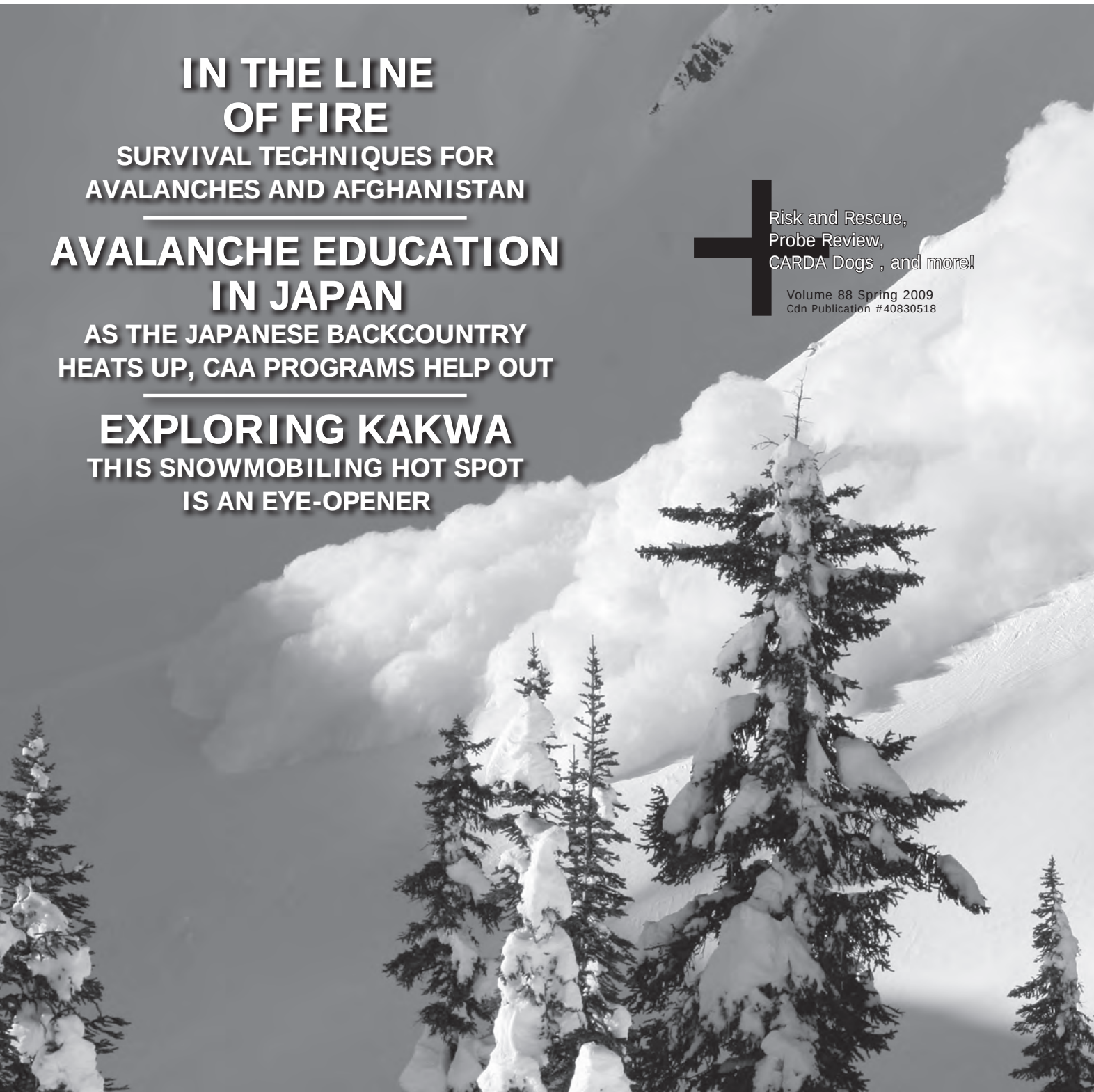
# avalanche.ca

The journal of Canada's avalanche community



## IN THE LINE OF FIRE

**SURVIVAL TECHNIQUES FOR AVALANCHES AND AFGHANISTAN**

## AVALANCHE EDUCATION IN JAPAN

**AS THE JAPANESE BACKCOUNTRY HEATS UP, CAA PROGRAMS HELP OUT**

## EXPLORING KAKWA

**THIS SNOWMOBILING HOT SPOT IS AN EYE-OPENER**

\+ Risk and Rescue, Probe Review, CARDA Dogs , and more!

Volume 88 Spring 2009
Cdn Publication #40830518


attach to food left in alpine huts


Wren McElroy


Peter Marshall

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Cover shot: This 2.5 in North Hiren Creek, northwest of Revelstoke, was triggered for testing purposes back in early February, 2006. A test dummy is in there somewhere, wearing a prototype version of the Avi-Vest, an avalanche airbag system created by the WARI Avalanche Research Institute. The avalanche went bigger than expected, ran off a cliff and completely destroyed the equipment. The six separate body pieces of the test dummy were recovered the following summer. The head is still missing but recovery attempts continue. WARI reports recent testing this past winter has been much more successful, with two test dummies and their air bags floating to the surface of five separate slides. We'll have more on the Avi-Vest in a future issue of *avalanche.ca*.

This journal is the official publication of the Canadian Avalanche Association (CAA), the Canadian Avalanche Centre (CAC) and the Canadian Avalanche Foundation (CAF). The CAA and CAC are non-profit societies based in Revelstoke, BC, serving as Canada's national organizations promoting avalanche safety. The CAF is a registered charity formed to provide a tax-deductible fundraising mechanism for the support of public avalanche safety initiatives. The CAF is based in Canmore, AB.

The goal of *avalanche.ca* is to keep readers current on avalanche-related events and issues in Canada. We foster knowledge transfer and informed debate by publishing submissions from our readers. Responsibility for content in articles submitted by our readers lies with the individual or organization producing that material. Submitted articles do not necessarily reflect the views or policies of the CAA, CAC or CAF.

We always welcomes your opinions, teaching tips, photos, research papers, survival stories, new product announcements, product reviews, book reviews, historical tales, event listings, job openings, humourous anecdotes and, really, anything interesting about avalanches or those people involved with them. Help us share what you have. Please send submissions to:

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| | |
|---|---|
| Editor | Mary Clayton |
| Layout & Design | Brent Strand |

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***Note:*** Digital contributions work best for us. For details, contact Brent Strand at bstrand@avalanche.ca.

## board of directors and committees

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| Brad Harrison | Joshua Milligan |

## failure plane

In the last issue of *avalanche.ca*, we spelled Julie Timmins' name incorrectly in the byline of her article "the Signs of Success" on page 27. We apologize for the error.



avalanche.ca

**Our vision:**
To be a world leader in avalanche awareness, education and safety services.

# Help Wanted

This has been a heck of a winter. A few days before this issue went to the printer, the 24h fatality of this season was recorded—the 18th snowmobiler. Of course we're alarmed; this is double the worst year in our records for snowmobile deaths. We've been examining our messaging and advice, our strategies, services and programs. How do we stop this trend?

Snowmobile safety has been a priority of the CAC since its inception in 2004. Our snowmobile outreach program brings evening courses and weekend awareness events to communities in Alberta and BC. The many AST providers who teach snowmobile-specific courses are marked with an icon on our website. We post to online discussion forums, we write articles for snowmobile magazines and we send targeted messages to snowmobile clubs. Our forecasts routinely use references aimed at sledders and we've created a new "landing page" on our website designed for snowmobile users. Take a look at avalanche.ca/sled to see what we've done.

None of these initiatives were created in a vacuum. Lori Zacaruk and Amber Wood, the mainstay of our snowmobile outreach program, work tirelessly for the cause of snowmobile avalanche safety and help tremendously with ideas and advice. We consult regularly with the BC Snowmobile Federation, the Alberta Snowmobile Association and the Association of BC Snowmobile Clubs. But we've done what we know how to do and as the death toll rises, it's clearly not enough.

What's also clear is the extent of the challenge before us. It's no secret there is a cultural divide between snowmobilers and skiers. They're a group that already feels besieged by environmental concerns and land access issues, so the CAC can seem like just another voice challenging their right to enjoy the backcountry. We know they use the terrain differently than skiers, they cover a huge amount of area in a day, helmets restrict their ability to observe the environment, the list goes on.

As Karl Klassen said in a recent interview with CBC radio, "We're at a loss." We need guidance, input and commitment from the snowmobile community to turn this trend around. We're looking to the manufacturers, distributors and retailers for help in this cause. We know we have good products and services that can be effective at preventing accidents. What we need is input from the people who know how to reach this audience. Expecting to do this on our own is a recipe for continued frustration and marginal results.

To paraphrase André Roch, "The avalanche doesn't know if you're a skier or a snowmobiler." Much of the backcountry skiing community's knowledge is hard-won, earned through tragedy and error. Just a few short decades ago, skiers were pretty much in the same boat as sledders today, many of them without safety equipment or knowledge, pushing limits with no awareness of the risks they were taking. Accidents happened, some of them big.

As we look back through our history, we can recognize points in our evolution where attitudes and practices have changed. Most, if not all, of these shifts are the result of fatal accidents. It's one of our great strengths that it's not just the survivors who gain knowledge, it's all of us. Data is shared, stories are told, lessons are learned and things change. Today backcountry skers enjoy an environment where commercial enterprises, community groups and individuals participate collectively in safety efforts, some spearheaded by the CAC but many others independent and complementary.

This winter has already earned a place in history. Now we need to help the snowmobiling community tell their stories, learn their lessons and make their changes. We need to shortcut decades of development and many preventable deaths to help build a culture of avalanche awareness, inter-agency support and collaboration.

This spring, we'll be pushing out a list of ideas to our snowmobiling stakeholder group to spark a discussion on projects we could take on together. We don't have unlimited resources but we do have a tremendous amount of knowledge and passion. We're going to keep sharing what we know, and we're going to keep working hard to gain a new perspective on this issue. If you've got any thoughts on this, please let me know. We can use all the help we can get.

# Mentors

As spring approaches and we prepare for the annual pilgrimage to Penticton for our Annual General Meetings, I am spending a lot of time thinking about mentors—past, present and future. Recently I was contacted by one of my early mentors, a Swiss mountain guide by the name of Reto Keller who gave me my first guiding job—as a tail gunner at SnoMuch Fun Cat skiing (now Powder Cowboy).

Reto took me under his arm and dedicated a significant amount of time to my education and development as an avalanche worker and guide. He laid the seeds of passion for avalanche science and practice, educated me on the art of guiding and helped me see the career that lay ahead of me. He was a fantastically enthusiastic individual, kind-hearted and dedicated to his work. Reto has returned to Switzerland and now works for the SLF, researching the risks in mountain rescue operations, specifically those associated with avalanches.

Transitioning into the Executive Director position of the CAA after a busy winter 'acting' as ED and still holding up my day job as CAA Operations Manager has been an interesting process and a time of reflection on my career. Mentors have been key to my development as a ski guide, avalanche worker and manager. This period of reflection has led me to a more detailed retrospective on mentorship in general, and to rethink some requests from our membership over the past couple of years regarding mentorship and the role of the CAA.

Mentorship is an integral component in the development of world-class avalanche workers in Canada, yet how many of us are actively involved in a formal mentorship program? For that matter how many of us actually know what mentorship really means?

While there are informal mentorship arrangements to be found around our community, many that I am aware of follow no defined process or structure. There have been numerous calls over the past couple of years for the CAA to develop a structured mentorship program for the avalanche workers of today (and tomorrow). Formal, structured and managed mentorship programs cost money and would most certainly add to the overall cost of professional avalanche education in Canada. In the context of the current economic climate and changing business models for us all, I am reluctant to do anything that could further increase the costs of our training without having very strong reasons to do so.

However, I do believe we can help provide resources to improve mentorship in our community without increasing costs, by examining how other agencies do it. We can learn many important lessons from our partners at the Association of Canadian Mountain Guides (ACMG) and their training programs at Thompson Rivers University. In their experience, they have found that a certain amount of responsibility needs to lie with the person being mentored, or else an imbalance

Alan Jones

in expectations and therefore outcomes quickly emerges. Essentially, the student expects more than the program can provide.

Of course, a lot of responsibility is taken on by the mentor in these relationships. From my research, it is clear that when a structure is followed—with clearly defined goals and expectations that both mentor and student agree to before the relationship starts—success is far more likely to occur.

The cost of professional avalanche training is already significant. One of the CAA's core values is to ensure high quality programs at reasonable costs, so I'm hesitant to try and implement an administratively complex, and therefore costly, program. However, developing resources to enable potential mentors and students find each other and structure their relationship is certainly well within our current capabilities.

I'd like to work on this with you, the members of the CAA, over the summer and present something to you in the fall edition of *avalanche.ca*. Send me your thoughts, resources, recommendations and experiences. I'll do my best to put together a framework that you can use in your respective workplaces to help develop a mentorship program or refine existing programs already in place.

## What is mentoring?

| Mentoring | Coaching |
|---|---|
| Focus on progress | Focus on task |
| Usually longer term - sometimes for life | Usually short term |
| Intuitive feedback | Explicit feedback |
| Develops capabilities | Develops skills |
| Driven by mentee/learner | Driven by coach |
| Helps you to work it out yourself | Shows you where you went wrong |

Taken from National Workforce Projects, Guidance Series: Mentoring Framework 10
www.healthcareworkforce.nhs.uk

**Useful resources / links**

www.coachingnetwork.org.uk
www.mentoring.org
www.managementhelp.org/guiding/mentrng/mentrng.htm
www.exemplas.com/individuals/leadership_management/services_mentors_forum.asp
www.clutterbuckassociates.com/content/Company/Home.aspx

Bob Covey

# Changing of the Guard

For this instalment I thought I'd say a few words about our outgoing Executive Director, Mr. Clair Israelson. Whether you know him personally or just know of him, if you work in an avalanche-related profession in Canada, Clair has had a dramatic influence on your life.

Clair began working as Managing Director of the CAA back around the turn of the century. The CAA had a substantial operating budget of a little more than $750k. In 2008-09 the total budget for the CAA/CAC was about $2.5 million. Staffing changed from a modest seven seasonal employees to the current roster, which now includes 23 seasonal staff. These figures don't account for the instructor pool, which now numbers over 70!

When Clair started, the CAC was an entirely different entity. The Canadian Avalanche Centre, Chris Stethem's brainchild, was evolving to be to the focal point of the Canadian avalanche community. Following the tragic winter of 2002-2003 the BC Public Avalanche Safety Program Review was released. This document called for the establishment of a national avalanche centre, whose role would be to coordinate public avalanche safety initiatives. This supported many of the CAA's objectives but also challenged the existing CAA configuration. Within a year the CAC, the distinct entity as we now know it, was incorporated.

With the new distinct corporate structures in place, Operations Managers were hired and the Managing Director evolved to the position of Executive Director. This was not simply a title change; it was a reflection of the increasing complexity of our affairs. The federal and provincial governments now recognized the CAC as Canada's national public avalanche safety organization.

When the first draft of WorkSafe BC's avalanche safety regulation hit the table we were taken aback, to say the least. The next 18 months were a blur of interagency collaboration, communication and, in some cases, negotiation. With last fall's regulation ratification by WSBC's board of directors, the CAA became officially recognized as a standards setting body. (Where we go from here is the next challenge we need to start discussing!)

> **"Clair believed that even our best is barely adequate when it comes to our knowledge and understanding of avalanches."**

Now one may argue that Clair was not personally responsible for the growth and evolution of the past eight years, and I am sure he'd agree. But combine his substantial influence with the immense external societal changes, an unprecedented 330% period of budgetary growth, over 300% increase in staffing levels and the realization of the CAC, it adds up to one crazy ride!

So now with a changing of the guard we must also look at the 117 avalanche fatalities that have occurred over the past eight years. Our work is nowhere near done. There are many leaders that expect results. Clair believed with the highest of conviction that even our best is barely adequate when it comes to our knowledge and understanding of avalanches. With that as the take home message, we offer a heartfelt thank you to Mr. Israelson for his dedicated years of service.

# FORECASTING PERSISTENT WEAK LAYERS

## PAST EXPERIENCE, CURRENT SCIENCE, FUTURE INNOVATION.

**Dr. Bruce Jamieson—The CR/FC layer of 1996/97**
**Cam Campbell—The CR/FC layer of 2002/03**
**Chris Stethem—Historical accidents involving PWLs**
**Bob Sayer—Communicating PWLs: an operator's perspective**
**John Kelly—Communicating PWLs: the public safety perspective**
**Karl Klassen— InfoEx as a PWL forecasting tool**
**Mark Vesely— PWLs at Fernie**
**Anton Horvath—South Coast PWLs in 2008/09**

# Spring CPD Seminar

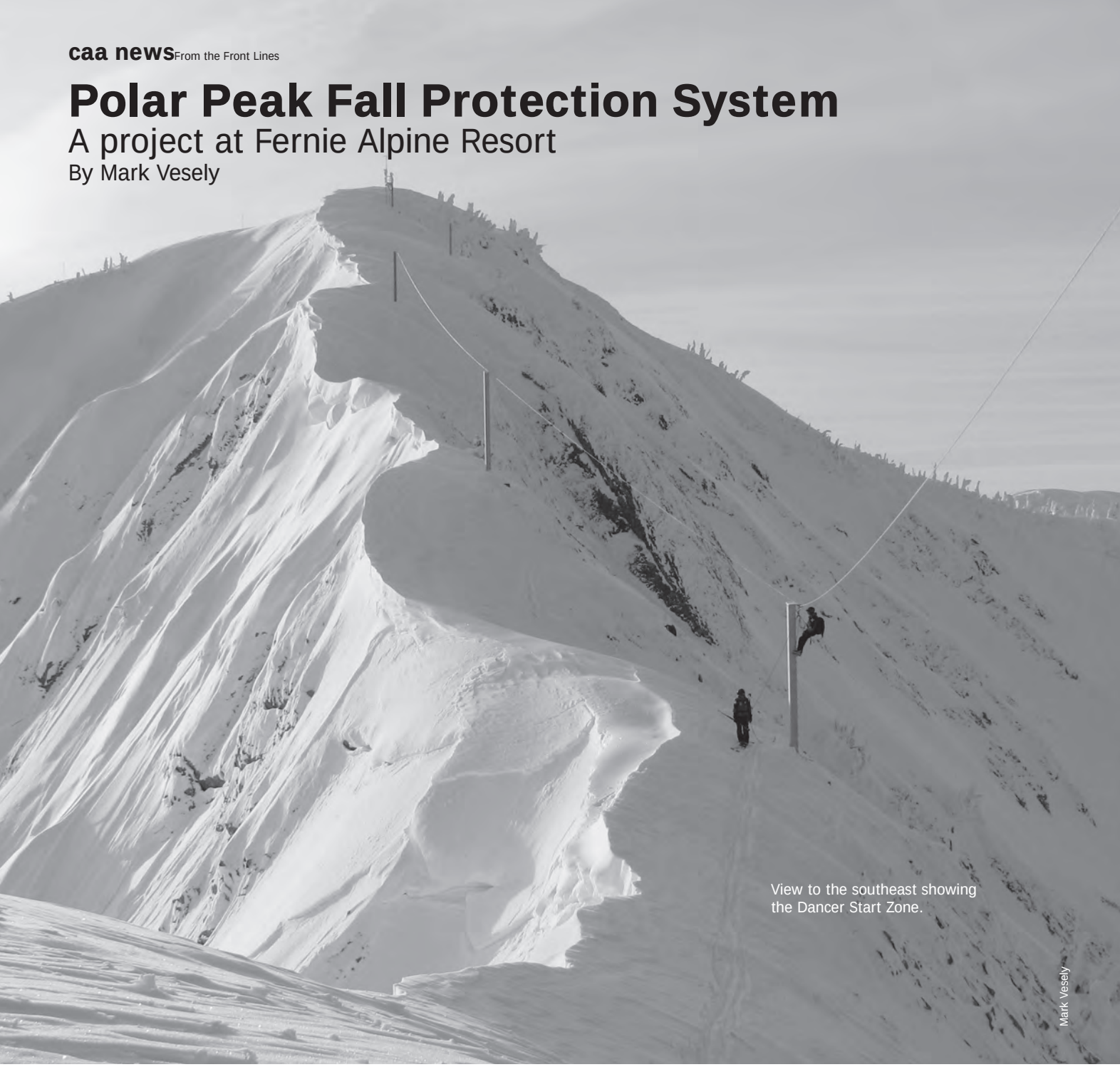
**Location: Ballroom, Ramada Inn, Penticton, BC**
**Time: 8:30am to 4:30pm, May 6, 2009**
**Tickets: CAA/CAC Members $85 Non-members $150**
**Ticket includes dinner and chance to win draw prizes.**

canadianavalancheassociation

# Polar Peak Fall Protection System

## A project at Fernie Alpine Resort

By Mark Vesely



View to the southeast showing the Dancer Start Zone.

Mark Vesely

Fernie Alpine Resort would like to introduce the newest tool that has been developed in its avalanche control infrastructure systems. The Polar Peak fall protection system consists of an overhead line that offers belay capabilities to workers needing to travel a heavily corniced and exposed section of ridge crest.

The idea for this system began in 2007 when debates within the avalanche forecasting team about the program's future directions included greater technician presence in the upper start zones of the ski area's larger slide paths.

The program at Fernie is and historically has been very dependent upon Avalauncher technology for stability testing and avalanche hazard mitigation. The guns have proven their worth but they are not always the most accurate or reliable tools in addressing conditions that trend towards deeper slab instabilities and cornice development.

Helicopter bombing has emerged as the best mitigation tool our area has to date, enabling us to deliver the required explosive charges to either cornice or snowfield targets in our looming headwall areas. Limitations here are obvious with expense, exposure, dependence on visibility and reasonable flying conditions. Historically we have had times where, due to extended snowfall periods, our guns have lost their effectiveness, the machines cannot fly, and we were faced with an ever increasing and prolonged closure condition that allows the development of highly destructive avalanches.

We discussed the option of developing a hand-charge route that could work from the ridge crest above the resort and deploy accurate and sizeable charges in almost any weather condition. The route would have a crux at the Dancer start zone but once past this, technicians could travel easily without a belay on a broad ridge crest.

We also discussed Gaz-Ex exploders or Avalanche Guard as future solutions. However, our team felt that reasonable access to the ridge must first be addressed. Thus began the three-year project of trying to reduce exposure to our snow safety team's travel on the Lizard Ridgeline.

This overhead cable system was designed and developed with assistance from Gravisys Inc., a company based in Edmonton Alberta that specializes in fall protection for workers. In total the project involved collaboration from a dozen companies and hundreds of man hours to install. Using the system on a trial basis this past winter have proven it effective, with good belay security for workers traveling the ridge line. There are a few challenges that have surfaced with material resilience in the harsh winter environment of the Lizard Range and reasonable weather that does not over expose technicians in both access and prolonged time periods on the ridge top.

A technician prepares to use the system.

Mark Vesely

The system is 230 m long, exchanges 55 m of relief and is comprised of six five-metre towers that have tieback ground anchors on either end. The tower anchors are made of floating concrete blocks anchored to the bed rock with one-and-half inch thread bar of varied epoxy depths depending on rock quality. The overhead line is half-inch stainless steel cable, clamped on either end of the system with a load limiter device at towers one and six. Through the other towers the cable is passed through a tapered steel bracket that allows a Sala shuttle device to pass without requiring the technician to clip or unclip the system to get around the post.

In standard applications the worker would have a body harness and a retractable cable device that controls tension to the main line. In our application, an 11 mm dynamic rope with tandem prussic attachments to a sit harness merges line adjustability and system weight without compromising safety to the worker. If a fall does occur the worker may become suspended. If adequate load is applied to the main line, the load limiters on either end will deploy and decrease the forces on the worker while bringing the fall to a stop.

Our future with this system will still require some work to develop both consistent access to the ridgeline for workers and a highly trained team of specialists able to work efficiently in this environment. If anyone has specific questions about this system please feel free to call me at 250 423 2426 or email mvesely@skifernie.com.

>>Mark Vesely is the Snow Safety Director at Fernie Alpine Resort.

Brad White

# LAND OF THE RISING FUN

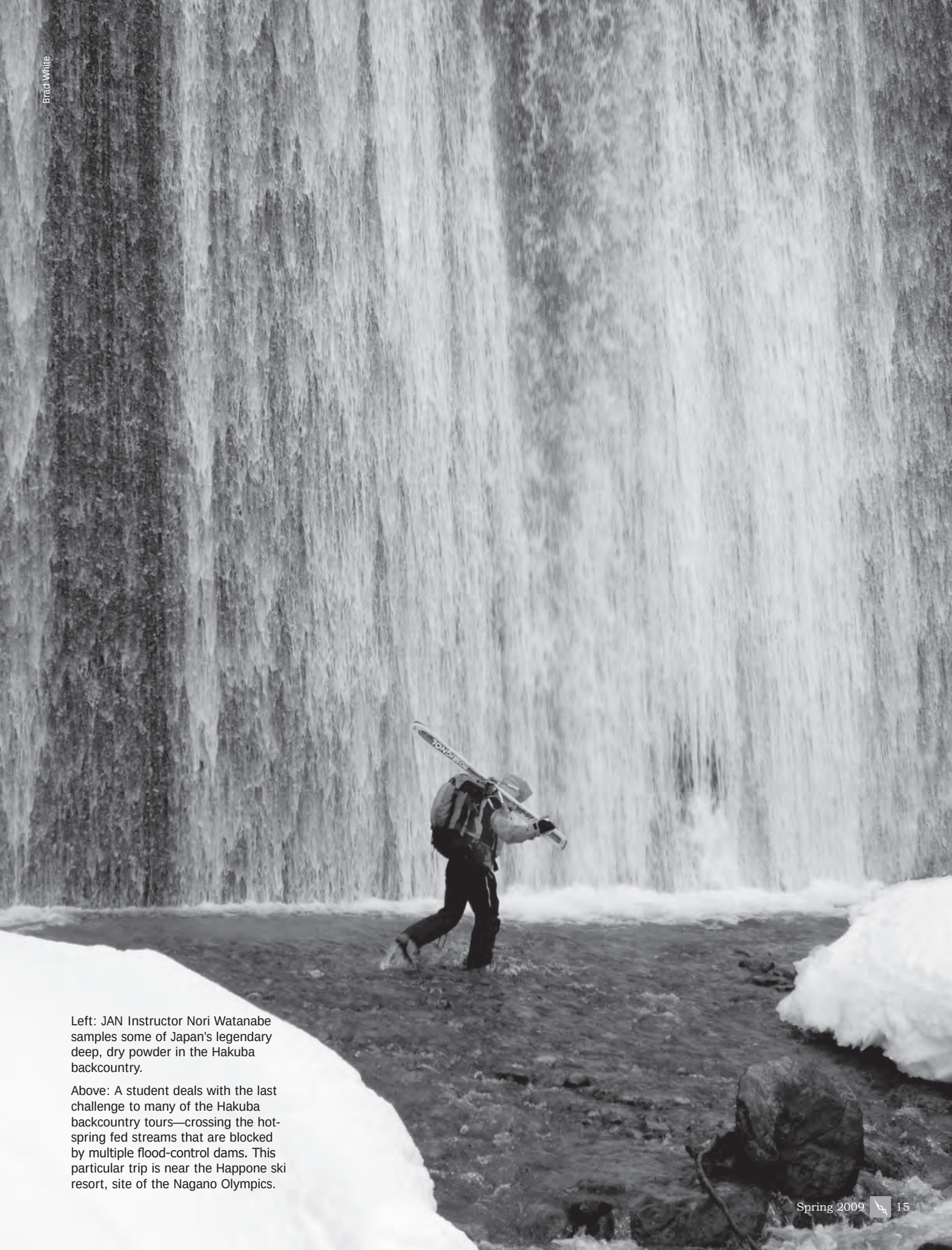
## As more people discover Japan's backcountry, the CAA continues to influence avalanche safety education

By Brad White

A denim-clad Japanese waitress wearing a black top hat is placing a tray of double-sized margaritas amid the wreckage of several chimichangas. Across the table three white banditos are bellowing to be heard above the din of a nearby table of Australians singing "Waltzing Matilda." One of the banditos is a grey-bearded pseudo-Scotsman in a giant ten gallon hat, the second is a tall bearded Rasta man with dread locks down to his mid-back and the third is grinning maniacally with a permanent Cheshire smile.

No, this is not a scene from some cheap western, but just another "normal" evening in Uncle Stevens Mexican Steak House in Hakuba, Japan. The three banditos are Roddy McGowan, Dave Enwright and Larry Stanier. They have joined me and our two Japanese instructors, Noriys (Nori) Watanabe and Shoji Matsumoto for dinner after another day of teaching the Level One Avalanche Course put on by the Japanese Avalanche Network (JAN). Roddy is in town doing some guiding for Dave's outdoor adventure school and Larry has a break between private clients and on his way to a one-day field refresher for some previous Level one graduates.

The Japanese avalanche course is essentially the same as that on a Level one course in Canada, as the material has been licensed by the CAA and the Canadian student manual has been totally translated from English into Kanji (Japanese characters). We have 18 students who are a mix of backcountry guides, mountaineers and ski patrol. All the instructors are bilingual in Japanese and English except for me, so all of my lectures and field instruction are translated. I added a bunch more photos to my talks, took out any technical English slides, and the course is one day longer to allow for the translation.



Brad White

Left: JAN Instructor Nori Watanabe samples some of Japan's legendary deep, dry powder in the Hakuba backcountry.

Above: A student deals with the last challenge to many of the Hakuba backcountry tours—crossing the hot-spring fed streams that are blocked by multiple flood-control dams. This particular trip is near the Happone ski resort, site of the Nagano Olympics.

Field days are spent outside the numerous ski hills near Hakuba that are developed along the eastern flank of Japan's Northern Alps, about four hours drive north from Tokyo in Nagano Prefecture. The terrain is a spectacular mix of alpine and treeline skiing with fabulous open tree skiing in deciduous beech and silver birch forests. Contrary to popular belief, the Japanese backcountry is open to skiers and snowboarders, and there are significant numbers out enjoying the powder on any given day. It is only within the confines of some ski areas that the off-piste tree skiing is restricted. The snow is deep and dry as the Alps are only 50 km from the Sea of Japan and the cold dry air masses sweep across Siberia before picking up moisture from the ocean and dumping it on the peaks. The snowpack this year in January was about three metres at 2000 m and increased as you gained elevation.

This is the eighth year of Canadian involvement with the JAN training programs. JAN was started in 2000 by Azusa Degawa, with the goal of increasing public avalanche awareness and providing professional avalanche courses and seminars. His long-term goal is to develop professional avalanche forecasters able to provide public avalanche bulletins for the mountain communities in Japan. There is no national avalanche association in Japan, and JAN is on the road to providing the foundation for a common community amongst the disparate agencies and organizations involved in avalanche forecasting or prevention in the country.

One of JAN's new initiatives in support of this goal is an online backcountry information bulletin board system where contributors can post field observations, snowpack structure comments and stability ratings in a structured form. In addition they have created SPIN, the Snow Profile Information Network, where contributors can post snow profiles.

As mentioned, there are now enough Level one graduates in the country to be able to fill a one-day refresher course that Larry instructed. In the evening, Larry, Nori, Degawa and I met with this group to provide some guidance on how best to utilize the bulletin board system. As we have seen in Canada, one of the most difficult skills to master in the avalanche profession is the ability to synthesize a vast amount of collected information and effectively communicate the critical elements of all this data in a concise, meaningful way. We discussed how the ACMG's MCR and InfoEx have struggled with the same issue in Canada and gave the students some guidelines and examples to help them improve their future postings.

On the last day of our course, a group of backcountry boarders triggered an avalanche above the Happoone ski resort with a critical burial. The victim was swept over 600 metres down a steep, tree-filled gulley and was buried with only a hand sticking out. He was recovered not breathing, but began breathing spontaneously when his airway was cleared. The police winch-equipped helicopter hoisted him from the scene to hospital where he was diagnosed with serious multiple fractures and internal injuries. Thankfully he is now well on the way to recovery.

One of the party members was a JAN Level one graduate, and the successful rescue in this case was due in part to his training. I met with the graduate and Degawa in Tokyo and reviewed some of the details of the incident and discussed the decision making and terrain choice of the party. A small layer of facets that formed on the north aspects on a warm clear day turned out to be the failure layer. We know that avalanche training is never going to prevent all accidents, and that trained individuals are also more likely to be traveling in avalanche terrain.

JAN is now working with the CAA to go the next step in the education process, and a Level II course is in development for next year. As increasing numbers of Japanese snow and avalanche workers are trained to professional recording and observation standards, we can expect further success with JAN's goal of a public bulletin program.

>>Brad White is an IMGFA/ACMG Mountain Guide and a Mountain Safety Specialist for Parks Canada. He's been a CAA ITP instructor for about 20 years.

Brad White

JAN Level 1 students recording weather readings at the study plot, Hakuba, Japan.

Brad White


Larry Stanier

Snowfall rates of 4-10 cm/hr are not uncommon. Students departing on a field trip near Tsugiake Kogen ski area, Hakuba, Japan.

Brad White

# CAA/CAC Spring Conference 2011

Jordy Shepherd

The CAA/CAC AGM and Spring Conference will be held at the Penticton Ramada from May 3- 8, 2009. Below is the DRAFT schedule. Please note it is only a draft and some changes should be expected. A detailed time schedule for the week will be available in online mid April.

**Sunday, May 3**

| | |
|---|---|
| 6:00 -9:00 | CAA/CAC BOD Meeting |
| 6:00 - 9:00 | CAC Bulletin Writers Workshop |

**Monday, May 4**

| | |
|---|---|
| 8:30 - 9:45 | ITP All Instructors Meeting |
| 9:45 - 12:00 | ITP Level 1 Meeting |
| 11:00 - 1:00 | InfoEx Advisory Meeting |
| 1:30 - 3:30 | ITP Level 2 Meeting |
| 1:30 - 4:00 | CAC Roundtable |
| 4:00 - 6:00 | Avalanche Explosive Control Guideline working group |
| 4:30 - 6:00 | CAC Youth Meeting |
| 7:00 - 9:00 | InfoEx Subscribers Meeting |
| 7:00 - 9:00 | EdCom Meeting |

**Tuesday, May 5**

| | |
|---|---|
| 8:00 - 9:00 | WorksafeBC & Avalauncher Stakeholders Meeting |
| 8:30 - 9:15 | CAA Affiliate Meeting |
| 8:30 - 9:15 | CAA Assoc Meeting |
| 10:00 -12:00 | CAC AGM |
| 12:00 - 1:00 | CAF AGM |
| 1:30 - 5:00 | CAA AGM |
| 5:30 - 7:00 | CAC/CAA StaffDinner Meeting |
| 7:00 - 9:00 | CAC Snowmobile Safety Programs |

**Wednesday, May 6**

| | |
|---|---|
| 8:30 - 4:30 | CAA CPD Seminar, Forecasting Persistant Weak Layers Past Experience, Current Science, Future Innovation |
| 6:00 - 9:00 | Awards, Tradeshow, Member Social with dinner |

**Thursday, May 7**

| | |
|---|---|
| 8:30 - 12:00 | Spring Conference |
| 9:00 - 10:00 | CAA Weather Services for Industry Meeting |
| 12:00 1:00 | CIL Avalauncher Lunch Meeting |
| 1:00-5:00 | Spring Conference Continued |
| 5:30 - 6:30 | Explosive Committee Meeting |
| 6:00 - 9:00 | CAA/CAC BOD Dinner Meeting |
| 7:00 - 9:00 | CAC AST Meeting |

**Friday, May 8**

| | |
|---|---|
| 8:30 - 3:00 | Spring Conference |

# First Annual CAA and CAC Service Awards

Do you know someone who has made a difference to avalanche safety in Canada? We are looking for nominations for the first annual CAA and CAC Service Award, an opportunity to honour those individuals who deserve special recognition.

***The CAA Service Award***—for contributing to professional avalanche safety programs and services in Canada
***The CAC Service Award***—for contributing to public avalanche safety in Canada

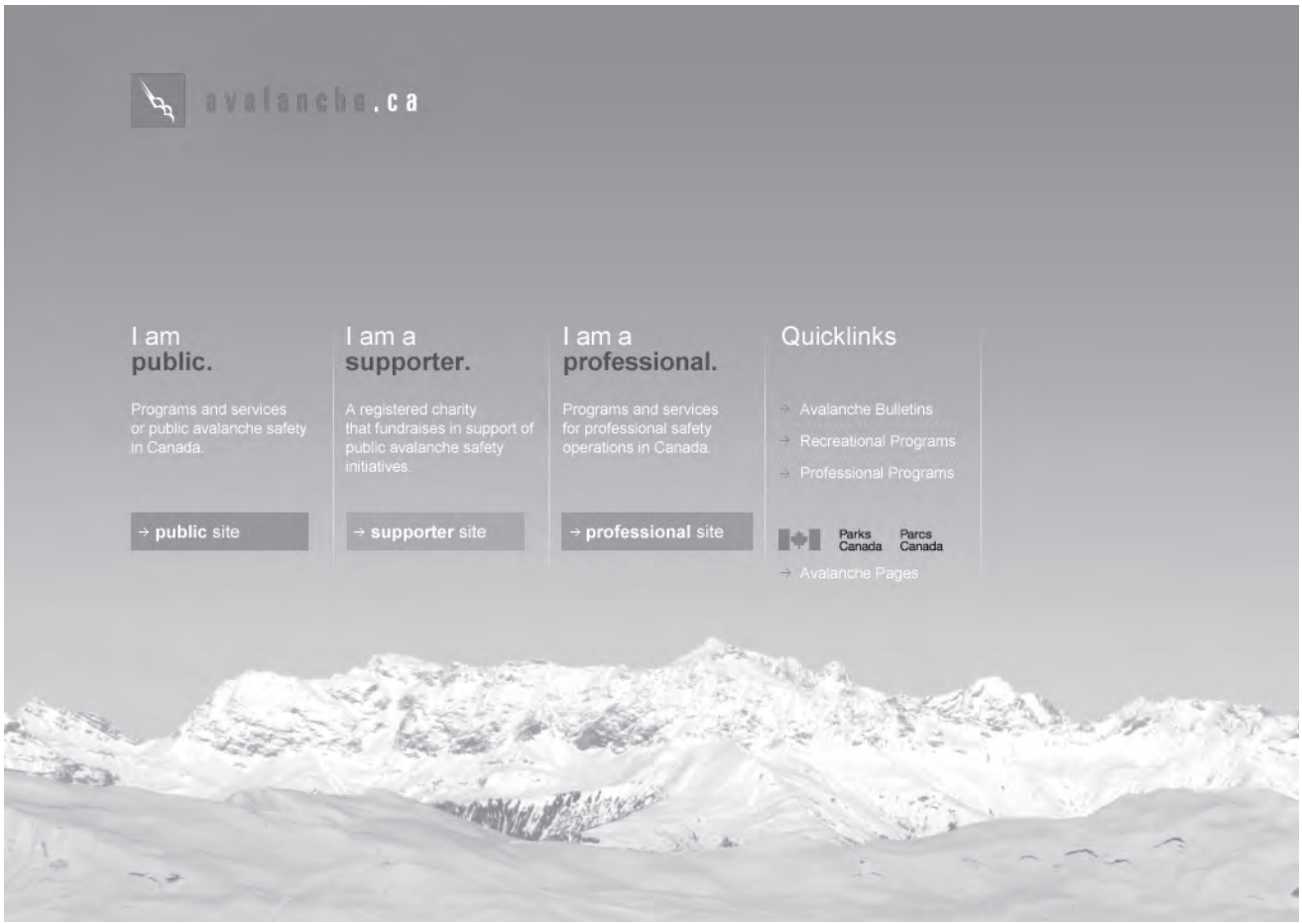
To nominate, please send an email to info@avalanche.ca, with a brief description of why the individual deserves either the CAA or CAC Service Award. The winners will be decided by the CAA and CAC Boards of Directors and the awards will presented at the AGM, during the tradeshow and social events on the evening of Wednesday, May 6.


Chris Moseley


Kyle Hale


Mary Clayton

# New Tracks




We hope you like the new look of our home page. Graphics Designer Kathryn Whiteside walked into our office earlier this winter and said, "I've just moved to Revelstoke, I like what you do and I'd like to offer my services if you need any graphic design help." It took us about a split second to take her up on it. She set to work right away designing a new, cleaner home page. We were so impressed we've offered her a contract and Kathryn is now steering the development of the new graphic elements of InfoEx that you'll be seeing soon.

Thanks to Elena Elder and Laure Perrier of Kootenay Bubble Refinery for their donation of a Rescue Bubble, their made-in-BC lightweight rescue sled. The Rescue Bubble will used in the Industry Training Program for rescue practices and as group gear for day trips. Thanks again!

Wren McElroy

# Virtual Rescues

By Kristin Anthony-Malone

For the last several years the CAA has been working with a multitude of stakeholders to bring the eTraining project to fruition. The hope is that the Mountain Operations and Avalanche Search and Rescue online training program will be ready for circulation by October of 2009. The creation of this program has been a complex process with numerous unanticipated hurdles. The majority of our challenges have, quite literally, come from speaking two different languages.

The computer programmers speak and function in "code" while the CAA speaks "avalanche" (both generally difficult for the average person to understand). Soon, the best practices established by the CAA will find a home within the electronic environment created by the programmers. We have only recently reached that exciting moment in time when we can begin to see our two worlds merge.

We are now able to see the simulation in action. The programming team has been able to integrate a GIS data system that simulates a true-to-life landscape. Along with this GIS technology, a physics engine has also been integrated. This means that while driving your snowmobile you are limited to slope angles that are physically possible. Another exciting feature of the simulation is that each time you begin the program the time of day and the weather are randomly generated. When you open the program it may be 4:00 in the afternoon and snowing and the next time you open the simulation it is 10 am and clear.

While we still have a long way to go till completion, the framework is taking shape. The time when the educational curriculum is integrated into the virtual landscape is coming soon to a computer near you.

>>Kristin Anthony-Malone is the eTraining Project Manager


In this scene from the Safety in Winter Mountain Operations module, the user is driving a snowmobile to a jobsite. Along the way, the user encounters a number of circumstances that will test their decision making skills.


This scenario, from the Best Practices for Avalanche Search and Rescue Operations module, begins with an announcement that an avalanche has happened. The user is faced with a wide array of decisions as the scenario progresses. The purpose is to execute a successful rescue but, just like in real life, there's more than one way to accomplish that goal.

# Active Avalanche Safety Plans

## Recommended Generic Table of Contents

The intent of this recommended generic table of contents is to facilitate the development of avalanche safety plans required under the recently approved WSBC regulation, and to encourage reasonable congruency within and between sectors. It is hoped that organizations such as Canada West Ski Areas Association, HeliCat Canada, Backcountry Lodges of BC, BC Commercial Snowmobile Operators Association and others will use this generic content to develop sector specific templates for their members to use when producing avalanche safety plans for their individual operations.

**Geographical description** (overview of location and climate)
**Operational goals, objectives, priorities**
**Supervision and reporting**
- Organization chart
- Role – responsibility statements for all reporting levels through to employer

**Staffing**
- Numbers, qualifications and/or certifications for each

**Training**
- Initial and recurrent training courses (essential, desirable)
- On-the-job training objectives

**Equipment, infrastructure requirements**
- Snow & weather
- Communications
- Avalanche control
- Explosives storage, transportation and use
- Signs, fences, barriers, etc.
- Vehicles, office & storage, information and data management
- Personal protective equipment

**Operational procedures**
- Pre-season tasks checklists
- Data collection (sources & mechanisms)
- Daily agenda
- Hazard – risk evaluation
- Risk mitigations (avalanche control methods, as appropriate for the operation)
- Communications
  - Event reporting, check-in procedures
  - Information sharing (InfoEx, etc)
  - Public information
- Documentation
- Post-season tasks checklists
- Others, as appropriate

**Emergency response procedures**
**Accident – incident investigation, reporting**
**Safety inspections, audits (quality assurance)**

**Appendices**
- Avalanche Atlas
  - Terrain zoning
  - Risk assessment(s) as per WSBC requirements
- Explosives storage, transportation and use – WSBC, NRCan approved procedures
- Staff training records
- Equipment, materials inventories
- Compendium of all relevant legal, regulatory, contractual, other references

John Weinel

# VOLUME 5 PHOTO CONTEST


**Do you have a great photo of an avalanche in action or an avalanche involvement? Enter the Volume 5 Photo Contest and you could win: Marmot Twilight two-person tent, Marmot Eiger 65 backpack, $500.00 and your photo on the cover of Avalanche Accidents in Canada Volume 5!**

## Each entry must include the date and location of the photograph and details of the incident. No fatal accidents please.

*Entry Deadline:* Entries must be received by July 31, 2009.

*Photo Formats:* High resolution digital (minimum 3 MB in size). No digitally altered images will be accepted. Images must be JPEG, TIFF or RAW format only; all other formats will not be accepted. Digital images may be received on CD, DVD and e-mail.

# In the Line of Fire

## An AST instructor discovers some striking similarities between staying alive in avalanche terrain and staying alive in Afghanistan.

By Wren McElroy

1 Combat Engineer Regiment—the privates, the sappers. These are the young men and women who fight in the Canadian Army. Most of this group has been to Afghanistan and some will go back on another tour of duty soon.

On a two-week training session in Trail BC, this Edmonton-based regiment took an AST 1 course in preparation for the Olympics. They won't be visible at Whistler Village or any high-profile events; they will more likely be patrolling the surrounding mountains ensuring no danger threatens the games. They know how to be close to danger. These young people are the ones we hear about on the evening news, when a report is read of yet another Canadian soldier killed.

As I write this, news comes again that the 108th Canadian soldier has been killed in Afghanistan, this one a 25-year old sapper, a Combat Engineer who hit a roadside bomb. During the evening classroom session, while I was explaining the waivers for the course, one of the soldiers said, "Ma'am, we've been to war." Right. These people know about risk.

What this group didn't know about was avalanches. Keyes Lessard, CAA Professional Member and Instructor with Selkirk Colleges Renewable Resources Program and I spent two days at Kootenay Pass with this group to help prepare them. What struck me and inspired me was how similar some of our collective experiences were. At first glance one wouldn't think so. How could you compare skiing powder in the Kootenays to combat conditions in Afghanistan at 60° Celsius? One has cold smoke to choke on. The other has fine silt-like dust invading the eyes and lungs. What we did have in common was exposure to risk.

I was very impressed with how well these soldiers assimilated the information presented. In the classroom we did an exercise to go over the steps of avalanche rescue. Splitting the soldiers into three groups we gave each group a small bag

These young soldiers are more than a little familiar with shovels and noted that snow pits are a heck of a lot easier to dig than trenches!

Wren McElroy

Probing avalanche debris, or probing for land mines. Which would you rather do?

Wren McElroy

with the steps for self rescue, companion rescue and organized rescue. Each step was cut out and their job was to put the steps in the correct order. With their experience in order and prioritizing it was an easy task

After signing out rescue gear on Saturday morning at Kootenay Pass, we headed across the highway to the Ministry of Transportation compound where MOT Avalanche Technician Robb Andersen and his CARDA dog Aquillo met us. A happy soldier volunteered to climb into a snow cave and be blocked in while he waited for Robb to give Aquillo the signal to start the search. Within minutes Aquillo was digging at the entrance of the cave ready for her reward—a game of tug-o-war.

The engineers described arriving in Afghanistan and, with no previous training or introductions, being assigned a dog team for sniffing out explosives. This group is very well adapted to learning on the fly, yet they appreciated the opportunity to see an avalanche dog at work and get an understanding of the needs of the dog handler. Robb answered all of their questions while Aquillo happily sniffed all of the green camo.

In the field, as we taught them how to do transceiver searches, they spoke of how they trust their equipment, and how they felt confident with the new skills. While we discussed and practiced spiral probing, they described "prodding" for land mines, which they do with a one-metre prod while they inch along on their belly. The same spiral technique is used when looking for hazards while searching a house, building or an area of land.

When it came to digging the snow profile they happily exclaimed, "Now this we are good at—digging!" They also commented on how much easier digging in the snow is than digging trenches. As we traveled higher on Cornice Ridge on the south side of Kootenay Pass, we stopped to discuss how they would handle travelling through the avalanche paths, cliffs, trees and gullies. One soldier described the use of "tactile exposure"—staying out of view of the enemy. He pointed out that he would travel just inside the trim line of the path to stay out of the line of fire. Once they began to appreciate the destructive force of an avalanche, they all agreed they would increase their safety margin and travel further into the mature timber.

On day two as we sat down for lunch I asked the question that had been on my mind while working with this group. Did they know any of the soldiers who had been killed in Afghanistan? A few of them did. As we talked of the trauma they had seen, it made me think of my own experience in avalanche rescues and of friends I had lost in the outdoors. The causes were very different but the impact of the trauma was the same. This was just one more crossover between our professions.

The ability of these soldiers to adapt to a new environment

Smiling soldiers with their civilian instructors Wren McElroy and Keyes Lessard.

Wren McElroy

and incorporate information was inspiring. The hardest thing for this group to deal with was the 30-or 40-year-old aluminum beavertail snowshoes, without teeth. The snowshoes would work fine in the prairies but they were certainly not designed for mountain travel. This fact we quickly discovered as we started to descend on a sun-crusted southerly aspect. The group appreciated traversing around to the north aspect and descending through the much softer crystalline surface hoar. The other option they had for travel were equally outdated cross-country skis they would strap in with their mukluks. It would be a lot easier for these soldiers to travel through the mountains with real ski equipment.

These combat engineers showed a high level of professionalism that made the course a pleasure to teach. When I spoke with their officer in charge, Lt. Mary Benjamin, after the course, she described the soldiers as being excited about their experience and bragging to their comrades that they knew what facets were. This group is hoping to get more training in preparation for the Olympics. Maybe we can get them through the newly developed SAR Level 1 program before February 2010.

Wren holds son River in her arms, while Conrad stands between her and Dad Chris Swetland.

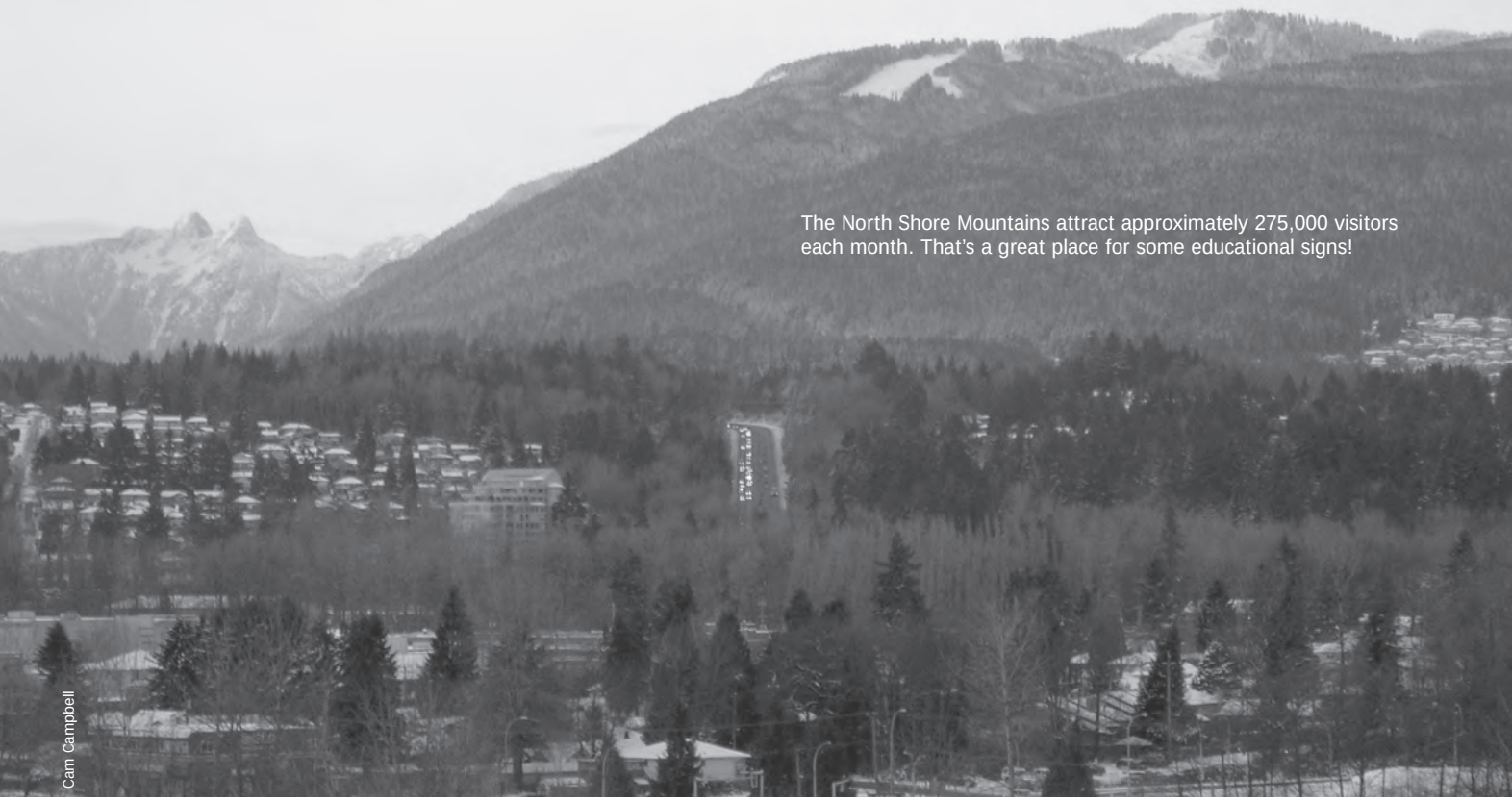
Sandy McElroy

Wren McElroy is a Professional Member of the CAA. Along with teaching avalanche courses, she works for the CAA on Industry Training Program Support and Curriculum Development. Currently Wren's eight-year-old son, Conrad wants to move to Revelstoke, get a ski pass and homeschool.

# Sign Language

## Trip Planning Signs for Provincial Parks on the North Shore, and beyond.

By Mark Grist



The North Shore Mountains attract approximately 275,000 visitors each month. That's a great place for some educational signs!

Cam Campbell

As a partner in the North Shore Avalanche Advisory, BC Parks is one land manager seeking to take advantage of the new sign templates developed by the CAC for avalanche safety in the backcountry (see "Signs of the Times" in Volume 85 pp. 40-41). These signs are an excellent fit with the public safety mandate of BC Parks and initial plans are to create five signs in two provincial parks (Cypress and Mount Seymour) in the North Shore Mountains near Vancouver.

These two parks see incredibly high use, with 175,000 visitors to Cypress and 100,000 visitors to Mount Seymour… each month! The ease of access (both are roughly a 30 minute drive from downtown Vancouver) coupled with proximity to a large population base (~2 million people in Metro Vancouver) means that huge numbers of people are accessing the mountains. Unfortunately, backcountry travel skill sets are typically quite undeveloped amongst all these park visitors. The North Shore Rescue team averages around 100 call-outs each year.

The trip planning signs are targeted towards beginner/novice users and the header ("You are heading into AVALANCHE terrain") is very effective in catching the attention of by-passers. Moreover, there is a large public appetite for avalanche information. When Rangers are out in the parks performing stability tests or field observations, the public really want to know about the latest conditions and ask lots of questions!

Of the three types of avalanche safety signs developed by the CAC, we chose the "Trip Planning" sign because it best fits our terrain. We have few large avalanche paths on the North Shore, which obviates the need for the "Identification of Avalanche Terrain" sign. The "Decision Support" sign is still in development.

The beauty of the trip planning sign is that it forces the reader to think about both the terrain they are considering and the current danger rating. It also reinforces CAC policy to focus on education and awareness. The onus is then put on the individuals to make their own (hopefully) good decisions when out in the backcountry.

Prominent display of the signs at five high-use trailheads also provides an opportunity to showcase the Avaluator trip planner graph. In particular, Mount Seymour is the location of several AST courses each weekend throughout the winter: These signs will be a useful tool for instructors to reinforce

course principles, and also give a superb overview of the local terrain.

Classification of terrain has already largely been done by CAC avalanche forecaster Cam Campbell, as he worked with local guidebook author John Baldwin to rate trips for the recently-launched third edition of his classic guide book, *Exploring the Coast Mountains on Skis*. We have been very fortunate to have Donna Delparte on board with this project with her expertise in avalanche terrain mapping, and Brent Strand has been instrumental in getting us up and running. We are also looking to include a waterproof slot for the current avalanche bulletin as an added feature to these signs.

Recently five BC Parks Rangers (three from Vancouver area and two from Garibaldi Park) went over terrain images and discussed areas throughout the Sea to Sky corridor—especially in the provincial parks of Garibaldi and Joffre Lakes—where these signs would be of particular benefit to the public. With signs projected to cost approximately $160 each, they will hopefully soon be coming to a provincial park trailhead near you!

>> Mark Grist is a Park Ranger with BC Parks in Vancouver Area.

Mark Grist works for BC Parks as a Ranger in the Vancouver Area and loves to explore the BC backcountry at every opportunity. Mark took his CAA Level 1 course this winter and says he looks forward to taking more ITP courses in the future.

Mark Grist collection

# Adventures in Kakwa Park

## Snowmobiling and teaching in the remote Northern Rockies

By Peter Marshall

Earlier this winter I was privileged to explore the Kakwa Provincial Park in the Rocky Mountains of Northern British Columbia. This was an opportunity for me to visit an area that I had very little knowledge of, but often wrote backcountry avalanche reports for. It was also a chance to be part of the snowmobile culture for one week.

At the start of the season I was given approval to plan a field trip with only one specific request—get into the Kakwa area and find out what's going on there. As I was researching my trip, Lori Zacaruk contacted me. Lori and her husband Randy own ZacsTrac's, an avalanche safety training company that focuses on sledders. Lori heard that I was trying to get into the Kakwa Park and was scheduled to teach an Avalanche Skills Training Course (AST) in Grande Prairie and Kakwa Park at the same time. Enrolment in this course was skyrocketing and she desperately needed another instructor. I think this arrangement worked out perfectly for both of us. Lori had additional help in teaching almost 120 students and I had support in arranging logistics for touring the park. It really couldn't have worked out any better for me.

The field portion of the AST course was planned to take place at the Kakwa cabin on the south side of Kakwa Lake. Getting into the Kakwa Park is an adventure of its own. We followed an industrial road southwest of Grande Prairie for approximately180 km. At the end of this road we came to a camp known as "Tin Town." There are around 80-100 permitted camps in this area, mostly consisting of converted school buses or trailers. We stayed in a deluxe trailer donated to us during the course, fully set up with a wood furnace, kitchen, television, surround-sound stereo and room for five people. We certainly weren't roughing it.

From Tin Town it was a drag-racing 45 km snowmobile trip to the Kakwa cabin. This was on a regularly groomed trail that crossed the Alberta/BC border approximately half way. Despite daily groomed this trail got pretty rough by the end of the day. I think I was more sore after my first couple days sledding than I would be after a typical day of ski touring.

I spent three days teaching AST courses and two days touring the park. Both were amazing experiences that I won't soon forget. The Kakwa area is absolutely stunning. I was fortunate to have beautiful weather for both days of exploration. It is not uncommon to put in more than 200km in a day in this area. We covered a vast amount of terrain, but probably only a small percentage of the riding areas.

Much of the terrain consists of valley bottom lakes and meadows quickly shooting up into massive peaks and bowls. The options are endless, but the allure of climbing huge slopes seemed to get the best of many riders. I watched sleds power up slopes that I thought would be impossible. Many of the sledders have extremely powerful machines capable of incredible things. Some of the "turbo'ed" sleds I saw had more than 300hp. Crazy! I would estimate the park sees more than 300 riders from the Alberta side on any given weekend. As we were teaching we watched snowmobiles zip by constantly in every direction.

Teaching AST to snowmobilers was eye opening for me. Many of the students had been directly affected by avalanche fatalities earlier this season. I think these accidents sparked an interest in avalanche safety in the entire community. Some of the students were keener than any I had previously taught, while others seemed to just be going through the motions, or just didn't entirely understand what we were talking about. In any case, it was great to see so many people interested in avalanche training and in enjoying the backcountry safely.

> **Skiers need to build up a certain amount of skill before they can even think about riding powder and venturing into the backcountry. A sledder just needs courage.**

Peter Marshall

This experience helped me to forget my somewhat typical prejudice of snowmobilers and understand more about their attitudes and habits. First, I have to say the people who hosted us and showed us around were a tremendous group of guys and I would be happy to ride with them in the backcountry any day. They were all about having a good time with good buddies, but doing it safely.

However, it's clear the avalanche safety message has yet to reach many in the snowmobile community. I spoke with several people who had just bought their $12,000 snowmobile in Edmonton the week before and were on their first ride in the mountains. That was amazing to me. Skiers need to build up a certain amount of skill before they can even think about riding powder and venturing into the backcountry. A sledder just needs courage. Only a few years ago riders needed to be very skilled to get their machines into the open mountains. New technology has changed that, and I was proof that you don't need to know what you are doing on a sled to ride in big terrain. For many, having all that horsepower underneath them also fuels an attitude of invincibility—

The flanks of Mt. St. George in the background are examples of some of the steeper terrain that gets ridden in Kakwa Park.

Peter Marshall

"If I get in an avalanche I'll just hold'er to the handlebars and I'll be fine."

I also observed the difference in the way snowmobiles move through the terrain compared with skiers. In some situations their exposure time is much less; at other times their only option is to shoot up the guts of an enormous bowl. Sleds can't easily tick tack through the trees and gain a ridge to follow the safe route. They might have to put the throttle down and go for it. I think this difference in travel makes sledders view terrain differently. As a skier I always analyze my safe spots and escape routes as I go, but on a sled I was more focused on holding the throttle down and hoping I didn't bog down and get stuck. I witnessed classic errors of three or four people rushing onto a big slope to help someone get unstuck, or a sled breaking down at the bottom of a sun-baked bowl and the rider spending half an hour working on fixing it in the heart of the runout zone.

We need to make people understand that part of the required safety equipment for sledding is training. Maybe a $300 avalanche course comes with the purchase of a new $12,000 mountain sled? There must be an effective way to increase enrolment in snowmobile avalanche courses without having multiple accidents affecting the community. I must add that after watching hundreds of sledders rip up slopes that made me cringe, my first thought was, "It's amazing more people haven't died." There are probably more than 2000 sledders in the Northern Rockies on a weekend day, and all of them make it home... most of the time.

>>Peter Marshall is a CAC Public Avalanche Forecaster.

# Knowledge North

## The CAC helps feed the growing demand for avalanche education in northern BC.

By Laura Bakermans

A desire for avalanche information is alive and well in the north, as demonstrated by the enthusiastic response to several recent events hosted in northern BC communities.

Inspired by the record turnout at the avalanche awareness evening hosted in Prince George earlier this season, the Bulkley Skeena Chapter of the Alpine Club of Canada and Bulkley Valley SAR hosted an Avalanche Awareness Night in Smithers on February 26.

It was standing room only in the Old Church, a restored church that serves as a popular community centre. Over 70 people showed up for the evening session of presentations and films. Local retailer Valhalla Pure was on hand with a booth of avalanche safety gear and Snowpulse rep Ken Bibby stopped in for an airbag demonstration and short Q&A session.

Smithers is my home and I was pleased to be able to take part by giving a presentation on behalf of the CAC. Although fellow presenters Sean Fraser (local ski guide) and Barry Finnegan (Bulkley Valley SAR) each approached their talks from a different background and perspective, the key messages of "take an avalanche course, choose terrain appropriate for the conditions, and carry the right gear and know how to use it" came through as strong common threads. A beacon session organized for the following Saturday was also well-attended, with more than twenty people coming out to hone their skills. Bulkley Valley SAR members did a great job setting up a rescue scenario for participants to tackle after reviewing and practicing basic beacon search strategies.

Thanks to funding contributed by Columbia Brewery, the CAC was also able to put on an evening Backcountry Avalanche Workshop session in Terrace on March 2. I joined forces with fellow CAC forecaster Ilya Storm and local BC Highways avalanche technician Scott Garvin to present to approximately 30 keen Terracites.

The typical Terrace backcountry traveller is quite avalanche savvy, and the evening's presentations were geared towards a more educated and experienced audience. Topics discussed included fracture initiation and propagation, snowpack tests, trip planning, what to do if caught in an avalanche, and risk. With input from the crowd, which included several local avalanche professionals, the evening wrapped up with an excellent discussion of the current snowpack and how to manage some of its challenges. Questions sparked interesting side discussion at several points during the presentation; this made for an evening slightly longer than planned, but nobody snuck out early and people stayed involved and interested right to the end.

Columbia Brewery's funding contribution has also allowed the CAC to work with local SAR to organize a Backcountry Avalanche Workshop in Fort St. James. This one-day event is scheduled for March 21 and will be targeted specifically to snowmobilers. In addition to presentations and videos, the afternoon will include some outdoor time at nearby Murray Ridge Ski Area to practice beacon searching, probing and shovelling. I'll be heading to Fort St. James to take part, and am looking forward to working with SAR members from Prince George and Fort St. James to make this event a success.

>>Laura Bakermans is a CAC Public Avalanche Forecaster.

Flux-line demonstration in the park.

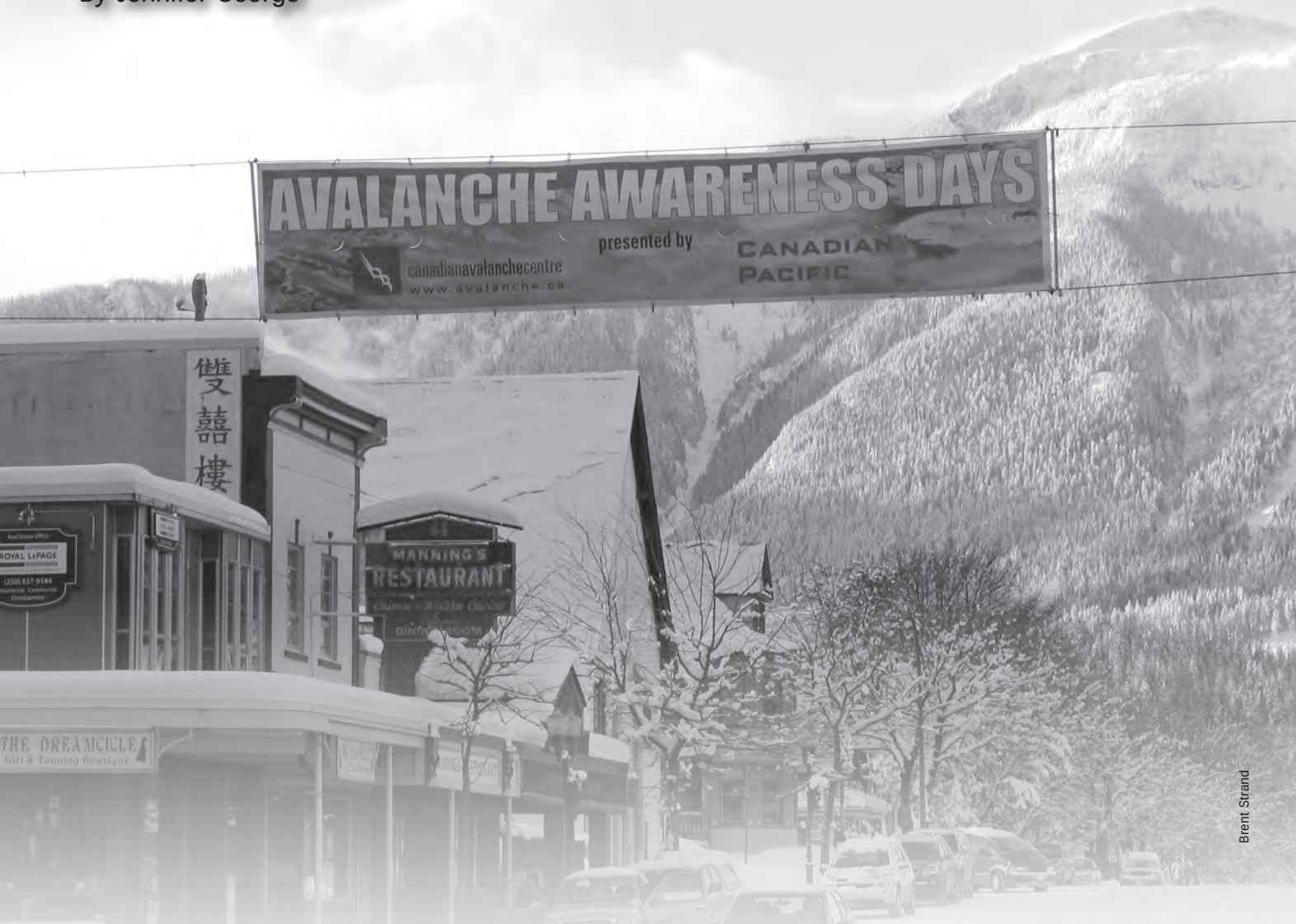
Ben Heemskerk

Full crowd at the Old Church for evening's presentations.

Laura Bakermans

# Avalanche Awareness Days National Event

By Jennifer George




Brent Strand

This year we held our National Avalanche Awareness Days Event in our own backyard on the weekend of January 9-11. Our theme was youth avalanche safety and we were ambitious with activities planned at two separate venues: at Revelstoke Mountain Resort (RMR) and on Boulder Mountain. With our dedicated staff, volunteer support from our membership and community organizations including staff at RMR, Parks Canada, Revelstoke Snowmobile Club, Snowmobile Revelstoke Society, Revelstoke Search and Rescue, Ministry of Tourism Culture and the Arts and AdventureSmart, we successfully engaged the public in a variety of field demonstrations and safety talks.

Special guests for the national event included producers of The Fine Line, Malcolm Sangster and Dave Mossop, and three young adults with a very compelling story of rescue in the Fernie backcountry. Todd Weselake, Janina Kuzma and Ian Bezubiak's story has been told in this journal (see Research and Results, vol 84, Spring, 2008 pg 56) but their close call and the message it sends about the value of avalanche education was well worth hearing again. We also had some local people presenting heartfelt and personal stories of being caught in an avalanche at our fundraising party on the evening of Saturday, January 10.

Public field events and demonstrations were held at RMR on both Saturday and Sunday, January 10 – 11. Activities included beacon basin, snow pit demos, and a great mock rescue demonstration with RMR Ski Patroller Al Roberts, and his CARDA dog, Sadie. AdventureSmart also participated with on-hill beacon races geared toward youth.

Events on Boulder Mountain were held on Saturday. With help from a host of volunteers from the local snowmobile club and community partners, we put on a poker rally with avalanche safety stations. This event was well attended and the snowmobile participants were very engaged in each demonstration including beacon training and self rescue shoveling methods.

To wrap up the weekend, we held a Fundraiser Party at the Revelstoke Legion Hall featuring presentations, movies, a huge live auction, prizes, beverages and food. It was our most successful Avalanche Awareness Days fundraiser with close to $9000 raised in donations and proceeds from the auction.

Due to the tragic accident in Sparwood in late December, and the rash of avalanche-related fatalities soon after, media interest in Avalanche Awareness Days was very high. Unfortunately (and ironically) the highways leading into Revelstoke before and during our event were closed due to an avalanche cycle. So, apart from two European ski magazine writers who were already on site, only local media could attend our events. While disappointing for the people who had put a lot of effort into the day, we had to be philosophical about it all.

We took some comfort from the fact that one of the larger community venues, Grouse Mountain, attracted much media attention that same weekend from CTV, Global News, CBC as well as numerous local newspaper outlets. Grouse Mountain also had many local political and ministerial leaders in attendance including John van Dongen, Solicitor General, Joan McIntyre, Minister of State for Intergovernmental Relations, and Ralph Sultan, West Vancouver MLA.

While planning our national event in Revelstoke, we made a big push to get as many communities signed on to host their own Avalanche Awareness Days with our support. This season we were very successful in achieving our goal to get newer venues signed up including snowmobile clubs and ski areas that had not participated in the past. Many venues had large turnouts due, in part, to the media attention to the numerous fatalities. Next year our national event will be held in Jasper, Alberta. Please join us if you're in the area!

Young skiers at Revelstoke Mountain Resort get a close look at the snowpack.

Verena Blasy

>>Jennifer George is in charge of Marketing and Special Events for the CAC.


Volunteers help out at a "what's in your pack" station as snowmobilers make their way up to Boulder mountain.

Greg Paltinger

Photo: Canadian Pacific Railway Archives

## Making tracks in the backcountry since 1884.

Since coming to Western Canada over 100 years ago, Canadian Pacific Railway has been a pioneer of backcountry exploration and safety. By finding the first route through Rogers Pass and opening the West. By building Mount Macdonald Tunnel, the longest railway tunnel in the western hemisphere, to avoid the avalanches and dangers of the Pass. By hiring Swiss guides to help ensure tourists stayed safe while mountaineering and exploring the backcountry. That tradition continues today through CPR's partnership with the Canadian Avalanche Association to make the backcountry a safer place for people to work and play.

To find out how you can support the Canadian Avalanche Association, please call **1-250-837-2435.**

**www.cpr.ca**

CANADIAN PACIFIC RAILWAY
Ingenuity.

# Avalanche Awareness Days Community Events

## Big White Ski Resort

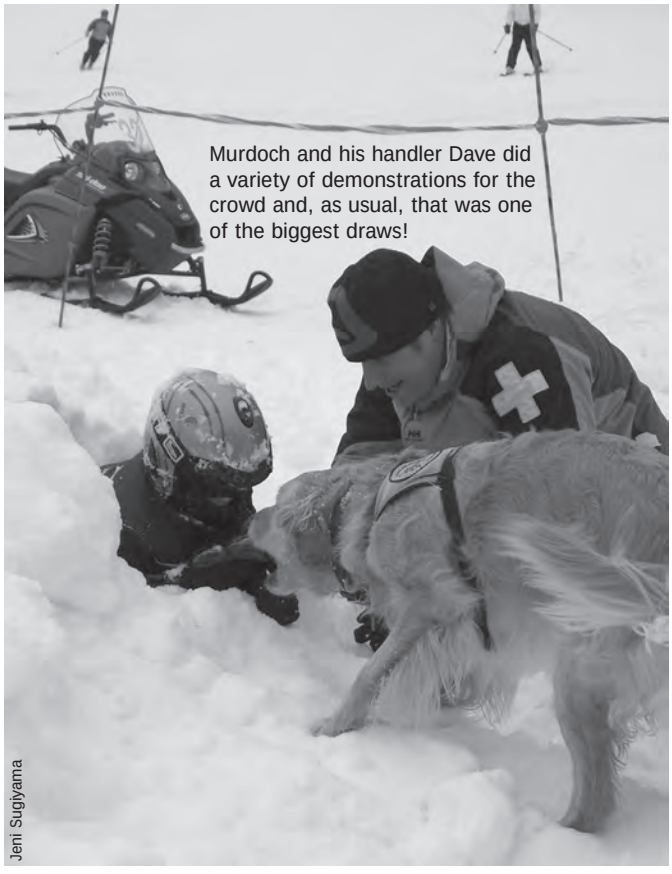
Submitted by Kris Hawryluik
Big White Ski Patrol Operations Manager

Thank you very much for all the great gear you organized. We gave it away by donation. Our biggest and best event was the Mountain Film Fest we hosted. I had some short lead in trailers and then featured The Fine Line. I had about 200 people attend and everyone loved the evening.

Our info table in our village center was also successful. We signed up about 60 people for up- coming AST programs. Lots of people came by and had a chat with me during the weekend, and I received lots of great questions and comment concerning mountain snowpack and the public bulletins. Overall it was informative and fun for everyone.

## Fernie Alpine Ski Resort

Submitted by Jeni Sugiyama
Events Coordinator, Fernie Alpine Ski Resort



Murdoch and his handler Dave did a variety of demonstrations for the crowd and, as usual, that was one of the biggest draws!

Jeni Sugiyama

The event ran super smoothly as usual and we had a great turnout. We had our transceiver search area at the base where we held contests. Participants were taught how to use a beacon and then had to find a buried one. We also performed a demonstration with our Recco device.

In the same area on Saturday, one of our CARDA dogs from last season, Murdoch, made a guest appearance (unfortunately all the resort's current dogs were in Whister on a training exercise). Murdoch and his handler Dave did a variety of demonstrations for the crowd and, as usual, that was one of the biggest draws! Meanwhile at the top of our Bear Chair our Pro Patrol did snow pit demonstrations.

At 3 pm on both days we held our "Avalanche Extravaganza" in the day lodge where we showed the avalanche education film "The Fine Line" and then had a member of patrol available after the movie to answer any questions. Saturday culminated with an action in our Griz Bar during après ski. Thanks to the generous donations from the CAC and a few local businesses we were able to raise $970. Overall it was a successful weekend. This year's event fell right after the tragic Sparwood accident so the community was definitely interested in snow safety, since avalanches had hit so close to home a few days earlier.

## Jasper, Alberta

Submitted by Darlene Skehill,
Parks Canada, Jasper National Park

Our Avalanche Awareness evening was very successful with a full house at the D'ed Dog Pub at the Astoria Hotel. Doors were locked 20 minutes after the advertised start time and we kept them busy. Columbia Breweries donated a keg of beer, so the first 100 people received a free pint of draft.

On each table was a placemat with a map of Jasper National park showing places and dates of avalanche fatalities. Also on each table were five multiple-choice trivia questions, set up so the people at each table had to work as a group to answer them. We were trying to stimulate conversation and get people to realize how much they may not know. If they were called for a door prize, they had to answer a question from quiz.

We had a great dinner provided by the Astoria, and "The Fine Line" was shown. The program began at 7:30. Wendy Hall has been our MC for the past three years and she has always grabbed the attention of the young adults. Speakers included Jeff Andrews from Marmot Basin pro patrol and CAC Avalanche Forecaster James Floyer. Our main speaker was

The D'ed Dog pub at Jasper's historic Astoria Hotel was packed with 180 people for Avalanche Awareness Evening. "We had to shut the doors due to max capacity," reports Parks Canada Public Safety Specialist Garth Lemke.

Katelyn Coholan

mountaineer and physics professor Raphael Slawinski, who focussed on decision making, risk taking and survival.

A Parks Canada Public Safety Specialist was available for questions and information at a gear table all evening and Cariboo Snow Cat Tours donated a day of Cat-skiing for two people for a draw prize. After all the serious information and advice, the evening ended on a light note with the "Pieps" playing a few songs.

## Hemlock

### Submitted by Steve Gunderson

CAA Active member, CAC Friend

Avalanche Awareness Days went well at Hemlock for the most part, though the weather didn't cooperate. The previous weekend we had lots of fresh snow and large crowds, but for AAD we had clouds and rain on Sunday. Saturday had enough people around to make the event really worth while but I'm afraid Sunday's rain killed it.

On Saturday, we a very enthusiastic response to what was being displayed. Very encouragingly I got a good response by the target age group of 18-26 year olds. I had numerous participants in transceiver searches, all enjoyed themselves. Draws for the books and Beacon Probe Shovel were greatly appreciated by the winners. Looking forward to a sunny event next year. Thanks for all your help!

## Prince George

### Submitted by John Huybers

Operations Manager, Prince George Forest District

We had a successful session in Prince George. Over 170 folks in attendance up at the University filled the room and 98% of them stayed from 7:00 to 10:00.

We had attendance from all outdoor user groups—snowshoers, snowmobilers, Backcountry skiers and local SAR personnel. The local Alpine Club of Canada and one major local sponsor put in prizes of $300 in addition to the CAC prizes. We had articles in both of our local papers, and two of the local radio stations had an interview plus ran notification of the event. Our local television station CKPG also aired an interview the evening before.

We showed the film "A Dozen More Turns" and had a discussion about it afterwards. Our speakers also talked about travelling in avalanche terrain and we split into groups to practice beacon, probe and shoveling. We also watched one of training films from "The Fine Line." Our committee felt the most useful prize were the smaller ones—avalanche awareness books and copies of the Avaluator. Next year we will need to have stronger involvement with the local snowmobiling community. This year that user group made up about 50% of the folks in attendance.

# Shames Mountain

Submitted by Travis Carter
Mt Remo Backcountry Society

All events seemed well attended. Two local professionals (Hatha Callis and Rod Gee) gave a Power Point presentation on terrain choices in the Shames Backcountry and decision making with the use of the Avaluator. Nearly 30 people attended that, then more a dozen folks went through the two lost beacon timed course and many others tried their hands for the first time on the single lost beacon area.

Nearly 20 people attended Scott Gavin's snow pack assessment forum, with many asking questions and getting a chance to get in the hole and try some things out for themselves. Most of them and many others then headed down the hill to see Kelsey the CARDA rescue dog and her handler/owner Shelly Hicks (who works as an avalanche tech with Ministry of Transport as well) do a demonstration of Kelsey's ability to sniff me out in a covered snow cave.

I believe nearly 40 plus people also came through the information tent as well. The Ministry of transport, in conjunction with Nechako North Coast (the contractor responsible for maintaining the access road to Shames and others) had the tent by the lodge with information on safe winter driving and avalanche awareness with respect to highways.

Scott Gavin's snow pack column and snow pit demonstration.

Travis Carter

All in all not bad for a day when few people had come out to the hill. I think many thought the wind would be an issue that day but the sun was shining, with little to no wind and great groomers. That about sums it up for another year, thanks for your support.

Amanda Christophers (standing), Dan Gaudreau (kneeling) and CARDA dog Aquillo perform a mock rescue at Whitewater Winter Resort.

Robyn Mitz

# Grass Roots

## Community involvement takes Avalanche Awareness Days to another level

By Nancy Geismar

The CAC has seen an inspiring increase of dedicated individuals, organizations and clubs offering avalanche awareness events this past season. Maybe it is due to the early season fatalities or more people heading out of bounds at the ski hills, but there is definitely a wave of energy in the outdoor community that has galvanized individuals to take the reins and organize an event in their community.

The Alpine Club of Canada (ACC) has been very beneficial to this grassroots support. Executive Director Lawrence White helped earlier in the season by passing our Backcountry Avalanche Workshop information on to all the sections. But what's really been effective for passing the word is the communication network between the ACC and community SAR groups.

In Prince George, John Huybers, chair of the ACC's section executive committee spearheaded that community's Avalanche Awareness Days events with an evening presentation titled "Don't Get Trapped," which included speakers, the film "The Fine Line" and a beacon contest. Over 170 people attended and all outdoor user groups (skiers, sledders, boarders, snowshoers) were represented.

John contacted other ACC section representatives up north resulting in Ben Heemskerk, section representative of the Bulkley Skeena Chapter contacting the CAC. The ACC of Bulkley Skeena worked together with the Bulkley Valley Search and Rescue and held two avalanche awareness events in Smithers (see Laura Bakerman's article on page 33). One was an evening presentation with over 70 people for a standing room only presentation. Two days later the Bulkley Valley SAR organized a beacon session for more than 20 people.

Avalanche awareness was heightened after the tragic death of eight snowmobilers in Sparwood. This incident galvanized Henry Nagtegaal of the Mid-Island Sno-Blazers Association to organize a weekend event in Nanaimo, BC for snowmobilers. Henry's event included an evening session and an AST 1 course run over the next two days delivered by a CAC AST provider.

Fort St. James Search and Rescue is organizing an avalanche awareness event which has turned into a Backcountry Avalanche Workshop thanks to funding from Columbia Brewery. Alex Michaels of the Fort St. James SAR is working with Prince George SAR to deliver a full-day workshop geared towards snowmobilers. The morning will be spent in the classroom with presentations from the CAC and Search and Rescue and the afternoon will be spent in the field. This is another example of groups approaching the CAC, of their own volition, to assist with avalanche awareness and education.

And then there are individuals with a good idea and lots of motivation who generate avalanche education. In the Kootenays, David Bryan organized a one-day avalanche awareness course in Rock Creek. His goal was to reach out to snowmobilers. He didn't have as many participants as he had hoped but the CAC wants to recognize people who are working towards increasing avalanche awareness in the public.

Another is Katie Burles, a geography student at University of Lethbridge who organized an evening event on campus. Fifty-five people attended for a viewing of "The Fine Line" and other presentations. As we heard from all the organizers, people stayed late asking questions and interacting with the presenters.

What does this tell us? The public is thirsty for more information. We are fortunate to have dedicated organizers and grass roots volunteers to help spread the word about avalanche awareness. Word of mouth communication has increased the CAC's presence in communities throughout Canada. We want to be able to assist with any avalanche awareness event, both big and small. Keep spreading the word!

>>Nancy Geismar is the Program Services manager for the CAC.

A snowmobiler practices beacon skills during an AST Level 1 course in the Owlhead region near Sicamous, BC.

Brent Strand

# Sledder Promo Sticker

In an effort to communicate some basic avalanche awareness messages to snowmobilers, the CAC designed and produced this static sticker meant to adhere to the inside windshields of vehicles. We consulted with the major snowmobiling clubs of BC and Alberta, and all four sled manufacturers (Yamaha, Bombardier Recreational Products, Arctic Cat and Polaris) provided funding and input into the design. The manufacturers have agreed to distribute the stickers to their dealers selling mountain sleds, where they will be attached to all new mountain sleds sold in BC and Alberta. We are very encouraged by the sledding community's participation and enthusiasm for this project and the four manufacturers have committed to more collaboration in the future.



Lyle Grisedale

# Local Street Banner

We are lucky to have some very creative people at our office. CAC Program Services manager Nancy Geismar is also an accomplished artist and she created this beautiful street banner for us. Street banners are an annual event here in Revelstoke, and every summer our main throughways are decorated with colourful and imaginative portrayals of our mountain community. The CAC is proud to support this initiative with the local Arts Council and we're secretly convinced that our banner is the best one.

# Whistler Gala

## Fundraising evening raises $23,000

By Sharon Audley

For the second consecutive year, the Canadian Avalanche Foundation enjoyed another evening of fine dining and auction bidding at the Roundhouse Lodge on Whistler Mountain. Despite the difficult economic times 150 guests attended to enjoy a delicious dinner, bid on a diverse silent auction and be entertained by Hector Mackenzie's presentation entitled "Northern Avalanches and Polar Adventures." More than $23,000 was raised, which will go towards supporting public avalanche safety initiatives, education and research projects. A further $850 was raised for CARDA from the sale of draw tickets.

Mother Nature provided a spectacular setting with a beautiful sunset and night sky. The Whistler Blackcomb Roundhouse Lodge staff transformed the room from a ski area day lodge/cafeteria to an elegant gala setting all within the time it takes most of us to get one last run in on the slopes and head home for a shower and change of clothes.

This season the Whistler community was tragically touched by two separate avalanche fatalities. The local community as well as businesses and individuals throughout BC and Alberta, and as far away as Austria, came forward with auction items despite the world recessionary fears.

Chef Eric Smith once again impressed all in attendance with a wonderful meal. We enjoyed wild BC spring salmon while being led on many an adventure with Hector MacKenzie. Hector's accompanying slide presentation made us dream of northern trips.

CAF Director Margaret Trudeau gave a powerful talk and held us spellbound. She impressed everyone in the room with the fact that while there have been advances in education and information we still have a long way to go.

Many of us never have an opportunity to enjoy an elegant evening on a mountain top. February 20, 2009 was a magical evening. Next year at this time Canada will be hosting the world in Whistler Valley for the Olympic Games. See you again in 2011!

>>Sharon Audley is the CAF Whistler Organizer

Supporters crowded into Whistler's Roundhouse Lodge for the CAF's second annual fundraising gala.

Sharon Audley

The Canadian Avalanche Foundation would like to send a special thank you to the following individuals and organizations that helped with the Whistler Gala

Sharon Audley, Whistler Blackcomb, Whistler Marriott, Vincor Wines, Albion Fisheries, Sportsinsurance.com, Hector Mackenzie, Jack Bennetto, Alix Nicol, David Thompson, Marsha Bennetto, Ben Thompson, Darlene Gaunt, Harry Smith, Whistler Secondary Recreation Outdoor Leadership Class, Mitch Sulkers, Emily Macalister, Marie Thellen, Kathleen Mercer, Rankin Mercer and all the volunteers and donors who make this event possible.

The evening's keynote speaker was avalanche specialist and expedition guide Hector Mackenzie, who entertained all with his stories from northern Canada.


Sharon Audley

# Fundraising Donators

Albion Fisheries
Alex Geary
Angela Morgan
Anne Hale
Arc'teryx
Armchair Books
Arnie Arnason
Art Junction
Association of Canadian Mountain Guides
BC Lions Football Club
Blackcomb Helicopters
Brad White
Callaghan Country Wilderness Adventures
Canada West Mountain School
Canadian Mountain Holidays
Canadian Snowmobile Adventures
Charlie & Louise Locke
Chatter Creek Mountain Lodges
Coast Mountain Guides
Cori Ross
Craig McGee
Cross Country Connection
Dave Sarkany
David McColm
Delta Whistler Village Suites
Echo Memoirs
Etienne Courchesne
Elizabeth Wiltzen
Escape Route
Gonzales Accounting Service
Grouse Mountain Resorts
Harbour Air Seaplanes
Hector MacKenzie
Husky Energy
Icebreaker
Intrawest
Jack Bennetto
Jason Roe - Atomic
Joan Baron
Lauralee Bowie Ski Adventures
Lions Bay Art Gallery
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Marsha Bennetto
McCoo's
Option Snowboards
Ortovox Canada
Outdoor Adventures Whistler
Pasta Lupino
Paul Morrison
Penny Eder Martyn
Phill Nicoll
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Powder Mountain Cat Skiing
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Purdy's Chocolates
Question Newspaper
RECCO Systems Ltd.
Rimrock Café
Roger's Chocolates
Sasha Gier
Sharon Audley
Ski Canada Magazine
Skitch
Solarice Wellness Spas
Spitz Grill Whistler
SportsInsurance.com
Squamish Lil'wat Cultural Centre
Sunny Raven Gallery
Sunpeaks Resort
Tatianna O'Donnell
The Brewhouse
TLH Heliskiing
Top Table Restaurant Group
Trattoria Di Umberto
Vanessa Stark
Vincor
Wesley Clark
Whistler Alpine Guides Bureau
Whistler Blackcomb
Whistler Community Life
Whistler Fire & Rescue Service
Whistler Golf Club
Whistler Heli Skiing
Whistler Real Estate Company

Sharon Audley

# Sweet Fundraising

An imaginative and delicious approach to avalanche fund raising has been established in the Gaspé region of Quebec. This past summer, Executive Chef Yvano Tremblay created "l'Avalanche," a dessert made of ginger sponge cake covered with white chocolate and maple mousse. This calorie-fest was added to the dessert menu of the Gîte du Mont-Albert, a four-star hotel located in the heart of the Parc National de la Gaspésie. For every l'Avalanche sold over the summer and through October, the hotel donated $1 to avalanche safety.

David Dubreuil is the Manager of the Gîte du Mont-Albert, and he committed to this fund-raising effort during Quebec's 2008 Avalanche Awareness Days. This past February, Mr. Dubreuil presented a cheque for $2405.00 to Dominic Boucher, Operations Manager of the Gaspe Avalanche Centre and representative of the Canadian Avalanche Foundation in Quebec. Plans are already underway to use to money to produce a French version of "The Fine Line."


Dominic Boucher, Operations Manager of the Centre d'avalanche du Haute-Gaspésie, receives a cheque for $2405.00 from David Dubreuil, Director of the Gîte du Mont-Albert. Between them stands Executive Chef Yvano Tremblay, who created the special avalanche dessert.

Natacha Huet

# Schedule of Coming Events

## April 19 – 24, 2009
### European Geosciences Union, General Assembly
There will be two sessions on snow avalanches—Snow Cover Processes and Avalanche Formation; and Avalanche Dynamics and Risk Assessment.
Where: Vienna, Austria
Info: meetings.copernicus.org/egu2009
Contact: Dave McClung at mcclung@geog.ubc.ca or Juerg Schweizer at schweizer@slf.ch

## April 20 – 23, 2009
### Western Snow Conference
An annual tradition since 1932, this international forum is for individuals and organizations to share scientific, management and socio-political information on snow and runoff. The principal aim is to advance snow and hydrological sciences. The theme this year is "What's Normal? Snow—Past, Present and Future."
Where: Canmore, AB
Info: www.westernsnowconference.org
Contact: Bruce McGurk, General Chair, bmcgurk@sfwater.org

## May 3, 2009
### HeliCat Canada Annual General Meeting
Where: The Delta Grand Okanagan Resort, Kelowna BC
Info: Phone 250.542.9020 or e-mail info@helicatcanada.com

## May 4 – 8, 2009
### Canada West Ski Areas Association 41st Spring Conference
Where: The Delta Grand Okanagan Resort, Kelowna BC
Info: Phone 250.542.9020 or e-mail office@cwsaa.org

## May 4 – 8, 2009
### CAA & CAC Annual General Meetings
See page 18 for conference schedule. See you there!
Where: The Ramada Inn & Suites, Penticton, BC
Contact: Call Ian Tomm at (250) 837-2435 or e-mail itomm@avalanche.ca

## Sept 27 – Oct 2, 2009
### International Snow Science Workshop 2009
For the first time, the ISSW will be held in Europe. The deadline for abstract submissions is April 24, 2009.
Where: Davos, Switzerland
Info: www.issw.ch

## October 14 – 16, 2009
### Wilderness Risk Manager's Conference
This annual conference focuses on risk management and practical skills for the wilderness adventure and education industry.
Where: Durham, North Carolina
Info: www.nols.edu/srmc

Ray Mason

# Search at Mt. Mara

By Michael Shynkaryk and Andrew Duncan

Rescue in action. Close to 75 people were on scene, not all of them equipped with transceivers. Note the three separate probe lines.

Trevor Watt

Andrew and I had made plans to go snowmobiling on January 11, 2009. Due to high avalanche hazard, we chose Owlhead (or Mt.Mara) in the Monashee Mountains near Sicamous, BC because it was an area we knew well. Our objectives were to find "Stash" cabin, dig a snow pit to study the reactivity in the snowpack, and travel safely in simple to challenging terrain.

The conditions on this day were clear skies, moderate winds, and a rising temperature from -15˚C to -6˚C. There was 10 cm of new snow with wind loading in alpine features. The backcountry advisory's main concern was depth hoar and a slab above of up to two metres of recent storm snow. These were the conditions that were responsible for a size three avalanche that would claim a life.

The following is the accident time line, avalanche facts, some interesting points and lessons learned during this intense day. We hope to highlight a few decisions we found challenging and how we relied on our CAA and Canadian Ski Guide Association (CSGA) training to make these decisions.

By noon on the day of the event, we had successfully found Stash cabin and noted a few recent (within 48 hours) avalanches on southeastern faces. While breaking for lunch, we saw a noticeably recent avalanche about three km away. We rushed toward the avalanche because we knew there were many snowmobilers in the area and wanted to ensure no one was injured.

We arrived on scene approximately 5-10 minutes later to find a sporadic search being performed for one buried person without a transceiver. It was clear, by the scene unfolding in front of us, that our knowledge was critical to making informed leadership decisions for this avalanche rescue. Being friends and knowing each other's strengths, Andrew took the role of Field Coordinator and I took on Site Coordinator. It was at this time that I activated my 'SPOT' (Satellite Personal Tracker) device.

Prior to the avalanche, there were three snowmobilers high marking on an east-facing ridge of an alpine bowl. One snowmobiler was digging out his sled when the avalanche hit at around 12:15 pm, releasing from the high-marked slope above. He was swept away by the avalanche and buried. The crown line was 1- 2 metres deep; the deposit was about 200 m by 300 m with an average depth of over two metres. His friends started probing areas using the last seen point and on-snow clues like his backpack. Andrew and I arrived on scene at 12:40.

My strengths in organization and management played an integral role as site coordinator. Through my avalanche training and education I was able to bring guidance and support to the team. As site coordinator, it was my job to take a step back and make sure the search runs efficiently as possible. I mitigated risks, gathered information from the victim's friends and ultimately ensured group safety during the search.

Andrew's leadership qualities, pre-season guide training and experience with avalanche scenarios provided him with the skills needed as field coordinator. His job was to oversee the search teams and ensure that probable areas were being searched in an organized manner. There were many times that he would have to call the step-by-step motions of a probe line, or run over to a possible probe strike and teach searchers the differences between rock, wood and ground strikes. He also formed the vital communication link between the searchers and me.

Even though we were both exercising our best judgment on how to perform a successful search, we took the time to listen, teach and understand each member of the search party's concern. For example, after some time had passed, the probe line members were becoming frustrated with the amount of time taken and lack of a successful strike. They spoke up and suggested new and random areas to search. Our reaction was to confirm that we would move there as soon as possible, but we also needed to eliminate the high probable areas such as terrain traps. By doing this, we would be able to complete the search and not have missed any one area. The decisions made during the search were based on education, not hunches.

One of the bigger decisions of the search was assessing the terrain for the possibility of another avalanche. Andrew and I determined the risk of another avalanche was minimal because the majority of snow had released, and the remaining slopes face south and west and were well supported. The main concern was the hang fire above the crown, but we determined if this snow did come down, it would break into small enough pieces that it would not bury anyone.

To further increase the safety of the group we decided to only allow searchers with beacons to participate in the probe lines. The searchers accepted this decision readily because of the Sparwood incident a few weeks earlier, where seven of the eight victims were buried with their transceivers on receive. In Mt. Mara's search, approximately15 people were without transceivers, and they were used to build a shelter and helicopter-landing area, as spotters, and two were sent to the trailhead to find and communicate information to RCMP.

The search lasted for approximately four hours and 57 searchers were involved when Shuswap Search and Rescue arrived. The victim was found two metres deep and efforts to revive him where unsuccessful. Everyone in the search did a great job. People involved in the search showed great perseverance and heart. In the Morning Star, Vernon's newspaper, Shuswap Search and Rescue manger Don Reed said, "The snowmobilers on the scene did a very good job during an emotional and trying situation…"

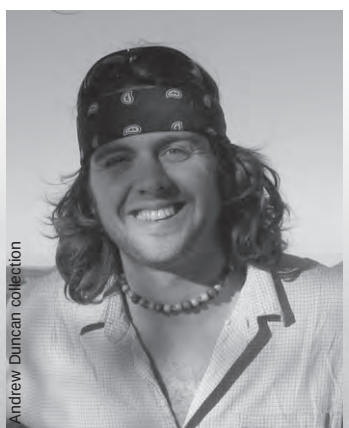
The CAA and CSGA courses we have each taken prepared us for this accident response, as well as the analysis that comes after a traumatic event such as this. I say this because I was involved in an avalanche search when I was 18. That situation was more difficult to deal with and the role I took on was minimal. After that event I chose to educate myself on safe backcountry travel and this helped immensely to deal with this avalanche accident at Mt. Mara.

Additionally, I'd like to point how useful the Avaluator is to the recreational backcountry user. On this particular day, six of the seven Obvious Clues questions were answered by a "Yes." Not surprisingly, the terrain chosen by the victim was not recommended by the Avaluator.

This was a very tragic event and our deepest condolences go out to the friends and family of the victim. We hope you find peace. For me some redemption has been found in the reaction of local Okanagan snowmobilers. Immediately after the event, local backcountry gear stores were sold out of avalanche gear and a few of the searchers enrolled in formal avalanche training. Hopefully with the proper equipment and training, incidents like these will become less frequent.

Michael Shynkaryk collection

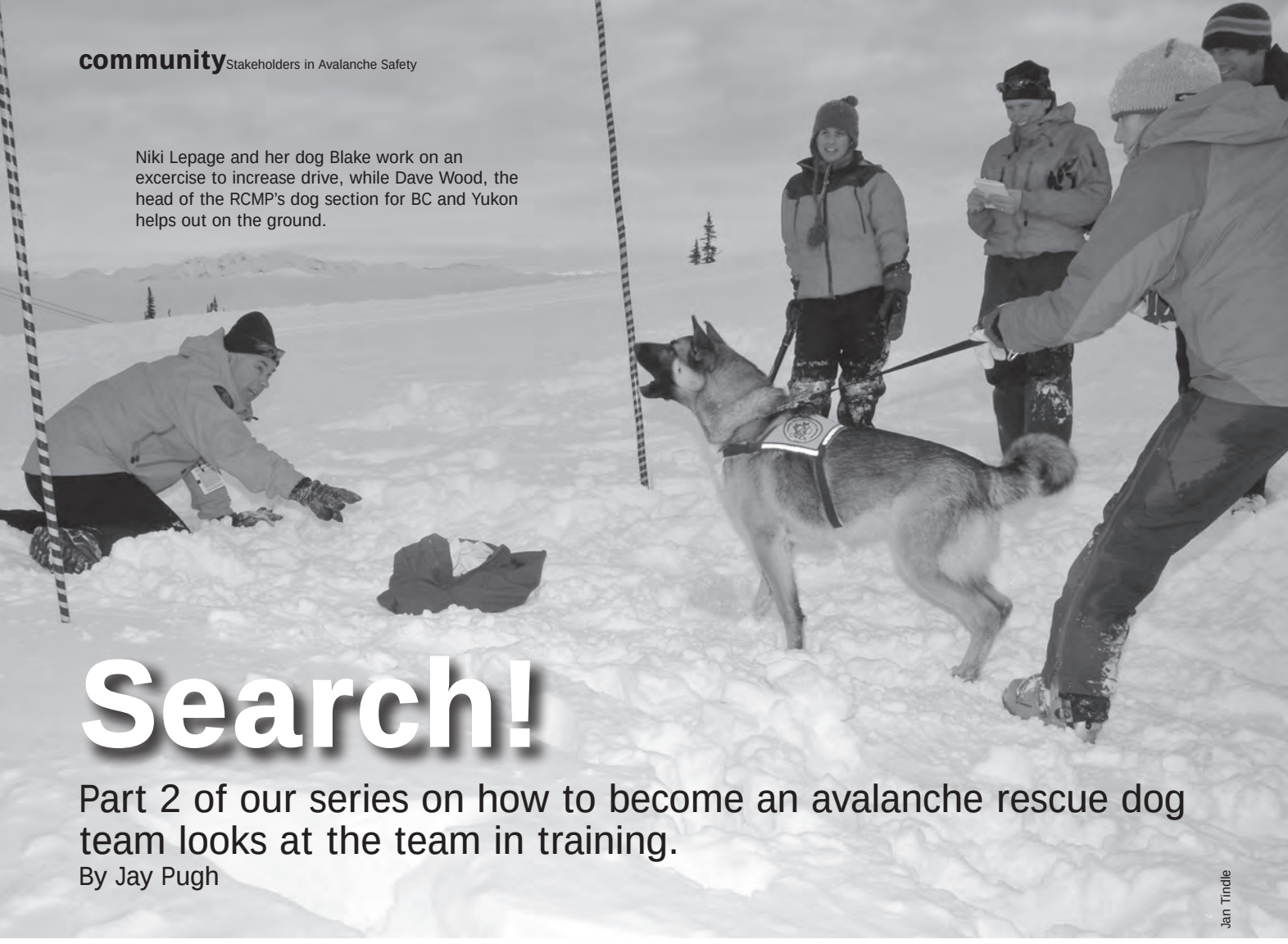
Michael Shynkaryk is a prairie boy who has found his paradise in the mountains of BC and plans to become an ACMG Guide. In addition to a Bachelor of Commerce Degree from the University of Alberta, he has taken a CAA Level 1, CSGA Level 1, and is a Level 3 instructor with the Canadian Ski Instructors Alliance. He currently works as a ski patroller at Silver Star Mountain and lives in the Okanagan.



Andrew Duncan collection

Andrew Duncan grew up skiing the interior of BC. His love of the mountains and the sport has taken him from big mountain ski competitions to beautiful isolated ski tours. He is working toward his ACMG assistant ski guides certification and Bachelors of Earth and Environmental Sciences through Okanagan College. Andrew has his CAA Level I and CSGA Level 1, and is currently working at ski patrol at Silver Star Mountain.

Michael Shynkaryk



Niki Lepage and her dog Blake work on an excercise to increase drive, while Dave Wood, the head of the RCMP's dog section for BC and Yukon helps out on the ground.

Jan Tindle

# Search!

## Part 2 of our series on how to become an avalanche rescue dog team looks at the team in training.

By Jay Pugh

In the process of training an Avalanche Search Dog there is no stage as crucial or unique as the first year. Those who passed the spring evaluation (described in Part 1 of the series) are joined by experienced handlers who are starting new dogs to form the "Beginner Group." The goal of this group is to nurture and promote the young dogs' hunting drive to find live human scent and associate that instinct with a positive reward. This is done at the CARDA Winter Course, which was held this year in Whistler, BC.

The week-long course at Whistler included the advanced and intermediate groups for a total of 27 dog teams. Although the other groups are undergoing intense training and are under somewhat more stress as they are being tested, no group works harder than the beginner group.

These handlers are subjected to long intense days. On top of the dog handling they have to attend lectures as well as the general meetings. They perform multiple searches throughout the week, both for their own dogs and the others. They learn the fundamentals of obedience and how to travel in the winter environment with their dogs.

The imprinting process is virtually identical to the testing process of the spring course but the goal now is to train the dog to use its hunting drive, rather just test it. The concept of finding someone under snow is also introduced.

The beginners spend most of the first morning hollowing out piles of snow to make a snow cave large enough for two people, which we call quinzees. These are used for most of the week for people (quarries) to hide in. The dogs progress from finding their owners, to finding strangers, and eventually, if all goes well, to finding packs. These tasks are gradually made more difficult by increasing the time between when the quarry runs away and when the dog is released. Eventually, the dog is brought into the search without ever seeing the quarry.

The walls of the entrance to the quinzees play a key role in the training because they teach the dogs to dig, to indicate that they've found the human. The walls are increased in thickness as the week continues, which teaches the dogs to pursue. As the dogs learn, they are given multiple quarries, increasing the time they have to work. Being intelligent, the dogs eventually figure out that the humans must be in one of these piles of snow, so another change is using shallow grave burials instead of the quinzees. As always, the reward the dogs get is an enthusiastic and very reinforcing reaction from their handlers.

The handlers are also learning, as they get to know more about their dogs. They are taught to watch for the body language as the dogs find the scent cones, and to know the difference between when their dog is interested and when they are indicating. Handlers must learn the best way to reward

their dog and how to communicate that to the quarries. They learn how the way they move affects how their dog moves. Every handler learns from watching the other teams as well. The group is encouraged to give each other feedback and to take feedback with professionalism.

All this is backed up by the afternoon lectures. These are presented by the instructors and cover training issues such as scent characteristics and guide the students through different methods. Later on in the week the handlers are shown what will be expected of them by the following year when they are up for validation. Demonstrations and exercises in obedience and the testing process are given. On the last day they are given the opportunity to load their dogs onto lifting harnesses, skidoos and are given a short flight on a helicopter. If all goes well in the week the teams are designated a "Team in Training" and given the green light to continue in the program.

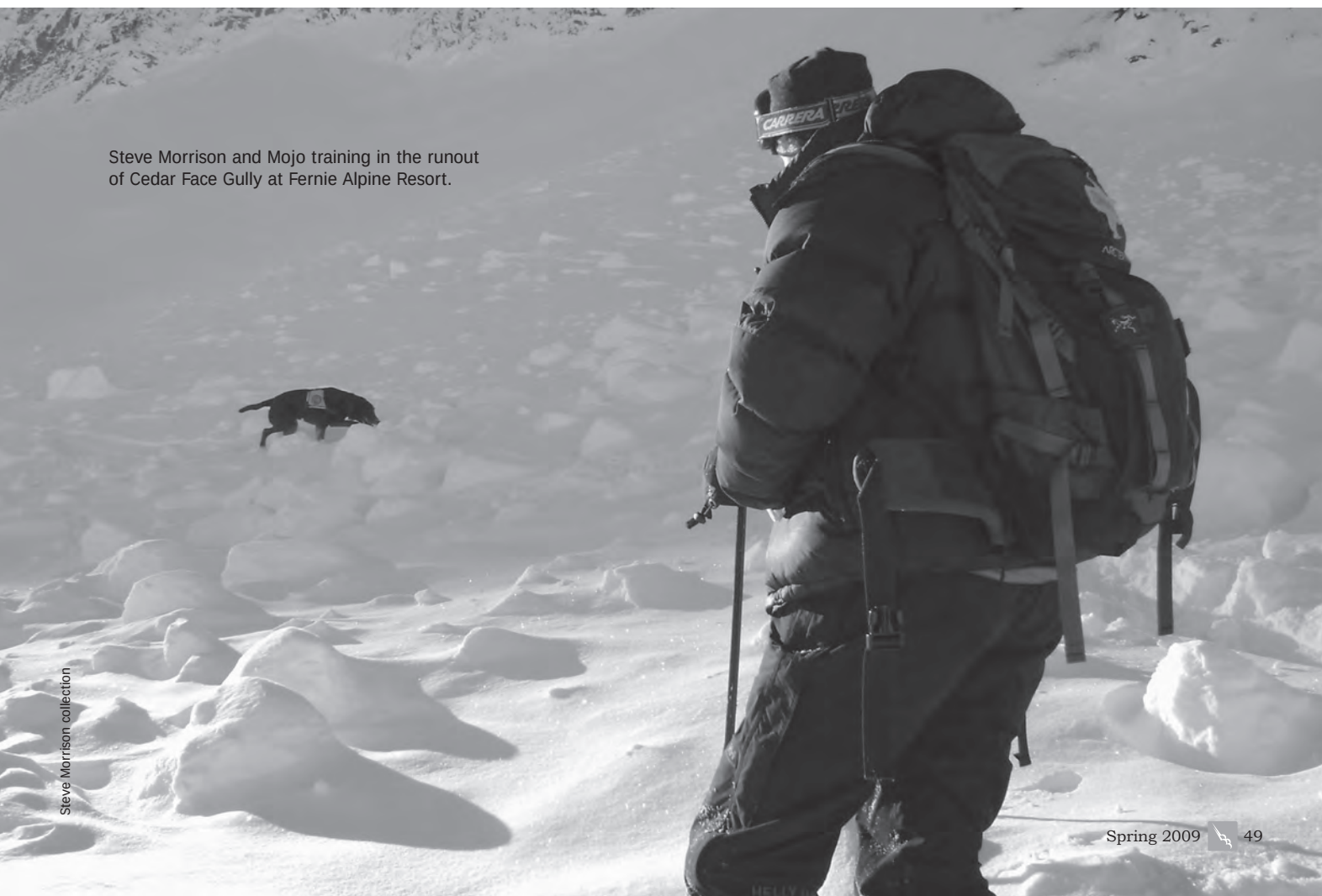
The last day also includes a meeting between the instructors and the handlers. Here we critique the course and come up with as much of a plan as possible for bringing the team up to validation standard by the next year.

As an instructor, the most fulfilling thing I witness with this group is the development of two bonds. One is between the individual handler and their dog and the other is between the new handlers. As the dog spends the week with the handler, performing exercise after exercise and being constantly rewarded, the bond that already exists is strengthened immeasurably. Trust—a key factor in the success of the team—is developed both ways. The dog realizes that nothing makes the Alpha (handler) happier then when the quarry is found, and this act is the means of getting the ultimate reward from the Alpha.

The handler, on the other hand, sees the dog consistently locate the quarry despite the increasing difficulty. They see the pure joy of their dogs doing what they were born to do and how well they do it. It is a goal of the instructors that every handler becomes convinced that they personally have the best dog.

This being said, it is also a basic concept that every handler in the beginner group holds themselves responsible for the success of every team in their group. They provide the best possible quarrying for each other's dogs. They give positive feedback and help each other through the glitches. In short, they are completely supportive of each other.

The bond created from this dynamic lasts throughout their careers. Personally some of my closest friends are those who were part of my first puppy group over fifteen years ago. From the first year on, these bonds will see each other over the ups and downs of validations, injuries or losses of the dogs and of actual responses. Many of the handlers keep in touch and try to train together whenever and wherever possible. They also help each other prepare for next year's validation—the topic of the next installment of the series.




Steve Morrison and Mojo training in the runout of Cedar Face Gully at Fernie Alpine Resort.

Steve Morrison collection

## Terms used by CARDA

**Quarry** • A person who is hiding for the dog. They must be outgoing and have the ability to get any dog ten out of ten on the excitement scale. Quarries are either members of the group or volunteers. This is an excellent way for discovering if one wants to be in the program. Volunteer quarries are treated like gold and never have to buy their own refreshments.

**Quinzees** • Large piles of snow hollowed out to provide a safe and relatively comfortable place for a quarry to hide. A group will typically use six to eight of these.

**Shallow Graves** • A simple trench where the quarry hides covered with a thin layer of snow. This gets the dog away from the quinzees and opens up the entire area for potential hides. They are not as comfortable as they sound.

**Scent Cone** • A description of how human scent looks to the dog. Narrow at the point of origin, scent tends to widen out in a downwind direction. Ideally the handler moves the dog into this cone allowing it to follow the scent back to the origin.

**CARDA Winter Course** • Held every year in January either in Golden, Fernie or Whistler, the Winter Course provides the format for training new teams, validations and fulfilling the requirement that all validated CARDA teams take a course every two years.

**Beginner Group** • Also known as the Puppy group, these are the first-year handlers plus experienced handlers who are bringing on a new dog.

**Intermediate Group** • Mostly composed of second-year handlers who are preparing for validation. They get an attempt based on the instructor's evaluation of their readiness.

**Advanced Group** • Teams fulfilling the obligation of a course every two years. They are exposed to more difficult search scenarios and are also re-validated sometime during the week.

**Validation** • The certification of an Avalanche Dog Team. It consists of a search problem, an obedience test and a backcountry ski test. The ski test is for the handler's ability and competence in avalanche terrain. This year CARDA has moved this test from the second year to the day before the first-year course.

Teams head up the Whistler gondola for a day of training.

Jan Tindle

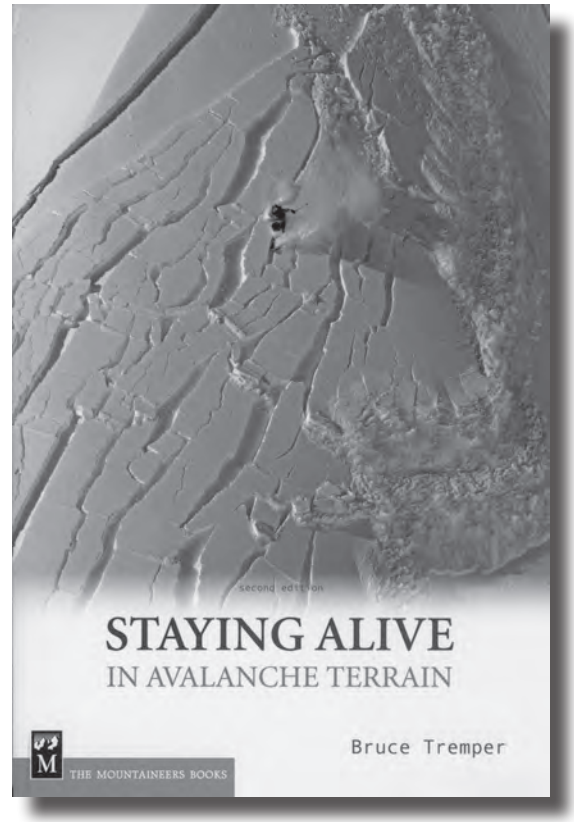
# New Publications

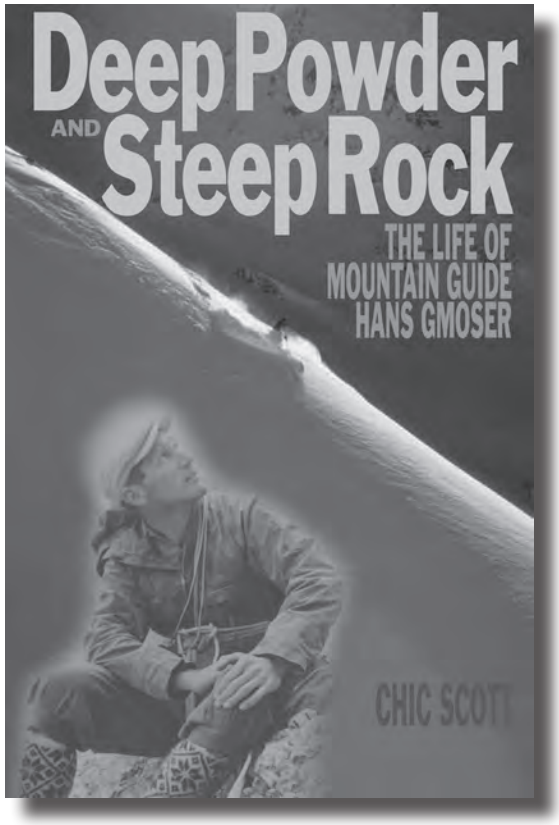
## *Staying Alive* Second Edition

One of the most popular books for avalanche educators, Bruce Tremper's *Staying Alive in Avalanche Terrain* has recently been revised. This second edition has a lot of new photos and charts, and many of the chapters have been rewritten. "There is nothing like reading something you wrote eight years ago and cringing," says Bruce. "No chapter went untouched."

A number of chapters received significant updates. The rescue chapter now includes information on the new digging techniques, and more information on air bags and Avalungs. The chapters on stability analysis now include the Extended Column Test and the Propagation Saw Test, while the chapter on human factors now includes much of Ian McCammon's recent work. The Avaluator and McCammon's "Alptruth" is now included in the hazard evaluation chapter, along with some of the work from the joint US – Canada committee on danger ratings, and information on Parks Canada's ATES ratings is now in the terrain chapter.

"It's a lot of damn work to update those books," says Bruce. "I don't make much money on them since it's such a niche market. I figure I made about 10 cents per hour on the work I put in so far. But it's good information to get out." There's no doubt about that. As the recommended reference book for the AST 2 course, the CAC endorses this book to all amateur recreationists who want to step it up a notch. Bruce may not be retiring early on the sales of this book, but the positive influence he's having on public avalanche safety is definitely enriching his karma.




## Hans Gmoser Biography

Just as this issue was going to the printer, we received word that another publication was doing the same. Chic Scott, the author of many great books on our local mountain history, has just finished his biography of Hans Gmoser. "*Deep Powder and Steep Rock*" tells the life story of this remarkable man, and this special hard cover edition will include a DVD with three of Hans Gmoser's films— Little Yoho 1957, Mount Logan 1959 and Helicopter Skiing in the Bugaboos 1966.

A launch party for this eagerly anticipated book will be held on May 9, 2009 at the Mount Norquay Ski Lodge. A free bus service for the event will be offered all evening from the town of Banff. For more information contact Chic Scott at chic_scott@hotmail.com.


MoT


MoT

# John Tweedy Honoured

## Long-time CAA member recognized for his contribution to avalanche safety in BC

In February of this year, John Tweedy received a "Premier's Award" from BC Premier Gordon Campbell at a ceremony in Kamloops. Now in its fifth year, the Premier's Awards promote and recognize innovation and excellence in the province. It would seem an honour to even be nominated for such an award so we should all be very proud of John for this acknowledgement of his career.

John is the Snow Avalanche Technician at Kootenay Pass, a stretch of highway that presents the highest avalanche risk to motorists in the province. John has worked for the BC Ministry of Transportation since 1981, where his involvement as an avalanche professional goes far beyond the job description. He's been an instructor and a Board Member for the CAA, participated in many rescue and recovery missions, collaborated with researchers and opened the Kootenay Pass for others to train and expand their knowledge of backcountry safety.

Mike Boissonneault is the Manager of the Avalanche and Weather Program for the BC Ministry of Transportation and has worked with John for many years. "His strengths include courage, humility and curiosity," says Mike. "John is the kind of guy who genuinely tries to pass on everything he knows so that when he retires, there will not be a missed beat—the quality will continue." Indeed, a legacy to be honoured.


John Tweedy accepts his award from BC Premier Gordon Campbell.

# 100 Years After

## The 1910 Rogers Pass Snow Slide Commemoration Project celebrates a century of science and innovation in avalanche safety

It happened near midnight on March 4, 1910. A giant wall of snow came down on a crew working to clear the Rogers Pass railway tracks of debris from a previous slide. Deep in a trench when the second avalanche hit, there was no chance of survival for 58 men.

That terrible incident remains the largest single avalanche accident in Canadian history. Next year will mark the 100th anniversary of that event, and a number of organizations are pulling together to make sure it doesn't go forgotten. CP, Parks Canada, the Friends of Mt Revelstoke and Glacier National Parks, the Revelstoke Museum and Archives, the Revelstoke Railway Museum and the CAC are all represented in a working committee on this project.

This was an event of national, and even international, consequence. Just three days prior to the Rogers Pass slide, an avalanche killed over 95 people in a passenger train in Stevens Pass, Washington. The train was pulled over on a siding, just outside a tunnel portal, waiting for the storm to ease. One avalanche cycle made history in two countries. That's worth remembering.

While still in early stages, the plans are to create events and exhibits that combine deep respect for the lives sacrificed with celebration for the advances made since that time. One of the prime objectives is to communicate how that accident became a catalyst for public awareness of avalanches, and how Rogers Pass became the birthplace of avalanche research and control. We'll keep you updated as the plans for the project solidify.

Revelstoke Museum and Archives

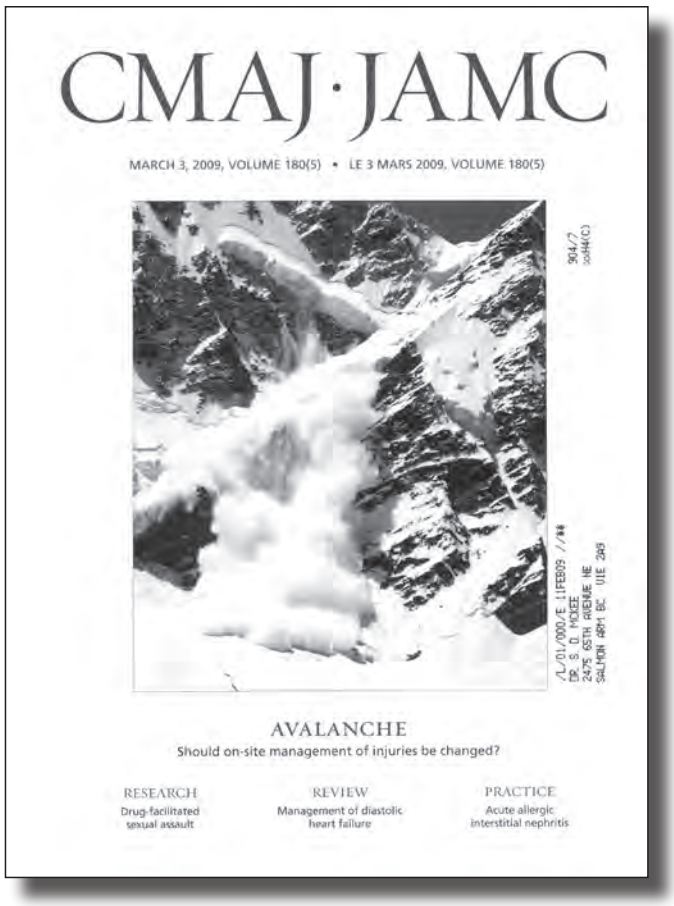
# Snowpulse Safety Warning

In early March of this year we became aware of a safety warning issued by Snowpulse regarding their "Life Bag." Apparently a default in the Velcro on the top of the bag may lead to a dysfunction of the airbag. According to Snowpulse, this failure results in non-inflation and has been reported in 0.5% of over 1500 inflations this year (most of these for training and demonstration purposes).


Snowpulse has identified the reason behind the misfires and found a solution to the issue. The Velcro covering the zip on the top of the bag is too robust and can, in some instances, hold the bag closed even under inflation. The solution is to reduce the strength of the Velcro. This is accomplished by applying a small patch of Velcro (40 mm x 16 mm) to the Velcro on the bag. Once sandwiched between the bag's closing Velcro, this patch reduces the contact area of the closing Velcro and ensures it will open unimpeded under inflation.

Velcro patches are available from Snowpulse's North American distributor Chuck Gorton. You can phone him toll free at 1 888 742 8769 or e-mail him at chuck@avalanchesafety.ca. If you know someone who owns a Snowpusle Lifebag purchased in 2008-09, please forward them this information. This warning is also available online at www.snowpulse.com. "Snowpulse is confident the patch will fix this glitch," says Chuck Gorton. "And this part of the pack will be re-designed for next winter."

# Patterns of Death




It's not often that a publication such as the CMAJ (Canadian Medical Association Journal) sports an avalanche for its cover photo. Long-time CAA member Dr. Jeff Boyd led a study on Canadian avalanche fatality patterns, showing how they differ markedly from European deaths, and that study was the focus of the March issue of CMAJ.

The 21-year study demonstrates that severe trauma causes a significant proportion of fatalities in western Canada. As current recommendations for rescue efforts focus on treatment of asphyxia and hypothermia, rather than trauma, Dr. Boyd's findings have significant implications for rescue measures, as well as avoidance strategies.

European studies have reported that asphyxia is responsible for the vast majority of deaths, with only 5% of all fatalities attributed to major trauma. Dr. Boyd and his co-author Dr. Pascal Haegeli found that in western Canada, trauma alone caused 24% of all deaths, while asphyxia caused 75%. Furthermore, even in cases initially determined to be caused by asphyxia, the authors found evidence of major and potentially lethal trauma in 13% of 117 victims that underwent full autopsies. Thus, in western Canada, major trauma contributed to a total of 33% of avalanche deaths during the study period. However, the cause of death varied considerably depending on activity, with 9% of snowmobilers dying from trauma compared with 42% of ice climbers.

As the majority of trauma victims hit trees, the authors suspect terrain preference to be one of the primary factors contributing to the high incidence of trauma deaths. "This trend is not shared by snowmobilers, which probably reflects their preference for open slopes," says Dr. Jeff Boyd, who is an emergency room doctor and an ACMG/IFMGA Mountain Guide.

Accompanying the study in the CMAJ was a commentary from Dr. Hermann Brugger, President of the International Commission for Mountain Emergency Medicine for ICAR and Associate Professor for Emergency Medicine at the Innsbruck Medical University in Austria.

"The higher rate of death by trauma in Canadian avalanches, especially in helicopter and snow cat accidents, may be explained in part by early rescue," said Brugger in his commentary. "It is possible that the high rate of trauma mortality in the current study was because of an exceptionally high rate of rescue within a short period after avalanche burial when asphyxia has had less chance to occur. This may be expected for helicopter skiers who are all equipped with avalanche transceivers and are accompanied by trained guides able to extricate them quickly in case of burial....Boyd and colleagues conclusively show that the on-site management of care for avalanche victims needs to be revised so that trauma management is given more prominence."

This study will run in its entirety in a future issue of *avalanche.ca.*

- **The study is based on 204 deaths over a 21-year period (1984-2005).**
- **BC and Alberta account for 88% of avalanche deaths in Canada.**
- **Younger people aged 20 to 29 years made up the largest single age group of fatalities (29%)**
- **88% of victims were male.**

Alan Maudie

# Risk and Avalanche Rescue

Krister Kristensen[1]*, Manuel Genswein[2] and Dale Atkins[3]
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ABSTRACT: The risk to rescuers is of serious concern for the International Commission for Alpine Res-cue (ICAR). For good reason, since ICAR receives annually reports of fellow rescuers injured or killed while on missions. In avalanche rescue many call outs occur when the general danger rating is 3 or high-er and where conditions are further deteriorating. This means that both the approach and the accident site can be exposed to avalanche danger. Under these circumstances the risk of rescue missions in ava-lanche terrain can be comparable to settings where explosions, structure collapses, hazardous materials, etc., present a risk to the rescue personnel. This work outlines a decision analysis approach to risk and benefit assessments in avalanche rescue missions. A simulation-optimization model allows for assessing the expected outcomes of rescue missions by considering key variables affecting both rescuers and the buried subject. The large number of input variables, their probability and the interaction between the input variables lead to a level of complexity which is difficult to handle without a well-structured decision making tool.

KEYWORDS: risk assessment, risk management, rescue simulation, rescuer safety, acceptable risk

## 1. INTRODUCTION

In the past, many avalanche rescuers worldwide have died during organized rescue missions. In some cases the accidents seem to be in the range of residual risk which is simply unavoidable and survival chances of the buried subjects were still great at the time of the accident. In other cases, fellow rescuers unfortunately died in situations where it was hard to justify the residual risk they accepted, both as an individual and as an organization when compared to the very low survival chances of the buried subjects. In some cases rescuers might not have been aware of the risk they took. In other cases the willingness to take risks seemed very unbalanced compared to the residual survival chances of the buried subjects.

The authors feel that the dictum “Risk a life to save a life” should be qualified and the desired outcomes of rescue missions better specified. Every rescue mission includes certain risks. Some risks are inherent to the environment of the accident site, and some of risks are inherent to standard means of transport in mountain rescue. Besides the inherent risks, which are hard to avoid due to lack of alternatives, there are many risks which may be reduced or avoided by alternative procedures, such as lowering uncertainty or postponing the rescue mission. In order to have the necessary awareness level, the contributing risk factors need to be quantified. This includes on the side of those subjects in need of help, survival chances at the time organized rescue is alerted and then the decrease of survival chances over time.

Balancing the collective risk of the rescue mission against the collective survival chances of the buried subjects will lead to a more transparent and objective decision base. If we, “society”, is regarded as a stakeholder, the preferred objective could be stated as an “optimization of the rescue effort, without subjecting the rescuers to an unacceptable risk”. We therefore propose to look at rescue operations using principles from decision theory.

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### 1.1 Ethical and legal issues

Although there is a vast literature on the ethics of emergency medicine, e.g. triage, very little is written about the ethics of rescue services, such as fire fighting and search and rescue (SAR) operations. Decision theory is based on the maximum expected utility (MEU) action axiom and uses a purely utilitarian point of view. Uncertainties are quantified by using probabilities, often derived from statistics. Although this may seem to some as bordering to cynicism, the principle for action embodied by an action axiom (such as MEU) is ethically defensible in many areas of civil society today, i.e. in the health services.

Many rescue services do state that the safety of the rescue personnel is a main concern and guidelines are often stated something like “Whatever you do, don’t increase the magnitude of a disaster by becoming a victim yourself”. This can be seen as a variant of the dictums “First, do no harm” (Primum non nocere) and “Take care of your own self” (Cura te ipsum) in the medical professions. In some rescue organizations, however, having an informed consent from the rescue workers is assumed to be a way for decision makers to avoid responsibility for accepting a high risk mission. Besides the fact that this is not a feasible option to reduce loss of rescue personnel in the long run, the ethical dilemmas arising are analogue to the “trolley problem”**, a classical philosophical dilemma concerning the ethics of sacrificing a

***The trolley car dilemma is a thought problem in ethics where an out of control trolley car speeds down a track with five peo-ple tied to the track. A flip of a switch will send the car to a different track with only one person tied down. Which choice should one make?*

life to prevent even bigger losses. It is also recognized that in recreational activities, people are typically willing to accept a much higher risk level than would acceptable in a work setting. This asymmetry means that a rescuer often cannot enter into the same risk domain as the victim, without breaching the organizational regulations.

There is also the possibility of legal action in case of an accident. In rescue situations there are examples of legal action being taken from the victim's side in case of rescuers refusing a high risk exposure. One is the case where a relative of a B.A.S.E. jumper went to court suing the volunteer alpine rescue group for waiting too long with the rescue effort after a failed parachute jump off a cliff in Norway in 2000 (Bore, 2002). It is also conceivable that civil cases can arise against rescue organizations where rescue workers (especially professionals) are injured or killed.

Even with worker protection laws existing in most countries, we are aware of few quantifications of the acceptable risk levels. Generally, many seem to follow the ALARP principle, i.e. that any risk should be "As Low As Reasonably Practicable". Although this can be seen as cost/benefit approach, it opens a wide field of legal interpretation.

When it comes to defining the acceptable risk levels for individual rescuers, a possible approach could be to consider the statistics of similar occupational hazards. In addition, society's aversion for large scale accidents could be taken into account. Of course, a complicating issue is that many rescue services, and especially the volun tary ones, depend on a heroic image to get economic contributions and goodwill from the general public, since the image of professionalism does not always seem to generate the same degree of sympathy. This is however not a topic in this work.

The objectives for taking the proposed approach to quantitative risk analysis and decision making are the following:

*a) To help increase the awareness of risks to rescuers using a quick quantitative risk analysis,*

*b) To optimize the use of the available rescue resources using a risk/ benefit assessment,*

*c) To make the decision making process as objective and transparent as possible.*

## 2. METHODS

A first approach was done in Norway around 2004 following discussions at the ICAR assembly in Poland the same year. Inspired by an Aviation Risk Assessment Chart developed, and kindly provided by the US Coast Guard, an adaptation was tried within the Norwegian Red Cross SAR (NRC-SAR) for avalanche rescue missions.

The chart (figure 1) uses of weighted sums of different risk components, influence of risk management actions, and subsequently, a benefit assessment. The definitions of risk and benefit levels are given in an explanation of the chart.

Finally a risk/benefit matrix with suggested actions can be used (figure 2). As with the US Coast Guard version, the avalanche rescue adaptation is intended as a tool for making quick, tactical decisions at the field commander level (Kristensen, 2004, 2007).

**Risk Management Calculator - Winter rescue operations**

Based of Model by Krister Kristensen, NGI (2007)
Modifications by Dale Atkins, Dec 2007

**Step 1** **Assess Risk** Enter data into outlined cell
**Step 2** **Assess Benefit** Pick benefit in outlined cell
**Step 3** **Evaluate Risk / Benefit from table**

***Step 1 Assess Risk***

**PERCEIVED RISK FACTORS** 1 to 5, low, moderate, considerable, high, extreme
Avalanche Danger Rating **HIGH** 16

1 to 5, low, moderate, considerable, high, very high

| | |
|---|---|
| **Plan** comprehensive plan based on good intelligence | 3 |
| **Environment** terrain, weather, visibility, access, safe zones, familiarity | 4 |
| **Mission** complexity, typicality, intelligence, control | 3 |
| **Resources** competency, capability, reliability, knowledge, skills, communications | 4 |
| **Perceived Risk Subtotal** | **30** |

**PERCEIVED RISK REDUCTION FACTORS** **0 to 3**, no change, little, some, considerable

| | |
|---|---|
| **Plan** more intelligence, more detailed plan, external help, time exposure | -2 |
| **Environment** improved conditions, typicality, alternative access, limited time exposure | -0 |
| **Mission** improved control, better intelligence, air support, better communications | -2 |
| **Resources** alternative resources, competency, capability, reliability, knowledge, skills, communications | -0 |
| **Perceived Risk Subtotal** | **4** |
| **PERCEIVED RISK - ADJUSTED - TOTAL** | **26** |

**RESIDUAL RISK REDUCTION FACTORS** **0 to 3**, no change, little, some, considerable

| | |
|---|---|
| **Experience** for this kind of mission | -2 |
| **Precautions** personal protection gear, beacon, recco, avalung, airbag, communications, explosive mitigation | -2 |
| **Residual Risk Subtotal** | **4** |

**OVERALL RISK ASSESSMENT** **22**

| LOW | MODERATE | CONSIDERABLE | HIGH | VERY HIGH |
|---|---|---|---|---|
| =5 | 6 – 12 | 13 – 21 | 22 – 32 | =33 |
| | | | | **HIGH** |

*Figure 1. A modified score chart for the risk compo-nents in a winter rescue operation, applied for a com-puter spreadsheet.*

### 2.1 Simulation/optimization approach

The risk matrix approach has some inherent weaknesses (see discussion in section 3.1). A step further is to use simulation techniques for optimizing decisions under uncertainty. This is done by using simulation and statistical data in a numerical model that allows assessing the expected utility and risk/benefit ratio by considering key variables affecting both rescuers and the buried subject(s). The large number of input variables, their probability and the interaction between the input variables lead to a level of complexity which is handled by this decision support tool.

The complexity of this problem reaches a level where an algebraic approach may not satisfy the requirements. Therefore a simulation based approach has been chosen, which allows incorporating a vast amount of variables from different fields of influence with various dependencies between the input variables.

| *Risk \ Benefit* | *High* | *Medium* | *Low* |
|---|---|---|---|
| *Low* | **Acceptable,** common risk reduction measures.<br><br>Continuously monitoring of risk factors | **Acceptable,** common risk reduction measures.<br><br>Continuously monitoring of risk factors | **Acceptable,** common risk reduction measures.<br><br>Continuously monitoring of risk factor |
| *Moderate* | **Acceptable,** common risk reduction measures.<br><br>Continuously monitoring of risk factors | **Acceptable** with all available consequence reduction measures. Continuous monitoring and rescue preparedness. Limit exposure in time | Not acceptable at present. Wait until risk factors change. |
| *Considerable* | **Acceptable** with all available consequence reduction measures. Continuous monitoring and rescue preparedness. Limit exposure in time. | Not acceptable at present. Wait until risk factors change. | **Not acceptable** |
| *High* | Not acceptable at present. Wait until risk factors change. | **Not acceptable** | |
| *Very high* | **Not acceptable** | | |

*Figure 2. The risk/benefit matrix tried by the NRC-SAR. The mission risks and benefits are given by the scorechart.*

The aim of the numerical simulation is to quantify and balance the collective survival chances of the population of buried subjects and the collective risk for the rescue operation (human loss only).

For each variable and event, likelihood and quantified influence to victim's survival chances and / or rescuer's risks are defined. Only variables which may be determined with an acceptable certainty are taken into account.

The survival chances of the buried subjects are mainly influenced by factors from two fields:

a) Survival chances within the debris.
   Characteristics of the buried subject, burial location, and mechanical stress to the buried subject during the motion phase of the avalanche.*
b) Burial duration.
   Detectability of the buried subject, burial depth, size of debris, number of buried subjects, availability, rescuer's competence level, and accident site access parameters.

The collective risk for the rescue crews is mainly influenced by:

a) Rescuer's related internal risks.
   Competence level, physical fitness, active and passive personal protection measures.
b) Rescuer's related external risks
   Duration and type of exposure to natural hazards, risks related to technical means of transport, risks related to uncertainty due to limited ability to evaluate terrain, weather, snow pack and other hazards.

The operational application of the simulation is an ongoing effort. For this, the simulation should provide a user-friendly user interface. Data entry in dynamic forms ensures that there is no valuable time lost in cases where key variables indicate that the victim's survival chances are high. The lower the survival chances and the smaller the decrease gradient of the survival chances, the more details need to be entered. Since the acceptable risk is low in such cases, the uncertainty should be rigorously reduced.

The current concept of the simulation only shows the operator the collective survival chances and the collective risk of entered parameters. However, the concept could in a later state be expanded to a simulation which shows to the operator a proposal of the three simulated approaches with the highest scores for the risk / benefit comparison.

## 3. DISCUSSION

### 3.1 Problems with risk matrices

As previously mentioned there are problematic mathematical properties of risk matrices. For instance they can assign identical ratings to quantitatively very different risks. Inputs to risk matrices require subjective interpretation, and different users may obtain different scores for the same quantitative risks. The limitations suggest that risk matrices should be used with caution, and only with careful explanations of embedded judgments. For instance it will often be necessary to state that a maximum score on one particular factor overrides all the others, or just stating

**Survival chances of a buried subject are based on the Brugger/Falk (1994) survival curve and supplementary correction factors. New technologies like remote vital sign detection may reduce the uncertainty concerning survival chances.*

that the method is not applicable in extreme situations. Another statement that often would be included is that when there is a very high uncertainty about one risk component, this should automatically receive a maximum value. The simulation approach is promising as it eliminates some of the shortcomings of the matrix and is a better way of optimizing decisions under uncertainty.

### 3.2 Upper bound risk level for rescuers

As it happens, the statistics of accident rates for alpine and avalanche rescuers are greatly lacking. For general rescue work, some numbers are available, mainly from the USA. Death rates amongst US emergency personnel stand at 12.7/100000, police at 14.4/100000, and fire fighters at 16.5/100000 workers (Maguire, et al., 2002). Case fatality rates for alpine rescue are not available and this is something we would like to propose as a task for further investigations.

Although the concept of "acceptable risk" is not well-defined outside the context of cost/benefit assessments, there seems to be good reason to set an upper bound. Werner Munter (2003) asserts that a case fatality rate of 1/100000 is within an acceptable domain for mountain ski touring and guiding. This is among other things justified by the societal acceptance of road transport which has a similar case fatality rate.

## 4. CONCLUSION

Starting from the "romantic heroism", which is to some degree probably still present in rescue organizations, it has been a long way towards quantitative risk analysis and decision making that is transparent and ethically defensible, especially when used in hindsight. A risk/benefit matrix is a first step towards this and the simulation/optimization approach holds promise.

Although a simulation is never perfect, it has the capability to filter out many of the most tragic situations that lead to severe injury or death of fellow rescuers in the past. Furthermore, the tool has a major effect on the awareness of rescuers and rescue leaders towards recognizing an acceptable risk / benefit balance and its contributing factors.

The authors hope to contribute to the reduction of severe accidents in avalanche rescue missions and hope to be able to further develop the strategies and tools in the future.

## 5. ACKNOWLEDGEMENTS

The authors would like to thank Joe Myers, CSP, MPH, US Coast Guard Headquarters for bringing to our attention the work being done by the USCG, and the NRC-SAR avalanche resource group and it's leader Albert Lunde for valuable input and discussions.

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# The Role of Moisture in Surface Hoar Growth

By Cora Shea and Bruce Jamieson
ASARC – Applied Snow and Avalanche Research, University of Calgary

In January 2007, surface hoar formed in the Columbia Mountains between Revelstoke and Rogers Pass—but only between about 1700 and 1300 metres in elevation. The layer plagued travel decisions through the season, and later resulted in an accident at Hall Mountain in March of 2007. With that layer, perhaps one of the questions that went through your mind was: "Why only those elevations?"

Great question. Most of you are probably shouting "cloud!" as an answer, but what proves easy in intuition does not prove so easy in physics. Let us dig further. Whenever you hear surface hoar, you may be thinking: Cold. Clear. Night. Or you may be even thinking: Calm or slight air currents. Protected. Open to the sky.

When surface hoar gets discussed in conjunction with specific elevations, more words come up: Cloud. Inversion. Humidity. Now we are getting down to the issue of moisture. But how many of us have those words on the tip of our tongue every time we think of surface hoar? The link between elevation and surface hoar—drawing our attention to clouds as a moisture source—can help our understanding of surface hoar formation in general.

In this article, we will show that surface hoar needs a lot of moisture to grow. We will talk about how things like temperature, diffusion, and other forces all simply assist in moisture transport, and that without lots of water we truly have no surface hoar. We will start here with how crystals themselves form, then move on to how moisture plays a part in that process, then do some calculations on how much water we actually need, and finally we will bring clouds back into the picture.

## A Short Course in Equation-less Snow Physics

Let us start at the beginning. First of all, molecules wiggle. More heat means more wiggling and jostling between molecules, and it also means that molecules inhabit more space. From this, it would seem that water vapour in the air just wiggles around, touches the snow, freezes on the snow, and forms surface hoar. Easy, right?

In physics, it is not quite that simple. At the most basic level, we actually don't know how surface hoar forms. In fact, we don't really even know how snowflakes in the air form, because it all happens at the chaotic molecular level. For example, we know that crystal formation changes from making plates to making needles at -5° C, then back again to plates and dendrites at around -10° C, and then back again to needles at -20° C. But why? No one really knows yet.

Despite the mystery, we do know a lot. Looking at the small picture, water molecules in the air form vapour, which then nucleate around tiny non-water particles to form ice. Then, more water vapour reaches and contacts that ice and forms crystals. Looking at an even smaller picture, you could do years of math concerning curvature, crystal structure, and so on (Libbrecht, 2005). There is lots to know, and lots to learn. But for our purposes, we will simplify and say that the main process that governs water molecules becoming crystals is diffusion.

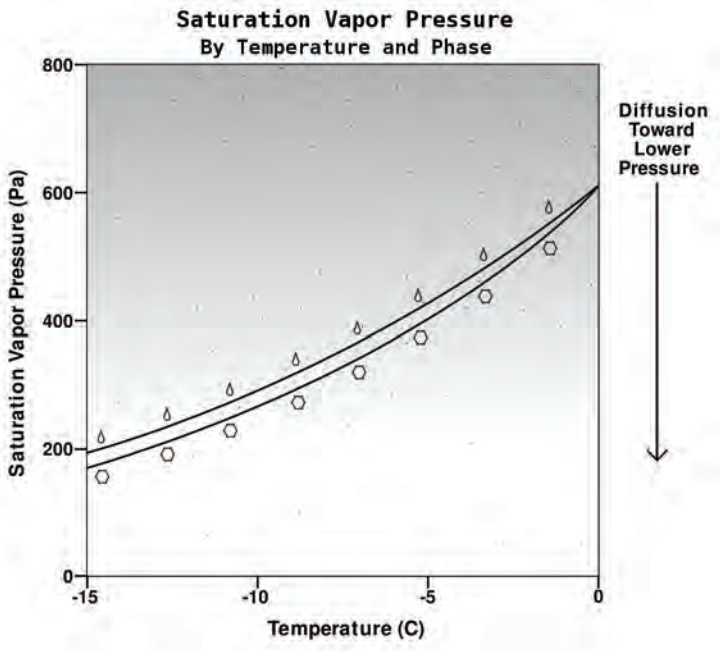


*Figure 1: Saturation Vapor Pressure*

## A Short Course in Equation-less Thermodynamics

Which brings us to this question: What, exactly, is diffusion? Well, diffusion is sort of like a molecule party in a room. All the molecules dance around, taking up space more or less equally in the room (no one likes to be crowded). When molecules at the edges of the room leave, the party doesn't just stay crowded in the center;

the remaining molecules move outward to take up the space. That way, no one stays too crowded. This tendency is known as the ideal gas law, and relates the space and the number of molecules to the temperature in the room.

But molecules, being the strange and wonderful things that they are, can also bond with the walls of the room, especially if those walls are made of other water molecules in the form of ice. In fact, the vapour pressure over ice is lower than it is over water, as shown in Figure 1. Higher "vapour pressure over water" simply means that if a water molecule dancing in the air comes close to ice, then it wants to become part of the ice. It feels less crowded on the ice. This tendency increases as the ice gets colder and the water gets warmer, as one can see by following the lines in the graph.

Beyond the growth from the microscopic pressure difference over ice versus water (known as phase-driven diffusion), we also have a more macro form of vapour pressure that can drive ice—and thus surface hoar—growth rates. Sam Colbeck and colleagues call it lateral diffusion, and this second type of vapour pressure comes from water molecules in a humid air mass (or cloud) wanting to move out toward the ground or sky. This type of vapour pressure comes from how crowded the water molecules feel in the humid air, and thus it directly drives the speed at which they move outwards and deposit on the ground.

Thus, the difference in vapour pressure governs the speed of diffusion, which in turn governs the speed of deposition of water vapour on ice, including ice in the form of surface hoar. This process of deposition-via-diffusion depends on three things: (1) The number of water molecules already present, (2) The vapour pressure felt by (and created by) those molecules to want to push themselves out of the air and toward the ice, and (3) The temperature, which drives the rate at which things occur. Remember, more heat means more wiggling and jostling, which means water vapour makes contact with ice more often.

**Water, Water Everywhere...**

For water vapour to deposit on the surface in the form of surface hoar, we need a lot of water vapour. We need so much water vapour, in fact, that the water vapour molecules need to feel crowded enough that they just want to sprint toward the ground surface. By one estimate (Colbeck, 2008), 20 mm surface hoar formation can be achieved by depositing 0.000459 g/cm2 of ice in a ten-hour night.

That might not sound like much, but sitting here typing this in a room with 75 percent relative humidity at 15° C, I have about 0.0000096 grams of water per cubic centimetre in the air around me (that is about 0.0000005 moles or 320 quadrillion water molecules). That might seem like a lot, but the surface hoar mass estimate above requires a nightly deposit of 0.000026 moles of water, or about 15 quintillion molecules per square centimetre. Now that's a lot!

Following this hypothetical situation, that means for every square centimetre of nightly surface hoar, we need absolutely every single last molecule of water out of 47 cubic centimetres of the sort of air I am breathing now. And to do that we would need an enormous vapour pressure gradient to make all of those molecules want to leave their air and become ice. Not to mention that colder air holds less water; 0° C air can hold about a third of the water vapour that my 15° C air can hold.

Next, remember that those calculations are per square centimetre. Imagine a column of cubic centimetres of air reaching out from the snow, all donating their water molecules to the ground. In that model, and re-doing the calculation with 0° C air, the above numbers would mean that every single last molecule out of the air nearly a metre and a half above the snow would have to come close enough to the ice to deposit on the surface in order to form that surface hoar layer. In reality, all the molecules cannot simply evacuate their air; the molecules from above must come down to balance the new absence, and those above them, and so on, which affects the air many times that in height.

Not to mention all the time and force needed for the quintillions of water molecules to wiggle down through all that space! Even with the role of wind included—which proves to be a complicated issue itself through the studies cited in references 3 (Feick, 2007) and 4 (Hachikubo, 1997)—we still need all of those molecules in all of that air to somehow get close enough to the snow to jostle onto it and deposit as surface hoar.

**The Role of Clouds**

Let us return to the original question: Where does that water vapour come from? The easy answer at first seems to be clouds since they have lots and lots of water, right? Again, not so simple.

Clouds affect temperature—both on the surface and in the air—because they affect radiation. Snow needs longwave radiation to have an escape route to the sky; it vents its daytime heat and gets cold again mostly by emitting longwave. Remember, the snow being colder helps phase-driven diffusion onto surface hoar. It also makes the vapour pressure gradient toward the snow stronger since colder areas hold less water and all the water in the warm areas want to go to the uncrowded cold areas which have lower vapour pressure.

But longwave radiation in particular is easily diffused and re-radiated by clouds. Think of how your shadow has fuzzy edges on the ground because the visible shortwave radiation at the edges gets diffused by the air. The same thing would appear with longwave radiation but to a much, much fuzzier degree if you could see the "shadows" from blocked longwave. Clouds do an

*Figure 2: Cloud beginning to form in the afternoon in the Columbia mountains. Its corresponding frost band footprint from the previous night appears along defined elevation bands. (Photo: Bruce Jamieson)*

especially great job of taking longwave radiation in and then just spitting it back out—re-diffused in all directions.

So snow can't get cold enough below a cloud because the longwave radiation that snow emits into a cloud just comes right back. Thus, even though the cloud is a great source of moisture, the vapour pressure gradients within the cloud would have to be enormous to drive diffusion. When ground and cloud are at the same temperature, Colbeck and colleagues estimate the cloud would need to be 8200 times as dense as a normal cloud to make the molecules feel crowded enough to want to deposit on the ground in the amounts we need!

Two things may be at work here. First, clouds don't stay still. They move up and down in elevation, and they move back and forth parallel to the ground. They can also shrink and grow. In Figure 2 one can see a tiny whiff of cloud growing, but the deposition on the trees is from cloud and humidity in the previous night. This fluctuation can give the snow a chance to cool off when the cloud leaves, and refresh moisture when the cloud returns.

Second, even when clouds do stay still, they have thicker parts and thinner parts. In Figure 3 one can imagine that snow at the top of a cloud may have just the right mix of being able to vent its longwave radiation and yet use the moisture from the cloud.

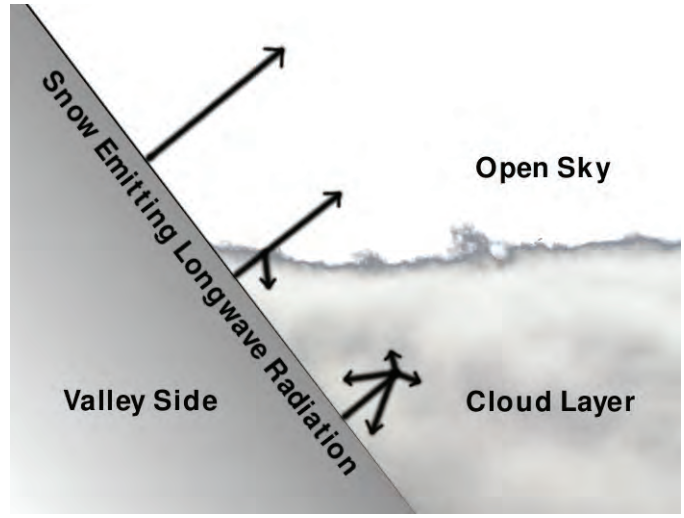


*Figure 3: The effect of clouds on longwave radiation escape. Within the cloud layer, the escaping radiation gets reflected and diffused back to the snow. Even with a relatively stationary cloud, however,there may be a portion of the valley side which receives moisture from the cloud but manages to emit some longwave through thin, noncontinuous cloud sections (middle arrow from snow surface).*

**The Future**

What this all means boils down to the following: Surface hoar needs lots of water vapour to grow. A huge amount of focus has been given to surface hoar formation occurring on cold, clear nights. As you now know from this article, those cold temperatures help drive the microscopic vapour pressures of

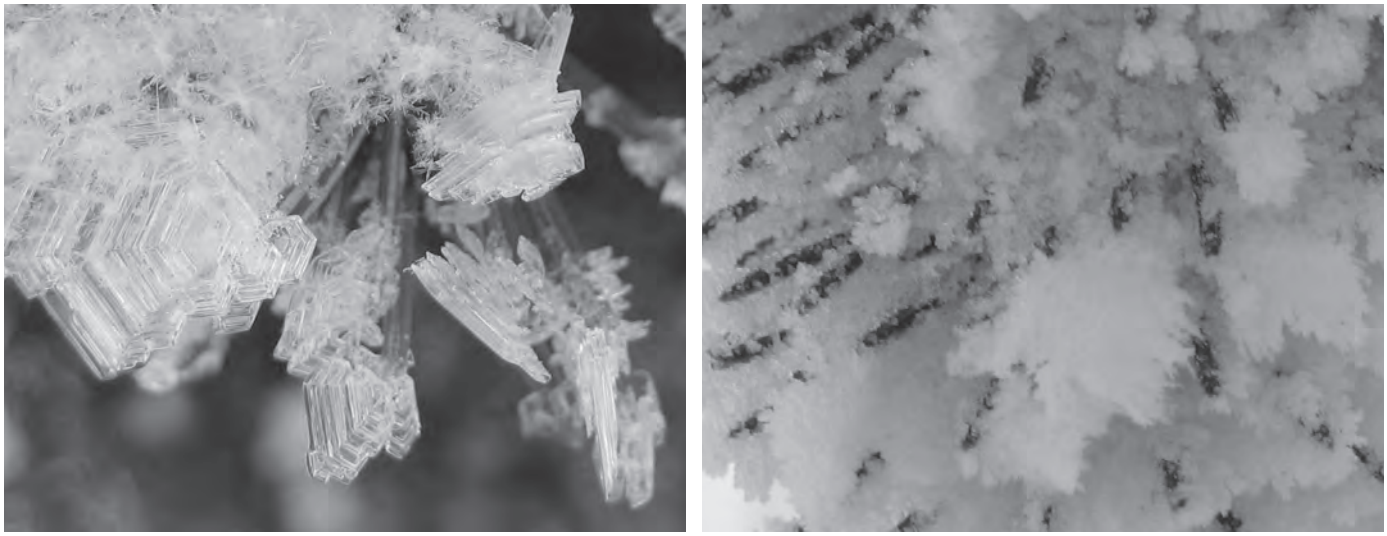

*Figure 4: Different deposition methods of water: surface hoar plates on pine needle tips (left), and rime feathers in and around a pine needle bunch (right). Both formed in the same surface hoar formation cycle, January 2009. (Photos: Cora Shea)*

water over ice, and they also help drive the "lateral diffusion"
vapour pressures. But cold, clear nights don't just create water out of nowhere. And since surface hoar also forms on trees, we cannot always point to the daytime melting of the snow as a source of its own water. Humidity, cloud moisture, and other water sources may play an equally large role in surface hoar formation as the typical "cold and clear" setup.

As always, the more we know, the more we realize what we do not know. For example, even if we have water, it can sometimes be deposited as surface hoar, and sometimes as rime. The two pictures in Figure 4 show that other things may also be at work here, namely vapour or droplet size.

Regardless, from this thought experiment, we can help improve our future directions. When nights are truly cold and clear, think of where humidity might be: in visible, condensed cloud form or otherwise. When clouds exist, try to think like the snow and find where it may be venting enough longwave radiation to cool. Will locations of clouds or non-visible "cloud formations" of humidity eventually help us to map surface hoar? Probably, but today no one can say exactly how. But the next time you see surface hoar, take a look around and ask yourself: where did all that water come from?

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# Avalanche Probe Review

By Manuel Genswein and Ragnhild Eide

This project was carried out under the patronage of The Austrian Alpine Club. All equipment has been purchased and paid for by the authors and none of the involved parties are in any kind involved in the manufacturing, sales or promotion of any of the tested equipment.

## 1. Probe selection criteria

From all major manufacturers, only one or two of the most promising (mechanically strong, ergonomic and lightweight) versions were selected for the test. One of each of these was purchased in a regular mountain sports shop. We would have liked more probes in the test from G3, but not all of their models were available.

## 2. General Description of Important Characteristics and Features

### Lengths

A companion rescue probe should not be shorter that 240cm, whereas an organized rescue probe should not be shorter than 320cm.

### Diameter

The smaller the diameter of the probe, the more often deformations and strong bending will occur in the debris. Carbon probes in particular need to have a sufficient diameter to withstand the forces applied in avalanche rescue.

Material

High quality carbon probes are not only lightweight, but they also withstand the stress they are subjected to in companion rescue. This implies probing will not be performed over several hours, i.e. in a probe line search. However, for organized rescue, metal probes are definitely preferable.

### Spanning mechanisms

The spanning mechanism should not allow any, or at most very marginal, play. This play leads to faster mechanical destruction of the probe and the overlapping sections in particular. Textile based spanning cords, including Kevlar, are not sufficient. The most static spanning mechanism is threaded probes, where the individual elements get screwed together. However, the necessity to frequently retighten the elements in respect to each other makes this option less attractive.

Spanning cables need to be long enough in their total lengths so that the probes may be easily folded in the collapsed state without damaging the cable or the probe segments.

### Connection between segments

The connection between the segments influences how smoothly the probe can be assembled and how durable the probe will be. Sharp, open edges are inferior to segments with a smooth finish on both sides.

### Probe design

Probes should be marked with a centimetre scale in order to determine burial depth and make them a versatile tool for snow pack investigation.

### Locking mechanisms

There is a large variety of locking mechanisms available. It is important to find a good balance between user friendliness when wearing gloves, reliability, durability and proper functionality under icing conditions. Probes with threaded locking mechanism are more time consuming to deploy and require most participants to take their gloves off to spin the locking nut.

### Tip design

The tip of the probe should be replaceable with a maximum diameter larger than the probe shaft. Probes with rounded tips were harder to push through hard layers in the debris than pointed tips.

**Proper use of the probe**

Always deploy the probe downwards. Wear gloves to prevent frozen hands. Always probe with two hands in order to penetrate the debris quickly and in control.

**3. Tested probes in alphabetic order**

The Ortovox Pro Steel 320 and Ortovox Carbon Pro 240 Plus have both nice features, but did not get fully tested as their locking mechanisms exhibited poor long term durability. The steel cable kept breaking just above the metal spanning bolt.

| | Length | Weight | Probe diameter | Tip diameter | Connection between segments | Tip replaceable | Looking mechanisms | Remarks |
|---|---|---|---|---|---|---|---|---|
| BCA Carbon 260 | 260cm | 211g | 10.2mm, too small in general (bending) | 11.7mm (+ 1.5mm) | angled on two sides | No | Easy to handle with big gloves, incl. attaching the clip at the end of the cable. Mechanically weak. | Centimetre scale printed on probe does not last very long. |
| BCA SR3 QuickDraw Probe | 300cm | 334g | 12.7mm | 13.0mm (+ 0.3mm) | angled on two sides | No | Easy to handle with big gloves, incl. the clip at the end of the cable. Mechanically weak. | |
| BCA SR3 Standard Probe | 300cm | 315g | 12.7mm | 13.0mm (+ 0.3mm) | all open | No | Very durable, oval. Time consuming assembly. | |
| Black Diamond Carbon Quick Draw Probe 230 | 230cm | 234g | 13.3mm | 14.2mm (+ 0.9mm) | angled on two sides | No | Easy to lock, harder to unlock with bigger gloves/mittens. Some icing problems make it difficult to unlock the mechanism. Nice grip on the top segment. Clip on mechanism at the end of the cable works well. | Measurement imprint should go to the top and not stop at 185cm. Cable length can be manually adjusted. |
| Black Diamond Guide Quick Draw Probe 300 | 300cm | 351g | 12.8mm | 14.4mm (+ 1.6mm) | angled on two sides | No | Easy to lock, harder to unlock with bigger gloves/mittens. Some icing problems make it difficult to unlock the mechanism. Nice grip on the top segment. Clip on mechanism at the end of the cable works well | Measurement imprint should go to the top and not stop at 263cm. Nice colour coding. Plastic coating of the metal wire is thin. The wire is too short which damages the wire in the dismounted state as the radius of the wire is extremely small. Cable length can be manually adjusted. |
| G3 Tech Probe 240 | 240cm | 270g | 12.6mm | 14.1mm (+ 1,5mm) | angled on two sides | Yes | Very durable, round. More time consuming. Needs to be periodically retightened or it will unscrew itself and fall apart. Missing locking clip for the end of the cable. | Best and most functional probe bag! |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mammut Expert Probe | 265cm | 230g | 10.8 mm | 12.7mm (+ 0.9 mm) | Open | No | Hard to unlock. | Measurement imprint should go to the top and not stop at 225cm. Cable length can NOT be manually adjusted. Weak probe in general. |
| Mammut Standard Probe | 280cm | 218g | 9.4 mm | 11.7mm (+ 2.3 mm) | Open | No | Knot in the rope, proper locking mechanism totally missing! | No measurement imprint, but simple colour coding. Cord is made from rope, far too much elasticity. Probe seriously deformed (destroyed) in the test. Very weak probe in general. |
| Ortovox 320 | 320cm | 440g | 13.3mm | 13.9mm (+ 0.6mm) | angled on two sides | Yes | Locking and unlocking easy to handle even with gloves. Should be more rigid. Locking mechanism for the end of the cable does not work. | No coating on wire. Cable length can be manually adjusted. Additional grip material gets slippery in wet snow conditions. |
| Pieps Standard Probe | 260cm (42cm wasted due to locking mecha-nism) | 286g | 13mm | 14.5mm (+ 1.5mm) | angled on two sides | No | Not easy to handle with big gloves, in particular the unlocking mechanism. Needs a lot of force to extend it so that there is no slop. This is only possible if extended to the very last segment of the locking rings where the segment is not in a straight, stable line to the probe any more. Mechanically rather weak. | |
| Voilé Tourlight Probe | 250cm | 266g | 11.1mm | 12.7mm (+ 1.6mm) | all open | No | Hard to unlock, mechanism failed during test. | Measurement imprint should go to the top and not stop at 195cm. Nice colour coding. Wire too short. Cable length can be manually adjusted. |

**4. Recommendation**

Personal probe for touring: High quality carbon probe, approximately 240 cm and with sufficient diameter.

Probe for frequent use in courses and organized rescue: High quality metal probe at least 300 cm in length.

# Transitions

## Kristin Anthony-Malone
### eTraining Project Manager

Kristin comes to us from the US, where she's spent many years teaching outdoor skills and guiding. Born and raised in Seattle, Washington, she attended the University of Montana where she graduated with a Bachelor of Science, specializing in resource conservation and wilderness studies. She spent her summers guiding in Alaska and dedicated the school year to teaching environmental education in Colorado and California.

While living in Alaska she began instructing for the National Outdoor Leadership School (NOLS), which brought her to the North Cascades. She fell in love with a guy from Canada and the rest, as they say, is history. "That Canadian became my husband and we needed to choose a country to live in," she explains. "We'd been looking for a small mountain town with good coffee and even better backcountry skiing, and we landed in Revelstoke."

There's no doubt her extensive outdoor experience will serve the project well but Kristin also brings some other valuable skills to the table. "This project has some unbelievable complicated spreadsheets but within three weeks, Kristin had them totally mastered," marvels CAA Executive Director Ian Tomm, who says she's already proven herself invaluable to the project's Lead Content and Curriculum Developer, Mark Bender. With the ease in which Kristin has fit into our office, we're sure she'll be invaluable to us all soon.

Todd Anthony-Malone

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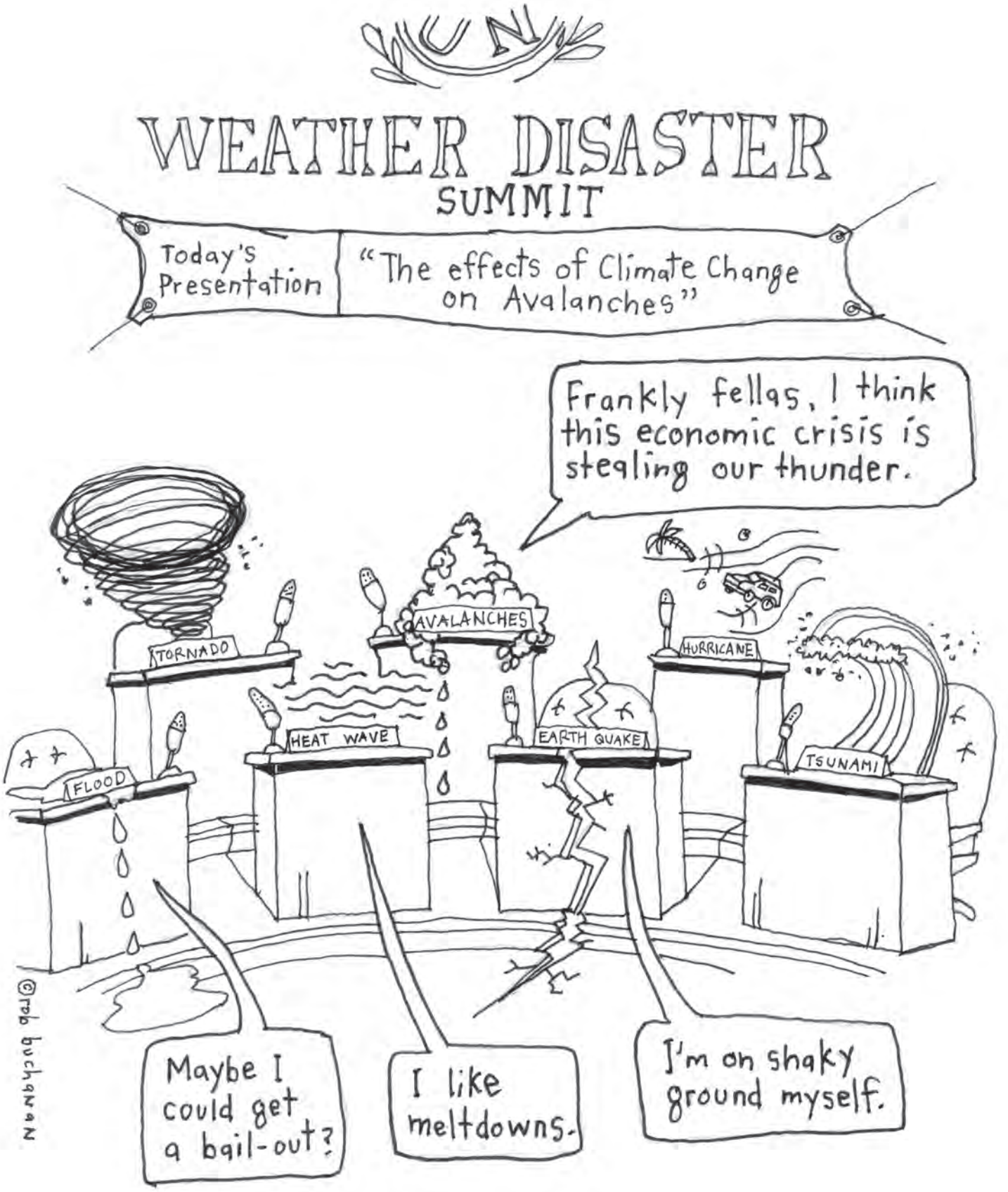
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