avalanche.ca
The journal of Canada's avalanche community

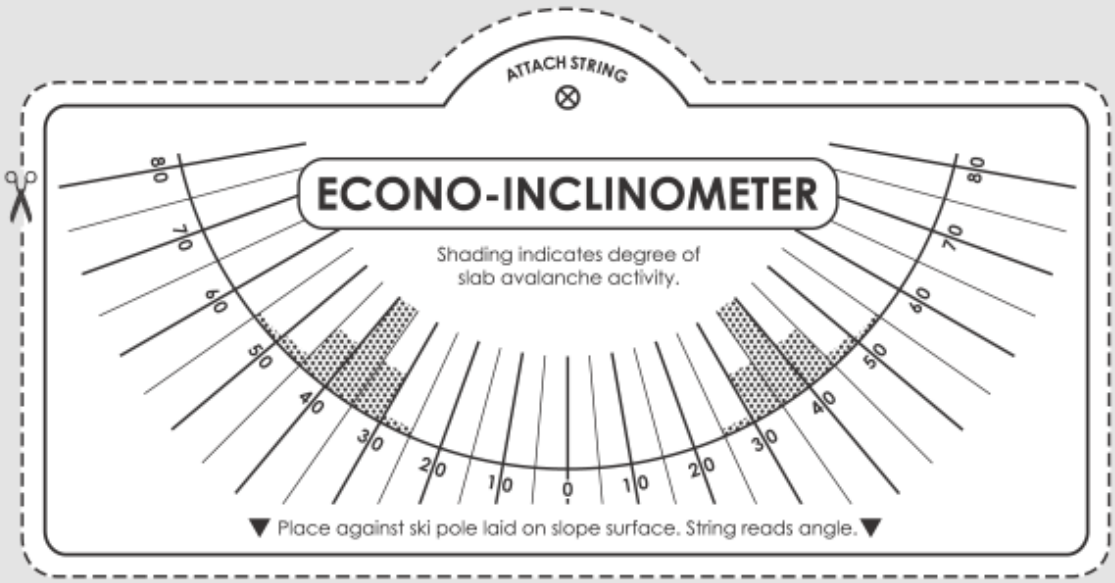
TEACHING THE
BLACK ART

BEYOND THE
DANGER
SCALE

THE MAN WHO WON THE "SNOW WAR"

+ Organizing Avalanche Search and Rescue, Weather Wise and more!

Volume 82 Fall 2007
Cdn Publication #40830518



Cover shot: This shot was taken at Bear Pass in early March, 2006, by photographer Dave Heath. The BC Highways crew used 25 kg of ANFO to trigger the slide in an area just north of the Yvonne Glacier, near the east end of Bear Pass. The crown was estimated to be three metres deep and Forecaster Mark Austin figures the avalanche ran on a rain crust laid down the previous November.

Table of Contents

failure plane

In our previous issue (Vol 81, Summer 2007) a phrase was lost in the research paper, *Fatal Avalanche Accidents and Forecasted Danger Levels* by Ethan Greene et al. The second paragraph of Section 4.3, on page 55, should read: "The Swiss Alps are divided into about 100 forecast areas. The forecasts are issued by the Avalanche Warning Group at the Swiss Federal Institute for Snow and Avalanche Research (SLF) and typically include the degree of danger (one out of five) as well as a description of the most dangerous areas." Also in the same paper, on page 56, the caption for Figure 2 includes information that was not meant for final publication. We regret the errors.

avalanche.ca

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

Return undeliverable Canadian addresses,
change of address and subscription orders to:
Canadian Avalanche Association
PO Box 2759, Revelstoke, BC V0E 2S0
email: publish@avalanche.ca
Publications Mail Agreement No. 40830518
Indexed in the Canadian Periodical Index ISSN 1911-5342

avalanche.ca
The journal of Canada's avalanche community
Volume 82 Fall 2007

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:

Editor, *avalanche.ca*
Canadian Avalanche Association
PO Box 2759, Revelstoke, BC V0E 2S0
Tel: (250) 837-2435 Fax: (250) 837-4624
E-mail: editor@avalanche.ca

Editor	Mary Clayton
Graphics & Advertising	Brent Strand

Content Deadlines:
avalanche.ca is published quarterly. Material is due on the 15th of February, May, August and November for our spring, summer, fall and winter editions respectively.

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

avalanche.ca

CAA BOARD OF DIRECTORS

President	Steve Blake
Vice-President	Rob Rohn
Secretary/Treasurer	John Hetherington
Membership Committee Chair	Ken Bibby
Director for Professional Members	Mike Boissonneault
Director for Active Members	Debbie Ritchie
Director for Affiliate Members	Janice Johnson
Director for Associate Members	Andrew Nelson

CAC BOARD OF DIRECTORS

President	Steve Blake
Vice-President	Rob Rohn
Secretary/Treasurer	John Hetherington
Membership Committee Chair	Ken Bibby
Director	Mike Boissonneault
Director	Jack Bennetto
Director for Supporters	Mike Mortimer
Director for Friends	Dan Markham

CAF BOARD OF DIRECTORS

President	Chris Stethem
Vice-President	Jack Bennetto
Secretary/Treasurer	Gordon Ritchie
Directors	
Donna Broshko	Scott Flavelle
Colin Johnston	Peter Schaerer
David Thompson	Justin Trudeau

COMMITTEES

Audit Committee

John Hetherington (Chair)	Bill Mark
Bruce Allen	Peter Schaerer
Jack Bennetto	Chris Stethem
Bruce Jamieson	Niko Weis

Education Committee

Marc Deschênes (Chair)	Janice Johnson
John Buffery	Bob Sayer
Cam Campbell	Helene Steiner
Sylvia Forest	Ian Tomm

Explosives Committee

Bernie Protsch (Chair)	Kyle Hale
Scott Aitken	Dave Iles
Colani Bezzola	Brian Johnston

Information Technology Committee

Andrew Nelson(Chair)	Jeff Goodrich
Jan Bergstrom	Alan Jones
Donna Delparte	

Membership Committee

Ken Bibby (Chair)	Mike Rubenstein
Richard Miller	Johann Slam
Tim Ricci	

Professionalism/Ethics Committee

John Hetherington (Chair)	Peter Amann
Rupert Wedgwood (Co-Chair)	Ilya Storm

Technical Committee

Rob Whelan (Chair)	Dave McClung
Cam Campbell	Bob Sayer
Bruce Jamieson	Doug Wilson

AST Committee

Mitch Sulkers (Chair)	Matthew Atton
Scott Grady	Peter Kimmel
Monica Nissen	Eric Vezeau

ISSW 2008 Committee

Brian Gould (Chair)	Helene Steiner
	Andrew Wilkins

Good News and Bad

In late August of this year, we received the great news that Environment Canada was going to announce federal funding for the Canadian Avalanche Centre. Parks Canada and the Meteorological Service of Canada, both long-time partners in avalanche safety, were signing on to multi-year funding. For an organization like ours, knowing we have an operating budget for the next few years makes a huge difference. Thanks to both of these organizations for their commitment and confidence in our work.

That announcement came hard on the heels of some terrible news to all of us—the death of Fred Schleiss. We honour Fred's legacy in this issue with some memories from people who knew him well. He touched many in our industry and we don't have room for everyone's contribution, but if you have a Fred story to share, please let us know. We'd be happy to collect more for our next issue.

I worked for Fred in Rogers Pass back in the mid-1980s. He was everything I'd heard about—stern, demanding and fiercely protective of his program and his team. I became a professional member of the CAA in my first year there, even though I didn't meet the qualifications. Fred's take on it was "One year in Rogers Pass is worth five anywhere else—of course you qualify!" And so, on his word, I became a professional member.

I only had a few opportunities to ski with Fred, as those were the years where he was handing over the operational reins to his brother Walter. He was an excellent skier and all of us "new guys" on the team were eager to show we had the right stuff. I remember on one trip, we had paused on our descent through the thick Selkirk forest on the slopes of Mt. Fidelity. Fred ordered me to "ski to that tree there." I looked in the direction he pointed; trees were all I could see. Too intimidated to ask for clarification, I pushed off into the waist-deep and stopped where it felt right. As we re-grouped, he didn't say a word so I could only assume I passed. That was good enough for me.

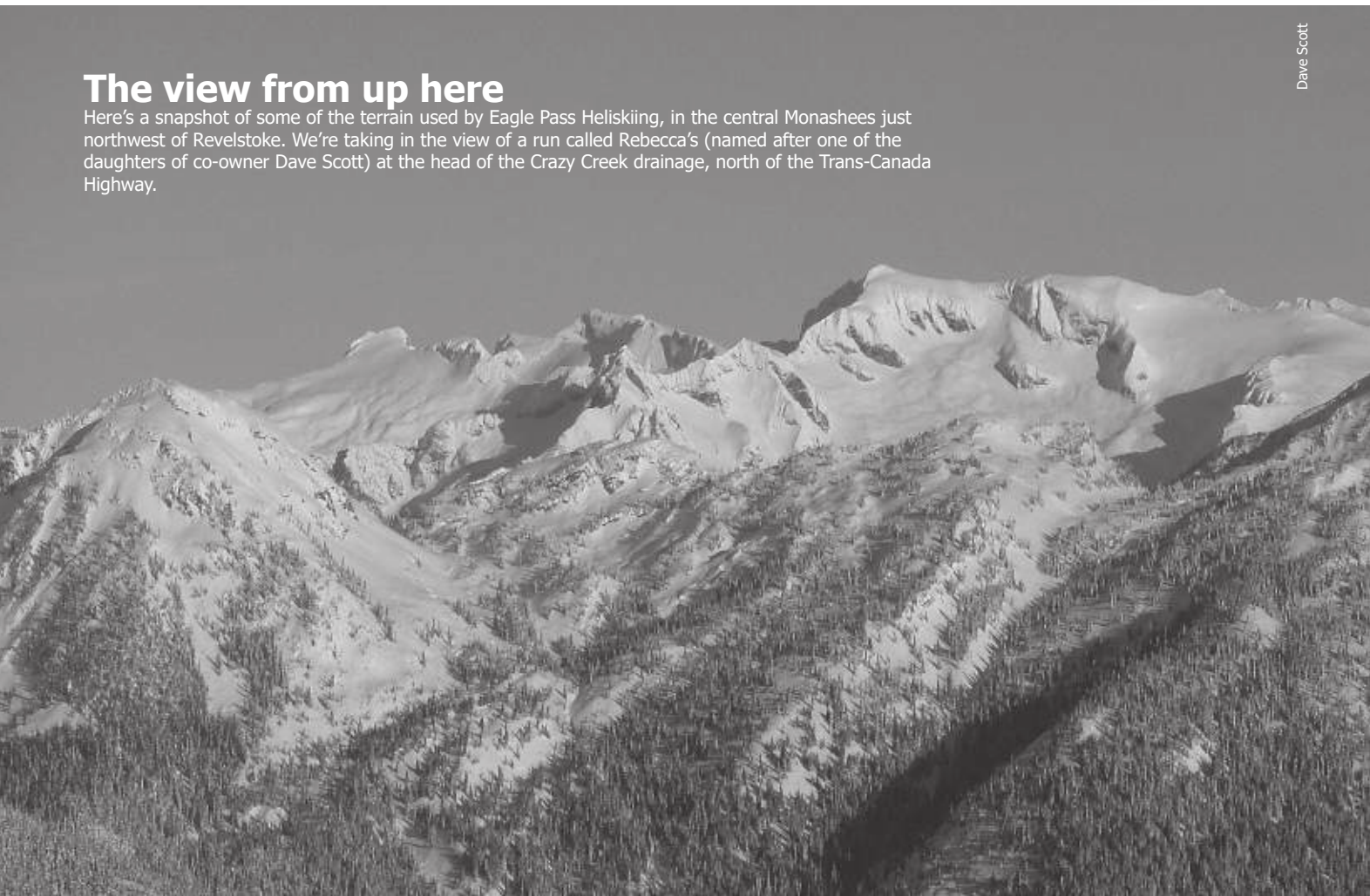
As you may have noticed, *avalanche.ca* is now printed on different paper than it has been in the past. We wanted to improve the image quality of the photos that are so generously donated by our readers, so we spent some time this summer investigating how we could do that and still stay within our budget. We were very happy to find that Hemlock Printers of Burnaby, BC could solve both those problems for us. On top of that, Hemlock has been named the Most Environmentally Progressive Printer in Canada for 2006 and 2007. In coming issues we will be exploring ways to take advantage of Hemlock's expertise in this area and make this publication greener.

We're also planning some new regular features. We'd like to highlight some great trips in the mountains, complete with information on things to look for and situations to avoid. If you'd like to share some local knowledge, contact me at mclayton@avalanche.ca. It would be great to hear from you.

M. Clayton

The view from up here

Here's a snapshot of some of the terrain used by Eagle Pass Heliskiing, in the central Monashees just northwest of Revelstoke. We're taking in the view of a run called Rebecca's (named after one of the daughters of co-owner Dave Scott) at the head of the Crazy Creek drainage, north of the Trans-Canada Highway.



Dave Scott

To the Editor

Thank you for the photo essay in your last issue that highlights the work done by the Avalanche Control team at Lake Louise Mountain Resort (Vol 81, pp 44-46). However, the top photo on page 46 shows a situation that may have caught the attention of some of your readers. I want to make clear that our control procedures state clearly that "pull wire fuse lighters shall be transported separately from any explosive or safety fuse assembly."

In the photo the helicopter is still on the ground. Craig was in the midst of getting organized and inadvertently set the igniters on top of the charges while fixing his seat belt. This is when the photo was taken. The igniters were immediately removed for the mission.

The Lake Louise Avalanche Control Explosives Procedural Manual dates back over 30 years and is regularly updated to encompass current standards, provincial and federal regulations as well as all manufacturers' recommendations. We regret any appearance of a breach of those procedures that this photo might have incurred.

David Iles
Avalanche Forecaster
Lake Louise Mountain Resort

InfoEx: Industry Standard for an Extraordinary Industry

InfoEx is a cooperative service managed by the CAA, providing a daily exchange of technical avalanche information between subscriber organizations. This uniquely Canadian service gives avalanche professionals access to data that is accurate, relevant and real-time. InfoEx is quite simply the most effective operational risk management tool available. If you're not on InfoEx, you don't know what you're missing.

SnoInfo PLUS

The CAA presents SnoInfo PLUS—a comprehensive data management system for operations concerned with avalanche safety. Created through collaboration, subscribers have direct input into the development of feature sets for the software.

The CAA welcomes additional subscribers to SnoInfo PLUS at any time.

SnoInfo PLUS Subscribers

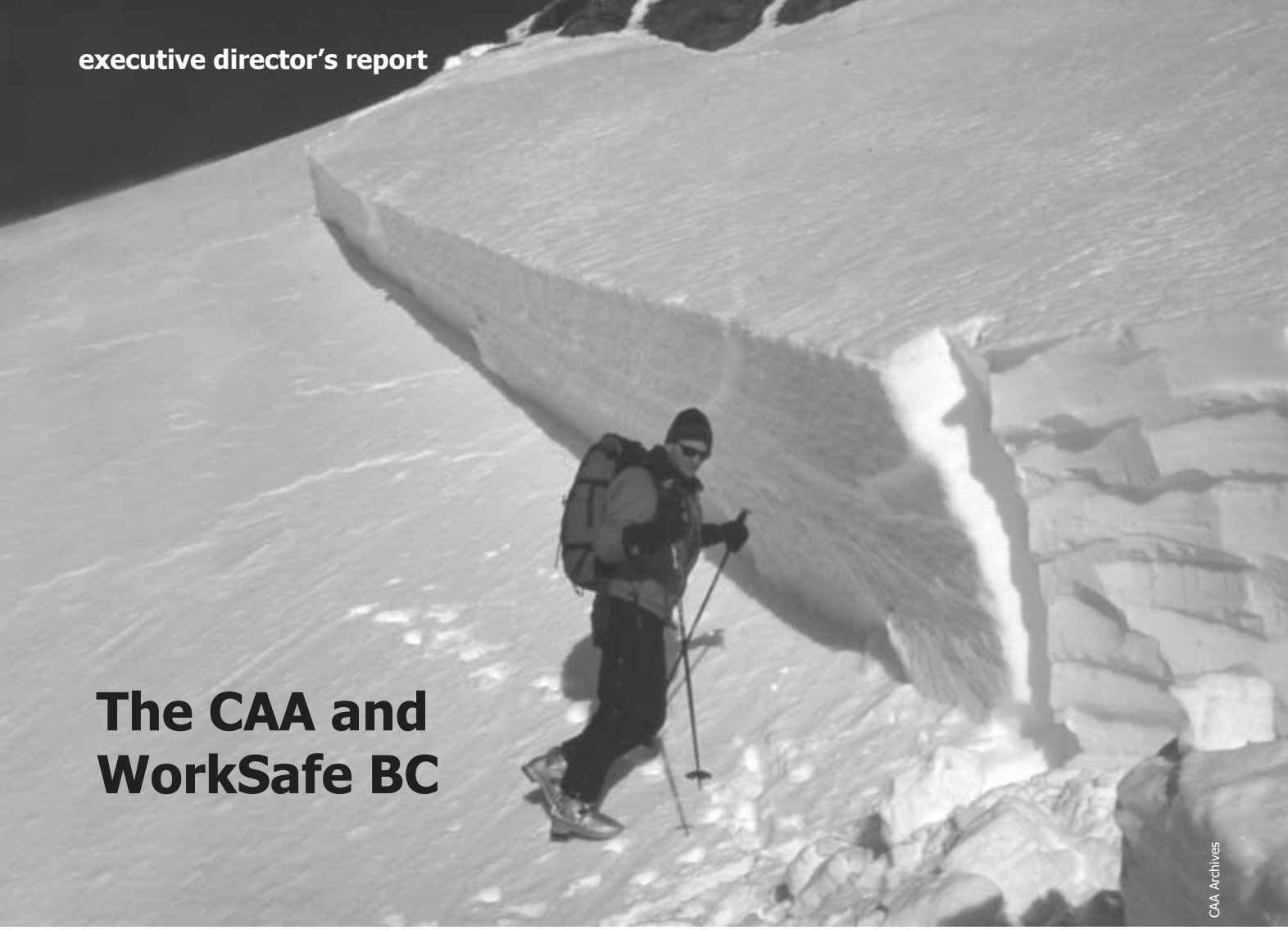
Ava Terra Services Inc.
Canadian Mountain Holidays
Chatter Creek Mountain Lodges
Great Canadian Heli-skiing
Island Lake Resort Group
Kicking Horse Mountain Resort
Mica Heli-skiing
Monashee Powder Snowcats
Northern Escape Heli-skiing
Panorama Resort
Powder Cowboy
RK Heli-skiing
Whistler Heli-skiing

InfoEx Subscribers

Ava Terra Services Inc.
Backcountry Snowcats Ltd.
Baldface Mountain Lodge
Baumann Engineering
BC MoTH - Bear Pass
BC MoTH - Central Region
BC MoTH - Duffey Lake
BC MoTH - Kootenay Pass
BC MoTH - Kootenay Region District
BC MoTH - North Cascades Avalanche Program
BC MoTH - Northwest Region
BC MoTH - Revelstoke District
Bella Coola Helisports Inc
Big Red Cats
Blackcomb Mountain Ski Resort
Burnie Glacier Chalet
Canadian Avalanche Centre
CMH Adamants
CMH Bobbie Burns
CMH Bugaboos
CMH Cariboos
CMH Galena
CMH Gothic
CMH Kootenay
CMH McBride
CMH Monashee
CMH Revelstoke
CMH Silvertip
CMH Valemount
Castle Mountain Resort
Cat Powder Skiing Inc.
Chatter Creek Mountain Lodges
Chris Stethem & Associates Ltd.
Coast Range Heliskiing Ltd.
Crescent Spur Heliskiing
Eagle Pass Heliskiing
Fernie Alpine Resort
Fernie Wilderness Adventures
Great Canadian Heliskiing Inc.
Highland Powder Skiing Ltd.
Island Lake Resort Group Inc
Kananaskis Country
Kicking Horse Mountain Resort
Kokanee Glacier Mountaineering
Last Frontier Heliskiing
Laughing Bear Adventures
Marmot Basin Ski-lifts
Mica Heli Guides
Mike Wiegele Helicopter Skiing
Monashee Powder Snowcats
Mustang Powder Lodge
North Shore Avalanche Advisory
Northern Escape Heli Skiing Inc.
Panorama Mountain Village
Parks Canada - Waterton
Parks Canada - Jasper
Parks Canada Mount Revelstoke and Glacier
Parks Canada - LLYK Field Unit
Powder Cowboy
Purcell Helicopter Skiing Ltd.
Purcell Mtn. Lodge
Red Mountain Ski Resorts Inc.
Retallack Alpine Adventures
Revelstoke Mountain Resort
RK Heli-Ski Panorama Inc.
Robson Helimagic
Selkirk Backcountry Lodge
Selkirk Mountain Experience
Selkirk Tangiers Helicopter Skiing
Selkirk Wilderness Skiing Ltd.
Skeena Heliskiing
Ski Banff @ Norquay
SnowWater Heli-Skiing
Storm Mountain Technical Services Inc.
Sun Peaks Resort
Sunshine Village
Thompson Rivers University
TLH Heliskiing Ltd.
Toby Creek Adventures
University of British Columbia
Valhalla Powder Cat Skiing
Whistler Alpine Guides Bureau
Whistler Heli-ski
Whistler Ski Resort
White Grizzly Cat Skiing
Whitewater Winter Resort Ltd.

Subscriber Training: We are planning to hold three training sessions on SnoInfo Standard (InfoEx) and SnoInfo PLUS (data management system) in Golden, Nelson and Whistler this coming November or early December. If you are interested in attending please contact Ian Tomm (itomm@avalanche.ca) or Yves Richard (yrichard@avalanche.ca).

Troy Grant



CAA Archives

The CAA and WorkSafe BC

We received some reassuring news in early September, shortly before this issue went to press. WorkSafe BC (WSBC) has decided to not go ahead with their proposed amendments to regulations that directly affect the avalanche community. As you know, the CAA and the many stakeholder organizations involved this issue found the proposed regulation unworkable and poorly considered. We engaged with the WSBC in the spring of this year and, through our coordinated efforts, were able to influence the tide of events in just a few short months.

However, workplace safety is a concern we all share. We have been told that WSBC's Policy and Research Division intends to engage key stakeholder organizations and, over the winter, draft a revised regulation regarding workplace avalanche safety. We believe this revised regulation will go to public hearings in May or June of 2008. The stakeholder consultation will begin later this fall, with the aim of completing the new proposal by March 2008, allowing time for final reviews before the public hearings.

In the last issue of *avalanche.ca*, we published the CAA's oral submission to the WSBC on this matter. In this issue, we have the CAA's written submission, delivered on July 12, 2007, to Ms. Anne Burch of the Prevention Policy and Regulation Review Department of WSBC.

Dear Ms. Burch:

On behalf of the Canadian Avalanche Association (CAA) I am pleased to submit the attached document containing suggested wording for Section 4.1.2 of the regulations pertaining to avalanche assessments. The CAA believes this suggested regulation wording will provide the basis for an effective framework for avalanche protection for workers in British Columbia. As I stated at the public hearings in Vancouver, the CAA believes that it will take at least one year to build the professional guidance and capacity to do the work that will fall from these regulations, and one additional year to develop the avalanche assessments and avalanche control plans for all British Columbia organizations that have workers exposed to avalanche risk.

The CAA is willing to work with all stakeholders to ensure that avalanche safety programs for workers in BC are the best in the world. I look forward to working with you and your staff as we move toward this mutual goal.
THE CAA SUGGESTS THE WSBC DRAFT REGULATIONS BE REVISED TO READ AS FOLLOWS:

Part 4, General Conditions, 4.1.2 Snow Avalanche Assessment

1. In this section:

"avalanche" means snow avalanche

"avalanche risk assessment" means determination of the characteristics of the terrain in and around a workplace based on an analysis of topographic variables, the snow climate, the estimated return periods and magnitudes of avalanches, and the type of work that is to be done in that workplace.

"avalanche risk zone" means a workplace or part of a workplace where an avalanche risk assessment has determined that avalanches could pose a risk to workers and avalanche risk reduction measures are required to make the area safe for the work to be conducted.

"avalanche control plan" means written procedures specifying
(a) structural and/or active avalanche control measures necessary to mitigate avalanche risk in the workplace;
(b) recommended worker training and experience qualifications for key levels of safety decision authority within operations; and,
(c) operational procedures to be followed by persons working in the workplace.

"structural avalanche control" involves long term methods to reduce avalanche risks. Risk reduction may be achieved through worksite layout, facility location and design, or restrictions for worksite use by workers. Berms, mounds, snow sheds, retaining walls and protective forests are some methods of structural avalanche control.

"active avalanche control" means monitoring weather, snow and avalanche conditions throughout the winter season, determining temporal fluctuations in avalanche hazard, and implementing activity restrictions, area closures or other methods to reduce avalanche risks.

"multi-disciplinary team" means two or more persons with the credentials, knowledge and experience required to produce high quality avalanche risk assessments and / or avalanche control plans.

"qualified avalanche expert" means a Professional Member of the Canadian Avalanche Association (CAA) who meets all qualifications recommended by the CAA for conducting qualitative avalanche risk assessments for operations in wilderness settings, and for specifying the contents of active avalanche control plans.


Conny Amelunxen

2. Before work commences at a workplace where there is or may be a risk to a worker from an avalanche, an avalanche risk assessment must be conducted.
(a) For workplaces involving forest operations, buildings, construction sites, transportation corridors, mining operations, or other developed worksites in fixed locations, a quantitative avalanche risk assessment must be conducted by a multi-disciplinary team led by a qualified registered professional.
(b) In wilderness settings, where workers range over vast expanses of undeveloped mountainous terrain, a qualitative avalanche risk assessment must be conducted by a qualified avalanche expert.

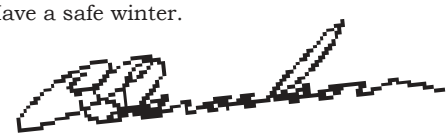
3. If an avalanche risk assessment identifies an avalanche risk zone, no work may be conducted in the risk zone at any time when snow depths have reached thresholds for significant avalanches to occur unless:
(a) a qualified registered professional has prepared a structural avalanche control plan, that plan has been signed off by the employer or primary contractor, and the plan is implemented as specified;
and/or,
(b) a qualified avalanche expert has prepared an active avalanche control plan, that plan has been signed off by the employer or primary contractor, and the plan is implemented as specified.

4. Where an avalanche risk assessment identifies the need for a combination of structural and active avalanche control methods, that avalanche control plan must be signed off by a qualified registered professional and a qualified avalanche expert, or an individual who possesses both credentials.

5. If an avalanche control plan has recommended procedures to be followed by people working in an avalanche risk zone, the employer or primary contractor is responsible to ensure that every person working in the risk zone is trained in, and complies with, any procedures applicable to that person's work.

The CAA is committed to working with the WSBC and all other stakeholders to help develop regulations that enhance worker safety in an effective, appropriate manner. In the next short while, the CAA will be working with members and the organizations you work for to identify common ground and map out possible solutions to the issues. When the consultation process with WSBC begins again, we want to be ready with a proposal that reflects the realities of our industry and is truly effective in reducing workplace avalanche accidents.

Have a safe winter.



Managing Change

Greetings. I have just landed back at home in Canada and I'm looking forward to getting my head back into my real job, as well as the role of CAA/CAC President. Since I have been essentially incommunicado all summer, I wish to extend my thanks to Vice President Rob Rohn and the rest of the board members for keeping things on track during my absence. For many, summer is considered down time in the avalanche business. Not for those working behind the scenes for the CAA and CAC!

In mid-September, the boards had a highly productive face-to-face meeting and training session in Canmore. It is truly a privilege to work with such an interesting, capable and dedicated group of people. On a personal level, the weekend served to re-ground me in the issues and challenges facing the CAA and CAC. Organizationally, it allowed the boards to solidify the direction we have given to Clair, as executive director, regarding this year's priorities and expected results.

So, you say, what are this year's priorities and expected results? Well, thanks for asking. The loud and clear direction the board took away from the AGM was to establish some tangible guidelines for scope of practice. This issue has been simmering for years, some would argue decades. While this is somewhat of a daunting task, we expect a concrete framework that will not only serve to enhance the professionalism of our association collectively but also our members individually. Discussions have been wide ranging and the concepts of qualification and certifications are clearly a part of the analysis.

At the Canmore meeting, the boards also participated in a developmental seminar with "Managing Change" as the key theme. This couldn't be more relevant from our perspective. Managing change is a bit of an oxymoron since change, of course, happens whether we like it or not. But the better we understand the elements of change, the better we are able to respond and make it work to our advantage. One of the significant outcomes is a framework that will help us address change in a consistent and thorough fashion.

On a related theme, we continue to focus our efforts on the WorksafeBC proposed regulatory changes. Immediately after the AGM, your directors and senior staff attended public meetings and put together written submissions that represent exceptional personal and collaborative efforts. Our opinions were heard and recently WorksafeBC has outlined its consultative strategy with an invitation to the CAA to participate. With the short timelines, the board has authorized the Executive Committee (President, Vice-President and Secretary Treasurer) to move things forward and we will be working very closely with Clair to ensure our members' interests are well represented.

While the short-term pressures necessitate this small team approach, the CAA's committees will be playing a key role in upcoming weeks and months. We will also be looking to the wisdom of our membership. It is the CAA's genuine commitment to work closely with WorksafeBC and all other stakeholders with the aim of getting it right.

Six hundred and twenty five thousand dollars! It looks like a big figure when written out that way and, guess what? It is a big figure. This is the amount of money the federal government has committed to supporting CAC activities over the next several years. A big "thank you" to the Meteorological Service of Canada (MSC) and Parks Canada for their continued support and endorsement of the products and services produced by the CAC. This amount is consistent with the federal support of the last several years and the CAC is pleased to have a more predictable funding platform on which to plan.

MSC has asked the CAC to ensure a portion of their funds get directed towards programs and services in eastern Canada. We recognize there are challenges and knowledge gaps that exist outside of Alberta and BC and we look forward to working closely with Dominic Boucher and the team at the Centre d'avalanche de la Haute Gaspésie this winter.

Looking forward, I see that we are in for interesting times. Mind, up until now things have also been very interesting, so no real change is expected in that regard. At the board level we are committed to using our best judgement to provide clear direction to the Executive Director and to make principled decisions that will benefit the CAA and CAC, now and in the future. Let us know how we are doing because there is no "us and them" in this scenario, just us.

president@avalanche.ca

Cheers!

OGRS Update

By Cam Campbell

A new edition of the *Observation Guidelines and Recording Standards for Weather, Snowpack and Avalanches* (OGRS) will be available for use this winter. On first glance, this new edition looks similar to the previous (2002) edition. However, significant changes have been made. Besides improved organization and layout, some of the more notable, and noticeable, changes include:

- New guidelines for making and summarizing field weather observations, with the objective of helping to evaluate slope-specific snow stability and avalanche hazard.
- New guidelines for summarizing snowpack and avalanche observations.
- New procedures for deep tap tests, with the objective of determining fracture character for a weak layer too deep to fracture consistently in compression tests.
- New standards for observing and recording rutschblock release type, with the objective of providing information on fracture propagation propensity in rutschblocks.
- New standards for observing and recording fracture character, with the objective of providing information on fracture propagation propensity in small-column stability tests (e.g. compression and shovel shear tests).
- Clarification of the avalanche size classification scheme with regards to half sizes and destructive potential as the defining factor.
- New snow failure type definitions that differentiate between cornice falls and icefalls as avalanches, and cornice falls and icefalls as triggers.
- A new appendix dedicated to the Canadian Avalanche Association Markup Language (CAAML).
- An updated avalanche incident reporting appendix that includes a reference to the new online incident reporting system.
- A new stability rating scheme that includes fracture character observations and spatial distribution.
- New definitions for danger, hazard and risk that came out of the ADFAR 2 project.
- Revised ICSI (now known as UCCS) classifications for seasonal snow on the ground (i.e. grain forms).

In addition, the working group is considering a relative avalanche size classification scheme, which will describe the size of an avalanche relative to the maximum size for the path. This scheme isn't intended to replace the current scheme based on destructive potential, but complement it. The OGRS Working Group will draft a set of interim guidelines, which will be passed on to the CAA Technical Committee in time for use this winter. Once the kinks are worked out, these interim guidelines will be added to OGRS as an addendum.

In order to accommodate the revised UCCS grain classification scheme, printing of the new edition of OGRS will need to be delayed until mid-November. We had hoped to have it available earlier but agreed it is important to include the new grain classification scheme, which will contain some significant changes. Check your monthly member e-newsletters for progress updates and a release date.

Again, I would like to acknowledge the working group chaired by Bill Mark. The members were Scott Aitken, Roger Atkins, Steve Conger, Dave Gautier, Jeff Goodrich, Mark Klassen, Mike Rubenstein, Chris Stethem, Ilya Storm and Simon Walker. In addition, Bob Sayer was the CAA Technical Committee representative. It was a pleasure to work with them on this project.

Cam Campbell prepares a pit at Balu Pass, Glacier National Park.

ASARC Collection

eTraining Makes a Name for Itself

By Ken Wylie

It is usually hard and smart work that makes a good name for people, projects, and services. The collaborative effort that is eTraining has all these elements. Sponsored by the RCMP, generously funded by the National Search and Rescue Secretariat—New Initiatives Fund, and strongly supported by numerous SAR and avalanche organizations across Canada, eTraining is a two-year multi-stakeholder project. The project will first establish best practices and protocols for safety in winter mountain operations, and avalanche SAR response and management. That knowledge will then be made available on the internet through leading-edge online training programs, aimed at professional and volunteer avalanche SAR groups.

In fact eTraining now has three names—one for each of the three online courses. These names were chosen by the project's twelve Subject Matter Experts (SME) this spring. The string of courses is called: WinterSafe, AvSAR Response and AvSAR Management.

WinterSafe addresses basic travel skills in the winter mountain environment. The course is designed to build a knowledge base of these skills for those whose work brings them into or near avalanche terrain. AvSAR Response will offer current best practices in avalanche search and rescue techniques. There are some interesting additions to best practices in this area and this course promises to provide some great online learning tools to help users acquire that new knowledge.

AvSAR Management will present all the elements of avalanche rescue planning and management. Users will be provided with tools and direction to build avalanche rescue plans that can be linked seamlessly to other groups, yielding the capacity for multi-organizational and multi-jurisdictional avalanche responses. So where are we in the process?

Over the summer, content has been written for the first two courses. This has been an amazing and challenging journey for both the SME group and me. We have been beating the bushes for quantitative, peer-reviewed and technical papers from past ISSW proceedings, the international commission for alpine rescue (ICAR), the web and a variety of authors.

The input has been fabulous from sources all over the world. First, we reviewed these papers to establish the current best practices for avalanche search and rescue. Then, from this research the course content was created. This content has now been reviewed and scrutinized by both the SME group and a subject matter advisory team. The best part about this work is that everyone involved has truly been searching for the best practice, whether new or old.

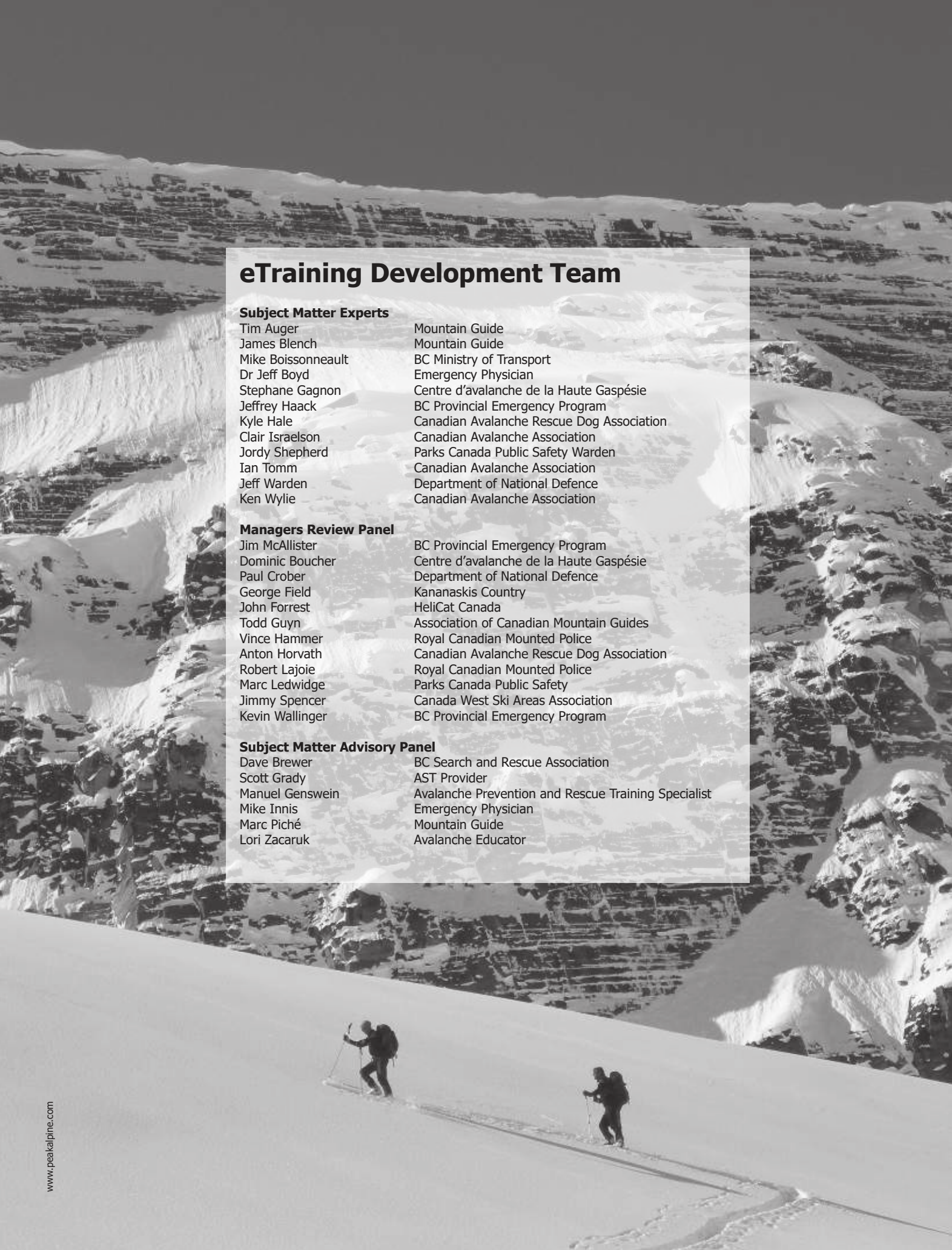
The material that's been developed for these first two courses has broken new ground. Advances have been made in the use of the Incident Command System and its application to avalanche response (see the article by Jordy Shepherd on page 46), avalanche rescue triage with the help of Dr. Jeff Boyd, and organized shoveling with the help of Manuel Genswein, who generously donated his time, research and flight costs from Switzerland. The feedback, ideas and commitment that has come to define the project has been nothing short of excellent. Now, with the results of our collaborative efforts in a written manual, the web design team will move on to the next phase of the project.

At the moment the course activities carrying the key concepts are being constructed. This is the "storyboard" linking one concept to the next, ending with the user gaining competence in key areas by the end of the course. These activities need to be supported by a variety of still images and DVD clips. We're looking for avalanches, involvements, rescues and rescue personnel, as well as avalanche dog teams in action. We are paying for these materials, so please contact me if you have some footage or photos that would benefit the project.

In early October the project will shift to the programming phase. This is where the concepts and content for Wintersafe and AvSAR Response turn into learning experiences online. This phase promises to be very exciting, as ideas are transformed into a product.

Thanks to everyone who has put their nose in the research and fingers to keyboard on this project so far. There has been huge support from all the stakeholders, and the in-kind donations from Parks Canada, BC Provincial Emergency Program and BC Ministry of Transport have all been very generous. I believe these online courses will greatly improve the style, professionalism and efficiency of the avalanche search and rescue response in Canada. By delivering information in an interactive way, these courses and the information they contain will help save lives. This is something that will make a better name for us all.

>>Ken Wylie is the Lead Content and Curriculum Developer for the CAA's eTraining Project



eTraining Development Team

Subject Matter Experts

Tim Auger	Mountain Guide
James Blench	Mountain Guide
Mike Boissonneault	BC Ministry of Transport
Dr Jeff Boyd	Emergency Physician
Stephane Gagnon	Centre d'avalanche de la Haute Gaspésie
Jeffrey Haack	BC Provincial Emergency Program
Kyle Hale	Canadian Avalanche Rescue Dog Association
Clair Israelson	Canadian Avalanche Association
Jordy Shepherd	Parks Canada Public Safety Warden
Ian Tomm	Canadian Avalanche Association
Jeff Warden	Department of National Defence
Ken Wylie	Canadian Avalanche Association

Managers Review Panel

Jim McAllister	BC Provincial Emergency Program
Dominic Boucher	Centre d'avalanche de la Haute Gaspésie
Paul Crober	Department of National Defence
George Field	Kananaskis Country
John Forrest	HeliCat Canada
Todd Guyn	Association of Canadian Mountain Guides
Vince Hammer	Royal Canadian Mounted Police
Anton Horvath	Canadian Avalanche Rescue Dog Association
Robert Lajoie	Royal Canadian Mounted Police
Marc Ledwidge	Parks Canada Public Safety
Jimmy Spencer	Canada West Ski Areas Association
Kevin Wallinger	BC Provincial Emergency Program

Subject Matter Advisory Panel

Dave Brewer	BC Search and Rescue Association
Scott Grady	AST Provider
Manuel Genswein	Avalanche Prevention and Rescue Training Specialist
Mike Innis	Emergency Physician
Marc Piché	Mountain Guide
Lori Zacaruk	Avalanche Educator

The Greatest Snow Show on Earth

The ISSW 2008 committee gets ready to merge theory and practice in Whistler

By Helene Steiner

As fall approaches, the ISSW 2008 committee has made big strides forward. Since the logo contest did not bring any satisfying results, we went to local Whistler artist Eckhard Zeidler. The Black Tusk is a great Whistler icon and Eckhard has done a wonderful job of recreating it for us. Look for our new logo on all our souvenirs, banners, printed material and website.

On our website, the content is in the final stages of being edited and the site is up and running. Check it out at www.issw2008.com. Also, the Papers Committee is taking submissions. If you would like to submit a presentation or a poster, go to "Papers & Posters" for more information.

Marmot has once again committed to being the Presenting Sponsor. Supporting sponsors include Arc'Teryx, Pieps, CIL Orion and Whistler Blackcomb. Contributing sponsors are Backcountry Access, Ortovox, Mammut and Canadian Mountain Holidays. Recco will also be on board. Thanks to all our sponsors and remember them when you need gear.

There are still spaces available for sponsors. If your company is interested in becoming a sponsor, go to our website and click on "Sponsorship" for more information. Positions are filling up so please get in touch with Sponsorship Chair Andrew Wilkins at geoclimb.andrew@gmail.com as soon as possible. We promise great exposure for the avalanche community from this exciting event. Besides prime space for sponsors in the entrance foyer, there will also be standard trade show space. Click on "Tradeshow" for more information.

We have blocked out hotel space for great rates at the Whistler Delta Village Suites, the Listel Whistler and the Whistler Pinnacle hotels. Destinations West Marketing has condos available to delegates at great prices as well. Who says Whistler is expensive? Thanks to Intrawest, we can also offer accommodations at a very economical rate in Whistler/Blackcomb staff housing for only $15.00 a night. This rate is based on a shared room, bunk beds, with a maximum of two people per room. So hurry, and make your reservations by clicking on "Lodging."

We have a great list of activities planned including a ladies night, a movie night on top of Whistler Mountain with live entertainment, mountain biking, a golf tournament and "Zip Trekking" to name a few. Bring your spouses and significant others as Whistler Village is full of great entertainment and activities at all times of the year. There is no such thing as off season in this first class resort town.

Of course, we are always looking for volunteers to join our team! If you are keen to be involved, have some great ideas or special skills, we would love to hear from you. Feel free to contact any one of us on the ISSW 2008 Team.

Brian Gould	*Chair*	brian@hautealpine.com
Helene Steiner	*Co Chair*	catours@telus.net
Andrew Wilkins	*Sponsorship Chair*	geoclimb.andrew@gmail.com
Central Email		issw2008@avalanche.ca
Website		www.issw2008.com

Industry Training Programs

By Ian Tomm

September 4 marked the official opening of registration for the bulk of the CAA's industry training programs. We are experiencing a significant increase in early season enrollment this year . As of September 26, our Level 1 program is 70% booked and bookings continue to stream in to the office. This season marks a significant departure for the Level 1 program in that we have more hut-based courses then courses based in a town or community. Our students have requested this, we've responded to those requests and it has been very favourably received.

We opened up the Level 2 program this year on May 1, marking the sixth season now that we've started this registration process in the spring. The Level 2 program has shrunk a little from last year. We have two Module 1 courses, three Module 2's and three Module 3's. This is down from 2006-07, when we held four courses each of Module 2 and 3.

Mapping also opened in the spring and, while enrollment was slow over the summer, we had a full course by the end of August. At press time the course is running in good old-fashioned Kootenay rain. Marc Deschêne, Alan Jones and Brian Gould are instructing on the program with a valued guest appearance from Peter Schaerer.

Interest in the CAA's professional development seminars has also increased this year. We have a revised weather program, taught by CAA Curriculum Developer Ken Wylie and Uwe Gramann of Mountain Weather Services (for more information on this course, see page 18). We're quite excited about this new program and are please to offer two introductory courses (Revelstoke and Whistler) and one advanced course (Canmore). Of particular note, we are offering Level 1 students the introductory weather course for only $75.

Avalanche training for the Canadian Forces has once again expanded to include one early-season course at Monashee Powder Snowcats with SAR Techs. We are also working on a custom Level 1 course for another division of the military in January, hopefully at White Cap Alpine near Pemberton, BC.

For additional information on all our training programs including dates, locations, prices and more, go to our website at avalanche.ca/registration.

>>Ian Tomm is the Operations Manager for the CAA

Learning to Teach

The CAA's Instructional Skills Workshops

In the coming months, the CAA has arranged an opportunity for its professional-level course instructors to improve their teaching skills. The Instructional Skills Workshop (ISW) is a three-day peer-based workshop, developed in BC in the early 1980's. The ISW is centred on the learner, with an emphasis on experiential and participatory learning. Using guided practice and role play, participants teach mini-lessons, and give and receive constructive feedback. The overall purpose of the ISW is to help participants develop increased competence and confidence as facilitators of learning and to provide resources to assist individuals to become more reflective teaching practitioners.

The ISW is now offered in more than 100 colleges, university colleges, institutes, universities and industry training organizations across Canada and the US, as well as in 17 other countries around the world. It is supported by the ISW International Advisory Committee. For more information on the ISW, check out www.iswnetwork.ca. Individuals who successfully complete the ISW, presenting three mini-lessons, may receive credit for PIDP 3102 - Instructional Techniques in the BC Provincial Instructor Diploma Program. This program is offered by Vancouver Community College on behalf of the BC Ministry of Advanced Education.

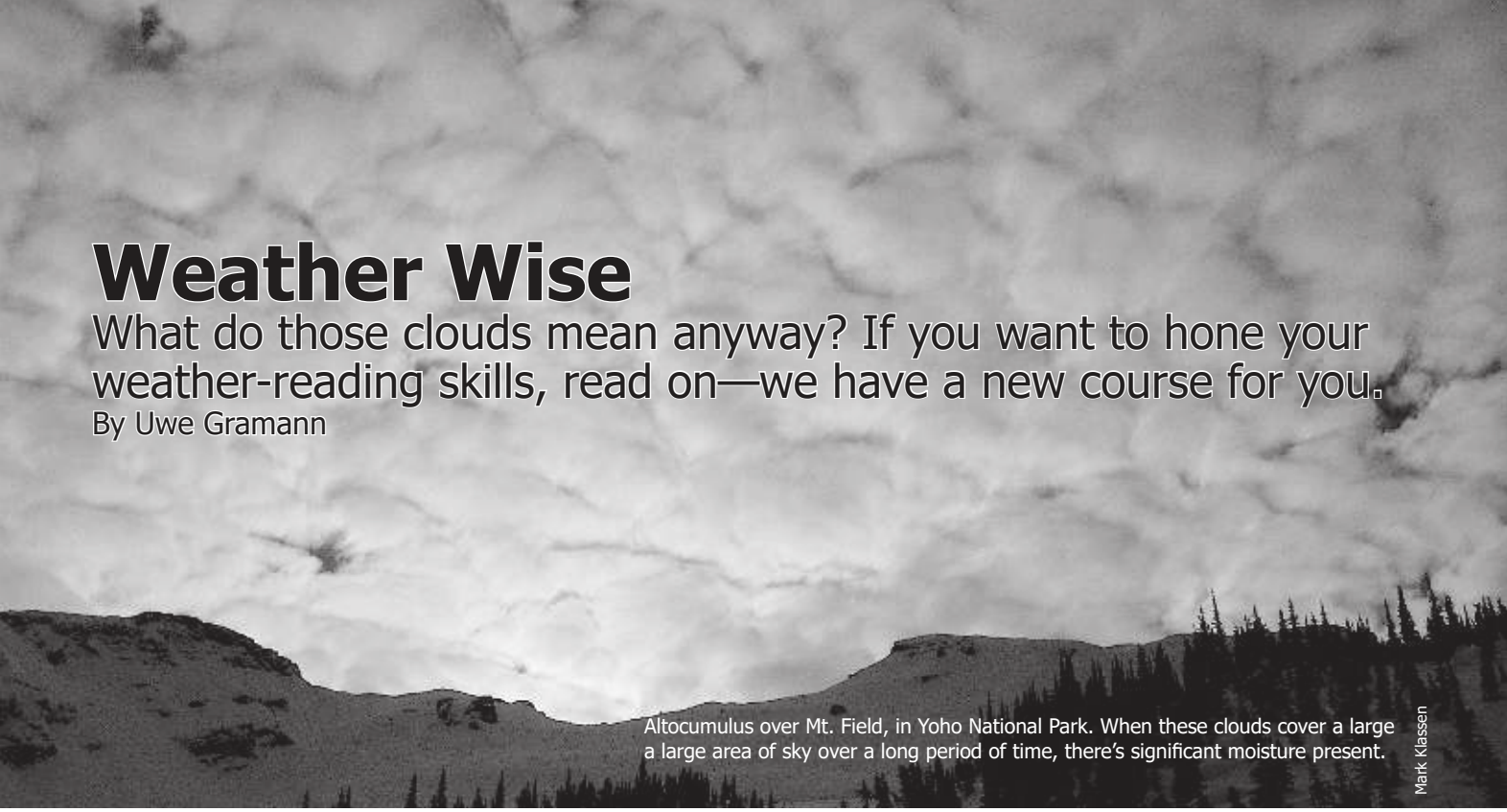
The CAA's Instructional Skills Workshops are led by Jan Johnson. In addition to being a CAA board member, Jan is a Facilitator and Instructional Developer at the UBC Centre for Teaching and Academic Growth. The workshops will be held in Vancouver on November 16-18 and in Revelstoke December 14-16.

Troy Grant

Weather Wise

What do those clouds mean anyway? If you want to hone your weather-reading skills, read on—we have a new course for you.

By Uwe Gramann



Altocumulus over Mt. Field, in Yoho National Park. When these clouds cover a large a large area of sky over a long period of time, there's significant moisture present. Mark Klassen

Are you interested in how to understand greater detail in weather events and their connection to the snowpack? Would you like to know more about the current weather situation before you go outdoors? Would you like to be able to look at a weather map and have a better idea of what it means as far as skiing quality and avalanche hazard? If you've answered yes to any of those questions, then our new weather course is for you.

Meteorology and its impact on the snowpack constitute a major ingredient in avalanche forecasting as well as outdoor safety. At the same time, most outdoor enthusiasts and young professionals have limited confidence in their weather assessment skills and the weather's connection to avalanches. This is mostly due to a lack of knowledge and tools. For this reason the CAA and Mountain Weather Services have developed a course we're calling "Weather for Avalanche Professionals and Winter Outdoor Enthusiasts." This two-part course is aimed at first filling your knowledge gaps and then introducing advanced methods for meteorological assessments and forecasts.

Part 1—Introduction to Weather—is held over two days. Here, you will be introduced to a real-life avalanche cycle that occurred in February 2007. We'll follow its meteorological development over the course of one month as you learn to read professional forecasts and satellite images. The emphasis will be on weather's effect on the snowpack and you will gain a good understanding of how weather contributed to one of the biggest avalanche cycles of last season.

This hands-on course is mainly aimed at people who are new to the interactions between the snowpack and meteorological principles, as well as for students who wish to firm up their current knowledge. You will be introduced to publicly available tools and methods that help you assess any weather scenario over the mountains of western Canada.

Part 2—Advanced Weather—is a three-day course, which will again lead you through a real-life avalanche cycle. Here, you will be introduced to the more advanced principles and tools of mountain meteorology, such as numerical weather prognosis, tephigrams and hodograph analysis. Through several group studies you will gain an appreciation of how meteorological parameters influence snowpack stability and how changes in those parameters can be seen days in advance. You will walk away with a firm grasp of meteorological terms, a good familiarity with tools available on the internet, the ability to assess weather changes in the field, and a method to assess future situations with new knowledge.

Uwe Gramann Collection

Uwe Gramann was born and raised in Stuttgart, Germany and has a Masters degree in meteorology from the University of Karlsruhe. He immigrated to Vancouver in 1992 where he worked for several years as a research assistant on a climate change research project called BOREAS, conducted in part by UBC. He went on to become a certified meteorologist with Environment Canada in Kelowna in 1998 and in 2006 he established his own meteorological consulting company, focusing on customizing weather model output and meteorological education. Uwe now lives in Smithers, BC.

Want to Know More?

The CAA's new weather courses have been developed and will be taught by Uwe Gramann, a highly experienced meteorologist and environmental educator, and Ken Wylie, mountain guide and educator with the CAA.

Intro to Weather
Where and When: Revelstoke October 27-28, Whistler November 29-30
Course costs: $275
Special Note—If you're enrolled in a CAA Avalanche Operations Level 1 course this season, take Intro to Weather for only $75
Prerequisites: None required

Advanced Weather
Where and When: Canmore Nov 10-12
Course costs: $400
Prerequisites: CAA Level 1 or equivalent. Intro course recommended but not required for people actively working in avalanche control operations.

Cirrocumulus over the Valkyr Range in the southern Selkirks. These clouds can be the harbinger of an approaching weather system.

Mark Klassen

Setting the Standard

On August 15 of this year, Canada's avalanche community lost one of its leaders when Fred Schleiss died. A pioneer who brought international recognition to the avalanche control program at Rogers Pass, Fred's legacy will be felt for many years to come. Below is the eulogy that was read at Fred's funeral, written by Dr. John Wood. Following the eulogy, we have some memories from two other men who worked with Fred for many years—Peter Schaerer and Bruce McMahon.

Parks Canada

Remembering Fred

Dr. John G. Woods

It will come as no surprise that Fred and I met over coffee. It was a hot mid-summer afternoon in 1975 and Fred was on a then-rare visit to the Revelstoke park office. I was newly arrived from Ontario with lots of experience in the woods but not in the mountains. I was gearing up for my first glacier-crossing trip and I knew that my soft "bush boots" would be useless. When Fred walked into the room, in came the expert I needed.

Coffee cup in hand Fred was ready with instructions: "You need cramponfast boots John." By then I knew that crampons were sets of metal spikes you strapped onto your boots to give you traction on glacial ice. But "cramponfast" was a new term to me. As it turned out, the boot-clerk in Mountain Equipment Coop also needed to add this term to his vocabulary. We eventually concluded if the boots had sturdy soles and tough leather sides, they would fit Fred's definition of "cramponfast." Fred's advice was concise, I bought the right boots for the job, and I had had my first lesson in Fred's English!

Over the years that followed, Fred spent more time in the Revelstoke office and I spent more time in Rogers Pass. Any office was brightened by Fred's energy and he saved me (and others) from many boring management meetings. His style was direct, factual and loaded with first-hand experience. Peppering the conversation with interesting expressions, he could be counted on to make sure everyone understood his point, or would by the time they left the room. His persistence to duty—in this case the avalanche safety of the traveling public—never faltered. Thanks to Fred, we all learned a great deal about the requirements for a world-class avalanche control program and about professionalism.

In these meetings I also learned my favourite word from Fred's English dictionary—"backwash." Fred used this word in conversation as a synonym for feedback. Don't expect reaction, feedback, comment or suggestions on a project, expect backwash. To me it is a perfect term: concise, vivid, and combined with just a hint of wariness that the feedback—the backwash—might not be totally pleasant.

As luck would have it, my first major assignment as a biologist at Mount Revelstoke and Glacier National Parks was to prepare a plan for the history of transportation through Rogers Pass. This history started in 1881 with the Pass's discovery and, in my view, is being continued every day into the present. Not only was Fred interested in the past, but along with his brother Walter, he was a participant in the on-going war with snow in Rogers Pass every winter. Spending time with Fred was like being a correspondent from the future able to revisit the past and talk, walk and

ski with the person in charge.

Fred and I became both friends and colleagues. Together we explored the mountains above Rogers Pass—Fred as the teacher, me as the student—and we both marveled at the beauty of the natural world we were paid to work in. This was all the more remarkable because when I started in Glacier I couldn't ski. My lessons had three parts—following Fred on the uphill climbs (and taking my equal turns breaking trail), enjoying the scenery, coffee and lunch from the top, and then tackling the downhill. We did the work on the way up; we had the fun on the way down.

"We go Abbott," "We go Fidelity," "We go Hermit." These were all Fred's English for, "Get your kit together, find the door, the mountains are waiting!"

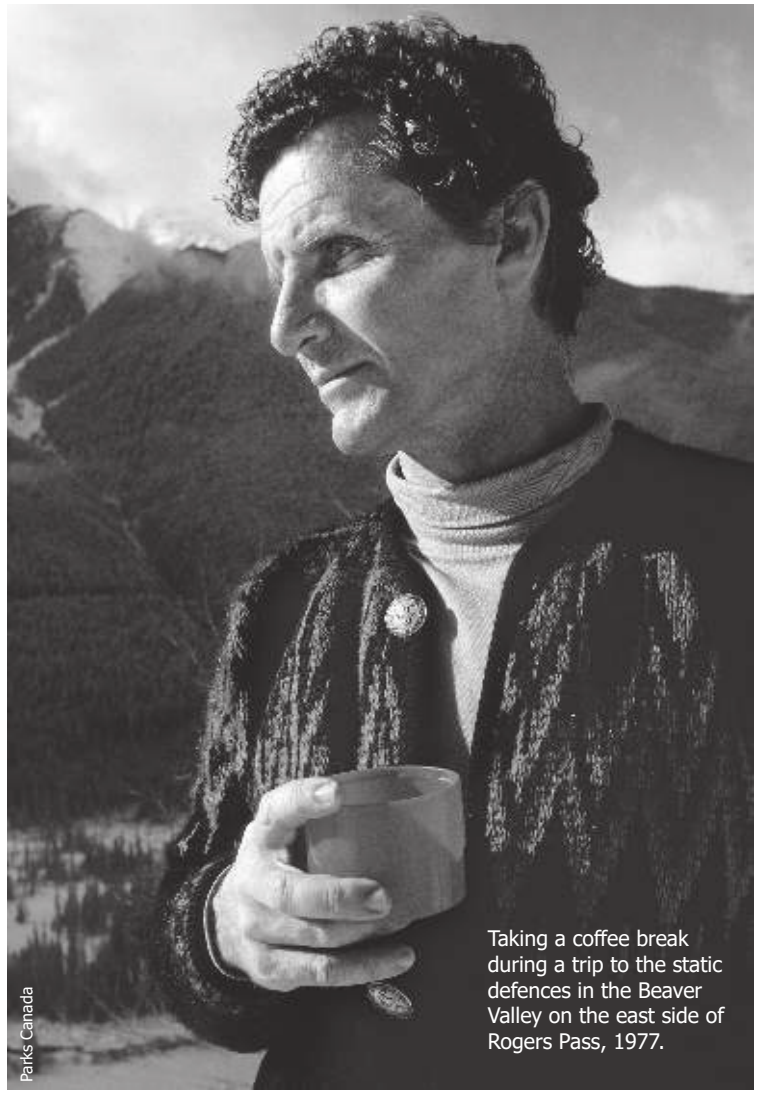
As a mutual trust developed, Fred and I tackled more challenging projects. For example, when a professional film crew couldn't get good footage of an avalanche because of poor weather, we decided to give it a try. This involved me setting up a movie camera in a slide path and Fred shooting an avalanche down at the camera and me.

My job was to make sure the camera was working while the slide hurtled towards it and to take appropriate evasive action if necessary. Fred's job was to decide when, where and how to shoot the avalanche. On our very first try the snowslide came bigger than expected and partially buried the camera. As instructed, I had taken the appropriate evasive action. The movie *Snow War* starring Fred Schleiss has now been seen by hundreds of thousands of people in the Rogers Pass Centre and millions of people around the world on TV.

I wasn't always good at following instructions and Fred made it abundantly clear when my mountaineering skills needed a tune-up. Each of these was a learning experience that later helped me in the mountains. "John, why choose that route when there is a safer one to the left of the boulder? Save your luck for times when you don't have a safe choice." Or, "We're on a glacier John, never ski past me; you could end up in a crevasse." And especially, "John, don't fall, you'll go over a cliff!"

This last bit of Schleiss advice was my favourite. As many of you will know, skiing requires confidence and a warning about falling sometimes doesn't help. I clearly remember Fred saying this to me on two occasions. Once when we were descending from Sapphire Col to the Lily Glacier and once while skiing from South Peak to the highway. It was good advice. In life there are some times when the only solution is exactly that—just don't fall.

Our adventures over the years developed into other shared projects, each with a strong outdoor component. One of our best was the *Avalanche Atlas* for Rogers Pass. I say the best because it involved lots of outdoor photography with Fred in the winter. We also had a lot of lively discussions over the facts—a job shared by Fred, Walter, Dave Skjonsberg and I.



Parks Canada

Taking a coffee break during a trip to the static defences in the Beaver Valley on the east side of Rogers Pass, 1977.

Our "editorial" meetings in the Revelstoke office certainly livened the place up. As others confided to me in later years, despite a firmly closed office door, the combination of our deep voices, forthright expression styles, and enthusiasm for the subject made it sound like we were having a fight. The staff didn't know whether to go for coffee or call the police!

The three experts—Fred, Walter, and Dave—would debate a fine-point of avalanche control between themselves while I sat listening and typing away. From time to time they would notice I was typing without waiting for their conclusions and everything would stop as they united to look over my shoulder at the words on the computer screen. This sudden silence probably worried the staff even more!

A proud Austrian by birth, Veit Gottfried Schleiss was born to a mountaineering-oriented family in Gurk on July 21st, 1929. A natural athlete, Veit specialized in mountain sports and by 1943 Veit had passed through kindergarten, elementary, and middle school and started a five-year college program in construction and engineering. Veit's college years were difficult, living away from home at a time when both accommodations and food were scarce. His school was bombed and

...Setting the Standard

At the SRAWS observation hut on Mt. Abbott, 1978.

Parks Canada

at Christmas, 1944 his whole class was drafted into a "Werwolf" unit attached to but not part of the regular German army. Posted to Northern Italy and Yugoslavia for six months, Veit instructed mountaineering skills and skiing.

With the end of the war in 1945 Veit had the misfortune of drinking polluted water and becoming terribly sick with two strains of typhoid fever simultaneously. Ever the survivor, he recovered, returned to school and graduated in 1948. For the next seven years the new graduate worked on several major construction projects in Austria including a high dam, a mountain tunnel, and a river diversion. During the summers, he surveyed for avalanches and located defense structures. During the winters he ski raced, coached, and boxed.

A second phase of Veit's life started in 1955 when he immigrated to Canada. He wanted to see "bush life" and appropriately headed for Prince George where he worked at a sawmill. There, Veit adopted the English name Fred and continued his youthful interests in boxing and ski racing. His boxing eventually lead him to the Golden Gloves competition in Vancouver and his ski racing to a job as coach of the American soldiers stationed at a radar base near Prince George. These activities came to the attention of the Park Superintendent of Jasper National Park who offered Fred the job of "alpine specialist." This was a perfect fit for the young mountaineer and in 1956 he moved to Jasper. His winters were focused on Jasper's ski hill and his summers at the Columbia Icefields where he advised climbers and led rescues when they got into trouble.

In 1959, Fred moved from Jasper to Glacier National Park where he worked for the newly formed Avalanche Section in the winter and was the park alpine specialist during the summer. During those early years in Glacier he helped establish the methods for avalanche control, and taught courses in mountain rescue techniques and backcountry skiing for park wardens and the RCMP.

These years were also times of immense change in Fred's personal life. In 1960, with National Parks' sponsorship, he became a proud Canadian citizen. In 1962, he married Edith and over the next four years became the proud father of Mary and Johann.

In 1965, Fred took over leadership of the Snow Research and Avalanche Warning Section—the largest direct-action avalanche program in the world. This position was both a huge responsibility and a source of immense personal pride. Today Fred is recognized as a leader in the development of observation methods and recording standards for avalanche control, and much of his original training manual remains the industry standard. Perhaps

most importantly for the profession, under Fred's watch Rogers Pass became the training grounds for scores of avalanche observers who have now made their way, and taken their skills, into the mountains around the world.

Ever the expert and dedicated communicator, Fred shared his knowledge with everyone who either needed to know about avalanche safety or wanted to know about the world-class program in Rogers Pass. As a public speaker he could engage an audience within moments—sharing his stories, his perspectives, and his unique and colourful English phrases. His public-speaking venues included regular orientation sessions for the winter staff in Rogers Pass, lectures in the United States and Switzerland and, in February 1978, to the Royal Canadian Institute in Convocation Hall at the University of Toronto.

In May of this year the Canadian Avalanche Association honoured Fred with a life-time achievement award for his contribution to the working standards of the profession. I think Fred would consider his outstanding working-life achievement as the safe passage of millions of highway travellers through some of the world's most active avalanche terrain.

Today I'm proud to remember Fred as my colleague, as my friend, and as my mentor. I'll never forget his energy, his sense of purpose, and his clear direction. Whatever the shape or name of your mountain—Go Abbott! Go Hermit! Go Fidelity!

Memories from Peter Schaerer

With the passing of Fred Schleiss, the CAA has lost a pioneer of avalanche safety and control. Fred was a leader by nature, had high standards and strong work ethics. He was a stickler who required his crew to carry out the observations by strict rules, to keep neat and complete field notes, and to carefully draw snow profiles and graphs of the weather. A manual, written by Fred and his brother Walter, that laid a system for making weather, snow and avalanche observations was strictly enforced. That manual later formed the base of the observation guidelines of the CAA.

Fred had to fight, often using drastic and convincing words, with his superiors, the local park wardens and the road maintenance staff to create an awareness of the avalanche hazards, and effect highway closures through quick and reliable avalanche control by artillery. His efforts resulted in one of the most efficient avalanche safety operation of its kind, serving as a model for other highways.

Parks Canada

Cougar Valley, 1980.

In December 1971, after receiving several requests from ski areas, the mining industry, and railways, Fred and I held the first week-long avalanche training course for industry at Rogers Pass. The manual for the local observers formed the base of the program and copies of the observation guidelines were handed to the course participants. Later course leaders were unable to convince Fred to continue serving as a full instructor, but he continued to participate in avalanche courses at Rogers Pass by giving selected lessons. I remember the students joining in spontaneous applause at the end his lessons, whereas other instructors did not receive this honour.

Fred applied his high standards when he served as the president of the CAA from 1984 to1986. At meetings of the directors he kept the discussions focused toward making decisions. In the mid 1980's, the CAA was small, had no office or hired staff, and encountered few demands but Fred visualized greater tasks in the future. He insisted on building up funds that proved essential later, when the CAA assumed the organization of the industry training courses.

Fred liked to communicate. While I carried out research on avalanche properties at Rogers Pass, Fred and I often had long discussions during slack times when the snow stability was good and there was no avalanche activity. Sometimes my work diary contained only the note "discussions with V.G. Schleiss" for the principal activity of the day.

In 1991, Fred retired at the age of 61 when the Government of Canada reduced staff by offering early retirement. Among his legacies are the continuous and efficient avalanche safety operations at Rogers Pass, as well as the observation standards his co-workers introduced to other avalanche safety operations. These standards were also instructed in courses and have been carried through many revisions of the Observation Guidelines and Recording Standards of the CAA.

>>Peter Schaerer is a retired engineer who spent most of his career as head of the Avalanche Research Centre for the National Research Council of Canada.

Remembering Fred

By Bruce McMahon

I first met Fred Schleiss when I arrived for my first day on the job as an avalanche observer with the Snow Research and Avalanche Warning Section (SRAWS) at Rogers Pass. It was the winter of 1980/81, a season prolific with storms that created some impressive province-wide avalanche cycles. I was hired in the spring, after spending the winter roaming the backwoods of Alberta and BC with friends, searching for powder snow between storms. We were avalanche savvy, but hardly educated. After a particularly close brush with disaster on a slope that had fractured in front of me but luckily hadn't released, I concluded that in order to keep enjoying the pow, I needed to know more about avalanches. I needed to get educated!

Brad White

With CAA President Steve Blake at his side, Fred acknowledges the standing ovation he received at the AGM, spring 2007.

So, on the first day of work, keen and energetic and in great shape from the winter ski-touring, I made the early morning drive from Canmore making sure to be on time. I had been warned to expect a demanding work environment so I certainly wanted to be punctual. When I walked in 5 or 10 minutes early, the first thing Fred said to me was: "You're Late!" It turned out that anything less than 15 minutes early to work in the morning wasn't showing enough commitment or dedication.

Those early years working with Fred were full of lessons in humility. Fred held a high standard of care in everything he did and expected his avalanche control team to do the same. Note taking always had to be impeccable. No details missed, no assumptions made. Mistakes weren't acceptable. Fred regarded a mistake in collecting snowpack data, or missing an avalanche observation, in the same manner as a grave route-finding error on an avalanche day. It's hard to argue against principles like that.

That's not to say there weren't some arguments. Anybody who knew Fred also knew he liked a good argument. Fred wasn't a tall man but his stature was huge, especially at those moments when he would impress a point of importance to us. He had a confidence and demeanor that was both intimidating and inspiring, at least from my perspective as one of the hired guns.

Fred was at home in the mountains—a very experienced and capable mountaineer. His movements were always relaxed and efficient. This was true on the long marches to mountain peaks or on the routine trips to telemetry stations. Fred established a network of backcountry huts to provide the requisite snowpack data needed for his analysis. These same stations still provide the bread-and-butter information used by the avalanche forecast team today.

Fred also placed a high value on physical fitness. He expected his team to be in top condition physically and still be able to think and react quickly. Those routine trips were not for the faint of heart. Through the deep snow, the pace was very swift, "SRAWS pace" as it came to be known. I thought myself in good shape but would still be amazed at both Fred and his brother Walter, as they climbed so gracefully and deliberately, while I was ready to cough up a lung. My favorite memories were ski-skill or route-finding exercises where Fred would share his knowledge of moving in mountain terrain, treating every slope as an avalanche slope and every day as an avalanche day.

As the years went by, I became increasingly more respectful of Fred's knowledge and skill as an avalanche forecaster. We worked together through some impressive, direct-action avalanche cycles, many of which were simply caused by too much snow, too fast. However it's not those routine situations that stand in my mind now. Rather, it's those oddball combinations of snowpack and weather that would gel, seemingly without warning, to produce unexpectedly large and destructive avalanches. Without the benefit of InfoEx or real-time remote data, Fred would time and time again amaze me with his ability to be at the right place at the right time, 24/7.

In more recent years I sometimes find myself at a computer monitor at 2 o'clock in the morning, having been awakened by another computer somewhere sounding the alarm on some combination of weather parameters. I look, staring blankly at the screen, adjusting my eyes and trying to make sense of the virtual snowboard or watching the graph climb as the wind steadily rises. Often in those moments, I wonder how Fred could have been so in tune with a given situation without all this new and instant technology. And then I remember those early lessons—the emphasis on being accurate, on being forever diligent, and being totally committed to your work. And always, the most important lesson of all—never let your guard down! And then I think of that first day as an avalanche professional and smile. Fred was a great mentor and the avalanche world has lost a giant.

>>Bruce McMahon is the Senior Avalanche Officer for Mt Revelstoke and Glacier National Parks

Teaching the Black Art

Can everything that counts be counted? Quantifying the art of avalanche forecasting.

By Ian Tomm

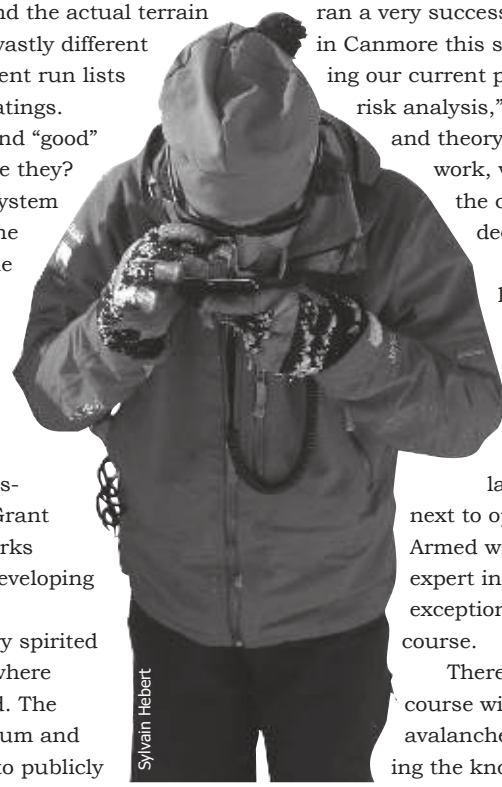
A couple of years ago, the CAA began working to develop an Applied Avalanche Forecasting course. The folks involved put a lot of energy into it but struggled to translate the science and art of forecasting into a logical and coherent curriculum. Greg Johnson, Alan Jones and, most recently, Dave Smith have all put time into this project and each are to be commended for their efforts.

One of the earliest attempts at quantifying how professionals forecast snow stability came during the 2004 ISSW at Jackson Hole, when heli-ski guide and software developer Roger Atkins presented a paper on avalanche character. Using data from CMH Heli-Skiing, Roger demonstrated the apparent disconnect between snow stability ratings and the actual terrain choices made by guides. Comparing two vastly different winters, Roger showed how entirely different run lists were produced under identical stability ratings. Clearly, factors other than "poor," "fair" and "good" are being considered, but what exactly are they? Roger suggested a more comprehensive system of stability assessment, which included the consideration of factors such as avalanche size and the behaviour of different types of instability. This early work laid some fertile ground for the ideas to come.

The following spring, the US/Canadian danger scale revision project got underway. With it came more ideas about the processes involved in the assessment of stability and avalanche danger. Grant Statham, Mountain Risk Specialist for Parks Canada, picked up the ball and started developing and refining some of these ideas.

In the spring of 2006 there was a very spirited international bulletin writers' workshop where many new concepts were brought forward. The discussions there provided more momentum and some members of our community began to publicly challenge common thought on avalanche risk and stability analysis. In November, 2006, Chris Stethem, one of Canada's most prominent avalanche safety educators and practitioners, gave a thought-provoking lecture at a CAA Level 2 Module 1 course in Canmore. For many, his presentation started a new train of thought. For others, it reaffirmed a nagging idea.

That same month, Grant presented his new concepts at the Meteorological Service of Canada Avalanche Conference in Vancouver and later at a CAA Industry Training Program instructors training session in the Rockies. These ideas simmered over the winter until the CAA's AGM in the spring of 2007, where Grant presented another interesting talk on avalanche danger ratings. Much discussion ensued and it was clear the time had come to revisit the ideas of stability and hazard analysis and, more importantly, put them in the context of avalanche forecasting.



Sylvain Hebert

Along came ADFAR 2—the second stage of the Avalanche Decision Framework for Amateur Recreationists project. Project manager Pascal Haegeli describes his focus as "developing a common language that will help users of public avalanche bulletins make better use of the information provided. Having a common language will help forecasters share their thoughts and will help users recognize specific conditions in the field and make appropriate risk mitigation decisions."

In the search for that common language, Grant and Pascal ran a very successful two-day Subject Matter Expert meeting in Canmore this spring. "I see what we are doing as translating our current practice into the language and context of risk analysis," says Grant. "Risk analysis techniques and theory give us a common platform from which to work, will unify us and help us better understand the concepts behind hazard forecasting and risk decisions."

The work done by the ADFAR 2 project has breathed new life into the CAA's efforts to establish an avalanche forecasting course curriculum. As concrete risk and hazard definitions are developed, it becomes increasingly viable to establish more objective methods of rating avalanche hazard and to place them in context next to operational realities of risk management. Armed with the theory, practical applications and expert input, we are well positioned to create a truly exceptional and world-class avalanche forecasting course.

There has never been the illusion that one course will instantly create a professional-level avalanche forecaster. Despite all our work in distilling the knowledge of our most thoughtful avalanche experts, text-based lessons are just one factor. As we all know in this industry, once in a while two plus two just doesn't equal four. This course will be an important element in any forecaster's training but field experience will always be primary to the process.

Of course, much work remains. In the next step, Grant and UBC Instructional Developer Janice Johnson will be leading a two-day seminar on ADFAR 2 concepts and the existing Applied Avalanche Forecasting curriculum. The aim of the seminar will be to further refine the curriculum and polish the theory. At press time, that seminar is planned for October 13-14 in Revelstoke, BC. Stay tuned!

>>Ian Tomm is the Operations Manager of the CAA

Level 2 Manual Revision

By Bill Mark

The current Avalanche Operations Level 2 manual was initially compiled during the SAR-NIF ADAPT project completed in 2003. Since that time the manual has undergone some refinements and updates, but this year it was slated for a more thorough revision. We needed to address some of the bigger issues with content and curriculum that have crept up over the years, and we had a number of goals for this revision so including making it a comprehensive manual for not all modules of the Level 2 program.

Changes include a re-write of the hazardous attitudes survey. This material was often criticised for over-generalizing both students and instructors, and using examples not relevant to the avalanche patch. In this area we are fortunate to have input from David R. Hunter from the Federal Aviation Administration, who has been an important researcher in the field of hazardous attitudes and aviation safety. Mr. Hunter has been the source of some very insightful feedback in this area and has agreed to extend his assistance by helping us better understand and use his ideas to enhance the Level 2 program further.

Also of interest is the adoption of Mr. Hunter's hazardous attitudes ideas to other professions outside of aviation, including medicine. A quick internet search will yield some fascinating research on the value of studying and analyzing physicians' hazardous attitudes in managing emergency room situations.

Another chapter that saw a major re-write is the section on risk homeostasis. Previously, we used a chapter from Gerald Wilde's book *Target Risk*. While this is an interesting read, students often found it too intense and not relevant enough to the avalanche profession. The chapter now uses some of Wilde's theories and examples—including decision making and risk management—and applies them to the avalanche industry specifically. This chapter is intended to make Level 2 students think about their own "target risk" and what biases may affect them in their avalanche work.

Another criticism of the Module 1 was the theories are great, but they don't relate to Module 2 or 3 or to the "real world." To address this, each chapter now concludes by asking the student to consider the implications of what they've learned and how it relates to the next modules and their workplace. These headings and subtle course changes are intended to help students make the transition from the theoretical side of Module 1 and integrating these concepts into the "real world."

I would like to thank everyone who gave feedback to these edits of the manual, especially to Pascal Haegeli, Ian Tomm, Ken Wylie, Clair Israelson, Chris Stethem, James Blench and Grant Statham.

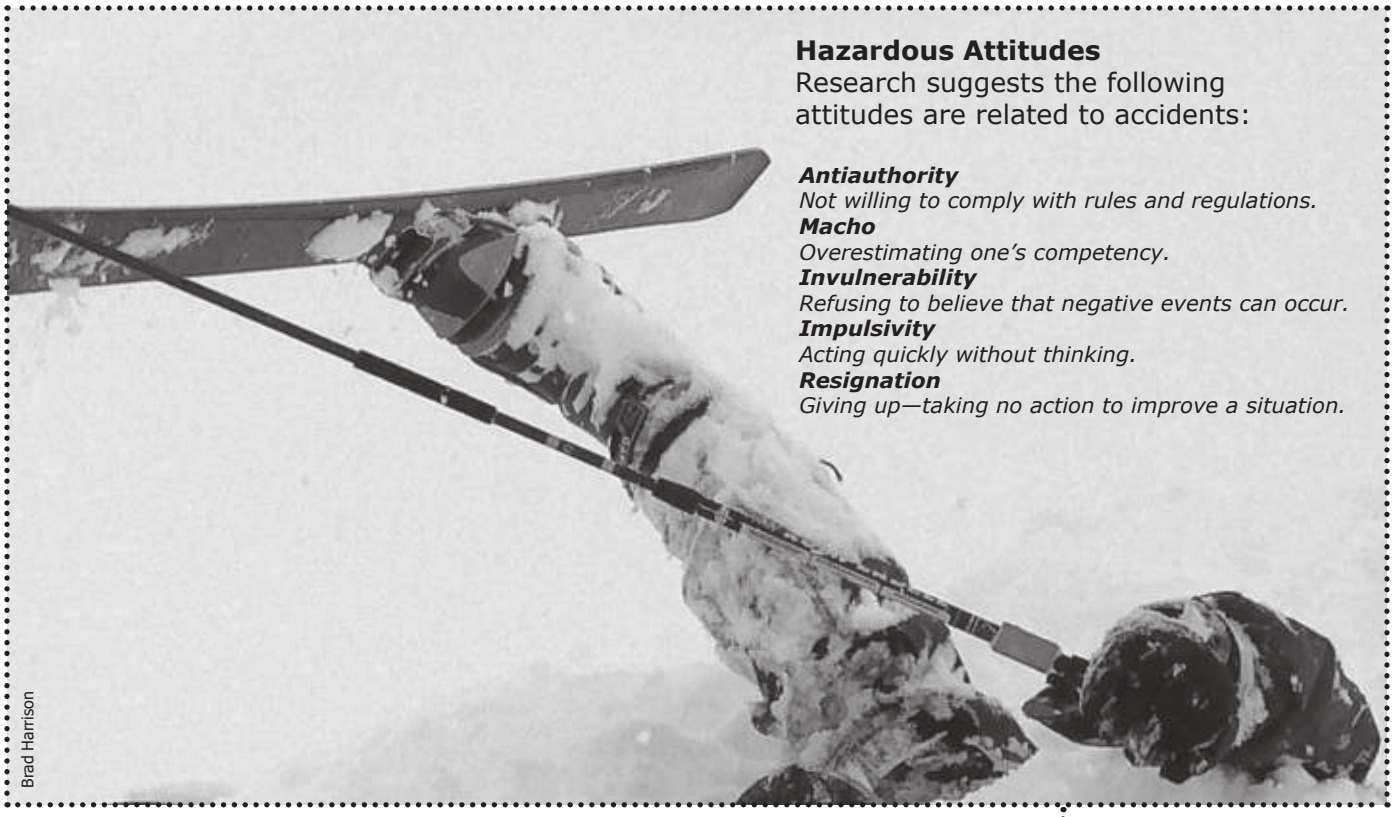
What does Aviation have to do with Avalanches?

During the update of the Level 2 manual, CAA Operations Manager Ian Tomm contacted David R. Hunter, Ph.D to ask him about his work into human factors in aviation accidents. A version of Dr. Hunter's research was already playing a part in the Level 2 curriculum but refinements were needed to make it a better fit. Dr. Hunter became very interested in adapting his research for avalanche safety and gave freely of his considerable talent and expertise.

Dr. Hunter is one of the more valuable resources the CAA has had the good fortune to encounter. Prior to his retirement from government service in 2004, he was the Principal Scientist for Human Performance at the Office of Aerospace Medicine, Federal Aviation Administration, Washington, DC. Some of his accomplishments while at the FAA include:

- Chaired joint FAA-industry team to improve pilot decision-making and reduce general aviation accidents.
- Managed multi-year research effort to improve general aviation safety through application of human factors research and concepts.
- Led research team that developed an extensive suite of training products to improve safety of civilian pilots.
- Assisted foreign aviation authorities in customizing training products—now adopted by all English-speaking nations.
- Conducted in-house research program to identify factors associated with accident risk for pilots.

Dr. Hunter's research into how highly trained professionals make decisions has many implications for our industry. Stay tuned as the CAA continues to find ways to apply this important research to education for avalanche professionals.



Brad Harrison

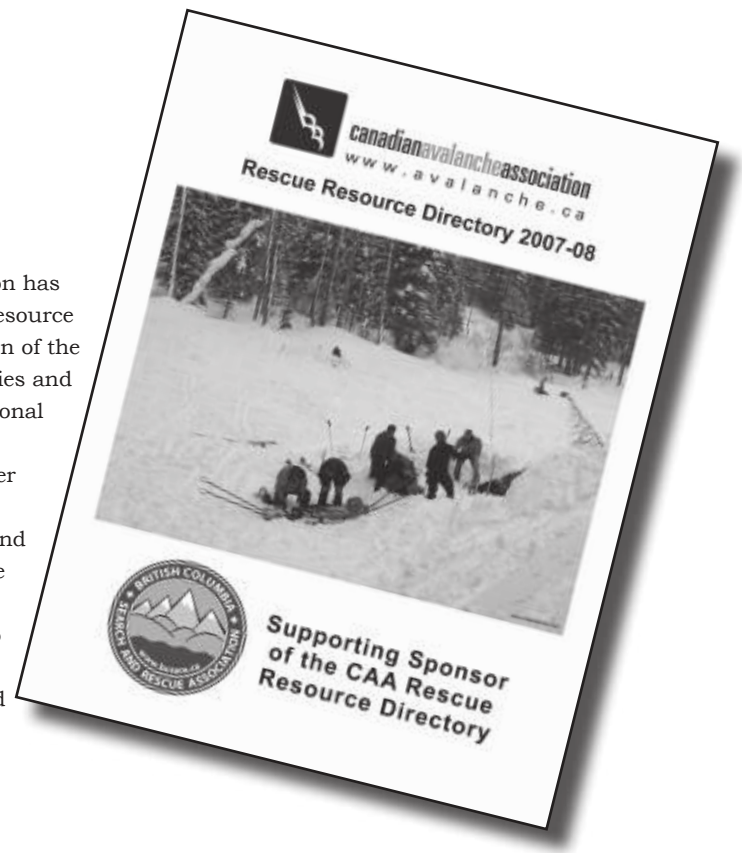
Hazardous Attitudes
Research suggests the following attitudes are related to accidents:

Antiauthority
Not willing to comply with rules and regulations.
Macho
Overestimating one's competency.
Invulnerability
Refusing to believe that negative events can occur.
Impulsivity
Acting quickly without thinking.
Resignation
Giving up—taking no action to improve a situation.

Rescue Resource Directory Hits the Streets

Once again, the BC Search and Rescue Association has generously funded the creation of our Rescue Resource Directory. This directory is an annual publication of the CAA and provides a comprehensive list of agencies and resources available for winter search and rescue and operational support. The CAA verifies each and every piece of contact information and provides this updated directory to the greater avalanche community in BC, Alberta, and across Canada.

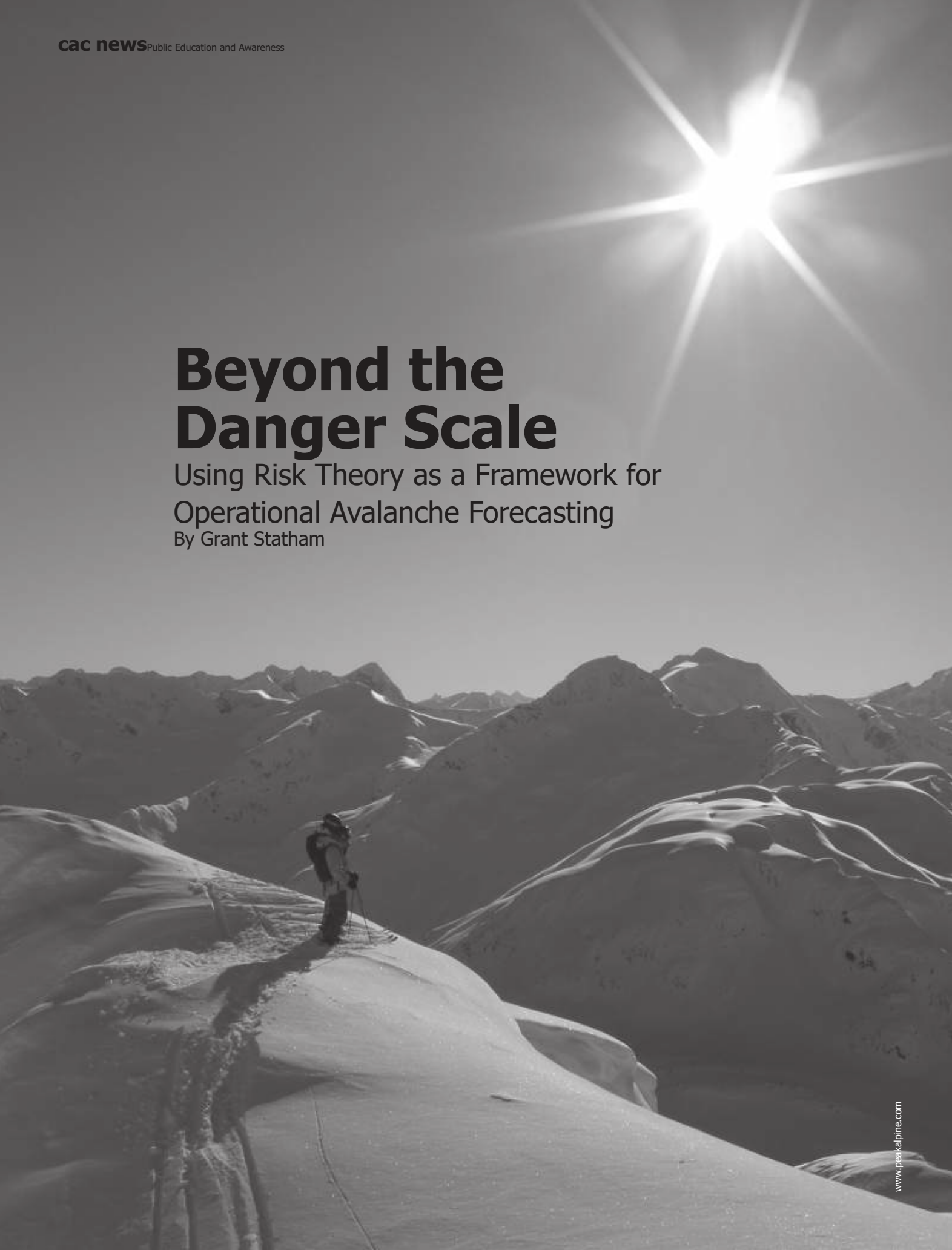
Through the generous assistance of our sponsors and advertisers we are able to offer this publication free of charge to our members and a number of avalanche SAR groups nationally. The Rescue Resource Directory is a great place to highlight your rescue products or services. If you would like to advertise in the Rescue Resource Directory or if you would like a copy for your emergency plan, please contact us at info@avalanche.ca.



Beyond the Danger Scale

Using Risk Theory as a Framework for Operational Avalanche Forecasting

By Grant Statham



www.peakalpine.com

On my first day with Parks Canada, somebody handed me my new business cards branded with the title "Avalanche Risk Specialist." That afternoon I quietly looked up the definition of risk in the dictionary and, without realizing it, took my first step into the world of risk theory. The more I read and learned, the more I realized that the constructs of risk explained those intuitive mountain skills that I had developed. I had always considered myself a practical man—short on theory and long on practice—but suddenly so many of those difficult-to-explain situations became clear to me when viewed through the window of risk.

As I became more familiar with these concepts, I began to realize that we have been trying to structure education and operational systems based on models that don't fairly represent how avalanche professionals actually think and work. The paradigms of avalanche danger and snow stability are entrenched in the Canadian system, but both are incomplete systems that only partially represent reality. The complete picture is best studied through the practices of today's avalanche forecasters, whose intuition and cognitive processes form the core of avalanche forecasting.

Ratings in avalanche forecasting are simply the conclusion of a process, not the main event. More important than any rating is the actual analysis required to get there. Understanding the chance of triggering an avalanche, where this might occur, what kind of problem you're dealing with, and how big the avalanche might be are fundamentally more important concepts than any single rating. Human analysis, reasoning and judgement are the backbone of professional avalanche forecasting, and yet we have always struggled to formally describe what we do and how we do it.

This paper is about using risk as a framework upon which to build operational avalanche forecasting and risk control systems. To build this framework, we have to first deconstruct the processes that go into evaluating avalanche hazard. From there, we can develop a systematic methodology—the need of which has become increasingly apparent in recent years. First, let's begin with some important history.

The Avalanche Danger Scale

Work towards a "unified avalanche scale" began in Europe in 1983, when each country was still using a different system for rating avalanche conditions. The European Avalanche Warning Services (EAWS) worked for 10 years to reach consensus and, in 1993, introduced the five-level Avalanche Danger Scale that remains in use today. The EAWS celebrates this consensus as a major achievement in their history and by 1994 the Avalanche Danger Scale had become the North American standard.

"Human analysis, reasoning and judgement are the backbone of professional avalanche forecasting, and yet we have always struggled to formally describe what we do and how we do it."

Yet even in 2006, when asked to explain the theory behind avalanche danger and how it differed from hazard or snow stability, most professionals answered "danger ratings are for the public and stability is for experts." A hollow reply to say the least, but what more could be expected? Professional avalanche education does not address the concepts of avalanche danger anywhere and focuses on snow stability as the overriding framework for avalanche forecasting.

The Snow Stability System

The OGRS states, "Snow stability refers to the chance that avalanches will not initiate, and does not predict the size or potential consequences of expected avalanches." The CAA training school's shift from hazard to snow stability evolved in the late 1980's by default. Stability essentially removed terrain from the picture, allowing students to exchange information and observations under the common platform of "snowpack structure."

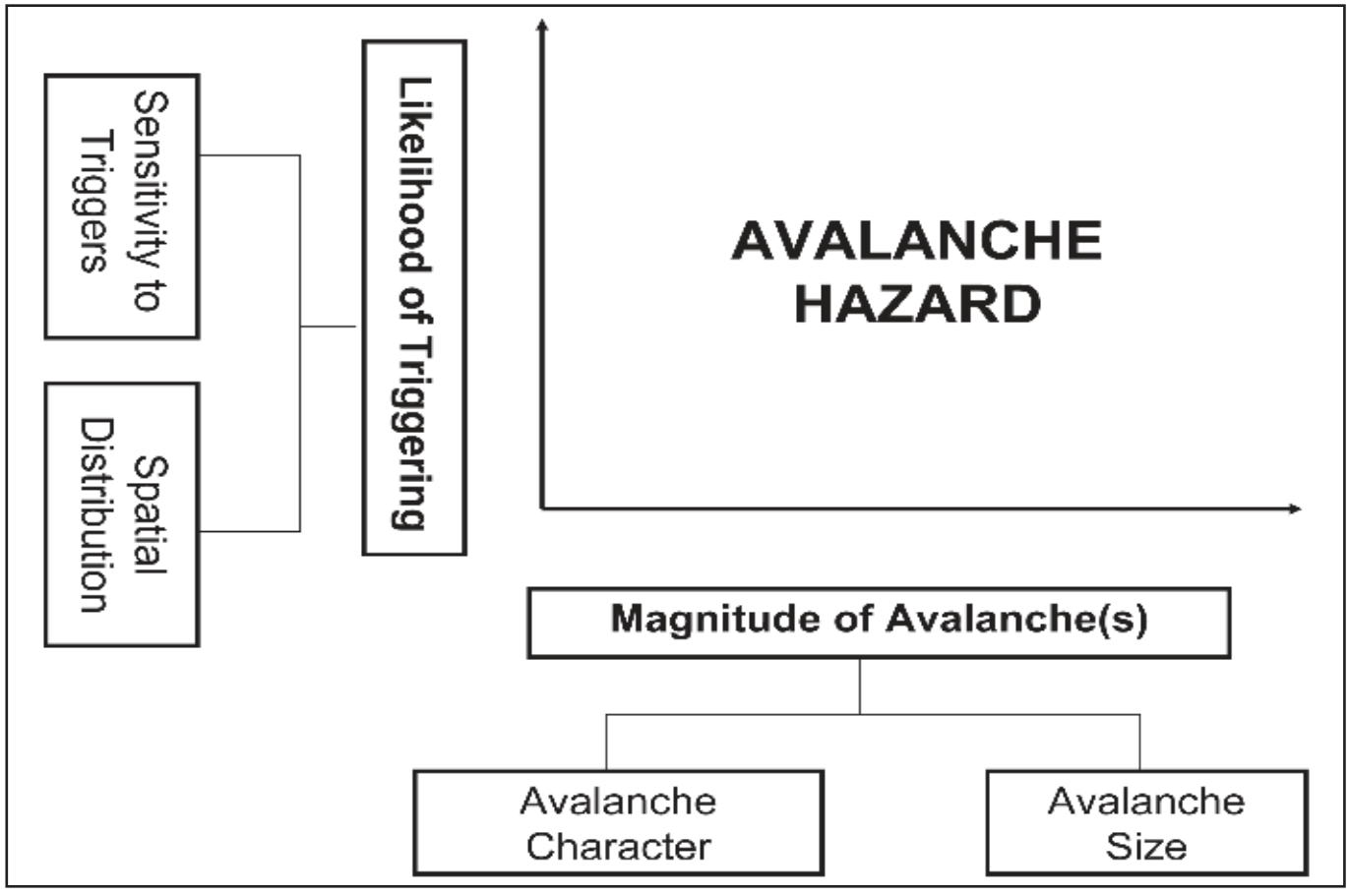
Then along came InfoEx and the need for a common language was extended to communication between operations. The CAA training regime was structured to support this, and stability ratings became further entrenched as the standard method of summarizing professional opinion. With the success and growth of InfoEx as an information exchange and data storage system, submissions have become increasingly data heavy, often delivering just a series of test results with a summary stability rating.

So, InfoEx and snow stability have defined how we have structured our systems today. But consider this: is not predicting the size or potential consequences of expected avalanches arguably the most important consideration of avalanche forecasting? Are we not already considering this intuitively? If so, why do we remain focused on snow stability evaluation as the structural backbone of our systems?

The Theory of Risk

In its most basic sense, risk theory says that risk is a product of the probability and consequence of an undesirable outcome. This is commonly expressed as (R = P x C), and its application to avalanches has mostly been in the context of zoning and land use planning. In this scenario, the exposure of the asset can be known exactly, and the risk can be calculated numerically. But when we consider recreation and the idea of humans seeking and optimizing risk while moving through the mountain environment, it's clear that managing the exposure component of risk becomes the essential step in how that risk is controlled.

Avalanche hazard and avalanche risk are closely related but with a critical difference. Avalanche hazard does not explicitly incorporate physical exposure to avalanche terrain. Hazard exists



The deconstructed components of avalanche hazard

whether we are there or not. Risk directly incorporates the physical exposure of a specific element to that hazard. To begin to understand avalanche hazard, it is necessary to deconstruct its complexity into pieces.

Probability

We invoke probability when we make decisions in the face of uncertainty. Engineers quantify it numerically between 0 and 1; mountain guides qualify it judgementally with words such as maybe or sometimes. Probability expresses our degree of certainty, and every avalanche forecaster knows this to be an entirely subjective representation of our belief.

Probability in avalanche work can be analysed using a variety of methods but essentially involves figuring out the chance of an avalanche occurring. Land use planners refer to this as frequency and use an annual return interval to measure this. But what are the proper units of measure when the time scale of the analysis is hours or days? What we are interested in is the likelihood of triggering, which can be seen as the combined measure of the sensitivity to triggers and the spatial distribution. How easy is it to trigger, and where is it?

Consequence

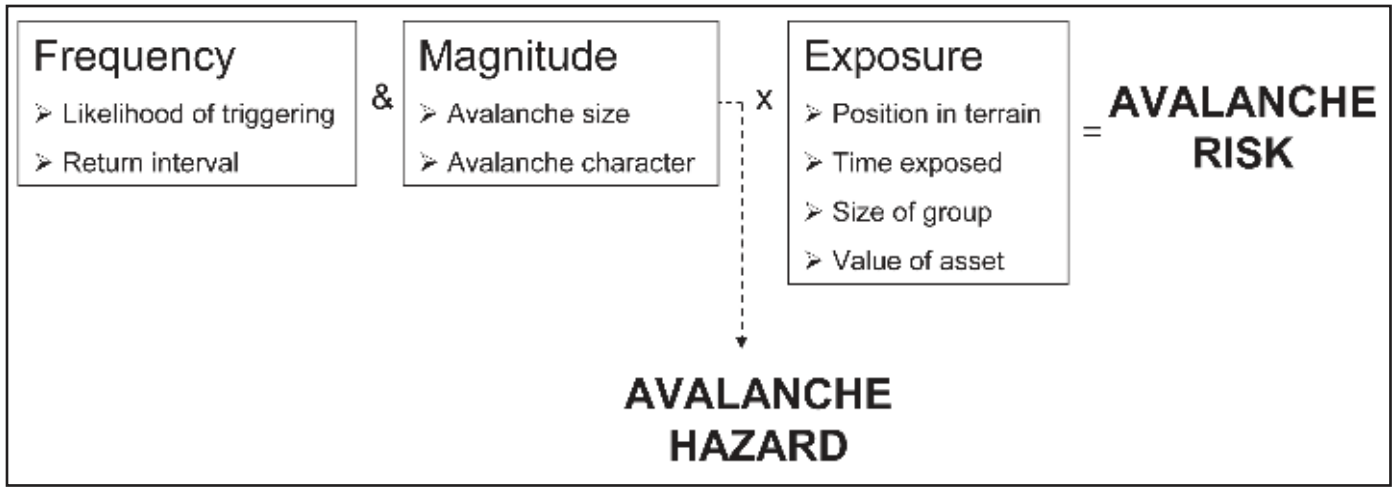
If it goes, what will happen? How big will it be? How far will it run? What will happen to my group, those cars or the pickup? These answers are more precise in land use planning, where we can model exactly what will happen when a size 3 hits a lift tower. But what about those moving humans? Are the consequences to them greater from a persistent instability than from storm snow? Where are they positioned in the terrain? Are they above a cliff where a size 1 matters, or are they on an open slope where a size 1 is nothing?

Consequence in avalanche risk is an extremely complex topic. It's a combination of the type of avalanche problem and the destructive potential of that avalanche, and is directly affected by the nature of the terrain. In operational forecasting, effective analysis of the consequence component requires deconstructing it further into magnitude and exposure.

Magnitude

The CAA's Guidelines for Snow Avalanche Risk Determination and Mapping in Canada describes magnitude as "the destructive potential of avalanches represented in applications either by expected impact pressure or the five-part Canadian system for sizing avalanches." Measuring destructive potential using avalanche size alone is sufficient for land use planning where the assets at risk are static. However, that changes in a dynamic environment, where it's no longer only the magnitude of the avalanche itself that matters but the magnitude of the avalanche problem. Size 3's in storm snow are a different beast than size 3's in surface hoar, and our terrain choices and decision making reflect this.

In operational avalanche forecasting, magnitude may actually be the combined measure of avalanche size and avalanche character. Avalanche character is important for describing what kind of avalanche problem exists, and articulating the differences between deep, persistent instabilities and more manageable



The flow of avalanche hazard and risk.

storm snow instabilities. Avalanche size describes the destructive potential of the avalanche. Together these considerations make up the magnitude portion of the risk equation for operational avalanche forecasting.

Uncertainty and Confidence

Avalanche forecasting operates in the untidy world of uncertainty, a place with little pretence of objective truth. There are few absolutes when predicting avalanches, as Mother Nature reminds us regularly. Avalanche forecasting assigns probabilities to things that are uncertain, and good forecasting admits to uncertainty up front. A "second order probability" describes and quantifies vagueness, and is literally the "probability of the probability." In the avalanche business we would call this confidence.

Confidence derives from numerous things such as scale, or the amount and quality of data. Obviously our confidence is very different when working on a spatial scale of 300 km² compared to 30,000 km², or a time scale of hours as opposed to weeks. Neither is right or wrong, they are simply challenges we face in avalanche forecasting. To be uncertain is not to be wrong, just honest

To this point our processes are shared, as all avalanche forecasting disciplines undertake a hazard analysis. What defines us from each other is when we take the next steps towards risk.

Exposure

Integrating exposure with hazard completes the risk assessment and takes us to the climax of the operational forecasting process—decision making. Likelihood and magnitude together will produce a hazard, but if nothing is specifically exposed to that hazard, there's no risk. Exposure is the final and most important component of risk, measuring when people (or assets) are in the way of avalanche hazard. This is why terrain skills are the most important attribute of any mountain traveller, and how back-country guiding can function all winter, even during high hazard conditions. Managing exposure controls risk.

Land use planning considers exposure to be 0 or 1; either the building is in, or it's out. This contrasts with the primary job of the ski guide, which is to analyse the avalanche hazard, and then manage the degree of exposure to keep the risk at a level acceptable to their clients. This might first be done with a run list and eventually distilled into precise on-slope instructions. Alternatively, both the highway and ski area forecaster incorporate exposure when they decide on terrain closures and control priorities. This is also risk control, and it comes after the hazard analysis. Public forecasting in general does not control risk. Avalanche bulletins warn of hazard, but only the public themselves can determine their own exposure and therefore control their risk.

Conclusion

There is a reason why risk theory is the basis for so many geotechnical and engineering practices—it is sound, and it works. Snow stability evaluations and the simple five-box danger scale constrain us by preventing a complete expression of what forecasters are actually thinking. Restructuring our forecasting, teaching and communication systems around subjective risk assessment techniques will allow professionals to incorporate the full range of knowledge they possess, in ways that correspond with how they actually think. Risk unifies us by better illustrating how avalanche hazard analysis is our common ground, while the different methods used to control avalanche risk are the final and most essential pieces of the specialties we choose.

Acknowledgements

This is a work in progress and many people have contributed to the evolution of this thinking over the past three years. I would like to especially thank Pascal Haegeli, as well as the rest of the group of experts who have helped me bring these ideas to life. They are: Bruce Tremper, Karl Birkeland, Chris Stethem, Bruce McMahon, Brad White, Clair Israelson, John Kelly, Ethan Greene and Susan Hairsine. Thanks also to Parks Canada, the Canadian Avalanche Centre, the National Search and Rescue Secretariat for supporting this work, and to Steven G. Vick for his influential book, Degrees of Belief

>> Grant Statham is the Mountain Risk Specialist for Parks Canada

Avalanche Safety in Twelve Languages

European Avalanche Warning Services Meeting, Stary Smokevic, Slovakia

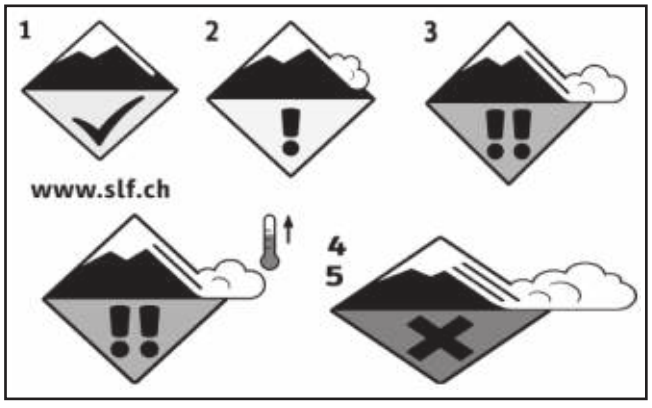
By John Kelly

A field trip to view avalanche terrain at the Jasna ski resort in the low Tatras Range.

Here in Canada, we're fond of pointing out the challenges of forecasting avalanches over our vast and sparsely populated landscape. We even have a commonly-used PowerPoint slide comparing Switzerland to BC. In Switzerland, there are 42 separate forecast regions, and the entire country fits easily into the North Columbia, a single forecast region covering some 40,000 square km. But this summer I was introduced to a different kind of challenge, one I had never encountered. Jakob Rhyner, head of the Swiss Federal Institute for Snow and Avalanche Research (SLF), made the point succinctly: "Try to imagine that each of those regions comes with politics, language and its own provincial issues."

Providing harmonized public avalanche safety services in a dozen languages within a highly populated and mobile Europe was one of the main topics at the European Avalanche Warning Services (EAWS) meeting in Slovakia this past June. This conference brings together avalanche forecasters from across Europe every two years to discuss common interests in avalanche forecasting. Many of these countries share mountain ranges, and the EAWS concentrates on the particular issues that revolve around public avalanche warnings and programs. Member organizations include a wide range of European national and regional avalanche centres.

The CAC and Parks Canada were invited by the Slovakian hosts to attend the 2007 conference as observers, subsequent to our interested inquiries at the Telluride ISSW. Grant Statham, Mountain Safety Specialist for Parks Canada, and I made the journey to Slovakia and each of us



Swiss icons for use in simplified warnings.

presented at the conference. Grant spoke on the development and implementation of our backcountry advisory icons, and gave another talk on the work done in North America on the avalanche danger scale. I presented an overview of Canada's public avalanche warning services.

The EAWS is a tiered organization with a general assembly and a more restricted working group. Membership in the general assembly is open to public agencies with an avalanche safety mandate in Europe. Membership in the working group is drawn from the general assembly by invitation. Problems identified in the general assembly are referred to the working group for discussion and solution. Working group results are returned to the general assembly for implementation by the various component agencies and organizations. The EAWS is a collaborative agency that possesses neither authority nor mandate. Instead it depends solely on consensus and the power of persuasion to influence decisions in avalanche forecasting among its members.

This year's conference focused on discussion of communication issues in public warnings and provided proof that there are world-wide common issues in avalanche forecasting. A starting point for the discussions was a review of the common adoption of a five-level avalanche danger scale in 1993. A retrospective and subsequent discussion identified the adoption of a unified scale as a landmark success of the EAWS in spite of growing pains and ongoing debate on topics such as number of increments and nomenclature.

Presentation of information to bulletin users was then discussed. A previous EAWS meeting proposed a "best practice" template for presentation of information on avalanche safety via the internet. The template demonstrated information presented as a pyramid, with simple and important information at the top, proceeding to graphical representations and followed by detailed text and descriptions.

At this meeting the concept of standardized graphical representations of avalanche danger was introduced. The Swiss delegation proposed the common adoption of a set of basic avalanche danger icons. These will be familiar to us in Canada, as they are based on our Backcountry Avalanche Advisory icons. In

Slovakian folk dancers provide after-dinner entertainment.

Canadian delegates John Kelly and Grant Statham ready for another day of simultaneous translations.

fact, Jakob Rhyner confessed he "stole" the idea and design from us, an admission that was greeted by a laugh from the audience.

Furthering the idea of using graphics to communicate ideas, the delegates from the Austrian Avalanche Centre in Tyrol added another suggestion. They proposed an intermediate-level icon to identify aspects and elevations particularly at risk on a given day. The group agreed to adopt the Swiss proposal for a two-year test period, and will decide on a standard at their next meeting in 2009.

A topic of considerable interest to the EAWS group is the standardization of danger levels across jurisdictions. To this end, the working group has spent considerable energy developing case histories that illustrate each of the five danger levels. These case histories are meant to be used as "standards" for comparison with current conditions. As ever, it was easy to gain consensus on what the extremes of the danger scale look like. There were no issues with the example of a "Low" avalanche danger day or an "Extreme" avalanche danger day. The more problematic situation was to present what the ideal or standard "Considerable" day looks like. This work continues.

Looking ahead, the participants identified some of the public avalanche safety topics that will become pressing in the near future. New technology is presenting opportunities for communication of avalanche risks. The associated challenge is developing the capacity to use these technologies to their best advantage.

To best use the increasingly powerful information pipeline of the web, the need for an xml standard for transmission of avalanche information was discussed. The development of CAAML in Canada was recognized as a brave beginning. The development of a European xml standard has been wrapped into an EU funded project called RARE (reducing avalanche risks in Europe). This project is set to begin this fall and is an ambitious collection of seven work dossiers with specific goals in each.

1. Spatial variations of snow cover properties and their effect on initial conditions for avalanche release
2. Prediction and warning
3. Variability of snow cover in the avalanche path and its influence on avalanche hazard
4. Harmonising hazard, vulnerability and risk mapping methods
5. Effect of permanent and temporary risk control measures
6. Quantifying uncertainty including the effects of climate change in avalanche forecast and hazard zoning
7. Harmonisation of avalanche forecasting, data management and education (outreach)

The overall purpose of RARE is to provide best practices and minimum standards for avalanche forecast and warning systems in Europe.

In conclusion, it was a privilege to observe the dynamic workings of the EAWS conference. It was also an eye-opening experience to see firsthand the challenges of communicating effectively over some fairly substantial language and cultural barriers. Many thanks to Jan Peto and our Slovakian hosts for providing an excellent venue and superb diversions.

What is the European Avalanche Warning Service?

The EAWS is the network of European agencies involved in operational avalanche warning. These agencies come from a variety of alpine countries. First formed in 1983, the group is comprised of working forecasters and program managers responsible for developing and producing avalanche warning products.

The EAWS meets every two years. In addition there is a working group of 10 members that meets more frequently to complete the objectives of the EAWS countries. The biennial meeting attempts to achieve consensus on standards and techniques applied across Europe.

Countries represented at the 2007 meeting: Austria, Canada, Czech Republic, France, Germany, Iceland, Italy, Poland, Romania, Scotland, Slovakia, Slovenia, Switzerland.

Revising the Avalanche Skills Training Curriculum

By Karl Klassen

In the fall of 2006, after the Avaluator was released, it became clear that the Avalanche Skills Training Level 1 Course needed a revision to accommodate this new, state of the art support tool for entry level decision makers. A set of interim lesson plans incorporating the Avaluator into the decision making components of the course was created in time for the 06/07 winter season, and many course providers use these lesson plans that winter.

Feedback on the interim lesson plans varied, but there was general agreement that the curriculum of the AST 1 course should be revised to make the Avaluator the core of the course. In addition, it was felt the AST 2 course should be revisited with an eye to modernizing the course and providing better support for intermediate level decision makers.

In the spring of 2007, the CAC had the funds required to update the AST program and hired me to develop a curriculum revision proposal. That proposal was circulated in April and in May, a group of instructors representing a cross section of course providers convened in Penticton and discussed the proposal. That meeting led to the creation of a committee whose task would be to review the new curriculum as it was developed and provide feedback.

As of early September, the following work has been completed:

- The AST 1 and AST 2 curricula have both been completely revised.
- Many existing lesson plans and field sessions have been deleted.
- Old lesson plans that remain in the curriculum have been updated and modernized.
- New lesson plans and field sessions have been developed, which adopt the Avaluator Trip Planner and Obvious Clues Method as the foundation of a decision making support system for recreational backcountry travellers.
- Instructor manual front matter and appendices have been updated and revised.

The following work is currently underway:

- Photos for AV support are being obtained and organized.
- Graphics for AV support are being created.

If time and funds allow we hope to also:

- Create a video resource list or perhaps even a video clip library for AV support.
- Create an online resource bank where instructors can share images, graphics, video, lesson plans, ideas, etc.

Some highlights of the new and improved AST curriculum are:

- Development of a “stages of mastery” matrix that illustrates the various levels of decision makers with an overview of the training, apprenticeship, and experience required at each level and the decision making support systems employed by the various levels.
- Full integration of the Avaluator as the core of AST 1 decision making lessons.
- Full integration of the Avalanche Terrain Exposure Scale as a primary terrain tool.
- Use of the Obvious Clues method as the foundation for AST 2 students to investigate and verify local avalanche danger.
- Incorporation of recent research by Bruce Jamieson et al to create snowpack investigation procedures that can assist in local verification of avalanche danger.
- Development of guidelines for instructing youth.

Instructor manuals and AV support materials will be completed and ready for AST providers to purchase this fall. All AST courses this coming winter will be expected to incorporate this new curriculum.

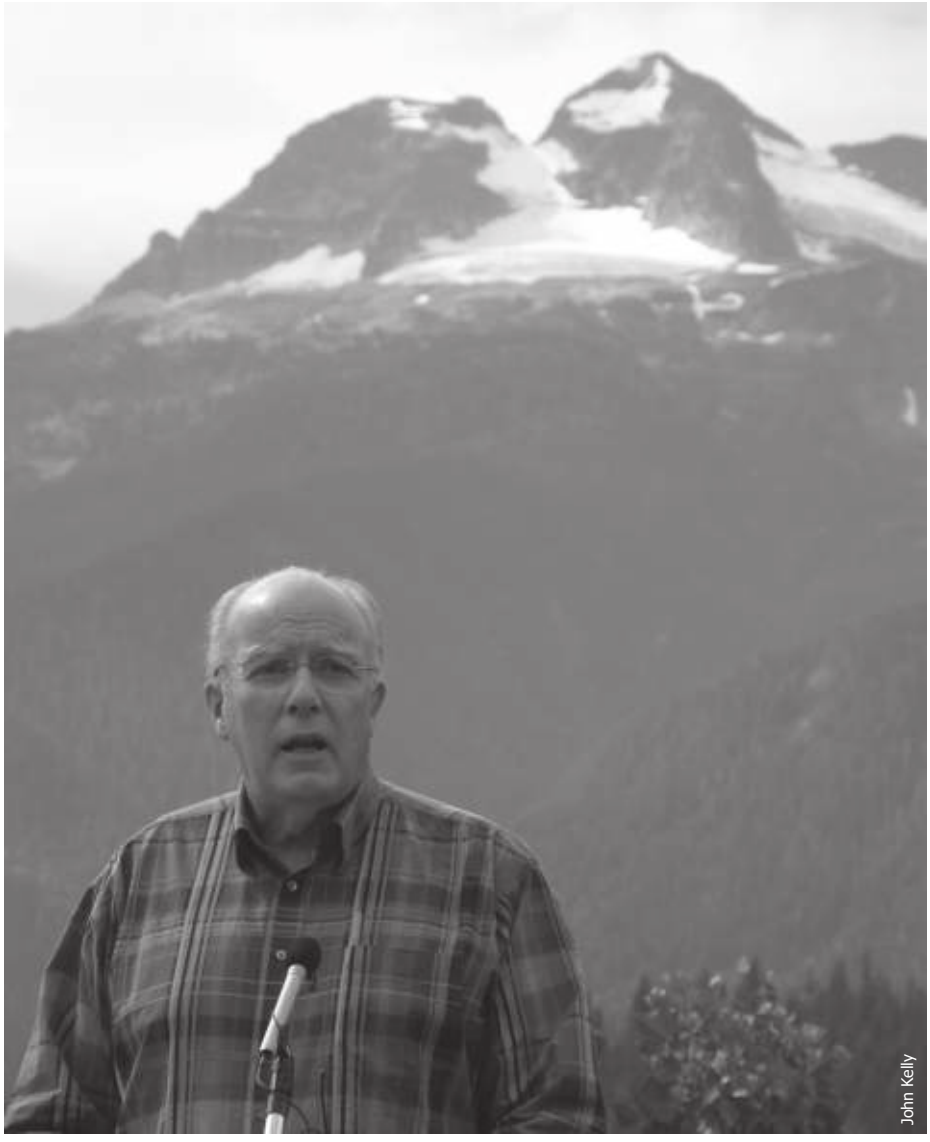
Feedback in the spring of 2008 will lead to final updates to the AST 1 curriculum. As the ADFAR 2 project begins to come up with results, the AST 2 course will be updated as required and it is expected that another round of revision on AST 2 will be undertaken in 2009 when ADFAR 2 wraps up.

From now on, the AST program and curriculum will undergo regular reviews and updates, similar to the process that keeps the professional level courses of the CAA relevant. With these reviews, we will ensure our AST courses continually reflect new advances in our understanding of how to best manage avalanche risk.

Troy Grant

Federal Funding Annoucement

Canadian Avalanche Centre Welcomes Funding from Environment Canada



On September 5, Jim Abbott, Member of Parliament for Kootenay-Columbia, came to Revelstoke to announce funding from Environment Canada for the Canadian Avalanche Centre. Speaking on behalf of the Honourable John Baird, Minister of the Environment, here is what Mr. Abbott said:

For most Canadians, an avalanche is something they see on television or in an action movie. Rarely is it something they would ever think about. But for a community like Revelstoke, avalanches are far more real, and far more personal—Golden, Invermere, Nakusp, are all impacted when tragedy hits. It was Revelstoke Mayor Mark McKee who said that an avalanche "lets the community know how vulnerable it really is." I believe him, and so does Canada's New Government, as I've carried this urgent message to Ottawa.

Too often in recent years, outdoor enthusiasts have set out for a day of adventure and never returned. Whether they were the victims of circumstance or the unfortunate victims of bad timing and bad luck, we can never be too sure. But we do know that in the aftermath of these tragic deaths—an average of 11 per year in Canada over the last 33 years—a natural reaction is always to wonder if the losses could have been prevented. It's sad to say that in many cases, the answer is yes.

Too often, backcountry recreationists have made common mistakes that have put them at increased risk of being involved in an avalanche accident. Poor trip preparation, an inability to recognize avalanche terrain or assess the stability of snow, and a lack of skill in backcountry search and rescue techniques have put these people in peril and sadly, have jeopardized their lives. Their safety was at risk, because for too long there was nowhere to turn for key tips and information on snow avalanche hazards.

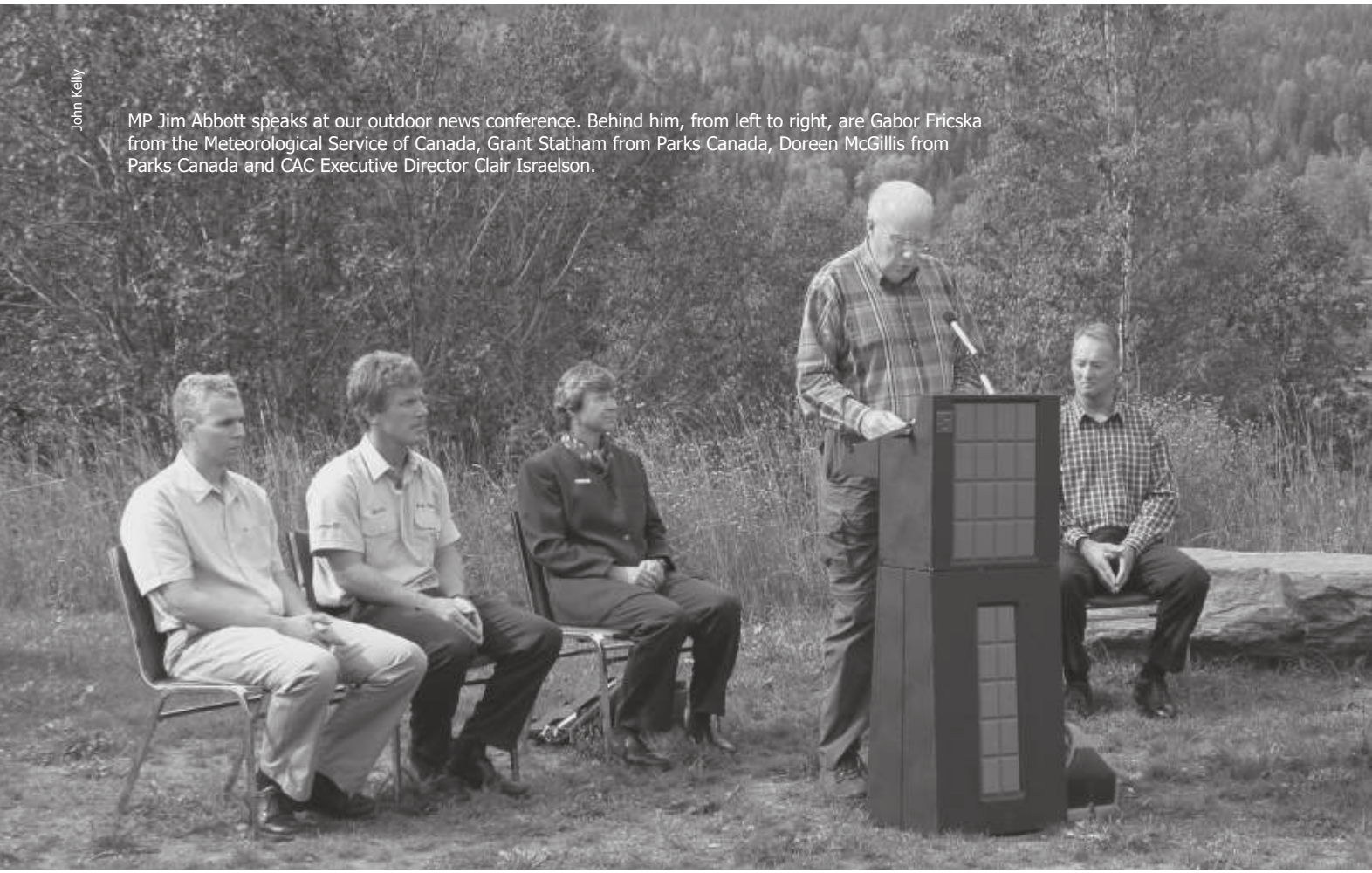
It took 29 deaths in the winter of 2002-2003 for Canadians to sit up and take notice that they had to act. That's why the Canadian Avalanche Centre was established.

With a vision of being "a world leader in avalanche awareness, education and safety services," the CAC has shown itself to be of critical importance.

Without a shred of doubt, I can say that in its short life the Canadian Avalanche Centre has saved a number of lives through its efforts:

- To coordinate public safety programming;
- To provide safety warnings;
- To deliver avalanche awareness and education;

"You have done great work, and we are pleased to continue to support you with this funding."



John Kelly

MP Jim Abbott speaks at our outdoor news conference. Behind him, from left to right, are Gabor Fricska from the Meteorological Service of Canada, Grant Statham from Parks Canada, Doreen McGillis from Parks Canada and CAC Executive Director Clair Israelson.

- To provide avalanche training for non-professional winter recreation;
- To serve as a point of contact for public, private and government avalanche information, and;
- To encourage avalanche research.

In less than four years, all of you have done a masterful job in shedding light on what people can expect when they head up into the mountains. In doing so, you have supported the Government of Canada's commitment to the health and safety of Canadians. This is important for two reasons. We all choose to live here because of our respect for and love of access to the backcountry. Secondly as visitors come and enjoy the backcountry they also make use of our restaurants, hotels and services that employ so many people in our area. Our visitors need the same thing that we want—confidence that they can stay safe.

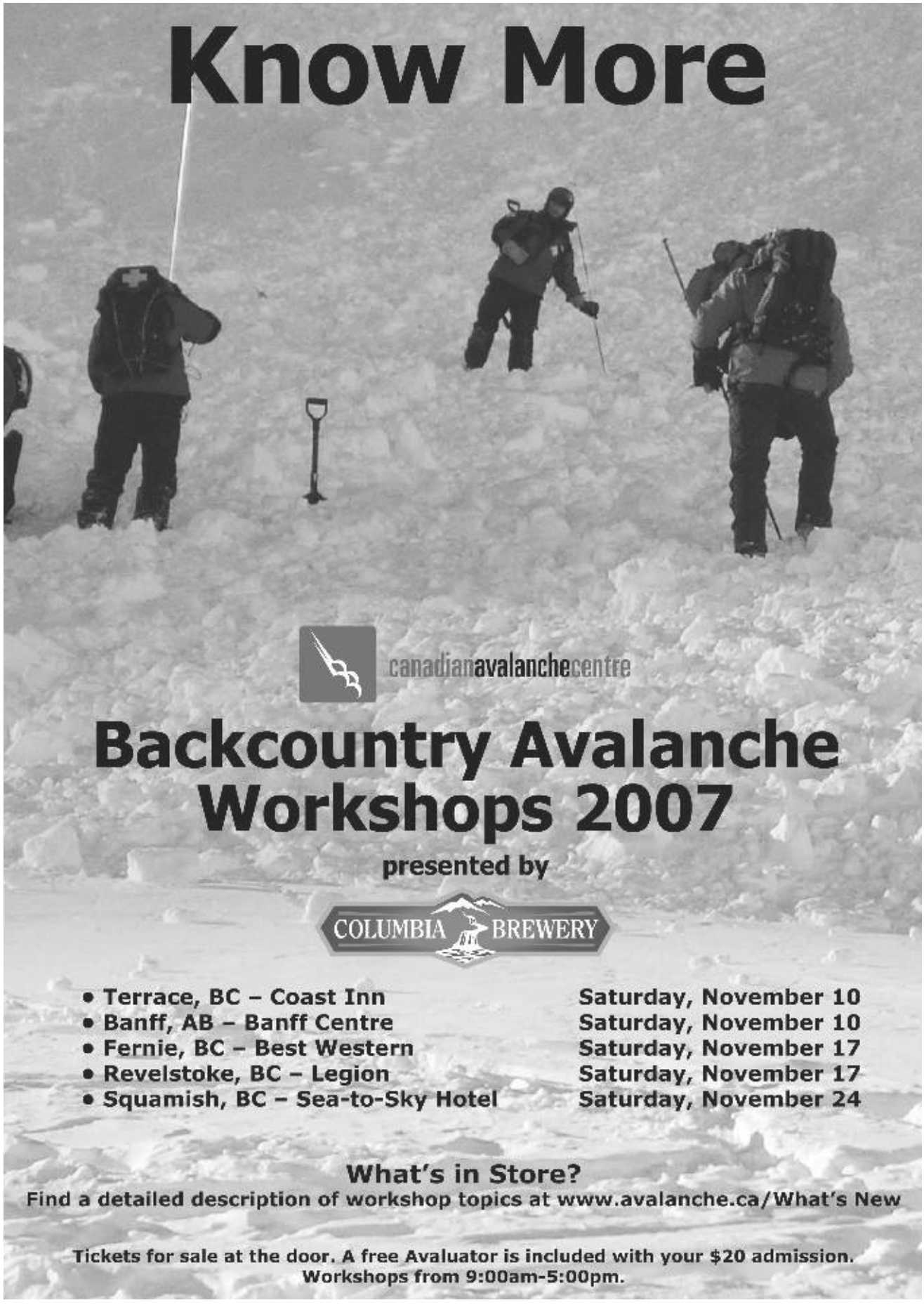
This has been a priority for our government since we took office a little over 18 months ago. Environment Canada, for example, provides timely information to Canadians about potential severe weather events. We tell Canadians when a hurricane sets its sights on our coastal communities. We warn them when excessive snowfall, severe thunderstorms or tornadoes are heading their way. Based on the information we give them, Canadians know to take cover and understand the risks if they don't.

The same needs to happen in the mountains. The people who head up there need to know the risks in advance, and must understand how to survive if they are caught in an avalanche. Environment Canada has been providing specialized weather forecasts and other assistance to support avalanche safety operations in western Canada for nearly 50 years. And more recently, Parks Canada has made important improvements to public safety in the backcountry, which have helped to reduce avalanche fatalities.

But that's not to say that we don't rely on other, non-governmental organizations to inform, educate and advise. This is where the tie-in between Environment Canada, the Parks Canada Agency and the Canadian Avalanche Centre comes in. And it is precisely why I am so pleased to announce today that the Government of Canada is contributing $400,000 through Parks Canada over four years and $225,000 over three years through the Meteorological Service of Canada—a total of $625,000 to support the CAC.

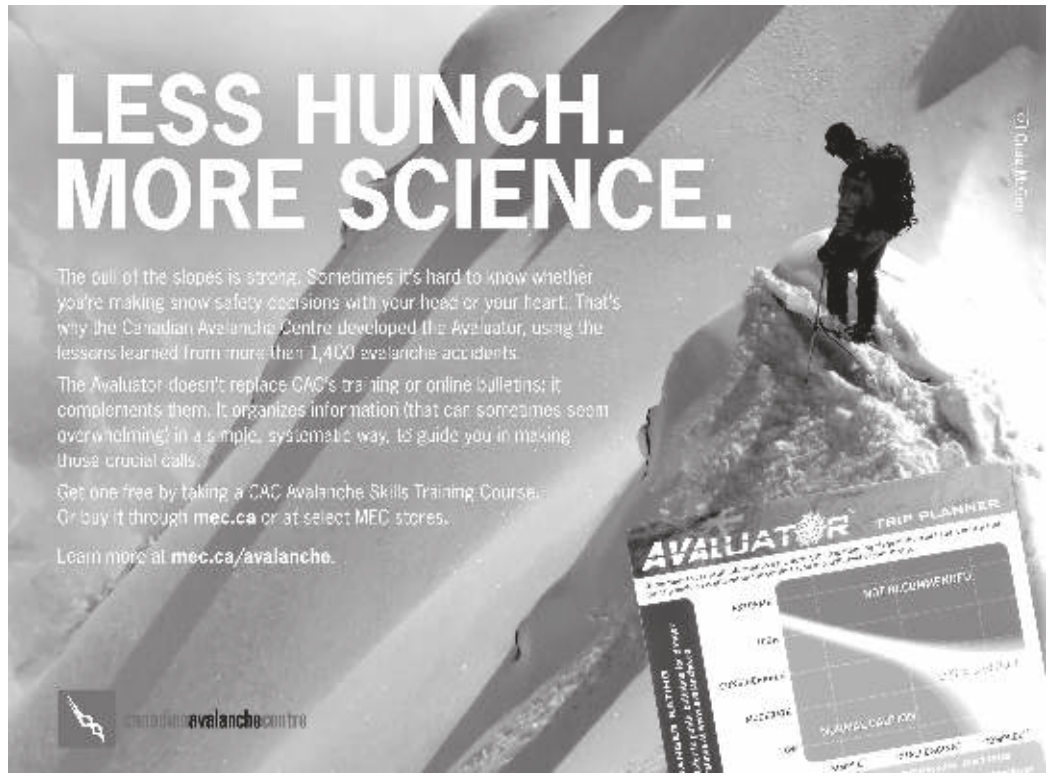
We are committed to protecting the health, personal and public safety of Canadians, and take seriously the risks and inherent dangers associated with natural hazards like avalanches. By working closely with other federal partners, the provinces and other stakeholders, we can do far more good for those people whose very survival in the mountains depends on the information they get from the Canadian Avalanche Centre.

With this in mind, I want to once more express the federal government's deep appreciation for your efforts to inform Canadians about avalanche dangers here in western Canada. You have done great work, and we are pleased to continue to support you with this funding. Thank you.


Know More
canadianavalanchecentre
Backcountry Avalanche Workshops 2007
presented by
COLUMBIA BREWERY
• Terrace, BC – Coast Inn Saturday, November 10
• Banff, AB – Banff Centre Saturday, November 10
• Fernie, BC – Best Western Saturday, November 17
• Revelstoke, BC – Legion Saturday, November 17
• Squamish, BC – Sea-to-Sky Hotel Saturday, November 24
What's in Store?
Find a detailed description of workshop topics at www.avalanche.ca/What's New
Tickets for sale at the door. A free Avaluator is included with your $20 admission.
Workshops from 9:00am-5:00pm.

Exposure

This winter, the Avaluator is sitting in some prime real estate—the back page of Mountain Equipment Coop's snow sports catalogue. MEC's creative team has come up with a terrific ad that's sure to catch the attention of the thousands of people who get that catalogue. Thanks MEC, you're a great partner.

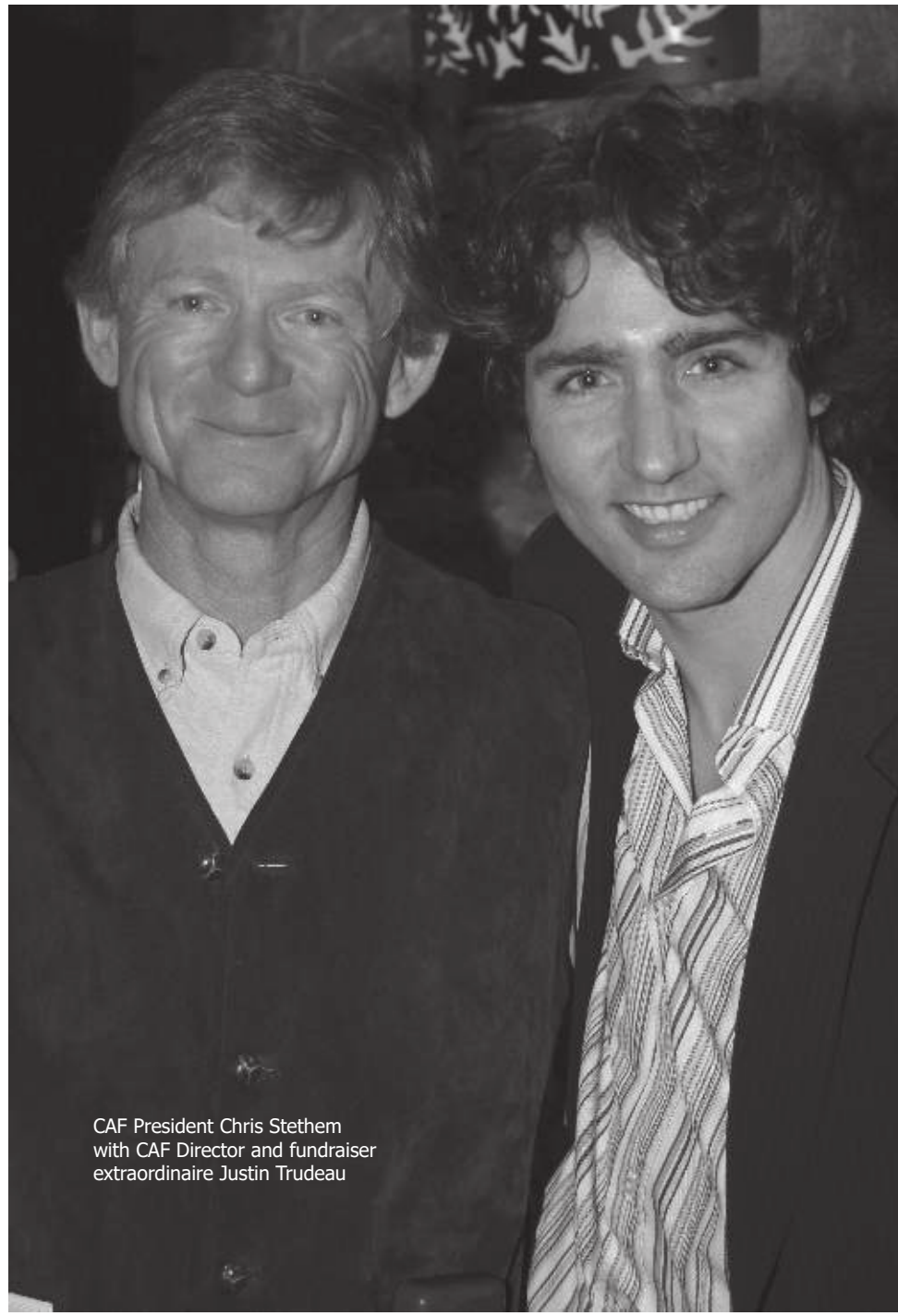


Canadian Avalanche Foundation President's Report

By Chris Stethem

The Canadian Avalanche Foundation is a vital link in promoting avalanche safety and reducing the number of avalanche fatalities in Canada. We're a federally-registered charity and the money we raise funds the preparation of public avalanche bulletins, avalanche awareness and safety education, programs that prevent or minimize avalanche risk to the public, and research projects to improve public safety. I am pleased to report that the Foundation enjoyed its most successful year ever in 2006-2007:

- We had a record year for fundraising, raising a total of $481,000.
- We enjoyed record attendance at the Foundation's annual fundraising dinners in Calgary and Whistler.
- $94,000 was provided to support avalanche safety programs across Canada.
- We finished the year with a very solid financial position, with over $600,000 in cash and short term deposits.
- We set a clear direction for 2007-2008 with a focus on youth education.



CAF President Chris Stethem with CAF Director and fundraiser extraordinaire Justin Trudeau

The Foundation is a funding cornerstone for the Canadian Avalanche Centre (CAC) located in Revelstoke, British Columbia. The CAC coordinates the delivery of public avalanche warnings and programs in Canada. Funding from the Foundation is crucial to the ongoing operations and success of the CAC. The quality of services provided by the Centre, notably the public avalanche bulletins would not be possible without the ongoing support we provide.

In addition to CAC, the Foundation currently funds a variety of avalanche safety programs including university research into avalanches, youth safety initiatives and other public safety programs across Canada.

There were seven avalanche fatalities in the winter of 2006-2007 in Canada, a sobering reminder of the power of avalanches. As tragic as that is, the trend has been positive. The number of avalanche fatalities has been steadily declining for the last four winters. The combined efforts of the avalanche community including the Foundation are having an impact.

I want to congratulate everyone who contributed to the Foundation's success this past year. Together, we're making a difference! Please don't hesitate to contact us if you would like to talk about avalanche safety.

Schedule of Coming Events

October 4-7, 2007
UIAA General Assembly
The International Mountaineering and Climbing Federation (UIAA) has been meeting since 1932 to encourage mountaineering for the young, develop international standards, raise awareness about safety, and protect the environment.
Where: Matsumoto, Japan
Info: www.uiaa.ch

October 13, 2007
The Alpine Club of Canada's Guides Ball
The ACC, in concert with the Association of Canadian Mountain Guides, celebrates their 18th annual Guides Ball. A portion of the funds raised will go the Karl Nagy Memorial Award, created to inspire and support future ACC amateur leaders and aspiring ACMG guides. This year's patron is Lloyd "Kiwi" Gallagher, who will be presenting a slide show prior to the events of the evening.
Where: Banff, Alberta
Info: www.alpineclubofcanada.ca
Contact: Shelley Freeman (403) 678-3200 ext 108

October 17-20, 2007
SARSCENE 2007
The sixteenth annual search and rescue conference will be held in Victoria, BC. As Canada's leading national forum on search and rescue, SARSCENE is a unique opportunity for members of the SAR community to come together and share their expertise. Highlighted this year will be demonstrations on search and rescue in Western Canada.
Where: Victoria, BC
Info: www.nss.gc.ca or call 1-800-727-9414.

October 17-21, 2007
59th ICAR Congress
The International Commission for Alpine Rescue is once again hosting an open forum to discuss ideas and share information on mountain rescue. ICAR represents 30 mountain-rescue organizations from Europe and North America.
Where: Pontresina, Switzerland
Info: www.ikar-cisa.org

October 24-26, 2007
Wilderness Risk Manager's Conference
This annual conference focuses on risk management and practical skills for the wilderness adventure and education industry. Attendees share field and administrative techniques in risk management, while building valuable networks with other leaders in the outdoor field.
Where: Banff, Alberta
Info: www.nols.edu/srmc

November 9-10, 17-18, 24-25, 2007
CAC Backcountry Avalanche Workshops and CAA Continuing Professional Development Seminars
Our CAC forecasters and CAA Industry Training Program instructors are hitting the road. See page 38 for more information about these events.
Where: Banff, Terrace, Fernie, Revelstoke and Squamish
Info: www.avalanche.ca
Contact: Call Karen Dubé (250) 837-2435 or e-mail kdube@avalanche.ca

January 11-13, 2008
Avalanche Awareness Days
The CAC's annual event continues the tradition! This year, our national media event will held on Jan 11 at Sunshine Village in Banff National Park. Over the 12-13 weekend, some 30 communities and ski areas across Western Canada and the US will take part by hosting their own Avalanche Awareness Days. Remember, there's always room for more volunteers!
Where: Sunshine Village Ski & Snowboard Resort, and at a ski or sledding area near you.
Info: www.avalanche.ca
Contact: Call Karen Dubé (250) 837-2435 or e-mail kdube@avalanche.ca

Rad Rando

Ski Mountaineering Competition Comes to Canada

By David Dornian

And they're off! It was a picture-perfect start to the North Face Canadian Ski Mountaineering Championships 2007 held at Whistler this past April. Whistler will host this event again in April 2008.

Dave Dornian

A lot of ski competition is out of touch with ski reality these days. How relevant to most personal experience is slamming rapid gates down a flooded rink tipped up at thirty degrees, or jumping out of a heli to drop a cliff, or bunnyhopping onto the frozen handrail of the fire escape stairs outside the base lodge bar? Sure as Kokanee sales it's all fun to watch on television, but you have to admit—sport gets a little lost in the welter of camera-oriented stunts.

Happily, there is a traditional kind of skiing, and a traditional kind of ski racing, that is (re)gaining momentum in Canada even as it grows in popularity around the world. We're talking here about races that feature the kind of skiing you and I and our friends do—mountain touring—revved up through the format of International Ski Mountaineering Competition.

As a long-standing member of the Union Internationale d'Associations d'Alpinism (UIAA) the Alpine Club of Canada is this country's principal organizer for this emergent sport. Ski Mountaineering Competition's governing body—the International Ski Mountaineering Council (ISMC)—is a subgroup of the UIAA and has been encouraging randonnée ski racing around the world for the past two decades. It is a multi-national group that would like to see Canada join their parade as they seek to make one particular format of racing recognized everywhere, and be considered as an Olympic sport. So? Why not? There are lots of skiers in our country—we should be able to find a few racers among them.

There have always been cross-country and up-and-down-mountain ski races in Canada. Often, like the Parker Ridge get-togethers of the Sixties, or the historical Rossland or Whistler shenanigans, these became regional favourites, often with illustrious (or notorious) reputations. Some events focused on downhill performance, some on distance and endurance, and some on ability in technical mountain terrain. The race format promoted by the ISMC today is an effort to bring these kinds of events and traditions together into a sport where randonnée skiers can compete regionally and nationally and where the best can then step up and compare performance internationally.

The ISMC suggests a randonnée race of 1600 metres (+/- 10%) cumulative climbing and descending, over a controlled course that the best racers might complete in approximately an hour and a half to two hours. Typically above treeline, the marked route usually links technical mountain terrain like ridges, peaks, and couloirs, and can require skiers to cover up to 10% of the route with their skis off—boot packing, traversing fixed lines, (running down the stairs to the top of Delirium Dive at Sunshine...), etc. Racers must use metal-edged skis of a certain width and weight, and carry packs, water, shovels, probes, transceivers, and certain clothing by the rules, plus any other gear the officials of that particular race deem necessary for safety. The skiers' gear must be of standard manufacture, and they are usually required to wear helmets.

We began racing to (roughly) this format in Canada when Whistler Ski Patrol leader Bernie Protsch and his team went to bat for a first event in 2003. In the intervening seasons, interest and participation has grown rapidly in both Canada and the US. Lifestyle skiers and industry workers stuck their heads out of the woods and came down from the lift shacks—they seemed to appreciate the races as a way to meet and share their enthusiasm. Life-Link has sponsored several race series south of the border, the Alpine Clubs in Canada and the US both joined the ISMC, formed ski mountaineering competition associations and began to name national teams. Officials have been trained, and

a calendar of events expanded and stabilized to the point now where there are regional and national championships held each winter in Canada. The next few years will see World Cups and continental championships hosted here as well.

In 2007, for the first time, there were enough sanctioned events held in Alberta and British Columbia to allow the ranking of all competitors over a complete race calendar. We could publish standings at the end of the season and recognize champions. For 2008 we anticipate a further expanded calendar, with repeat events at Whitewater (second year) and Sunshine (third year), and the possible additions of races at Fernie and Revelstoke. For the third year in a row, the season will finish big and bright, culminating with an uphill race, and the North Face Canadian Ski Mountaineering Championships along the Spearhead traverse during the festival atmosphere of the World Backcountry Freeride Jam at Whistler.

Some members of our current Canadian Ski Mountaineering Team will compete next March at the World Championships in Portes du Soleil, Switzerland. Last June, the top three Canadian females and males over the previous year's rankings were named to our national team.

They are all fast and light, and just beginning to realize their athletic potential. Give these skiers all the support you can (because there is very little money for them anywhere as yet). Better yet, you could be among them on the 2009 team. Find full details and complete rankings on the ACC website at www.alpineclubofcanada.ca/ccc/results.html

And at the same time, give a nod to our pioneering competitors. Five or six years ago the ISMC came to the Alpine Club of Canada with the offer of a subsidy for our team, to help get them to the World Championships in Serre Chevalier, France. At the time, we just kind of looked at each other, and at the letter offering $3000 to go skiing in Europe, and said, "What? What team?" Then we said, "We should find a team." In a testament to ski bums everywhere, Richard Haywood and Ptor Spricenieks got their ducks in a row in mere weeks over Christmas, found plane tickets, and then flew the leaf and bars for all of us that January. Probably a good thing that there was no doping control in the sport at the time....

The flame was sparked again a year or two later, at the Whistler race, when a kid from Revelstoke wearing Völkl G4s and an open leather jacket surprised everyone by straight-lining the final mogul field to win by seconds. He was bent over in the finish area, throwing up against the snow fence while potential sponsors were trying to talk to him. Gregg Hill became our next "National Team."

At the most recent World Championships, in Cuneo, Italy, early in 2006, Greg was joined by his regular training partner, Aaron Chance. The two were mid-pack on the Single Men's course when it was swept by a small avalanche triggered by unrelated skiers higher on the mountain. The race had to be annulled while competitors and officials dug each other out—remember the probes, transceivers, and shovels. Greg is staying home with his family this winter, but Aaron is already raising money for his travel to the championships in Switzerland next March.

Of course, with more events on the Canadian calendar, more athletes are vying for the team now. Rankings leaders from '07, Andy and Mike Traslin, will be going to the World Championships as well, along with our first female entry in international competition, Melanie Bernier. Andy wanted first place badly enough that he skied across the finish line at the Whistler Roundhouse last April with a shoulder he'd separated in a fall more than half an hour earlier. He still skinned through the timing apparatus ahead of all the Canucks but Greg.

But the great thing about ski mountaineering competition is that it's not just for turbo-charged monsters. Or, for that matter, for sprites like Killian Jornet Burgada, the Spaniard who came second at Whistler last year, and holds the current record for 1000 metres elevation gain in a pure uphill race (less than 30 minutes!). No, the great thing about ski mountaineering competition is that it's fun right down to the grass roots. Entry in the races is cheap, prizes are plentiful, and you probably own most of the gear already. There's always a party atmosphere, and every first-timer is pleasantly surprised by how fast they can travel with a stripped down pack and a few friends to chase. To make initiation less intimidating, there is always a shorter course, with less accumulated vertical, set for "Recreational" class entries. Mountain Equipment Co-op buyer Jonathon Wong, followed closely by an enthusiastic team from MEC Vancouver, took this category at the National Championships last year. His infant children didn't even really notice what their dad had done, they were so psyched by the purple and pink cowbells available in the finishing corral.

So. It doesn't ALL have to be powder and pre-dawn starts, big packs, and pits. Let your bad skiing self in on a party—enter some of the randonnée events this winter. The races combine well with avalanche awareness programs, raise awareness of the backcountry without beating it to death, and highlight the terrain and snow safety capabilities of any hosting ski area. You can find news and registration information for Canadian Ski Mountaineering Competition events as their dates and locations become finalized, through The Alpine Club of Canada's website www.alpineclubofcanada.ca/ccc/ismc.html or the specific ski area and events sites. Start your sneak training now, so you can casually challenge your work mates in a few months.


Murray Toft

David Dornian abandoned careers in academia and oil exploration when skiing and climbing took over his life. Drafted to help with a one-off local climbing event in the early '90s, the inability to say "no" brought him to the point where today he coordinates all types of mountain competition for the Alpine Club of Canada, and serves as Canadian representative on several international mountain sports bodies. He chairs the organizing committee of the fledgling Ski Mountaineering Competition Canada/Compétition du Ski Randonnée Canada. When not dragooning volunteers or sponsors, he manages commercial ski touring and mountaineering camps, writes about skiers and climbers, and generally uses it all as an excuse to throw it down with fun people all over the world. He lives in Calgary.

Bryan Ralph

Canadian Ski Mountaineering Team

MEN	WOMEN
Aaron Chance	Melanie Bernier
Jeff Colvin	Lydia Marmot
Sean Easton	Julie Matteau
Greg Hill	
Andy Traslin	
Mike Traslin	

Race Rules:

Racers must carry for the length of the course:

- Skis at least 160 cm. in length, metal edged, 60+ mm underfoot, with lateral and forward releasing bindings
- Skins
- Three layers of clothing for the torso and two layers of clothing for the legs. One layer will be wind/waterproof
- Shovel, Avalanche Transceiver, Probe at least 2.4 m in length
- Gloves, hat, sunglasses, 20+ litre pack
- Helmet
- (organizers may ask for additional insulating layers, harness, crampons, headlamp, slings, and carabiners if the course requires)

Race Locations for 2008

Fernie, BC – January 19-20
Mountain Storm (Info: www.mountain-storm.com)

Sunshine Ski Resort, AB – February 2
ARC'TERYX Sunshine 5000

Nelson, BC – February 23
Cold Smoke Festival, ROAM Randonnée Rally

Whistler, BC – April 18-19
World Backcountry Freeride Jam (Info: www.wbfj.com)
Whistler Windup, Whistler Dash and North Face Canadian Ski Mountaineering Championships

Who's in Charge?

The Incident Command System and Avalanche Search And Rescue

By Jordy Shepherd

Over the past three decades, the Incident Command System (ICS) has become the preferred system for emergency management across North America. This summer, the CAA embarked on a collaborative project to look at the value of integrating the ICS into avalanche search and rescue (SAR). This research is part of the CAA's eTraining for Mountain Operations and Avalanche SAR project which is creating an online training program so any group—professional or volunteer—that may conduct SAR operations in avalanche terrain has access to the "best practices" in this field.

As the Parks Canada representative on the Subject Matter Expert team for this project, I have been working with numerous avalanche industry professionals to determine those best practices for organized avalanche search and rescue operations. With numerous long-standing avalanche rescue agencies in Canada and wide recognition that Canadian avalanche workers are world-class, it initially seemed a simple task to develop these best practices. However, when we met in Vancouver in June it proved a little more difficult than I had originally thought.

In particular, one topic that was the focus of a lot of discussion was ICS. As the adoption of ICS is still in its infancy for most Canadian avalanche operations, this led to some interesting discussions regarding its utility and adoption by this project. I have noted some resistance in the Canadian SAR world to embrace this system but as we look beyond our borders and our industry, it's clear that ICS is here to stay. It is well established as best practice for a wide range of search and rescue operations in North America and, in my opinion, should also be best practice for avalanche operations in Canada.

The ICS was developed with an eye for simplicity, redundancy, multi-agency coordination, communication and, most importantly, to enable the fastest, most effective and safest SAR operation possible. As more SAR agencies adopt ICS into their training and tactical operations, we become that much closer to being able to work together safely and efficiently during emergency operations, no matter how big or small and no matter how many different organizations may be involved. In my experience, once ICS is integrated into any agency's emergency management protocol, sceptics soon find themselves wondering how they ever worked without it.

As a warden and rescue professional for Parks Canada, I have been using ICS for winter and summer rescue operations for several years. Glacier National Park was one of the first parks to fully embrace ICS for all SAR response, including avalanche rescue. Through this experience I gained a few insights into working with and integrating this system into SAR operations:

Probe line and RECCO at an interagency avalanche rescue practice.

www.peakalpine.com

- Changing to ICS initially seems like a daunting task, with all of the military-like position titles and the huge number of boxes that appear on an ICS organizational chart. Don't get scared off! ICS is flexible and was designed to be infinitely expanded and contracted. In small operations one person may hold several titles. As long as this is communicated clearly, the operation will run smoothly.
- Span of control is key. No person will have more than seven people (ideally no more than five) reporting to them. I have personally experienced the difference between a rescue operation with strict span of control, and one where a rescue leader had upwards of 50 personnel reporting directly to them. The latter works, but not nearly as well as the ICS-style reporting structure. Maintaining span of control is less stressful, more organized and, because there's less mental fatigue for the rescue leader, it's safer.
- Conduct realistic training with ICS on a regular basis. With just a little practice, people slip easily into the roles and adapt to the new titles when the SAR call is real.
- Use ICS on every operation, no matter how small. By vocalizing the ICS structure and titles, everyone in the operation becomes more at ease with the new system. This sets you up to utilize ICS effectively on subsequent SAR missions. In Glacier Park we use ICS on every motor vehicle accident on the Trans-Canada highway (upwards of 100+ per year). This prepares us well for the less common, but highly stressful, backcountry SAR incidents.

- Integrate ICS into your most common SAR pre-plans, so the structure is already built and ready to implement.
- In a real situation, time is critical. This often makes personnel accountability, pre-mission briefings and staging area management difficult to maintain. Through training sessions, try to find the balance between a rapid response and maintaining ICS principles.
- Train everyone in your operation to at least the ICS 100 basic level. Work toward getting your field SAR-staff trained to the ICS 200 level or higher. Anyone in a command team role should have ICS 300 or 400.

Finally, it's vital to train with other local SAR agencies. Utilize the ICS Unified Command approach, which allows effective collaboration between agencies during disaster planning exercises and large SAR operations. I have found the best way to integrate with other agencies is to initiate an annual meeting of all the regional SAR stakeholders. Usually this is an evening event in November prior to the winter season, combined with a social function. Share rescue plans, radio frequencies and contact information. Meet the players in a relaxed setting before you get that SAR call and are stepping out of the helicopter onto the avalanche debris at the next rescue site.


Jordy Shepherd Collection

Jordy Shepherd is a Mountain Guide and National Park Warden living in Revelstoke, BC. He has been working with ICS for more than 15 years, in wildfire, law enforcement and search and rescue operations. He was Site Commander for the Parks Canada SAR response to the Connaught Creek avalanche accident in Rogers Pass, February 2003.

What is the ICS?

The Incident Command System (ICS) was developed in California in the 1970s by firefighters struggling to overcome an organizational paradox that most crises create. Crises require a mix of skills and capacities that are beyond a single hierarchy and therefore require a network of responders. At the same time, crises require coordination, rapid decision making, and decisive, coordinated action, characteristics associated with hierarchies. The ICS sought to solve this paradox by using aspects of both networks and hierarchies in a manner consistent with the needs of crisis situations.

A hierarchical network is a form of social coordination that uses hierarchical control in the form of unified and centralized command, to help manage a network of organizations pursuing a shared goal. An ICS is neither a pure network nor a pure hierarchy, but it combines elements of both. The ICS model organizes incident responses around a central command. An incident commander sits atop the hierarchy, overseeing a variety of functional units—usually planning, operations, logistics, and administration/finance. In terms of an organization chart, the ICS model looks like a hierarchy, but relies on the efforts of multiple organizations that enjoy some measure of autonomy.

From Forest Fires to Hurricane Katrina: Case Studies of Incident Command Systems by Daniel Moynihan. Published by the IBM Center for the Business of Government (2007)

www.peakalpine.com

ICS training is available online at the Justice Institute of BC's website: www.jibc.ca. The course is free but if you want take the exam and receive a certificate there is a fee of $30.

For more information on the CAA's SAR-NIF eTraining Project check out the web at www.avalanche.ca/caa and look for SAR-NIF eTraining under the Knowledge Centre tab.

CAN STABILITY TESTS HELP RECREATIONISTS ASSESS THE LOCAL AVALANCHE DANGER?

(slightly revised from Proceedings of the 2006 ISSW)

Bruce Jamieson[1,2], Jürg Schweizer [3], Pascal Haegeli [4], Cam Campbell [1]
[1] Department of Civil Engineering, University of Calgary, Calgary, Alberta, T2N 1N4, Canada
[2] Department of Geology and Geophysics, University of Calgary
[3] WSL Swiss Federal Institute for Snow and Avalanche Research SLF,CH-7260 Davos Dorf, Switzerland
[4] Avisualanche Consulting, Vancouver, BC, Canada

ABSTRACT: In western Canada, various agencies issue public avalanche bulletins three to seven times per week for regions which range from less than 500 km^2 to almost 30,000 km^2. Sometimes avalanche danger varies substantially within the larger regions. In this study, we assessed whether the results of local rutschblock tests (including whole block releases) and compression tests (including sudden fractures) could help recreationists assess the local avalanche danger. Since occasional or "weekend" recreationists cannot reliably select areas of below average stability for their snowpack tests, especially in wind affected areas, we restricted the test sites to sheltered areas at and below treeline where our observers were likely to get the same results as recreationists. Field studies in the Coast, Columbia and Rocky Mountains yielded stability test results and local danger ratings. After a small number of data were filtered to minimize an observation bias, the results of compression tests and rutschblock tests were assessed using ratings of the local avalanche danger. Without considering the danger rating from the regional bulletin, the results of stability tests correlated weakly but significantly with the local avalanche danger. The score from the rutschblock test, with its greater area, correlated better than any of the compression test variables with the local avalanche danger. Various combinations of the regional danger rating and stability test results were assessed in terms of their performance in recognizing when the local avalanche danger was higher than the regional rating. Again the rutschblock results were more predictive than the compression test results. Some simple results of stability tests such as the observation of sudden fractures in compression tests and the release of the entire block in rutschblock tests showed promising results.

KEYWORDS: Snowpack stability tests, avalanche forecasting, avalanche danger, spatial scale.

1. INTRODUCTION

During early and mid-winter, some recreationists perform stability tests as part of their usual assessment of the avalanche danger in the area in which they are skiing, snowmobiling or snowboarding, and some do not. The question about the value of stability tests has been phrased "To dig or not to dig?" In an area where a regional bulletin is available, the danger ratings from the bulletin can be used as an initial estimate of the local avalanche danger in the area of the day's recreation. Hence, the value of stability tests would seem to be less in areas covered by a regional avalanche bulletin. However, in Canada many recreationists travel in areas not covered by regional forecasts (bulletins) or in areas for which the forecast regions are large and the bulletins issued three times per week (Jamieson, Campbell and Jones, 2007, subsequently referred to as JCJ).

For a typical day of backcountry snowmobiling, snowboarding or ski touring, recreationists are exposed to avalanche paths within an area of roughly 10 km^2. This is the local scale for which recreationists want to know the avalanche danger. They can use

1. the regional avalanche bulletin (if available)
2. various weather and snowpack observations that do not require digging a pit, and optionally
3. snowpack observations, especially stability tests, that do require digging a single pit.

While there are many weather and snow observations relevant to assessing the local avalanche danger (e.g. McClung and Schaerer, 1993, pp. 124-161; Tremper, 2001, pp. 88-170), we focus on stability tests, which are considered Class I data (McClung and Schaerer, 1993, p. 125). It is impractical for those seeking recreation to spend a lot of time on stability tests or any snowpack observations that require digging a pit. We chose to assess the value of stability tests from a single pit, specifically the rutschblock test (Tremper, 2001, pp. 156-158; Greene and others, 2004, pp. 40-42) and the compression test (Canadian Avalanche Association, 2002, pp. 32-34). We considered including snow profiles and assessing them based on Lemons (McCammon and Schweizer, 2002) or Yellow Flags (Jamieson and Schweizer, 2005) but subsequently excluded them because many recreationists do not observe snow profiles and because the level of detail probably varies substantially among those that do.

Given the variability in stability tests on individual slopes (e.g. Campbell, 2004), how can a stability test based on an area ranging from 0.1 m^2 for the compression test to 3 m^2 for the rutschblock test be indicative of the avalanche danger in an area of 10 km^2 (Bloeschl, 1999; Haegeli and McClung, 2004)? At sites selected by experts such tests have been shown to be indicative of the stability on adjacent slopes (e.g. Föhn, 1987; Schweizer and others, 2005). Because of this scale issue, we recognize that the correlations between the results of tests and the local avalanche danger cannot be strong and cannot be as good as they are for the stability of adjacent slopes.

The spatial variability increases in wind affected areas and the potential correlations between stability tests and local avalanche danger must be reduced. We chose to limit our study to treeline (TL) and below treeline (BTL) areas. If we found correlations, then perhaps a study of alpine areas would be worthwhile.

Comparisons between the regional danger rating and the local danger rating are analyzed in JCJ. In this paper, we focus on using the results of stability tests and optionally regional danger ratings to estimate the local avalanche danger.

This study has three objectives:

1. To identify which rutschblock and compression test results, if any, can help recreationists assess the local scale avalanche danger;
2. In situations where the regional danger rating is available, to evaluate whether stability tests can improve a recreationists' assessment of the local avalanche danger;
3. To identify some limitations of rutschblock and compression tests for assessing the local avalanche danger.

2. REGIONAL AND LOCAL DANGER RATINGS

Regional avalanche bulletins in western Canada include danger ratings and several short paragraphs of text. The text typically explains how the weather and snow conditions are contributing to the avalanche danger and discusses the avalanche danger in terms of the terrain. The danger from the regional forecast (or bulletin), D_{RF}, is rated as either Low (1), Moderate (2), Considerable (3), High (4) or Extreme (5). While the numbers for danger ratings are used in some European countries, they are currently not included in Canadian bulletins.

In western Canada, forecast regions vary from 100 km^2 to almost 30,000 km^2 (JCJ). The largest regions are approximately 250 times larger than the smallest region and 2,500 times larger than the scale of a ski tour (approximately 10 km^2). The frequency of bulletins ranges from daily to three times per week, adding an issue of the time scale (JCJ).

The local ratings of avalanche danger and field test results for this study are the same as in JCJ. On each observation day in the winters of 2004-05 and 2005-06, field teams of two or three skilled observers traveled on touring skis to a sheltered site at or below treeline. Although avalanche workers in Canada often probe the snowpack to select a uniform representative site before digging a pit, this practice was discouraged to capture the variability inherent in stability tests performed by recreationists. At the site, the team observed a detailed snow profile (which we did not analyze in this study), two or three compression tests and often one or two rutschblock tests. In addition to the compression test score (number of taps) the observers noted the Fracture Character (van Herwijnen and Jamieson, 2005, 2007) which is similar to the Shear Quality (Johnson and Birkeland, 2002; Greene and others, 2004, p. 36-37). In addition to the rutschblock score, the observers noted the amount of the block that released (Schweizer and Wiesinger, 2001). The team also made observations of avalanches and other less formal, but often valuable, observations of snow stability while traveling to and from the site. In addition, they had access to weather, snowpack and avalanche observations from the hosting operation and from neighboring avalanche safety programs. Using all available information, a danger rating for the local area and the current day, called the "local nowcast", D_{LN}, was selected by consensus. These local danger ratings were recorded for treeline and for below treeline—provided both could be done with confidence. On most days, ratings were recorded for both treeline and below treeline, yielding two cases per observation day.

3. OBSERVATIONS

3.1 An observation bias in the data?

During the 2004-05 winter of observations, we were occasionally concerned that the stability test results might have a strong influence on the local danger rating and therefore could not be used as independent predictors of the local avalanche danger. However, in most cases we were convinced that our local danger rating was based on a wide variety of correlated information and that the stability test results were not dominating the local ratings. To assess the potential bias, in the following winter we rated the local avalanche danger before and after the snowpack observations including the stability tests. If the danger rating changed, observers recorded the reasons for the change. Out of 130 cases with compression tests in the second winter, the local nowcast was changed 22 times (Table 1). In ten of the 130 cases (8%), the change was primarily because of the compression test results. Out of 52 cases with rutschblock tests, the local nowcast was changed five times. In two of the 52 cases (4%), the change was primarily because of the rutschblock results. We excluded the data from the second winter in which the change was primarily due to the specific stability test results. Given this small rate of change caused primarily by the test results in the second winter, we accepted the data from the first winter, acknowledging that we were including a small percentage of biased data (Table 1). After rejecting these biased data, our dataset consisted of 176 cases with compression tests and 85 cases with at least one rutschblock test.

Table 1. Exclusion of cases in which the local nowcast was changed primarily due to the stability test result

	Cases with compression tests			Cases with rutschblock tests		
winter	total	changed	Excluded	Total	changed	excluded
2004-05	56	0*	0*	35	0*	0*
2005-06	130	22	10	52	5	2
Total	186	22	10	87	5	2

* none excluded because local nowcasts were not recorded before the snowpack observations.

3.2 Frequency of the local and regional danger ratings

For cases with compression tests, the frequencies of the local danger rating are cross tabulated against the regional danger ratings in Table 2 and shown in Figure 1. The cases in which the regional danger rating is the same as the local rating are called

hits (Wilks, 1995, p. 240), and the diagonal of hits in Table 2 is shaded. The cases in which the regional danger rating is higher than the local nowcast are called "Overs"; these lie above and to the right of the shaded diagonal. The cases in which the regional danger rating is lower than the local nowcast are called "Unders" and lie below and to the left of the shaded diagonal.

Table 2. Cross tabulation of regional and local danger ratings for cases with compression tests

Local danger rating D_{LN}	Regional danger rating D_{RF}					Row totals
	1 Low	2 Mod.	3 Cons.	4 High	5 Ext.	
1 Low	30	19	2	2	0	53
2 Mod.	13	49	17	0	0	79
3 Cons.	2	5	25	1	0	33
4 High	0	2	2	4	0	8
5 Ext.	0	0	0	2	1	3
Column totals	45	75	46	9	1	176

For the cases with rutschblock tests, the frequencies of the local danger rating are cross tabulated against the regional danger ratings in Table 3.

Table 3. Cross tabulation of regional and local danger ratings for cases with rutschblock tests

	Regional danger rating D_{RF}					
Local danger rating D_{LN}	1 Low	2 Mod.	3 Cons.	4 High	5 Ext.	Row totals
1 Low	13	7	0	0	0	20
2 Mod.	7	27	8	0	0	42
3 Cons.	0	1	15	1	0	17
4 High	0	1	2	2	0	5
5 Ext.	0	0	0	0	1	1
Column totals	20	36	25	3	1	85

The overall hit rate in the two winters was 62% for cases with compression tests and 68% for cases with rutschblock tests.

If regional danger ratings are interpreted simply, then Unders may contribute to riskier decisions than Overs. In this study we assume the local danger ratings from the nowcasts are unbiased estimates of the local avalanche danger.

The relative frequency of Overs, hits and Unders can be calculated from the difference ΔD between the regional danger rating D_{RF} and the local danger rating D_{LN}

$$\Delta D = D_{RF} - D_{LN} \qquad (1)$$

For Unders $\Delta D < 0$, for hits $\Delta D = 0$, and for Overs, $\Delta D > 0$. The relative frequency of the Unders, hits and Overs for cases with compression tests and for cases with rutschblock tests are shown in Figure 1. Consequently, the higher rate of Overs compared to Unders in Figure 1 indicates a tendency of regional bulletins to be more cautious than our local danger ratings. Unlike with rutschblock tests, there are a few cases with compression tests in which the local danger rating was two or three steps lower than the regional danger rating.

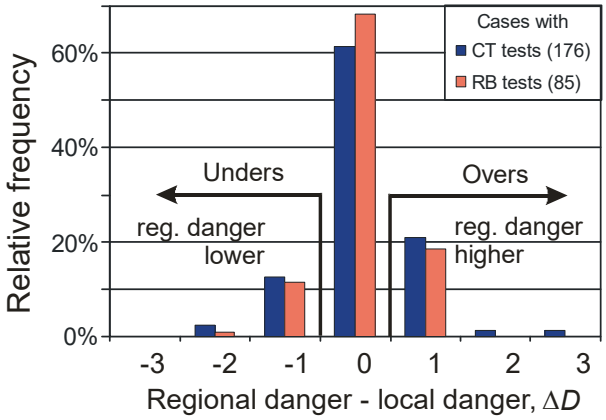


Figure 1. Relative frequency of difference between regional and local danger rating for cases with compression tests.

3.3 Predictor variables from stability tests

We analyzed three predictor variables from each set of compression tests at a specific site and five predictors from each set of rutschblock tests (Table 4). In addition to the compression test score CT, i.e. the number of taps for the first fracture, we recorded the number of taps for the first sudden fracture CTS. This allows us to calculate the average number of sudden fractures per compression test nCTS. Observers classified fractures as sudden if they were Sudden Planar (pops) or Sudden Collapse (drops) (van Herwijnen and Jamieson, 2005, 2007), or equivalently Shear Quality 1 (Johnson and Birkeland, 2002; Greene and others, 2004). For rutschblock tests, the observers classified the release type as whole block if 90 - 100% of the block released, or most of the block if 50 – 80% of the block released. This is compatible with the Release Type developed by Schweizer and Wiesinger (2001) and Schweizer (2002). We expect that recreationists with basic training will get the same result as our field team for observations of release type in rutschblock tests or sudden fractures (pops or drops) in compression tests.

4. RESULTS AND DISCUSSION

4.1 Rank correlations with local danger ratings

If a variable such as a compression test score or rutschblock score does not correlate with the local avalanche danger then compression or rutschblock tests will not help recreationists assess the local avalanche danger. Accordingly, correlations of the various predictors from Table 4 with the regional and local avalanche danger are shown in Table 5. Significant correlations ($p < 0.05$) are shown in bold. We used rank correlation because all the predictors are ordered but most lack the interval property. Some of the variables such as the number of whole block releases in compression tests nRBW are only likely to take on a limited number of values such as 0 or 1 and occasionally 0.5. This leads to many ties in the data, particularly for nCTS, nRBW and nRBM. For this reason, we used the gamma correlation in preference to Spearman *R* or Kendall Tau because it explicitly takes ties into account. Gamma γ is the difference between the probability that the rank ordering of the two variables agree, minus the probability that they disagree, divided by one minus the probability of ties (Statsoft, 2003).

Table 4. Predictor variables from stability tests

Variables	**Compression tests**
CT	Median of scores (number of taps) from first fracture in each test. If no fracture, CT was set to 35.
CTS	Median of scores from first sudden fracture[1] in each test. If no fracture occurred, CTS was set to 35.
nCTS	Average number of sudden fractures[1] per compression test.
	Rutschblock tests
RB	Median of first rutschblock score from each test. RB = 7 if there was no planar fracture.
RBW	Median rutschblock score of first release of the whole block[2] from each test. RBW = 7 if there was no whole block release.
RBM	Median of rutschblock score of first release of the whole block or most of the block[2]. RBM = 7 if there was no release of the whole block or most of the block.
nRBW	Average number of whole-block releases[2] per test.
nRBM	Average number of releases involving the whole block or most of the block[2] per test.

[1] Sudden fractures are Shear Quality 1 (Johnson and Birkeland, 2002) or Sudden Planar or Sudden Collapse (van Herwijnen and Jamieson, 2005)

[2] Rutschblock release type (Schweizer and Wiesinger, 2001; Schweizer, 2002)

The correlations in Table 5 are all weak with the highest having an absolute value of 0.39. Strong correlations were not expected because stability test scores vary on the slope scale (e.g. Campbell, 2004) and because the cross sectional area of these compression and rutschblock tests, 0.1 or 3 m^2 respectively, is very small in relation to the local and regional scales of avalanche

danger. The rutschblock score RB, with its greater area, correlated better than any of the compression test variables at the local scale and at the regional scale (Table 5).

At the local scale, which is considered most relevant for our objectives, CTS correlates with avalanche danger better than CT. This result suggests that observing and classifying the suddenness of the fracture (Johnson and Birkeland, 2002; van Herwijnen and Jamieson, 2005; Greene and others, 2004) can considerably improve the interpretation of test scores from small column tests, as previously shown on the slope scale (van Herwijnen and Jamieson, 2005, 2007; Schweizer and others, 2006, 2007). The predictors CT and CTS are plotted against the local avalanche danger in Figure 2.

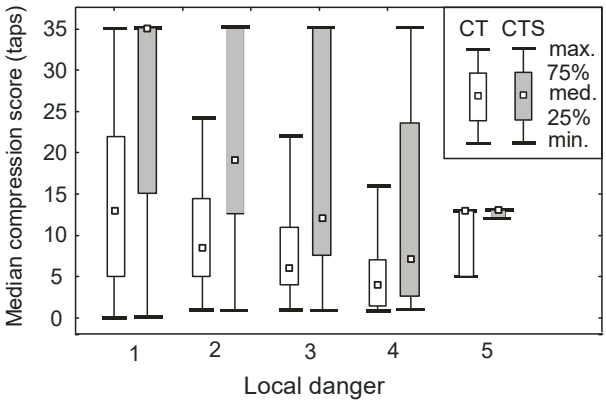


Figure 2. Compression test variables CT and CTS for each level of local avalanche danger.

The variables nCTS, nRBW and nRBM correlate significantly with the local avalanche danger. This is of interest since the "suddenness" of the fracture (Johnson and Birkeland, 2002; van Herwijnen and Jamieson, 2005) or the amount of a rutschblock that releases (Schweizer and Wiesinger, 2001; Schweizer, 2002) are observations for which it is reasonable to assume that backcountry recreationists with various levels of training get accurate results.

The sign of the significant correlations is as expected. Lower compression test and rutschblock scores are associated with higher avalanche danger. A higher number of sudden fractures in compression tests or a higher number of whole block or most-of-block releases is associated with higher avalanche danger.

For each rating of local avalanche danger, Figure 3 shows the distribution of the rutschblock variables RB, RBW and RBM. The different correlations for the variables is subtle in Figure 3 although apparent for $D_{LN} = 3$. All the correlations are weak. According to Table 5, RB has a higher gamma correlation with the local danger than RBM or RBW, which is not significantly correlated with the local danger. This is surprising since at the slope scale, the release type supplements the rutschblock score for improved correlations with slope stability (Schweizer and others, 2006, 2007).

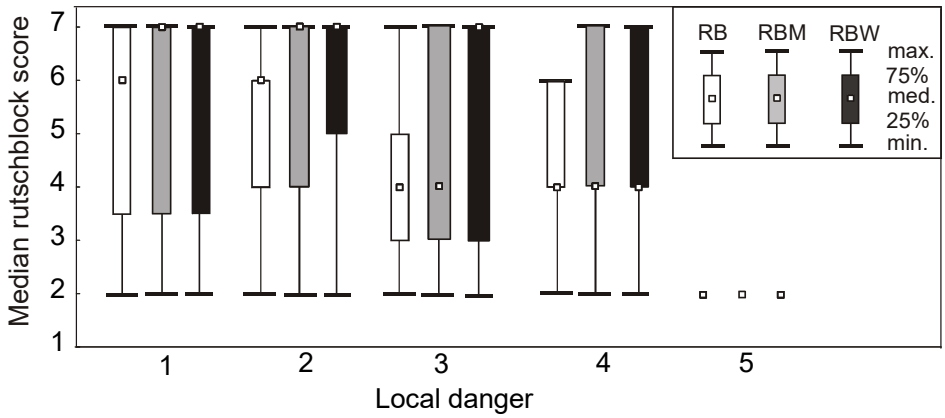


Figure 3. Rutschblock variables RB, RBW and RBM for each level of local avalanche danger.

Although seven of the eight predictors correlate with local avalanche danger in Table 5, only three of eight correlate significantly with the regional avalanche danger. This, combined with the weakness of the correlations, identifies severe limitations of these tests for estimating avalanche danger on the regional scale.

Table 5. Gamma correlations of predictors with local and regional avalanche danger								
Danger	nCTS	CT	CTS	nRBW	nRBM	RB	RBW	RBM
Regional D_{RF}	0.06	-0.26	**-0.19**	0.08	0.16	**-0.31**	-0.06	-0.14
Local D_{LN}	**0.23**	**-0.29**	**-0.33**	**0.28**	**0.26**	**-0.39**	-0.23	**-0.26**
n	176	176	176	85	85	85	85	85

4.2 Given the weak correlations with avalanche danger, can the local danger be estimated from stability tests?

Figures 2 and 3 show that for a given level of avalanche danger, the rutschblock score or range of compression test scores varies widely—too widely for estimating the local danger from rutschblock or compression tests observed at sites below treeline or sheltered treeline area. However, experts sometimes interpret the results of surprising low scores as indicating that the avalanche danger is not Low or neither Low nor Moderate. To evaluate this approach, the relative frequency of the rutschblock score RB is tabulated against the maximum local avalanche danger in Table 6, yielding the cumulative frequency distributions by rutschblock score. Since the number of cases is small for some cells in the table, the rutschblock scores are grouped into 2 ≤ RB ≤ 4, 5 or 6, and 7 to smooth the cumulative frequency distributions in Figure 4. In our data, rutschblock scores of 6 or less occurred less than 20% of the time when the danger was Low. Data such as these could be used to develop guidelines for recreationists, e.g. when the rutschblock score is 6 or less, there is only a 15-20% chance that the avalanche danger at or below treeline is Low. Such guidelines might help recreationists recognize local areas where the avalanche danger is higher than expected.

Table 6. Relative frequency of the maximum local avalanche danger by rutschblock score						
	Maximum local avalanche danger					No. of cases
RB	1	2	3	4	5	
2	0.36	0.64	0.82	0.91	1	11
3	0.14	0.43	1	1	1	7
4	0.06	0.53	0.88	1	1	17
5	0	0.71	1	1	1	7
6	0.18	0.89	0.93	1	1	28
7	0.60	0.87	1	1	1	15

In Table 5, CTS correlated better than other compression test variables with the local avalanche danger. For cases with compression tests, Table 7 and Figure 5 follow the approach used in Table 6 and Figure 4 for cases with rutschblock tests. Table 7 shows that when CTS ≤ 20, i.e. a sudden fracture occurred within the first twenty taps (average of 2-3 tests), the local danger was Low in less than 20% of cases. In contrast when the first sudden fracture occurred between the 21st and 30th tap (average of 2-3 tests), the avalanche danger was Low in 42% of cases. This suggests that the expectation of Low avalanche danger could be questioned by a sudden fracture within the first twenty taps (average of two or three compression tests).

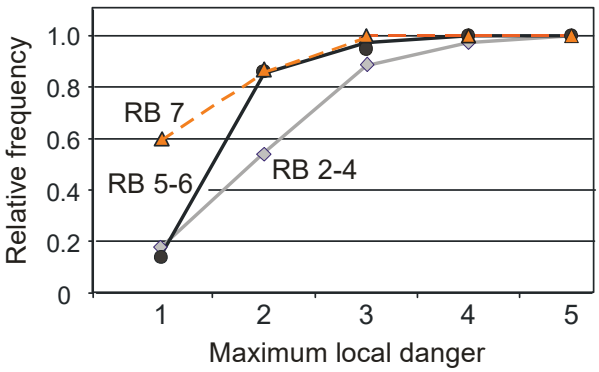


Figure 4. Relative frequency of rutschblock scores by the maximum local avalanche danger.

Although compression and rutschblock scores have been correlated with stability in adjacent slopes (Föhn, 1987; Schweizer and others, 2005), Figures 2 and 3 show that, in many situations, stability tests from a single pit are—by themselves—poor predictors of the local avalanche danger. This is why experts rely on a wide variety of observations of weather, snowpack and avalanches. In most situations, however, our data support the advice of avalanche experts that stability tests from a single pit are not a sound basis for estimating the local avalanche danger. Systematic approaches, perhaps based on a threshold sum (e.g. McCammon, 2004; Schweizer and others, 2006, 2007; Haegeli and McCammon, 2006; Haegeli and others, 2006), that integrate many observations might be developed for local scale decisions.

Table 7. Relative frequency of the maximum local avalanche danger by compression test score CTS

	Maximum local danger					No. of
CTS	1	2	3	4	5	cases
CTS ≤ 10	0.19	0.38	0.30	0.14	0.00	37
10 < CTS ≤ 20	0.17	0.52	0.24	0.02	0.06	54
20 < CTS ≤ 30	0.42	0.58	0.00	0.00	0.00	24
No sud. fract.	0.44	0.38	0.15	0.03	0.00	61

4.3 Is the regional danger rating better than local snowpack observations for estimating the local danger?

For cases with compression tests, the danger rating from the regional forecast correlates better with the local avalanche danger (Spearman $R = 0.61$, gamma $\gamma = 0.76$, $n = 176$) than any of the stability test variables in Table 5. The rate of agreement, or hit rate (Wilks, 1995, p. 240) between the danger rating from the local nowcast and the regional forecast is 62% for cases with compression tests and 68% for cases with rutschblock tests. So, given the constraints of this study and including our attempt to select sites similarly to recreationists, the regional danger rating is much better than local snowpack tests for estimating the local avalanche danger.

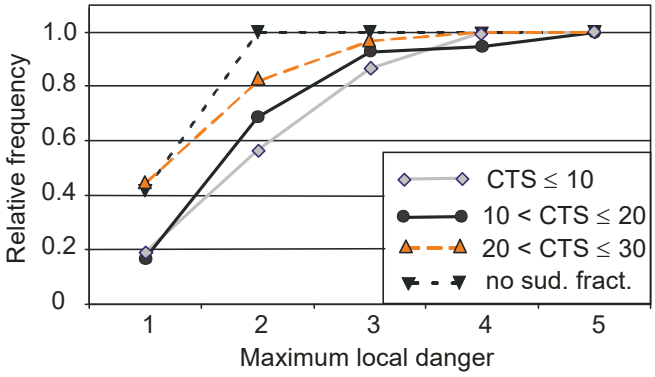


Figure 5. Relative frequency of compression test variable CTS by the maximum avalanche danger.

4.4 In areas where the regional bulletin is available, can local stability tests help recreationists assess the local avalanche danger?

In other words, when traveling in area with a regional bulletin, can stability tests help recreationists assess the local avalanche danger? Since a lot of recreation takes place in areas with a regional bulletin, this is a central question of this study.

Table 8. Gamma correlations of predictors with ΔD
Significant correlations ($p < 0.05$) in bold.

Predictor	ΔD	p
nCTs	**-0.24**	**0.001**
CT	-0.02	0.74
CTs	**0.18**	**0.01**
nRBW	**-0.32**	**0.02**
nRBM	-0.12	0.40
RB	0.09	0.46
RBW	**0.26**	**0.046**
RBM	0.15	0.21

To assess the potential of combining the regional danger rating with the results of stability tests, Table 8 shows the gamma correlations of the predictor variables with the difference between the regional and local avalanche danger. Four of the predictors, two based on the compression test and two based on the rutschblock test, are significant ($p < 0.05$). Notably, all of the four significant predictors include either the appearance of the fracture in compression tests or the release type in rutschblock tests, both of which Schweizer and others (2006, 2007) argue are indicative of fracture propagation.

As a practical example of combining the regional danger rating with stability test results, experts might consider a whole block release in a rutschblock test to be an important indication of local avalanche danger when the regional danger is Low or Moderate but such a result might not be surprising when the regional danger is High.

The following analysis focuses on recognizing Unders since it is particularly important to recognize when the local avalanche danger is higher than the regional danger. Table 9 shows that, in our dataset, Unders (regional danger less than local danger) are more common when the avalanche danger is Low.

Table 9. Relative frequency of Unders and Overs by regional danger rating

	Regional danger rating D_{RF}				
	1 Low	2 Mod.	3 Cons.	4 High	5 Ext.
Cases with compression tests					
Unders	33% (15/45)	9% (7/75)	4% (2/46)	22% (2/9)	0% (0/1)
Overs	0% (0/45)	25% (19/75)	44% (41/46)	33% (3/9)	0% (0/1)
Cases with rutschblock tests					
Unders	35% (7/20)	6% (2/36)	8% (2/25)	0% (0/3)	0% (0/1)
Overs	0% (0/20)	19% (7/36)	32% (8/25)	33% (1/3)	0% (0/1)

To assess the combination of regional danger rating and certain stability test results, we chose to explore the available data with an if-then rule:

If <regional condition> and <local stability test condition> then <conclusion about local danger>

The <regional condition> can be of the form $D_{RF} \leq D_{RF}^*$ where D_{RF}^* is some specified threshold of avalanche danger, e.g. Moderate, and <local stability test condition> can be of the form RB ≤ RB* where RB* is a specific threshold rutschblock score, e.g. 3. The <conclusion about local danger> could be qualitative like "be extra cautious" or quantitative like "local danger rating is regional danger rating + 1". We rejected the quantitative conclusions because we doubt that recreationists quantify extra caution in terms of one or two steps of the danger rating and because there were too few differences of ΔD = -2 or -3 to assess rules involving such conclusions. Since an Under is exactly the situation in which extra caution may be appropriate, we assessed each rules ability to recognize Unders using the contingency table shown in Table 10.

Table 10. Two by two contingency table for recognizing Unders

	Observed		Row totals
Predicted	Unders	Hits + Overs	
Unders	a	b	a + b
Hits + Overs	c	d	c + d
Column totals	a + c	b + d	n = a + b + c + d

The effectiveness of various rules and the thresholds on the stability test results for recognizing Unders were assessed with the Threat Score TS, the False Alarm Rate FAR and the True Skill Score TSS (Wilks, 1995, p. 240-250) defined as follows:

$$TS = \frac{a}{a+b+c} \qquad (2)$$

$$FAR = \frac{b}{a+b} \qquad (3)$$

$$TSS = \frac{d - b}{(a+c)(b+d)} \qquad (4)$$

The Threat Score is the number of times an Under is correctly predicted divided by the number of times an Under was predicted and/or observed. This is an improvement score that can range from 0 when no Unders are correctly predicted (a = 0) to 1 when all Unders are correctly predicted and none are incorrectly predicted ($b + c$ = 0).

The False Alarm Rate is the proportion of predicted Unders that were not observed. The best FAR is 0 (b = 0) and the worst value is 1 when no Unders are correctly predicted (a = 0).

The True Skill Score or Hanssen-Kuipers discriminant is a measure of the improvement over a random forecast (Wilks, 1995, p. 249) and ranges from negative values for predictions that are worse than random to 1 for perfect predictions.

With the chosen set of stability test results as predictors, we varied the thresholds on the regional danger rating D_{RF}^* and the threshold on the stability test results until the Threat Score was maximized. In almost all case the True Skill Score was

simultaneously maximized. The results for the compression test and rutschblock tests predictors are summarized in Tables 11 and 12, respectively.

Each condition in Tables 11 and 12 represents a way of recognizing Unders. For each condition, TS was maximized when the regional avalanche danger was Low (D_{RF}* = 1), probably because Unders occurred most often when the regional danger was rated Low (Table 9).

Table 11. Performance of compression test conditions for recognizing Unders						
Condition for recognizing Unders						
If $D_{RF} \leq D_{RF}$* and CTS ≤ CTS*	D_{RF}*	CTS*	TS	FAR	TSS	*a* + *b*
	1	23	0.275	0.560	0.330	25
If $D_{RF} \leq D_{RF}$* and CT ≤ CT*	D_{RF}*	CT*	TS	FAR	TSS	*a* + *b*
	1	19	0.333	0.533	0.432	30
If $D_{RF} \leq D_{RF}$* and nCTS ≥ nCTS*	D_{RF}*	nCTS*	TS	FAR	TSS	*a* + *b*
	1	1	0.275	0.560	0.330	25

Table 12. Performance of rutschblock test conditions for recognizing Unders						
Condition for recognizing Unders						
If $D_{RF} \leq D_{RF}$* and nRBW ≥ nRBW*	D_{RF}*	nRBW*	TS	FAR	TSS	*a* + *b*
	1	1	0.308	0.333	0.337	6
If $D_{RF} \leq D_{RF}$* and nRBM ≥ nRBM*	D_{RF}*	nRBM*	TS	FAR	TSS	*a* + *b*
	1	0[a]	0.292	0.650	0.465	20
If $D_{RF} \leq D_{RF}$* and RB ≤ RB*	D_{RF}*	RB*	TS	FAR	TSS	*a* + *b*
	1	6	0.438	0.417	0.571	12
If $D_{RF} \leq D_{RF}$* and RBW ≤ RBW*	D_{RF}*	RBW*	TS	FAR	TSS	*a* + *b*
	1	6	0.385	0.286	0.428	7
If $D_{RF} \leq D_{RF}$* and RBM ≤ RBM*	D_{RF}*	RBM*	TS	FAR	TSS	*a* + *b*
	1	5	0.385	0.286	0.428	7

[a] 7 of the 20 predicted Unders (regardless of nRBM value) occurred in the 11 cases when Unders were observed.
[b] 9 of the 54 predicted Unders (regardless of nRBM value) occurred in the 11 cases when Unders were observed.

In terms of TS or TSS, the conditions based on rutschblock predictors performed better than the conditions based on compression test predictors. For compression test predictors, CT performed better (TS = 0.33, TSS = 0.43) than CTS or nCTS but with a very high False Alarm Rate of 0.53. For rutschblock predictors, RB performed better (TS = 0.43, TSS = 0.57) than RBW, RBM, nRBW or nRBM but with a high False Alarm Rate of 0.42. RBW performed as well as RBM (TS = 0.39, TSS = 0.49, FAR = 0.29). RBW and RBM show promise because they exhibit substantially lower False Alarm Rates than RB and because their values of TS and TSS are only slightly lower than for RB. In our dataset, there were few cases of most-of-block releases and consequently there is no advantage of RBW over RBM. However, we note that Schweizer and others (2006, 2007) found that whole block releases correlated much better than most-of-block releases with skier triggered slab avalanches on adjacent slopes (i.e. slope scale).

The optimal threshold for RBW is 6, which includes all whole block releases since there is no release for RB = 7. Thus it seems that performance of RBW ≤ 6 and nRBW ≥ 1should be equal. However, the different performance results from RBW being a median score and nRBW being an average. Also, to simplify the interpretation, we did not try fractional values of the thresholds when optimizing the conditions.

In summary, our method of optimization identifies the potential of stability tests and, in particular of whole block releases and of the rutschblock score, for supplementing the regional danger rating.

4.5 Are stability tests more helpful in large forecast regions?

When the form of rules was introduced in the previous section, the <regional condition> was restricted to the regional danger rating being below a certain threshold. Another possible <regional condition> involves the area of the forecast region. Table 13 shows the relative frequency of Unders and Overs for small, medium and large forecast regions, as classified by JCJ. The frequency of Unders and of Overs increases with the area of the forecast regions. This is because the hit rate is reduced as the area of the forecast region increases (JCJ). Hence, rules for recognizing Unders and Overs might perform better in larger forecast regions than in smaller regions. However, we do not have sufficient data to partition them by forecast area, regional danger level

and stability test result before assessing the performance; also, partitioning by danger level and stability test result (Section 4.4) is more relevant to our objectives. Nevertheless, we note that stability tests are reportedly more often done by recreationists in Canada, which has many large forecast regions, than in Switzerland, which has mostly smaller forecast regions. While there could be other factors, we expect that stability tests in large forecast regions could be more helpful to recreationists than in smaller regions simply because the local avalanche danger is more variable in larger regions.

Table 13. Relative frequency of Under and Overs by the area of the forecast region

	Area of forecast regions (JCJ)		
Cases with compression tests	Small (100-500 km^2)	Medium (8,000 km^2)	Large (15,000-30,000 km^2)
Unders	7% (4/59)	17% (4/24)	19% (18/93)
Overs	20% (12/59)	17% (4/24)	27% (25/93)
Cases with rutschblock tests	Small (100-500 km^2)	Medium (8,000 km^2)	Large (15,000-30,000 km^2)
Unders	3% (1/33)	12% (2/17)	26% (9/35)
Overs	21% (7/33)	24% (4/17)	14% (5/35)

4.6 What about using stability tests to recognize Overs?

It seems practical to use stability tests to recognize Overs partly because there is a greater proportion of Overs than Unders (Tables 2, 3 and 13, Figure 2) so there would be more data for correlations and for assessing the performance of rules. We note that Overs occurred mostly when the regional danger was Considerable or High (Table 9) or for large forecast regions (Table 13). If conditions to recognize Overs were developed, the conclusion would indicate extra confidence or possibly *reduced safety measures* (!) because the local danger could be less than the regional danger. Extensive data and analysis, including a careful analysis of the False Alarm Rate, would be required before rules to recognize Overs could be recommended.

5. CONCLUSIONS

A large dataset consisting of local danger ratings for areas of approximately 10 km^2 and stability tests at and below treeline from seven forecast regions in western Canada were analyzed. After filtering out cases in which the stability test result primarily influenced the local danger rating, there were 85 cases with one or more adjacent rutschblock tests and 176 cases with three adjacent compression tests. Since local danger ratings for both treeline and for below treeline were typically associated with one set of stability tests, the overall number of data points for the study is roughly twice the number of sets of compression tests and sets of rutschblock tests.

The danger rating from the regional forecast was by far the best predictor of the local danger since correlations between the results of stability tests and the local danger were consistently weak. Seven of the eight predictors (stability test variables) correlated significantly with local avalanche danger, whereas only three of eight correlated significantly with the regional avalanche danger, identifying severe limitations for the regional interpretation of test results from a single pit. The rutschblock score RB correlated better than any of the compression test variables at the local scale and at the regional scale.

On the local scale, which was most relevant for our objectives, the compression tests score for the first sudden fracture correlated more strongly with the local avalanche danger than the compression test score for the first fracture (sudden or not), suggesting that observing and classifying the appearance of the fracture (Johnson and Birkeland, 2002; van Herwijnen and Jamieson, 2005; Greene and others, 2004) can considerably add to the interpretation of the test score from small column tests at the local scale.

Observations of sudden fractures in compression tests (independent of score) and of whole block releases in rutschblock tests (independent of score) correlated significantly with the local avalanche danger. This is of interest since the “suddenness” of the fracture or the amount of a rutschblock that releases are practical observations for backcountry recreationists with basic training.

Various conditions for recognizing when the local avalanche danger is higher than the regional danger were assessed. This situation occurred most often when the regional danger was Low and, accordingly, each of the performance measures for the rules were consistently optimized for Low avalanche danger. Rutschblock variables outperformed compression test variables. In terms of the True Skill Score or Threat Score, the traditional rutschblock score performed best; however, it predicted increased local danger in many cases in which the local danger was not higher than the regional danger. The rutschblock score for the first release of a whole block did not overestimate the local avalanche danger as often and recognized many cases when the local avalanche danger was higher than the regional danger. More data are required before data-based rules or guidelines for interpreting local snowpack observations in conjunction with the regional avalanche danger could be developed for recreationists.

Stability tests comprise only a few of the many weather and snowpack observations relevant to assessing the local avalanche danger. This study did not compare the value of stability tests to the numerous other observations, many of which are easier and faster to observe. Also, this study did not assess stability tests in wind affected alpine areas.

ACKNOWLEDGEMENTS

For meticulous snowpack observations, we thank Paul Langevin, Antonia Zeidler, Ken Matheson, Ali Haeri, Laura Bakermans, James Floyer, Dave Gauthier and Catherine Brown, as well as Gord Irwin, Percy Woods, Brad White, Lisa Paulson, Marc Ledwidge, Steve Michelle, Mike Henderson and Christine Aikens from Banff, Yoho and Kootenay National Parks. The study relied on the logistical support and advice from the Avalanche Control Section of Glacier National Park, BC Ministry of Transportation at Pemberton and Hope, Whistler Blackcomb Ski Resort, Cypress Mountain, Banff, Yoho and Kootenay National Parks, Kicking Horse Mountain Resort and from Mike Wiegele Helicopter Skiing. Thanks to Susan Hairsine and Clair Israelson for encouragement and to the National Search and Rescue Secretariat for funding for the field work part of this study under the Canadian Avalanche Association's ADFAR project. For funding to analyze the data, Bruce Jamieson is grateful to the Natural Sciences and Engineering Research Council of Canada, the HeliCat Canada Association, the Canadian Avalanche Association, Mike Wiegele Helicopter Skiing, and the Canada West Ski Areas Association.

REFERENCES

Campbell, C. 2004. Spatial variability of slab stability and fracture properties in avalanche start zones. MSc thesis. Dept. of Civil Engineering, University of Calgary, Calgary, Alberta, Canada.

Canadian Avalanche Association. 2002. *Observation Guidelines and Recording Standards for Weather, Snowpack and Avalanches*. Canadian Avalanche Association, Revelstoke, B.C.

Bloeschl, G. 1999. Scale issues in snow hydrology. Hydrological Processes, 13(14-15), 2149-2175.

Föhn, P.M.B. 1987. The rutschblock as a practical tool for slope stability evaluation. In: B. Salm and H. Gubler, eds., Avalanche Formation, Movement and Effects. International Association of Hydrological Sciences, Publication No. 162, 223-228.

Greene, E.M., K.W. Birkeland, K. Elder, G. Johnson, C. Landry, I. McCammon, M. Moore, D. Sharaf, C. Sterbenz, B. Tremper, and K. Williams. 2004. *Snow, Weather, and Avalanches: Observational Guidelines for Avalanche Programs in the United States.* American Avalanche Association, Pagosa Springs, Colorado, 140 pp.

Haegeli, P. and McCammon, I. 2006. The Avaluator - avalanche accident prevention card. Canadian Avalanche Centre. 30 pp.

Haegeli, P., I. McCammon, B. Jamieson and C. Israelson. 2006. The Avaluator - a Canadian rule-based avalanche decision support tool for amateur recreationists. In J.A. Gleason (ed.), Proceedings of the 2006 International Snow Science Workshop in Telluride, CO, 254-263.

Haegeli, P., and McClung, D.M., 2004. Hierarchy theory as a conceptual framework for scale issues in avalanche forecast modeling. Annals of Glaciology, 38, 209-214.

van Herwijnen, A. and B. Jamieson. 2007. Fracture character in compression tests. *Cold Regions Science and Technology:* 47(1-2), 60-68, doi:10.1016/j.coldregions.2006.08.016.

van Herwijnen, A.F.G. and B. Jamieson. 2005. Fracture character in compression tests. Proceedings of the 2004 International Snow Science Workshop in Jackson Hole, Wyoming. USDA Forest Service, Fort Collins, CO, 182-191.

Jamieson, B., C. Campbell and A. Jones. 2007. Verification of Canadian avalanche bulletins including spatial and temporal scale effects. *Cold Regions Science and Technology*: doi: 10.1016/j.coldregions.2007.03.012.

Jamieson, B. and J. Schweizer. 2005. Using a checklist to assess manual snow profiles. *Avalanche News* 72, Canadian Avalanche Association, Revelstoke, BC., 57-61.

Johnson, R. F., and K. W. Birkeland. 2002. Integrating shear quality into stability test results, in Proceedings ISSW 2002, International Snow Science Workshop, edited by J. R. Stevens, pp. 508-513, 29 September-4 October 2002. BC Ministry of Transportation, Victoria, BC, Canada.

McCammon, I. 2004. Evidence of heuristic traps in recreational avalanche accidents: Evidence and implications. *Avalanche News* 68, 42-50.

McCammon, I. and Schweizer, J., 2002. A field method for identifying structural weaknesses in the snowpack. In: J.R. Stevens (Editor), Proceedings ISSW 2002. International Snow Science Workshop, Penticton BC, Canada, 29 September-4 October 2002. International Snow Science Workshop Canada Inc., BC Ministry of Transportation, Snow Avalanche Programs, Victoria BC, Canada, pp. 477-481.

McClung, D.M. and P. Schaerer. 1993. *The Avalanche Handbook*. The Mountaineers, Seattle, Washington, U.S.A., 271 pp.

Schweizer, J., 2002. The Rutschblock test - Procedure and application in Switzerland. *The Avalanche Review*, 20(5): 1,14-15.

Schweizer, J., K. Kronholm and T. Wiesinger. 2003. Verification of regional snowpack stability and avalanche danger. *Cold Regions Science and Technology* 37(3), 277-288.

Schweizer, J., and T. Wiesinger. 2001. Snow profile interpretation for stability evaluation. *Cold Regions Science and Technology* 33(2-3), 179-188.

Schweizer, J., C. Fierz and B. Jamieson. 2005. Assessing the probability of skier triggering from snow layer properties. Proceedings of the International Snow Science Workshop in Jackson Hole, Wyoming. USDA Forest Service, Fort Collins, CO, 192-198.

Schweizer, J., I. McCammon and B. Jamieson. 2007. Snowpack observations and fracture concepts for skier-triggering of dry-snow slab avalanches. *Cold Regions Science and Technology*: doi: 10.1016/j.coldregions.2007.04.019.

Schweizer, J., I. McCammon and B. Jamieson. 2006. Snow slope stability evaluation using concepts of fracture mechanics. In: J.A. Gleason (editor), Proceedings of the 2006 International Snow Science Workshop in Telluride, CO., 211-218.

Statsoft, 2003. Statistica Electronic Manual. Statsoft Inc., Tulsa, OK.

Tremper, B. 2001. *Staying Alive in Avalanche Terrain*. The Mountaineers Books, Seattle, WA.

Wilks, D.S. 1995. *Statistical Methods in the Atmospheric Sciences*. Academic Press, San Diego.

Clearly Defining Relative Hardness and Visual Clues at Layer Interfaces Using a Brush

Or: A good way to dull your pencil and fill up your field book with layers

By Steven Conger

This brief article describes a standardized and reproducible field method for layer identification using a brush. This method was developed during field work in support of validating high resolution snow profile probes. Anderson (1960) introduced the use of a brush to highlight layers in snow profiles. Other references offer the following limited guidance:

- Careful horizontal strokes will model out layers (USFS, 1961).
- Brushing "... will help bring out the natural layering..."(Greene et al., 2004).
- One of three options to reveal changes of hardness and layer borders (McClung and Schaerer, 2006).

Two steps were undertaken in this study. First, the selection of a "best" brush, and second, the development of a general method. Ten brushes in a range of styles and brush materials were selected, representing examples of cost and widespread availability. Criteria for development of the general method were set such that the results are: 1) reproducible, 2) comparable between pits and observers, and 3) consistently identify changes in more than one hand hardness level from fist (F) or four finger (4F) requiring nothing more than the brush.

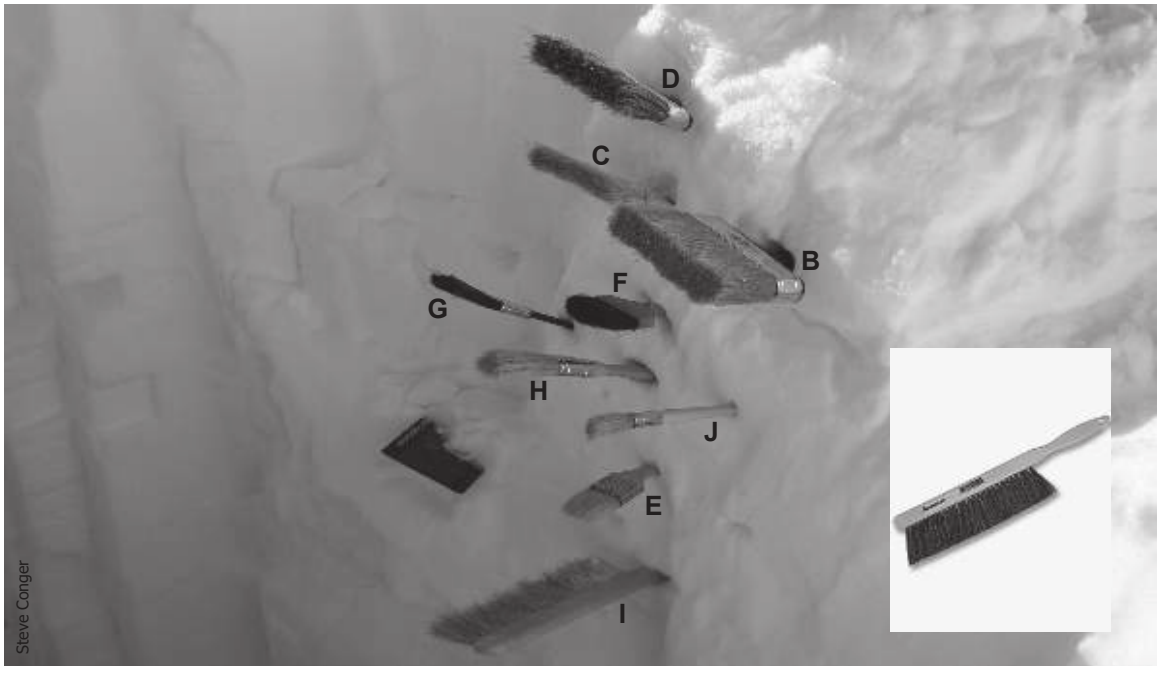


Figure 1. Selection of brushes (left) and choice brush Staedtler model 989 00 (inset).

Table 1. Brush characteristics

Photo	Style	Supplier	Weight (g)	Material	Width (mm)	Thickness (mm)	Length (mm)	Pressure Test Area (mm^2)	% of length flexed in Pressure Test	Pressure index (Pa)
not shown	Wallpaper Brush	Paint Sundry Products	229	bristle	180	20	50	6960	40.0%	975
B	Stain	Simms	151.5	polyester	101.6	20	80	3200	25.0%	2445
C	Wall	Simms	62	bristle	101.6	10	47	2920	42.6%	1056
D	Stain	Simms	127	bristle	101.6	17	70	3840	28.6%	689
E	Sash	HydroTech	21.5	bristle	37	7	42	1040	47.6%	880
F	Wax	Swix	21	polyester	50	8	37	1480	54.1%	1464
G	Sash	Generic	25.5	polyester	50.8	9	45	1040	44.4%	1839
H	Sash	Rona	37	bristle	30	14	65	1200	30.8%	1101
I	Drafting	Staedtler	65.5	bristle	200	6	53	2640	37.7%	1218
J	Sash	Simms	16	bristle	12	round	50	640	40.0%	1024

Figure 2. Illustration of technique for the flat ground pit wall using the brush of choice.

The assumption is made that the brush applies a force of disaggregation to the grain structure on the face of the snowpit wall based on the stiffness of the brush. Disaggregation force is related to the density and strength of the layer (Mellor, 1964). However, no stiffness standards exist for paint brushes (ASTM, 2002).

Using a test stand (DuPont Filaments, 1999) each brush's stiffness was measured by displacing 2 cm of the brush tip from the brush while it was held perpendicular to the measurement surface. The area pressured by the flexed brush and its splayed end was measured to determine a value per unit of pressure to compare brushes (Table 1).

Field trials consisted of excavating a long trench, exposing similar conditions at each point along the pit wall where testing was to occur. Multiple tests of each brush were completed, working into the pit wall and cleaning the back wall with a fresh shovel cut between each test. The brushes were rated on the ease of differentiating layers visually and the relative disaggregation of the grains.

The better-rated brushes (C, H, and J) fell in the mid range of pressure values. Thicker (B and D) and stiffer (G) brushes did not perform well. They damaged the surface, making relief and layering difficult to see. Snow adhesion was a problem on synthetic brushes when snow and air temperature were warmer. A drafting table brush (brush I in Figure 1) received the best overall rating and was the brush of choice.

Several methods of brushing were attempted and evaluated. Trial and error using the rating based on the ease of differentiating layers visually and the relative disaggregation of the grains resulted in a satisfactory method. This general method consists of the following steps:

1. Prepare pit wall as customary with a shovel blade (with a shaded side wall if the method is to be used for an inclined snowpit).
2. Determine the upper layer representing fist resistance.
3. Hold and maintain the brush perpendicular to the pit wall while brushing lightly, smoothly, and parallel to the layering. Make a full sweep across before beginning the return stroke.
4. Exercise caution to maintain the brush handle perpendicular to the wall and parallel to the layering to ensure accurate results.
5. Count the number of strokes (each direction is counted individually) until the fist snow is displaced by the brush to a depth equal to half the bristle length.
6. Move to an undisturbed area or re-prepare the pit wall.
7. Brush a 40 – 60 cm width of the wall horizontally back and forth with the number of strokes determined in step 5.
8. Move the brush position down the wall one brush-width and repeat step 7.
9. Continue down the wall to the base of the profile.

This method provided adequate results using the brush of choice in discriminating layering for comparison to a high resolution snow profile probe. The drafting table brush distinguished thin F or 4F layers from adjacent layers that were harder or softer by one hand hardness level. Variations in the hardness relief of the lowest density layers (HN and HST) generally corresponded to subtle grain differences representing variations in near-surface conditions during deposition (wind and grain type) and variations in metamorphism occurring near the surface.

Preliminary observations indicated a set of generally consistent characteristics of the brushed pit walls. The regions of F and 4F contained more relief than 1F and harder. 1F and harder were generally smooth with only strongly bonded layers (e.g. former crusts or ice layers) or persistent weakly bonded layers (e.g. buried SH) presenting any relief. In regions where primary densification was taking place, nominally in storm snow, there were alternating rounded ridges and valleys with a relief of 0.5 to 1 cm. This was associated with no distinct layering or multiple layer behaviour.

General stiffening of the layers with increasing depth in the storm snow was observable. Often the location of compression test results coincided with soft layers where brushing left a near right-angle at the interfaces between layers. A general notation of), (,], and [were used to indicate this difference between distinct layer boundaries.

Beyond this preliminary study, application of this method has potential to improve amateur observation quality for incorporation in snow profile analysis using threshold values based on the common field method for determining relative layers—the hand hardness test. The classic method of hand hardness has many limitations: its accuracy is observer dependent; it is unable to test thin F or 4F layers; and the ranking of such lesser hardness when occurring between harder layers is purely subjective. Ferguson (1984) highlighted this when she estimated the uncertainty of hand hardness when converted to force as ± 5 x 103 N/m2.

References:

Andersen, V. H., 1960: A technique for photographing snow-pit stratigraphy. *Journal of Geophysical Research*, 65, 1080 -1082.

ASTM, 2002: D5301-92 *Standard Practice for Physical Characterization of Paint Brushes*, 3 pp.

DuPont Filaments, 1999: *How to Evaluate a Paint Brush*, 8 pp.

Ferguson, S. A., 1984: *The Role of Snowpack Structure in Avalanching*, Geophyisics, University of Washington, 150 pp.

Greene, E., K. Birkeland, K. Elder, G. Johnson, C. Landry, I. McCammon, M. Moore, D. Sharaf, C. Sterbenz, and K. Williams, 2004: *Snow, Weather, and Avalanches: Observational Guidelines for Avalanche Programs in the United States*. American Avalanche Association, 136 pp.

McClung, D. and P. Schaerer, 2006: *The Avalanche Handbook*, 3rd Edition. The Mountaineers, Inc, 288 pp.

Mellor, M., 1964: *Properties of Snow* Part III - Sec A., 105 pp.

USFS, 1961: *Snow Avalanches: A Handbook of Forecasting and Control Measures*. U.S.D.A., 84 pp.

Product Review

Backcountry Access Snow Profile Kit and Snow Saw

By Rob Hemming

One thing is for sure. You can't do a good snow profile and think about the stuff that's bugging you at the same time. You have to stop thinking about how the quaint little ski towns you lived in or visited recently are being gentrified, changing beyond recognition until they begin to look like theme parks.

Thankfully, when observing a snow profile correctly, all the world's concerns seem to fall away. Pondering the physical processes that might be occurring on a molecular level in a layer of snow that has been buried for a week or more, you start to transcend the experience and it's possible you may begin to think about quality. Are those small facets, old surface hoar or both? Did the surface hoar begin to form on the small, near-surface facets and now they have rounded and that's why they look so funky? And why don't I get a consistent sudden planar shear on this obvious weak layer overlying the crust? To get good information requires a high level of concentration and good tools.

The BCA Snow Study Kit, with 1 metre and 2 metre folding rulers.

Rob Hemming

The BCA snow profile kit is one of those good tools. It comes in a moulded semi-rigid case that does a nice job of protecting the instruments from impact and moisture. Open the zipper and the case opens like a book, lying flat to expose its contents. The interior has an elastic mesh pocket on one side and a foam core with cut-outs for instruments on the other. Digital thermometer, inclinometer, and folding 6x magnifier are all secure in the cut-outs.

An empty cut-out is provided for a pencil. A little piece of webbing attached to the back makes it easier to pull the pencil out, like some battery boxes for small electronics have. Nice detail. This cut-out or slot would also do a good job of holding an alcohol or mercury thermometer. Every kit must have two thermometers in case one becomes non-functional for some reason. The elastic mesh pocket on the lid of the case holds the crystal card. The mesh offers some protection from the extra equipment some radical consumers may jam in the case before heading off to the hills.

Included in the package I received were BCA's 1 m and 2 m folding rulers. It's funny how people are about deciding what to take to investigate the mountain snow pack. When I showed the 1 m ruler to practicing avalanche professionals I got reactions like, "What use could that possibly be?" or "That's all I use for a ruler in the backcountry" and "Oh, that's soooo cute darling, will you give it to me?" The industry sure has changed in the last 15 years.

You need to use whatever works for you, as long as you can meet your objectives. Personally I like to use my 3.2 m probe pole/ruler in the corner of a snow pit whenever possible. Until the depth of the snowpack exceeds 3 m, I'll leave my 2 m ruler at home. The 1 m ruler is only 13 cm long when folded and fits easily into the snow profile case.

The rulers, like all of the equipment I've seen from this company, are well made with attention to detail. I like the colour. All equipment made specifically for snow profile work should be made of a light colour or have some other technology to resist warming from solar radiation.

The inclinometer is easy to use and read. The colour-coded bars next to the curved axis correspond to the ranges of inclination for avalanche initiation found on the Colorado Avalanche Center website, avalanche.state.co.us

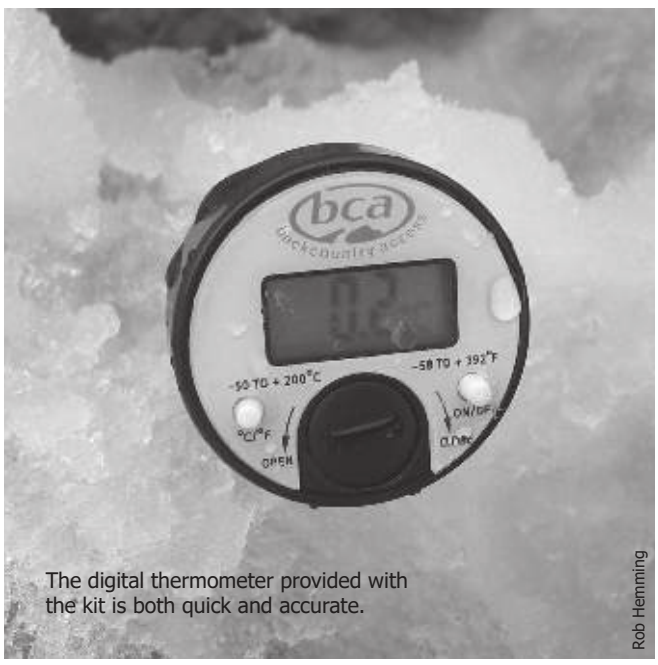
The digital thermometer is easy and simple to use even with gloves on. The BCA unit I tested was solid, displaying the temperature quickly when turned on even at –15 °C (or +5 °F

The inclinometer is easy to use, offering a dependable method of determining slope angle.

Rob Hemming

for those of you still clinging to the old imperial system). Access to the battery is convenient. It passed the slush test at plus or minus 0.2 °C and correlated well next to a proven thermometer from my personal kit. The only way to improve it would be to install an auto shut off. Why do all these digital thermometers have such a large range? You could check if the roast is done with this model.

The BCA crystal card is very nice. Silver in colour with black etching, it's 1.5 mm thick and nearly unbendable, making it a sturdy tool. There are three grids from 1 mm to 3 mm and a reference for snow grains on the ground on one side and reference for the compression test, shovel shear test and rutschblock test scores on the other. It also has a small hole drilled in one corner for attaching a leash if you want. This leash could be attached to the small web loop sewn into the elastic web pocket of the snow profile case. What's missing on the card, and I'm being real picky here, is a millimetre grid ruler on one side for measuring the thickness of thin persistent layers. Dr. Jamieson told me this is an important observation and I've been noting it for the last few seasons.



The digital thermometer provided with the kit is both quick and accurate.

Rob Hemming

The folding BCA 6x magnifier is a good thing. It takes up little room in the kit when collapsed and I like the fact that the lens is accessible for cleaning. Snow grain type and size seem to be easy enough to determine at this magnification. The grid marks along the sides of the capture area are useful for confirming the size of the snow grains as well.

The BCA snow saw is a work of art. The padded ergonomic handgrip controls a thin, stiff saw blade that cuts through the toughest crusts. Dual chisel teeth cut on the push and pull stroke. Dual purpose, it would make a fine addition to the survival kit. Guides who have spent any time improving trails or cutting emergency firewood will really appreciate the blade on this puppy. A 30 cm ruler laser-etched onto the blade seems to be a permanent feature. I cut many green branches and windfall off our local climbing trail this spring with no sign of wear. With an overall length of just over 45 cm some may think it too short for a snow saw but I don't agree.

Snow profile observations are required for the assessment of avalanche hazard. Whether you are a recreational backcountry skier, a professional running an operation in avalanche terrain, or a movie star making a life-and-death decision at the top of a big fat face, you must look at the structure and layering of the snowpack around you. This information is not available unless you get your face up close against a pit wall (or perhaps you have trusted man servants that can get the information for you?). Pits should be done frequently, with an attitude of learning, opening your mind to the world of ice crystals and physical processes. Then make a call and re-evaluate as you get new information.

Your objectives determine what kind of observation tools you need to bring with you (see the sidebar). This kit and accessories would make a nice basic kit for someone interested in studying snow science. Best of all there is still room in the

case for more instruments. Let's see, I can get a field book in there, spare thermometer and pencils and maybe even my density kit….

The BCA Snow Study Kit (moulded case with digital thermometer, inclinometer, crystal screen and a 6x magnifier) weighs in at 310 g. Throw in the 1 m ruler and a pencil and it comes up to 355 g. The BCA snowsaw with blade guard is 200 grams.

The kit is available at the Mountain Equipment Co-opand retails for $95. The 2 metre ruler is $11, the 1 metre ruler is $6 and the snow saw is $20. CAA members and AST instructors are eligible for a discounted pro price. Contact Backcountry Access at 1 800 670 8735 or check the website at www.backcountryaccess.com.

>> Rob Hemming has been an avalanche professional for 15 years. He is currently the Assistant Avalanche Technician for the BC Ministry of Transportation in Revelstoke, BC.

"My pencil is way down there"
Bernard Faure (from the movie Snow Wars)

The BCA snow study kit in action.

Rob Hemming

Recommended equipment list for full, test and fracture line snow profiles
- Collapsible probe
- Snow shovel
- Snow thermometer
- Ruler (graduated in cm)
- Loupe or magnifying glass (10x to 20x magnification)
- Crystal screen
- Field book
- Pencil
- Gloves
- Compass
- Altimeter
- Inclinometer
- Any equipment required for snowpack tests

Additional useful equipment for snow profiles:
- Brush
- Spare thermometer
- Snow density cutter and appropriate scale
- Camera
- Portable GPS receiver
- PDA (personal digital assistant) with digital field book/profile software
- Calculator
- Safety belay rope (see the Avalanche Handbook 3rd Edition)

Examples of equipment required to perform snowpack tests:
- Snow saw
- Rutschblock cutting cord 4 - 7 m in length or folding snow saw
- Rammsonde penetrometer including hammers
- Metal cutting plate about 30 cm x 30 cm
- Shear frames
- Small metal spatula
- Force gauge
- Tilt board
- Stuffblock kit

Other equipment nice to have
- Knife
- Time piece
- Digital camera, video capable
- Copy of the OGRS 2002 pages 15-34 and pages 62-68 or the relevant sections of the new revised edition
- Copy of the latest reference for shear quality
- Steve Conger pit wall brush
- Kestral 1000 pocket wind meter

Information regarding equipment can be found in the CAA *Observation Guidelines and Recording Standards for Weather, Snowpack and Avalanches*

Product Review

The Rescue Bubble

By Wren McElroy

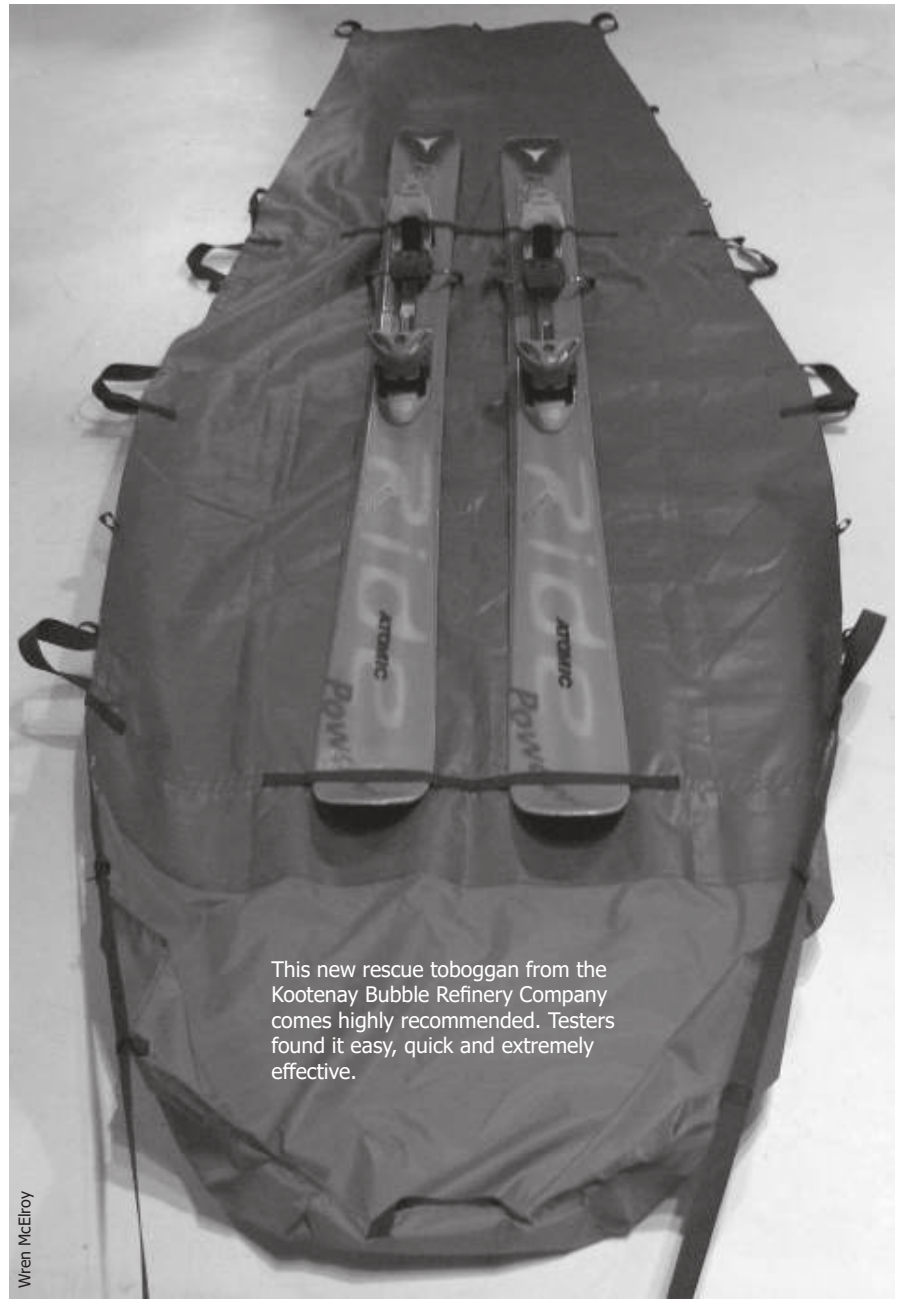
How much stuff does it take build a rescue toboggan? Skis, shovels, tarps, hose clamps, tape, cord, ingenuity? The list goes on. Over the years I have had a few different set-ups. Recently I've discovered the Rescue Bubble, a new option that really works for me. It is specifically designed as an efficient rescue toboggan and it's made in BC.

Working with local guides and keeping simplicity in mind, the Kootenay Bubble Refinery Co. of the Slocan Valley has created a foolproof design requiring no assembly and strong enough for long-term use. This business is the creation of entrepreneurs Elena Elder and Laure Perriere, who first worked with heavy-duty tarp material (cold crack to -45 °C) while developing herbal extraction bags. After consulting with skiers, guides and owner-operators of heli and cat operations, Elder saw a need for a durable rescue toboggan and she realized the waterproof tarp material already in her shop was the perfect vessel.

The design is straightforward—a .9 m x 2.6 m (3 ft by 8½ ft) piece of heavy-duty waterproof poly/vinyl tarp. On the inside are loops that hold the skis in place at the level of the patient's shoulders and calves, giving the sled stability and creating a smooth and fast sliding surface. The loops are designed to accommodate even the fattest of skis.

Having the skis inside provides rigid support for the body in the event of multiple trauma or potential spinal injury. Any available padding can then be layered over the skis and the patient placed on top. The tarp material folds up over the patient and laced with a piece of 3.5 mm nylon cord threaded though 1 cm poly/nylon webbing loops.

There are also six 2.5 cm nylon webbing handles attached with reinforced sewing along the sides, and another one at the head. These handles are purposely placed to support the heaviest parts of the body—the head, shoulders, hips and thighs. These give the toboggan an even weight distribution and allows the patient to be lifted once secured in. The Rescue Bubble is designed to carry somebody up to 1.9 m (6 ft 6 in) tall and comes complete with a lightweight nylon stuff sack to keep it compact and contained. The total weight is less than .9 k (2 lbs).

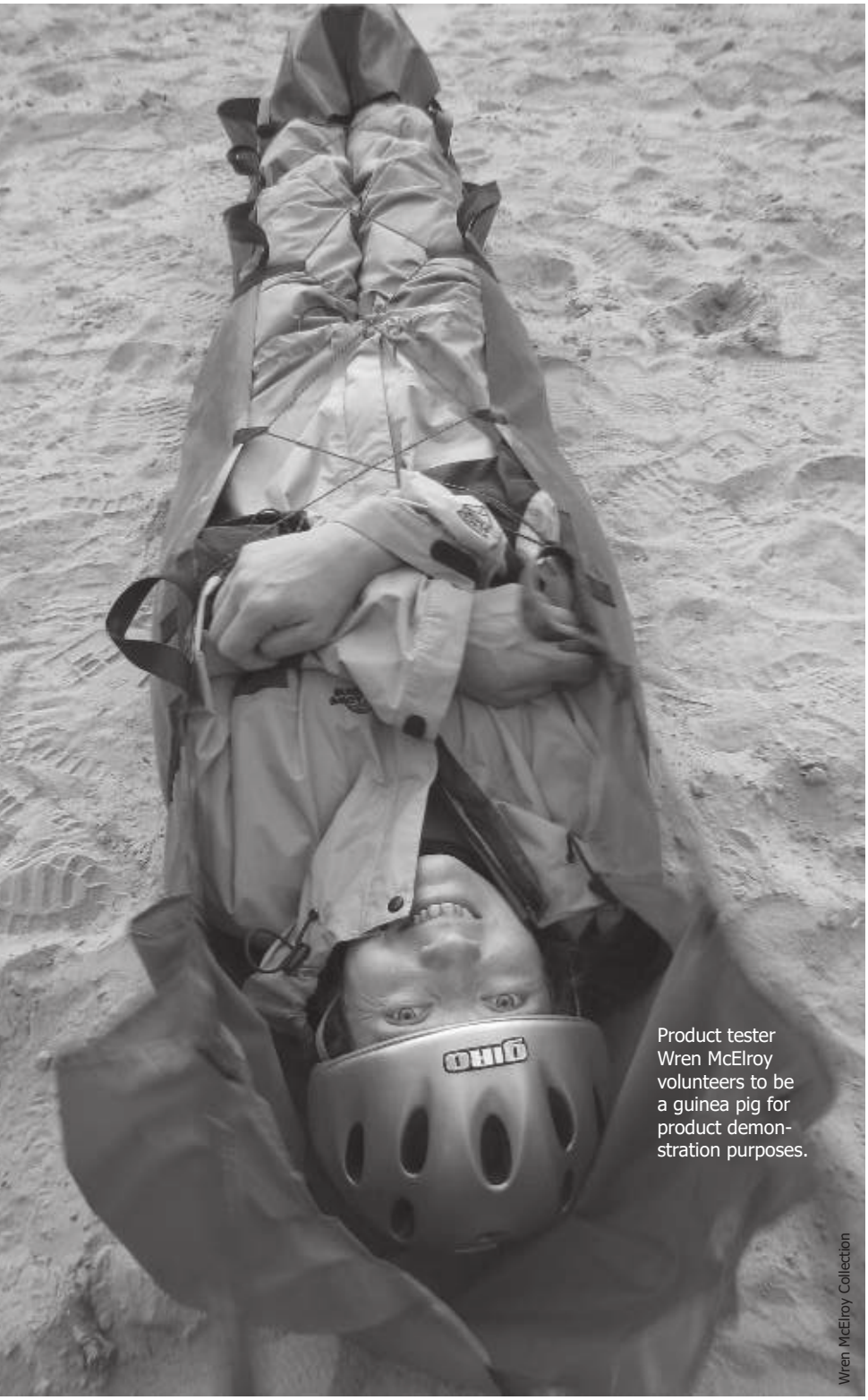


This new rescue toboggan from the Kootenay Bubble Refinery Company comes highly recommended. Testers found it easy, quick and extremely effective.

Wren McElroy

I had the chance to try out the Rescue Bubble on a three-day avalanche/winter camping course in March 2006 with the Renewable Resource Program of Selkirk College. This trip is the culmination of a semester-long Advanced Avalanche Skills Level 2 Course. I brought the Rescue Bubble in case of emergency as well as for a practice run and demonstration.

A spring cycle dropped about 30 cm on the last night of the course. The third day dawned with heavy snow and freezing levels just barely hanging in there. While waiting for the 16



Product tester Wren McElroy volunteers to be a guinea pig for product demonstration purposes.

Wren McElroy Collection

students to get packed up and ready, I found a volunteer willing to be my patient. We inserted a pair of skis into the slots of the Bubble and within minutes he was cocooned in with his gear.

Despite the smooth setup I still had a few reservations. I was concerned with how the bindings would affect the patient's comfort and, of course, the extra weight. Due to the proportional fit of using the patient's own skis as the frame, the binding height turned out to be a non-issue. For a 1.8 m (6 ft) person with 190 cm skis, the ski tips curl around the shoulders and the bindings ride just below the buttocks, with a slight flexion of the knees. I tried it out on myself with 170 cm skis. I am 1.6 m (5 ft 6 in) and I found it actually comfortable and very snug. However, in the event of a femur fracture the bindings would likely need to be adjusted or removed.

As for the weight, any misgivings I had about carrying the Bubble were soon dispelled as we plowed through the deep March powder. The strong, vinyl-coated material slid smoothly through the heavy snow, even though there was a good 40 cm of foot penetration. In fact, the material slides so well that a tail person for braking is certainly needed.

The burrito-like effect of the tarp wrapped up and around my patient kept him well covered. In addition, I really liked the stability of the whole package. Even if a steep traverse rolled the patient onto his side, he would be protected as if in a full body splint. For the first time I was carrying an adjustable hard collar (which weighed next to nothing and slid in along the back of my pack). In the event of a serious accident one could break out the Rescue Bubble and a hard collar and have their patient going very quickly and securely.

The most valuable feature about the Rescue Bubble is that there are only two parts—the nylon cord and the tarp. There are no attachments, no metal parts and nothing to break. You could even make the sled into a sturdy emergency shelter or bivy in the unfortunate circumstance of an unplanned night out.

Another story of the Rescue Bubble's success comes from Rod Gibbons, an ACMG instructor/examiner and Operations Manager for RK Heli-Skiing. In his capacity on the ACMG courses he has had the opportunity to see many different toboggans, store bought and homemade. He calls the Bubble "the best, hands down, out of anything that I have seen. When people try to rig a rigid sled it takes longer and there are more pieces to come apart."

Gibbons' first experience with the sled was on an ACMG exam in the first week of December 2006 at Monashee Powder's Tsuius Lodge. As many of you will remember, the storm cycles at that time made for very deep conditions across BC. The foot penetration on that course was 40 - 50 cm of low-density snow.

During the mandatory toboggan assembly part of the exam, participants have to put their sleds together, package their patient and take them down a 300 m slope. The exercise must be completed in 45 minutes. One of Gibbons' students, Shawn

West, showed up with a Rescue Bubble prototype he had co-designed with Elder. Two groups began their assembly at the same time. West had his patient in the sled and down the slope in 10 minutes. The deep snow billowed around the patient who was well sheltered by the tarp. The other group, using another brand of toboggan, took 40 minutes.

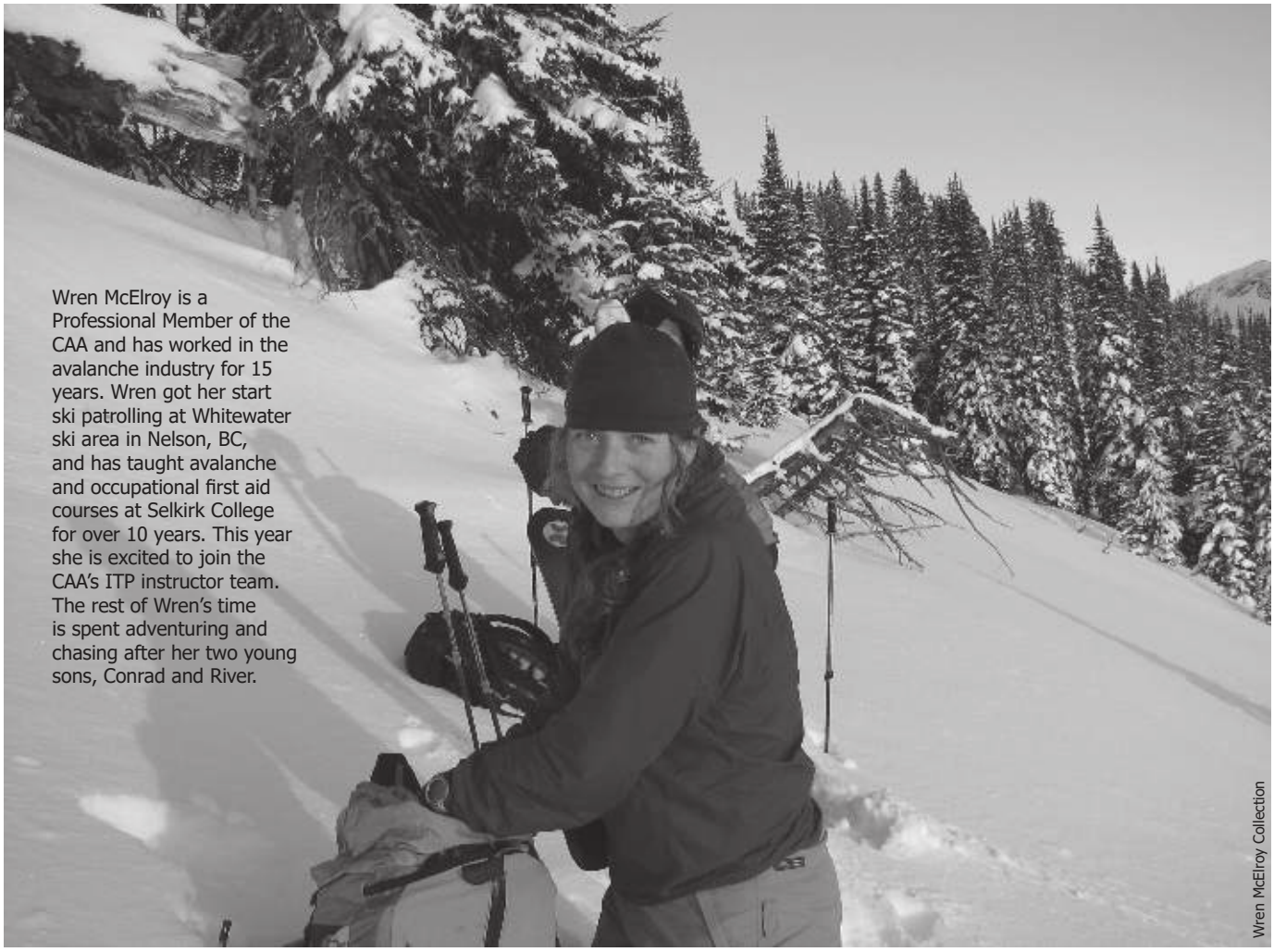
"If anything it was more of an issue to control the speed," said Gibbons. "With most sleds it is hard work to pull through deep snow. Clearly it was much easier to operate. The patient was in quicker and moving easier." The examiners weren't timing the students as such, but they do pay attention to time. Without a doubt, in the event of a life-threatening injury, time is of the essence. The quicker somebody is moving, the better their chances of survival.

After that experience Gibbons purchased his own Rescue Bubble. In his role as a heli-ski guide, Gibbons sees the opportunity for expanded use of the Bubble. "I see many more situations where this sled would get more use than calling for a Cascade-type rescue toboggan," he said.

I am excited to find a product that is not only very useful but is also made in a manner that fits with my personal values, in that it's BC-built and not mass-produced offshore. Elder and Perriere are also very aware that they are producing safety equipment. Each Rescue Bubble is individually sewn and carefully inspected. You won't find a missed stitch.

As an avalanche and first aid instructor, I believe all groups heading into the backcountry facing the unfortunate circumstance of having to rescue a client, student or friend would benefit from carrying this sled. As an emergency toboggan, the Rescue Bubble is appropriate for use by professional and recreational skiers alike and it makes a great crazy slide on a down day!

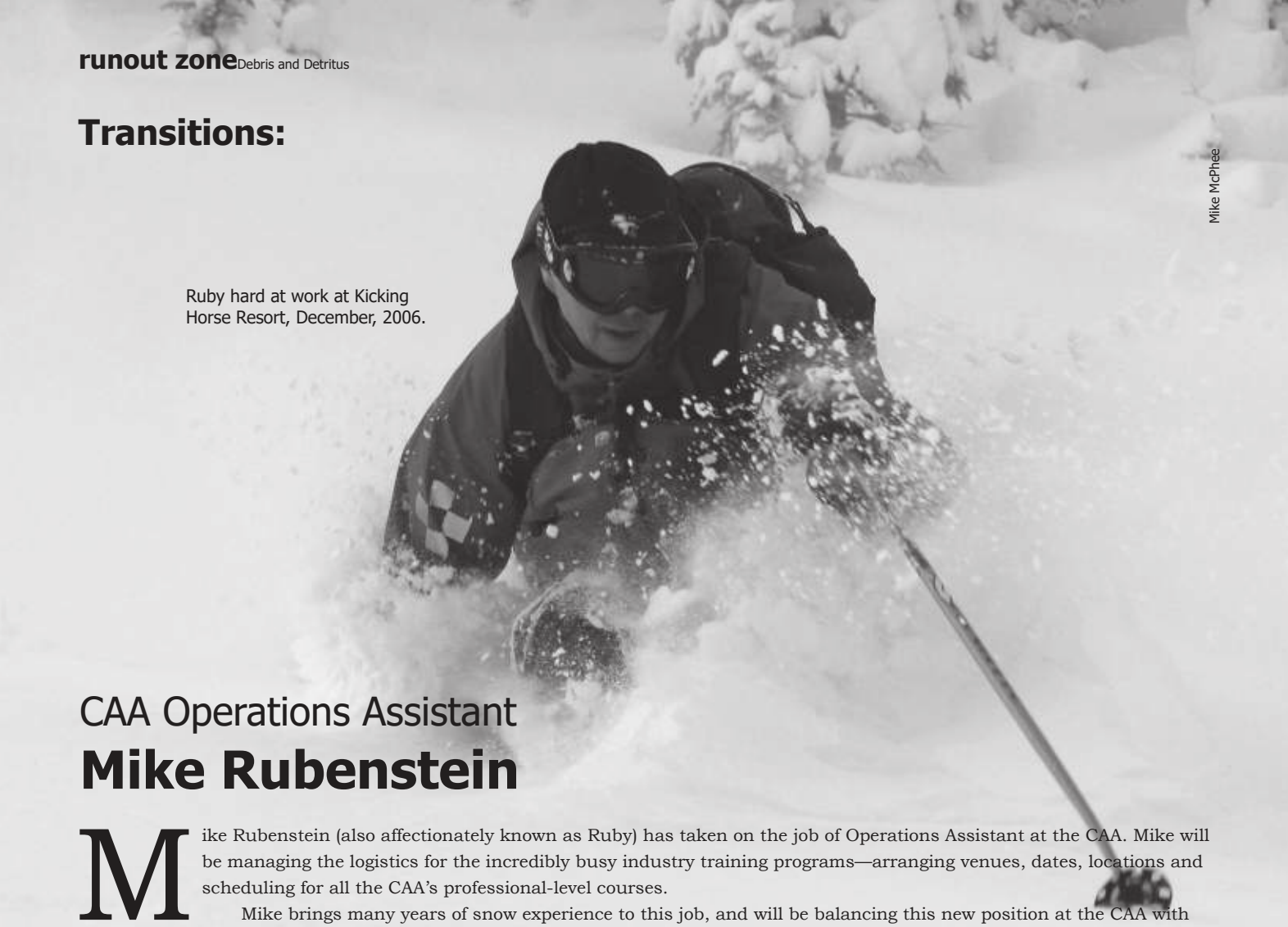
For more information see www.rescuebubble.com



Wren McElroy is a Professional Member of the CAA and has worked in the avalanche industry for 15 years. Wren got her start ski patrolling at Whitewater ski area in Nelson, BC, and has taught avalanche and occupational first aid courses at Selkirk College for over 10 years. This year she is excited to join the CAA's ITP instructor team. The rest of Wren's time is spent adventuring and chasing after her two young sons, Conrad and River.

Wren McElroy Collection

Transitions:



Mike McPhee

Ruby hard at work at Kicking Horse Resort, December, 2006.

CAA Operations Assistant
Mike Rubenstein

Mike Rubenstein (also affectionately known as Ruby) has taken on the job of Operations Assistant at the CAA. Mike will be managing the logistics for the incredibly busy industry training programs—arranging venues, dates, locations and scheduling for all the CAA's professional-level courses.

Mike brings many years of snow experience to this job, and will be balancing this new position at the CAA with his current responsibilities as Snow Safety Manager at the Kicking Horse Ski Resort in Golden. He moved to Golden seven years ago to take on the job as Ski Patrol Supervisor. He's also been the resort's avalanche forecaster before moving to his present role in management. Before Golden, he ski patrolled at Lake Louise for four years.

CAA Operations Manager Ian Tomm says, "Mike has really taken the bull by the horns here. We've needed someone to fill this position for a while now, and I'm really glad to have him on board." For his part, Mike says he is "proud to work for something I really believe in. The CAA sets standards worldwide and does a lot of great things for industry and the public."

On a final note, Mike's skills at juggling the demands of various jobs will soon be meeting yet another challenge. In November, Mike and his partner Melissa Huntley are expecting their first child. It's a good thing Mike is no stranger to multi-tasking!

Reception

Tammy Beech


CAA Staff

Tammy Beech took on the role as receptionist in the late spring and we are all happy to see her back at the front desk this fall. Tammy has strong roots in Revelstoke. Her parents came to this mountain town in 1956 and raised five girls here—Tammy being the youngest. Tammy's husband Jeff has even stronger ties; his family has been here since 1910.

Tammy and Jeff have three teenaged children. After living in a number of small towns and cities in BC and Alberta they returned to their home town in 2001 to put down roots. They've bought one of Revelstoke's distinctive historic buildings and are currently renovating the beautiful structure, built in 1897, into a home.

Before coming to the CAA, Tammy worked at the Government Liquor Store, helped her husband run a small business, but "mostly I've been a stay-at-home mom for the last 18 years." Tammy says she "enjoys the atmosphere here in the office. Everyone is really into their work and very friendly. It's a great environment."


Jennifer George with husband Greg Paltinger and their son Noah.

Jennifer George Collection

CAC Marketing and Sponsorship Coordinator

Jennifer George

Jennifer George is back from her maternity leave. Along with her new role as mom, she has also taken on new responsibilities at the CAC. As the Marketing and Sponsorship Coordinator, Jennifer will manage the current CAC sponsorship contracts, create new sponsorship products and promote the CAC to potential new sponsors.

Jennifer is well suited for this position, with a Bachelor of Science Degree in Business Administration and Marketing with honours. Before coming to the CAC, she held a number of sales and marketing positions in the Information Technology Consulting industry. Her most recent sales accomplishment was selling the idea of attending daycare to her one-year-old son, Noah. So far, it's been successful!

Everest

By Ursula K. LeGuin

How long to climb the mountain?

Forty years. The native guides
are dark, small, brave, evasive.
They cannot be bribed.

Would you advise
the North Face?

All the faces
frown; so choose. The travelers describe
their traveling, not yours.
Footholds don't last in ice.
Read rocks. Their word endures.

And at the top?

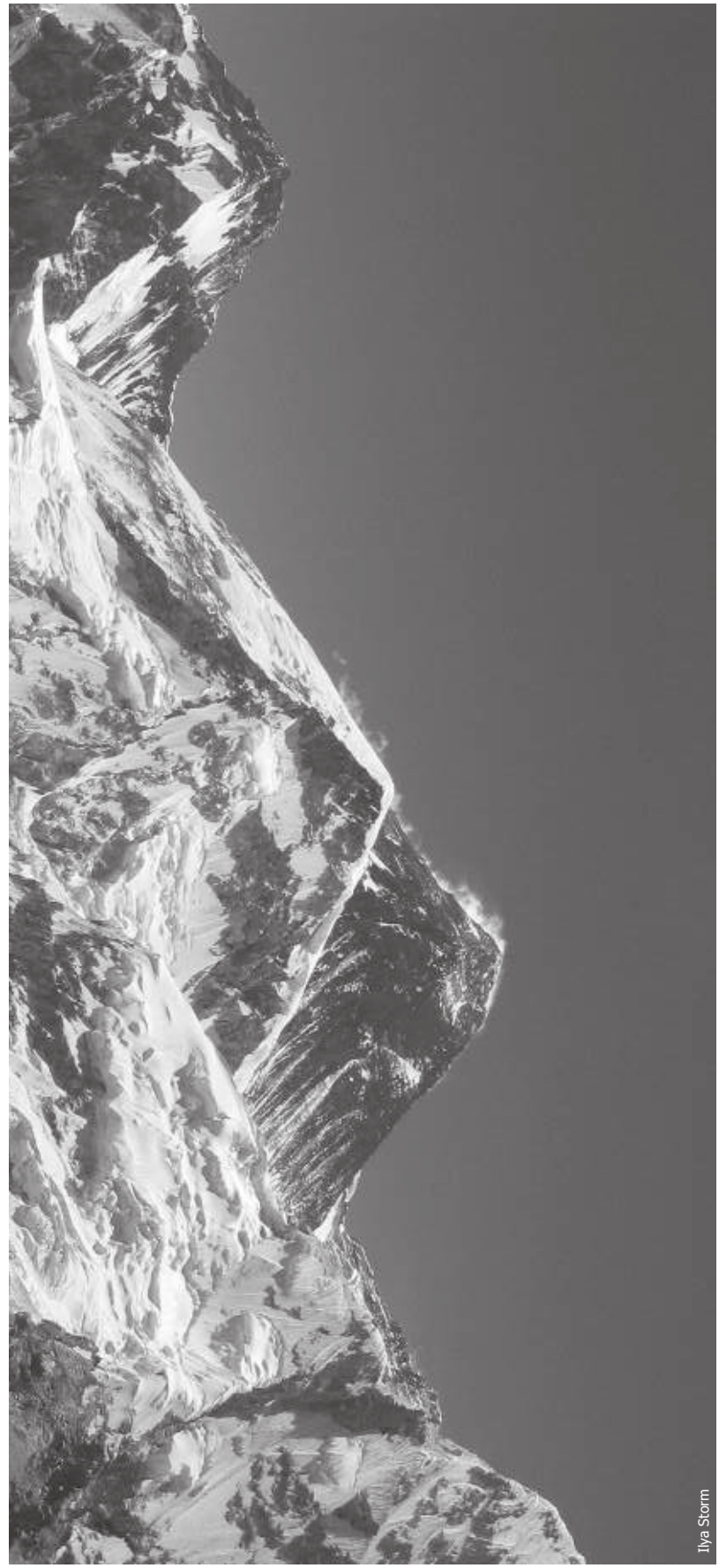
You stop.

They say that you can see
the Town.

I don't know.
You look down. It's strange
not to be looking up; hard to be sure
just what it is you're seeing.
Some say the Town; others perceive
a farther Range. The guides turn back.
Shoulder your pack, put on your coat.

From here on down no track,
no goal, no way, no ways.
In the immense downward of the evening
there may be a far within the golden haze
a motion or a glittering: waves,
towers, heights? remote, remote.
The language of the rocks has changed.
I knew once what it meant.

How long is the descent?



Ilya Storm

> Under Freddy Schleiss, I think (the Rogers Pass avalanche control program) was developed to perfection, or as close as it can come to perfection. I was always very impressed by what he did. On a number of occasions, I was actually able to go with him and he would direct the shot to be fired at such and such a place. He'd say, 'This one is going to come down to that bench.' He had so much data in a relatively controlled environment…that is really a great example of what can be done.
>
> *Hans Gmoser in the CAA's Oral History Project*

Avalanche Detective

Do you know where this picture was taken?

For many years, this photo was misidentified in the files of the Revelstoke Museum and Archives, bundled in with all the other images from the 1910 Rogers Pass avalanche that killed 58 men. However, earlier this year, Dr. John Woods and Fred Schleiss took it upon themselves to positively identify all the photos relating to that accident in the collection. Of the hundreds of shots, the two managed to locate all but four of them. Of those four, this one is the most intriguing.

"That's a huge pile of avalanched snow," John Woods pointed out. "It's a significant avalanche but Fred and I studied this problem for days and we can only determine that if it was taken in Rogers Pass, it was from a perspective that we don't know. I thought it could have been taken below Avalanche Crest and Fred thought it might be in the Beaver Valley, but on our field trips this spring we just couldn't find the right vantage point. That's when we started to think that it might be from somewhere else completely."

If you think you know the location of this photo, write in and let us know. Send your best guesses to canav@avalanche.ca. Fame and fortune (well, fame anyway) await!

Revelstoke Museum & Archives

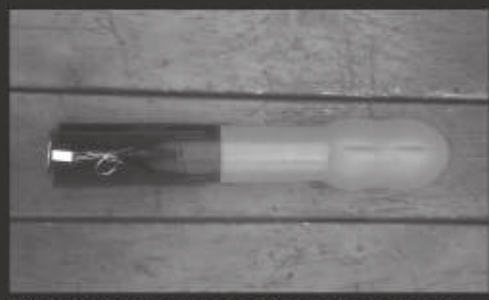
Flakes


THE Adventures OF Facet & Graupel
AREA-51
rogers pass
Ahhh! Aliens from above coming to probe us and take our bonding partners. Propagate for your lives!
Wooo! A portal to sublimation is opening. A Gaseous State awaits. Take me. Take me.
©rob buchanan


COLUMBIA BREWERY
Kokanee
GLACIER BEER
Kokanee
GLACIER BEER
COLUMBIA BREWERY
BC'S
GLACIER
FRESH
TASTE

C·I·L / ORION

CIL/Orion explosives for avalanche control and a full line of accessories are now available throughout North America at:



▲ Stubby Tornado Snowlaunchers

▲ Shock Tube Initiating System
▲ Aerodynamically Engineered

▲ Experienced Technical Field Service

▲ Current season performance
0.01% Dud rate

CANADIAN LOCATIONS

Austin Powder Ltd
- Calgary, Alberta
- Kamloops, BC
- Courtenay, BC

FEATURING:

- ▶ The Avalanche Guard System with all the Explosives and Pyrotechnics
- ▶ Snowlaunchers
- ▶ MILDET USA factory made Fuse Assemblies
- ▶ Emulsions, Dynamites & Cast Primers
- ▶ Custom AN/FO Heli Charges
- ▶ Pull-Wire Igniters from Canada, USA and Germany

When you request CIL/Orion products, you are supporting your industry!

3% of ALL PURCHASES go to the Canadian Avalanche Association for training purposes.

CONTACT OUR AGENT:
David Sly 250.744.8765
davidgsly@mapleleafpowder.com