be available if this happens.

When the flight safety crash scene hazards management approach was updated, the Directorate of Flight Safety (DFS) identified the need to improve its PPE process and that flight safety personnel needed better training in the use of their equipment.

Although the review is ongoing, DFS has made some important advancements. The Suffield Research Centre’s Chemical and Biological (CB) Assessment and Protection Section has confirmed that the military issued gas mask system (C4 gas mask and C7A canister filter) is a viable respiratory protection option for investigators at an aircraft crash scene provided that the individual has been trained in its use and properly fit tested to ensure they have the correct size. This section has also confirmed that the military issued rain jacket and pants (or equivalent civilian attire) provides similar or better protection than the DFS issued coveralls provided they are properly prepared as described later in this article. These confirmations have allowed DFS to develop the flight safety PPE Orders of Dress. The new Orders of Dress (poster included in this issue) consists of two

categories that are intended to allow flexible choices to suit the conditions of a crash scene. The categories are: Low Risk and High Risk.

Low Risk PPE is for relatively clean sites, such as intact aircraft interiors and hangar spaces, where there is little, if any, contamination and only nuisance dust. Recommended PPE items include non-impermeable coveralls, N95 dust masks, nitrile gloves, hard hats and boots with boot covers.

High Risk PPE is for contaminated sites, such as a crash involving a post-crash fire, injuries or fatalities, and broken or fragmented aircraft wreckage. Recommended PPE items include impermeable coveralls, full face masks, hard hats, nitrile gloves with leather outer gloves and steel toe rubber boots. Permissible alternatives to the standard High Risk PPE order of dress include military issued rain jacket and pants (or equivalent civilian attire), gas mask system, helmet, nitrile gloves with leather outer gloves and steel toe work boots.

The CB Assessment and Protection Section confirms the DFS practice of taping closures tightly shut to increase the performance of the closure and significantly reduce (and possibly eliminate) the penetration of particulates. Whether using the issued rain jacket and pants or equivalent civilian attire, the section recommends that the rain suit is

Personal Protective Equipment

Low Risk

Coveralls



High Risk

Coveralls



Military



Civilian



Dry Environment - tucked and taped clothing

Wet Environment - loose and layered clothing

appropriately sized for the user. A tailored fit avoids the bellowing effect that draws in particulates. In a dry environment, the jacket should be tucked into the pants and the “tuck line” at the waist should be taped. In a wet environment, the jacket should be left untucked in a loose and layered style to allow the particulates to be directed down and off. The ankle and wrist closures and the front zipper of the jacket should be taped, including a small patch along the neck line over the top of the zipper. Any passive venting under the armpits should be tightly zipped closed. Passive venting on the back (or elsewhere) should be taped to reduce the air flow through the closures due to the bellowing effect. If the hood fits loosely to the respirator, it should be taped, and if the hood is separate from the jacket, it should

be taped at the neck line. It is important to ensure that the rain jacket is not designed in a way that leaves a gap that exposes the skin at the neck, or that the hood cannot be tightened against the respirator. The rain suit option should provide someone trained in using PPE in a hazard zone, moderate to high protection performance, depending on the activity level.

Depending on the conditions of the crash scene, flight safety personnel will not necessarily be required to wear all PPE items specific to the Low and High Risk categories. The PPE Orders of Dress are intended to serve as a framework that the investigator-in-charge should use to determine the PPE required to be worn at the crash scene.

While DFS will continue to supply standard PPE items as listed in the *A-GA-135-001/AA-001 Flight Safety for the Canadian Armed Forces*, units have more flexibility now that the military issued rain suit (and civilian equivalent) and gas mask system have been added to the approved list of PPE options.

In addition to the enclosed articles and poster, DFS is producing a series of short videos to increase awareness of crash scene hazards, introduce the new flight safety PPE Orders of Dress and improve training on the use of PPE. These videos will soon be available on the DFS website. 📺

Keep Scanning

by Corporal Mirjon Gjoza, 450 Squadron, Petawawa

It was Friday afternoon in mid-September. The sun was shining, and we were enjoying unusual high temperatures for that time of year. With the weekend up ahead and great weather it was the perfect time to go flying.

Our trip was a local area training flight in the north Tactical Low Flying Area (TLFA). It included a tactical navigation with multiple landings in confined areas throughout the route. The north TLFA is a vast, sparsely populated area of natural beauty and abound with rivers, lakes, forests and dirt roads. The crew was standard for a CH147 Chinook consisting of 2 pilots and 2 flight engineers with a mixture of experienced and junior crewmembers.

Amongst the Landing Zones (LZ) was one that is commonly known as the waterfall. A chute in the Coloungue River with a small rocky outcrop to one side, just big enough to set the two aft wheels of the helicopter. This place is very popular to conduct a pinnacle landing, it's quite spectacular. Due to its beauty and access from the road it's also a popular destination for outdoor enthusiasts.

On short final, the area started to open up through the trees. I was positioned at the cabin door of the aircraft, voice marshalling the pilots,

to position the aircraft for landing. On the final few strokes of the approach we came to a hover approximately 60 feet above the ground. My focus was to the aft of the aircraft where rocks and trees were the biggest danger. As we came into a hover, I heard the other crewmember from the ramp announce "Overshoot! Overshoot! Overshoot!" while simultaneously I watched camping gear start to fly around.

A tent, stove and cooler were thrown by the immense rotor wash of the Chinook. In the overshoot, the condition was exacerbated as power was increased, and the gear flew into the lake and farther around the rocks. During the departure a canoe, with two men fishing out of it, was spotted at the end of the lake. They were still in the canoe, floating and uninjured, so we proceeded with the rest of our training mission without further irritating them.

Back in Petawawa, after shutting down, I reflected on the incident and tried to figure out what went wrong and how to prevent it from

happening again. This time the damage was minor, with only some wet and damaged camping gear, but the potential for severe injury or worse was there, considering we had people so close to being blasted with our rotor down wash.

The moral of this story is to always keep scanning your areas of responsibility. Especially during those last few feet of the approach where the tendency is to focus on the immediate danger. Had I been paying attention forward just as much as aft we would have overshoot the area early, high enough above the landing site to not affect the canoeists. In addition, knowing this site is a popular area for campers and picnic goers, the crew could have briefed it beforehand. The brief could have stated that we would conduct a low recce (reconnaissance) of the LZ prior to turning into a final approach to land. Instead of creating two angry gentlemen, we would have possibly gotten a wave and the two canoeists would have had a good story to tell rather than having all their gear soaked and their fishing trip possibly ruined. 🐟



Photo: Sgt Marc-André Gaudreault

LESSONS LEARNED



Photo: Cpl Audrey Solomon

Recognizing and Reacting to Change

by Sergeant Andrew Latta, 431 Squadron, Moose Jaw

We've all heard that humans are "creatures of habit." This is probably why we find change difficult to handle but, unfortunately, change is inevitable. Luckily, changes that happen gradually are easier to mitigate and we can prepare for the foreseeable outcomes. However it's the little changes that happen quickly that we have a difficult time recognizing and reacting to.

When organizing aircraft maintenance and servicing, the influencing factors of aircraft schedules, personnel levels, available qualifications and weather, all must be considered. When these factors change suddenly we need to recognise the changes and react accordingly.

One morning, while walking out to an aircraft to see how a B check was progressing, I noticed the flight line was wet due to the rain we had experienced overnight. A few hours later, on a subsequent trip to the aircraft, I failed to

realize that the temperature had dropped significantly and the wet looking flight line was actually covered in a thick layer of ice. After a few steps my feet and my shoulders were horizontally even and I quickly learned the painful lesson of not recognizing and adapting to change.

"After a few steps my feet and my shoulders were horizontally even and I quickly learned the painful lesson of not recognizing and adapting to change."

On another occasion, I was in charge of a crew towing a CC130 out of the hangar to make space for another CC130 that required maintenance. The hangar was congested so

the outer wing of the first CC130 would have to pass over a piece of equipment on the way out of the hangar. Since the wing of a Hercules aircraft is quite high, I wasn't worried. We towed the aircraft out without issue, passing over the equipment with lots of space to spare.

We connected the tow bar to the second CC130 and proceeded towards the hangar, to the spot we had just towed the first aircraft from. As the CC130 entered the hangar, I noticed something significant. This Hercules aircraft was fitted with air-to-air (AAR) refueling pods while the first aircraft was not. The AAR pods hang down about four feet below the wing. I looked to my wing walker who was happily walking with their thumb up in the air indicating everything was good. As the pod approached the piece of equipment in the hangar, I could see that it wasn't going to have the needed clearance, so I yelled for

Continued on next page

LESSONS LEARNED

Recognizing and Reacting to Change ...Continued

the aircraft to be stopped. I walked over to the wing walker and we looked at the pod versus equipment battle we had narrowly avoided. I asked the wing walker why they hadn't warned me about the imminent collision. The wing walker replied that they weren't really paying attention because they had assumed that if the first aircraft cleared the equipment on the way out than the second aircraft would clear it on the way in. I reminded them of the

popular saying to what happens when we "assume", then we moved the equipment out of the way and safely carried on with the tow of the second CC130.

What these experiences have taught me is that situations and environments change, whether by our hand or due to forces beyond our control. As technicians, we need to recognize these changes and then adapt quickly. We are

well trained which makes adapting easier, but we need to work on maintaining our situational awareness to help us recognize the changes. If we can do that, then maybe we can avoid the negative consequences that make changes so difficult to bear. ⚡



Photo: Cpl Ian Thompson

LESSONS LEARNED



Photo: MCpl Robert Bottrell

UNINTENDED HOOD ORNAMENT

by Master Bombardier Corey Bowe, W Battery, The Royal Regiment of Canadian Artillery School, Gagetown

Prior to the use of the current RAVEN B and the Maveric Unmanned Aerial Systems (UAS), the Canadian Armed Forces used the Skylark. Like many miniature UAS, the Skylark was designed to be hand launched and was recovered by inducing a deep stall and using a highly visible, yellow airbag system which allowed it to land gracefully on the ground.

The following event occurred in 2010, in a large, open area of the CFB Gagetown training area. A small detachment of three members, including myself, Gunner (Gnr) "Red" and our detachment commander, were sent out on a tasking to fly the Skylark over one of the many impact areas.

The flight went as expected with Gnr Red as the pilot and I as the launcher. We had no complications during its flight until the landing.

We intended to land the Skylark nearby to ease the recovery process but, upon time to do so, an unexpected pickup truck rolled up. The driver, an unqualified officer named Captain "Pink," stopped his truck, rolled down his window and asked how things were going. I told him that we were preparing to land the Skylark near the spot where he was parked and suggested that he should move his vehicle back off the landing point. Captain Pink looked out the window trying to spot the aircraft but did not seem to see it. He shrugged off my warning, stating that he was going to be quick and would pass through and be on his way. From behind me, I heard Gnr Red say "the aircraft is in Autoland", meaning the aircraft had stalled and started its descent. We had less than a minute before the Skylark reached the ground.

I tried to tell Captain Pink that he should wait to move but he disregarded my suggestion and started to turn the truck around.

Shortly afterwards, the Skylark dropped on the hood of the pickup truck and then bounced on to the ground. Captain Pink jumped out of his vehicle and proceeded to go above and beyond to declare that we were in the wrong and should have "controlled the aircraft better." We made it abundantly clear that we were not in the wrong and that he had neglected the warning to move back from the landing site.

People make the joke that "if a warning exists, it's usually because someone had ignored a situation before and something, most likely bad, had happened because of it." This rings true to this situation and is the reason why we tell people to remain clear of landing sites so injury and/or damage can be avoided. Despite this event being only a minor incident in the end, we were all lucky that no one was injured. It was, however, a valuable lesson of why we should all take heed to warnings, no matter the rank or position of those who give them. 🚩

DON'T FORGET TO LOOK UP

by Master Corporal Chris Sheehan, 429 Transport Squadron, Trenton

Ten years ago our “periodic inspections” of the CC177 Globemaster were being carried out in the United States due to a lack of internal infrastructure. Our maintenance section consisted of myself and one other person. This meant that we had to prepare and build the pack for the trip and also manage the team pairings and assignments when the main body for the inspection was pulled from the servicing section. This was a never ending cycle of two weeks deployed and then two weeks of unpack, followed by pack and prepare for the next inspection. It was a busy job for the two of us.

During one trip to the States, when we were in the repair and operational checks phase of the inspection, I required hydraulic power to check an item that I had repaired. I did my normal look around the cockpit for tags, breakers or locks and everything looked good. But, by failing to take the time to review all the paperwork of the morning's events, I had just made my first mistake. I then proceeded to do

my walk around the aircraft and talked to all technicians to ensure that no one had an issue with hydraulic power being applied. Everyone was fine with the intended application but by

“There was no injury or damage and a decade later we are still friends but this occurrence abruptly taught us to be mindful of all of our surroundings, to pay close attention to details and to follow recommended practices.”

then I had made my second mistake. I had forgotten to look up during my walk around. Satisfied with my checks, I proceeded back to the cockpit and pressed the hydraulic systems power button. Within seconds I heard yelling and could see people scrambling to get to me.

I immediately turned the system off and went to see what was going on. Outside the aircraft I saw my teammate and partner in crime coming down from a suspended maintenance platform at the tail. He had finished his tasked job and thought he would give us a hand by affecting a quick repair up between the upper and lower CC177 rudders. In his haste to assist, he neglected to safety the surface he was working on and he did not inform anyone of his intentions. Luckily, he had just pulled his arm out of the danger area between the rudders seconds before I applied power. I had almost crushed his arm.

There was no injury or damage and a decade later we are still friends but this occurrence abruptly taught us to be mindful of all of our surroundings, to pay close attention to details and to follow recommended practices. Had I looked up during my walk around,

I would have seen my friend or at the very least seen the suspended maintenance platform and had I checked the paperwork of the morning's events, I would have seen my friend's entry into the work log. Having an awareness of at least one of these things would have alerted me to not turn on the hydraulic system. In regards to my friend, had he safetied the hydraulic breakers in the cockpit, he would have prevented the hydraulic system from being turned on. And, had my friend informed others of his intention to conduct the work on the area between the rudders, I would have been informed about the potential conflict when I conducted my walk around. Four safety holes lined up that morning, but we were lucky. Here's your chance to read my story and learn how you too can fill in some of your own safety holes! 🦄



Photo: Cpl Kenneth Galbraith



Photo: MCpl France Morin

LESSONS LEARNED



Photo: MCpl Pierre Thériault

The Importance of Follow Through

by Captain Joel Wilson, 2 Canadian Forces Flight Training School, Moose Jaw

As a flying instructor, follow through is the act of observation physically, visually, and mentally as the student is flying the aircraft. Following a student through on the controls allows for easy identification of errors and, most importantly, helps ensure the maneuver being flown is done so safely. As a junior flight instructor, the importance of follow through was reinforced abruptly when I found myself where no instructor ever should ever be: out of control of the situation.

I was flying a basic aircraft handling mission on the CT-156 Harvard II with a student I had become quite familiar with having flown the majority of the course with them. Landing the aircraft, up to this point in the course, had been well performed and safety of flight was never an issue in previous missions. In this particular instance, the student pilot commenced a landing transition above the

desired height above the ground. Rather than rectifying the situation by overshooting from the unsafe flight condition, the student made the opposite control inputs resulting in a stall and hard landing. In recent history, a hard landing from a similar situation on the same aircraft type lead to catastrophic damage to the aircraft and an ejection as the crew was unable to achieve a suitable landing configuration. With this in mind, I immediately took control of the aircraft to abort the subsequent takeoff roll and taxied the aircraft back to the ramp without further incident.

Due to familiarity with the student, my follow through as an instructor was weak at best. Therefore the time required to rectify the situation, caused by the student's incorrect control inputs, far exceeded the time available to recover. I had lost control of the situation. The aircraft involved was inspected and found

to be airworthy following the incident; nevertheless, many lessons were brought forward from the ensuing flight safety investigation. The intensity of the situation reinforced the importance of active follow through during student handling especially during critical phases of flight such as landing. Regardless of airborne or ground operations, familiarity with a student should never be an excuse for weak follow through or supervision during a task; no one is immune to mistakes especially in the training environment. Finally, with respect to this specific scenario, anticipating student errors and being prepared for intervention before they occur is the best way to maintain control over the situation and to ensure safety in the aircraft is never jeopardized. ✈

From the Investigator

TYPE: SAR Griffon CH146432


LOCATION: Opa Locka, Florida

DATE: 28 February 2018

The six person crew was operating the 424 Squadron CH146432 Griffon helicopter (search and rescue configuration) out of Opa-Locka airport, near Miami, Florida, as part of Ex Southern Breeze. During the winter months, search and rescue crews travel to Florida to conduct overwater training that cannot be accomplished at the home unit. The mission was a training flight for an under-training flight engineer consisting of mostly overwater hoisting work.

Approaching the Opa-Locka airport control zone after the mission, the crew had commenced the pre-landing checks when the life raft inadvertently departed the aircraft. The raft was visually tracked by the instructor flight engineer as it fell from approximately 500 feet above ground level and was seen to impact the roof of a house. The crew circled the helicopter back overhead the house to mark its location, then continued to the airport for landing.

The incident was reported to local police who assisted the crew in recovering the life raft from the house. There were minor injuries sustained by an occupant of the house, and the house sustained damage to the roof and a bedroom. There were no injuries to the crew or damage to the aircraft.

The investigation is focusing on how equipment is secured in the aircraft during flight. 



Photos: Maj Andy Haddow

Epilogue

TYPE: CH12424 Sea King
LOCATION: CYA 102,
South of Victoria, BC
DATE: 2 December 2014

During an over water CH124 Sea King pilot conversion flight south of Vancouver Island, the crew, consisting of a maritime helicopter flight instructor, a student pilot, an air combat systems officer, and an airborne electronic systems operator, carried out various tactical manoeuvres in accordance with the maritime helicopter co-pilot training plan. During a freestream manoeuvre where the helicopter must initially climb vertically from the over water hover to several hundred feet, the helicopter began drifting rearward and down. The maritime helicopter flight instructor took control from the student pilot and attempted to stop the descent by applying power and adopting a nose down attitude but was not able to fully arrest the descent. This resulted in the helicopter unexpectedly touching down on the water. The maritime helicopter flight instructor then lifted off from the water and returned to Victoria International Airport.

Post-occurrence maintenance inspections and instrument panel video monitoring system revealed no technical faults. The investigation focused on aircrew actions and human factors. The investigation explored the conditions required for settling with power, vortex ring state, and procedures for conducting freestream manoeuvres.

The investigation concluded that the crew did not recognize the onset of vortex ring state and did not completely carry out a vortex ring

state recovery procedure. This was likely due to the lack of maritime helicopter vortex ring state training.

Recommended preventative measures include evaluating Maritime Helicopter vortex ring state recovery procedures, adding vortex ring state ground and simulator training to the 406 (Maritime) Operational Training Squadron maritime conversion course, and a review of the 406 (Maritime) Operational Training Squadron student pilot flight currency policy. 4



Photo: Maj Devereux



Photo: Cpl Blaine Sewell

Epilogue

TYPE: CF188796 Hornet
LOCATION: Cold Lake, AB
DATE: 20 June 2017

Two CF188 pilots (call signs Mig-1 and Mig-6) completed individual Maple Flag missions uneventfully in the Cold Lake Air Weapons Range and returned to base together as a two-ship formation. Mig-1 led and Mig-6 was the wingman. In order to deconflict with the other aircraft returning to base Mig-1 and Mig-6 maintained a higher airspeed to the airport.

Overhead Cold Lake aerodrome runway 13R at 1,500 ft above ground level and a speed of 470 knots, Mig-1 entered the overhead break in a right hand turn followed three seconds later by Mig-6. During the overhead break Mig-6 set the throttles to idle, initially set the bank angle to 81 degrees, and pulled up to 6.8g in order to slow the aircraft in preparation for turning final with gear down and locked.

Mig-6 did not perform the anti-g straining maneuver, and was flying with a loose fitting g-suit with comfort zippers undone. Two seconds into the overhead break and at 6.8g, Mig 6 almost lost consciousness. Mig-6 experienced

short term (approximately 5 seconds) impairment of cognitive and motor functions, and the aircraft began descending towards the ground. Mig-6 heard the audible warning from the Terrain Alert Warning System, and with improved cognitive and motor functions, Mig-6 pulled 7.0g and avoided the ground by 270 ft.



Mig-6 climbed away from the ground and now fully recovered, advised Mig-1 of the need for assistance and the desire to land. Mig-1 notified air traffic control to give them priority to land and calmly assisted Mig-6 to a safe landing. Mig-6 was met by first responders and taken to the 4 Wing base hospital for evaluation.

The evidence demonstrated no aircraft or aviation life support equipment (ALSE) malfunction. The incident occurred due to human factors. The pilot was knowingly flying with a loose fitting g-suit. The g-suit was loose fitting due to pilot weight loss, and lack of adherence to an ALSE – Canadian Forces Technical Orders requiring a g-suit on body fit check to be completed every six months.

The safety recommendation is to incorporate the g-suit inspection requirements and pilot responsibilities regarding g-suit fitting into an appropriate aircrew publication to provide lasting education/awareness for CF188 pilots. ✈



Epilogue

TYPE: Jet Ranger C-FTHA
LOCATION: Portage la Prairie, MB
DATE: 6 May 2015



The accident aircraft, a Bell 206B Jet Ranger III helicopter, was on mission NAV 1 of the Phase III pilot training course out of 3 Canadian Forces Flight Training School in Portage la Prairie, Manitoba. The helicopter was crewed by a qualified flying instructor and a student pilot.

During the return to base following completion of the navigation portion of the mission, the qualified flying instructor gave the student pilot a simulated engine failure emergency at approximately 500 feet above ground level. The qualified flying instructor reduced the throttle to idle to simulate the unexpected engine flameout while advising the student pilot of the simulated emergency. The student pilot responded by reducing the collective to enter autorotation. The student pilot completed the required radio call while establishing the aircraft into wind on final approach to the

selected landing area – a field of low-cut hay which included several water-filled depressions.

With no intention of continuing the autorotation to a landing, the qualified flying instructor took control of the helicopter at approximately 120 feet above ground level and initiated a power recovery, but the engine did not respond as expected.

This resulted in the rotor revolutions per minute decaying as the helicopter continued in a slight descent over the field. While overflying approximately 1,200 feet of distance over the open field, the qualified flying instructor continued to gradually increase collective to prevent the helicopter from settling into a couple of shallow, water-filled depressions.

Running out of energy in the rotor, it became apparent that an overshoot was not possible. The qualified flying instructor flared and used

what energy remained in the rotor to settle the helicopter onto the ground. The helicopter landed firmly with considerable forward speed and came to a stop approximately 200 feet past the initial touch down point, after which the helicopter was shut down.

The helicopter sustained serious damage to the tail boom and numerous components surrounding the main rotor transmission. There were no injuries.

The investigation focused on the apparent slow response from the engine and on human and organizational factors. With no deficiencies found related to the engine power response, the preventive measures are aimed at human factors related to maintaining rotor speed during autorotations. ⚡

Epilogue

TYPE: CF188747 Hornet
LOCATION: Cold Lake Air Weapons Range
DATE: 28 November 2016

The pilot of aircraft CF188747, using the call sign “Swift 32”, was part of a two-ship formation led by “Swift 31” for an air-to-ground training mission. The mission objective was to practice level deliveries of two Mark 83 inert bombs followed by two laser guided training rounds, simulating laser guided bombs, in the Cold Lake Air Weapons Range. The plan was to ingress to the target and drop weapons from 600 feet above ground level. To avoid simulated bomb fragmentation after dropping their bombs each pilot would fly a “breakaway manoeuvre” comprising a steep turn through 90 degrees of heading change.

Following his Mark 83 drop, Swift 32 manoeuvred his aircraft in a manner that was suggestive of a pilot attempting to visually spot his weapon impact, losing over 200 ft of altitude in the process. Swift 32 then assumed tactical lead, with Swift 31 flying about 2 miles in trail of Swift 32 and lasing the target for Swift 32, who

then dropped his laser guided training round. The ingress to the target was flown at approximately 500 feet above ground level.

Immediately after dropping his laser guided training round Swift 32 initiated a steep left turn, reaching a maximum left bank angle of 118 degrees while pulling approximately 5g. The aircraft nose began to pitch towards and then below the horizon, eventually reaching a nose-down pitch angle of minus 17 degrees and concurrently generating a large descent rate.

About 1.5 seconds before impact the aircraft began rolling right. The bank angle had reduced to approximately 30 degrees left and the pitch angle increased to approximately minus 10 degrees when ground impact occurred. Swift 32 made no radio calls during the turn, did not eject and was fatally injured when the aircraft struck the ground in a descending left turn.

The available evidence did not support a mechanical failure, bird strike or pilot incapacitation scenario. Therefore, it appears that the pilot was capable of controlling the aircraft but did not adequately monitor the aircraft’s flight path while manoeuvring in the low level environment, and allowed the aircraft to enter an overbank situation and the nose to drop well below the horizon. A recovery may have been attempted at the last second but there was not enough altitude available to safely recover the aircraft. While the reason for this lack of flight path monitoring is not knowable with any certainty, circumstantial evidence suggests that the pilot may have been distracted from the critical task of terrain clearance while attempting to spot his weapon impact.


Safety recommendations include the re-enforcement of low level awareness training principles and improved training on Terrain Awareness Warning System reactions. 



Photo: © Bryan Carter

Epilogue

TYPE: CC130338 SAR Technician
LOCATION: Yorkton, Saskatchewan
DATE: 8 March 2017

The accident occurred during a 435 (Transport and Rescue) Squadron CC130H Hercules Search and Rescue training mission. The aircraft departed Winnipeg with a crew of nine and proceeded to the Pelly / Kamsak area of Saskatchewan to complete basic Search and Rescue sequences and then transited to the Yorkton airport with the intent of doing live static line parachute jumps followed by supply drops.

Once in the Yorkton area the aircraft was established at 2,000 feet above ground in level flight at 124 knots indicated airspeed in a flap 50 percent configuration and flown into wind over the desired target. The sky was clear, it was -16° Celsius and the surface wind was out of the northwest at 19 knots gusting to 24 knots. After completing their briefings and safety checks, the Search and Rescue Technician Team Leader exited the aircraft via the open rear ramp at the pre-determined point. The Team Leader exited using the “ball” style technique. The Search and Rescue Technician Team Member followed a few seconds after the Team Leader using the “reverse arch” (semi-sitting) exit technique.

Immediately after leaving the aircraft the Team Member appeared to interact with the aircraft’s slipstream, causing his left leg to move upwards and his body to roll slightly to the right. As this was happening, the static parachute line system began to deploy his main parachute. The parachute did not deploy normally and the evidence strongly suggests that the main canopy suspension lines became severely twisted. This resulted in an uncontrollable parachute that entered a rapidly descending clockwise spiral.

The Team Member was observed to attempt to untwist the lines, and at one point performed the non-standard action of releasing his Search and Rescue – Personnel Equipment Lowering System bag, presumably to aid in the required kicking motion with his legs. His efforts were unsuccessful and while attempting to clear the twists he likely lost situational awareness of his altitude and descent rate. As a result, he did not take action to cut-away and deploy his reserve parachute before reaching the ground. The Team Member was fatally injured when he struck the ground.

The investigation did not find any evidence of an improper pack or a materiel failure of the Team Member’s equipment. Malfunctions during parachute jumps from the lower altitudes (for example 1,500 to 2,000 ft above ground) leave little room for error and action

must be taken quickly to resolve the problem or cut-away the main parachute and deploy the reserve.

Preventive measures are focussed on enhanced training processes and the implementation of an automatic altitude awareness aural warning device. 🔥



Photo: Cpl Ian Thompson



Photo: MCpl Johanie Maheu

Note: These are stock images and not from the actual occurrence.

United Kingdom Flight Safety Symposium



In December 2017, DFS was invited to participate in a United Kingdom Flight Safety (FS) Symposium and to make a presentation on RCAF Wing FSO duties. While there, the Canadian FS team visited the Defence Accident Investigation Branch (DAIB) at Farnborough House, in Hampshire, England, to learn more about the United Kingdom Ministry of Defence flight safety and investigation organisations.

Left to right:

Colonel John Alexander, Director of Flight Safety, RCAF;
Group Captain Andrew Bastable, Head of the DAIB, Royal Air Force (RAF);
Colonel (Retd) Steve Charpentier, DFS 3 – Promotion and Safety, RCAF;
Major Alasdair Clarke, 4 Wing Flight Safety Officer, RCAF;
Wing Commander Stuart Oliver, SO1 Air, DAIB, RAF.

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