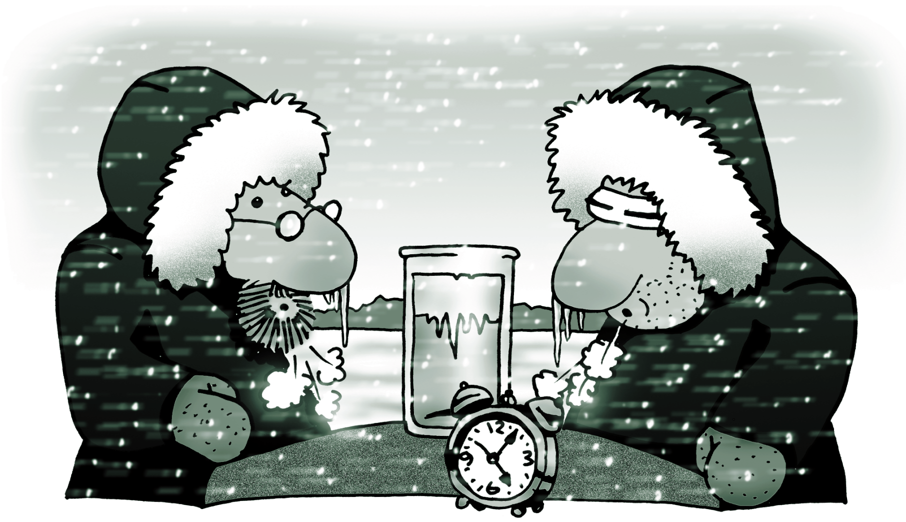
Transport Canada Transports Canada

Aviation Safety

Vortex

Learn from the mistakes of others; you'll not live long enough to make them all yourself . . . **Issue 1/2003**

A Cold Wind Blowing



The sun was warm but the wind was chill.
You know how it is with an April Day
When the sun is out and the wind is still,
You're one month on in the middle of May.
But if you so much as dare to speak,
A cloud comes over the sunlit arch,
A wind comes off the frozen peak,
And you're two months back in the middle of March.
From *Two Tramps in Mud Time* (1936) Robert Frost

When we think of sensations that stir people to write poetry, a bitter wind doesn't exactly spring to mind. On the contrary, it is almost universally despised, because it makes outdoor life in the Canadian winter less comfortable, and in many cases, much more dangerous.

We hear about wind chill on radio and television weather forecasts all winter long. It's a popular topic of conversation in coffee shops and on buses, at breakfast tables and supermarket checkout counters, and gets generously sprinkled throughout our winter vernacular. It gets exaggerated and substituted for actual temperatures, as if having the highest wind chill value won some sort of morose, climatic door prize. It is repeatedly described using adjectives like bitter, chilly, icy, biting, arctic, raw, frosty, freezing, frigid, and poetic expletives deemed unprintable in a family helicopter safety publication. But what is it??

Of course, wind chill has been around since there has been wind, but it's only in the past 30 or 40 years we've started to quantify it, since it started being mentioned in public weather reports. What we now call *wind chill*, describes a feeling—the way we perceive the combined cooling effect of temperature and wind on skin. This feeling cannot be measured using an instrument, instead it is calculated using a mathematical formula that relates air temperature and wind speed to the cooling sensation we feel.

The original wind chill formula was derived from experiments conducted in 1939 by two members of Admiral Byrd's first Antarctic expedition, Paul Siple and Charles Passel. They measured the time it took

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250 grams of water to freeze in a small plastic cylinder when it was placed outside in the wind (not much else to do, I guess). Over the years, the formula was modified somewhat, but remained based on data from the Antarctic experiments. The resultant wind chill was officially expressed as a cooling rate of watts per square metre (W/m^2), but was loosely translated into degrees in public weather forecasts. But there were problems…

New Needs + New Science = New Wind Chill Formula

While the Siple and Passel formula was useful, there was a need for improvement. People in colder parts of Canada were reporting that the wind chills being broadcast were not accurate, in other words, a reported wind chill of -40, and a real temperature of -40ºC did not result in the same feeling of cold. Environment Canada recognized a potential danger in this, as some people might be led to believe they could tolerate a much lower temperature than they actually could.

The inaccuracy was attributed to several factors, but two main reasons stood out. First, a plastic cylinder filled with water differs in many ways from the human body, most notably the fact that our bodies produce heat. Additionally, the wind speed used in the formula is measured at ten metres above the ground, usually at airport weather stations. At this height, as all helicopter pilots know, the winds are faster than those at 1.5 m (the height of an average person's face) because of friction with the ground. As a result, the method produced a colder wind chill value than people actually experienced. The new formula would have to take the thermal properties of the body into account, and use a more realistic wind speed that would more accurately reflect values found at the face height of a human.

Figure 1

Wind Chill Calculation Chart

V_{10} \ T air	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-31	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	38	-45	-51	-57	-64	-70
30	0	-7	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-70	-76
55	-2	-9	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-37	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-59	-66	-73	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

T air = Air temperature in ºC

V_{10} = Observed wind speed in km/h at 10 m elevation, mathematically corrected to face height

Frostbite possible in 2 minutes or less

Frostbite possible in 3 to 5 minutes

Frostbite possible in 6 to 10 minutes

Chart developed from Environment Canada Data.

Canada took the lead in an international effort to develop a new wind chill formula. In April 2000, Environment Canada held the first global Internet workshop on wind chill, with more than 400 participants from 35 countries. Almost all agreed on the need for a new international standard for measuring and reporting wind chill that was more accurate, easy to understand, and incorporated recent advances in scientific knowledge.

In 2001, a team of scientists and medical experts from Canada and the U.S. developed a new wind chill index, which is based on the loss of heat from the face—the part of the body that is most exposed to severe winter weather. The research agency of the

(cont. on page 7)

Sign of the Times

Transport Canada / Transports Canada

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Sécurité aérienne — Vortex *est la version française de cette publication.*

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In early 1976, Transport Canada's Aviation Safety Bureau started a publication entitled *Helicopter Accidents*, which contained early notification of accidents and incidents involving helicopters in Canada. The first issue, 1/1976, was only one page long, and contained a brief narrative on 6 accidents. It eventually grew to 6 pages, as the editors began to include more than just the brief synopses of accidents, and included relevant articles to helicopter safety. To reflect this increased scope, they changed the name to Aviation Safety Vortex, starting with issue 10/1979.

In its 26-year run, Vortex has seen many changes, including:
- Size and schedule,
- Appearance (remember the green pages?),
- Publishing and production methods (*cut and paste* used to mean *scissors and glue*, not icons on the toolbar),
- The internet (shameless plug for www.tc.gc.ca/vortex),
- Management (we're no longer under Aviation Safety Bureau, but System Safety),
- Style, as individual editors brought their own experiences and talents to the newsletter.

This issue also brings with it a change—Vortex is breaking from its roots. You will recall that in Issue 1/2002 I removed the aircraft registration from the incidents reported in the Occurrence Synopsis, for privacy reasons. Since that time, Canada's privacy legislation, and a heightened profile of privacy issues, both from government and industry, mean it is no longer deemed appropriate to print any information that may lead to the identification of persons, before the accident report is completed. This includes information such as aircraft type, location, date, or any other information that could lead to the identity of persons involved. Of course, without this data, the Occurrence Synopsis in its current form loses much of its punch—"Somewhere, sometime, some helicopter had a tail rotor strike. Everyone's OK."

Unfortunately, the decision to delete these references was made too late to prepare anything for this issue of Vortex—the Occurrence Synopsis had been written in the 'old' style, and I pulled it. Which leaves a challenge—to pass on relevant safety information in a timely manner, without using preliminary accident information as we have in the past. One idea is to incorporate a narrative piece in each issue, outlining the types of accidents that have occurred in a given recent period, using the preliminary data. This would be written in very general terms, without the tombstone data, but would try and ensure that important information and lessons were provided to pilots in a timely manner. I plan to profile more accidents, following the release of the relative TSB report.

I know this decision will not sit well with many of you; the Occurrence Synopsis has been a very popular part of Vortex for 26 years. It is, however, a sign of the times and changing attitudes toward privacy in Canada. I welcome any of your comments or ideas on how we can improve the publication and continue to get the message out. A few have taken up the call for *Tips and Tails*, including the excellent story that appears in this issue, and I'd like to see more of this type of thing. After all, we can learn more from somebody else's hard-earned lessons and personal experiences, than from a thumbnail sketch of a faceless occurrence.

Everything's Under Control

It was early evening on a beautiful summer day. The Bell 212 was returning to base from a long day of slinging drill equipment at a remote site. The pilot, a veteran with 25 years experience, was looking forward to the barbeque they were having that evening with friends who were visiting from out of town. Also on board was an AME who'd been working on this aircraft for the entire summer. He took pride in the fact that he kept this old 212 in great shape, and as they flew along he listened intently to all the sounds and watched the instruments for anything suspicious. Today, as usual, everything looked fine.

As they approached the airport where the helicopter was based, the AME thought he noticed a slight fluctuation in the No. 2 engine ITT, and he was sure he heard something too.

"You see that?" he asked the pilot.

"Yeah, that's a Northern Harrier, they're … "

"No, not the stupid bird! Check this out—looks like No. 2 ITT needle is fluctuating a little."

"Really? I didn't see anything; it's hard to say with the needle in that range of the gauge."

Their conversation was interrupted by slight, rapid popping sounds, and No. 2 ITT and N1 gauges were now exhibiting definite, but minor fluctuations. The pilot placed his hand on the No. 2 throttle, and stared at the instrument cluster, looking for a clear indication of what was going on. Then, No. 2 engine began to decelerate slowly, No. 1 increased, and the rotor RPM was drooping through 98%. The pilot immediately recognized the classic symptoms of a low-side governor failure. As he began to roll No. 2 throttle to idle and select manual governor, the engine started surging erratically, the popping sounds increased, and within a few seconds, the engine failed. This took the pilot by surprise, as it didn't seem normal for a governor failure—shouldn't it just go to idle, or stay at the last setting?

At this point, they were about 6 mi. from the airport. The pilot began cleaning up No. 2 engine and preparing for a one engine inoperative (OEI) landing. He called the Flight Service Station (FSS) before entering the zone, and briefly thought about telling them that he had one engine shut down and declaring an emergency, but decided against it. They were two on board, with the longline and sling gear in the back, and just over 600 lbs of fuel—an all-up gross weight of around 8 000 lbs. At this weight, a single-engine landing would be a non-event. The pilot figured he'd just slide it on the ramp in front of the hangar; no real need to panic. Besides, since the airport fire department had closed, the fire trucks had to come from town. It was only a few kilometres, but he didn't really see the need in getting them out to the airport for something as silly as this—and can you just *imagine* the paperwork? Not tonight, he could hear the barbeque and cold beer calling his name.

They were now flying along at a pokey 80 knots, 4 mi. back. The fact that the engine had failed was still bothering the pilot; something didn't add up. He looked over at the AME, who had gone silent—perhaps preoccupied with the thought that it could be something he had neglected to see, and was going over all the maintenance that had been done to that engine in the past while.

At 2 mi. back, he advised FSS that he'd be approaching the taxiway in front of their hangar, and the reply came back that the winds were from the west, at 15 knots. This was going to be too easy, he thought. A single-engine landing, directly into a 15-knot wind, right in front of the hangar! He couldn't believe his luck—imagine if this had happened 3 hours ago on the drill job? The gods were surely smiling on him today.

Then, the gods stopped smiling, and Murphy elbowed his way into the picture. Unbeknownst to the pilot and AME, the cause of the surging and deceleration in No. 2 engine was not a low-side governor failure. The previous evening, maintenance had been performed on the engine fuel system, and a massive fuel leak had developed resulting in the No. 2 engine losing power. It had also resulted in a considerable amount of fuel being dumped into the engine bay, and down the side of the helicopter. As the aircraft slowed for touchdown in front of the hangar, they began to smell the fuel as the airflow changed around the machine. The smell was quite strong, in fact, and the pilot turned his attention to other potential problems—where is the leak? Is it still leaking? Am I going to lose No. 1?

At the same time, an airport vehicle rounded the corner of the hangar, and the driver failed to see the helicopter at first. The pilot noticed the truck and slowed the 212 down with a little aft cyclic. "Is that guy blind or what?" Finally, the driver saw the aircraft; he slammed on the brakes, and stopped in plenty of time to avoid a collision. However, the damage had been done. The strong smell of fuel, and the distraction of the vehicle, had taken the pilot's concentration off the OEI approach, and the helicopter was now much higher and faster than he wanted for the run-on landing. He quickly lowered power and flared to descend and slow down, trying to get back to a good angle for the approach—but he was a little too aggressive. While levelling before touchdown, with a high rate of descent, the heel of the right skid struck the ground hard. The helicopter bounced back into the air, with a slight nose down attitude, and was heading for the fence by the hangar. The pilot pulled power to prevent a second hard landing and aft cyclic to level, but the aircraft was now unrecoverable. It hit again on the toe of the left skid, which collapsed, and the main rotor struck the asphalt. The 212 rolled right, coming to rest on its side in front of the hangar, and caught fire. The pilot and AME managed to climb out through the co-pilot's door and were not injured, but the fuel-fed fire soon spread to the hangar.

By this time the FSS had alerted the town's fire department, which arrived on the scene in five minutes, but were unable to save the hangar or its contents. The End.

Some story. Happily, it's a fictitious account, but it's derived from real incidents. During my research through accident and incident files, I have come across a disturbing trend—pilots with malfunctions who fail to declare an emergency, or deny the services of emergency response units when they are available. A few have been OEI situations where the cause of the failure was not obvious. Others, like hydraulic failures or chip lights, are also common. Some helicopter pilots in Canada rarely get the luxury of actual *airports* to operate from, and emergencies are conducted to the nearest clearing or bald rock, out of necessity. But some others, operating from or near fully equipped aerodromes, are needlessly going it alone in dealing with malfunctions.

So when does one declare an emergency? There have been questions surrounding this issue since emergencies were invented. In this article I'm not advocating that you scream MAYDAY, jettison the doors, pull the rotor brake, and bail out the next time you get a chip light in your S76—what I will attempt to do is highlight some of the factors involved with declaring emergencies, and what happens when you do. Hopefully, this information will help make the decision easier next time you're confronted with it.

Of course, some situations are obvious emergencies—like engine failure in a single-engine helicopter, fires, tail rotor failures, etc.—but others are more difficult to classify. In some cases, quiet bravado would have you believe that declaring an emergency would be overreacting to a benign situation, which is obviously not an emergency. I'll step out on a limb and say that if it's in the Emergency section of the flight manual, then it is, *or could soon become*, an emergency.

While thinking about this article, I asked several pilots why they would, or wouldn't declare emergencies in different situations. Here are some of the reasons given for NOT doing so, with some colour commentary on each.

"It's not an emergency"

Things like engine failures in twins and hydraulic problems sometimes fall into the category of 'not a real emergency.' They are practiced over and over again, until most of us can do them in our sleep (see next page). But what is the *cause* of the failure? Problems with an engine, transmission, or other systems, even where the cause seems blatantly obvious, should not be taken lightly. In our accident above, what looked like a low-side failure turned out to be a serious fuel leak, which could have lead to a fire or the loss of much-needed fuel. In addition, the first sign of a problem may not always give clues to deeper issues. Indications of fuel pressure or filter clogging may be a sign that the entire fuel system is affected, and the second engine may be about to become involved in your little adventure.

We have had several accidents in recent years that have immediately followed a chip light, or the cleaning of a chip detector after a light. The fact that many of these lights are considered 'nuisance' warnings, and are the result of normal wear accumulating on the plug, we sometimes tend to diminish their importance. However, when the real thing happens, the end result can come swiftly—engines, transmissions, and tail rotor gearboxes, when they fail, usually do so in very short order. A recent accident involving a transmission failure took less than 20 seconds to play itself out from the first indication of trouble, to the aircraft ending up on its side.

Hydraulic failure is another malfunction that often gets treated with benign indifference. We train for this over and over, and our training pilots often have us hover the helicopter to show us that this is truly a manageable event, even though the flight manual says run it on at a given speed (see next paragraph). While this has the positive effect of increasing confidence, it fails to highlight some key issues surrounding hydraulic failure. What kind of failure is it? Did the pump fail? Did the belt break? Did the fluid (which is flammable) leak out?

A hydraulic fluid fire can have consequences beyond those normally considered in either a hydraulic failure, or a fire by itself. Fire can damage other components, like wires that lead to autopilot actuators, and bring about secondary failures such as hardovers. If the fire is near a servo, the seals that trap fluid inside the servo can be damaged, resulting in a condition known as 'dry boost.' The trapped fluid is there to provide a 'cushion' between aerodynamic forces from the rotor system, and the controls. In the absence of this fluid, the pilot workload is significantly increased as feedback forces cause the control(s) to vibrate, and in certain conditions the aircraft can become uncontrollable. This is the reason that some flight manuals mandate running landings and recommend reducing airspeed during hydraulic failures. Thankfully, dry boost and hydraulic fires are rare events, but consider this—if you have a hydraulic failure and are unsure of the cause, your chances of experiencing one or the other have significantly increased.

"I can do this procedure in my sleep"

Wrong. You can do the *simulation* of a *single event* in your sleep. We don't usually train for multiple failures, and the adrenalin associated with surprise emergencies serves to complicate matters as well. The hydraulic failure followed by a fire or dry boost condition is a prime example of something you cannot do in your sleep.

"My customers will get the wrong impression if they see fire trucks waiting for us"

This is a tough one, and a powerful motivator; you just told them that there's nothing to worry about, and here come the fire trucks. The passengers may indeed get the wrong impression—if they're allowed to form it. I have always found it best to explain all situations to my customers in detail, whether they have to do with performance, technique, weather, emergencies, or regulations. We have an advantage in the helicopter world; we don't have 358 people in the back, we have 2, 3, or maybe 15. Explaining the nature of a problem to them either during, or after the event is relatively easy. Another approach, especially for longer-term clients, is to make your policy on emergency procedure part of your pre-flight briefing. This could serve to minimize the surprise factor and nervous uncertainty if the situation arises.

"Too much paperwork!"

This one was brought up over and over again as I talked to pilots about this article. Of course, if you work for an operator, you'll have to do a company incident report. We've all filled these things out—"Name," "Brief description of the incident," "Was the pilot wearing sunglasses?"—stuff like that. You have to do that anyway, whether an emergency was declared or not. But what else? Surely there are mountains of government forms to fill out? Endless reams of duplicate and triplicate copies of sheets full of arcane questions? Well, here's what else you have to fill out if you declare an emergency, and the trucks come screaming out, and you land safely:

Nothing.

Well, almost nothing. Depending on the nature of the event, you or your company *may* get a call from NAV CANADA or the Transportation Safety Board for additional information. Other than that, your suffering should be limited to your company incident report, and the sheer embarrassment of having landed safely.

"Inconvenience to others, such as emergency crews or ATC, for no reason"

Emergency crews are a unique breed. They respond to tragedies, or potential tragedies and try to avert them. They want you to land safely, and hold no long-term grudge if you do. Really, I promise.

Then there's the 'inconvenience' to ATC, and several factors come into play here. ATC expects you to be capable of doing anything they ask, within the NORMAL performance characteristics of your aircraft. If they ask you to speed up, or slow down, or go around, and you say, "Ahmmm, negative on that, I have one engine shut down," or, "I can't, I have a hydraulics failure," then you could possibly jeopardize others or introduce delays in the system. Conversely, if you advise them of problems early in the game, even if a full-on emergency isn't declared, it gives them time to react to the situation. The priority handling may also mean the difference between a non-event and a disaster, or between an 'inconvenience' to ATC and crippling the system.

"I am great, and will look very cool when I pull this off"

OK, nobody really said that, but I needed a way to bring up this point. If you are in a situation where you're dealing with a malfunction, and do not request priority handling and emergency services when they are available, you may be leaving the door open for legal action from parties injured in the event. Due diligence on the part of responsible persons is becoming a significant part of litigation these days. If things get ugly, and services were available and declined, you may have to tell someone in a funny black robe a very good reason why. No hard and fast rules here, but it's something to consider.

Most of us share a well-deserved pride in our ability to get the job done, often by ourselves, and frequently in very trying conditions. In many cases, 'help' from others is unwelcome and unnecessary, and may do more harm than good. As pilot-in-command of an aircraft, however, we have a moral and legal responsibility to ourselves, our passengers and all third parties, to take *all reasonable steps* to ensure a safe operation. I would submit that this should include taking available assistance when it can't possibly do any harm. In an emergency situation, it is often said that 'the book goes out the window'—this refers to breaking rules because following them will likely result in greater danger than not following them. A person may get relief from prosecution in these events, because they were acting to prevent harm to persons or property. However, failing to declare an emergency because of personal pride or inconvenience does not fall into this category. In this case, it's best to keep the book inside.

A Cold Wind Blowing (cont. from page 2)

Canadian Department of National Defence, with its knowledge of how troops are affected by cold weather, contributed to the effort by conducting experiments using human volunteers. They were dressed in winter clothing, with only their faces exposed directly to the cold, and exposed to a variety of temperatures and wind speeds inside a refrigerated wind tunnel. To simulate other factors affecting heat loss, they also walked on treadmills and were tested with both dry and wet faces.

The new wind chill index developed from this research is expressed in temperature-like units, instead of the original W/m^2. However, since the wind chill index represents the feeling of cold on your skin, and is not actually a real temperature, it is given without the degree sign (for example, "Today the temperature is -10°C, and the wind chill is -20"). This index is also being used in the United States, but is provided on the Fahrenheit scale. The coldest wind chill in Canada (on record) occurred at Kugaaruk (formerly Pelly Bay), Nunavut, on January 13, 1975. On that day, the air temperature was -51°C, and the winds were 56 km/h, resulting in a wind chill of -78. To compare, this would have been -92 under the previous wind chill calculation system.

Warning!

Wind chill warnings are issued by Environment Canada at varying values, depending on where you happen to be. In parts of the country with a milder climate (such as southern Ontario and the Atlantic provinces, except Labrador), a wind chill warning is issued at -35. Further north, people have grown more accustomed to the cold, and have adapted to the more severe conditions. Because of this, warnings are issued at progressively colder wind chill values as you move north. Most of Canada hears a warning at about -45. Residents of the Arctic, northern Manitoba and northern Quebec are warned at about -50, and those of the high Arctic, at about -55.

One resident Canadian—the Common Wood Frog (Rana Sylvatica)—is immune to these warnings as it comes equipped with a built-in *freeze tolerance*. This is the only frog found north of the Arctic Circle, and in winter, it hibernates under stones, stumps, or a pile of leaf litter, which offers little protection from the cold. Up to 45% of its body tissues and fluids may freeze, and breathing, blood flow and heartbeat cease. The wood frog's body

Figure 2

Approximate Threshold of Frostbite Danger

Risk of frostbite in prolonged exposure: wind chill below:	**-25**	
Frostbite possible in 10 minutes at:	**-35**	Warm skin, suddenly exposed. Shorter time if skin is cool at the start
Frostbite possible in less than 2 minutes at:	**-60**	Warm skin, suddenly exposed. Shorter time if skin is cool at the start

Figure 3

Minutes to Frostbite
(for the 5% most susceptible segment of the population)

Wind (km/h) \ Temperature (°C)	-15	-20	-25	-30	-35	-40	-45	-50
10	*	*	22	15	11	8	7	6
20	*	*	14	10	7	6	5	4
30	*	18	11	8	6	4	4	3
40	42	14	9	6	5	4	3	2
50	27	12	8	5	4	3	2	2
60	22	10	7	5	3	3	2	2
70	18	9	6	4	3	2	2	2
80	16	8	5	4	3	2	2	1

* Frostbite unlikely

Wind speed at 10 m elevation (as reported in weather observations), mathematically corrected to face height.

Frostbite possible in 2 minutes or less
Frostbite possible in 3 to 5 minutes
Frostbite possible in 6 to 10 minutes

Chart developed from Environment Canada Data.

functions return to normal when it thaws. Helicopter pilots do not possess this function, so great care should be taken to protect exposed skin in this environment to prevent some common cold-related skin ailments, including the following:

- Hypothermia, which results when body temperature falls below 35ºC. Symptoms include drowsiness, impaired coordination, weakness, and the obvious—feeling chilled. It can be fatal.
- Frostnip, a condition where ice crystals form under the skin.
- Frostbite, which is the actual freezing of the skin. It causes swelling, redness, tingling and burning. Skin turns white and waxy as the frostbite progresses, and loss of extremities and infection can result. Alcohol, nicotine, and caffeine can also influence your susceptibility to frostnip and frostbite. Alcohol can increase heat loss by increasing surface blood flow. Caffeine causes water loss and can speed dehydration. Nicotine can decrease the blood flow to peripheral body parts and increase your chances of getting frostnip or frostbite.
- Chilblains are small, red, swollen spots on the skin, which can be very itchy and gradually become very painful. They usually occur on the smaller toes, but can appear on the finger, face and the nose. They occur when bare skin is exposed to cold water, or when wet skin cools. Chilblains can lead to gangrene.

So how do we protect ourselves against wind chill? Basically, the answer is to stay dry, and remove the wind component using shelter or clothing. Cover exposed areas, and minimize the time that bare skin is open to the elements by wearing gloves, mitts, scarves and hoods (incidentally, the fur around the hood of your favourite down parka is not there for looks—it creates a large boundary layer around the face to help reduce the effect of cold and wind).

Awareness and education are also important in preventing injuries related to cold, and Environment Canada has produced some great tools to help. First, you have to be aware of what you're dealing with for actual wind chill. This is available in two ways; by accessing weather reports, or determining the value from the new Wind Chill Calculation Chart from Environment Canada (Figure 1). The average person's skin begins to freeze at a wind chill value of -25, and freezes in minutes at -35 (Figure 2)—keep these numbers in mind as a rough guide. To more accurately determine the risk, Environment Canada has produced a chart to help calculate the approximate exposure time before frostbite occurs (Figure 3).

Using these tools, and taking the appropriate precautions will go a long way toward preventing cold related injuries when the days get cold and short. The extra comfort may also help clean up your poetry, but you'll be no Robert Frost.

Tips and Tails

Recently, a low fuel incident took place at our operation that some might find interesting. The dates and times of the incident are not critical here. Rather, the sequence of events and "switchology" are.

Some background is required. This is a multi-crew, multi-engine, instrument flight rules (IFR) operation. Both pilots have credentials and experience that suggests this incident should not have taken place. Crews are regularly changed on this operation, making the use of the standard operating procedures (SOPs) and checklists essential to safe operation.

Despite the fact that the pre-takeoff checklist was used and the proper challenge/response was exchanged, *both* pilots failed to observe four illuminated caution panel lights during the pre-takeoff check. The flight commenced, and approximately 10 minutes after takeoff, a LOW FUEL light illuminated on the caution panel, and the Master Caution began cycling at random intervals—a classic low fuel situation, although the fuel indications looked sufficient. The helicopter was landed immediately and the problem sorted out on the ground.

After landing, three different fuel pump switches were found out of position for flight operation—instead, they were in the position they normally occupy for the start sequence. All had corresponding caution panel lights (which were illuminated) that go out once the switch is moved after the start sequence. In addition, the No.1 generator switch was OFF and a corresponding caution panel segment was lit—an indication that it had not been set to ON prior to take off. When all switches were placed in the correct position for flight, the warning lights extinguished, fuel began transferring normally, and the LOW FUEL light went out. It was obvious that the start sequence had become interrupted, or some other factor resulted in improper "switchology."

How did both pilots miss the illuminated caution lights prior to take off? In this helicopter, there are several rheostats controlling light intensities. As in many configurations, one of them also controls the master caution panel brightness. One of them had been left on after the previous flight, therefore dimming the caution panel. It was not reset for the flight in question. The caution panel segments were illuminated as expected on start, but were dim. The angle of the sun entering the cockpit and the dim caution panel made it all work out so that Murphy could have another go. The fuel system worked as advertised and after a short while the LOW FUEL light began indicating.

And we thought we had seen it all! In this case, the consequences could have been huge, as a double engine flameout was next. Vortex 3/2002 tells of a base manager who once said, "there's no excuse for running out of fuel in a helicopter." Well, we had lots of fuel, just not in the proper tank!

Thank goodness for a flashing Master Caution!

Snow Landing and Take-off Techniques

Throughout the course of winter operations, helicopters face a significant hazard associated with takeoffs, landings and hovering when the ground is covered with fresh or light snow. The rotor down wash can produce a flurry of re-circulating snow, reducing local visibility and causing whiteout conditions. There seems to be limited reference material available on the subject, but the following techniques are used by the industry as standard practice.

The towering takeoff

When conducting takeoffs in conditions conducive to re-circulating snow, apply enough power to get the snow blowing while keeping enough weight on the aircraft to prevent it from moving. Leave the power on as long as necessary to get good visual references. This could take up to a minute to accomplish.

Once good references are established, use a towering take-off technique (altitude over airspeed) to stay out of the re-circulating snow during the remainder of the departure procedure.

If the aircraft is equipped with a wheeled undercarriage and a runway is available, a rolling takeoff could be another option.

The rolling takeoff

Prior to starting the take-off roll, apply power to blow the runway clear in the vicinity of the aircraft—this will give you some reference for the start of the take-off roll. When ready for takeoff, apply enough power to get the aircraft accelerating ahead of the re-circulating snow. When ahead of the snow, lift the aircraft into the air, accelerate to the aircraft's normal climb speed and follow the normal climb profile.

- Use this technique when the snow cover is light (less than approximately 5 cm), and the snow is relatively dry. Deep or heavy snow could impose excessive load on the landing gear.

Landing: high-hover technique

Before using this technique, ensure that the aircraft is at a weight that will allow hover out of ground effect performance. If the aircraft is flying in clear air prior to the approach, activate the aircraft's anti-ice systems (if equipped) prior to entering the re-circulating snow.

Plan your approach to arrive in a high hover above the landing site. This hover could be several rotor diameters above ground depending on snow conditions, aircraft weight, rotor diameter, and aircraft type.

When in a high hover, the re-circulating snow will form beneath the helicopter, obscuring the landing site. This re-circulating snow will also rise; be sure to stay above the rising snow and wait until solid references appear beneath the aircraft. This could take up to a minute. These references are directly under the aircraft and within the diameter of the rotor disc. Once solid references have been obtained, a slow vertical descent to a touchdown is all that is required.

Landing: no-hover technique

This technique is generally used when aircraft do not have hover out of ground effect performance. The idea is to fly the approach fast enough to keep ahead of the re-circulating snow and complete a no-hover landing before the re-circulating snow engulfs the aircraft, causing local white out conditions.

Some of the negative aspects of this technique:

- Requires excellent timing—usually only one chance at getting it right.
- May not be able to get a detailed look at the touchdown area prior to landing.
- Not recommended for use at night helipads because of the reduced visual references required for judging the landing flare.

The run-on landing

A run-on landing could be another option, if your aircraft is equipped with a wheeled undercarriage and you are landing on a runway.

The technique is to fly the approach fast enough to keep well ahead of the re-circulating snow. On touch down, the aircraft has to have enough forward speed to stay ahead of the re-circulating snow and allow the collective to be fully lowered (lowering the collective reduces the re-circulating snow). Bring the aircraft to a full stop and taxi with caution.

- Use this technique when the snow cover is light (less than approximately 5 cm), and the snow is relatively dry. Deep or heavy snow could impose excessive load on the landing gear.

Safety first

Landings and takeoffs in re-circulating snow require skill, training, and adherence to the following safety points:

- Be certain you have sufficient power available to permit the manoeuvre.
- To prevent dynamic rollover, ensure that the skids or wheels are not frozen to the ground prior to lift off.
- Observe the flight manual and company operations manual limitations. In the transport category, the height-velocity diagram is a limitation and must be respected. In other helicopters, it should be considered in your planning.
- When using the towering takeoff or high-hover landing technique, be patient. Wait for solid references to appear before proceeding.
- Practice landings and takeoffs using references that are inside the diameter of the rotor disc.
- Training should be obtained from a qualified training pilot or flight instructor before using the techniques described here. ♣

Rob Laporte, RASO—Helicopters
Ontario Region

In Memoriam

James Clancy

Canada's helicopter industry lost a respected, veteran pilot when James Clancy died on August12, 2002 in Victoria, BC after a valiant battle with stomach cancer. Clancy, 48, was known for his dry sense of humour, resourcefulness and reliability during a career that spanned 22 years and more than 10 000 flying hours. He was an employee of Alpine Helicopters at the time his condition was diagnosed and had been involved in heli-skiing (out of Valemount), seismic and fire fighting operations. After 17 years as a contract pilot, James was lavish in his praise for his employer and his colleagues, including those on the heli-skiing side at Canadian Mountain Holidays, an Alpine affiliate.

Clancy began flying airplanes in 1974, but soon determined helicopters were his destiny when he started flying them in 1979. He obtained his commercial licence with Canwest Aviation Ltd. in Okotoks, Alberta, and started flying for their operation immediately thereafter, soon adding his instructor rating. In 1981, when Canwest was operating a fleet of 21 helicopters, he received Canwest's Pilot of the Year Award.

Beginning in 1984, he worked as a contract pilot, which took him across western Canada and the Arctic, along with tours in eastern Canada and overseas. During that time, he flew with several companies, including Northern Air Support, Peace Helicopters Ltd., Liftair International Ltd., ALC Airlift Canada Inc., Pender Holdings, Ltd., Quasar Helicopters Ltd., HeliQwest Aviation and Venture Helicopters. In 1988, it was off to Papua New Guinea, where he spent three years with Pacific Helicopters, serving for a time as base manager in the national capital of Port Moresby.

James enjoyed the challenge of working with diverse cultures in countries such as Romania, Yemen, Bolivia, Greenland and Papua New Guinea and was as fiercely loyal toward his ground crews as they were to him. Over the years, he flew many types of helicopters, including Bell 47, 204, 205, 206, 212, Hughes 300 and 500, the AS350 series, SA315B Lama and SA341 Gazelle. The bulk of his experience was in mountain flying, with about a third of his total flying time spent at the end of a longline. His career saw him engaged in many different operations, including high-altitude construction and drill moves, forest fire suppression, portable seismic, heli-skiing, MEDEVAC emergency and mountain rescue, heli-logging and bird towing. When he turned all his energy to fighting his cancer, his greatest regret was that he was stuck on the ground while his heart remained in the air. James Clancy is survived by his wife Susan, and two sons, Ryan, 20 and Daniel, 17.

Remembering Pierre Looten

by Steve Buckles

There are many people in the helicopter business who knew Pierre Looten better than I did, indeed he was well known and admired by an entire generation of helicopter pilots in Canada like me. His recent passing got me to thinking about him and the times we shared. It got me thinking about writing down memories that are the fabric of our industry.

I first met Pierre in the spring of 1981 in St. John's. He taught me to fly the S61, land on oil-rigs and how to survive in a two-crew cockpit—a big change for a VFR guy whose IFR experience was inadvertent and scary! Teaching people was something Pierre was very good at and there are many of us who benefited from his patience and style. Years later, again in St. John's, we listened to Miles Davis on scratchy old records and talked about training pilots and how to get the best from them. One of his tricks was to find out something personal about a student so he could get to know them on another level; it made the flying part easier. He stressed the need to be disciplined and systematic when dealing with an emergency with "half your brain gone out the window," as he liked to say. To assist his fellow pilots with emergency procedures, Pierre wrote an "aide memoire" for his beloved S61 that has formed the basis for SOPs on that aircraft to this day, and will never be forgotten. Many 61 pilots, past and present, still have tattered folders containing ragged photocopies of the original.

He came to Canada after the war in Algeria, where he flew night MEDEVAC because he didn't want to be part of the killing. He headed north in an S55 that first year not knowing his wife was pregnant, and came home later that year to a new baby girl. Now that was a tour!

I laughed the first time I saw Pierre turn his reading glasses upside down in order to see the overhead panel clearly and again when he did it with a pair of Ray-bans as a backdrop! Then I laughed at myself the first time I did it many years later!

His love of the spirit of exploration and adventure was a big part of his life. Remember the Saint Brendan's voyage—that bunch of crazy guys in a round ox-skin boat that crossed the Atlantic from Europe to the north-east coast of Newfoundland? Pierre was there to meet them when they arrived on the beach.

When long-time friend—Harvey Easton—died, Pierre and I talked about the need to remember those who have gone before us in this industry, and the oral history we were losing because no one was writing it down. With Pierre's passing it looks like we have lost another opportunity.

Pierre—thanks for the friendship, your long-standing contribution to our industry, and for the memories. I will try to write more of them down.

In Vortex 3/2002, an article on *Fuel Drum Etiquette* repeats a common error (in item 9) that "grounding is critical." Electrical charge differentials are equalized through bonding the different parts of the system together, not through grounding.

The National Fire Protection Association (NFPA), which is recognized as the North American authority on fire protection, states in *NFPA 407 - Standard for Aircraft Fuel Servicing 1996 Edition*, that grounding is not required. Canadian Standards Association publication B836-00 *Storage, Handling and Dispensing of Aviation Fuels at Aerodromes* also cites NFPA 407 as the reference on bonding. In addition, *AIP Canada* AIR 1.3 has been amended, and is now consistent with this standard.

NFPA 407 App A A-3-4: Grounding during aircraft fuelling or refueller loading is no longer required because: (a) It does not prevent sparking at the fuel surface (see *NFPA 77, Recommended Practice on Static Electricity*). (b) It is not required by *NFPA 77, Recommended Practice on Static Electricity*. (c) The static wire might not be able to conduct the current in the event of an electrical fault in the ground support equipment connected to the aircraft and could constitute an ignition source if the wire fuses.

The paragraph in the article also suggests that static is generated exclusively by the helicopter rotors during operation *before* fuelling. This overlooks two of the major causes of electrical charge *during* fuelling:

1) The passage of fuel through filters and hoses (see NFPA 407 A.A-3-4 below)

2) Electrical faults in pumps causing voltage to be applied to the fuelling hose and nozzle.

NFPA 407 Appendix A. A-3-4: Hydrocarbon fuels, such as aviation gasoline and Jet A, generate electrostatic charge when passing through the pumps, filters and piping of a fuel transfer system. The primary electrostatic generator is the filter/separator that increases the level of charge on a fuel by a factor of 100 or more as compared with pipe flow.

In addition, NFPA 407 states that funnels or other refuelling equipment fabricated from nonconducting materials, such as plastic, can increase static generation. The use of chamois as a filter is extremely hazardous.

Here is a summary of the relevant advice on static electricity and fuel:

Bonding requirements

Sparks resulting from the static electricity created by fuel passing through pipes and filters can be avoided by proper electrical bonding of all components of the fuelling system and the aircraft. Bonding cables must be conductive, durable and flexible. Bonding connections must be electrically and mechanically firm. Jacks, plugs, clamps, and connecting points must be clean, unpainted metal to provide a positive electrical connection. The bond must be maintained until fuelling connections have been removed, thus allowing separated charges that could be generated during the fuelling operation to reunite.

First, the drum, fuelling vehicle, or cabinet must be bonded to the helicopter, using a separate wire, not contained within the fuel hose. If using a drum, the pump should now be bonded to the drum, the drum cap opened, and the pump standpipe inserted.

Next, the hose nozzle, (which must be fitted with a bonding wire with a clip or plug attached), must be directly bonded to a part of the helicopter that is metallically connected to the tank filler port. Only then may the aircraft fuel cap be removed, and fuelling commence.

Once fuelling is complete, the aircraft fuel cap must be replaced before unhooking fuel lines and bonding wires in the reverse order.

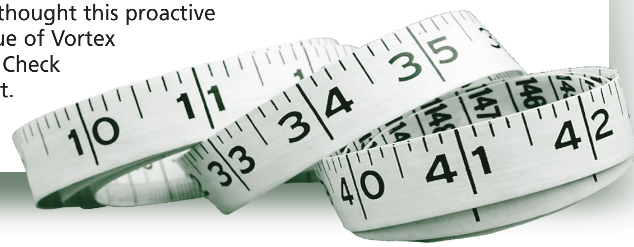
Jet B and AVGAS ignite much more easily than Jet A, and a Jet B or AVGAS fire will spread about thirty times faster than a Jet A fire.

Guy Smith
Civil Aviation Inspector
Commercial & Business Aviation
Pacific Region
Transport Canada

Think winter flying!

HOW DO YOU MEASURE UP?

This year, at the Prairie and Northern Region Aviation Safety Council meeting, Mr. Gary Hillman of Hillman Air, raised the issue of Transport Canada Enforcement Inspectors distributing ramp check forms at a local fly-in breakfast as an education tool. Mr. Hillman thought this proactive approach was a great idea, and so do we. This issue of Vortex contains a tear-out Aircraft Document/Equipment Check form that inspectors use when checking an aircraft. Use the form to ramp-check yourself and your aircraft to see how you measure up!



Upcoming Helicopter Icing Video Project—We Want Your Stories!

Over the past decades, several spectacular accidents in the fixed wing world (Roselawn, Dryden, Gander) have created a heightened awareness of the unpredictable nature and insidious consequences that ice can have on an aircraft. Over the years, a variety of training products have been produced on aircraft icing, from books to videos, but they primarily speak to airplanes. One of the aviation community's foremost providers of icing training products is the NASA Glenn Research Center in Cleveland, Ohio. They have an impressive suite of excellent icing training products for the fixed wing world, such as their recent DVD *Icing for General Aviation Pilots* (TP14041-1). System Safety has recently translated this product into French (*Le givrage pour les pilotes de l'aviation générale*) and begun to distribute it in a bilingual format to regional System Safety offices.

At a meeting in Ottawa last summer, NASA expressed an interest in developing a helicopter-related product, and we jumped at the chance to get on board. Since that time, Transport Canada System Safety has entered into a joint venture with the NASA Glenn Research Center, and our helicopter icing project is slowly taking shape.

As very few helicopters are equipped with ice protection systems, the best way for the vast majority of us to deal with ice is to avoid it. Therefore, the video will carry the message that each icing encounter is unique and unpredictable, and concentrate on education, planning, and avoidance strategies for the helicopter pilot.

One of the things I thought would be helpful in delivering this message would be testimonials, in which pilots describe encounters with unexpected or unforecast ice, what effect it had on the flight, and what they did to escape the condition. If you have such a story (I know I have a few) and would like to share it, I'd love to hear from you. Contact information is on the editorial bar on page 3.

Remember, one of the best ways we have to help ourselves and others is to share our experiences.

IN THIS ISSUE

Transport Canada's Canadian Aviation Safety Seminar,

CASS 2003

April 14–16, 2003

Hilton Montréal Bonaventure

Aviation Human Resources: The Core of Our Industry

info/registration:

http://www.tc.gc.ca/CASS

Transport Canada Transports Canada

Aircraft Document / Equipment Check

General

Date ____________ Time ________ Location ______________________________ A/C Ident ________

Wheels ☐ Floats ☐ Skids ☐ Crew: (Male) ____ (Female) ____ Pax: (Male) ____ (Female) ____ (Children) ____

Arrived from ________________ Flight plan closed? __________ Load security ______________

Flight Crew

PIC: Name: ________________ Address: ______________________________

Postal code: ________ Telephone: Off ( ) ________ Res: ( ) ________ DOB: __________

Licence no.: ______________ Medical certificate valid to: ____________ PPC: ______________

Co-pilot: Name: ________________ Address: ______________________________

Postal code: ________ Telephone: Off ( ) ________ Res: ( ) ________ DOB: __________

Licence no.: ______________ Medical certificate valid to: ____________ PPC: ______________

Aircraft

Type: ______________ Com: ☐ Pvt: ☐ Reg. Owner / Op.: ____________________

Address: ____ Postal code: ________

Telephone: Off: ( ) __________ Res: ( ) __________ Fax: ( ) __________

Documents / manuals	(on board) Yes	No	Equipment	(on board) Yes	No
Pilots licence	____	____	Fuel reserves	____	____
Medical certificate	____	____	Fire extinguisher	____	____
C of R	____	____	Seat belts	____	____
C of A	____	____	Harness	____	____
Journey Log	____	____	First aid kit	____	____
Insurance	____	____	Life jackets	____	____
A/C Flight Manual	____	____	ELT	____	____

Commercial Operators

Co. Ops manual	____	____	Load control/W&B	____	____
S.O.P. manual	____	____	Pax brief cards (702 n/a)	____	____

Comments ____

____

____

____

Inspector - ______________________ Dept. - ______________________ (see reverse for ref.)

CARS REFERENCES

(Note: general references only - subject to revision - check your specific requirements)

Load security	**602.86**	Flight plan closed	**602.77**
Pilots licence	**401.03**	Fuel reserves	**602.88**
Medical certificate	**401.03**	Fire extinguisher	**602.60**
C of R	**202.26**	Seat belts	**605.22**
C of A	**605.03**	Harness	**605.24**
Journey log	**605.95**	First aid kit	**602.60**
Insurance	**606.02**	Life jackets	**602.62**
A/C flight manual	**605.04**	ELT	**605.38**

COMMERCIAL OPERATIONS

702 Aerial Work: aeroplane or helicopter in aerial work involving;

a) carrying passengers other than flight crew;
b) helicopter class B, C or D external loads;
c) towing; **or**
d) dispersal of products. (Note: this subpart does not apply to Ultra-light aeroplanes or aircraft sightseeing operations.)

703 Air Taxi: Canadian air operator, in an air transport service or in aerial work involving sightseeing operations, using any of the following aircraft:

a) a single-engined aircraft;
b) a multi-engined aircraft, other than a turbo-jet-powered aeroplane, that has a MCTOW of 19,000 lbs or less **and** (excluding pilots) seating for 9 or less; **or**
c) as authorized by the Minister.

704 Commuter: Canadian air operator, in an air transport service or in aerial work involving sightseeing operations, using any of the following aircraft:

a) a multi-engined aircraft that has a MCTOW of 19,000 lbs or less **and** (excluding pilots) seating for 10 to 19 inclusive;
b) a turbo-jet-powered aeroplane, max zero fuel weight of 50,000 lbs or less **and** Canadian type certified for not more than 19 passengers; **or**
c) as authorized by the Minister.

705 Airline: Canadian air operator, in an air transport service or in aerial work involving sightseeing operations, using any of the following aircraft:

a) an aeroplane not covered in subpart 4, that has a MCTOW of more than 19,000 lbs **or** Canadian type certified for 20 or more passengers;
b) a helicopter that has (excluding pilots) seating for 20 or more; **or**
c) as authorized by the Minister.

COMMERCIAL OPERATORS

	702 Aerial	703 Air Taxi	704 Commuter	705 Airline
Carry Ops manual	.83	.106	.122	.136
Carry S.O.P.	.84	.107	.124	.138
Load control/W&B	*Ops manual*	*Ops manual*	*Ops manual*	*Ops manual*
Pax brief cards	*n/a*	.39	.35	.44
PPC valid	.65	.88	.108	.106