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Flight Comment

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Canada

Director of Flight Safety

Views on Flight Safety

By Colonel Gary Doiron, Director of Flight Safety, Ottawa

Since taking over as the Director of Flight Safety this past August, I have had the opportunity to meet many of the Flight Safety professionals throughout Canada and abroad at the annual DFS seminar. I am constantly amazed at how passionate and active all of you are in promoting Flight Safety.

I am also very much looking forward to meeting the airmen, airwomen and others that support operations during the annual DFS briefing. It is each and every one of you who provide the key to the success of our Flight Safety program.

It should be evident that the Canadian Forces and the Air Force are in the midst of major change. I would suggest that the period we are going through right now is very similar to the early 1950s. Then, like now, we are seeing a major investment in new aircraft to replace many of the aging fleets and with these new aircraft we will be taking major leaps in technology. We will continue to support operations that demand significant resources, while at the same time increasing the intake of new personnel to ensure we will have the right people with the right skills to do the right job in the future.

All of our new aircraft have increased automation integral to their design and we should expect automation to be prevalent in our future fleets. There will be a lot more emphasis on simulation, not only for aircrew but also for ground crew. The complexity of these new weapon systems will affect how we operate and maintain them, bringing new maintenance concepts and the attendant potential for errors. At the same time we are developing a new maintenance workforce with less experience on current aircraft systems. Our Flight Safety program will become more important than ever in maintaining our enviable safety record. While the nature of our work has inherent risks, and we have no magic formula to determine exactly what that risk is, there is a big difference between what we consider an acceptable level of risk in a training environment and what we are willing to accept in actual operations. Regardless of the environment, whether we find ourselves in the conduct or support of operations, we must ensure that risk is accepted at the appropriate level.

While no one comes to work with a personal mission to have a flight safety occurrence, a review of occurrences for 2007 indicates that human factors remain the largest source of flight safety concern. The last 63 years of the Flight Safety program have resulted in the development of a strong safety culture that relies on open and honest reporting. The key to maintaining our success in this Flight Safety program is by reporting and learning from our errors and thinking through decisions in order to balance our can-do attitude. While we are indeed in a situation similar to the 1950s, our Flight Safety program can provide much lower accident rates than that of our predecessors.

Remember:
Safety is no Accident! ◆

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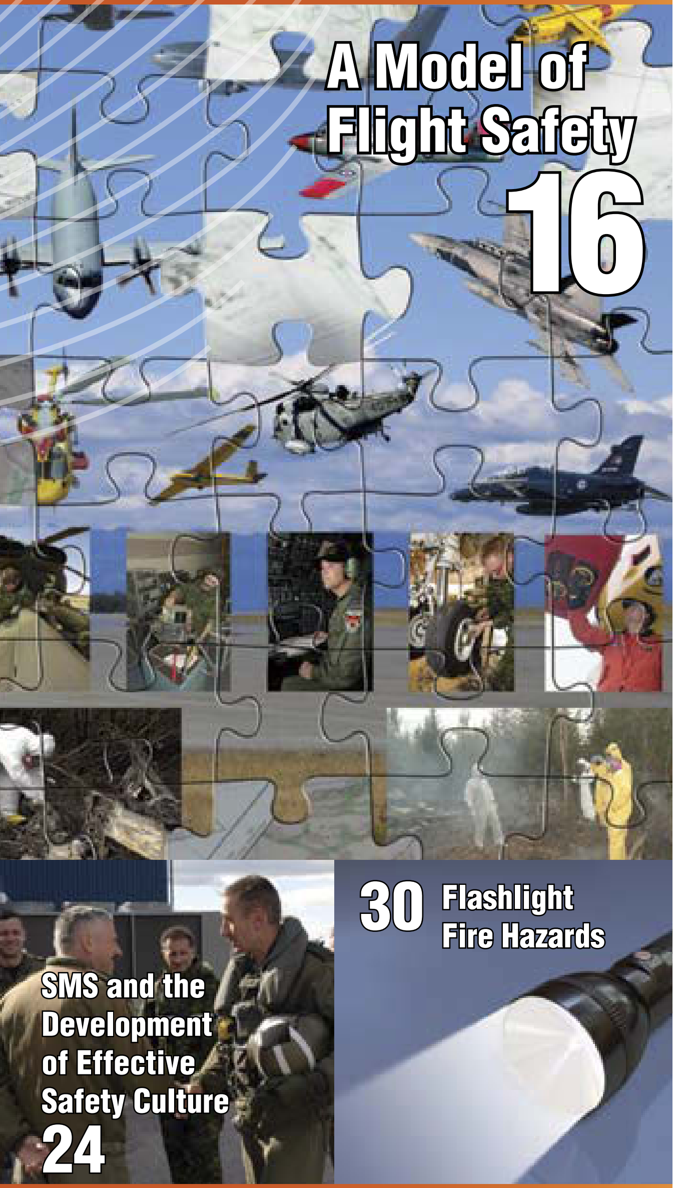

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Cover Page: An Aviation Systems Technician and a Flight Engineer of 440 Squadron, Yellowknife, installing a new generator on the starboard engine of a CC-138 Twin Otter aircraft at Eureka, Ellesmere Island, Nunavut. Photo by Mcpl Kevin Paul

DIRECTORATE OF FLIGHT SAFETY

Director of Flight Safety
Colonel Gary Doiron

Editor
DFS 3, Jacques Michaud

Graphics and design
Christine Savard
Corporal Eric Jacques

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Send submissions to:

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

Telephone: (613) 992-0198
FAX: (613) 992-5187
E-mail: dfs.dsv@forces.gc.ca

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Good Show

For Excellence in Flight Safety

Private Frederic Tremblay-Gagnon

On 6 May 2008, Pte Tremblay-Gagnon was assisting with a Supplementary Inspection on Sea King CH124410. While wiping the rotary wing head of excess grease, he discovered seven out of eight bolts holding the horn assembly to the #2 blade sleeve and spindle were loose. Being an apprentice technician, he immediately informed a qualified technician who confirmed the unserviceability. On his own initiative Pte Tremblay-Gagnon quickly investigated the remaining sleeve and spindles, as well as a random search of other aircraft in the hangar, discovering several were in the same condition. He then informed his supervisor of the findings and a hangar-wide inspection of all aircraft was carried out revealing seven out of ten aircraft were affected. He persisted in researching the history to find there were two previous fleet Special Inspections carried out addressing the same issue. Subsequently, with assistance, he drafted and submitted an Aircraft Inspection Change Proposal (AICP) proposing torque checks be carried out on the horn assembly hardware during #12 and #24 Supplementary Inspections.

Although the Supplementary Inspection card calls for a visual inspection of the head and every blade, it is highly unlikely this problem would have been found without touching each bolt head one by one. It was discovered only through Pte Tremblay-Gagnon's keen eye and impressive attention to detail. Had the unserviceability gone undetected, it could have led to a complete rotor head failure and loss of aircraft control while airborne. The result would have been catastrophic.

Pte Tremblay-Gagnon's meticulous inspection techniques and exceptional professional attitude averted a serious flight safety occurrence. ◆

Pte Tremblay-Gagnon is currently serving with 423 Maritime Helicopter Squadron, 12 Wing Shearwater.

From the *Flight Surgeon*

Dry and High

Dehydration causes an insidious degradation of pilot performance that must not be lightly regarded.

By Linda Werfelman

This article was published in the Flight Safety Foundation Journal AeroSafety World, June 2008. It is reproduced with the kind permission of the Flight Safety Foundation.

Excessive loss of water from the human body can lead to dehydration, marked by fatigue and a deterioration of mental and physical performance that can have serious consequences for pilots.

Pilots with health problems, including intestinal viruses or food poisoning, and pilots of small airplanes and helicopters without air conditioning and/or with large, heat-intensifying windshields — especially those operating on hot days — may be most susceptible to the ill effects of dehydration. However, pilots of air carrier aircraft are not immune.

For example, the first officer of a Boeing 737-700 said, in a report submitted to the U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS), that she had become ill in July 2004 during a flight from Nashville, Tennessee, U.S.[1]

In her report, the first officer said that the night before the flight, she had been sick with nausea, vomiting and diarrhea, which she assumed to be associated with food poisoning, but that she felt “physically fit to fly” when she reported for duty. During cruise, she experienced repeated bouts of nausea and complied with the captain’s eventual instructions to leave the cockpit to rest in the cabin while he diverted the airplane to an en route airport for landing. Emergency medical services personnel met the airplane, examined the first officer and determined that her nausea was not a sign of serious illness and her lingering weakness was caused by dehydration.

Dehydration occurs when water consumption is inadequate or when the human body loses an excessive amount of water — through heavy perspiration, exposure to hot weather, fever, vomiting or diarrhea, use of diuretics to increase urine excretion, and some diseases. The low humidity in pressurized air carrier aircraft also is a contributing factor. In addition, alcoholic beverages — such as those consumed a day before a flight — and caffeine have diuretic effects.

Water accounts for about two-thirds of body weight and is an essential component of the human body, needed for replicating cells, moving nutrients and waste products, and regulating body temperature. The kidneys excrete between 1.0 pt (0.5 L) and several gallons (1.0 gal equals 3.8 L) daily — a typical amount is 3.0 to 4.0 pt (1.4 to 1.9 L); in addition, varying amounts of water are lost to perspiration.

To stay healthy, an individual must consume enough water to offset these losses. For years, typical recommendations have called for drinking 2.0 qt (1.9 L) of water daily, although some medical specialists question the rationale for that recommendation (see p.6 for “Recommendations for Preventing Dehydration”).

An editorial in the April 2008 *Journal of the American Society of Nephrology* said that the origin of the recommendation is unknown but that different studies have made a variety of claims about the supposed benefits of drinking water, ranging from improving kidney function and aiding weight loss to preventing headache.[2]

“There is no clear evidence of benefit from drinking increased amounts of water,” the editorial said. “We concede there is also no clear evidence of *lack* of benefit. In fact, there is simply a lack of evidence in general.”

Recommendations for Preventing Dehydration

The following are recommendations for preventing dehydration and other heat-related problems:[1]

- Drink about 2.0 qt (1.9 L) of water every 24 hours, although the exact amount varies widely. Drink before you become thirsty, and drink from a container that allows you to measure daily water consumption;
- Limit consumption of alcohol and caffeine. Both are diuretics, which increase the excretion of urine;
- Monitor work and recreational activities, and stop what you are doing if you feel light-headed or dizzy. Exercise can result in water loss that is difficult to overcome quickly;
- Be aware of your physical condition, especially if you have recently been ill; and,
- Remember that your body's adjustment to a major change in weather, such as the sudden onset of hot weather, can take one to two weeks.

— LW

Reference

1. Shaw, Rogers V. III. "Dehydration and the Pilot." *The Federal Air Surgeon's Medical Bulletin* (Spring 2000):0.

Nevertheless, aeromedical specialists say that failing to drink an adequate amount of water can result in an increased susceptibility to fatigue.

For example, the U.S. National Transportation Safety Board (NTSB) discussed dehydration and fatigue in its final report on the crash of a Bell 206B during a sightseeing flight on the Hawaiian island of Kauai on Sept. 24, 2004. The pilot and all four passengers were killed in the crash, which also destroyed the helicopter. The NTSB report said that the operator's schedule included no breaks for pilots, who typically ate lunch in their helicopters and remained at the controls for up to eight hours, and that the staging area had no restroom facilities.[3]

"The lack of scheduled breaks, the short turnaround times between flights and the unavailability of private restroom facilities probably discouraged consumption of food and liquids during the workday because there was little opportunity to go to the bathroom," the report said. "This increased the risk of dehydration and other physiological problems, which could have degraded performance."

As a result of its investigation, the NTSB issued nine safety recommendations, including two involving development and enforcement of operational practices to provide for rest breaks for the pilots of sightseeing helicopters.

Quay Snyder, president and CEO of Virtual Flight Surgeons, an aeromedical consulting group, said that dehydration is "a definite contributing factor" not only to fatigue but also to the formation of kidney stones — stonelike masses that form in the urinary tract and can cause severe pain. Medical specialists attribute their formation to a concentration of mineral salts in the urine or to the absence from the urine of substances that inhibit formation of the stones.

Although smaller kidney stones may be asymptomatic, larger ones can cause abdominal pain, nausea and vomiting, fever, and blood in the urine. Recurrent kidney stones can result in loss of medical certification. Formation of kidney stones generally can be prevented simply by drinking enough water, Snyder said.

He said that some flight crewmembers might have intentionally reduced their fluid intake since the terrorist attacks of Sept. 11, 2001 — and the subsequent adoption of an elaborate set of requirements for pilots who leave the flight deck, even for a visit to a lavatory.

"It's a bad idea for health reasons," Snyder said, noting "at least a perception" that more pilots have been calling his office about kidney stones in recent years than in the period before September 2001. "But it's perhaps a convenient idea for the flight crew."

Snyder and other aeromedical specialists recommend that pilots drink fluids — but not caffeinated fluids — "on a regular basis" throughout their flights. Although some specify a precise amount of liquid that should be consumed, Snyder does not. Instead, he says that it should be enough to keep their urine clear and light in color. Sometimes the amount may be less than 2 qt; other times it may be more.

"I believe in what I'm saying," Snyder said. "As a glider pilot, I consume 170 to 200 oz [5 to 6 L]."

Similar quantities are not necessary for air carrier pilots, who do not operate in the hot, sunny environments typical of gliders, he said.

Similar advice comes from Rogers V. Shaw III, team coordinator of the Airman Education Program of the U.S. Federal Aviation Administration Civil Aerospace Medical Institute Aerospace

Medical Education Division, who said that a primary consideration is for pilots to continually be aware of their physical condition.[4]

"Most folks will become thirsty with a 1.5-quart [1.4-liter] deficit, or a loss of 2 percent of total body weight," Shaw said. "This level of dehydration triggers the thirst mechanism. The problem, though, is that the thirst mechanism arrives too late and is turned off too easily. A small amount of fluid in the mouth will turn this mechanism off, and the replacement of needed body fluid [will be] delayed."

Medical authorities say that symptoms accumulate as the body continues to lose water (Table 1 *Symptoms of Dehydration*, page 8). After a deficit of about 3.0 qt (2.8 L), symptoms may include fatigue, nausea and emotional instability.

Transport Canada (TC) calls this "a very dangerous level for pilots, as this is where your faculties start to become affected, but you may not be aware of the deteriorated performance." One TC publication described experiments involving U.S. Army helicopter pilots and said that the pilots' self-reporting of problems related to dehydration was inaccurate, even at the early stages of dehydration, and pilots who felt no adverse effects had "clear, objective difficulty with cognitive tests."[5]

A 4.0-qt (3.8-L) deficit can result in clumsiness, headache and elevated temperature. After loss of a little more than 12.7 qt (12.0 L), death is imminent.[6]

Water vs. Sports Drinks

Under normal circumstances, medical authorities suggest that

A Matter of Personal Readiness

By Major Clavet, Flight Surgeon, Directorate of Flight Safety, Ottawa

Some situations associated with individuals directly involved in a flight safety occurrence (aircrew, controllers or maintenance personnel) affect their conditions, practices and actions and contribute to the final sequence of events by predisposing it to happen. Dehydration might just be one of those.

Under normal circumstances, the body will lose water every day from basal metabolism, breathing, sweating and excretion. These are normal functions. Add to these normal functions vigorous exercise, consumption of caffeinated drinks, food or supplements, use of diuretics, fever, vomiting or diarrhea resulting from infections, food poisoning or other illnesses, environmental exposure (e.g. to hot weather), to name just a few, and further (at times excessive) loss of water from the body can result.

It then becomes a matter of balance. Enough water has to be consumed to offset not only losses from normal functions of the body but also abnormal losses. The water loss, or decreased/insufficient water intake, can result in dehydration, which in turn can lead to fatigue, increased susceptibility to stressors and deterioration of cognitive and physical performance. This can have serious consequences on the safety of the task/mission.

It then becomes a matter of personal readiness. In any occupational setting, individuals are expected to show up for work ready to perform at optimum levels. This is even more so in aviation. Not all personal readiness failures occur because rules and regulations have been disregarded or broken. While certain behaviours or conditions may not be governed by any rule or may not be against any existing regulation, individuals must use good judgement when deciding whether there are "fit" to work.

If personal habit patterns or behaviours interfere with the requirement to show up for work ready to perform at optimum levels, inadequate personal readiness becomes a player. A breakdown in personal readiness can occur when individuals

- fail to prepare physically and mentally for the task/mission they must perform;
- do not rest properly;
- do not stay fit;
- do not report medical conditions; or,
- inappropriately consume alcohol, drugs, supplements or self-medication (including over-the-counter drugs);

all of which can be detrimental to their performance, lead to errors and impede safety. Decreased/insufficient water intake leading to dehydration is just one such example.

Among other things, stay hydrated. It is a matter of personal readiness. ◆

Amount of Water Lost	Symptoms
1.5 L (1.6 qt)	Thirst
3.0 L (3.2 qt)	Sluggishness, fatigue, nausea, emotional instability
4.0 L (4.2 qt)	Clumsiness, headache, elevated body temperature, elevated pulse, elevated respiratory rate
5.0 L (5.3 qt)	Dizziness, slurred speech, weakness, confusion
6.0 L (6.3 qt)	Delirium, swollen tongue, circulatory problems, decreased blood volume, kidney failure
9.0 L (9.5 qt)	Inability to swallow, painful urination, cracked skin
12.0 L (12.7 qt)	Imminent death

Source: Maidment, Graeme. "Chapter 15: Thermal Physiology." In *Aviation Medicine*, Third Edition, edited by Ernsting, John; Nicholson, Anthony N.; Rainford, David J. Oxford, England: Butterworth Heinemann, 1999.

Table 1 Symptoms of Dehydration

water is usually the best drink for a pilot to consume, although there is a place for rehydration drinks, including so-called sports drinks, that have been formulated not only to replenish lost fluids but also to restore the proper concentration of electrolytes — dissolved minerals such as sodium and potassium — in the blood. The electrolytes are electrically charged molecules that are key to many essential bodily functions.

"I don't believe there is any harm in sports drinks, et cetera, as long as individuals don't drink excessive quantities, but they are of little additional benefit for a pilot who has a normal, balanced diet," said Dr. Anthony Evans, chief of the International Civil Aviation Organization Aviation Medicine Section.

Rehydration drinks may be required if pilots undergo significant or prolonged heat stress, he said.

Heat-Related Illnesses

In some situations, such as prolonged exposure to very hot temperatures in a cockpit that is not air conditioned, dehydration can progress to a heat-related illness, such as heat cramps — characterized by muscle cramps, profuse sweating, fatigue and thirst.[7,8] Treatment typically includes drinking a sports drink or other fluid containing electrolytes and moving to a cooler spot.

Without such treatment, heat cramps can develop into heat exhaustion, with symptoms including headache, dizziness, nausea and dark urine. Without treatment — again, drinking a fluid containing electrolytes and moving to a cooler spot — the result can be heatstroke, a life-threatening condition in which the body temperature climbs to 104 degrees F (40 degrees C) or higher. Heatstroke can lead to shock or organ damage.

Treatment for heatstroke is more aggressive than treatment for less serious forms of heat related illness and may include immersion in cold water or wrapping the victim in a cooling blanket and placing ice packs at the neck and other areas of the body. The goal is to quickly reduce the body temperature to normal in order to limit damage to the brain and other vital organs. ◆

Notes

1. NASA ASRS. Report no. 624470. July 2004.
2. Negoianu, Dan; Goldfarb, Stanley. "Editorial: Just Add Water." *Journal of the American Society of Nephrology* Volume 19 (2008). <www.asn-online.org/press/pdf/2008-Media/Water%20Study.pdf>.
3. NTSB. Weather Encounter and Subsequent Collision Into Terrain, Bali Hai Helicopter Tours Inc. Bell 206B,N116849, Kalaheo, Hawaii. Sept. 24, 2004. The NTSB said that the probable cause of the accident was "the pilot's decision to continue flight under visual flight rules into an area of turbulent, reduced-visibility weather conditions, which resulted in the pilot's spatial disorientation and loss of control of the helicopter." Among the contributing factors was "the operator's pilot-scheduling practices that likely had an adverse impact on pilot decision making and performance."
4. Shaw, Rogers V. III. Dehydration and the Pilot. <www. faa.gov/pilots/training/airman_education/topics_of_interest/dehydration/index.cfm>.
5. TC. "I Need a Drink." *Aviation Safety Vortex*, March 2002.
6. Maidment, Graeme. Chapter 15, "Thermal Physiology." In *Aviation Medicine*, Third Edition, edited by Ernsting, John; Nicholson, Anthony N.; Rainford, David J. Oxford, England: Butterworth Heinemann, 1999.
7. Shaw.
8. Mayo Clinic. Heatstroke. <www.mayoclinic.com/health/heat-stroke/DS01025/DSECTION=3>.

Photo by Pte Jean-François Carpentier

"PRESS-ON-ITIS" VS. EXPERIENCE

By Lieutenant-Colonel Larry McCurdy,
DFS 2 Chief Investigator, Directorate of Flight Safety, Ottawa

In the vein of "I learned about flying from that" I would like to relate a personal experience that could have easily ended in an "A" Cat occurrence rather than a simple life-lesson. I was on an extended helicopter cross-country mission with another pilot. Between us we had over 9,000 hours of flying experience and we were both multi-toured flying supervisors – no problem, right?

As we approached our destination, the weather started to deteriorate due to snow squalls, low visibility and whiteout. The helicopter was not certified for IMC flight (let alone flight in icing) so it took some creative sneaking and peeking to make it safely into an aerodrome just north of our ultimate destination. We were highly skilled, and we could handle a little snow, right? What was I thinking?! But we did attempt to get an in-depth weather briefing and make an informed decision on the final leg. ATTABOY!

The local weather was VFR, and forecast to remain so, but we were planning a flight into rising terrain and there were no reporting stations on the high ground. Furthermore, there was no information available on the top of cloud expected, or the severity of the icing within it. It was VFR at both ends of the leg, we planned on remaining VFR, and it was only a one-hour leg. Again, no problems, right? Was I thinking at all?

Shortly after take-off, we once again flew into reduced visibility in snow squalls (how unexpected). The rising ground and whiteout conditions made navigation difficult, and we soon found ourselves just above treetop level, heading into a large open field. The discussion in the cockpit was brief. We could land in the field, but the fresh snow and whiteout could make the touchdown interesting. Besides, we really didn't feel like camping there for a few days. Alternatively, we could climb up on top of cloud and complete the trip, although we really didn't know how thick the cloud was. We were only one short (albeit illegal) IMC hop from our planned destination, a nice hotel and a hot shower.

This was a tempting option that I seriously considered for several nanoseconds, until I pictured the FSIR heading: "Senior Pilots Killed in Inexplicable Helmet Fire." I executed a turn around the only shrub in the large white field and headed back to the aerodrome of departure.

It turns out that the clouds were topped at 12,000', the icing was moderate (fatal to my helicopter) and had we attempted to fly through we would have lasted about 2 minutes before returning to earth as an ice cube. Maybe it was experience that prevented a serious accident, but in retrospect, "press-on-itis" put me in a position to almost turn a bad "let's try" decision into a fatal one. Experience is no antidote for "press-on-itis" unless it is accompanied by measured doses of common sense and patience. From that day forward, I started using my experience to keep me out of trouble instead of *needing* it to get me out. ◆

Taking the Scenic Tour*

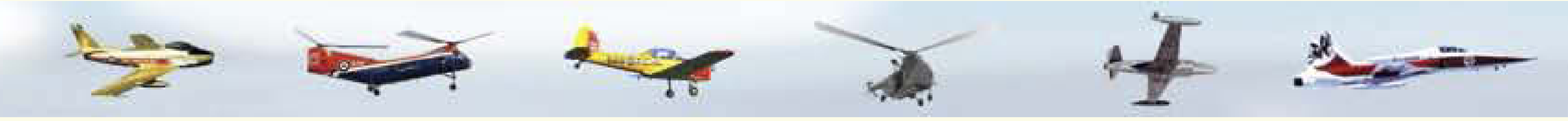
Ejection Experience in the RCAF

EJECTION SEATS were discussed in a short article which appeared in the Third Quarter issue of Crash Comment for 1951. As these seats had only been introduced in the Service at that time, the article merely outlined the general operating procedures and did not reflect any RCAF experience. Since then a number of RCAF aircrew have, through necessity, made good use of the ejection seat. We feel, therefore, that a summary of their experiences would be interesting and beneficial to readers of FLIGHT COMMENT in case they may one day be to use this seat in an emergency. NINETEEN EJECTIONS have been made by RCAF Personnel - eighteen from Sabres and one from a Canuck. Ten of these ejections were executed either without injury or with only minor bruises; five resulted in fractured vertebrae, although no permanent injuries were sustained; and four resulted in fatalities.

Safe ejections were made at altitudes from 1000 feet to 9500 feet and at speeds of from 150 to 500 knots. The fatalities all occurred on those ejections which took place at altitudes below 300 feet. In three of these cases involving Sabre aircraft, it is believed that each of the pilots had inadvertently ejected his seat while attempting to jettison the canopy prior to a forced landing. Action has been taken to modify all seat triggers in these aircraft to prevent unintentional ejections in future. In all cases where the pilot suffered either a fractured vertebra or a bruise, the cause of the injury was IMPROPER POSITIONING IN THE SEAT prior to ejection.

It is interesting to note that the USAF with a far greater number of ejections than the RCAF has had markedly similar experiences and has reached similar conclusions about the use of these seats. The conclusions are as follows:

- Ejection seats will successfully and safely remove flying personnel and carry them clear of the aircraft under any known conditions.
- The "G" forces produced during ejection will NOT cause death or spinal injury if seat posture is correct.



- With present seats, ejection should be made at a safe altitude to allow time for aircrew to release the seat and open their parachutes.
- More training is necessary on both the maintenance and use of ejection seats.

Certain points of interest arise out of these conclusions. Because of the fact that cockpits have not been standardized, the procedures for ejection vary slightly from one type or model of aircraft to another. Pilots' Operating Instructions, of course, detail the steps to be followed on your particular aircraft. There is one step in the bailout cycle, however, which is the same for every ejection procedure: the correct posture to assume. The feet should be in the stirrups; the body should be centered; the spinal column must be straight and firm against the rear of the seat; the arms must be close to the body; and the shoulder harness should be locked. False rumours have been circulated occasionally to the effect that some pilots who have ejected have had their feet cut off or suffered other damage to their extremities. Nothing could be further from the truth. The majority of pilots have not followed the correct procedure to the letter and yet they generally get off with only a few bruises to show for their carelessness.

AT LOW ALTITUDE the ejection problem is complicated by the time factor. Seconds lost in deciding whether to eject or ride the jet down can mean the difference between life and death for the pilot. Generally, between 7.5 and 11.5 seconds are required to go through the ejection procedure. Since considerable height could be lost in this period of time, it is imperative that pilots realize they must not waste time debating whether to get out or stay with the aircraft. Future development of these seats will permit automatic release of the pilot from the seat after ejection has taken place. This provision, coupled with an automatic parachute release will obviate the necessity for the pilot to take any action other than the initial ejection and will also enable him to eject safely at much lower altitudes.

Until such improved equipment is available in the RCAF, aircrew members can go a long way toward ensuring successful emergency ejections at low altitude by regularly running through the mechanics of the entire operation to make certain that each action is performed correctly in the proper sequence and with a minimum of delay. Should a low altitude ejection be unavoidable, the pilot - if he can maintain proper position on the seat - should unfasten his lap belt before proceeding with the ejection sequence. Obviously the determining factor in this situation will be flight conditions, from the standpoint of turbulence and aircraft attitude. One RCAF pilot, who successfully ejected at 3000 feet while his Sabre was diving at 500 knots, had this to say after the experience: "Tumbling and rotation of the seat was so fierce that I was almost incapable of thought and action. After jettisoning my canopy I found that the combined effects of detonation of the charge, decompression of the cockpit, and the roaring of the air stream stunned me so much that all further procedures seemed to be carried out involuntarily as the result of good training rather than as a result of conscious thought on my part." Despite a few evolutionary shortcomings, the present ejection seats are mighty handy in an emergency.

Pilots can increase the range of their usefulness by acquiring a thorough knowledge of how they operate and by suggesting, from experience, how some of their shortcomings may be eliminated. The pilot's safety in an ejection will depend largely on two factors:

- His own familiarity with the functions and purposes of the entire ejection apparatus
- The rapidity and accuracy with which he can go through his emergency drill. ◆

Taking the Scenic Tour was first published in Flight Comment, Third Quarter, 1954, with similar illustrations. "Taking The Scenic Tour" was a Sabre-pilot colloquialism for "seat ejection bailout from the aircraft." This issue as well as all other issues of Flight Comment can be viewed on the DFS website: http://www.airforce.forces.gc.ca/dfs/publications/fc/archive/1950-1954/pdf/1954-3-eng.pdf

JETTISON CANOPY

CORRECT POSTURE

LEAVE AIRCRAFT

UNFASTEN SAFETY BELT
KICK AWAY FROM SEAT

Editorial Note

Parachute Descent Considerations

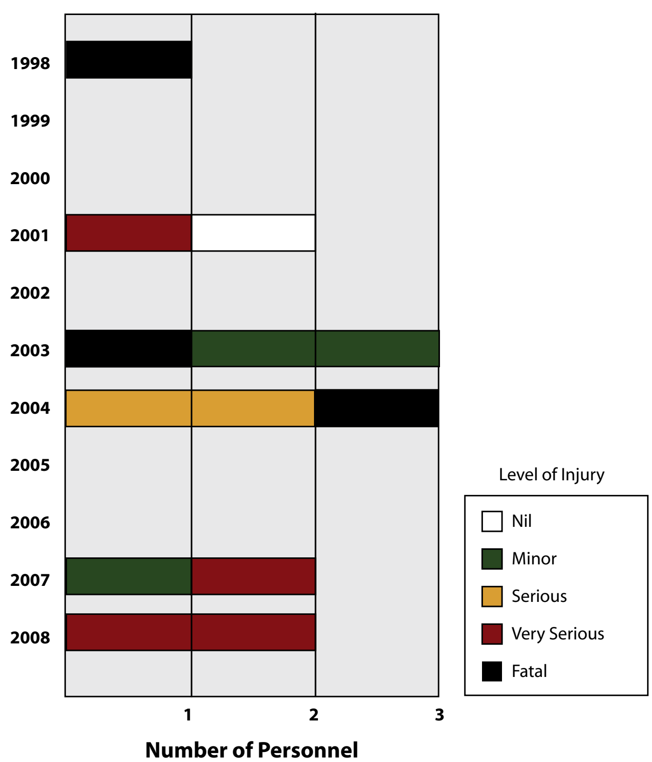
Issue 2, 2008 of Flight Comment published an exhaustive article on ejections and improvements made to the ejection systems. Captain Paquet wrote in his Riding the Rocket Seat article that: "This type of progress means that the crews are increasingly confident in their escape systems, which in turn may at times translate to a certain degree of complacency, and pushing the limits. As can be seen by the conclusions of the Check Six article, *Taking the Scenic Tour*, familiarity with the ejection equipment and rapid and accurate execution of ejection drills are critical to the success of the ejection. Statistically, of the 13 personnel who ejected from CF aircraft during the period 1998-2008, three have died (14%) and six others suffered very serious or serious injuries (35%).

The Manual of Aviation Life Support Equipment and Techniques (B-22-050-278/FP-000, 2008-04-15) (http://winnipeg.mil.ca/a3oa/alse/Files/B-22-050-278FP-000%20Apr08.pdf), has a section on parachute descents. It states that:

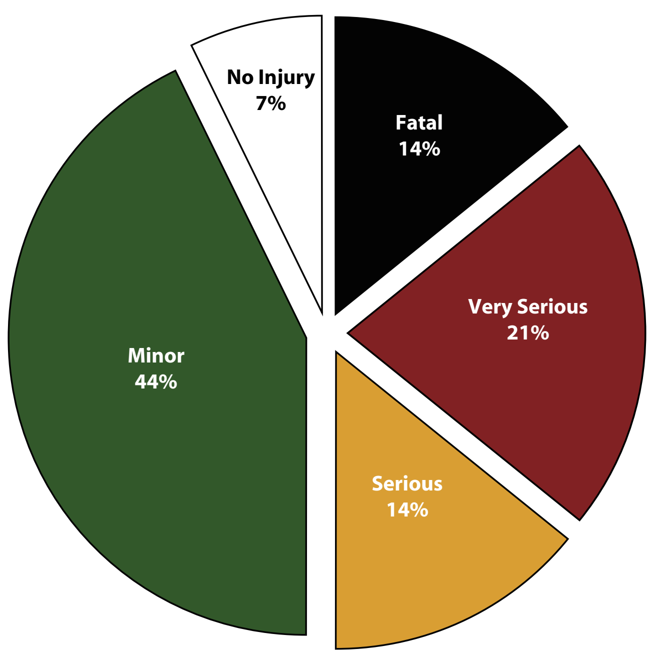
- When using current CF flat circular parachutes, manipulation of the risers is the only means of controlling descent, and it is extremely limited. Parachutes with forward drive and steering capability will increase in descent rate whenever drive is reduced.
- Attempts at parachute control must be discontinued in time to permit the rate of descent to reduce and stabilize before ground contact. As a general rule, manoeuvring should not be initiated or continued below 500 feet.
- During a ground level ejection, the apex of the arc is somewhere between 150' to 200' AGL. Therefore, unless it is to avoid a significant hazard, ejectees should not even attempt to steer the chute if they were on the ground when ejection was initiated. ◆

Ejection Statistics 1998-2008

Personnel Ejected/Level of Injury



Percentage Breakdown of Injuries to Personnel



Slippery Deck Moment

By Sergeant John Lindsay,
427 Tactical Helicopter Squadron, Petawawa

During several years of Sea King deployments, I have had many occasions to learn the value of workspace husbandry. I have watched and listened and sometimes even chimed in on the chorus of moans that usually followed the direction to scrub the flight deck or clean up the hangar.

On HMCS Preserver, there is no "Haul-Down" system. As such, the Air Det must utilize a small, very heavy tow mule to transit the helicopters in and out of the hangar. Depending on the trip, there may have been 2 or 3 aircraft on board and often, there was a requirement to shuffle the aircraft around in order to get the serviceable one positioned on the deck.

Through normal operations, the Sea King tends to leave a considerable amount of residual fluids on the flight deck for a variety of reasons: leakage, engine washes, fluid expansion, etc. Without frequent and diligent cleaning, the flight deck's non-skid properties are greatly diminished.

As one of only a few qualified tow drivers at the time, it was often my responsibility to tow aircraft during periods of particularly rough seas. On one such day, the ship was rolling between 15 to 20 degrees both port and starboard and towing in these conditions requires both good timing and proper braking to be successfully accomplished. Midway through the evolution, the ship took an unexpectedly violent roll to starboard and I stood on the brakes to stabilize the helicopter until the ship's movement levelled off. Unfortunately, due to the accumulated fluids on the deck surface, the aircraft began to slide toward the nets and the ocean beyond.

The technician in the cockpit was pressing on the brakes for all he was worth but the aircraft continued to slide. As the aircraft approached the edge, both the technician and I began to plan our escape route should we tumble into the sea. My mule was at this point nothing more than a several thousand pound anchor.

As the aircraft reached the edge rail, a combination of the ship's roll, the tires striking the lip and our desperate braking caused both the aircraft and the mule to fetch up against the rail. The remaining members of the tow crew immediately chained the helicopter and the mule to the deck. Both the brake man and I took several minutes to stop shaking from the adrenaline of fear.

Shortly after this incident, I became both a willing participant and a vocal champion of proper cleaning and husbandry of all workspace areas. I have cited this incident on multiple occasions as the nexus of my new found respect for proper housekeeping. ◆

Photo by Cpl Karen Livingstone

Don't Play your Joker

(unless you really have to!)

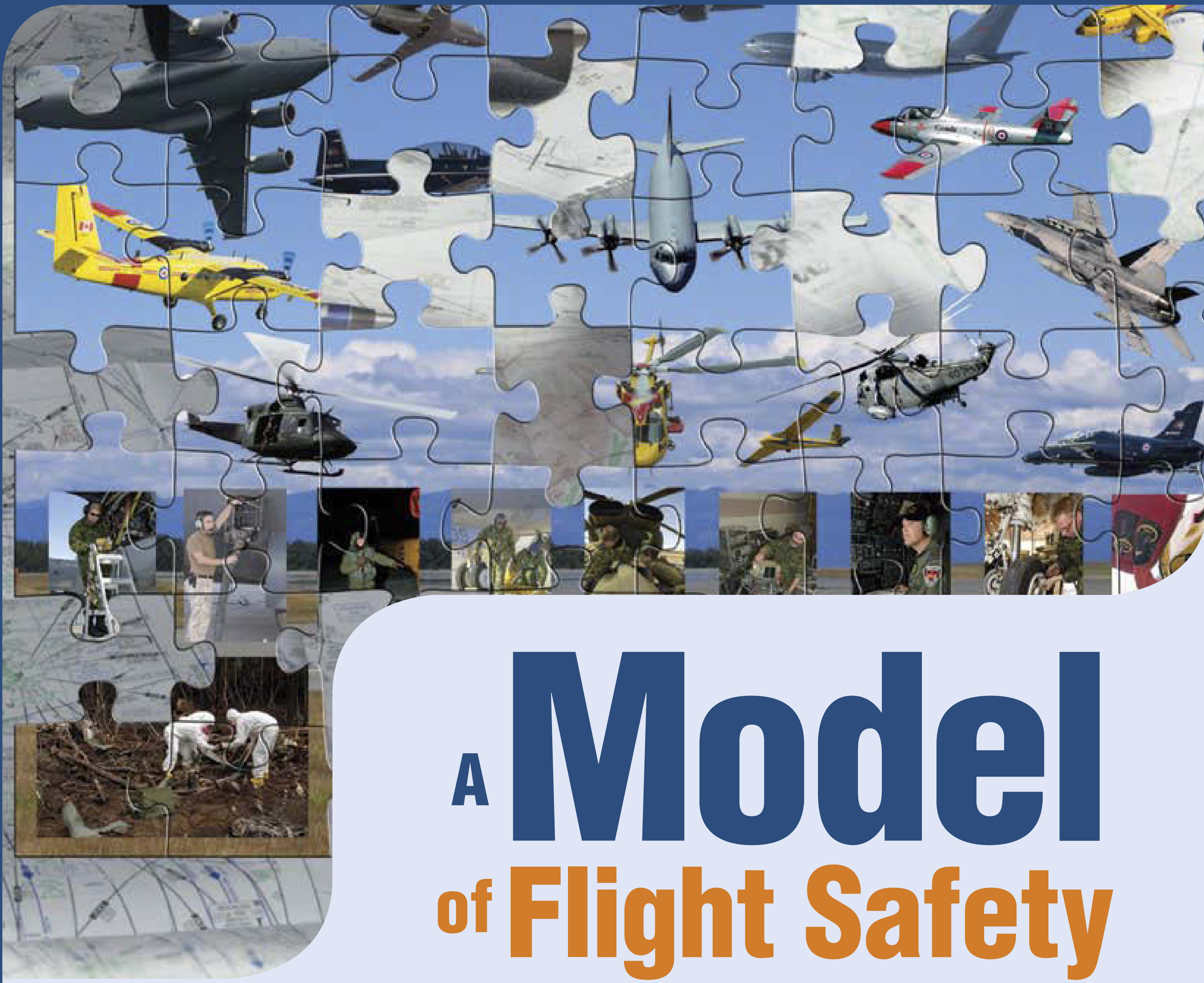
By Squadron Leader Adrian Leonard, Former Force Command Flight Safety Officer, SHAPE, Belgium

During Operation Allied Force I was an aircraft commander of a Royal Air Force E-3D Airborne Warning and Control System (AWACS) aircraft operating from Aviano Air Force base (AFB) in northern Italy. It had been a demanding detachment - personal security measures had increased, the weather was at its most volatile and we had just executed a high speed rejected takeoff a few days earlier due to abnormal engine indications. The sortie described in the following paragraphs involves airmanship, supervision, decision-making, crew resource management and a bit of luck! We were planning for a night sortie over the middle of the Adriatic Sea to the east of Ancona Falconara airfield. Our orbit area had been chosen to give us sufficient time to run away or "retrograde" from a high, fast Serbian Mig 29 and our planned altitude of flight level (FL) 290 provided optimum radar performance with sufficient air density for high angle of bank manoeuvring. It was going to be a ten hour sortie with an 80 000 pound uplift of fuel from a KC-10, air-refuelling tanker. The weather forecast was favourable; however, as usual, the sortie was going to be longer than the length of the forecasts for some of the alternate airfields so we would have to receive updates in the air. Operationally this was going to be an extremely busy night for allied aircraft and as the operators of a high value airborne asset, the pressure on us to be "on station/on time" could not be overstated.

As the sortie progressed into the early hours of the morning, the initially harmless-looking cumulus clouds started to tower forcing us to climb to stay out of the turbulence. The weather radar returns were beginning to turn from green and yellow into red and to the northwest we could see frequent flashes of sheet lightning. Going home early was not an option and repositioning would leave the allied aircraft without AWACS cover. We continued to climb to FL390. Now very close to our performance ceiling, a retrograde would be a considerably more delicate manoeuvre. As the thunderstorms were affecting the radios, we were having trouble receiving updated weather forecasts and our onboard teletype machine was omitting vital digits in the terminal area forecasts (TAFs) rendering them useless. Our primary alternate airfield was Ancona and, despite its latest TAF being sound, we were not confident that it would remain that way at landing time. Just as we were about to check the Ancona meteorological terminal air report (METAR), the mission commander or tactical director (TD) informed me that he had heard on another radio that Ancona was currently experiencing a severe thunderstorm. By this time we were one of the only aircraft left over the Adriatic as all other players had either returned to base or diverted. We informed combined air operations centre (CAOC) of our predicament and they offered us another tanker. An E-3D AWACS is dual air refuelling capable meaning that it can refuel from either a drogue or a boom tanker. A few weeks earlier an E-3D had been vectored behind a tanker equipped with a boom-drogue adaptor (BDA), which is not suitable for heavy-jet aircraft. We did not have enough fuel to chase a tanker only to find out that it may be incompatible so we considered flying south to land at Brindisi. Another option was to head back to the northwest towards base and use the weather radar to fly around the thunderstorms. We could then land at either Aviano or Venice. The latter was to be our plan.

Now in UHF radio range of base and eager to receive the latest METARs and TAFs, we contacted our Flying Supervisor only to find out that his weather information was as out of date as our's. Once the current weather information finally came it revealed that all bases in range and open were in thunderstorms. On most occasions my Flight Engineer was happy with my decision-making but on this occasion he summarized everyone's feelings by simply asking, "Captain, what are your intentions?" I was now in a highly undesirable situation: low on fuel, a doubtful crew and thunderstorms everywhere. I had "played my joker" by not electing to fly direct to Brindisi and my good ideas drawer was officially empty! After a detailed conversation with Aviano Metro, we decided to attempt a landing at Aviano as the thunderstorms were passing over the airfield in waves. The navigator was working hard differentiating between ground clutter and thunderstorm cells on the weather radar as he vectored us for an instrument landing system (ILS) approach on runway 05. We were fortunate to land on our first attempt and the weather was eerily benign. Minutes later a spectacular hailstorm began which damaged all exposed vehicles in the local area.

We arrived back at the hotel for a healthy breakfast of beer and war stories. So, what did we learn? Well, whether you are a supervisor on the ground or a crewmember airborne, always keep on top of the weather. In addition, as a crewmember, keep your crew informed of your thought processes at all times, and above all, don't play your joker unless you really have to. Although this sortie had a happy ending, we are mindful of the fact that there are several accidents in aviation history that have resulted from alarmingly similar circumstances. ◆



A Model of Flight Safety

By Major Adam Cybanski, D/DFS 3; and Jacques Michaud, DFS 3

An instructor pilot teaches a new student the best way to fly an instrument approach. A contractor performs quality control on aircraft parts to be delivered to the Canadian Forces supply system. A maintenance technician repairs a helicopter windshield crack onboard a ship. All these individuals are contributing to the prevention of accidents in their own way, but it may not be completely clear how each of these examples support Flight Safety, which enables mission accomplishment.

A Flight Safety program is comprised of a wide spectrum of personnel and processes, each carrying out specific activities in support of accident prevention. Understanding what the personnel do and how they interact is important in order to ensure that they serve the end goal of aircraft accident prevention. The Canadian Forces Flight Safety Program is well established and thoroughly described in the A-GA-135-001/AA-01 Flight Safety for the Canadian Forces; yet, the simple conceptualization of accident prevention activities is missing from this publication.

A clear yet comprehensive overview of all the Flight Safety processes proved impossible to find in any of the other Flight Safety publications consulted. This article proposes the adoption of a strategic level conceptual model of Flight Safety-related processes for the Canadian Forces Flight Safety Program.

Background

The search for a comprehensive strategic business model for accident prevention was initiated in the Spring of 2008 in order to document the requirements for the next generation of the Canadian Forces Flight Safety Occurrence Management System (FSOMS).

Well-known safety models were reviewed in the development of this conceptual model, including James Reason's Swiss Cheese model and Nancy Levinson's model of Systems Theory Accident Modeling and Processes. These models correctly describe the sequence of events and factors leading to accidents but do not directly explain how Flight Safety activities prevent accidents. After much research and consultation, the authors have put together a Strategic Flight Safety Model (SFSM) (Figure 1). The Model is quite comprehensive and captures all the ICAO Safety Management System components. By extension, the Model encapsulates all the activities listed in the A-GA-135-001/AA-01, which describes a comprehensive SMS Program. Resilience Engineering, a new term used in safety engineering documents has been incorporated into the model under the term Resilience Management. With Risk Management and Program Management, they represent the high-level management activities supporting accident prevention and risk control.

Description of SFSM

The overall objectives of an effective Flight Safety program are the prevention of accidents and the control of risks. Many organizations, with or without a pure FS mandate, contribute to Flight Safety. The SFSM attempts to describe in a comprehensive manner all the FS processes irrelevant of the source.

The Model identifies three management pillars in the form of Resilience Management, Risk Management and Flight Safety Program Management. Resilience and Risk Management represent the pillars around which most of the critical FS processes and activities gravitate. Resilience Management is considered a more proactive form of accident prevention because it reduces the potential or severity of threats to air operations. Risk Management on the other hand is more reactive in that the associated activities are in response to newly identified hazards.

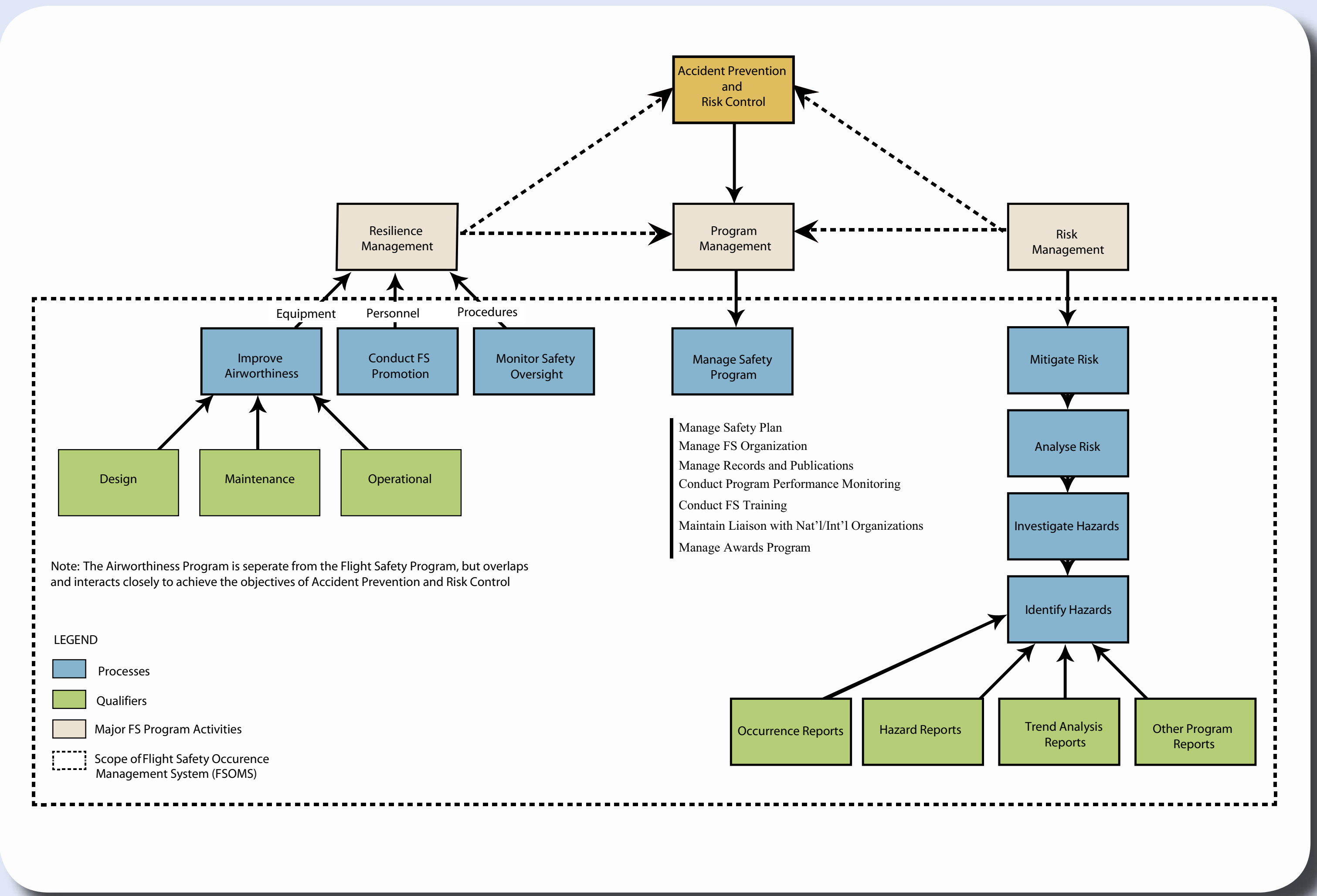


Figure 1 Strategic Flight Safety Model

Resilience Management

In the SFSM, the placement of Resilience Management on the left implies that it is present at the very start of any new acquisition of airworthiness products, specifically when a new airplane is being introduced or new training methods and delivery are planned.

In the past, a proactive approach meant that hazards were acted upon before they resulted in accidents or fatalities and reactive processes followed an accident or incident. In reality, these two approaches are predominantly reactive, since they represent actions stemming from the identification of a hazard. A true proactive approach involves designing an integrated system (people, procedures, machines) for safety before there is even a chance of having an accident. A more comprehensive model of proactive accident prevention was needed, so the concept of Resilience Management was introduced.

Resilience Management aims to make the personnel, procedures and equipment more resistant to accident-causing conditions, and thus better capable of dealing with hazardous situations even before specific hazards are identified, hence the reason why it is considered more proactive than Risk Management. Good training, education, and design all increase resilience to accidents and minimize risks. As an example, a well-trained instrument pilot should be able to successfully deal with most emergencies in cloud and recover the aircraft. Therefore, Resilience Management improves the overall airworthiness of equipment, personnel and procedures.

Airworthiness Improvements

Conceptually, improvements to airworthiness takes place in three key areas: Design, Maintenance, and Operations. As an example, a new aircraft requires a good design that should address all the hazards of the previous aircraft. It should be resilient to any new hazards and threats to Flight Safety that could be experienced. At the beginning, steps are undertaken to field an aircraft with suitable design specifications, proper maintenance support and well written operation procedures and training standards. All these steps aim to put in place an airworthy product capable of addressing all known hazards.

The same requirements apply for any modifications that must be made to the aircraft once it is introduced into service. Quality maintenance on an aircraft helps to ensure that it is capable of meeting any challenges it may face during its lifecycle. Operationally, aircrew, maintenance and support personnel must be well-trained, experienced and qualified so that all people involved are "airworthy" or able to address any dangerous situations they may encounter. Given the constant evolution and changes affecting the operation of any aircraft during its lifecycle (aircraft configuration, roles, operating environment, procedures, etc.), training standards and procedures must be continuously reviewed for effectiveness and currency with documentation amended accordingly.

FS Promotion

The promotion and passage of Flight Safety information is a key component of an effective FS Program. The use of FS Magazines and posters (Flight Comment, On Target), newsletters (Debriefing, Flash), websites (DFS, DFSO, Wing sites) and FS briefings done at all levels promote the awareness of personnel and make them more resilient to accidents. Personnel involved in flying operations must be aware of safety concerns and occurrences experienced by others in the CF. When pilots, maintainers and support personnel are aware of hazardous situations and best practices; they are in a better position to recognize potential hazards when they occur, and to deal with them appropriately. The passage of lessons learned across flying communities is a very effective method of improving safety through promotion. In addition to FS personnel, there are many organizations outside of the FS program that contribute promotional material which serves to improve the resilience of aircraft operations to accidents.

Safety Oversight Monitoring

Airworthiness processes require the conduct of safety oversight. The Airworthiness Investigative Authority (Director of Flight Safety) and FS personnel at all levels (NDHQ, Division, Wing, Units, Contractors, Special or Foreign Operations) maintain an independent view on operations. This oversight is done through safety visits and audits on a regular basis. As a result of these visits, FS personnel are able to provide feedback and recommendations to the chain of command in order to improve the resilience of aircraft operations to accidents. Specific hazards can be addressed through the Risk Management process.

Risk Management

The Risk Management pillar consists of four distinct steps: Identify Hazards, Investigate Hazards, Analyze Risk and Mitigate Risk. As part of this process, any risk identified as a threat to aircraft operations must be tracked from identification to resolution. Identification of such threats will come from many sources, including those hazards identified by the Airworthiness Program. Many forms of risk management are done by a variety of organizations. The Records of Airworthiness Risk Management (RARMs), which reside administratively within the scope of the Airworthiness Program, follow the Risk Management processes.

There is an upward flow from Identify Hazards up to Mitigate Risk. Unless all steps are completed, risk will not be effectively controlled. Many accident prevention programs fall short in this respect as not all identified preventive measures are properly addressed. Often, there is a failure to confirm the PM was actioned as intended and, thereafter, evaluated for effectiveness.

Identify Hazards

The first critical step in risk management is identification of hazards, as it initiates the whole process. There are many ways to identify hazards: hazard reports, occurrence reports, RARMs, data analysis, and many others. Specific observed hazards are normally reported through a Hazard Report or HAZREP. Other methods of identifying hazards include Flight Safety surveys, trend analysis, minutes of safety meetings, and safety inspection reports. Incidents involving foreign nations operating similar aircraft can also serve to identify potential hazards to our own operations. Proper recording and follow-up on hazards is very important and paramount to an effective and viable safety program.

Investigate Hazards

Once specific hazards have been identified, they usually become the Flight Safety organization's responsibility to investigate either at the Unit, Wing, or DFS level based on the classification of the occurrence or hazard and other factors as per A-GA-135-001/AA-01. The investigation will uncover findings, evaluate the risk and recommend specific preventive measures (PMs). These suggested PMs are aimed to counteract the threats/hazards that were identified. PMs are then transferred to the appropriate level of the chain of command for assessment and resolution in accordance with the evaluated hazard risk level.

Analyze Risk

Once the risk potential is estimated by Flight Safety staff, it is up to the chain of command to examine the risk in detail, evaluate it, confirm the risk level, then either implement measures that will address or reduce the risk, or accept the risk as it is. The hazards are analyzed against two parameters: probability of occurrence and severity of effect. Anything that is both very likely to happen and catastrophic severity should be addressed with the highest priority and documented with a RARM. The decisions made and mitigation measures taken by the chain of command on all serious hazards must be tracked and documented in order to ensure proper and comprehensive risk management.

Mitigate Risk

Commanders mitigate risk by ensuring that it is accepted at an appropriate level, by rectifying deficiencies, and by taking measures to reduce the risk. Supporting FS staff monitor the actions taken by the chain of command so that hazards are addressed in a timely and appropriate manner.

Program Management

Safety Program Management is the center *pillar* of flight safety processes. Safety Program Management does not directly contribute to the prevention of accidents or control of risks, but is a very important component of the SFSM. Without proper documentation, a proper FS culture, dedicated FS staff, proper funds and leadership commitments, cracks would develop in the FS foundations. Flight Safety depends on a vast network of people and processes, and is only as strong as its weakest link.

Program Management provides the legislative/administrative tools and financial support to run an effective FS Program, and sets the expectations of behaviour. The Safety Program Management component supports Resilience Management and Risk Management so that they can effectively prevent accidents and control risk. Any successful program must be grounded with a well-documented plan and supporting policies. It also needs a well-structured organization, effectively managed to ensure that there is enough qualified personnel to apply the Flight Safety program.

Conclusion

When an instructor pilot teaches a new student the best way to fly an instrument approach, they are improving the operational "airworthiness" of the pilot, making them more resilient to accidents in the IFR environment. The technician repairing a windshield crack onboard a ship is addressing a specific hazard to flight that has been identified through the risk management process. The contractor conducting quality control on aircraft parts to be delivered to the Canadian Forces supply system ensures the aircraft remains resilient to potential accidents. All these individuals are helping to prevent accidents and control risk. The associated activities are critical components of the CF Flight Safety system and very important enablers for mission accomplishment.

A safety model such as the SFSM makes it easier to understand how FS activities work together to prevent accidents and control risk. The model reveals synergistic effects between processes and clarifies the potential effectiveness of upgrades to components in the system. It has been designed strictly for FS, but could be employed on a larger scale for other safety programs.

CF air operations and technology will always be in a state of change. Flight Safety processes can similarly be expected to change, and so this model should be considered a living document. The current incarnation provides a baseline starting point. Please forward any suggestions regarding this model to dfs.dsv@forces.gc.ca, or to: Adam.Cybanski@forces.gc.ca. ◆

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Working to the Limit

By Linda Werfelman

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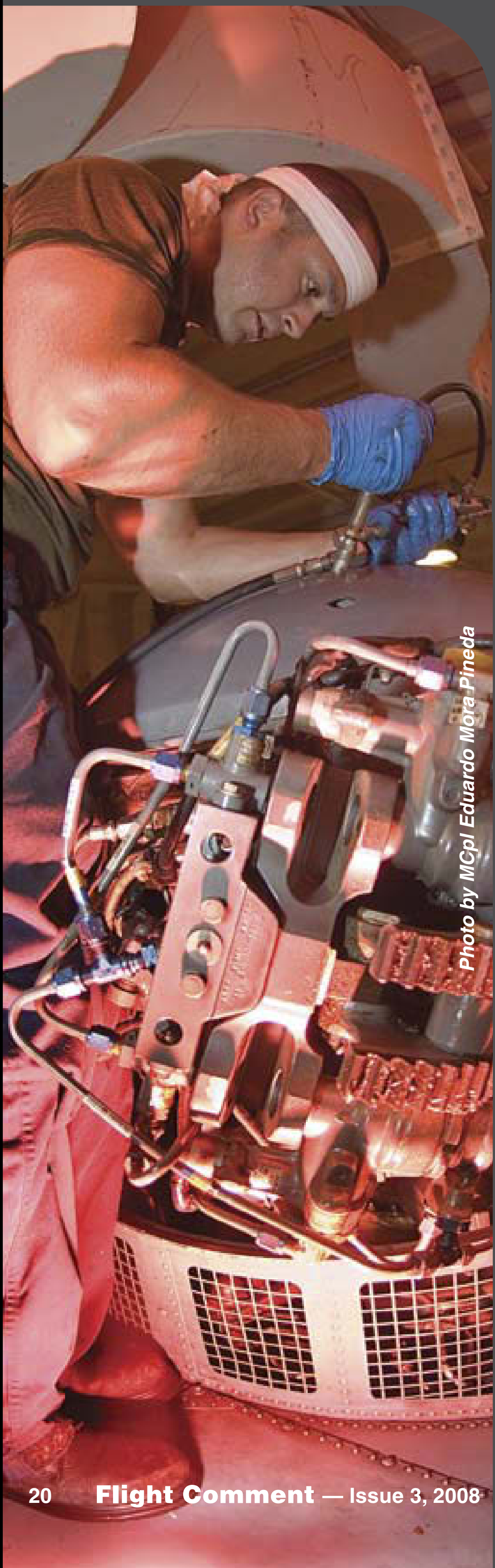

Photo by MCpl Eduardo Mora-Pineda

Slowly but surely, operators and regulators are implementing programs to prevent fatigue among aviation maintenance personnel.

Although aviation maintenance personnel typically work long hours, often at night, they rarely are included in aviation industry programs to fight fatigue. Duty time limits and other efforts to address fatigue typically are intended for flight crews — not maintenance personnel.

Nevertheless, in recent years, some civil aviation authorities and operators have taken steps to ensure that maintenance personnel are not pushed beyond their limits. The International Civil Aviation Organization (ICAO), in its 2003 manual for maintenance human factors, said that fatigue among aviation maintenance personnel has resulted from "excessive hours of work, poor planning, insufficient staff, bad shift scheduling and a working environment with no proper control of temperature, humidity or noise."[1]

Although fatigue among maintenance personnel has not specifically been cited as a cause of a major accident, on several occasions, maintenance work "performed at night by staff who may have been affected by fatigue or lack of sleep" has been identified as a causal factor, ICAO said.

For example, ICAO cited a June 10, 1990, incident in which the left windshield of a British Airways BAC 1-11 blew out as the airplane was climbing through 17,300 ft after departure from Birmingham International Airport in England. The commander was drawn halfway out of the opening and held there by cabin crewmembers until the first officer landed the airplane in Southampton. Investigators said that maintenance personnel who had replaced the windshield the night before had used bolts that were not the size specified. The U.K. Air Accidents Investigation Branch (AAIB) said in its final report that several human factors issues had contributed to the incident, including "circadian effects" — biological patterns that influence the time of day when the body is programmed to sleep — on maintenance personnel.

Fatigue also contributes to non-reportable incidents, and ICAO cited the case of one unidentified operator of a fleet of 12 aircraft that experienced extensive structural damage to one aircraft because of incorrect jacking procedures, extensive structural damage to two aircraft because of a towing collision, and serious injuries to three maintenance technicians because of a traffic accident that occurred as they drove home after a long shift at work (see "Fighting Fatigue-Related Errors," p.22).

Studies conducted for several civil aviation authorities and accident investigation bureaus have identified fatigue as a significant problem for aviation maintenance personnel.

One study, a U.S. Federal Aviation Administration (FAA) survey of maintenance human factors programs worldwide, found that of 414 survey respondents, 82 percent said that fatigue is a safety issue in aviation maintenance. Only 36 percent said that fatigue was addressed in their training programs, however, and only 25 percent said they had a fatigue management system.[2]

"The discontinuity between recognizing the fatigue threat and establishing barriers is alarming," two of the study's authors said. (ASW, 3/08, p.34–40).

Another study, conducted in 2002 for Transport Canada (TC), found that aviation maintenance engineers (AMEs) were working an average of more than 50 hours a week, often in 12-hour shifts "with very few days off for recovery." A significant number of AMEs worked during their days off, either putting in overtime or working extra shifts for another employer, the study said. In addition, the study found that half of the 1,209 AMEs responding to questionnaires believed that overtime worked during night shifts "had a strong negative effect on their work."[3]

The U.K. Civil Aviation Authority (CAA) also recognized the adverse effects of tiredness and fatigue. In an airworthiness notice discussing "personal responsibility when medically unfit," the CAA said that individual maintenance personnel "should be fully aware of the dangers of impaired performance due to these factors and of their personal responsibilities."[4]

ICAO, citing various human factors guides, said that although individuals are responsible for "sensible" sleep habits, "management and local supervision ... have a responsibility to control shifts, breaks, duty periods and overtime to minimize fatigue."

The most straightforward approach is a strict limit on the number of hours worked, said Darol V. Holsman, FSF manager of aviation safety audits. During evaluations of corporate operations, he always recommends a fatigue management policy and always says the best policy is a 12-hour duty-time limit.

"This is one of the human factors issues that should be considered by every operator," Holsman said.

Nevertheless, his estimate is that less than 10 percent of corporate operators have duty-time limits — the limit most often is 12 hours, but some operators establish 14-hour limits — or fatigue management programs. These limits have been implemented within the last three or four years, Holsman said, noting that when he began auditing in 2000, he never found a corporate operation that limited duty time for its maintenance personnel.

"The reason for the low percentage is tradition," he said.

"It's always been this way," he said. "If there's work that needs doing, the expectation — of managers and the technicians themselves — is that they'll be out doing it. The technicians are sometimes their own worst enemy; they willingly do what's expected."

Often, the problem is complicated by sporadic work hours; many operators tell mechanics that when there's no flying activity, there's no reason for them to report to work. "The thinking is that if they work only a few hours one week, then the next week they should be able to work long hours if necessary," Holsman said. "But this still doesn't relieve the responsibility of management to limit duty hours."

Despite the willingness of most maintenance personnel to work long hours to meet those expectations, some also tell


Photo by MCpl Eduardo Mora Pineda

Fighting Fatigue Related Errors

Human factors guides recommend a variety of actions to prevent aviation maintenance errors that stem from fatigue. For example, the International Civil Aviation Organization, in its *Human Factors Guide for Aircraft Maintenance Manual*, recommends the following:

- Because tools and parts can obstruct flight controls if they are left in an aircraft after maintenance, a box or shadow board for wrenches, screwdrivers and other hand tools should bear contrasting-color outlines of each tool to provide a cue if it is not replaced;
- Hand tools that are the personal property of a maintenance technician should be marked, and checklists should be used for each technician's toolbox before an aircraft is released for return to service;
- When maintenance personnel take possession of company-owned tools, a loan system using personal "tool checks" or electronic card controls should be used to identify the person who has possession;
- "Loose-object" inspections should be conducted before final panel closures;
- To limit interruptions, people not involved with maintenance on a specific aircraft should be excluded from the area, unless they have the permission of a supervisor, and only those not working on the aircraft should answer telephone calls; and,
- To avert cross-connections of wiring or plumbing, parts should be color-coded as they are disassembled; to identify cross-connections, functional testing should be conducted any time wiring or plumbing is disturbed. Any instances of cross-connection should be reported to the regulatory body and the type certificate holder.

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stories of falling asleep while working on an airplane, he said.

A few operators and regulatory authorities have rejected duty-time limits in favor of a fatigue risk management system (FRMS), designed to detect behavior related to fatigue and, by doing so, to prevent fatigue-related incidents.

Drew Dawson, director of the Centre for Sleep Research at the University of South Australia, said that FRMS requires consideration of five major levels: "sleep opportunity or average sleep obtained across the organization, actual sleep obtained by individual employees, presence of fatigue-related behavior, occurrence of fatigue-related errors and occurrence of a fatigue-related accident or incident." In an effective FRMS, all five levels are addressed with organized defense systems.[5]

In most cases, FRMS has thus far been applied only to flight crews, but a Canadian initiative aims to incorporate FRMS for both flight crews and maintenance personnel as a mandatory portion of an operator's safety management system (SMS). At press time, the FRMS notice of proposed amendments to the Canadian Aviation Regulations was being reviewed by the Department of Justice; the requirements were expected to take effect for aviation maintenance organizations (AMOs) in March 2009, said Jacqueline Booth-Bourdeau, chief of technical and national programs for TC.

"The implementation of an FRMS is an extension to this [SMS] approach in that it requires operators to implement robust management systems for identifying fatigue-related hazards and managing the related risks," Booth-Bourdeau said. "The FRMS approach clearly establishes the accountabilities at the management and employee levels for fatigue-related issues."

To aid the industry, TC developed an FRMS toolbox, a collection of policy templates, training materials and other approved methodologies for FRMS implementation. The topics covered in the toolbox's training information for employees include how to obtain sufficient rest, manage fatigue and recognize fatigue symptoms in themselves and others. Management materials discuss the implementation process and how to provide sufficient rest; investigate fatigue-related errors, incidents and accidents; and conduct FRMS audits.[6]

A planned implementation trial, using the toolbox, was cancelled because of a change in management at the participating airline, Booth-Bourdeau said.

In Australia, the Civil Aviation Safety Authority (CASA) also is moving toward implementation of FRMS in aviation maintenance.

The CASA maintenance regulations project team said that, although FRMS is not mandatory for aviation maintenance personnel, "CASA is convinced that [it] is necessary and is initiating its design and formulating requirements for implementation.

"Safety outcome-based legislation being developed will place the onus on an employing organization to ensure that there are systems in place to 'preclude an employee from fulfilling any maintenance action where the employee's capability to do it is impaired.'"

The regulation will be accompanied by an Acceptable Means of Compliance, "which will describe how an organization may meet the requirements of the regulation, with a range of options dependent on the size of the organization and the nature of the maintenance to be conducted," the project team said. Maintenance organizations will be required to submit written plans explaining how they will comply with FRMS requirements.

The team said that CASA plans to establish a group including representatives of CASA, AMOs and employee associations to “formulate a way forward” in development of detailed FRMS policies.

Some operators and AMOs have implemented fatigue management programs — sometimes through labor agreements — even without a regulatory requirement to do so.

In Canada, for example, provincial governments limit hours for workers of all types, although they also establish provisions that allow the limits to be exceeded. In addition, some operators, usually smaller organizations, limit work hours to a single eight-hour daytime shift in what is essentially a form of FRMS, Booth-Bourdeau said.

In the United States, the National Transportation Safety Board (NTSB) has for years urged the FAA to limit work hours for maintenance personnel and others in the aviation industry “based on fatigue research, circadian rhythms, and sleep and rest requirements.” A recommendation was added in 1999 to the NTSB’s annual “most wanted” list of safety improvements, specifically calling for a review of fatigue in aviation maintenance and the subsequent establishment of duty time limitations “consistent with the current state of scientific knowledge for personnel who perform maintenance on air carrier aircraft.”[7]

The NTSB said that it disagrees with the FAA’s position that regulatory action is not appropriate, and said that Advisory Circular 120–72, *Maintenance Resource Management (MRM) Training* — characterized by the FAA as a focus of its fatigue education and training efforts for aviation maintenance personnel — in fact contains “little … guidance on human fatigue in maintenance crews other than generalized warnings that attention to fatigue is important and should be considered in MRM training.”

However, the FAA has emphasized, as Deputy Associate Administrator for Aviation Safety Peggy Gilligan told a congressional subcommittee in June 2007, that fatigue research by the FAA and others has shown that fatigue “does not easily lend itself to a set of prescriptive rules.” As a result, she said that, in the future, fatigue risk management will become increasingly important.[8]

The FAA and other proponents of FRMS say that rules to limit work hours are not enough to combat fatigue. The University of South Australia’s Dawson said that, increasingly, sleep specialists believe that traditional duty-time limits “may not be the most appropriate or only way to manage fatigue-related risk.”[9]

“The assumption is that compliance with the limits on working hours is evidence that an individual is adequately rested and fit for work and will not make any fatigue-related errors,” Dawson said. Nevertheless, “any hazard has multiple causes and should thus be managed using multiple overlapping defenses.” ◆

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SMS and the Development of Effective Safety Culture

Photo by Cpl Kevin Scott

By Curt Lewis, P.Eng., CSP, ATP and L. Christopher, Ed.

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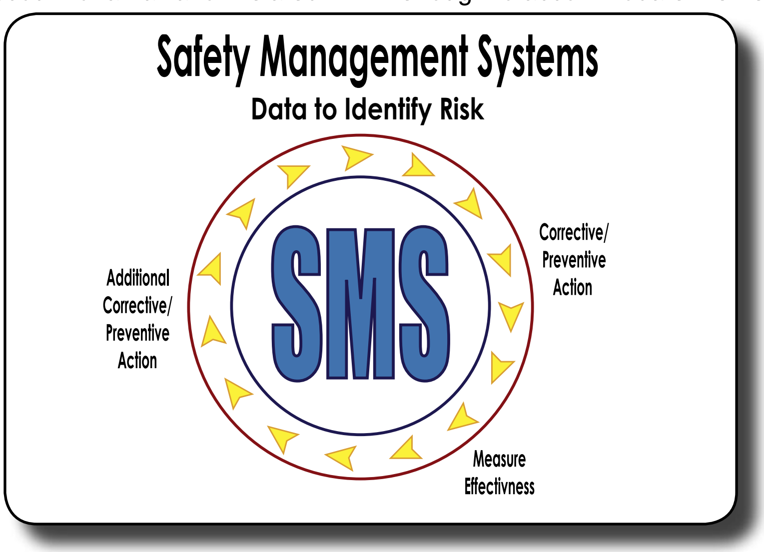
Whenever you turn on the nightly news, chances are you will be hearing some mention of the aviation industry. It may be an account of an aviation-related incident. It may be a report detailing changing airline policies or the rising cost of air transportation. Or, more recently, it may be a discussion of air safety and new FAA regulations.



As we all know, Safety Management Systems, or SMS, has been of primary importance to the FAA for a number of years. SMS was recognized as vital to the continued growth and success of the aviation industry that a set of uniform safety standards should be created, one which would conform to international SMS aviation protocols while being flexible enough to accommodate the needs of individual American airports. To this end the FAA implemented a pilot program to study and compare the current Airport Certification Programs and developing SMS principles. The results of this pilot program are already being put to use by the FAA, resulting in the implementation of new safety protocols for the aviation industry, and the establishment of SMS as a US aviation regulatory standard.

But although we know why SMS should be adopted and what it should accomplish, Safety Management Systems are about more than just regulations and enforcement. In order for SMS to not only work but to remain effective, the aviation industry needs to create a *culture of safety.*

Safety culture can be very simply defined as an organizational commitment to safety at all levels of operation. Establishing an effective safety culture, however, is anything but simple. Effective safety cultures distinguish themselves through having clearly defined procedures, a well understood hierarchy of responsibilities at all levels, and clear lines of reporting to facilitate effective and useful communications regarding safety issues. A more detailed list of the attributes of an effective safety culture was presented by the International Civil Aviation Organization, which placed a strong emphasis on the role of senior management and the importance of communication.

All levels of aviation management must make it clear that safety culture is concerned with the safety not only of airline passengers but also of airport and airline employees. Safety management should not be viewed as simply a means to an end or a blind adherence to industry standards, but rather as a company-wide – and indeed industry-wide – commitment to best-practices and continuous improvement of everything safety-related. In an effective safety culture under SMS, human error is seen as inevitable, and the focus is shifted from reactive to the proactive method of managing risk. The prevailing view of risk should be professional and realistic, focusing on eliminating or maintaining optimum levels of acceptable risk using past incidents, perspective, and insight.

The aviation industry has in the past been comfortable maintaining a reactive position to safety regarding occurrences as isolated incidents, and consistently taking action only when something happens. This attitude gradually became more calculated, growing into a regulatory system and developing a bureaucracy to enforce it. The introduction of SMS is shifting the focus from enforcement-centered to a more proactive approach, and hopefully will give rise to a culture of safety so firmly established that the perception will be that safety is simply the best, most effective, and most profitable way to do business.

Effective safety management is a learned skill and, as with any skill, continues to grow and develop over time the more it is practiced. Therefore an effective culture of safety is one that has practiced safety management until that skill set has become second-nature – safety is simply the way business is done, and improvements to the system are considered improvements to the company as a whole.

Of course, this procedure for creating and maintaining a safety culture sounds much easier than it actually is; roadblocks must be expected throughout the process at all levels. Management, initially on board with the implementation of SMS, may become less enthusiastic as they realize that some changes will not be cheap or simple to implement. Managers may be uncomfortable soliciting and responding to negative feedback, and lower-echelon staff members may be difficult to convince that reporting honestly on current or potential problems is in their best interest. In some groups, such as pilots or physicians, where perception of infallibility can be closely linked to professional reputation, the idea of admitting personal error may be akin to admitting personal and professional failure - or possibly to committing professional suicide. These are all hurdles which must be overcome systematically at an organizational level, with a major top-down emphasis on building trust and establishing non-punitive reporting systems. Without these two factors in place, SMS cannot be successful and a culture of safety will not develop successfully. Similarly, the basic conditions which must exist in order for safety culture to flourish are:

- Trust;
- A non-punitive policy toward error;
- Commitment to taking action to reduce risk-inducing conditions;
- Diagnostic data that show; the nature threats and the types of errors occurring;
- Training in threat recognition and error avoidance and management strategies for crews (CRM); and,
- Training in evaluating and reinforcing threat recognition and error management for instructors and evaluators (Helmreich, 1999).

The concept of Crew Resource Management, or CRM, is based on the idea that organizations must recognize that human error is unavoidable and that it is the responsibility of a mature organization to effectively manage that error (Hayward, 1999). CRM seeks to

- Reduce the likelihood of error;
- Isolate errors before they have an operational effect; and,
- Reduce the consequences of errors when they do occur.

CRM as it is known today is an outgrowth of Cockpit Resource Management training, which was developed in the early 1980s and gradually expanded into other aspects of aviation and outward from there into other industries. Properly implemented according to the specific needs and culture of a particular organization, this approach to the

In a good safety culture, Senior Management

- Places a strong emphasis on safety
- Has an understanding of hazards within the workplace
- Accepts criticism and is open to opposing views
- Fosters a climate that encourages feedback
- Emphasizes the importance of communicating relevant safety information
- Promotes realistic and workable safety rules
- Ensures staff are well educated and trained so that the consequences of unsafe acts are understood

Flannery, 2001

"There is a growing awareness that safety is a system phenomenon and that accidents represent a concatenation of multiple factors that cannot be addressed by training and by new technology alone."

Helmreich, 1999

THE EVOLUTION OF SAFETY CULTURE

➤ **Pathological**
We don't care as long as we don't get caught

➤ **Reactive**
We take action only in response to incidents

➤ **Calculative**
Our approach to safety is systematic, through an established bureaucracy

➤ **Proactive**
We take steps to deal with issues before incidents occur

➤ **Generative**
Safety is how we do business

Hudson, 2001

handling of incidents and reporting can be highly effective for combating and correcting issues with reporting, feedback, and admission of fallibility.

Establishing and maintaining such systems requires a firm commitment from management to 'stay the course' even when, from a purely financial perspective, it would be more advantageous not to. Data-gathering, for example, can be a costly and time-consuming process, as can the creation and implementation of new training programs. Management must not only be cognizant of the long-term benefits of those costly, inconvenient actions, they must also be aware that employee and indeed public perception of their willingness to pursue safety ahead of or at least on a visibly equal basis with profit will greatly contribute to the trust-building which is such a vital element of effective safety culture.

Finally, the concept of safety culture cannot be discussed without also touching on the related concept of safety climate. These terms are sometimes used interchangeably, but they actually define different dimensions of the issue of safety. Safety culture, so closely tied to SMS, speaks to the development of safety regulations and related organizational safety systems which work to create a stable and long-lasting environment. Safety climate, on the other hand, more often refers to the psychological perception of the state of safety at a particular time (Zhang et al., 2002), which of course can be expected to change frequently under the influence of any number of social and environmental factors. Monitoring the safety climate within an organization, therefore, should provide valuable insights into the state of that organization's developing culture of safety, especially during the implementation phase of new systems and procedures.

All in all, safety culture should be seen as a natural outgrowth of the application of well thought-out Safety Management Systems, the commitment of senior management to safety as the best way to do business, and the growth and development of safety-oriented organizational norms. Like SMS, the evolution of safety culture is a continuous process, not a means to an end or a static goal to be reached; a healthy culture of safety should maintain its stability while constantly reaching toward new heights, never stopping in place and saying, "That's good enough, we don't need to do any more." Through this continuous process the aviation industry, and other industries as well, can proactively expect to reach a goal where safety truly will become just the way we do business. ◆

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Editorial Note

In *Flight 2005: A Civil Aviation Safety Framework for Canada, Transport Canada* committed to the implementation of SMSs in aviation organizations. At the most fundamental level, the aim is to improve safety through proactive management rather than reactive compliance with regulatory requirements.

Holders of Transport Canada-issued operation certificates will be required to implement an SMS. The implementation date for various Parts of the Canadian Aviation Regulations will vary based on the progress of the Notice of Proposed Amendments (NPA) through the regulatory system. The expected result of this initiative is the improvement of safety practices fostering stronger safety cultures within the civil aviation industry.

The following website provides Transport Canada's implementation plan for SMS for civil aviation, guidance material, as well as other relevant information: http://www.tc.gc.ca/CivilAviation/SMS/menu.htm.

The Canadian Forces have been running their own SMS for a number of years. Our Program is seen by many organizations as a model to follow. Notwithstanding, it is important to emulate best practices of civilian and military counterparts on both the national and international fronts.

AIR FORCE PERSONNEL FOOTWEAR

By Major Christopher England, Aviation Life Support Equipment Officer, Directorate of Air Programmes, Ottawa

This is the second instalment in a series of articles on Aviation Life Support Equipment (ALSE). As the Chief of the Air Staff ALSE Officer, I thought that it might be a great opportunity to discuss an item that is near and dear to the hearts and minds of all aircrew (and Air Force personnel for that matter) – FOOTWEAR!!

In this article I hope to dispel some of the urban myths and misconceptions about all the new boots that are being introduced into the Air Force inventory that will "enhance survivability and comfort for Air personnel conducting operations in environments ranging from -40°C to +40°C" – namely the Extreme Cold Wet Weather Boot (ECWB), the Cold Wet Weather Boot (CWWB), the Temperate Combat Boot (TCB), the Desert Combat Boot (DCB) and the Combat Sock System (CSS).

I will cover the background chronology that has led the Clothing and Equipment Millenium Standard (CEMS) project staff to the decision to introduce these four new pairs of boots, the design and performance advantages of the new footwear, the importance of properly fitting the new footwear (with a discussion on the CSS) and the proper care of the new footwear. I would also like to acknowledge the fact that I used the CEMS website (http://www.forces.gc.ca/cems) for some of the technical data and discussion points.

To address various deficiencies in Air personnel clothing and equipment, the CEMS project was established in May 2000. Of the 24 items addressed by the project, four new boots were specifically designed "to keep feet warm and dry in colder climates, all the while allowing for breathability and heat dissipation in warmer climates." The first question to be answered by the project staff was in what role these boots would be used.

A comparison of the respective roles of Army personnel to Air Force personnel revealed that Army boots were designed for use over long distances with heavy loads and therefore were lighter in design. In addition, unlike Air Force requirements, Army boots were not designed with Flame Resistant (FR) or Shock Resistant qualities, part of the CSA Grade 1 certification requirements. In years past, aircrew were simply provided with boots that were designed for use by Army personnel (e.g. Mk III Combat Boot or Boots Flyers, which were simply Mk III Combat Boots with an anti-FOD sole). Quite simply adopting the newer General Purpose Boot (introduced by the Army) would no longer meet the requirements of the Air Force. The net result of differing roles and differing certification requirements has led to the Air Force boots being heavier than the Army counterpart.

Whereas the Army boots are constructed partially with leather uppers, the Air Force boots are constructed entirely from leather. In an attempt to save weight in the boot design, the use of composite materials was considered, but these materials did not offer the CSA safety standard that was required – therefore leading to the use of steel plates and steel toes in the new Air Force boots. A compromise was struck between a better boot and a heavier boot as well as a more stable boot with the appropriate amount of cushioning. The end result was four pairs of boots that struck the right balance between the sole design (soft or hard compounds) and cushioning (foam, felt, cork and resin layers inside the boot). In addition to these design characteristics, all the boots "feature a speed lacing system; a three part sole for shock absorption; a modified sole for anti-FOD, POL and penetration resistance; flame resistance; safety toes; waterproofing; and wicking characteristics." *Prior to authorization for use by all aircrew in all fleets*, these boots underwent extensive Engineering and Operational Test & Evaluations leading to the issue of the respective Technical Airworthiness Certifications and Operational Airworthiness Certifications.

Let's have a quick look and compare some of the characteristics of the four new boots. In addressing the operational needs of the Air Force, a temperature range was defined (-40°C to +40°C) paired with the concept that not all personnel would require all of these different boots all of the time (i.e. extreme cold and extreme heat protection would only be required to a select population within the Air Force). The net result was a boot that would address the bottom and top extremes of the temperature spectrum and two boots that would address the middle of the spectrum.

Each of the boots described here have "been designed for a specific environment and temperature range, including the rubber compound used on the outsoles." The Extreme Cold Wet Weather Boot (ECWB) will address the -40°C to -25°C range. This boot is still being developed but will exhibit all the same features previously discussed. The Cold Wet Weather Boot (CWWB) will cover the -25°C to +10°C range "in all operating locations." The boot sole is designed much like a winter tire, with a softer compound that will more easily grip icy surfaces without becoming a FOD hazard. The Temperate Combat Boot (TCB) will address the +10°C to +30°C range and will have a harder rubber compound sole, providing the appropriate amount of cushioning in warmer climates. The Desert Combat Boot (DCB) will protect Air Force personnel in extreme heat environments (+30°C and above). Of note, the ECWB and CWWB have a Gore Tex liner within the boot wall, providing the Wet Weather resistance, whereas the TCB and DCB are made with breathable liners, thus providing the appropriate wicking in moist/warm environments. Hopefully by now, you have a better appreciation of the design and performance advantages of the newly designed boots; but what about getting the right boot to fit your foot?

Myth-buster:

"THE USE OF STEEL TOES AND PLATES HAVE BEEN AUTHORIZED FOR USE IN ALL AIR FORCE BOOTS BEING USED IN ALL APPLICATIONS, INCLUDING AIRCREW AND SAR TECHS."

These boots were designed to be used in conjunction with the Combat Sock System (CSS) and therefore a few words about the CSS. The Combat Sock System (CSS) is a modular sock system "designed to provide enhanced thermal protection, moisture management and abrasion protection." When used with the new boots and existing Arctic footwear (White Mukluks), this sock system will "provide protection and comfort in climatic conditions existing in the temperature range –57°C to 49°C." The system will also "provide significant improvements in moisture management, protection against injury from environmental effects and enhancement of comfort. It will be a layered system that will permit the liner sock to be worn with either the mid-weight or the heavyweight sock to meet requirements." There are three components to the CSS (description taken from the CEMS website):

- A lightweight black sock/liner intended to provide moisture management and blister prevention; worn either as a stand-alone sock in temperate and higher temperature ranges or as a liner for one of the other system components, based on insulation or comfort requirements.
- A mid-weight green sock to provide the required levels of comfort and cool climate thermal protection. Wearing this sock with the liner component will enhance moisture management and blister prevention.

- A heavyweight gray sock to provide the required levels of comfort and cool to extreme cold climate thermal protection. Wearing this sock with the liner component will enhance moisture management and blister prevention.

Therefore, to take advantage of all the design and performance advantages afforded by the new boots and the CSS, it is imperative that the boots be fitted properly. Historical problems with ill-fitting boots (pressure points and blistering) raised significant concerns amongst Air Force personnel about their footwear. In years past, there were limited lengths and widths available and personnel were left to accept the best fit that they could find through trial and error. The trial and error portion remains to this day but the availability of more choices has been addressed. This has been resolved with the use of a newer sizing system that has introduced 72 sizes of boots with varying lengths (in 5mm increments) and widths (in 4mm increments). So remember that when you go to get sized for your new boots – wear the CSS (as appropriate to the boot you are ordering) and start with the foot measurement device to get you in the right ballpark. You will still need to try on several pairs to find the right one for you. For those that wear orthotics, remember to include those in the boot sizing exercise (since the new boots have been designed to accommodate orthotics)! This new system of boot sizing will address the majority of Air Force personnel requirements – but there will still be exceptions to this and will be addressed on a "case by case" basis with custom ordered boots. Time spent initially getting the right size of boot will pay dividends in the long run. The supply system on each Wing (with the exception of the NCR due to imminent relocation of supply) has been provided with the sizing tools and sample boots (yes, all 72 sizes!) to assist you in finding the right boot. It is your responsibility to make sure that you take the time to find the right boot for yourself.

For those of you wondering how many of these new pairs of boots you are entitled to, the ECWB (once developed and delivered) and the DCB have an entitlement of one pair of each (as dictated by operational environmental necessities). The CWWB and the TCB have an entitlement of two pairs of each (regardless of the environment in which you are working). Traditionally, boots worn by all aircrew had their entitlement reflected on the Aircrew Scale of Issue (D01-319), but now since these new boots are for all Air Force personnel, the entitlement will be reflected on the Air Force Operational Clothing & Equipment Scale of Issue (D01-341). One last point, with the exception of the DCB, these new boots are designed to be maintained with paste (not shoe polish) so as to maintain their respective design characteristics and the paste is available at supply. The time required to "break-in" the new boots should be less than previous boots in the system.

In summary, there are four new pairs of boots available to the Air Force. The CEMS project has "undertaken extensive technical and engineering development, human factors evaluations and user trials to ensure that the new boots in the Air Force supply system meet the operational and comfort needs of all personnel carrying out Air Force tasks." As aircrew you will notice the improvements made to the new footwear as compared to previous models. The new boots introduced into the system will also help to alleviate the necessity for Local Purchase Orders (LPO) of appropriate winter boots (for example, the Matterhorn boots).

Remember to take time to understand the concept behind the use of these new boots (boot + sock = system); take time to get the proper size – if the boots don't fit properly when you first get them, they will never feel right! As usual, use the ALSE Chain of command to report any concerns or questions that you may have – not only on footwear but on any ALSE issue. ◆

FLASHLIGHTS….
THE ORIGIN OF FIRE?

By Warrant Officer Cordell Deck, Canadian Forces Tool Control Centre, Life Cycle Material Manager Technical Authority, Aerospace and Telecommunications Engineering Support Squadron, Trenton

Most aircraft technicians and aircrew consider flashlights to be an essential part of their personal kit. Flashlights can be found in almost any tool board, tool pouch, tool crib or aircrew bag. In practice, they are safe to use but can represent a fire hazard. There was a recent Flight Safety incident involving a flashlight found in the on-board tool kit of a CH146 Griffon Helicopter. The light was found to have somehow overheated and melted the flashlight casing. The cause of this failure was determined to be the result of reverse polarity.

It is a common misconception that flashlights will not work if the batteries are put in backwards, i.e. with reversed polarity. In some cases this is true, but not always. Tests conducted by the Canadian Forces Tool Control Centre (CFTCC) located at the Aerospace and Telecommunications Engineering Support Squadron showed that six of the 10 different types of flashlights tested worked when the polarity is reversed.

Visits to various Air Force Units across Canada revealed that units employ several different types of flashlights. This is not surprising given the large selection of flashlights available on the market. Unfortunately, the Class and Division specifications had been ignored in many instances during the procurement process although these flashlights were to be used during aircraft maintenance or in aircraft operations.

Flashlights used on aircraft and in aircraft hangar shall meet the requirements set forth in the C-05-005-P10/AM-001. Practically, the flashlight shall have a Canadian Standards Association (CSA) or Underwriters Laboratory (UL) (see Figure 1) approved rating for Class 1, Division 1 (Division 2 in some cases) (see Figure 2). Aircraft hangars and aircraft are deemed

WHAT MAKES A FLASHLIGHT SAFE

Products must pass a battery of rigorous tests conducted by safety agencies before getting a stamp of approval. When you're in a potentially hazardous environment, using a flashlight that carries these approvals is vital.

UL Underwriters Laboratory	FM Factory Mutual	MSHA Mine Safety Health Association	SP Canadian Standards Association
IECEx International Electrotechinal Commission	c ETL LISTED us Electrical Testing Laboratories	USAR Urban Search And Rescue	CE Ex ATEX Europe

Figure 1. Laboratories Stamp of Approval

to be hazardous locations given the fact that gases may be present in sufficient quantities to produce explosive or flammable mixtures.

Flashlights tested and approved for use within specified environments will usually cost more. They are tested by independent laboratories such as UL or CSA against strict standards for electrical appliances for use in hazardous locations. You can easily check the rating of flashlights since they have markings on the casing identifying what organizational approvals they have and what environments they are safe to use in.

CFTCC is always eager to provide advice and recommendations and may be contacted regarding any tool control issue. ◆

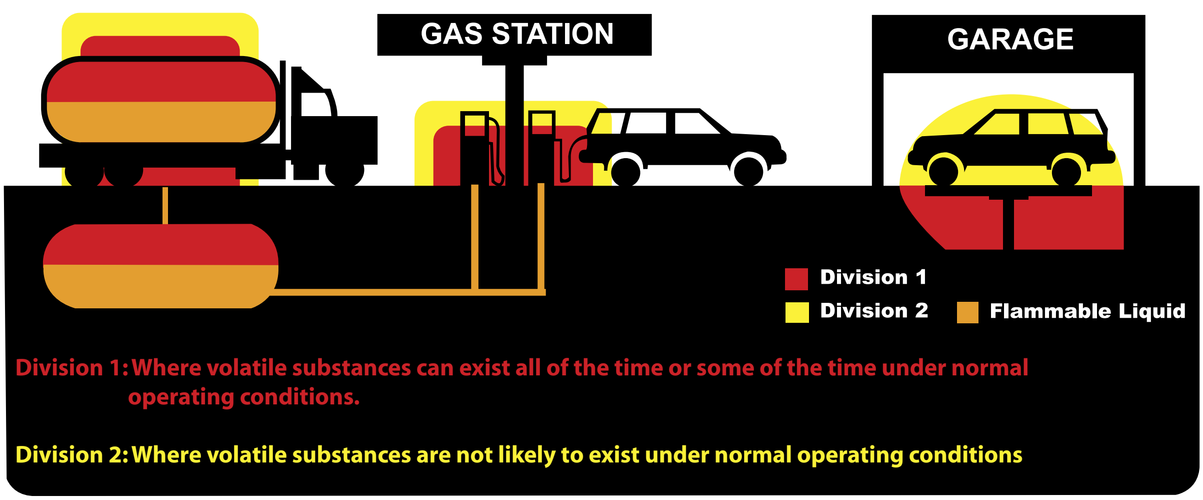
CLASS	HAZARDOUS MATERIAL	TYPICAL ENVIRONMENTS	CLASSIFICATION	VOLATILITY
Class I	Flammable Gases, Vapors or Liquids (Acetylene, Hydrogen, Ethylene, Propane)	Oil Refinery Paint Warehouse Offshore Oil Rig Spray Booth	Division 1	MOST
			Division 2	
Class II	Combustible Dusts (Metals [Div.1 only], Coal, Grain)	Coal Mine Grain Silo Munitions Factory Hay Storage Facility	Division 1	
			Division 2	
Class III	Ignitable Fibers & Flyings (Machined Magnesium)	Paper Mill Woodworking Facility Textile Mill Cotton Gin	Division 1	
			Division 2	LEAST

Class

- Class I location is an area where flammable gases may be present in sufficient quantities to produce explosive or flammable mixtures.
- Class II locations is an area where combustible dust can be present.
- Class III location is an area containing easily ignitable fibres and flyings.

Division

- Division 1 designates an environment where flammable gases, vapours, liquids, combustible dusts or ignitable fibres and flyings are likely to exist under normal operating conditions. Therefore, hazard is likely.
- Division 2 designates an environment where flammable gases, vapours, liquids, combustible dusts or ignitable fibres and flyings are not likely to exist under normal operating conditions. Therefore, hazard is unlikely.



Reference: Canadian Electrical Code, Part 1, Section 18

Figure 2. Hazardous Area Electrical Guidelines

Accumulated Stress
Presents Range of Health Risks

By the Flight Safety Foundation Editorial Staff

This article was published in the Flight Safety Foundation journal Human Factors & Aviation Medicine (Vol. 53 No.1, January-February 2006). It is reproduced with the kind permission of the Flight Safety Foundation.

Although small amounts of stress can yield benefits such as increased alertness and an improved ability to concentrate, an accumulation of stress caused by daily frustration and major life events has been associated with numerous health problems. In studies of flight crew members, stress has been associated with pilot error.

Stress is the body's response to demands, pressures or changes. Causes of stress (stressors) can be major life events, such as a death in the family or a new job; ongoing aggravations, such as a chronic illness or an inflexible work schedule; or the annoyances of daily life, such as traffic jams or — to crewmembers — exposure to aircraft engine noise and vibration during flight.

Each encounter with a stressor causes a complex reaction that begins with a signal from the brain to the autonomic nervous system, which controls involuntary body functions such as breathing, heart rate and blood pressure. The signal from the brain also triggers the release of hormones — primarily adrenaline and nor adrenaline (also known as epinephrine and nor epinephrine) from the adrenal glands — into the bloodstream to prepare the body to cope with a perceived danger.[1]

In response to the brain's signal, the breathing rate increases to allow the body to take in more oxygen, and the heart rate increases, blood pressure rises, and some blood vessels narrow, directing blood to the muscles and brain and away from the skin and other organs not involved in the response to the perceived danger. Some blood cells (platelets) become "stickier" (more adhesive) to prevent excessive bleeding in the event of injury. Fats and glucose (sugar) are released from storage sites to provide energy, and muscles become tense.

Long ago, the stress response was vital in fighting off enemies and running from predatory beasts (the "fight-or-flight" response). However, the stress response typically occurs today in situations that are considerably less than life-threatening; repeated activation of the stress response, rather than providing the impetus to fight or to flee danger, may contribute to serious health problems.

The body "does a poor job of distinguishing between life-threatening events and day-to-day stressful situations," says a Harvard Medical School report on stress.[2] "Anger or anxiety triggered by less momentous sources of stress, such as financial fears or traffic jams, doesn't find a quick physical release and tends to build up as the day rolls on. Anticipation of potential problems, such as anxiety brought on by government warnings of terrorist activity or more personal worry stemming from awaiting medical [test] results, adds to the turmoil. The physical and psychological symptoms of stress — a clenched jaw, shakiness, anxious feelings — compound this, creating a negative, self perpetuating cycle" (see "Symptoms of Stress" p.33).

Stress Can Have Benefits

Stress cannot be avoided, and the right amount of stress is considered beneficial; it helps people stay alert, focused on the task at hand and interested in the world around them.

Individual stress responses differ; some people become stressed in response to minor daily occurrences while others cope with virtually everything with no outward indication of stress. Genetics may be partly responsible for the differences.

"The genes that control the stress response keep most people on a fairly even keel, only occasionally priming the body for 'fight or flight,'" the Mayo Clinic said.[3] "Overactive or underactive stress responses may stem from slight differences in these genes.

"Life experiences may increase your sensitivity to stress as well. Strong stress reactions sometimes can be traced to early environmental factors. People who were exposed to extreme stress as children tend to be particularly vulnerable to stress as adults."

For pilots and other crewmembers, even under ordinary conditions, the flight environment includes stressors such as noise, vibration, decreased barometric pressure, and accelerative forces. Fatigue and altered sleep-wake cycles also may be factors, especially for crewmembers on flights that span several times zones.[4]

The "Wrong Stuff"

Moreover, a 2000 study found that the captain's personality type also influences the amount of stress on the flight deck.[5]

During the study, 24 three-member

flight crews performed line operations, including emergency operations, in a Boeing 737 simulator; afterward, they were tested for perceived stress. The crews that committed the fewest errors reported experiencing less stress than crews that committed more errors. The crews with the fewest errors typically were led by captains who were categorized in the report on the study as possessing the "right stuff" (for example, they were described as "active, warm, confident, competitive and preferring excellence and challenges").

Other captains were categorized as possessing either the "wrong stuff" (for example, they were described as arrogant, authoritarian, emotionally invulnerable, impatient, irritable, preferring excellence and challenging tasks, and having limited interpersonal warmth/sensitivity) or "no stuff" (for example, they were described as "unassertive [and] self subordinating, [with] average interpersonal [skills], low self confidence, low desire for challenging tasks and low desire for excellence").

"General Adaptation Syndrome"

Researchers have studied stress for many decades, but it was not until the 1940s that Hans Selye, an endocrinologist at McGill University in Montreal, Quebec, Canada, developed the "general adaptation syndrome" (stress syndrome) theory. According to this theory, an encounter with stress develops in three stages: [6,7]

- The *alarm reaction* includes an initial shock, in which an individual's resistance is lowered, followed by a counter shock, in which the individual's defense mechanisms are activated;
- *Resistance* is the stage of maximum adaptation; if the adaptation succeeds, the individual's body functions return to normal; and,
- If the stressor persists or if the defense mechanism fails , the result is *exhaustion*, in which the defense mechanisms collapse.

Symptoms of Stress

Symptoms of stress are numerous and differ from one person to another. Common symptoms include the following: [1,2,3]

Physical symptoms

- Tense muscles, especially in the neck and shoulders;
- Headache or backache;
- Stomachache, nausea, vomiting, diarrhea or constipation;
- Tiredness or difficulty sleeping;
- Unusually rapid heartbeat;
- Shakiness or excessive sweating;
- Weight loss or weight gain;
- Clenched jaw or clenched teeth;
- Fingernail-biting;
- Sighing or changes in breathing patterns; and,
- Decreased interest in sex.

Emotional symptoms

- Frustration, irritability or anger;
- Depression or anxiety;
- Nervousness; and,
- Boredom or apathy.

Behavioural symptoms

- Abuse of alcohol, drugs or other substances;
- Marital problems;
- Binge eating; and,
- Self-destructive behaviour.

Cognitive symptoms

- Forgetfulness, preoccupation and difficulty concentrating;
- Indecisiveness;
- Work mistakes and loss of productivity;
- Excessive worry;
- Decrease in creativity; and,
- Loss of sense of humour.

Notes

1. Harvard Medical School. *Stress Control: Techniques for Preventing and Easing Stress*. Boston, Massachusetts, U.S.: Harvard Health Publications, 2002.
2. Mount Sinai Medical Center. *Stress*. <www.mssm.edu>
3. The Cleveland Clinic. *Keys for Managing Daily Stress*.<www. clevelandclinic.org>.

Later research found that one or more sources of stress — either at home or at work — in combination with personality traits such as competitiveness and impatience (typically described as elements of a "type A" personality), may lead to a variety of "stress manifestations" such as physical illness or mental illness or dissatisfaction with a job or a marriage.[8]

For pilots — who have been identified as having one of the most stressful occupations — on-the-job stress may occur when operational demands exceed the pilot's physical capacity and/or mental capacity. In these situations, researchers have assumed that pilots with "an overload of information" have an increased risk of stress-related performance errors.[9,10]

Study Links Stress, Pilot Error

A 1985 study of more than 700 U.S. Naval aviators who were involved in major aircraft mishaps found that the 381 aviators who were "causally involved" were more likely to have had problems with interpersonal relationships — one of the symptoms often displayed by someone who is not coping well with stress — than were the 356 aviators who "had no culpability in their mishaps."[11]

A report on the study said that the data showed that aviators in the causally involved group also "are more likely to be poor leaders, to be less mature and stable, to lack an adequate sense of their own limitations, and to lack professionalism and the ability to assess troublesome situations. In addition, they are more likely to have financial problems, to have trouble with interpersonal relationships, to have trouble with superiors and peers, and to drink to excess or to have recently changed their alcohol intake. They are more likely to have recently become engaged to be married, be making a major career decision and to have undergone a recent personality change. …

"It also appears that there are certain personality factors that render some aviators more susceptible to the adverse effects of stress, as evidenced by their higher human-error-mishap potential. Such factors as a lack of maturity, no sense of their own limitations and an inability to assess potentially troublesome situations are more prevalent among those who are subsequently assigned fault in an aircraft mishap."

Home Stress Adds to Job Stress

Researchers have studied the effects on pilot performance of both job-related stress and stress at home.

A study based on a questionnaire administered to 19 U.S. Coast Guard helicopter pilots in 2000 found that, as stress at home increased, stress on the job also increased.[12]

"Pilots under stress at home felt tired and worried … at work," said the U.S. Federal Aviation Administration (FAA) report on the study.[13] "Pilots indicated that as the home stress experienced at work increased, self-perceptions of flying performance decreased, especially the sense of 'not feeling ahead of the game.' Authors of the FAA report said that their findings were that the pilots surveyed identified their primary coping strategies as a stable spousal relationship, a stable home life and the ability to talk with an understanding partner.

"The first warning signs of home-based psychological distress may be more evident in the daily work activities rather than in cockpit error," the report said. "If support services and management recognized the early warning signs at work that were symptomatic of home-based stress, they could provide timely intervention before the occurrence of more serious flying performance decrements."

Results of Stress

Researchers estimate that more than 40 percent of adults experience adverse health effects associated with stress and that more than 75 percent of visits to physicians' offices are for stress-related problems.[14]

These problems can be relatively minor, such as clenched teeth or tiredness, but they also can be life-threatening. For example, stress is associated with heart disease and diseases involving the immune system, as well as accidents and suicides. Stress also can exacerbate a number of medical conditions, including gastrointestinal disorders and asthma; some medical specialists believe that stress can be a factor in the development of cancer.

The Harvard Medical School report said that the widespread implications of stress include direct effects, "such as … long term suppression of the immune system, causing stickier than normal platelets, slowing wound-healing, or constricting major blood vessels, and indirect effects on behavior. Overeating, smoking, drinking too much, not exercising enough and engaging in other risky behavior can certainly take a toll."[15]

More specifically, stress influences heart disease in several ways:[16]

- The stress-related release of adrenaline and other hormones into the blood increases the amount of cholesterol manufactured by the body. (For example, one study found that the blood cholesterol levels of medical students increased by about 25 percent during their final exam period). Elevated blood cholesterol levels contribute to atherosclerosis, the narrowing of blood vessels, which can lead to chest pain, heart attack or stroke;
- Stress-related increases in blood pressure can contribute to hypertension (high blood pressure), which — by placing extra pressure on the blood vessels — can result in injury to the vessels and can force more cholesterol into the artery walls, increasing the risk of atherosclerosis; and,
- The stickier-than-normal blood platelets, which speed blood clotting, also increase the risk that a clot will form within a blood vessel — a problem that could increase the risk of heart attack, especially in an individual with atherosclerosis.

Chronic stress reduces the effectiveness of the body's immune system. The immune system typically responds to an infection by releasing substances to fight the infection; after the infection subsides, the adrenal glands release the hormone cortisol to stop the body's infection-fighting response. During periods of stress, cortisol is among the hormones that remain elevated; at the elevated level, cortisol can suppress the immune system, preventing a response to infection.[17]

However, in some cases, stress causes the immune system to overreact. The result is an increased risk of autoimmune diseases, such as lupus, in which the immune system attacks healthy cells. Stress also can exacerbate the symptoms of existing autoimmune diseases.

Some medical specialists believe that chronic stress — because of its effects on the immune system — may influence the development of cancer by restricting the body's ability to stop the spread of cancer cells. Their theory is that cancerous changes in the body's cells occur often and for many reasons but that the immune system destroys these altered cells; when the immune system cannot do its job, the cancer cells spread.[18]

Stress is one of several factors that can contribute to gastrointestinal ailments. For example, stress can cause an increase in the secretion of gastric acid, which can lead to heartburn. Studies have found that a combination of stress and other psychological factors and physical factors can cause gastrointestinal pain and abnormal contractions in the intestines that often are symptoms of irritable bowel syndrome. Another study found that people who considered their lives stressful were about twice as likely to have ulcers as people who did not believe that they were experiencing stress. Earlier findings identified a bacterium as the primary cause of ulcers, but some medical specialists now believe that stress could delay the healing of ulcers.[19]

Stress is one of dozens of factors that can trigger an asthma attack. The stress response causes small airways in the lungs to contract (tighten), interfering with the flow of air into and out of the lungs. Some specialists also believe that a person's exposure to intense stress when very young can contribute to the development of asthma.[20]

Relax...

Progressive muscle relaxation and deep breathing, also known as relaxed breathing or abdominal breathing, are techniques designed to help manage stress.

To perform progressive muscle relaxation, assume a comfortable position, with support for your head and neck. Close your eyes and tense the muscles in the hands and arms to 25 percent to 50 percent of maximum tension; maintain the tension for a few seconds as you continue to breathe, then release the tension and focus your attention on the contrast between tense muscles and relaxed muscles. Repeat the muscle-tensing and tension releasing process once for each of six other muscle groups: muscles in the face; in the neck and shoulders; in the stomach and abdomen; in the buttocks and thighs; in the calves of the legs; and in the toes. Sit quietly for several minutes and focus your attention on the feeling of relaxation. Slowly open your eyes.[1]

To perform deep breathing, inhale through your nose while mentally counting to 10. As you inhale, your upper abdomen — not your chest — should rise. Exhale slowly and completely, again mentally counting to 10. Repeat between five times and ten times.[2]

— FSF Editorial Staff

Notes

1. Mount Sinai School of Medicine. *Stress*. <www.mssm.edu>. The technique is one suggested by the American Heart Association.
2. Mayo Clinic. *Stress: Why You Have It and How It Hurts Your Health*. <www.mayoclinic.com>.

How to Cope

People cope with stress in many ways. Specialists say that the first step in coping is to identify stressors and the symptoms that occur after exposure to those stressors.

Other recommendations involve development or maintenance of a healthy lifestyle, with adequate rest and exercise, a healthy diet, limited consumption of alcoholic drinks and avoidance of tobacco products.

More specific recommendations include the following:[21, 22]

- Remove the stressor, or change your way of thinking about the stressor;
- Seek training in common stress-reduction techniques such as meditation, yoga, tai chi; and biofeedback-assisted relaxation. Some people also find relief in prayer;
- Perform progressive muscle-relaxation or deep-breathing exercises (see "Relax..");
- Talk to someone else about the situation. Psychiatrists, psychologists and licensed clinical social workers all have training to help people cope with situations that trigger a stress response;
- Visit a massage therapist, use a hot tub, or take a bath or shower;
- Exercise or play sports;
- Go outdoors; or,
- Listen to music, read a book, write in a journal or write a list, engage in a hobby or other enjoyable activity.

Major life events and the frustrations of daily living result in an accumulation of stress that has been associated with numerous health problems, as well as with pilot error. With a healthy lifestyle, an understanding of what causes stress and selection of appropriate coping mechanisms, people can learn to alleviate their stress. ◆

Notes

1. Harvard Medical School. *Stress Control: Techniques for Preventing and Easing Stress.* Boston, Massachusetts, U.S.: Harvard Health Publications, 2002.
2. Ibid.
3. Mayo Clinic. *Stress: Why You Have It and How It Hurts Your Health* <www.mayoclinic.com>.
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9. Ibid.
10. Bowles; Ursin; Picano.
11. Alkov, Robert A.; Gaynor, John A.; Borowsky, Michael S. “Pilot Error as a Symptom of Inadequate Stress Coping.” Aviation, Space, and *Environmental Medicine* Volume 56 (March 1985).
12. Fiedler, E.R.; Della Rocco, P.S.; Schroeder, D.J.; Nguyen, K. *The Relationship Between Aviators’ Home-based Stress to Work Stress and Self-perceived Performance.* DOT/FAA/AM-00/32. Oklahoma City, Oklahoma, U.S.: U.S. Federal Aviation Administration (FAA) Civil Aeromedical Institute (CAMI; now the Civil Aerospace Medical Institute). October 2000.
13. Ibid.
14. American Psychological Association. *How Does Stress Affect Us?* <www.apahelpcenter.org>.
15. Harvard Medical School.
16. Ibid.
17. Mayo Clinic.
18. Harvard Medical School.
19. Ibid.
20. Ibid.
21. Mayo Clinic.
22. Mount Sinai School of Medicine. *Stress*. <www.mssm.edu>.

The Editor’s Corner

Flight Safety Seminar

The Annual Flight Safety Seminar was held in Ottawa the last week of October 2008. It brought together some 80 members of the FS team from all over the country and from organizations involved in flight operations. The group was representative, as it included officers and non-commissioned members of the Directorate of FS, the Division, the Wings and some Units, and the Air Cadet Gliding Program. It also included representatives of contractors supporting flight operations, such as L3 Military Aviation Services, Bombardier and Top Aces Inc.The new Director of FS, Col Gary Doiron, and the Division FS Officer, LCol Steve Brabant, had their hands full answering questions from FSOs about decisions made at previous meetings and concerns they had voiced during the seminar.

Rest Period for Maintenance Personnel

One hot topic was the suggestion to set work/rest period standards for aircraft maintenance personnel. A draft was written to establish a Division order, but it was decided that a mandatory rest period for maintenance personnel would deprive the organization of too much flexibility. Though sound and responsible leadership is clearly still the best resource management tool, I think that guidelines should exist for the health and safety of our maintenance personnel and the protection of our personnel and aircraft. This seems simple, but it can be a nightmare to carry out.

I think that setting rest standards for maintenance personnel is a good idea. These standards would not necessarily be the same as aircrew rest standards. The new standards would be a constraint not only for the leadership, but also for people who routinely work outside their organization in their free time and vacation time to make ends meet or to make more money.

The current issue of *Flight Comment* contains two articles from the Flight Safety Foundation on this same topic. The first article deals with a number of civilian operators implementing programs to reduce fatigue among aircraft maintenance personnel (p. 20). The second talks about the health risks of built-up stress (p. 32). These two articles are relevant because fatigue problems are often related to stress problems. Human factors in flight operations, such as fatigue and stress, will be addressed in much greater detail in the next issue of *On Target Magazine*, published by DFS. The issue will come out in late March 2009. (http://www.airforce.forces.gc.ca/dfs/publications/ot-dab/ot-dab-eng.asp).

Request for Articles

We’re always looking for interesting articles for our FS magazines. Feel free to contact us with any feedback or subjects that you’d like to see. Better yet, send us your draft articles! ◆

Fly safe!

Erratum

On page 15 of Issue 2, 2008 of *Flight Comment* there is an error in Figure 3 — Amended CF-HFACS, version 2008. Under the “Preconditions for Unsafe Acts” element, the middle box should read “Conditions of Personnel” instead of “Practices of Personnel”. The error does not appear in *Propos de vol*.

Photo by MCpl Kevin Paul

Never Assume

Replacing the Incorrect Part

By Sergeant Simon Roberts,
440 Transport Squadron, Yellowknife, 17 Wing

During Operation Nunalivut in April 2008, maintenance was carried out on a CC138 Twin Otter for a time-expired starter generator. After the part was replaced, the aircraft had flown 6.9 hours before it was observed that the wrong starter generator was replaced. How could this have happened?

As maintenance personnel were preparing a schedule to have the time-expired (TX) item replaced, there was some discussion between the Flight Crew and Maintenance Crew Chief that one of the two starter generators was acting up. Because it was a minor issue, replacing the part was not considered an urgent need. When the time came to replace the starter generator, the post-flight check revealed that the right hand brake was worn beyond limits and needed replacement. Because of extreme weather in Eureka and a lack of hangar space, a decision was made to split the workload. A Level A technician and an apprentice would replace the worn right hand brake assembly, while the TX starter generator would be replaced by a Flight Engineer (FE) in training and the FE, who was fully qualified for starter generator replacement.

The aircraft continued with ferry flights between Eureka and Alert over the next few days. When it arrived back at CFS Alert on the third day, the Crew Chief went through the Aircraft Maintenance Record Set (MRS) and noticed the discrepancy when he pulled up the CF339 (Aircraft Information Record Sheet) on the Deployable Automated Data for Aerospace Management System (Dep ADAM) screen. After checking the serial numbers in the MRS and the part itself, he confirmed that the wrong starter generator had been replaced and a flight safety occurrence was initiated.

Many mistakes contributed to this flight safety occurrence. First, both the qualified Technician and the Flight Engineer failed to verify which part was time-expired with the CF339 in the MRS and the Dep ADAM. They should have done this before the task was started and again when they completed the paperwork on the CF349 (Aircraft Unserviceability Record) and the CF358 (Aircraft Item Record). This would have been verified when they double-checked their paperwork. After maintenance was carried out, the Qualified Level A Technician should not have released the aircraft until he made sure the CF339 in the MRS and the TX item list in the Dep ADAM were updated in accordance with P-series Canadian Forces Technical orders Policy and Procedures for Aircraft.Weapon System Maintenance. On the pre-flight check, the FE is responsible for checking the ADAM and the MRS to confirm that there are no Out of Sequence Inspections or TX items due before the next flight. If they had done these checks, they would have seen that the TX starter generator had not been changed.

Once the flight safety occurrence was initiated, it was immediately clear why this happened. In the previous week it was mentioned several times that the starter generator was acting up. It was also known that a starter generator would be TX in under 60 hours. It was assumed all along that the faulty generator was the item being replaced, when in fact it was the other one. ◆

Maintainer's Corner

Riding on Air

By Second Lieutenant Alex Marshall from the Directorate of Flight Safety and Peter Dioguardi from the Directorate Technical Airworthiness and Engineering Support (DTAES 7-4-4-8), Ottawa

When it comes to our cars, keeping tires properly inflated can have many benefits. Besides prolonging the life of the tires, it also reduces vibration, increases ride quality, and improves fuel efficiency. Failing to take proper care of tires will negatively impact efficiency and ride quality. In extreme cases, it could even lead to a complete blow out. Those of us who have pushed our luck know how painful it is to change a car tire in the dead of winter with only the biting cold, chilling winds, and slushy shoulder as your roadside companions. Normally, after a little cursing and some elbow grease, most of us will get back on our merry way without being any worse for wear. The story does not often go the same way when we talk about aircraft tires.

Photo by MCpl Kevin Paul

Photo by Cpl Paul Ross

Aircraft tires are not in the same league as passenger car tires because the demands of use are very different. For any given flight, aircraft tires are exposed to cyclic variations in temperature and pressure. When the aircraft lands, its tires are accelerated from a stand still to race car speeds in a split second, and they go from a zero load to supporting tonnes of weight within the blink of an eye. When an aircraft tire goes, there's no gently pulling over onto the shoulder of the road. The failure of an aircraft tire can be quite catastrophic. In the worst-case scenario, it could result in aircraft loss and casualties.

Technological improvements in

aircraft tires have made them more robust and capable of dealing with the stresses that are unique to the operational demands. That is only true if we do our part to ensure that they are in serviceable condition. One of the simplest proactive measures we can take is to ensure that tires are inflated to the pressure detailed in the technical orders.

Most of us check pressure of our car tires once a month. For most aircraft, tire pressure is checked on a daily basis (or as detailed in the applicable technical orders). The simple reason for this difference is that tubeless aircraft tires lose inflation pressure more quickly than car tires.

Pressure checks can reveal an over inflation or an under inflation of the tires: Both conditions will result in uneven tread wear. The effect of over inflation can be reduced traction, increased susceptibility to cutting for tread, and increased level of stress on wheel assemblies. As dangerous as this can be, the effects of under inflation are worse. Under inflation causes greater sidewall flexing, also referred to as tire deflection, which generates more heat. Tests have shown that the bead area of an underinflated tire can be up to 50% hotter than that of a properly inflated one. This increased heat will cause damage to rubber compounds and materials, reduced life, and potentially tread/carcass separation and bead failures.

There are many factors that can cause pressure to change in an aircraft tire. For starters, up to 5% pressure loss per day is normal or allowable. Temperature changes can also lead to a change in tire pressure. As a general rule, you can expect a 1% change in pressure in the same direction of every 3 degree change in temperature. Pressure losses can also be a result of the failure of other wheel components such as rim assemblies and valve stems.

When a tire is found deflated, the solution is not necessarily to re-inflate it. If the pressure falls by an amount greater than 5% in two simultaneous days, the entire wheel assembly must be removed and fully inspected at a retread facility before further operation. If a major pressure loss occurs, i.e., 20% loss to complete deflation, the tire or the tire and its mate for dual-tire application need to be returned to a retread repair line for inspection.

The technical orders will generally provide steps to ensure proper inflations. Here are some of them:

- Check tire pressures in accordance with the frequency detailed in the technical orders applicable for your fleet. Don't eye ball it! Use a proper pressure gauge to check.
- Always check pressure when tires are at the ambient temperature. Excessive pressure should never be released from "hot" tires.
- Use dry nitrogen to inflate the tires. Nitrogen does not sustain combustion and has an anti-corrosion effect on the wheel assembly.
- Keep tires clean and free from oil, hydraulic fluid, grease, tar, and solvents as they can degrade tire rubber. Before commencing any kind of clean up, always refer to the applicable technical orders for proper tire care instructions.
- When manoeuvring the aircraft use wide radius turns and slow speeds to prevent shoulder damage, tread scrubbing, and overheating. Make sure to avoid hazards like deep cracks and potholes.
- Ensure that aircraft manoeuvring areas are clear of FOD which often becomes embedded in the tire tread, and can cause future damage.

Photo by WO Serge Peters

These simple steps can play an extremely important part in the conduct of safe flight operations. If you are interested to know more about tires, precautions, and allowable limits, please refer to CFTO C-13-010-001/AM-001 (Aircraft Tires and Tubes). ◆

FROM THE INVESTIGATOR

TYPE: Glider Schweizer 2-33A (C-GQYY)
LOCATION: Lachute Municipal Airport, Lachute, QC
DATE: 6 September 2008

The accident flight was the second of two flights that formed the 60-day check for the cadet. The cadet was seated in the front seat and the instructor was seated in the rear seat. The instructor briefed the cadet that there would be a simulated rope break in this flight. The brief did not specify any altitude or any location where the cadet could anticipate the simulated rope break.

A simulated rope break is initiated by the instructor who physically releases the rope by activating the release handle. A rope release in flight is often accompanied with a distinctive sound that can be heard in the cockpit (a metallic "clunk" sound). A similar sound can also be heard when "slack" develops in the rope between the Tow Plane and the Glider and the ring at the end of the rope moves freely in the hook assembly.

On the accident flight, between 80 and 130 feet above ground level, the cadet heard a metallic "clunk" sound and, thinking that it was the instructor simulating a rope break, the cadet initiated the rope break procedure. The procedure asks for the pilot to activate the rope release handle twice to ensure that any rope still attached to the Glider following the break would be jettisoned. After the instructor confirmed that the cadet had just released the rope, the instructor took control. The off-field landing area straight ahead was quickly assessed as not viable due to a line of bush and small drainage ditch that ran from left to right at the nearest edge of a field in front of the Glider. The instructor then initiated a low level steep turn in an attempt to return to the departure runway. The right wingtip contacted the ground during the turn and the Glider impacted position in a drainage ditch that ran parallel to the runway.

The cadet sustained serious injuries and the instructor sustained very serious injuries. The Glider was damaged beyond economical repair.

The preliminary investigation has indicated that both the Tow Plane and the Glider suffered no mechanical problem prior to the rope release and that the rope was in good condition. The investigation will focus on training practices and human factors. ◆

FROM THE INVESTIGATOR

TYPE: Tutor CT114 (114065)
LOCATION: Approximately 2.5 km northwest of CFB Moose Jaw
DATE: 9 October 2008

The accident aircraft was crewed by a pilot in the right seat and a military photographer in the left seat and was part of an authorized four-aircraft dissimilar formation ("Snowbird Blues") tasked with taking pictures for publicity purposes. The main formation consisted of a CT114 Snowbird Tutor leading a CT156 Harvard II and a CT155 Hawk, with the occurrence aircraft being used in a photo-chase role. Following a flypast at Assiniboia and photographic work south of the airfield, the formation returned to the airfield to take pictures of the main formation against a background of the headquarters building and the control tower. As they approached the airfield the formation was advised by the control tower that the inner (Runway 29R) runway pattern was clear for them but that the outer (Runway 29L) pattern was still active. The formation lead acknowledged the information and advised the tower that they would remain north of the outer runway. Lead then advised the photo-chase aircraft to restrict his manoeuvering to the 3 to 6 o'clock quadrant of the main formation.

The main formation crossed over the Base in "Vic" formation at about 300 feet AGL in a gentle left turn then, as it approached the headquarters building and the control tower, they rolled into a 25 degree right bank and began a right turn towards the northwest.

At this time the chase aircraft was flying just behind the 3 o'clock line and high above the formation to take a picture of the formation as they passed the tower. As the formation continued its turn to the northwest the chase aircraft was observed to descend, roll with the formation and fly a slightly convergent path with the formation. It continued in this steady descending turn until it impacted the ground on a heading of 297 degrees magnetic in the approximate 4 o'clock position below the plane of the main formation. Both occupants were killed immediately and the aircraft was destroyed.

The investigation found that the aircraft struck the ground in a slightly nose low right banked attitude. At the time of impact the speed brakes were extended and the landing gear and flaps were retracted. No ejection had been attempted. To date, the investigation has not found any indication of a pre-existing technical fault with the aircraft or evidence of a bird strike.

The focus of the investigation will be on the requisite training and knowledge required for pilots tasked for photo-chase missions. In addition, the investigation will examine the available guidance and direction available with respect to photo-chase missions, and in particular, low altitude photo-chase missions. ◆

EPILOGUE

TYPE: Glider Schweizer 2-33A (C-GCLN and C-FBJH)
LOCATION: Debert, NS
DATE: 24 July 2007

At 1938Z on 24 July 2007, two gliders from the Regional Gliding School (Atlantic) (RGS(A)) operating at Debert airfield, 85 km north of Halifax, Nova Scotia, collided on the landing roll-out. The two gliders involved were C-GCLN, referred to as Glider #7, and C-FBJH, referred to as Glider #1.

On downwind leg the pilot of Glider #7 had decided to line up on the secondary landing lane, as a glider that had just landed occupied the primary lane. Glider #7 made an appropriate radio call to inform all gliders of his intention. At the same time, the pilot of Glider #1 had also decided to land on the secondary landing lane as the primary lane was occupied. However, Glider #1 neither heard Glider #7's radio call mentioning his intention to land on the secondary landing lane, nor saw Glider #7 as it was flying on the downwind leg slightly lower than Glider #1. Glider #1 finally noticed the position of Glider #7 just prior to turning to base leg, after three radio calls from the solo monitor. The pilot of Glider #1 then changed his plan from landing on the secondary landing lane to the tertiary landing lane as the primary landing lane was still occupied.

The occurrence happened just after Glider #7 had landed on the secondary landing lane from a dual instructional flight, while Glider #1, a cadet solo flight, was on its landing roll, on the tertiary landing lane. Glider #7 was stopped on the right side of the secondary landing lane with the crew still sitting in the cockpit of the glider, conducting a debrief. Glider #1 drifted to the left side of the tertiary landing lane with the left wing leading edge coming into contact with the trailing edge of the right wing of Glider #7 at a speed of approximately 30-40 miles/hr.

This accident was the result of perception errors as both gliders were allowed to drift beyond the boundaries of their respective landing lanes to a point where recovery attempts by the solo cadet to correct for the lateral drift and avoid collision were ineffective.

The main contributing factors to the accident were channelized attention, lack of standardized landing lane dimensions, and the lack of ground markings to accurately evaluate the amount of lateral drift in the landing roll-out.

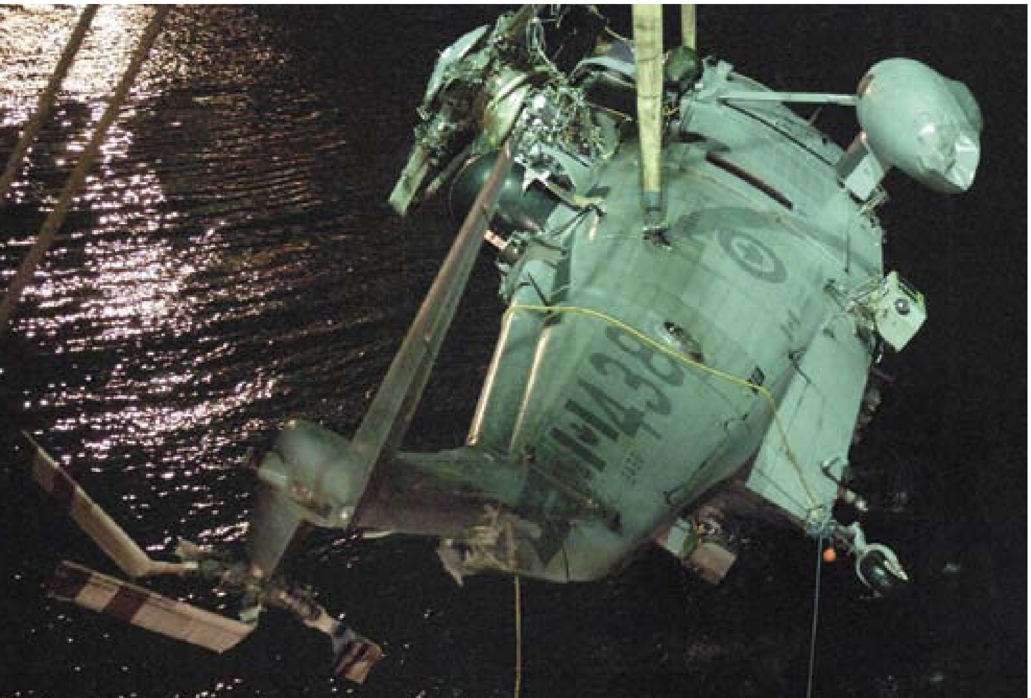
Shortly after the occurrence, the RGS(A) introduced landing lane markings using chalk lines (as used on sport fields) at the Debert site with very positive feedback. Standards have also been developed and published in the latest version of the Air Cadet Gliding Program Manual (A-CR-CCP-242/PT-005) for the dimensions of landing lanes and obstacle clearance criteria. Recommendations for Preventive Measures include the use of standard landing lane dimensions and markings at all Basic Glider Sites. ◆

EPILOGUE

TYPE: CH124 Sea King (124438)
LOCATION: The Baltic Sea, near Aalborg, Denmark
DATE: 2 February 2006

After completing night circuit training at Aarhus, Denmark, the five crewmembers onboard the Sea King helicopter were returning to Her Majesty's Canadian Ship (HMCS) ATHABASKAN when the accident occurred. On completion of one radar controlled approach, the crew commenced an overshoot and entered the visual circuit to land. On short final, at approximately 30 meters off of the ATHABASKAN's port quarter, the helicopter's rear fuselage and tail rotor contacted the water. The helicopter pitched forward, became airborne again, and began to yaw to the right. The helicopter then impacted the water in a near level attitude and, while still yawing right, rolled left. Water flooded the helicopter almost immediately as it rolled inverted. All five crewmembers then egressed and were recovered to the ATHABASKAN, by Zodiac, within approximately 15 minutes. One crewmember received minor injuries. The aircraft remained afloat for approximately one hour, and then sank in 16 meters of water.

The investigation concluded that the accident occurred when the pilot at the controls became momentarily disoriented and lost visual and situational awareness during a critical phase of flight. The other pilot, the aircraft captain, did not take action soon enough to prevent the tail rotor from striking the water. Contributory to these causes was an insidious combination of circumstances that led to a lowering of aircrew proficiency within the Sea King community. Low aircraft serviceability coupled with fewer decks being available for night evolutions led to a situation where it became the norm for pilots to achieve only the absolute minimum levels of currency, vice the levels of proficiency commensurate with safe and effective flight operations.



The report's recommendations include changes to the currency requirements and training for maritime helicopter aircrew. Other preventive measures are directed at improvements to Aviation Life Support Equipment. Since the accident, the Air Force has developed a specific night visual approach procedure for use when helicopters recover to ships, including specific guidance concerning the transition from an instrument or night visual approach from one-half nautical mile to the Delta Hover Astern position. ◆

For Professionalism

For commendable performance in flight safety

CORPORAL LARRY PRICE

In October 2007, Corporal Larry Price was tasked to assist with carrying out an inspection of the tail section as part of the Periodic Inspection on the Canadian Forces Hercules aircraft CC130319. This required the removal of a small access panel to complete the required maintenance action.

Although not part of the inspection requirements, Cpl Price also used the time with the access panel removed to better familiarize himself with the airframe structure of the CC130. Using a small mirror he examined the area where the vertical stabilizer attaches to the aircraft dorsal fin. In so doing he noticed what appeared to be a crack in a longeron fitting which attaches the stabilizer to the fin. He immediately informed his supervisor, and upon further investigation confirmed that there was indeed a fracture.

This particular fault and its location are not commonly encountered during aircraft maintenance. Nevertheless, Cpl Price took it upon himself to research not only the procedure for accessing the area but also the process for rectifying the fault.

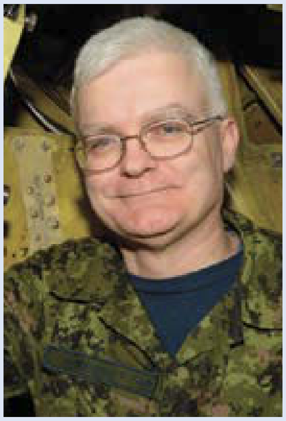
The initiative he exhibited to further his knowledge of the aircraft resulted in the detection of a structural defect. Had it gone unnoticed, could have resulted in damage

to the vertical stabilizer with possible Flight Safety implications. As well, the extra time and effort spent consulting with subject matter experts and the Canadian Forces Technical Orders are proof of Cpl Price's tenacity.

His dedication and professionalism are all the more noteworthy and further exemplified by his volunteering to work extended hours to rectify this fault. As further testimony to the significance of his finding, an Aircraft Inspection Change Proposal requiring regular monitoring of this part, as well as testing of all other fittings currently held in the Canadian Forces Supply System was initiated. Cpl Price's notable efforts brought to light an undetected abnormality that could have resulted in a critical structural failure and the loss of both personnel and material resources. He is most deserving of this For Professionalism award. ◆

Cpl Price is currently serving with 8 Air Maintenance Squadron, 8 Wing Trenton.

MASTER CORPORAL ROBERT SOMERSET



Master Corporal Somerset's keen attention to detail and outstanding investigative efforts are laudable. They have enabled him to very consistently and efficiently identify and rectify serious aircraft faults that have threatened the airworthiness of two Coastal Patrol Aurora aircraft.

Of particular note, while conducting a Corrosion Control Inspection on Aurora CP140106, MCpl Somerset discovered that the inboard support bearing seal for the right hand Elevator Torque Tube was displaced. After researching the applicable Canadian Forces Technical Orders and confirming the seriousness of the airworthiness implications, he immediately informed his supervisors and ensured that a Flight Safety occurrence Report was registered and an immediate repair initiated.

Additionally, while carrying out maintenance on aircraft CP140120 Elevator Trim Actuators, MCpl Somerset discovered that the Elevator Down Hook Spring Assembly was installed 180 degrees out of position and incorrectly adjusted. His search of the Automated Data for Aerospace Maintenance system revealed that an incident such as this occurred on another aircraft three months earlier. Knowing the serious implications and significance of this assembly, he immediately spearheaded a repair as well as generated a Flight Safety Occurrence. To further ensure that no other Spring Assemblies were incorrectly installed, he immediately took it upon himself to carry out an informal local survey on the remaining fleet confirming all aircraft were serviceable.

MCpl Somerset's notable dedication undoubtedly averted a potentially serious and catastrophic flight event on two aircraft. His professionalism coupled with his refined technical skills played a major role in assuring Safety of Flight and security of aircrew resources. These fine qualities make him most deserving of this For Professionalism award. ◆

MCpl Somerset is currently serving with 14 Air Maintenance Squadron, 14 Wing Greenwood

CORPORAL KEITH GRANTER
MASTER CORPORAL RICHARD GOSSE

On 21 January 2008, Corporal Keith Granter, an Aviation Technician working at 413 Squadron's Aviation Life Support Equipment (ALSE) shop, was tasked to reseal a Hercules CC130 aircraft's First Aid Kit. While signing for the inspection in the Aircraft Mobile Support Equipment Log Book, he observed that the Distress Radio Beacon (PRQ-501) radios were still installed on the aircraft. Upon carrying out a further detailed inspection of the CF363, he discovered that the battery in the radios would time expire on 31 January 2008, making the Squadron's entire fleet of aircraft unserviceable for any function at that time.

Cpl Granter quickly alerted Master Corporal Richard Gosse who was employed in 413 Squadron's Aircraft Maintenance Control Record Office. MCpl Gosse then immediately contacted Canadian Forces Base Trenton's ALSE shop to ascertain if they were cognizant of the impending deadline for the PRQ-501 radio removal. Trenton was not aware of the problem and the entire Canadian CC130 fleet was in jeopardy of being operationally impaired as of 31 January 2008. Realizing the high degree of urgency associated with Cpl Granter's find, MCpl Gosse instantly took the initiative and contacted the Life Cycle Maintenance Manager who stated that the PRQ-501 radio batteries already had a two-year extension and this extension would not be reinstated under any circumstances.

With only ten days remaining before the batteries life expired and faced with the tremendous amount of work required to replace the radios, MCpl Gosse immediately informed the 413 Deputy Squadron Aircraft Maintenance Engineering Officer. He in turn liaised with the fleet Aircraft Engineering Officer to rectify this fault in minimal time prior to impacting the operational capability of the fleet.

MCpl Gosse and Cpl Granter's initiative, professionalism and tenacity played a paramount role in averting the catastrophic consequences of a complete operational pause of the CC130 Transport and SAR aircraft fleet. Their expert training and very proficient efforts clearly display that they are fully deserving of this For Professionalism award. ◆

Cpl Granter and MCpl Gosse are currently serving with 413 Transport and Rescue Squadron, 14 Wing Greenwood

LIEUTENANT (USN) MATTHEW GOOD

On 25 September 2007, Lieutenant (Lt) Good from the United States Navy (USN) was employed at 407 Maritime Patrol Squadron as a CP140 Aurora Aircraft Captain and was preparing for a patrol mission from 19 Wing Comox. Upon being assigned an aircraft, Lt (USN) Good conducted his Pre-Flight Inspection (PFI) of the aircraft's exterior during which he discovered excessive play in the Right-Hand Inboard Aileron Push Rod Support Assembly.

He highlighted this deficiency to the technicians on duty who checked and tightened the rigging but were unable to fully rectify the problem. Not satisfied with the outcome and in an effort to assist with finding a solution, he continued to discuss the problem with the technicians to ascertain a possible cause. Further investigation in the hard to access fault area revealed that the associated horizontal rollers had worn excessively and were not able to hold the control rod in its proper position. This condition was previously overlooked on several occasions as the components are set forward inside the wing trailing edge area and are difficult to inspect. If this fault had continued unnoticed, the excessive movement of the control rod would have caused binding or an in-flight failure of a primary flight control surface, the result of which could have been catastrophic.

The CP140 Aircraft Operating Instructions do not require pilots to conduct an external visual 'hands on' inspection of the aircraft during their PFI. Lt (USN) Good made it his personal practise to do a "walk around" inspection prior to flight.

His professional attitude and attentiveness led to the discovery of a significant aircraft fault which had previously gone undetected. Lt (USN) Good's, attention to detail, tenacity and professionalism averted a potentially serious in-flight incident. His genuine concern for the well-being of all resources assigned to him as well as the Safety of Flight make him most deserving of this For Professionalism award. ◆

Lt (USN) Good is currently serving with the US Naval Base of North Island in the State of California

For Professionalism

For commendable performance in flight safety

MASTER CORPORAL LYNDON LOCKE

After Hornet aircraft CF188778 was towed into the hangar for a nose wheel shimmy snag, Master Corporal Locke performed a fault verification process that revealed metal filings on the left hand nose landing gear axle assembly. This potentially dangerous high profile abnormality placed the aircraft unserviceable which resulted in a compulsory scheduled evening repair time.

Realizing the unusually high number of new personnel within the squadron, he took the initiative the following morning to research the cause of the fault and the rectification process used. Although the aircraft was listed as mission capable, the recorded rectification was foreign to him so he re-inspected the aircraft and found that the pile of shavings were still located on the left hand nose landing gear axle assembly. Extremely concerned that the safety of flight may be in jeopardy, he immediately called for a landing gear subject matter expert to thoroughly re-examine the nose landing gear axle assembly. This extremely fruitful decision revealed that a spacer was missing on the left nose wheel assembly and the locking washer had ground its way into the rim assembly causing the metal filings.

MCpl Locke's keen eye for detail and persistence in ensuring that a potentially dangerous situation was repaired correctly played a paramount role in identifying and rectifying a fault that possessed the potential to cause a catastrophic incident.

His exceptional professionalism and tenacity were major contributors to preventing the loss of extremely limited material and personnel resources. These actions clearly demonstrate a high degree of expertise and proficiency that make him very deserving of this For Professionalism award. ◆

MLCpl Locke is currently serving with 409 Tactical Fighter Squadron, 4 Wing Cold Lake.

MASTER CORPORAL TINA FOOTE
MASTER CORPORAL BRIAN COMEAU
CORPORAL SYLVAIN ROY

On 17 January 2008, Master Corporal Foote, MCpl Comeau and Corporal Roy were working on a Coastal Patrol CP140 Aurora aircraft, troubleshooting an Autopilot Snag. In the process of changing a suspected faulty relay in the Forward Electrical Load Center (FELC), Cpl Roy was required to move the FELC door slightly to gain better access. This instantly resulted in sparks and flames erupting from a wire bundle secured by clamps adjacent to where he was working.

Cpl Roy's first instinct was to blow out the flame; however the flames reignited which resulted in him calling for a fire extinguisher. While waiting for the fire extinguisher, he again successfully blew out the flames. Shortly thereafter the fire extinguisher arrived and was available but not discharged during the incident.

Upon hearing Cpl Roy's call for assistance MCpls Foote and Comeau immediately took action to render the area safe. MCpl Foote proceeded to the nearest phone to call 911, pulled the fire alarm to evacuate the hangar and waited at the main entrance of 14 Hangar to provide direction to emergency services. MCpl Comeau disconnected the aircraft battery and he and Cpl Roy monitored the situation in the aircraft until emergency services arrived.

The resultant inspection revealed that the engine fuel shut-off DC power wire had chaffed under the wire clamp and shorted to ground when the FELC door was moved. The chaffing occurred due to wire routing and years of opening and closing the FELC door. A Special Inspection was carried out on the Aurora fleet which revealed that several other CP140 aircraft had defective wiring in the same area.

MCpl Foote, MCpl Comeau and Cpl Roy are commended for their calm demeanour, and step-by-step approach while addressing this potentially catastrophic situation. Their notable professionalism and steadfast determination to protect all resources and eliminate collateral facility damage are most appreciated. They are very deserving of this For Professionalism award. ◆

MCpl Foote, MCpl Comeau and Cpl Roy are currently serving with the Maritime Proving and Evaluation Unit, 14 Wing Greenwood.

CORPORAL NANCY WILD

On 26 September 2006, while working on the Flight Data Computer, Corporal Wild identified an Electronic Flight Instrument System (EFIS) fault on CT142 Dash 8 aircraft that was ongoing for 17 years. The EFIS system error message was not being displayed when the difference in heading, pitch and roll information between the # 1 and # 2 systems was greater than 6 degrees. This error message is a critical requirement for the flight crew and is part of the certification requirements for the aircraft. The discovery was not part of normal maintenance practices and had been continually overlooked.

Cpl Wild took sole ownership of the snag and found that the aircraft had been wired incorrectly since it was delivered to 402 Squadron in May 1991. At any time since the delivery of the aircraft, a critical situation could have arisen and the information that the EFIS system delivers to the flight crew would have been corrupt.

Cpl Wild immediately grasped the criticality of this abnormality, independently delved into aircraft drawings and investigated the remaining Dash 8 fleet to ascertain their serviceability and wire configurations. Her research into technical manuals not normally available to technicians was hindered by the fact that the aircraft engineering drawings available for the EFIS were not the correct revision for the aircraft model. This necessitated the expeditious delivery of up-to-date drawings from the Original Equipment Manufacturer. Cpl Wild again took the lead on the Aircraft Engineering Officer's request and provided two comprehensive 19-page reports on approximately 1600 wire identifications in the EFIS system that ultimately led to the identification of the snag and subsequent repair.

Cpl Wild's diligent and determined approach is laudable. Her maintenance ethos played a major role in eliminating a highly dangerous situation that existed for a substantial amount of time. She is a consummate professional and very deserving of this For Professionalism award. ◆

Cpl Wild is currently serving with 402 Squadron, 17 Wing Winnipeg.

SERGEANT TROY LAPLANTE

Hercules aircraft CC130339 had undergone its second maintenance action for parking brake failure. These faults resulted in premature aircraft movement, and in one instance the aircraft rolled backwards contacting a fuel bowser causing extensive damage to a propeller blade.

After discussion with several aircrews about this accident, Sergeant Laplante realised that during the previous five-month period, there were other non-reported parking brake failure occurrences. With this in mind, he contacted the Servicing Section and told them to make entries in the Maintenance Record Set (MRS) to conduct a full brake system rigging check.

The following day he reviewed the Aircraft Maintenance Management Information System and discovered that the aircraft un-serviceability record (CF349) had been closed without the full brake system functional and rigging check being completed. Only the parking brake rigging had been checked without the hydraulic pressure at the brakes being verified. His extensive CC130 aviation experience led him to believe that the repeat snags were due to junior technicians not looking deep enough into the system. Knowing that the aircraft was to depart for Operation BOXTOP that morning, he went immediately to the Servicing Section and entered another CF349 in the MRS. This entry detailed exactly the functional checks required by the maintenance publication on the Brake Control Valve Rigging Utility System and the verification of the brake pressure.

Using every opportunity as a training platform, he briefed the technicians involved on all required maintenance actions. Subsequent pressure and rigging checks of the whole brake structure found that the system was considerably out of tolerance and required the adjustment of all cables and associated rods and bolts.

Sgt Laplante's superior skill and knowledge played a major role in guaranteeing the safety of flight and the prevention of a major incident due to the treacherous operating areas encountered in Thule and Alert. This along with his tenacity, refined mentorship qualities and dedication to the development of junior personnel make him very deserving of this For Professionalism award. ◆

Sgt Laplante is currently serving with 435 Transport and Rescue Squadron, 17 Wing Winnipeg.

For Professionalism

For commendable performance in flight safety

MISTER ROBERT WILSON

On 28 November 2007, Mr. Wilson was conducting his stores clerk duties on the 7 Canadian Forces Supply Depot (CFSD) receiving dock. When specially fabricated "Tundra" tires for the CC138 Twin Otter aircraft were unloaded, he noticed that the tires on both pallets had been deformed as a result of damage during transit. Mr. Wilson immediately informed the Technical Services Section (TSS) of the anomaly. TSS ascertained that heavy weight loads from other items in transit might have been placed on top of the tires.

All ten tires had been severely compressed horizontally. The tires on the bottom end of the stack on each pallet were squashed with such force that they were deformed and that the actual tire treads appeared to be part of the sidewall. Pictures were taken for the Life Cycle Material Manager (LCMM) who in turn directed that the most damaged of the tires be sent to the Quality Engineering Test Establishment (QETE) to have its structural integrity analyzed.

The tires were declared acceptable and recommended for use; however, two manufacturing problems were observed. A small fragment of rubber fell out of the tire during inspection and there were rough edges in the bead area, which might interfere with the fit on the wheel. As a result, the LCMM stated that a technical instruction will be provided to the field technicians directing careful internal inspection of the tires prior to installing. Unnoticed debris could contribute to localized internal stresses and cause a catastrophic tire failure. Additionally, it was recommended that as a precaution, these tires were to be shipped with semi-inflated tubes or bubble packing to prevent crushing.

Mr. Wilson is commended for his situational awareness, quick action and dedication. His knowledge of 7 CFSD's safety culture played a major role in support of the Department of National Defence's Technical Airworthiness Program. His observation has also led to the improvement of packaging for these aircraft tires during shipment. His outstanding professionalism and work ethic have averted the potential for an aircraft incident or accident. He is very deserving of this For Professionalism award. ◆

Mr. Wilson is currently serving with 7 Canadian Forces Supply Depot in Edmonton, Alberta.

CORPORAL ROBIN VARDY

While deployed on Operation ALTAIR, Corporal Vardy an Aviation Technician (AVN Tech) was preparing to carry out a number one Corrosion Control inspection on the driveshaft assembly of Sea King Helicopter CH124407. To perform this inspection, an Avionics Technician (AVS Tech) is normally required to unbolt the ALQ-144V (Infra Red Jammer) from the airframe. This allows the AVN Tech to gain access to the tail rotor driveshaft. In an effort to assist fellow detachment members to promptly return the aircraft to service, Cpl Vardy offered to unbolt the mount.

While executing this procedure, his attention was drawn to excessive movement of the mount assembly. Although outside of his trade expertise, he employed his highly refined technical skills to meticulously inspect the mount assembly area. Suspecting fatigue cracks on the mounting surface, he methodically removed all potting sealant to gain access to the mating surfaces of the aircraft and the ALQ mount. His perseverance revealed that two stationary mounts and one hinged mount had broken off and were being held in place only by the sealant. The 30 lb ALQ assembly in this configuration possessed great potential to fail at anytime during the high tempo flight operations and would have caused a catastrophic component failure and a complete loss of aircraft flight integrity.

Cpl Vardy notified the Detachment Chief of his findings, and the seriousness of the situation. He suggested that this fault might have fleet-wide major implications on the Sea King helicopter, especially those on deployment. The resultant 12 Wing- directed informal inspection of all ALQ-144V equipped aircraft revealed that no other aircraft had a faulty mounting area.

Cpl Vardy's commitment to pursuing corrective actions with respect to this previously undetected condition displayed professionalism of the highest standard. His superior attention to detail is commendable, his technical ability second to none. His steadfast determination to ensure that the Safety of Flight and aircraft integrity remained absolute is a clear indicator that he is very deserving of this For Professionalism award. ◆

Cpl Vardy is currently serving with 423 Maritime Helicopter Squadron, 12 Wing Shearwater.