the avalanche journal

101 // F 2012

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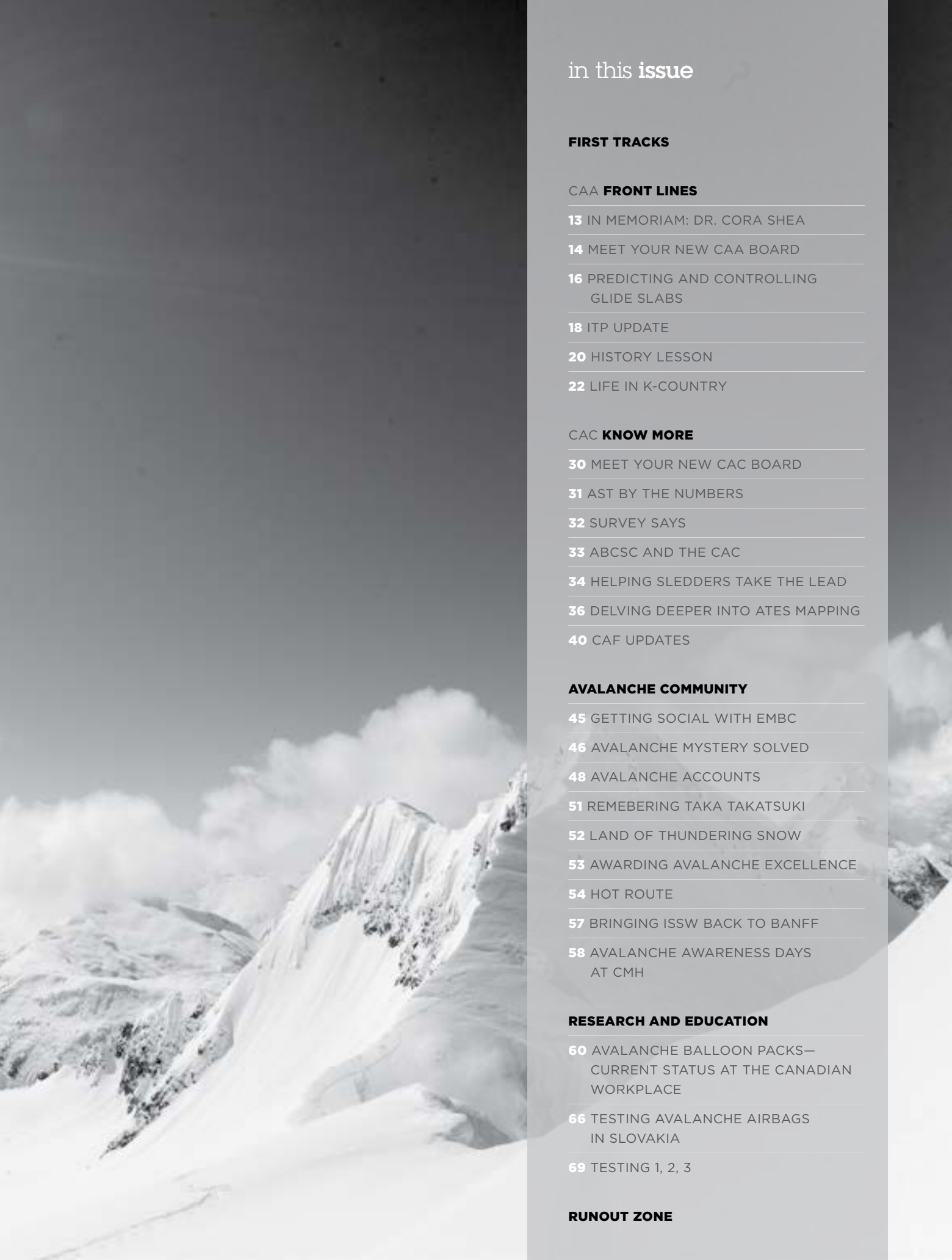
Thank you
to **Kootenay Mountain Culture**

FOR SUPPORTING OUR CAC MEMBERSHIP DRIVE

COVER BOW VALLEY PHOTOGRAPHY AND KANANASKIS COUNTRY PUBLIC SAFETY // **CONTENTS** CHRIS CHRISTIE



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the avalanche journal

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MAMMUT

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SWISS TECHNOLOGY

Looking Ahead

WHEN THIS ISSUE OF *THE AVALANCHE JOURNAL* HITS THE PRESS, ISSW 2012 IN ALASKA WILL BE JUST WRAPPING UP.

Karilyn Kempton
Managing Editor

WE ARE FORTUNATE to work in an industry with so many innovative, knowledgeable individuals striving for excellence in the professional avalanche industry and in public avalanche safety. The energy during many of the CPD presentations and case study presentations at the spring conference was palpable. It is gratifying to see so much enthusiasm for progress, thought-provoking discussion, and teamwork. Events like ISSW and the annual conference contribute to the future of our industry by continually propelling it forward. I encourage you to attend next year's conference, and to start thinking ahead toward ISSW 2014 in Banff. This issue of the magazine features skews a bit heavily toward research. I am sure many of you have been eagerly waiting to read the results of Pascal Haegeli's avalanche balloon pack study, and it is complemented by a Slovakian study on their efficacy. As always, I welcome contributions of articles, research papers, product reviews, trip reports, first-hand avalanche accounts, on-the-job stories, letters, photos and more. Email editor@avalanche.ca.

I hope you enjoyed your summer. Winter will be upon us before we know it.

Cheers,

Continued Supporter CIL/Orion

KARILYN KEMPTON

EVERETT CLAUSEN, PRESIDENT OF CIL/ORION, presented a cheque for $9173.05 to CAA Explosives Committee Chair Scott Aitken. Each year, CIL/Orion donates a portion of their company's revenue to the CAA. Thank you Everett and CIL/Orion for your ongoing support.

Failure Plane

IN "GO FARTHER, EXPERIENCE MORE, BE SAFE, BECOME AVALANCHE TRAINED" in Volume 99, we said that registration is not mandatory for snowmobiles in British Columbia. Snowmobile registration is, in fact, mandatory in British Columbia. We apologize for any confusion around this issue. Please contact snowmobile@avalanche.ca with any questions.

IN "SPORTSCOTLAND AVALANCHE INFORMATION SERVICE" in Volume 100, Alan Dennis' acknowledgements were missed. Alan's article should conclude with "With thanks to Ross Purves and Bruce Jamieson for review and comment – the errors are mine (e&oe)." Due to space and editorial discretion, some parts of Alan's article were left out. They may be included in an upcoming issue in "Part Two of the Scottish Avalanche Experience."

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Contributors

PASCAL HAEGELI
After graduating from university in Switzerland, Pascal moved to Vancouver to complete a PhD in the study of avalanches. Since finishing in 2004, Pascal has been working as an independent avalanche safety researcher and consultant. He developed the Avaluator and more recently co-authored Decision Making in Avalanche Terrain. He is also an adjunct professor at Simon Fraser University. Whenever there is time, he tries head into the mountains in search of powder turns.
60 AVALANCHE BALLOON PACKS

IAN GALE
Ian spends his winters working on the Mountain Safety team at Kicking Horse Mountain Resort and exploring the Dogtooth Range, Rogers Pass and the Rockies on both skinny and fat skis. He splits his summers between biking, mountaineering and working as a fire fighter, not necessarily in that order. Ian lives in Golden with his wife Shauna, and they're expecting their first child in October.
56 HOT ROUTE

BRIAN GOULD
Brian Gould, P.Eng., IFMGA, is an avalanche consultant based out of Squamish, BC. Most of his work time is spent on avalanche projects as company principal for Alpine Solutions Avalanche Services; however he still guides mountain and ski trips a few weeks each year. Outside of work he can be found exploring everything from the local playground to the faraway rock climbing crags with his wife and two young daughters.
36 DELVING DEEPER INTO ATES

NOEL ROGERS
After falling in love with the Alps, Noel decided it was time to leave the Eastern shores of New Brunswick where he grew up and follow a dream in the mountain ranges of Canada. Today, that dream has led him to Canmore, Alberta and to the creation of Bow Valley Photography, where he is driven by a passion to share the beauty of the mountain parks with others.
COVER SHOT

MELANIE BERNIER
A passionate backcountry skier at heart, Melanie has been on the Canadian National Ski Mountaineering Team since 2006. She raced in the 2008, 2010 and 2011 World Championships in European countries, which has brought her to explore on skis mountain ranges in other countries. She currently lives, plays and train in Revelstoke, BC.
56 HOT ROUTE

CAM CAMPBELL
Cam is a Senior Forecaster and Special Projects Coordinator with the CAC, a CAA Industry Training Programs Instructor, and an Avalanche Specialist with Alpine Solution Avalanche Services. He chairs the CAA's Technical Committee and is on the Education Committee. After developing ATES zoning methodology three years ago, Cam and his teams have zoned over 4000 km^2 of recreational avalanche terrain.
36 DELVING DEEPER INTO ATES

caa

front lines

in this **section**

GREG PALTINGER

CAA President's Message

WHEN I LEARNED TO SKI AT MOUNT NORQUAY, I DID NOT REALIZE THAT IT WOULD LEAD ME TO A LIFE OF SNOW AND ADVENTURE. I TOUCHED DOWN IN WANAKA, NZ SHORTLY AFTER GRADUATING HIGH SCHOOL, AND THEN EVENTUALLY IN NELSON, BC. I PLANNED TO BE IN THE KOOTENAYS FOR ONE WINTER BEFORE HEADING HOME TO THE ROCKIES. THAT WAS IN '93; I'M STILL IN NELSON.

Robb Anderson
CAA President

I WORKED as a ski patroller at Whitewater Ski Resort for ten years before joining the Ministry of Transportation Snow Avalanche Program at Kootenay Pass, mentoring under the close eye of John Tweedy. In the winter of 2006 I was lucky enough to work in Stewart, BC with the MOTI Bear Pass avalanche program; we had record snowpack levels accompanied by numerous climax avalanche events.

Throughout my career, other CAA professionals have helped me along informally and formally. CARDA member Jason O'Neil and retired RCMP Constable Terry Barter nudged me towards becoming a CARDA member, which I did from 2004-09. I became the program manager at Kootenay Pass after John Tweedy retired in 2010, enabled by mentorship and encouragement.

Over the last 30 years, many avalanche professionals have had the foresight and commitment to build the CAA. I am proud to now be a part of that great history. It is a privilege to serve as your president. We are at some critical junctures in our association's history and we are charting our future course.

I find myself asking how I can best work with CAA members, board members, and staff to ensure all CAA members have opportunities to grow and develop in new directions through mentorship and professional directions set by the CAA.

SEIZING CHANGE

Many of our professionals have similar stories: openness to change and new opportunities leads to success. The CAA has been no stranger to change this past year, and our challenge is to continue to find opportunity in this change.

The formal separation of the CAA and the CAC is obviously the largest of these changes, but necessary given the distinct mandates, goals and objectives of each organization. The CAA can now focus on member services, industry training programs and industry services.

As of May, there are three new representatives on the board: Secretary/Treasurer Rob Elliot, Director of Affiliate Members Dave Dornian, and myself. Thanks again to Phil Hein, Mike Boissonneault and Scott Brushy for their past (and hopefully future) contributions.

Joe Obad was hired in January as CAA Executive Director. In the short time I have worked with him, I have been impressed with Joe's personality and disposition. Joe has quickly gained the confidence of the board with his positive leadership style, background in non-profit organizations, and work with key stakeholders. I tip my hat to Phil Hein and Aaron Beardmore for the hard work that went into hiring a new ED.

It is safe to say that your new ED and directors are still getting their respective feet back underneath them. Our first workshop in early June gave us an opportunity to discuss the issues facing our association. We have made a commitment to focus on member services and communication.

During the spring AGM, a member motioned for the board to look into providing "mini" CDP seminars during the year. Board brainstorming on delivery methods ranged from webinars to several local sessions in accessible communities. We explored topics from working with WorkSafe BC on how to improve Avalanche Safety Plans to exploring the practical implications of Pascal Haegeli's recent study on avalanche airbags. What are your ideas? Send CPD session suggestions to me at president@avalanche.ca or to Joe at jobad@avalanche.ca.

Ultimately, professional development means all CAA members carry the burden of advancing the profession. Consider how you can advance the CAA for the next generation. Whether it is spearheading a CPD topic, leading a committee, or joining the Board of Directors, our incredible group of professionals got here by taking responsibility for the direction of our association.

My responsibility now is to listen to you. I am always open to ideas and feedback to advance the CAA and find opportunities in the new changes facing us. Send me an email any time at president@avalanche.ca.

Robb Anderson, CAA President

CAA Executive Director's Report

METAPHORS FOR INCREMENTAL CHANGE RUN A GAMUT FROM POSITIVE TO NEGATIVE. THE PROVERBIAL FROG THAT DOESN'T NOTICE THE TEMPERATURE GRADUALLY RISING IN THE POT OF WATER HE SITS IN, DEMONSTRATES PASSIVITY IN THE FACE OF CHANGE TO ONE'S DETRIMENT.

Joe Obad
CAA Executive Director

MORE HOPEFULLY, Confucius offered that the journey of thousand miles begins with a single step. So where is the Canadian Avalanche Association? Are we passive in the face of change or are taking the right steps to position CAA members in their careers in the future? After a year of significant changes with the formalization of our separation from the CAC, these are important questions for members to ask. It's critical that the members, committees, Board and staff of the CAA scan for key incremental changes and chip away at efforts that will pay off in the long term for members and association. These efforts sometime get lost in the hustle and bustle around large changes, but are no less important. Here are some key changes that shouldn't be lost in the mix.

CAA MEMBERS STEP UP

In the last issue, I made a gentle call to service for members to consider committees and the Board of Directors. This request was merely the echo of actual phone calls from committee chairs and board members to CAA members to serve our membership in a variety of roles. We have had several members step into new roles, some for the very first time. This also includes the CAA's new board members–President Robb Andersen, Secretary/Treasurer Rob Elliot, and Director Dave Dornian for Affiliate Members. Each brings the right balance and has enough "skin in the game" to ensure decisions are experience driven, while at the same time looking at the big picture for the interest of the entire membership.

The CAA has also made moves in the structure of its committees to encourage greater communications between committees, particularly as new challenges and opportunities arise. For instance, the Professional Practices Committee will likely engage in several issues that touch on the nature of what it means to be a member of the CAA. It may seem obvious that the Membership Committee should be kept in the loop on these issues, but once the busy winter season sets in these connections can be overlooked. Formalizing these steps is a small but important step to making sure the interests of CAA members are safeguarded.

Coordination cannot cover every situation. Sometimes, a new approach is needed. To this end, the board has taken the initial steps towards a Governance Committee to help proactively define and assist the yearly cycle of governance of the board and committees.

RESPONDING TO CHANGING SERVICE REQUIREMENTS OF MEMBERS

While we have communicated with InfoEx subscribers about the upgrade project with TecTerra, some subtler service changes are on their way. In a response to InfoEX subscribers, we are increasing service from Uwe Granman's Mountain Weather Services. Weekend services will now include tables for precipitation, wind, freezing levels, and alpine temperatures. We will continue to work with Uwe towards delivering full weekly coverage across the season to help member forecasters and operators to proceed with additional confidence in their decisions.

FISCAL STABILITY

The ability to offer services to members depends on running a healthy organization. Secretary/Treasurer Rob Elliot has been working with the staff on a model for the organization that is stable in the long term while allowing us to meet short-term challenges. At this year's AGM, the board brought forward a fee increase of 25%. The measure passed with very strong, but not universal support. Part of the sticker shock of the 25% increase relates to the fact that member fees had not increased since 2006.

By not addressing the incremental costs of change, the CAA had to ask for a significant leap in fees. Rob Elliot, the staff and I will be looking at long term goals to ensure the fiscal health of the CAA while avoiding dramatic changes in fees or service delivery.

In all these efforts, we appreciate the member support and input we've received thus far. Our doors are open to hearing from you about steps we need to take together on the path forward.

Joe Obad, CAA Executive Director

In Memoriam: Dr. Cora Shea 1980 - 2012

James Floyer

BRUCE JAMIESON

CORA WAS ONE OF THOSE PEOPLE who made you smile. She was nerdy and clever. She was amazed by the world around her, which would manifest at times as an endearing kind of schoolgirl excitement. She was passionate and keen, and her knowledge burned with a special kind of animated fervour. She was at once helpful and full of ideas. She was generous with her knowledge and advice, and would offer freely, not expecting in return. She was endlessly enthusiastic.

Cora had a knack for reducing complicated research questions into bite-sized chunks that even the most die-hard practitioner with no penchant for science could comprehend. This, coupled with an ability to give some of the best science talks on the circuit, made her an instant hit at meetings and conferences within the avalanche patch. "She's always got some cool new gadget or toy to show off," I remember someone remarking once. It was true, and you just knew you wanted to know more about whatever it was that was on display.

Cora's list of achievements within the avalanche industry is impressive. She gained her Ph.D in Geophysics from the University of Calgary's ASARC program in 2011. She was able to use a high resolution thermal camera to help elucidate some of the small-scale snowpack processes that have turned out to be critical for snow metamorphism. She developed a new sampling technique to analyse the spatial distribution of surface hoar, and developed a prediction algorithm to determine the likelihood of surface hoar formation given certain parameters. Cora also developed ARFI—the Avalanche Research Forecasting Interface—which has been in operational use at the CAC and elsewhere for two years now. It is an interactive geo-catalog with a map-based interface that allows users to instantly locate and view resources close to their area of interest.

The preceding partial list of Cora's achievements would stand well on the resume of an experienced researcher with a mature understanding of the needs of the avalanche industry. Her breadth of research, her list of publications, and the uptake of her ideas by the community are exceptional. These achievements are all the more remarkable considering Cora had only relatively recently turned her attention to solving avalanche-related problems. Sadly, we can now only dream of what else might have come forth from her amazing analytical mind.

With Cora's passing, we have lost a friend, a remarkable researcher, an endlessly enthusiastic colleague and a growing star in the realm of avalanche science. We will remember your quirky, hilarious presentations, your superb ideas for advancing science, and your hat with the built-in umbrella for keeping the snow off your research pit wall.

The Cora Shea Memorial Fund has been established to provide modest financial assistance to women working to establish a career in the avalanche world. One award of up to $1000 will be awarded each year. Applications should be sent to the Canadian Avalanche Foundation by May 31, 2013. For more information, visit avalanche.ca/caf/programs/cora-shea-memorial-fund. Please feel free to send your thoughts on how Cora affected your life to kkempton@avalanche.ca before October 15.

DAVE DORNIAN, RICHARD MILLER, AMBER WOOD, SCOTT BEARDMORE, DEBBIE RITCHIE, ROBB ANDERSEN, CAA EXECUTIVE DIRECTOR JOE OBAD AND ROB ELLIOTT; MISSING: SCOTT HICKS

Meet Your **New** CAA Board

THE CAA WELCOMED SEVERAL NEW FACES TO THE CAA BOARD OF DIRECTORS AT THE AGM IN MAY.

ROBB ANDERSEN, PRESIDENT

Robb Andersen is the program manager of the BC Ministry of Transportation and Infrastructure Snow Avalanche Program in Kootenay Pass. Robb grew up in Banff, but has called Nelson home for nearly two decades. Robb spent ten years on the Whitewater ski patrol before starting with the MoTI avalanche program in 2004. He has worked at Kootenay Pass for all but one of those years, when he spent a season in Stewart, BC during their biggest year for snowfall since 1972.

A forest fire fighter for 17 summers, Robb finished fire fighting in 2010 to take on his current position. Robb is passionate about snow, skiing, and the value of avalanche education training—he has been instrumental in helping organize the logistics of CAA avalanche operations courses in Kootenay Pass. Robb and his dog Aquillo were a CARDA team for six years, and he hopes to get another dog and do it again in the future because he calls it incredibly rewarding.

Robb looks forward to his position as President of the CAA: "I feel that it is the responsibility of the membership to be involved in the great work the CAA is doing." He thanks the many outstanding individuals that have made great contributions over the years, and is "honoured to have been considered for the position."

ROB ELLIOTT, SECRETARY/TREASURER

Rob Elliott is the lead guide at Revelstoke Mountain Resort's Outdoor Centre. He runs their cat-skiing operation, provides AST courses and has developed a sled assisted touring component for the resort's activity list. Rob is a CSGA Level 3 ski guide and has recently completed the requirements necessary to become a Qualified Avalanche Planner.

Beyond his time in the avalanche industry, Rob has a business background that positions him well for the CAA Secretary Treasurer's role. Rob has a degree in economics and has spent several years as an accountant and comptroller with firms in Calgary and Vancouver. Entrepreneurial inclination and an over-active lifestyle prompted a move into the restaurant business in 1990. A series of restaurants have since followed and even though his former lifestyle pursuits have faded (rugby and mountain bike racing), active work remains a priority: patrolling at Lake Louise, ski-guiding in the Kootenays and Columbias, and currently, timber-falling throughout BC and AB. He moved to Revelstoke with his family in 2004 and, while he still has a small finger in the restaurant business, his focus is now on ski guiding and the resort's development. Rob believes he can provide an original, informed voice to the CAA board, and is

looking forward to exciting prospects ahead for the CAA. Rob has also joined the CAC Board as a CAA Appointed Director.

DAVE DORNIAN, DIRECTOR FOR AFFILIATE MEMBERS

David Dornian is a climber and skier who works with the Alpine Club of Canada managing mountain sports programs—climbing, ice climbing, and ski mountaineering competitions. Born in Edmonton, Alberta, he has lived most of his life in Calgary, working first as an academic while pursuing graduate degrees in the Philosophy of Science, and then in the Geophysical end of the oil patch, all the while spending as much time and money as possible on mountain recreations.

Taught to ski at Parker's Ridge by the legendary Brad Geisler while in high school, today David is a long-lapsed CANSI instructor and ruined mogul competitor whose interests and activities gradually moved more into the backcountry with the passing seasons. Ski touring since the 80s, he has traversed and managed tent and lodge camps for the ACC and other commercial interests, expedition skied in the St. Elias, and in the last ten years served as the unelected chair of Ski Mountaineering Competition Canada, the sport's national federation, where he promotes and organizes a calendar of races, works as an internationally certified referee, and helps manage the National Team.

"The proto-science of avalanche research has always fascinated me as an example of an emerging discipline that is lent urgency by the life and death aspects of its application. At the same time it appeals to the Earth Scientist in my background, and provides tools for a richer experience for my mountain recreations. I hope to be able to bring a broad perspective to the CAA as representative of Affiliate Members, where no one member can be said to be 'typical,' yet all share a passion and concern for the same subject."

Thank you to outgoing board members Phil Hein, Mike Boissonneault and Steve Brushey for their hard work and commitment to the Canadian avalanche industry.

GLIDE SLAB EXPLOSIVES CONTROL RESULTS, 50 MILE PATH. SKEENA RIVER CORRIDOR, WEST OF TERRACE, BC // ROD GEE

Predicting and Controlling **Glide Slabs**

Rod Gee is a CAA and AAA Professional member with thirty years industry experience. His association with Chris Stethem and Associates Ltd. from 1985 to 2011 provided participation in a broad variety of Canadian avalanche programs. Rod is owner of Northwest Avalanche Solutions Ltd., and is based in Terrace, B.C.

MY TWENTY-FIVE YEAR GLIDE SLAB EDUCATION BEGAN ON AN EARLY MORNING IN JANUARY 1989. A SNOWPLOW OPERATOR ON HIGHWAY 16 WEST OF TERRACE REPORTED WITNESSING A SIZE 3.5 AIRBORNE WET AVALANCHE CROSS THE RAILROAD AND HIGHWAY CORRIDORS.

THE DEPOSIT pushed sections of concrete guardrail into the Skeena River. Fortunately, no one was involved. I arrived at the site shortly after hearing the plow operator's report. "Argh! It's the glide slab I've been monitoring for the last week," I thought; "Why this morning? It's not raining, and it's not warm. Why did it run now? Were there indicators I'd missed?"

I came to the north coast of British Columbia to work in CN Rail's Skeena avalanche program. I brought seven years of work experience in the Rockies, and ITP training in the Selkirk Mountains and the Coast Ranges. However, I had minimal knowledge of glide slab behaviour.

Glide slab prediction is a challenge, compared to the relative predictability of most maritime snowpack avalanche activity. They are classic poster children for the discussion surrounding why "Hazard Level 2" is perhaps a better descriptor than "Stability Good, with the occasional size 4." Without start zone instrumentation monitoring glide rates, the CN Skeena program offsets uncertainty to some degree with frequent explosives control, and, where effective, runout zone earthworks.

These are some of the observations on formation and natural initiation I now use to evaluate glide slab stability:

- A low-friction ground surface is important for slab formation, but the degree of support from terrain features immediately below the slab is at least as important for slab failure.
- Rapid, early season snowpack accumulation associated with relatively warm air temperatures increases the likelihood of early- and mid-season glide slab formation.
- Lack of an effective ground freeze prior to snowpack accumulation results in increased mid-winter glide rates.
- Rainfall and meltwater percolation in an isothermal starting zone snowpack may accelerate glide rate by decreasing friction at the slab/

ground interface. Free water may also decrease the strength of the supporting snow downslope of the glide slab as well as the slab itself. Rain falling into the glide crack above the slab, likely has a similar net effect. However, rain does not guarantee slab failure it is only part of the equation.

- Glide slab failure does not require an isothermal snowpack. Failure may occur before the snowpack becomes isothermal or during the overnight cooling phase of the diurnal cycle, and without free water being present at the snow/ground interface.

EXPLOSIVES INITIATION

The ideal condition for explosives control occurs when the slab itself maintains a degree of strength greater than that of the snowpack below the toe and along the flanks of the slab. In an ideal scenario, a combination of terrain and weather factors unbalances the downslope snowpack stress/strength relationship to a greater degree than within the slab itself. The toe and flanks are now barely able to support the loading of the gliding slab. Explosives applied at this time cause slab initiation by triggering a failure of the snowpack at the toe of the slab.

Technicians Herb Bleuer and Mike Zylicz began experimenting with charge quantity and placement in the Skeena corridor in the early 1980s. They realized that conventional charge quantity was usually insufficient for glide slab initiation, and that charge placement was extremely critical.

They also realized that placing the explosives charge into the glide crack above the slab was ineffective because that was not where the stress/strength relationship was deteriorating. Effective glide slab control is about "kicking the knees out" from under the slab, and not adding load to the slab itself. Their testing produced reasonable results using 100-150kg ANFO charges placed at the toe of the slab.

The best charge placement is a very specific point where the gliding slab is having the greatest effect on the non-gliding downslope snowpack. Current Skeena corridor glide slab control strategy includes the use of charges of 150 and 500kg on 200-500cm deep slabs. Large charges are used because they increase the likelihood of triggering, which reduces hazard at the runout zone transportation corridor and minimizes the likelihood of natural events disrupting rail operations.

A complex, ever-changing interplay of factors affects glide slab stability, and the puzzle is not completely understood.

That said, control is not always successful. A complex, ever-changing interplay of factors affects glide slab stability, and the puzzle is not completely understood.

Some factors I consider in evaluating explosives control effectiveness include:

- Control is more likely to be successful on glide slabs poorly supported by the terrain below the slab. For example, a poorly-supported glide slab can be initiated with explosives so it will then trigger a better-supported glide slab lower in the starting zone that does not respond to explosives.
- Rain or melt-water at the ground/snow interface is not essential for initiation to occur, but it does increase the likelihood.
- Initiating sections of glide slabs is useful both by reducing the deposit volume of a single occurrence, but also because it exposes the ground surface to solar radiation, which then potentially aids in increasing glide rate by introducing more heat into the slab's basal layers.
- The strength of the snowpack below and alongside the slab allows the slab to glide a significant distance downslope without failing. Increasing glide rate may indicate decreasing snowpack strength.
- A 300-600cm slab can easily glide 50-100m without initiating if the downslope snowpack and terrain accommodates the glide's loading effect. Increasing glide rate and/or deteriorating strength of the snowpack supporting the slab are two critical initiation factors.
- Three reliable nearby indicator paths I use to assess an east aspect path prone to glide slab formation have a northwest aspect, but the starting zones are at the same elevation. This suggests ambient air temperature affects glide slab behaviour to a lesser, but still relevant, degree.

Prediction and control have improved since the 1980s, but we still include a healthy dose of "art" to the "science" of our craft. Explosives control in January 2012 put a size 4 deposit within 2m of the rail roadbed. Is our understanding of glide slab management improving, or were we just lucky on that mission?

ITP Update

AS MENTIONED IN PREVIOUS JOURNALS, THE INDUSTRY TRAINING PROGRAM CURRICULUM HAS BEEN UNDERGOING A MAJOR OVERHAUL THIS YEAR.

Emily Grady
CAA ITP Manager

A BIG THANK YOU goes to the ITP curriculum project team and the many key resources engaged and consulted along the way: Janet Lemieux, Project Manager and Curriculum Specialist; Mark Bender, Curriculum Specialist; James Blench, Subject Matter Experts; James Floyer and Peter Marshall along with Marc Deschenes, Keyes Lessard, Uwe Gramann, Matt Macdonald, Alan Jones, Steve Conger, Brian Gould, Andrew Nelson, Kevin Fogolin, Randy Stevens, Dave Smith, Amber Wood and CAA instructors.

The ultimate end results of this project are standardization of curriculum and revisions to course objectives and goals. Benefits of the project include better linking and congruency between all ITP courses, as well as consistency with industry needs and current best practices.

Below are some of the project outcomes:

In 2012 an examination process was added to the following courses.

- Introduction and Advanced Weather
- Avalanche Search and Rescue Response
- Avalanche Control Blasting

Avalanche Operations Level 1

- New avalanche rescue component
- Clear linking to hazard and risk framework in Operations Levels 2 and 3
- Written exam revision

Avalanche Operations Level 2

- New prerequisites as of winter 2013/2014: Introduction to Weather and Avalanche Search and Rescue Response courses. Level 2 applicants will need to enrol and complete these courses, or have completed a Prior Learning Assessment (PLA) before applying
- Improvements to manuals and lesson plans

Avalanche Operations Level 3

- Creation of an evaluation rubric
- Pre-course reading notes

Introduction to Snow and Avalanche Mapping

- Upgrades to student and instructor materials
- Addition of a computerized component

Weather courses

- Complete revamp of both weather courses
- Creation of a student manual
- Stronger linking to avalanche operations

Avalanche Control Blasting

- New field book

Avalanche Search and Rescue Response

- Removal of the medical aspects

Resource and Transportation Avalanche Management and Field Module

- Creation of a field module component in order for RTAM graduates to obtain equivalency to the Avalanche Operations Level 1

A lot is coming down the pipes for students this year. I look forward to hearing your feedback on the many changes resulting from this project. Please email or call me directly at egrady@avalanche.ca or 250-837-2435 ext. 223.

Notice of Change

TUITION FEE INCREASE

After over a decade, instructor fees have been increased and course fees have gone up accordingly. Please check the website for course fees.

NEW AVALANCHE OPERATIONS LEVEL 1 COURSE VENUE

This season, Sol Mountain Lodge, located south of Revelstoke in the Monashee Mountains, will be hosting an Avalanche Operations Level 1 course for the first time.

INDUSTRY TRAINING PROGRAM REGISTRATION SYSTEM CHANGES

The online course registration system will now require students to provide proof of prerequisites at the time of registration. For example, for the Avalanche Operations Level 1, a driver's license photo can be uploaded to prove that the student is over 18 years of age and a scanned image or photo may be used to provide proof of an Avalanche Skills Training course.

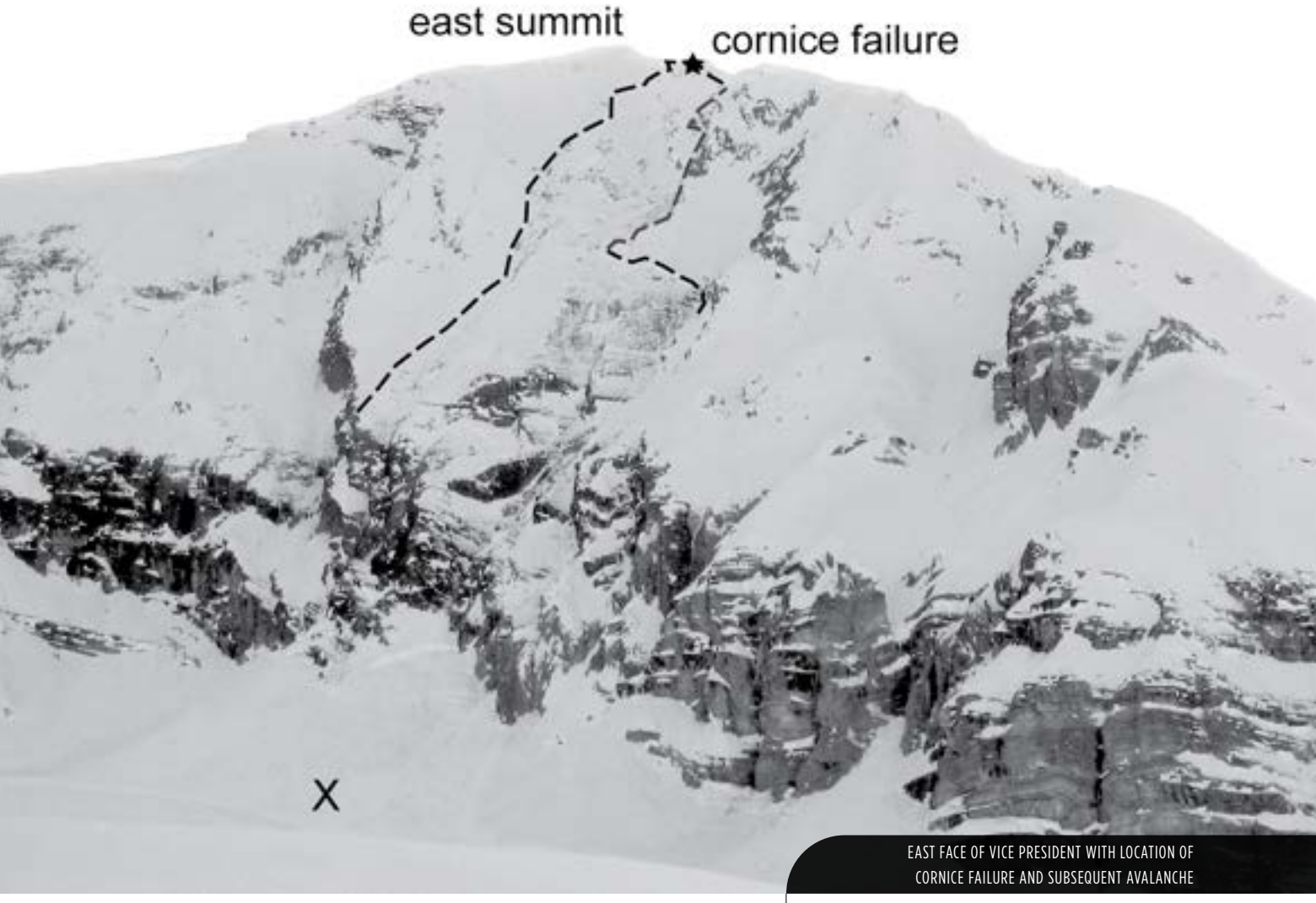
CIL/Orion
Member Social and Tradeshow

OUTGOING MEMBERSHIP SERVICES SIOBHAN QUINN
RECEIVES WELL WISHES FROM ROCKET MILLER

MATT CHAREST WITH G3 PRODUCT ENGINEER CAM SHUTE

GORD BURNS FROM RECCO WITH KYLE HALE

JOE OBAD AND ROCKET MILLER WITH MARK TALBOT
THE WINNER OF THE IPAD FROM CIL/ORION



EAST FACE OF VICE PRESIDENT WITH LOCATION OF CORNICE FAILURE AND SUBSEQUENT AVALANCHE

History **Lessons**

AVALANCHE ACCIDENTS IN CANADA VOLUME 5: 1996 - 2007

9 APRIL 2004 VICE PRESIDENT, YOHO NATIONAL PARK, ROCKY MOUNTAINS

ONE BACKCOUNTRY SKIER KILLED

AVALANCHE DANGER RATING AT LOW

THE APRIL 2004 SNOWPACK in the Rocky Mountains had settled into the typical pattern of spring conditions. Under these conditions, surface crusts that develop through diurnal cycles of daytime surface melting and overnight refreezing generally hold the snowpack together. Avalanche hazard is generally low during the morning when snow surface is still frozen, but rapidly increases during the day as solar radiation and mild temperatures weaken the surface crust.

On Friday, April 9, 2004, the Little Yoho Valley started off with blue skies and below-freezing temperatures. The previous day brought 2.7cm of new snow, which was much less than originally forecast and did not significantly affect the avalanche danger. The public avalanche forecasts for Banff, Yoho and Kootenay National Parks from the previously afternoon rated avalanche danger at Low at all elevations, but warned of loose snow slides on steep southern aspects as new snow warmed up, and the potential for cornice failures.

At 09:30, five friends from Montana left the Stanley Mitchell Hut with the goal to climb the President and the Vice President. From the hut, the route to the two summits follows the President Glacier drainage up to President Pass, where both summits can be reached by bootpacking up the obvious ridgelines. Heading up the east ridge of the President, the group passed a group of three Canadians also staying at the hut. The groups met again at the summit before heading back down the pass to attempt the Vice President. Since not everyone wanted to climb the Vice President, the groups split up at the pass. Three from Montana and two Canadians climbed together toward the summit of Vice President, and the remaining three individuals started to descend down the glacier toward the hut.

The skiers from Montana had eyed up a ski line from the east summit of Vice

President. The line consists of a north-northwest facing chute that drops north from the summit ridge separating the Emerald Glacier on the south from an unnamed pocked glacier on the north, east of the President Glacier. It is a steep 400 vertical metres straight down to the glacier below. To get to the line, one needs to find a safe entrance along the heavily corniced and seriously exposed north ridge of the east summit of the Vice President.

Once on the summit, an American and two Canadians decided to attempt the line, while the other two stayed behind on the main summit to take photos. They skied over to the east summit and found a non-corniced entrance to access the north ridge. The three skiers then dropped onto the north ridge. The American skier first descended about 20m, and then another 15m along the ridge searching for an entrance to the chute on skier's left.

As the first Canadian skied down to the same spot, he was warned about the potential of cornice failures. Suddenly, there was a cracking sound and a large gap appeared between the two skiers. The American skier was standing on top of the cornice as it was calving off the ridge down the east face to the skiers's right. He tried to jump to the safe side and arrest himself, but was unable to stop his fall and disappeared out of sight from his two partners. The falling pieces triggered a size 3 avalanche on the face. The two skiers at the top could see the avalanche debris running onto the glacier below, but no signs of the victim.

The two Canadian skiers were unable to descend the face where the avalanche occurred, so decided to climb back up to the summit of Vice President, descend back to President Pass, down President Glacier, and then make a high traverse to the avalanche debris around the two descending ridge lines. Back at the summit, they informed the two other American skiers of the accident. Using radios, they relayed the news to the other group members halfway down President Glacier, who quickly descended to the Stanley Mitchell Hut where the custodian called Parks Canada for assistance using a satellite phone.

After descending President Glacier, the two Americans followed the high traverse to get to the accident site, while the two Canadians descended to the Stanley Mitchell Hut to gather additional rescue material. The Americans arrived at the avalanche site 1.5 hours after the accident. By that time a Parks Canada search and rescue helicopter with two public safety wardens and an avalanche rescue dog had arrived. The victim was not visible from the helicopter, but his skis were on the surface of the debris and provided clues about the potential burial site.

The area was heavily crevassed, so a safety warden first approached the scene on a sling rope under the helicopter. He quickly located the victim using a transceiver and probe, using the helicopter sling rope as a belay. Since he felt the burial site was safe, both wardens and the rescue dog got off the helicopter to excavate the victim. He was found under about 60cm of snow, but succumbed to the traumatic injuries from the fall.

CORNICE FAILURE ON NORTH RIDGE OF VICE PRESIDENT

Summary

FALLING CORNICES are a concern when travelling exposed ridgelines, particularly in the spring when the snowpack is steadily weakened by milder temperatures. It is often difficult to determine how far the cornice overhangs the ridgeline, and falling cornices often involve more snow on the ridgeline than may be expected.

SIZE 4 OFF OF POCATERRA RIDGE IN HIGHWOOD PASS // KANANASKIS COUNTRY PUBLIC SAFETY

Life in **K-Country**

PRECIPITATION

LOCATION	HN24	LOCATION	HN24
WHISTLER	40CM	RK HELISKI	35CM
POWDER CK LODGE	40CM	BANFF PARK	20CM
ROGERS PASS	40CM	KANANASKIS	8CM

UNFORTUNATELY, this is an all-too-familiar situation on the east side of the Divide in Kananaskis Country. When other regions bask in the snowfalls of the latest storm, Kananaskis Country usually gets noticeably smaller amounts of snow and a significant amount of wind as the tail end of the storm rolls down the eastern side of the Rockies. A forecaster who previously worked in the region had a habit of rating the alpine wind speed with the Fujita hurricane scale, comparing our wind speed to an F2 hurricane: "significant transport of snow was ongoing and anyone living in mobile homes in alpine terrain should be concerned." Having said this, the last two winters have reminded a few of the older locals in town of the early 1970s when there were routinely big snowfalls and great skiing could be found along the Spray Lakes Road.

With the exception of the National Parks in the province, Kananaskis is the only area in Alberta with an active avalanche control program on Alberta's provincial highways. The Alberta Parks Public Safety section, staffed by three ACMG guides and CAA professional members, work with local conservation officer staff who have all been trained to the CAA Avalanche Operations Level 1 standard. The Public Safety section produces daily avalanche forecasts, and all emergency response related to backcountry emergencies throughout Kananaskis and parts of southern Alberta is coordinated through this office.

The majority of the avalanche control work occurs along Highway 742 (commonly known as the Spray Lakes Road). The first and most obvious control area is within eyeshot—and earshot—of the town of Canmore. Many Canmore dogs have madly barked away in their house (or taken off at the off-leash park) after a bag of ANFO goes off on the east end of Mt. Rundle. Staff from the various downtown businesses have put a "Back in 5 min" sign on their doors to stroll out onto the street to watch size 2-3 avalanches pour down over a 2000' cliff, creating spectacular powder clouds and burying the two lane road that runs through the tracks near the base of the slide paths.

Over the past few seasons, isothermal avalanches in steeper trees have created problems for the road. Without a ditch for catchment, size 1-2 avalanches quickly bury the road in the spring as temperatures warm up. This problem is not uncommon to the area, but the extent of it over the past few seasons has led us to develop new tactics like water bucketing to address it. Previously, hand charging in the trees would release loose wet slides, but we would always look down through the timber wishing we that we could have hit a few more areas to get a total clean out.

"If it would just pour rain for a few hours," once mused Burke Duncan, CAA member for over 20 years. Helicopter

pilot at the time Chris Robertson replied, "I can make it rain." We looked at him with wonder, questioning his divine weather abilities. "I can grab the Bambi bucket," he said after an awkward moment. After a short trip back to the Canmore hanger, we were water bucketing isothermal snow using the local reservoir. It is rather impressive what 1800lbs of water can do to isothermal snow. We were pleased with the result, getting a great cleanout. Unfortunately for the Highways crew, the road was buried for close to 300m with the odd chunk of guardrail missing. However, I do recall seeing a slight smile on the equipment operator's face as he cut tunnels through snow up to 3m deep in some places.

Winter continues on longer in the Rockies. Friends on the BC coast and in the Invermere valley were biking and climbing while we were still dealing with storm snow instabilities from the latest upslope storm that gave us an overnight snowfall of 50-60cm along the Spray and Highwood areas. In the winter of 2011-12, a few new slide paths affecting the highway were created in the Highwood Pass area. We suspected that the likely persistent weak layer in the formation of these new paths was the "Valentine's Day" surface hoar that was a problem for many regions during this past winter. This layer—buried down between 1.5-2m—combined with our (unfortunately common) facetted and depth hoar structured base, created some large avalanches involving the entire winter snowpack.

During one of the bigger cycles in the first part of March, over four hectares of trees were logged from the runout of a path that had been identified as "potential only;" the road, located a significant distance uphill on the opposite side of the valley, was buried. It is a unique sight to see a significant size 4 event within sight of the prairies. Even Burke Duncan, who has been working in Kananaskis since the early 1980s, stood on the side of the road looking at the debris and destruction repeating the word "cool." Fortunately, this road is closed to traffic from December 1 to June 15. Control work, if needed, does not occur until June when highways crews require access to the area to clean the road.

The past two winters in the Kananaskis area have had brought snowfalls and great skiing for people in the Canmore and Calgary areas. It has been a pleasant change from some of the dry earlier years in the 2000s, where a 10-15cm "storm" would excite us. We have learned a lot over the past few seasons, and we suspect that will continue. All we can say is that we hope to return to the winters of the 1970s with big snow, Snik sunscreen and the Bee Gees blasting on the AM radio in our leaded gasoline trucks. Also, what is the InfoEx abbreviation for heli water bucketing slides: Hwb?

Mike Koppang is an ACMG Ski guide and CAA professional member working as a Public Safety Specialist and Avalanche forecaster for Kananaskis Country, Alberta.

CAA/CAC Service Awards


KARILYN KEMPTON

BOB SAYER received a CAA Service Award in recognition of his contributions to the CAA Technical Committee and his service to the avalanche community. Bob has sat on the Technical Committee for a number of years, is the president of the Canadian Ski Guide Association and recently completed his 25th year guiding at Mike Wiegele Helicopter Skiing.


KARILYN KEMPTON

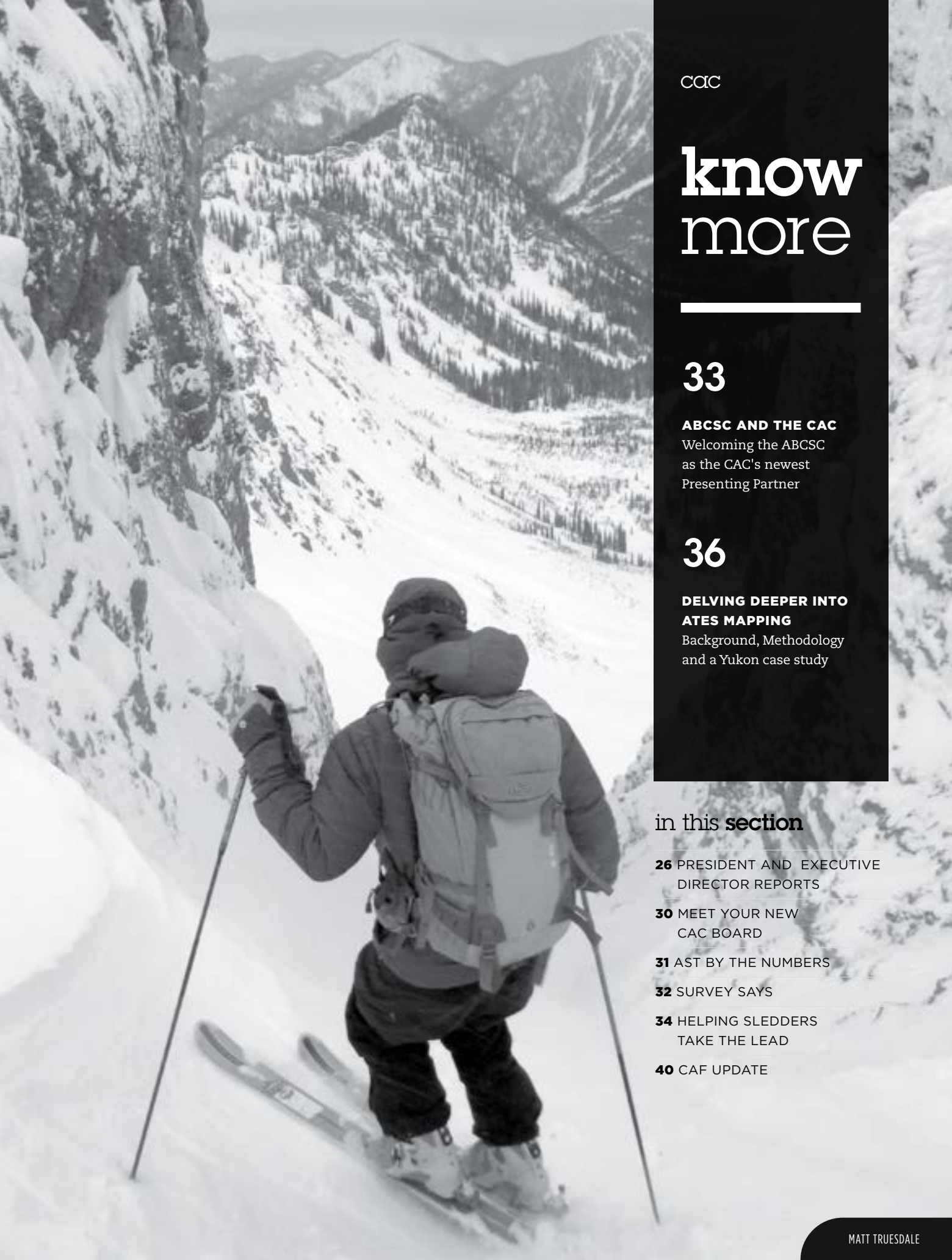
ANTON HORVATH received a CAA Service Award in recognition of forecasting excellence, service on several CAA committees, and other contributions to the avalanche community. A dedicated forecaster and rescuer for many years at Whistler Blackcomb, he has served on the CAA Board of Directors, the InfoEx advisory group, and other committees. He has been involved in SAR and AvSAR with CARDA, where he is a validator of avalanche rescue dog teams and has handled three dogs.

KARILYN KEMPTON

JEREMY HANKE received a CAC Service Award for his ongoing dedication to promoting avalanche awareness within the mountain snowmobiling community.

KARILYN KEMPTON

PARKS CANADA received a CAC Service Award for their immense contributions to public avalanche safety in Canada, including the development of AvalX avalanche forecasting software. Grant Statham accepted on Parks' behalf.



CAC

know more

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ABCSC AND THE CAC
Welcoming the ABCSC as the CAC's newest Presenting Partner

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DELVING DEEPER INTO ATES MAPPING
Background, Methodology and a Yukon case study

in this **section**

MATT TRUESDALE

CAC President's Message

THANK YOU TO ALL CAC MEMBERS FOR THEIR SUPPORT AT THE ANNUAL GENERAL MEETING HELD IN PENTICTON IN MAY. THE BOARD APPRECIATES YOUR SUPPORT FOR THE DIRECTION WE ARE MOVING. IF YOU ARE A CAC MEMBER OR A MEMBER OF THE PUBLIC, IT WOULD BE GREAT TO SEE YOU AT NEXT YEAR'S AGM.

Ross Cloutier
CAC President

IN THE MEANTIME, we will continue to update you through *The Avalanche Journal*. Since the restructure of the CAC in September 2011, the board has focused on creating an appropriate organizational structure to enable future growth. We have also concentrated on professionalizing the financial and administrative processes of the CAC. Some of this is a challenge as the CAC and CAA sort out the best methods of evolving into two organizations with complementary but arms-length relationships. We are now one year into this process.

In Volume 99, I outlined the CAC Board's priorities as follows. Here is an update of how we are doing.

1. *To organize the CAC so that it is poised to respond to the increasing opportunities that will be presented to it on the Canadian and world stage.* It is our vision that the CAC will continue to be a world player, and become even more prominent. Executive Director Ian Tomm sits on the International Commission for Alpine Rescue (ICAR). Kevin Seel, Chair of the CAC Board Finance and Audit Committee, presented at the May ICAR meetings about the impact of accidents on public avalanche safety funding. AST courses are delivered in numerous countries including the USA, Japan and others. We are talking with Sweden about licensing the Avaluator for their avalanche courses. We have also committed to Simon Fraser University to help fund an endowed avalanche research position.

2. *To professionalize the fiscal and administrative processes of the CAC in order to meet the increasingly stringent public scrutiny of being a prominent national not-for-profit organization.* The CAC Board has spent a good deal of time on this item over the past year. We will bring new CAC bylaws to the 2013 AGM that meet the incoming Federal Not-for-profit Corporations Act (2014). We will implement financial audits in 2013 that meet the terms of the new Act. We are working with the CAA to sort out who owns which intellectual property and operating expenses.

3. *To diversify, and stabilize, the funding of the CAC in order to create a sustainable and healthy organization.* We are working to stabilize and lengthen the financial agreements the CAC has with government funders and industry sponsors. We are working with the CAC Training Committee to identify ways to pay for the upgrading of curriculum, and for the training program to contribute to CAC operations. We are developing membership benefit programs because we see a large, diverse membership as a backbone to the CAC's strength. In June 2012, the CAC and Canadian Avalanche Foundation boards held joint meetings to discuss a strengthened and closer relationship.

4. *To further develop identifiable public avalanche safety career paths and to be a desirable and sought-after employer.* We are engaging with staff to develop full-time employment positions, reviewing benefit and retirement plans, and trying to provide stable, long-term employment. We envision CAC staff who are engaged in public safety, research and education as part of their employment.

5. *To "nationalize" the CAC's public avalanche safety mandate and to play an increasingly involved role in all avalanche terrain where Canadians recreate—right across Canada.* The CAC is increasing its commitment to cross-Canada programming and this will develop into a larger part of the CAC role. We are working with public safety agencies in Quebec and Newfoundland and Labrador, and began terrain assessments in Newfoundland during the spring of 2012. To become a truly national organization, we will increase our focus on providing services to winter recreationists in these regions.

6. *To find ways for the CAC to serve its ever expanding and diversified membership.* We are working to develop a growing, diversified CAC membership—recreationists and the public are the key. We want to increase our focus on youth. Software is being developed to be able to manage a growing membership and we will undertake a wide membership recruitment campaign during the 2012-13 season.

You can see from the above that the CAC Board is busy and I would like to thank them for all their efforts!

Ross Cloutier, CAC President

Safety is at Our Core

At Teck, we're committed to ensuring everyone goes home safe and healthy every day. We're proud to support the Canadian Avalanche Centre's work to promote safety on our mountains.

Teck

CAC Executive Director's Report

SINCE THE INCORPORATION OF THE CAC INTO ITS OWN SEPARATE LEGAL ENTITY IN 2004, THE CAC HAS GROWN AND MATURED. ITS SUCCESS HAS BEEN POSSIBLE BY THE STRONG PARTNERSHIPS AND ALLIANCES THAT IT HAS NURTURED OVER TIME WITH MANY STAKEHOLDERS: GOVERNMENT, PRIVATE INDUSTRY, AND ITS USERS, THE GENERAL PUBLIC. THE CONVERSATION IS NOW SHIFTING TO THE FUTURE. WHAT DOES THE NEXT ERA OF PUBLIC AVALANCHE SAFETY PROGRAMMING LOOK LIKE IN CANADA?

Ian Tomm
CAC Executive Director

RESEARCH AND DEVELOPMENT

The quality of Canada's avalanche safety programs, both public and industrial, are directly related to close ties with researchers. In Canada this close relationship is a given, and input from the avalanche community helps drives relevant, important research topics. While we take the relationship for granted, in some countries those ties are not as close as in Canada. Programs at the University of British Columbia have scaled down over the last few years. Bruce Jamieson's second term of his NSERC Research Chair in Snow Avalanche Risk Control at the University of Calgary is coming to an end in 2014; while he intends to remain fully and actively involved in the community there are questions about the future of university-supported research. Dr. Pascal Haegeli and Simon Fraser University are hard at work developing a new NSERC Research Chair, and have received firm commitments of support by the CAC and CAF. Momentum is building with the potential for large private contributions to support this chair.

The foundations of any safety and prevention program are rooted in research. Evidence-based prevention programs are key. UBC, U of C and more recently SFU have all played key roles in where we are today, along with other smaller initiatives like those of Dr. Keith Nichol, Dr. Bernard Hétu and David Liverman in eastern Canada. As we look to the future we see closer ties between research and programs through the CAC, and I look forward to the next era of snow avalanche research.

STAFF EXPERTISE

It is an overused phrase in business literature but it is true: an organization's most valuable assets are its people. We have renewed our approach to staffing at the CAC and are better recognizing and appreciating our high levels of staff expertise—the CAC employs some of the very best in public avalanche safety in this country. The CAC is now focused on expanding employment opportunities to transition to more long-term careers, including (I hope) research roles in partnership with university programs, new initiatives like the growth of public forecasting into priority regions, and improved off-season development projects.

PARTNERSHIPS WITH GRASSROOTS EFFORTS

One of the most important aspects of the CAC's constitution and operating model is its focus on coordination and collaboration. We have worked collectively together with our key partners to achieve some significant things in support of public avalanche safety in this country.

Partnerships with grassroots initiatives are vital for our next era. A key topic of discussion right now is how to improve public avalanche safety programs in Quebec, Vancouver Island, Newfoundland and the north and south Rockies, especially the north Rockies. How does the CAC work with government, users, local stakeholders and private industry to expand and improve programs in these regions? Moreover, how does the CAC interact with its funders to help empower grassroots initiatives? These are ongoing discussions but one thing is clear—grassroots initiatives have always been key to the success of public avalanche safety initiatives in this country, and will continue to be vital in the years ahead.

FUNDING

Funding is always top of mind in non-profits, and in the post-2008 world that is unlikely to change. Benefit/cost discussions justify existing spending and investment and ensure that future investment is well reasoned and grounded. The CAC has been able to establish cost effective programs that easily prove their economic worth. As economies grow and change, this important conversation will continue. The period since the spring AGM has been an interesting time of interaction with our many funders and sponsors; new organizations are coming on board, there is expanded government involvement on many fronts, and long-time existing sponsors have renewed and increased their contributions—both in-kind and cash—to CAC operations. Sponsors and

funders find enormous value in supporting and partnering with the CAC, and I hope to keep improving that.

We have a great community of supporters for public avalanche safety in Canada, not least of which is the Canadian Avalanche Foundation. This past June the boards of the CAC and CAF meet for a day of meetings and discussion. As the CAC grows, so does the CAF—it was an exciting meeting, helping to define the next era of charitable fundraising and operations to support the best public avalanche safety programs we can operate in this country.

PARTING THOUGHT

Thanks to the many, many folks in this community who have provided so much support and enthusiasm for the CAC over the years. It has been an honor to work with you all. We have celebrated many successes together and worked hard to overcome many challenges, so it is exciting to write about the CAC's exciting future. As always, my door, inbox and phone are open and available for your input. If you have any questions about public avalanche safety in this country and where it is going in the future, give me a call. I would love to hear your thoughts, and am excited to talk about partnership and collaboration opportunities to improve existing programs or to bring public avalanche safety programs to regions of Canada where they are needed and none current exist.

All the best,

Ian Tomm, CAC Executive Director

SFU Partnership

Part of the Canadian Avalanche Centre's mission is to encourage avalanche research because we believe the future of public avalanche safety lies in continued research. Last winter, the CAC made a funding commitment to Simon Fraser University to support a new research chair in Avalanche Risk Management.

SFU
ANDREW PETTER
PRESIDENT AND VICE-CHANCELLOR

April 10, 2012

Mr. Ross Cloutier, President
Board of Directors
Canadian Avalanche Centre
Box 2759, 110 MacKenzie Avenue
Revelstoke, BC V0E 2S0

Dear Mr. Cloutier,

Thank you for the Canadian Avalanche Centre's generous pledge to help establish the Chair in Avalanche Risk Management at Simon Fraser University.

The Canadian Avalanche Centre's commitment to research focused on the human dimension in avalanche risk management provides an excellent start to the Faculty of Environment's fundraising efforts to establish this new research chair.

We look forward to working with you to develop avalanche safety research in Canada and the world.

Yours sincerely,

Andrew Petter
President and Vice-Chancellor

AP:eo
c. Mr. Ian Tomm, Executive Director, Canadian Avalanche Centre
Dr. John Pierce, Dean, Faculty of Environment
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Meet Your New CAC Board

MEET THE NEWEST MEMBERS OF THE CANADIAN AVALANCHE CENTRE BOARD OF DIRECTORS. WE WOULD LIKE TO OFFER A SINCERE THANK YOU TO OUTGOING CAC BOARD MEMBERS MIKE BOISSONNEAULT AND JOHN HETHERINGTON.

ROB ELLIOTT, CAA-APPOINTED DIRECTOR: Read Rob's bio in "Meet Your New CAA Board" on page 14.

JOHN IRVINE, DIRECTOR: John Irvine has 18 years of experience in outdoor retail, sales and marketing campaigns for two of the outdoor industry's top brands— Arc'teryx and Mountain Equipment Cop-op. After ten years with Arc'teryx, the past three as Director of International Sales, John is now the Director of Sports Marketing for Mountain Equipment Co-op. With his experience in virtually all the core functions of the outdoor industry business, John brings a strong skill set in effective marketing and promotions. His passion for a wide range of outdoor activities, including ski mountaineering, ensures credibility with the end users—an important asset for any board.

"I'm very excited about the possibility of working with the CAC," says John. "I am always inspired to share my passion for winter mountain travel. Working with the CAC to promote public awareness of these activities, and how to participate in them safety, is a very big motivator for me."

LAWRENCE WHITE, DIRECTOR: Lawrence White is the Executive Director of the Alpine Club of Canada (ACC), a non-profit organization with over 10,000 members in 20 regional sections across the country. Lawrence grew up in Victoria, BC and studied Outdoor Recreation and Tourism Management at Capilano University. He completed a semester-long work placement with the ACC in 2000, and was offered the job of ACC Mountain Adventures Coordinator after graduating. In 2002 he and his wife moved to Canmore to start new lives in the Rockies.

Since then Lawrence has held a number of positions in the ACC, including Facilities Manager and Facilities Director. He has been Executive Director since 2007. Lawrence also sits on the Canmore Enrichment Advisory Committee, and Parks Canada's Advisory Development Board. "I'm looking forward to participating in the growth of the CAC," he says. "There are a lot of exciting initiatives ahead and I feel I can apply my experience in a member-driven organization to help realize the CAC's full potential."

KEVIN WILLIAMS, DIRECTOR: A passionate backcountry skier and ski mountaineer, Kevin Williams has been involved in avalanche science, rescue and education since the early 1980s.

Born in Montreal, Kevin holds a B.Eng and M.Sc (Geophysics) from McGill University and was a PhD candidate in avalanche research at UBC. His work in oil and gas exploration has taken him to remote locations around the world. Kevin spent two and a half decades living in Calgary and now calls Canmore home.

As a member of the Canadian Ski Patrol System, he patrolled and was involved in avalanche work at Lake Louise, Fernie and Whistler. He was instrumental in the early development of the Avalanche Skills Training (AST) education program. Kevin is happy to sit on the CAC Board: "the CAC delivers one of the best avalanche awareness, education and information systems in the world. I'm proud to contribute to an organization that has so much to offer."

Rob Elliot

Lawrence White

John Irvine

Kevin Williams

WREN MCELROY

AST by the **Numbers**

Nancy Geismar

THE 2011-12 SEASON WAS ANOTHER SUCCESS FOR THE AVALANCHE SKILLS TRAINING (AST) PROGRAM.

OVER 7000 STUDENTS completed either an AST 1, AST 2 or a Companion Rescue Skills course. Numbers in AST 1 courses grew by 1.5% and numbers in AST 2 courses grew by a resounding 32% over 2010-11. The CAC was gratified to see more students taking AST 2 courses and increasing their knowledge and skill level in the backcountry. The numbers of AST instructors grew 8% over last year to a total of 258 licensed AST instructors.

There were 291 graduates from the new Companion Rescue Skills course. The fall 2011 AST instructor training focused on the curriculum for this one-day course, and 44% of AST instructors attended. We are hopeful that more AST instructors will offer the course in the upcoming season. The Companion Rescue Skills course was created in response to a recommendation from the BC Coroner's Death Review Panel report. It is appropriate for any backcountry recreationist and may be a needed stepping stone for further avalanche education.

Are you an AST instructor? The training committee recommendations on future AST instructor training can be found in the summer AST newsletter that was emailed to all AST instructors at the end of June.

The AST program has grown significantly since it evolved from the RAC (Recreational Avalanche Courses) to AST curriculum. We are at another crossroad of growth and the CAC is focussing on the sustainability of the AST program. Instead of depending on government funding, the CAC is striving for self-sustainability. Possible options include materials fees for AST supplies or per student fees that would enable the CAC to continue improving and updating AST curriculum resources, and providing meaningful and useful instructor training sessions.

It is gratifying to work with professional and active CAA members who are committed and dedicated to teaching avalanche skills to the public. We appreciate the hard work that goes into an informative and well-taught course. Keep up the good work.

Survey **Says**

THE CAC ACCORDING TO YOU: RESULTS FROM OUR SPRING SURVEY

IN APRIL 2012, 181 people answered a five-question survey on Canadian Avalanche Centre programs and services. The survey was distributed via social media channels (Facebook and Twitter) and emailed to all CAC subscribers and members. Thank you to everyone who responded. We would like to share what you told us.

The first thing we wanted to find out was which CAC services or programs people used this winter. Ninety six per cent of respondents used daily avalanche forecasts last season. We're happy to note the popularity of the Forecaster's Blog, which was new last winter. The table below details who used what.

Secondly, we asked what changes would most improve our services or programs. We were very interested in the answers to this question. Many answers were from people who are happy with how things are. The most common suggestion from users was to include more technical information and observations in the avalanche forecasts (though many comments on the new format were very positive).

Other suggestions included featuring the incident report database more prominently; more mobile development; decreasing the size of forecast regions for better accuracy; clarifying the forecast region map by identifying cities on it; including more detailed weather info; using plainer language in the weekly summaries; re-designing the discussion forum; and adding more Backcountry Avalanche Workshop events.

Thirdly, we wanted to know how much the CAC's public avalanche forecasts affect decision-making in the backcountry. Just over half of the respondents called the avalanche forecasts "essential" to their decision-making, and another 34% said that avalanche bulletins "affect my decision-making a great deal." Just 13% said that avalanche forecasts affect their decision-making "somewhat" and only 1% said "not at all." Notable comments included "When it's High across the board it affects my wife's decision making, meaning she won't let me go out. If she knows the avy bulletin your info is getting out;" "It's my bible;" and "We check daily to get a better feel for what is going on. Weekend warriors must read!"

We then asked people how easy it is to find the information they need on our website avalanche.ca. Most people said it is very easy (47%) or moderately easy (47%) to find the info they need on the CAC website. We received some good comments from people about making the avalanche forecasts and incident report database easier to get to.

Finally, we asked people to rate their overall satisfaction with the CAC. Over 90% of respondents rated the CAC at least 8 out of 10. Many let us know that they feel there have been some improvements over the last several years, and that the CAC provides a very useful public safety service. Notable comments included: "The new bulletins are very graphical and a great tool for less experienced users. I particularly liked reading the technical analysis and the forecasters blog. You guys are worldwide leaders and it is for a reason" and "How about publishing snow pit information on Google earth or something geo-referenced like that? Pros and amateurs could put their information up for others to look at."

Thank you to everyone who responded. The feedback we received is very important to us, and the suggestions will help us improve.

WHICH CAC SERVICES OR PROGRAMS DID YOU USE THIS WINTER?

SERVICES	% OF RESPONDENTS
DAILY AVALANCHE FORECASTS	96
FORECASTER'S BLOG	60
WEEKLY AVLANCHE REPORTS	44
AVALANCHE SKILLS TRAINING COURSES	16
TRIP PLANNER	11
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MEMBERS OF ABCSC BOARD PRESENT CAC EXECUTIVE DIRECTOR IAN TOMM WITH A CHEQUE
LEFT TO RIGHT: COLIN BURKE, SUZANNE CLARK, IAN TOMM, AL HODGSON, TRACY SENIO AND CURTIS PAWLIUK

ABCSC and the CAC

THE CANADIAN AVALANCHE CENTRE RECENTLY WELCOMED THE ASSOCIATION OF BC SNOWMOBILE CLUBS (ABCSC) AS A PRESENTING PARTNER, THE HIGHEST TIER OF THE CAC'S SPONSORSHIP DESIGNATION. THIS MARKS THE FIRST TIME A MEMBERSHIP ASSOCIATION HAS COMMITTED TO THIS LEVEL OF FINANCIAL SUPPORT.

TO RAISE MONEY for the CAC, the ABCSC with the support of its member clubs implemented the "Buck-A-Day" fundraising program in the 2010-11 season. Each contributing member club donated $1 from every trail day pass fee throughout the winter, yielding close to $12,000 in its first year. In the 2011-12 winter season, ABCSC contributing member clubs donated $42,195 to the CAC. For more information on the "Buck-a-Day" Program, see "Buck-a-Day for Avalanche Safety" in *The Avalanche Journal*, Volume 100, Spring 2012, p. 45.

"The ABCSC is setting a new standard of commitment to public avalanche safety," says CAC Executive Director Ian Tomm. "Their fundraising efforts are directly supporting programs for snowmobilers. As a non-profit, the CAC depends on a wide range of funders. The ABCSC is a tremendous partner and together, we are making great strides in the area of snowmobiling avalanche safety."

"It's important to us to help to advance avalanche awareness within our own community," says ABCSC President Al Hodgson. "Through our support, the CAC can further develop Avalanche Skills Training for snowmobilers along with other core services. We are honoured to be named as a Presenting Partner of Canada's public avalanche safety organization."

ABCSC joins other Presenting Partners Canadian Pacific (sponsor of Avalanche Awareness Days), Columbia Brewery (Backcountry Avalanche Workshops), Mountain Equipment Co-Op (Avalanche Skills Training program), and Teck Resources Limited (Companion Rescue Skills course and South Rockies Field Observer Program).

Helping Sledders **Take the Lead**

Carole Savage

LAST SEASON, THE CANADIAN AVALANCHE CENTRE OFFERED BURSARIES TO SNOWMOBILERS PURSUING THEIR CAA AVALANCHE OPERATIONS LEVEL 1 OR 2 COURSE.

THE BURSARY PROGRAM was funded through the SAR NIF Mountain Snowmobile Education Project as part of the effort to help develop technical avalanche expertise in the snowmobiling community using a 'train the trainer' approach. Helping key members of the snowmobiling community to increase their knowledge and experience base will enhance avalanche awareness from within the snowmobiling community through peer messaging, training, and outreach activities.

The program was focused on active members of the mountain snowmobile community and/or respective organizations interested in providing a positive contribution to public avalanche awareness. Advertisement of the initiative went out to Emergency Management BC, the BC Commercial Snowmobile Operators Association, and organized snowmobiling groups in British Columbia and Alberta. Bursaries were provided to 11 individuals for the CAA Avalanche Operations Level 1 and to eight individuals for the CAA Avalanche Operations Level 2.

Candidates were evaluated by a group of CAC Sled Com members based on their past and present contributions to mountain snowmobiling, including commercial guiding, search and rescue, and organized snowmobiling. Criteria included:

- Interest in furthering their knowledge and skill set in avalanche safety.
- Desire to give back to the mountain snowmobile community through eventual instruction of AST 1 courses, promoting outreach for safe travel in avalanche terrain, furthering their SAR skill set, or a desire to work in the field of avalanche safety related to mountain snowmobiling including snowmobile-based commercial operations.
- Summary of past training and contributions to public safety and/or avalanche safety.
- Candidate involvement with local and/or other snowmobile clubs, SAR organizations, or any other experience or involvement that the candidate feels is relevant for consideration.
- One or more letters of reference detailing the reasons that the candidate should be considered for partial funding reimbursement (ideally, letters of reference came come from snowmobile club executive, SAR leaders, members of the CAA, or an employer).
- Description of what benefit the course will bring to them and how they will utilize their training to contribute to increasing public avalanche awareness in the mountain snowmobile sector in their future endeavours.

Following are profiles of some of the successful bursary applicants. Congratulations to everyone who received a bursary, and who completed a CAA Avalanche Operations Level 1 or 2.

CHAD EDWARDS

Chad was born and raised in Vernon, BC, and lives in Coldstream. Mountain snowmobiling for ten years, he loves to snowmobile in the Lumby, Cherryville, Sicamous and Eagle Valley to Revelstoke regions. Chad took his CAA Avalanche Operations Level 2 last winter to better his own knowledge to help avoid accidents in the backcountry. "I have seen a lot of growth in use where I ride, and how little people realize that hazards that surround us in these areas," he notes.

Chad runs Innerspace Watersports Inc., which sells avalanche safety equipment and maintains and refills avalanche airbag systems, among other things. They run AST 1 courses through the stores, and attend trade and snow shows. He is currently working on a website at okanaganavalanche.wordpress.com. His other passions include flying, scuba diving, motocross, riding ATVs, stand up paddle boarding, and kayaking.

CURTIS PAWLIUK

Curtis Pawliuk lives and plays in and around the mountains of Valemount, BC. Curtis grew up in Prince George and has been mountain snowmobiling since 1998 in the Cariboo, Monashee and Rocky ranges.

Curtis is the General Manager of the Valemount Area Recreation Development Association (VARDA) and took his CAA Avalanche Operations Level 2 last winter. He plans to teach his own snowmobile-focused AST courses. He believes that "being as educated as possible in the backcountry is always best practice. I hope others will follow our lead with continuing education and practice, as that is the ultimate goal."

He is on the CAC Board of Directors and on the board of the Association of BC Snowmobile Clubs. Curtis loves spending time with his wife and daughters, and anything that brings him outside: mountain biking, fishing, sledding and split-boarding.

JEREMY VANDEKERKHOVE

Jeremy is from Vernon, BC. He rides the Monashee Mountains in the Hunters Range, Owl's Head and Pinnacles ranges. Jeremy has been mountain snowmobiling for the past four years; prior to that he "used to jump, roll and crash snowmobiles on an unnamed ski resort in the Rockies."

Jeremy took his CAA Avalanche Operations Level 2 this winter to help his search and rescue abilities for his local SAR group. Jeremy plans to contribute regular snowpack and weather observations for his local sledding area to the CAC, and hopes to eventually develop a more substantial operational area for his local sledding area in cooperation with SAR. In the winter, he has been a ski patroller at his local mountain, and throughout the rest of the year works as the project manager for his family's landscape and aggregate supply company. Jeremy also enjoys mountaineering, rock climbing, rafting, and stimulating arguments. His passions include his wife Sylvia and one-year-old Tom.

SCOTT HICKS

Sledding since the early 1970s, Scott Hicks has been mountain riding since 2001. He lives in Terrace, BC and rides the Terrace and Stewart area. Scott hails from Valcartier Village, QC.

Scott took his CAA Avalanche Operations Level 2 for several reasons: improved SAR winter response capability by sled or air; better avalanche course offerings to sledders; and for the sake of continued learning. It has already paid off, says Scott: "I was recently activated on a local SAR call as the avalanche safety officer where Level 2 skills and knowledge were integral to my decision making."

As a member of Skeena Valley Snowmobile Association, Scott teaches an annual self-rescue course. He hopes to expand his sled-based courses to other areas of the Northwest this coming season.

Scott works as a Stewardship Officer with BC Forests, Lands and Natural Resources Operations, and he enjoys working in the avalanche hazard mapping sector. He and wife Shelly have three boys.

WES GANO

Wes has been mountain snowmobiling for ten years. Wes lives and rides in Sicamous, and is from Salmon Arm, BC. Wes sees the CAA Avalanche Operations Level 1 as a way to promote avalanche safety at his local club the Eagle Valley Snowmobile Club (EVSC) and to further his snowmobile guiding career.

Wes plans to spread the message of avalanche safety to mountain snowmobilers the Avalanche Director for the EVSC, and by teaching AST 1 courses. In the winters, Wes is employed by the EVSC and he spends his summers as a farm hand. His other interests include backcountry skiing, mountain biking, climbing and backpacking.

Delving Deeper into ATES Mapping

Cam Campbell and Brian Gould
The authors field checking preliminary maps in the Tombstone Range, Yukon.

THE AVALANCHE TERRAIN EXPOSURE SCALE (ATES) IS AN EFFECTIVE TOOL TO HELP AMATEUR RECREATIONISTS QUANTIFY EXPOSURE TO AVALANCHE TERRAIN, CHOOSE TRIPS THAT ARE APPROPRIATE FOR THE CURRENT CONDITIONS, AND ULTIMATELY AVOID AVALANCHE ACCIDENTS.

ATES WAS DEVELOPED by Parks Canada in 2004 (Statham et al., 2006) to help self-directed backcountry recreationists with trip planning by classifying the overall seriousness of a specific route with respect to exposure to avalanche terrain. In order to use the current ATES technical model for zoning, a clear definition of the approach (i.e. route-based vs. terrain based) and scale is needed. The default parameters can add a deterministic element to the zoning process, but most parameters are subjective, so expert judgment is required.

Delparte (2008) developed Geographical Information System (GIS) algorithms to categorize forest density, slope angle, slope shape, and interaction with avalanche paths with respect to the ATES technical model. Each parameter category is assigned a weighted score that when totaled automatically determines an ATES class. Although promising, the results were only considered useful for supplementing traditional field-based methods of avalanche hazard zoning, so some manual adjustment was needed to produce accurate ATES maps.

To date over 70 different backcountry ski and sledding areas encompassing over 4000km^2 of terrain have been zoned with ATES through Canadian Avalanche Centre (CAC) projects with Recreation Sites and Trails BC (RSTBC) and BC Parks, as well as Alpine Solutions Avalanche Services projects with the Yukon Avalanche Association (YAA) and Yukon Government (YG).

METHODOLOGY

Preliminary Zoning

Once the area of interest is defined (Fig. 1), preliminary ATES polygons (Fig. 2) are manually drawn in Google Earth using prior knowledge of the terrain, Google Earth imagery and terrain modeling, GIS-derived slope angle overlays, publically-uploaded Panoramio embedded photos, and forest cover overlays.

Common routes and high-use areas are given special attention for accuracy and precision; however, the ATES polygons are entirely terrain-based and independent of trips or routes. Precision is often high (~30m) during this phase—the intention is to reduce precision and increase accuracy during the field-checking and final zoning phases.

Much of the terrain can be reliably classified using only slope angle, forest density, slope shape, interaction with avalanche paths, and terrain traps. These ATES parameters can all be reasonably visualized in Google Earth assuming high resolution imagery or uploaded photos, as well as accurate slope angle overlays.

Slope Angle Overlays

Slope angle is one of the more deterministic default ATES parameters, so slope angle overlays are heavily relied upon during the preliminary zoning phase (Fig. 3). They are generated from Digital Elevation Models (DEM) with approximately 20m cells, using an eight-neighbours slope algorithm. The slope categories include the 30 and 35 degree ATES class thresholds as well as multiple categories for angles less than 25 degrees to help visualize convolution for low-angled terrain—an important determining factor between Class 1 and 2.

Overlays can give a decent representation of slope angle as well as slope shape (convolution) and depression- and gully-type terrain traps. However, elevation errors inherent to DEMs can have significant effects on calculated slope angles.

Field Checking

Due to the inaccuracy of digital terrain modelling and the inability to digitally visualize important ATES parameters, field checking is necessary, and is probably the most important part of the process. Parameters such as avalanche frequency, interaction with avalanche paths, exposure time, and route options are easiest or only possible to assess in the field. Maps are printed on waterproof paper and taken into the field, where they are annotated with adjusted polygon boundaries, major avalanche paths, decision points, and any other avalanche terrain or area information.

Helicopter-assisted field work is often most efficient and effective for large complex areas, especially if ground-based travel is hazardous or difficult. Ground travel is still an essential component for more complex areas, and to enable 'placing oneself in the terrain.' Field trips usually take place in winter, when the terrain can be assessed with snow cover for a more accurate avalanche exposure evaluation. Summer surveys can also work, and are especially useful for glacier assessment.

Final Zoning

Final maps incorporate all the adjustments made during the field checking phase, and are usually in the form of a GIS-based, hard-copy map and KMZ overlays for viewing in Google Earth or Google Maps. At the current resolution, the resulting maps are intended to be used at the basin-scale (100m to 1km). A 10 to 20m polygon overlap is used to express the uncertainty associated with the ATES zones. The maps are usually not drawn at a sufficiently small scale to see this overlap; however, in a digital viewer such as Google Maps, with uncontrollable and limitless zoom, this overlap becomes important.

Area info such as common routes and destinations is also added at this phase, but these maps are intended for trip planning purposes only and not drawn at a high enough resolution for navigation or route-finding. Other useful avalanche terrain features can also be added, such as major avalanche paths and decision points.

DISCUSSION

Even though the methods described above have become quite established, there is potential for evolution. We feel spatial analysis may lead to more deterministic ATES parameter thresholds that are more appropriate for at least the preliminary zoning. This could be especially useful for increasing consistency amongst assessors.

FIG. 1: THE TUTSHI CHUTES AREA IN THE YUKON, OUTLINED IN WHITE, SHOWN IN GOOGLE EARTH. HIGH RESOLUTION IMAGERY IS AVAILABLE FOR THE EAST END OF THE AREA, MAKING FOREST COVER AND TERRAIN FEATURES EASY TO VISUALIZE. HOWEVER, MOST OF THE AREA OF INTEREST HAS LOWER RESOLUTION IMAGERY, WHICH IS NOT PARTICULARLY USEFUL EXCEPT FOR DETERMINING GENERAL VEGETATION PATTERNS.

FIG. 2: IN THE ABSENCE OF HIGH RESOLUTION IMAGERY, VEGETATION OVERLAYS CAN BE USED TO SUPPLEMENT THE LOW-RESOLUTION IMAGERY TO GIVE A BETTER INDICATION OF FOREST COVER. THIS PARTICULAR EXAMPLE SHOWS FORESTED AREAS IN GREY.

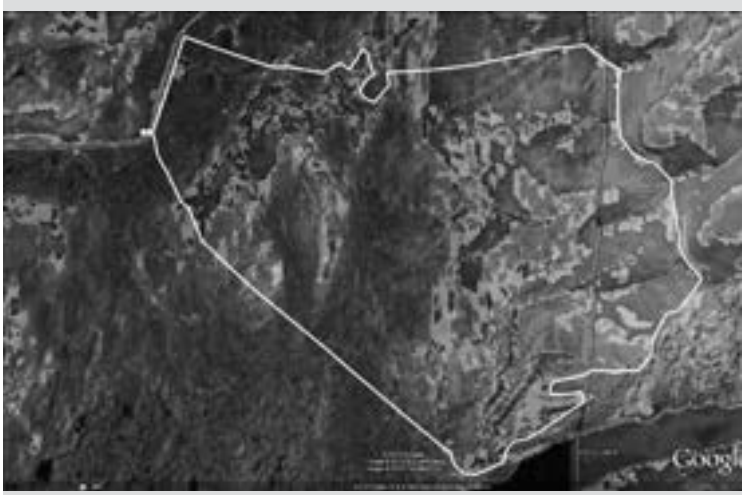

FIG. 3: SLOPE ANGLE OVERLAYS ARE THE MOST RELIED UPON TERRAIN VISUALIZATION TOOLS FOR PRELIMINARY ZONING. NOT ONLY CAN THE DEFAULT SLOPE ANGLE PARAMETER BE DETERMINED, BUT THESE OVERLAYS CAN ALSO GIVE A SENSE OF SLOPE SHAPE (CONVOLUTION), AND DEPRESSION- AND GULLY-TYPE TERRAIN TRAPS. THIS EXAMPLE SHOWS SLOPES 20-30 DEGREES SHADED IN LIGHT GREY, LESS THAN 20 DEGREES IN DARKER GREY, AND OVER 30 DEGREES SHADED THE DARKEST.

FIG. 4: FINAL ATES OVERLAY FOR THE TUTSHI CHUTES AREA IN THE YUKON SHOWING CLASS 1 "SIMPLE" TERRAIN SHADED IN LIGHT GREY, CLASS 2 "CHALLENGING" TERRAIN SHADED IN DARKER GREY, AND CLASS 3 "COMPLEX" TERRAIN SHADED THE DARKEST. THE ATES POLYGON OVERLAP, EXPRESSING UNCERTAINTY AND ERROR, CAN ALSO BE SEEN.

In addition, the development of ATES zoning has highlighted the need to review and refine the ATES Technical Model, or else develop a separate parallel model specifically for this application. We have identified two specific limitations with the established ATES Technical Model v.1.04 for zoning:

1. The default of glaciated terrain to Class 2 "Challenging" or higher. This limitation is highlighted in northern areas where there are many large flat glaciers with minimal overhead hazard. Avalanches reaching Size 2 or larger are very unlikely in this terrain and we should, therefore, have the option to zone it Class 1 "Simple." Crevasses and other glacier-related mountaineering hazards are the primary concern for these large flat glaciers. Using an avalanche exposure scale to describe serious glacier travel may be giving the wrong message. It essentially recommends being prepared and trained for avalanches when people should be prepared and trained for glacier travel. As an option, glaciers could fall under a different grading system. The International French Adjectival System is probably the most detailed of the mountaineering grading systems when it comes to glacier travel.
2. The limitation of only three ATES classes. By definition, Class 1 terrain must have some areas that are affected by avalanche hazard. We feel a fourth class that specifies 'Non-avalanche terrain' (Class 0) may be appropriate for some areas depending on the resolution, as well as the intended use of the ATES zoning. It would be beneficial for parties to be aware of locations that would be acceptable in all avalanche conditions to establish a camp, turn off transceivers, and freely roam within a small area. If Class 0 terrain was considered an established zone, it would certainly need to have clearly defined parameters that indicate an area that it is too flat to avalanche and has no overhead exposure. In addition, the resolution of the zoning of Class 0 terrain would need to be clearly defined.

Yet another discussion point is the acceptance and application of ATES for workplace safety programs. All zoning maps produced to date for RSTBC, BC Parks, YAA, and YG have been intended for self-directed backcountry recreational avalanche safety. There has been some limited use of ATES zoning for industries where workers may be freely roaming through avalanche terrain, as opposed to following standard routes or corridors. Although this is certainly not a new idea, the increased acceptance and standardization of ATES zoning combined with current worker safety needs may lead to more widespread use and acceptance of ATES zoning for backcountry workplace scenarios.

We have our ideas regarding the above discussion points, but are also interested in hearing from other avalanche professionals. Please feel free to email with comments or questions: ccampbell@avalanche.ca or bgould@avalancheservices.ca.

ACKNOWLEDGEMENTS

For their assistance with fieldwork and zoning, the authors would like to thank Mark Bender, Chris Davis, Sean Fraser, Colin Mackenzie, Pete Marshall, Wren McElroy, James Minifie, Gord Ohm, Matt Peter, Tom Riley, Carole Savage, Ilya Storm, Dave Tracz, and Claude Vallier.

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The Great Debate

ATES MAPPING is being used more and more to help amateur recreationists quantify exposure to avalanche terrain and plan their routes accordingly.

HOW CAN (OR SHOULD) ATES ZONING MAPS BE USED FOR INDUSTRIAL AVALANCHE SAFETY? WHERE DO YOU SEE THE POTENTIAL FOR ATES ZONING WHERE AVALANCHE WORKERS TRAVEL FREELY IN AVALANCHE TERRAIN?

WHAT'S YOUR OPINION?
Let us know at
greatdebate@avalanche.ca

Yukon Case Study

THE YUKON AVALANCHE ASSOCIATION recently embarked on a two-year, federally-funded ATES rating project with the intention of producing ratings for several popular skiing and riding areas in the Yukon and far northern BC. Yukon Parks jumped on board to have several areas in Tombstone Park rated at the same time. Considering all the great zoning map development work done by CAC in BC, it seemed appropriate to put ATES zoning to the test in a northern setting. This seemed especially relevant for an area such as the Yukon that does not have the same degree of historical usage as some of the popular areas of southern and central BC. Consequently, there are very few 'standard' routes that are required for traditional ATES ratings.

The history of ATES in the Yukon is very limited; however, some work was done for the Yukon Board of Education and Parks Canada in the years following the development of the ATES rating system (2003-05). None of this work included zoning; however, a limited area in Chilkoot National Park was zoned by overlaying ATES polygons on oblique photos.

Right off the bat it became apparent that there were going to be some differences between the south and north ATES zoning analysis:

- The Yukon is a blank slate with minimal preconceived ideas of what the terrain is like.
- Most of the terrain is above treeline, so applying the avalanche frequency parameter was more challenging since there were often no vegetation indicators.
- At this time there is no regional avalanche bulletin with danger ratings in the Yukon, so there is no application of ATES in a rule-based system such as the Avaluator.
- 95% of the fieldwork was completed with the aid of a helicopter (as opposed to less than 5% in the south). This allowed for efficient work.

The ATES zoning methods used in the north followed the same methodology as the south: preliminary zoning, field checking, final zoning, and public delivery. The final product is still being decided on, but likely will include a suite of public delivery format including Google Earth files, brochures, and signage at standard trailhead locations.

NEIL MACDONALD (PARKS CANADA) BIDDING AGGRESSIVELY

Calgary Gala Raises **$70,000**

SPONSORS, DONORS AND FRIENDS GATHERED ON MARCH 8, 2012 AT THE CANADIAN PACIFIC RAILWAY PAVILION FOR THE CANADIAN AVALANCHE FOUNDATION'S ANNUAL CALGARY GALA FUNDRAISER WHICH RAISED OVER $70,000.

THESE MONIES will be used to fund avalanche forecasts issued by the Canadian Avalanche Centre, avalanche research and education programs. Since 1999, the CAF has contributed over $1.3 million to avalanche safety in Canada.

The CAF would like to celebrate and thank the contributions of their major sponsors and donors: Canadian Pacific, Canadian Mountain Holidays, First Energy Capital, BMO Capital Markets, Ski Cellar Snowboard, Gibson Energy, McDaniel & Associates, Resorts of the Canadian Rockies, Murphy Oil Company, Peters & Co., Athabasca Oil Sands Company, Worley Parsons and Chatter Creek Mountain Lodges.

Explosive growth in winter backcountry use over the past ten years is challenging our avalanche education and warning systems, while government funding falls well short of the cost of issuing public avalanche bulletins in Canada. Avalanche fatalities all too often grab the headlines. More is needed to make our winter mountains a place for all to enjoy safely. The CAF's mission is to provide financial support to public avalanche information, education and research, and the success of events like these help achieve that mission.

Generosity in Whistler

ATTENDEES AT THE CANADIAN AVALANCHE FOUNDATION'S WHISTLER FUNDRAISING GALA ON MARCH 17, 2012 WERE TREATED TO AN INSIDER'S VIEW OF PREPARATIONS FOR THE 2014 SOCHI OLYMPICS.

ROGER MCCARTHY, a long-time Whistler-ite and past executive officer at Intrawest and Vail Resorts, was the evening's guest speaker. McCarthy shared his experiences in Russia consulting for the Sochi ski area. The comparisons to the Whistler 2010 Olympics were enlightening.

The Whistler fundraiser generated close to $25,000 for avalanche safety. The Saturday night dinner event was a sell-out at the Nicklaus North Golf Club. Participants enjoyed a special "Avalanche Menu" and mingled with members of the avalanche and Whistler communities. Attending were Peter Schaerer and Chris Stethem, founding members of the Canadian Avalanche Association and Canadian Avalanche Foundation; Ross Cloutier, President of the Canadian Avalanche Centre; along with current CAF board members Gordon Ritchie, Jack Bennetto, David Thompson, John Hetherington, Geoff Freer and Kory Fawcett. Special guest and Whistler Mayor Nancy Wilhelm-Morden got into the spirit of the silent auction by offering a dinner for six at her house.

Special thanks to Presenting Sponsors V. Lange Consulting and Meyers Norris Penny LLP; Supporting Sponsors Hatfield Consultants, Hemmera and Toba Montrose General Partnership; and Contributing Sponsors Zaui Software and Lucent Strategies. Thank you to all silent auction donors, in particular Whistler Blackcomb, Monashee Powder Snowcats, Coast Range Helisking, Whistler Heliskiing, Arc'teryx, and Pique Newsmagazine, as well as a very special thank you to Sharon Audley, the event organizer.

CAF Updates
2012-13 Grant Recipients

Pattie Roozendaal

THE BOARD OF DIRECTORS OF THE CANADIAN AVALANCHE FOUNDATION IS PLEASED TO ANNOUNCE ITS DECISION TO APPROVE FUNDING OF $158,510 IN FISCAL YEAR 2012-13, IN SUPPORT OF PUBLIC AVALANCHE SAFETY INITIATIVES.

THIS YEAR'S MAJOR granting decisions include:

- $111,510 to the Canadian Avalanche Centre in four key areas: operations, youth education, public outreach and applied research
- $88,000 for ongoing operational support of the Public Avalanche Warning System
- $15,000 for expansion of the youth education program (this grant was made possible through the generous support of the Hugh & Helen Hincks Memorial Fund, a CAF legacy fund)
- $6,510 for ongoing support to community-based avalanche awareness and outreach activities in Newfoundland by Dr. Keith Nicol of Cornerbrook, NF
- $2,000 in travel subsidies to four CAC forecasters to present research findings at the 2012 International Snow Science Workshop in Anchorage, AK
- $20,000 to the Applied Snow and Avalanche Research Chair at the University of Calgary
- $10,000 to the Centre d'avalanche de la Haute-Gaspésie for ongoing operational support
- $15,000 to the Canadian Avalanche Association to support the production and publication of Snow Avalanche Risk Mitigation (lead authors Dr. Bruce Jamieson and Alan Jones).

In addition to these major funding decisions, the CAF has committed $2,000 from the Craig Kelly Memorial Scholarship Fund to support the professional development of two CAA Avalanche Operations Level 2 candidates.

The Board of Directors of the Foundation expresses its sincere appreciation to the many donors, volunteers and event sponsors who make all of this possible. Your dedication to the cause of public avalanche safety is both remarkable and essential. Thank you.

MICHEL TRUDEAU MEMORIAL ROSE SALES

Adamson's Heritage Nursery in Langley continues to support the CAF with sales of the "Michel Trudeau Memorial Rose," with proceeds of $1225 in 2011. Thank you to everyone who purchased this lovely rose for his or her garden. Read more about the Michel Trudeau Memorial Rose at: avalanche.ca/caf/support/michel-trudeau-rosebush.

JOIN THE DISCUSSION

Please visit the CAF blog to join in the discussion on what priorities the CAF should focus on when allocating funds to avalanche safety in future. Find the blog at: canadianavalanchefoundation.blogspot.ca.

NEW IN THE ONLINE STORE

See our newest selection of Marmot technical t-shirts and down sweaters at avalanche.ca/caf/store. Proceeds benefit the CAF's avalanche safety fundraising efforts.

New CAF Directors

TWO new Directors were elected to the Canadian Avalanche Foundation Board of Directors at the Annual General Meeting in Penticton. The rest of the board remains unchanged.

ROBERT KENNEDY Robert is actively involved as defence counsel for the outdoor commercial recreation and adventure tourism industry in BC. He received the Marshall Award and the Jimmie Spencer Award for his contribution to the Canadian ski industry, and is an associate member of the Canada West Ski Areas Association. Robert is the former Chair of the CWSAA Safety Committee and works closely with the ski industry developing mountain safety and risk management programs. He is an active member and a former director of the Association of Ski Defence Attorneys. He was appointed Queen's Counsel in 2011.

KORY FAWCETT is the founder and CEO of Zaui Software in Vancouver. Kory grew up in the Alberta Parks and lived in the Bow Valley. He is an avid skier, climber and cyclist. Kory currently resides in North Vancouver.

*TM/MC Columbia Brewery

avalanche **community**

in this **section**

MARK AUSTIN

Schedule of Upcoming **Events**

CANADA WEST SKI AREAS ASSOCIATION ZONE MEETINGS

Oct. 2-4, 2012: AB, SK & MB Zone
Norquay, Banff, AB
Oct. 22-24, 2012: BC & YT Zone
Delta Sun Peaks Resort, Sun Peaks, BC

For more information:
cwsaa.org/calendar3.html

ICAR 2012

Oct. 2-7, 2012
Krynica, Poland

The International Commission of Alpine Rescue is hosting an open forum to discuss ideas and share information on mountain rescue. ICAR represents 30 mountain-rescue organizations from Europe and North America.
For more information:
ikar-cisa2012.pl

ICELANDIC ASSOCATION FOR SEARCH & RESCUE'S RESCUE 2012 CONFERENCE

October 19 – 21, 2012
Reykjavik, Iceland

Held in English and Icelandic, the conference features up to sixty lectures on SAR topics.
For more information:
icesar.com/rescue

ADVANCES IN AVALANCHE FORECASTING

October 22, 2012
Podbanské, Slovakia

Covering themes and trends related to avalanche forecasting, and celebrating the 40th anniversary of the Slovakia's Avalanche Prevention Centre.
For more information:
avalanches.sk/forecast/index.html

WILDERNESS RISK MANAGEMENT CONFERENCE

October 24 – 26, 2012
Portland, Oregon

This annual conference focuses on risk management and practical skills for the wilderness adventure and education industry.
For more information: nols.edu/wrmc

BANFF MOUNTAIN FESTIVAL

Oct. 27-Nov. 4, 2012
Banff Centre, Banff, AB

The Banff Mountain Festival brings you the world's best mountain films, books and speakers.
For more information:
banffcentre.ca/mountainfestival/

BACKCOUNTRY AVALANCHE WORKSHOP SERIES

November 2011
Across BC and AB

Featuring evening sessions in many communities throughout BC and AB, as well as full-day events in Revelstoke (Nov. 10) and Calgary (Nov. 17). Volunteers are always welcome.
For more information: avalanche.ca/cac/events/backcountry-avalanche-workshops

HAZARD AND RISK ASSESSMENT WITH SPATIAL PREDICTION MODELING METHODS AND TOOLS

November 28-30, 2012
Ashurst, UK

A course for those who would like to understand the basic principles underlying spatial prediction models and their associated uncertainties.
For more information:
wessex.ac.uk/hazardrisk2012.html

AVALANCHE AWARENESS DAYS

January 19-20, 2013

National celebration of Canada's avalanche safety expertise and an invitation to enjoy the winter backcountry with education and training. Mark your calendars and get involved. Check our website in early December for a complete schedule of events.
For more information: avalanche.ca/cac/events/avalanche-awareness-days

Getting Social with **EMBC**

SENIOR MOUNT WASHINGTON SKI PATROLLER LARRY ROY DEMONSTRATES HOW TO CONDUCT A CT DURING AVALANCHE AWARENESS DAY // EMERGENCYINFO BC

EMBC's Social Media & Online Communications Unit

EMERGENCY MANAGEMENT BC USED SOCIAL MEDIA TO REACH NEW AUDIENCES DURING AVALANCHE AWARENESS DAYS

GET THE GEAR, get the training, check the forecast, file a flight plan. Those four, fundamental lifesaving tips were the core of Emergency Info BC's social media blitz to support national Avalanche Awareness Days January 13 to 23, 2012.

For ten days, the message was shared via the Emergency Info BC Twitter feed, with informational links to Emergency Info BC's YouTube Channel and Flickr photo set, and to partnering agencies like the Canadian Avalanche Centre.

A total of 100 tweets were sent during the campaign, attracting more than 210 new followers and reaching an estimated amplified audience of 25,000-plus people. So did it make a difference? Did the blitz work? Good question. Social media naysayers would be quick to argue you cannot beat traditional media in getting the word out. And they are right, but only partially.

TV, radio and print media remain key in raising awareness about avalanche safety. However, much of their coverage is limited by the short news cycle and typically centres on a tragic event. Where social media excels is in conversation—more specifically, the ability to maintain that conversation over time with a growing audience. Prior to the Emergency Info BC avalanche awareness campaign, a great deal of effort was focussed on identifying and reaching out to targeted stakeholders. The list included the BC Search and Rescue Association, Vancouver Island Avalanche Bulletin, Alberta and BC snowmobiling clubs, ski resorts and industry magazines, as well as local governments with backcountry terrain on their doorsteps.

We encouraged them to follow our campaign, provide input and spread the word among their friends and followers. These strategic relationships helped steer the discussion and reinforce the avalanche safety message. At the peak of the ten-day blitz, the subject of avalanches in Canada was trending on twazzup.com with EmergencyInfoBC listed as an "influencer."

Now comes the hard part—quantifying the results. It is extremely difficult to say whether the social media campaign saved a set number of lives. Decreased fatalities seem an obvious measure, but without a way to definitively count the number of backcountry users in BC, there is no way to say for sure.

What we do know is that the campaign got people talking online. If people are talking about safety, the hope is they're acting on the message. We look forward to supporting the CAC again this season to keep the safety conversation going.

AVALANCHE AWARENESS DAYS

View our Avalanche Awareness Flickr photos: flickr.com/photos/emergencyinfobc/sets/72157630454914590/. Watch our Avalanche Awareness YouTube videos: youtube.com/playlist?list=PLEDEECDCAB2C7A679&feature=plcp.

MEET EMERGENCY INFO BC

Emergency Info BC is run by Emergency Management BC's social media unit. Created in December 2011, its top priority is providing real-time alerts about emergency events via the EmergencyInfoBC blog and Twitter feed. Its other focus is helping British Columbians prepare for emergencies. Meet the team: youtu.be/w3TFwlXYUSI.

WHERE EMERGENCYINFOBC IS NOW

Since the Avalanche Awareness blitz—EmergencyInfoBC's first ever social media campaign—we've run six campaigns, including the internationally-recognized Zombie Preparedness Week. Visit emergencyinfobc.gov.bc.ca/awareness-campaigns.html to check them out.

STAY CONNECTED

- Blog: emergencyinfobc.gov.bc.ca/
- Twitter: @EmergencyInfoBC
- YouTube: youtube.com/user/EmergencyInfoBC/featured
- SoundCloud: soundcloud.com/bcgov/sets/emergencyinfobc/
- Flickr: flickr.com/photos/emergencyinfobc/
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PARTNERS

- The BC Wildfire Management Branch on Facebook: facebook.com/BCForestFireInfo
- The BC Wildfire Management Branch on Twitter: @BCGovFireInfo

Avalanche Mystery Solved: **Greenslide**

John G. Woods , Wildvoices Consulting and Cathy English, Revelstoke Museum and Archives

WHILE LOOKING THROUGH HISTORIC PHOTOGRAPHS AT THE REVELSTOKE MUSEUM AND ARCHIVES A FEW YEARS AGO, WE CAME ACROSS A SPECTACULAR BUT UNIDENTIFIED PRINT OF A HUGE AVALANCHE DEPOSIT ACROSS A DOUBLE-TRACKED RAILWAY LINE (FIG 1).

John Woods John arrived in Glacier National Park in 1975. As Chief Naturalist, he found himself working in the heart of Canada's avalanche country. Now a consultant, he continues to probe mountain mysteries.

WHILE THE SITE looked familiar and the photograph was associated with a large collection of views taken in Rogers Pass, we could not place the exact location.

Seeking help from the avalanche safety community, a number of people suggested locations which ranged along the mainline of the Canadian Pacific Railway from the west boundary of Glacier National Park to Kicking Horse Pass. However, all early suggestions failed to match our unlabeled print. Perplexed, but sure that someday the mystery could be solved, the photograph was published in *Snow War: An Illustrated History of Rogers Pass, Glacier National Park, B.C.* (Woods 2010) with a plea for help—where was it taken?

We are happy to report that Johann Schleiss of the Rogers Pass avalanche control team solved the puzzle. Johann pointed south of Revelstoke along the Columbia River to the base of Mount Cartier. Here a CPR branch line once connected the railway's mainline at Revelstoke to Arrowhead (the upper end of the Arrow Lakes). About 16km south of Revelstoke, railway plans dating from 1894 show the name "Green Slide" at a point where the railway crossed the run-out zone of a slide path originating from near Mt. Cartier's summit (Order-in-Council 1894). The name "Greenslide" is marked at the same location on a 1926 map held by the Museum (background). A field trip to Greenslide confirmed the location (50°53'07.54" N 118°06'19.61" W). The double-track shown in the mystery photograph was a siding.

Trains running on this branch line connected Revelstoke with the CPR's sternwheeler service on the Arrow Lakes from 1896 to 1954 (Turner 1984). In the 1960s, the railway route across Greenslide was abandoned to the rising flood-waters above the Hugh Keenleyside Dam on the Columbia River.

Today, a secondary public road continues to cross this slope at Greenslide. The *Snow Avalanche Atlas for Revelstoke-Mica-Galena Pass-Greenslide* (Province of British Columbia 1984) actually maps two adjacent slides here

(Greenslide #1 & #2) both with a history of reaching from the heights of Mt. Cartier to and beyond the present-day road. The most northern (Greenslide #1, 16.0) has an amazing vertical fall of 2,135m and has deposited snow up to 12m deep on the road since 1982. Its twin (Greenslide #2, 16.5) has a vertical fall 1,830m and deposited up to 4.5m of snow on the road during the same period (Bruce Allen, Ministry of Transportation, unpublished data).

Located close to Revelstoke and occasionally avalanching spectacular amounts of snow, it is not surprising that there are a number of Greenslide avalanche photographs in the Revelstoke Museum and Archives including a series taken circa 1912 (Fig 2) and an amazing photograph taken by Emma Roberts in March 1920 (Fig 3).

Although we do not know who named Greenslide or why, we note that the Greenslide avalanche paths have the ability to reach the valley bottom very late in the avalanche season—occasionally into May when the slide alders in the runout zones would already be green.

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Turner, R. D. (1984). *Sternwheelers and Steam Tugs: An illustrated history of the Canadian Pacific Railway's British Columbia Lake and River Service,* Sono Nis Press.

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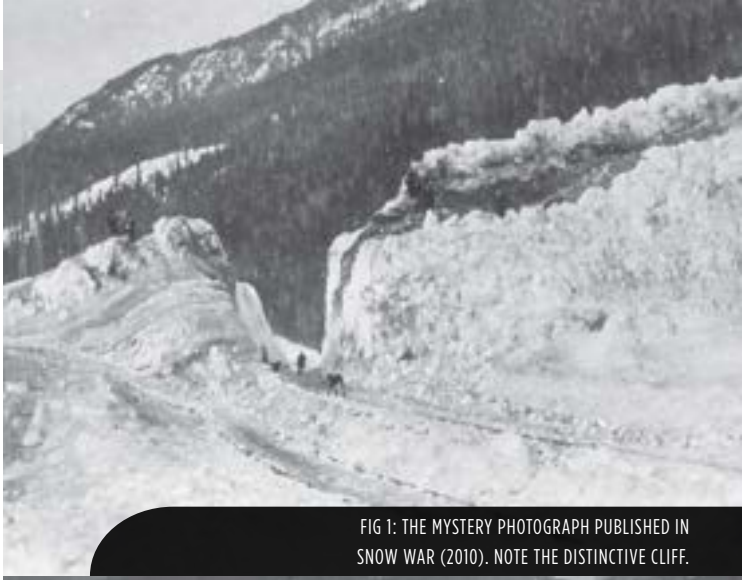


FIG 1: THE MYSTERY PHOTOGRAPH PUBLISHED IN SNOW WAR (2010). NOTE THE DISTINCTIVE CLIFF.

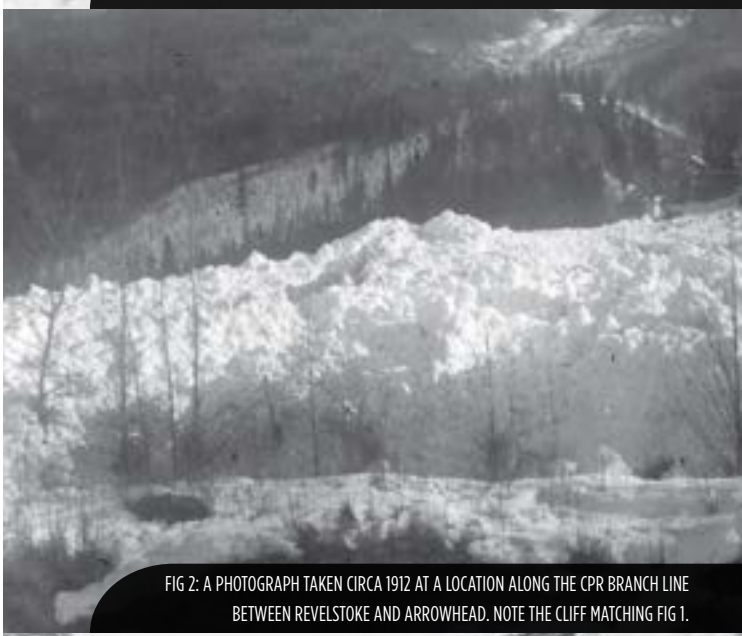


FIG 2: A PHOTOGRAPH TAKEN CIRCA 1912 AT A LOCATION ALONG THE CPR BRANCH LINE BETWEEN REVELSTOKE AND ARROWHEAD. NOTE THE CLIFF MATCHING FIG 1.

FIG 3: MARCH 1920, THIS IS ONE OF THE FEW FULLY-LABELED PHOTOGRAPHS OF A HUGE AVALANCHE AT GREENSLIDE

Avalanche Accounts
Avalanche in the **Panorama Slackcountry**

Story and photos by Justin Futa

ON SUNDAY APRIL 1, 2012, MY GIRLFRIEND SARAH AND I WERE SKIING SLACKCOUNTRY LAPS JUST BEYOND THE TAYTON BOWL BOUNDARIES AT PANORAMA MOUNTAIN VILLAGE RESORT. ON OUR FIRST LAP, WE SET A TRACK ACROSS THE RIDGELINE AND DID A LITTLE SNOW ANALYSIS TO SEE WHAT THE CONDITIONS WERE LIKE.

I had enough time to accept that *this was the end,* and that at least I was going to die doing what I loved.

THE BULLETINS said moderate to considerable avalanche hazard; the conditions corresponded and seemed quite moderate. We skied a modest line on the east side of the bowl through trees, and down into the lower part of a run called Never Never Land. After our first descent, we decided to drop into a more rewarding—but also riskier—region of the bowl.

As we were ascending for our second lap we discussed safety protocol and exit strategy. We were being followed by three ski patrollers from Panorama, and two staff members were ahead of us on the uptrack. Point A in the photo is a safety zone above a large tree that I chose for us to gear up and drop in. The patrollers behind us continued past, following our first tracks. They skied around the ridge into the zone represented by Point B. The top left line shows their path; they stopped at Point B to watch me drop in. I told Sarah to stay behind the tree in the safety zone and wait for further instruction.

The line from A to B shows my route. I dropped in with the intention of hitting the large cliff near the bottom, to the left of the line. I changed my mind and slashed into a no-fall zone to the right of the exposure. The slope sluffed and swept me briefly before I made a high-speed exit down to where the patrollers were standing. We chuckled about me nearly losing it on the lower portion. I instructed Sarah to re-skin and follow our original route around the ridge, and I would wait there for her. She gave the thumbs up and disappeared into the trees.

I hung out with the patrollers for another five minutes or so, talking about skiing and avy conditions, then they said good-bye and left. The three of them cut a track right underneath the most dangerous part of the slope (convex and 35+ degrees), which I guess was marginally better then skiing right over the convex face directly below us. After noticing the snowpack's instability during my descent, my plan had been to walk uphill slightly to exit high and to the southeast in order to avoid the danger zone below, but I figured "they know what they are doing; I guess when Sarah gets here, I'll follow that route, too."

I waited alone for Sarah to pop out on the ridgeline behind me. Approximately ten minutes had passed when suddenly I noticed movement in my peripheral vision down and to the right of where I was standing. I looked over just in time to watch the snow fracture on the northwest side of the face near the treeline (Point C). The slide had started just below and to the right (north) of where I was standing, and was working its way across and up the mountain. It was like slow motion. I watched the huge crack slowly spread across the face towards where we had stopped (Point A). It flowed slowly for just a moment, like a huge slab of ice cream, and then suddenly exploded.

TELL US YOUR STORY
If you have been involved in an avalanche and want to share your story, email us at: stories@avalanche.ca

There was a massive wall of snow moving towards me at an incomprehensible speed.

I had enough time to accept that this was the end, and that at least I was going to die doing what I loved. I even had enough time to contemplate pulling out my camera to film my own death. Then the first miracle of the day happened. Thousands of tonnes of raging avalanche debris suddenly diverted, no more than a metre in front of me, because of the small hump I was standing on. The blast blew me right off my feet, completely covered me in snow, and buried the spot where the patrollers had just been standing. I couldn't see anything for a couple of minutes; it was like being inside a snow tornado. I picked myself up, in shock at what just happened. I gathered my gear and started running up the hill to try to reach a safer area, in case there was more to come.

The final line shows crown line and slide path. So much time had passed between Sarah leaving Point A and the avalanche triggering that I thought that any second I would be seeing her ski down from the east side of the bowl. I yelled as I was climbing but got no answer. I called her cell phone. This is when the second miracle of the day happened. There was no answer on the first call, but the second call picked up. I could hear her whimpering and struggling to breathe. Her iPhone was zipped up in her inside pocket and she was buried, so I don't know how the call was answered. I turned around and began running back across the danger zone and up the debris. From about 500 feet away I could see the tip of her ski. As I got closer I could hear muffled screams for help, and the third miracle of the day happened. Even with a broken neck, Sarah was able to self-expose her head and clear her airway. I was still far enough down the debris that without her doing so, she would have suffocated before I reached her.

After digging her out and stabilizing her, I called the ski resort to ask for immediate help. I was put on hold, which was the worst. At the time, I had no idea how big the slide actually was or how bad her injuries were. The slide had reached the upper end of size 3—some say size 4. It travelled more than a mile and a half down the mountain, right into the ski boundaries. Within 15 minutes, a team of heroes arrived, including long-time family friend Rod Gibbons, Nate (an RK Heliski guide), and the same ski patrollers who had been standing with me about a half hour earlier.

We were on a 32-degree slope near the top of the slide debris, and at the bottom of a huge exposure. Sarah's helmet was broken nearly in half, and her avy vest was completely destroyed. All four layers of ballistic nylon were shredded right down to the spine protection. Her shovel, probe and water bladder were dangling from the remnants; one ski was gone and the other in half. She had tomahawked off an 80-100 foot rock exposure, and been buried. We put Sarah in C-spine and the team slid her down the mountain. I climbed up and down the debris, shuttling everyone's gear to just above

the helicopter landing zone. Sarah was heli-evaced to the Invermere hospital.

I joined the search and rescue team until I was too exhausted to be much help, at which time I was flown out. The magnitude of the situation was unbelievable: 64 people were involved in the search and rescue, multiple helicopters, and four avalanche dogs. Luckily no one else was harmed. We spent some time in Invermere emergency before being transported to Cranbrook. We spent 18 hours there before the severity of Sarah's injuries were fully assessed. Monday afternoon we were air-lifted to Foothills Hospital in Calgary. Sarah suffered a shattered tibia and fibula that was screwed and plated. She also suffered six fractures in the C4, 5, 6 and T6 and 7 vertebrae. Doctors fused her C5 and 6 together. Doctors expect a full recovery with a slight limitation in neck movement.

I can't say for sure whether I was the direct cause of the avalanche or whether there were multiple or natural factors that triggered it. I can say that I hold myself personally responsible for making the decision to ski in a marginal zone. I can remember thinking "bahhh, if the risk was extreme, those patrollers would have stopped me when they skinned past us, and they definitely wouldn't have gone down to be spectators. It can't be too bad." I told myself, "no biggie; I've got my exit strategy and if things get sketchy I'll tell Sarah to leave and follow our first track." I've been skiing for 28 years now, and have managed to make mostly sound decisions and calculated descents. I have to live with the fact that a lapse in my judgment has left the love of my life with terrible injuries and nearly cost us both our lives.

Whether the avalanche happened because of us being there or not is inconclusive. However, we were there and that is all that matters. I take full responsibility for my actions and now it is time to deal with the consequences. This was a humbling and eye-opening event for many, especially me. Sarah and I live for the mountains and sometimes it seems like they live for us. Indulging in our lifestyle can be risky, but usually produces life-long memories and unique experiences—most good, some bad. This was a life-changing event that ended in tragedy; however, our lives will go on and we will live to ski another day, thankfully. We want to thank everyone involved with the search and rescue from the bottom of our hearts. You are all heroes. If you know someone involved, you please forward this article to him or her. We would also like to express the love we have for the amazing circle of family and friends that surrounds us, who have all been unbelievably supportive. Much love and respect to all of you and the mountains.

This story was previously published on Facebook on April 3, 2011, two days after the incident.

Remembering **Taka Takatsuki**

Brad White

WE RECEIVED VERY SAD NEWS FROM JAPAN LAST WINTER, WHEN A STUDENT AND COLLEAGUE WAS KILLED IN AN AVALANCHE.

YASUHARU "TAKA" TAKATSUKI was caught in an avalanche on his home mountain Tanigawa-dake in March 2012. Taka was a graduate of the Japanese Avalanche Network (JAN) Level 2 Avalanche Operations course. This course has been developed with the assistance of the Canadian Avalanche Association, and Taka was one of only five graduates of the first exam held in 2011.

Taka was an independent guide running his own business at Tanigawa, and was training for the first Japan Mountain Guides Association assistant ski guide exam when the accident occurred.

Taka was training with Chika Hayashi, a long-time instructor and interpreter for the JANS Level 1 program, and one of the other Level 2 graduates, and Sachi, a Level 1 graduate. As he was attempting to ski cut a steep start zone outside of the ski area, he triggered a size 2.5 avalanche 50cm deep on a melt freeze crust that fractured above him and carried him down through the trees. Chika and Sachi found him quickly and performed CPR until the rescue helicopter arrived, but he could not be revived.

Taka was a great character with a good sense of humor and an infectious enthusiasm for travelling in the mountains. He was an excellent telemark skier and passed his love of powder on to all who travelled with him.

This incident, coming approximately one year after the tragic avalanche deaths of three ski guides that occurred on the same day as the earthquake and tsunami disaster, has left a huge hole in the Japanese avalanche community. Our best wishes and sympathy go out to our Japanese compatriots and Taka's friends and family.

Brad White is an ACMG/IFMGA mountain guide and Visitor Safety Specialist with Parks Canada. He has been instructing CAA ITP courses for over 20 years and was the Canadian instructor on the CAA Avalanche Operations Level 2 courses held in Japan by the Japanese Avalanche Network.

TAKA ENJOYING THE POWDER // BRAD WHITE

AN AVALANCHE DESTROYED PART OF A CPR SNOWSHED AT LAURIE SLIDE PATH WEST OF GLACIER NATIONAL PARK, BC, APRIL 1959 // REVELSTOKE MUSEUM AND ARCHIVES PETER SCHAERER FOND PSS.38

Land of Thundering **Snow**

John Woods

VIRTUAL MUSEUM EXHIBIT ANNOUNCED FOR SNOW RESEARCH AND AVALANCHE SAFETY IN CANADA

THE REVELSTOKE MUSEUM AND ARCHIVES is excited to announce the launch of a two-year project to gather artifacts and information on the history of Canadian snow research and avalanche safety. "Our immediate goal will be to present this history in a dynamic website we are calling 'Land of Thundering Snow,'" explains Museum Curator Cathy English. "In the longer term, we want to ensure that Canada's professional avalanche heritage is preserved and presented to Canadians and the world."

"A virtual museum contains exhibits that people can access via the internet. Like all museum exhibits, it is based on real objects—such as photographs, diaries, newspaper clippings, sound recordings, objects—that have stories to tell. Anything we can digitize might become part of the exhibit," outlines English. "Also, like all museum exhibits, everything in the virtual exhibit will be well-researched and linked back to the original artifact. As we build the exhibit, we'll be building a larger collection that will become a major resource for future researchers."

The 'Land of Thundering Snow' virtual exhibit will feature themes including the history of avalanche science and safety; avalanche control; the anatomy of an avalanche; staying safe in avalanche country; and, the ecology of avalanches. Although the website will be designed to appeal to a wide variety of audiences, there will be a special section suitable for teachers and students.

When it is launched in 2014, 'Land of Thundering Snow' will become part of the Virtual Museum of Canada and will include online exhibits, interactive resources and other educational resources designed to engage online audiences in Canada's history and heritage. The project is funded by the Canadian Heritage Information Network's 'Virtual Exhibits Investment Program. One of only seven projects chosen for funding this year (out of 31 proposals nation-wide), the Revelstoke Museum and Archives was very happy to receive this national recognition. Other major partners in the project include the Canadian Avalanche Centre, the Revelstoke Railway Museum, Okanagan College, and Parks Canada.

The scope of this project is vast in terms of both time and space. For example, very few people realize that serious avalanche studies started in Canada as early as 1885 when the Canadian Pacific Railway stationed 'snow camps' along the Rogers Pass route, or that there are records of a snow avalanche destroying a First Nations village near Nain, Newfoundland in 1782.

A recent donation of material by Canadian Avalanche Foundation Honourary Director Peter Schaerer gave the Revelstoke Museum a major head-start on the project. The Museum would appreciate anyone with avalanche-related stories, photographs, journals or important objects such as avalanche research or safety equipment to contact Cathy English (curator@revelstokemuseum.ca).

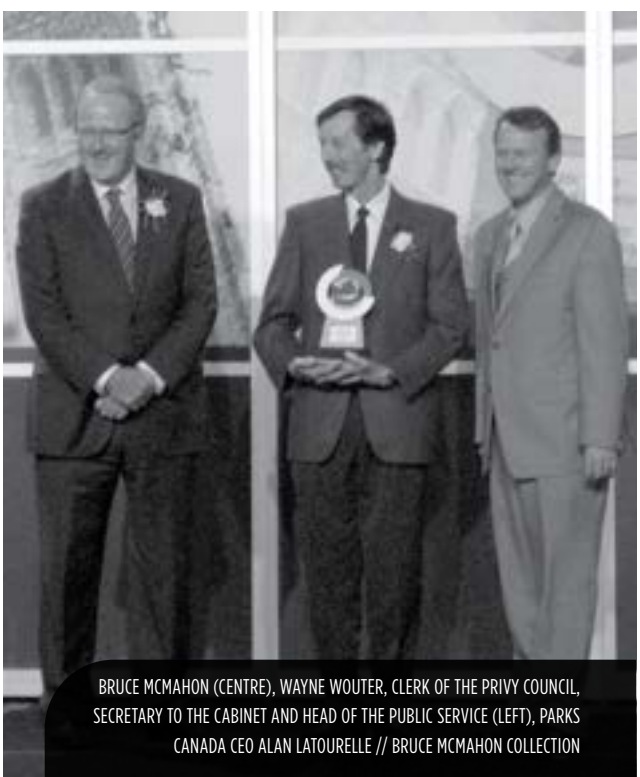
Awarding Avalanche **Excellence**

Parks Canada

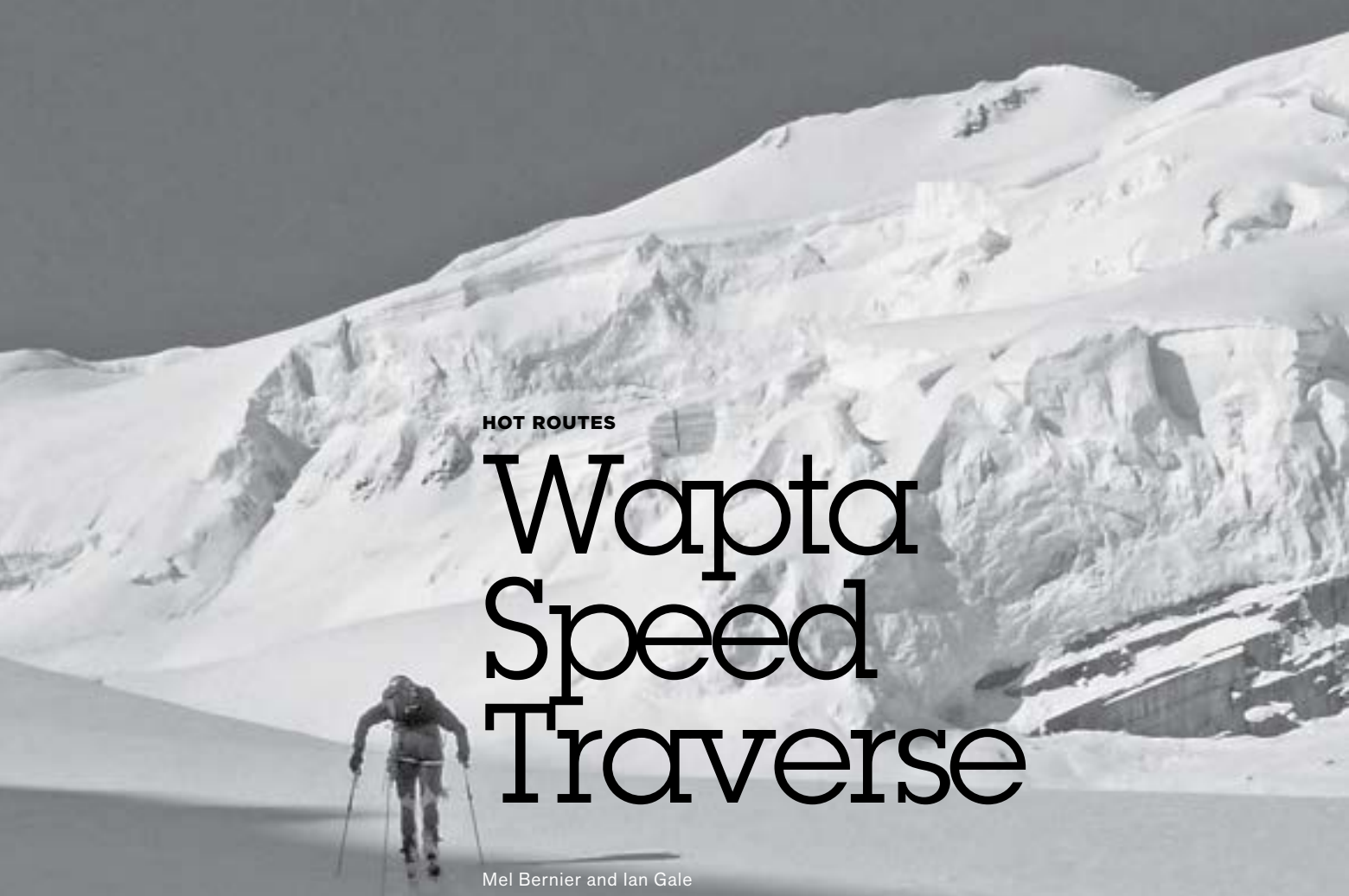
ON JUNE 11, 2012, BRUCE MCMAHON WAS PRESENTED WITH THE PUBLIC SERVICE AWARD OF EXCELLENCE FOR HIS OUTSTANDING CAREER IN PARKS CANADA.

MCMAHON, a Senior Avalanche Forecaster for Parks Canada in Glacier National Park, was chosen from a selection of 650 public servants nominated from federal departments, agencies, and other federal organizations from coast to coast. The Award Ceremony recognized over 250 extraordinary public service employees.

Bruce McMahon was recognized for his important contribution to the field of avalanche control and protection in an outstanding public service career that has spanned over thirty years. Bruce has excelled in serving Canadians and in strengthening the avalanche industry as a whole. He helped to develop the Avalanche Terrain Exposure Scale (ATES), a tool now recognized in Canada and internationally as the most effective and accurate means of classifying wilderness avalanche terrain. Soon to retire, he will leave behind a legacy of innovation and achievement that will be felt for years to come. Congratulations, Bruce.



BRUCE MCMAHON (CENTRE), WAYNE WOUTER, CLERK OF THE PRIVY COUNCIL, SECRETARY TO THE CABINET AND HEAD OF THE PUBLIC SERVICE (LEFT), PARKS CANADA CEO ALAN LATOURELLE // BRUCE MCMAHON COLLECTION



HOT ROUTES

Wapta Speed Traverse

Mel Bernier and Ian Gale

STATS	
SKIERS	Mel Bernier and Ian Gale
DISTANCE	44 km
ELEVATION GAIN	2,150m
ELEVATION LOSS	2,575m
HOURS	7:34
START	Bow Summit
FINISH	Sherbrooke Lake

At 3:00am on May 6, 2012—under the biggest moon of the year—Ian Gale and Melanie Bernier loaded skis into a car in anticipation of a special ski mission. While the town of Golden was still very much asleep, the friends put the lights of Golden in their rearview and pointed the headlights towards Peyto Lake to attempt the Wapta Traverse in a day.

APPROACHING FIRST PART OF BALFOUR COL

WE MET through competitive ski mountaineering or "rando races," and later became teammates on the Canadian National Ski Mountaineering Team. As our legs and lungs became stronger from years of training and racing, we started to imagine moving unencumbered through a classic traverse, shedding the typical heavy loads and focusing on a race-type effort. After racing in Europe and being inspired by the "Grand Courses," which include the popular Pierra Menta four-day stage race in France; La Patrouille des Glacier, a race of the famed Haute Route from Chamonix to Zermat; and the Mezzalama in Italy, it seemed appropriate to pick a challenge in our own backyard.

The Wapta Icefield Traverse is an obvious choice. It is a perfect arena for fast and light missions; as a high glacial plateau, the vertical is gained at the beginning of the trip and subsequent climbs are relatively small.

Ian had done the trip with a heavy pack over multiple days, enjoying the relative luxury of the hut system. He was intrigued at the idea of linking it together as a big day trip. A couple of attempts with fellow racers James Minifie and Reiner Thoni in prior years were unsuccessful due to conditions and visibility. Melanie had been on sections of the traverse; she was supposed to cover the distance in a day in 2011 at the end of the ½ Great Divide Traverse but had to change exit plans, again due to temperamental weather.

THE ROUTE

Just before 5:00am, armed head to toe with race equipment, we left Bow Summit for Peyto Lake. Descending through isothermal snow in the dark was a challenge, but after regrouping on the lake we found a supportive crust allowing for a comfortable and consistent pace. We kept momentum up as we worked through the moraines and creek gully below the toe of the glacier. Once on the Peyto Glacier, the sunrise on Rhonda North encouraged us out of the morning shadows. Gaining Peyto Hut in just under two hours had us pretty charged with our progress, as the travel to that point was good with very little trail breaking. Unfortunately, it was a different story above 2500m. The crust we'd been gliding on so well no longer supported our weight, and our skinny race skis started to break through 15-20cm. Not wanting to lose momentum, we worked together, taking turns setting track while the other drafted behind—hydrating, recovering and recharging.

We reached the St. Nicholas/Olive Col in just over three hours. Finally feeling the sun on our faces, we enjoyed the 5km rolling descent down the Vulture Glacier, allowing a switch in muscle groups and a chance to gawk at amazing scenery under perfect blue sky.

Expecting to see a set track up over the Balfour High Col, we were disappointed to find out we'd be working hard setting our own to the top. Roped up, we worked as a team, regularly swapping leads in order to set the safest and fastest route possible. Reaching the highest point of the traverse, still smiling, we were able to breathe light again and take a minute to soak up the day. Softer snow allowed for a quick glide to the Niles/Daly Col. Then some really nice corn turns brought us to the Sherbrooke Lake and the best surprise of the day: the lake frozen! We whipped the last bit of energy out of our legs and skated across the entire length to kamikaze ski down the hiking trail. At the lodge, we high fived and clicked the watches, seven hours and thirty-four minutes after leaving Bow Summit. Tourists at West Louise Lodge gave us weird looks as we slithered out of our race suits and planned a cookie and a cappuccino at Laggan's Bakery in Lake Louise.

CRUX

During every trip, there are pleasant surprises and uncalculated challenges. No matter the traveling speed, not all the details of a ski trip can be accounted for. Here are some ups and downs.

Ian: "Perhaps due to the headlamp skiing, isothermal snow, more likely 'over-caffeination' and most likely a combination of all three, the start of the trip wasn't that smooth. The ski down from Bow summit to Peyto Lake was in rugged conditions and in my haste I cut a corner on the trail that after six or seven punchy turns became obviously not "the" trail. Survival skiing kicked in and as we descended further we ran out of snow, removed our skis and started swinging down the shrubby cliffs until we were plunked onto the frozen lake where I could start apologizing to Mel for my navigational blunder."

Mel: "I would say besides from fighting through the dark forest at the start of the day (*haha, it's all good Ian!*), my biggest challenge was trail breaking. We rarely have to worry about this when racing, especially in big events. You just put your head down and concentrate on moving fast. Picking a busy weekend of spring for the Wapta Traverse, we were sure that there would be a few helpful tracks long the way. I just had to adjust my speed and control the energy level better to make sure I would be energized again when it came time for me to break trail, and never push to the point of not being able to make good decisions. "

IAN LOVING HIS RACE ENERGY FOOD

SUNRISE ON RHONDA NORTH

THE GEAR

We left our powder skis at home in favor of efficiency: 160cm skis with mohair skins cut to just behind the boot allow a mountaineer to climb efficiently while still maintaining enough downhill "skiability" to safely make it down any slope. We fussed over all the gear in our 20L packs. We carried mandatory avalanche rescue gear as well as a pared-down crevasse rescue kit. A down jacket, 2.5 liters of electrolyte water each and a well-balanced lunch rounded out the packs.

For comfort, ease of movement and since they are so flattering . . . I mean, practical, we wore full spandex ski suits. The suits not only have active recovery material on the legs and lower back, but also have all sorts of great pockets for food and, more importantly, for skins. We both brought superlight windshell pants and jackets, which we used for descents. We kept our climbing helmets and harnesses on from the start until the end just to save some time and be on the safe side.

FASTEST?

As much as the objective was driven by speed, we also both simply wanted to get out there and enjoy working hard and covering a large amount of beautiful terrain.

Ian: "Using race-style tactics opens many options for the team. Planning our caloric intake, using high-performance race fuels (as well as one of my ski touring favorites: peanut butter/butter/Nutella/banana sandwiches), and eating on the move ensures you have the energy to push all day. Employing race style skins on/skins off transitions where de-skinning takes 20 seconds and putting skins on takes 30-50 seconds shaves time and let you focus on constant forward momentum."

Mel: "We shaved a lot of time using what we know from ski racing. The weight of our equipment and packs made a huge difference, enabling us to keep a fast cadence and resist fatigue over the course of the day. During a training week with coaches in Europe back in 2010, we learned that for each 100g shaved off a racer's equipment and/or body, about a minute can be shaved off a 1200m climb (4000ft). One hundred grams is certainly very little, so you can imagine what 1000g can do! A lighter load makes it easier to achieve a fast cadence. Skinning technique also had a lot to do with energy level conservation and speed. For the terrain we were in, the strides didn't need to be very long. On the flats and light inclines we, of course, used the good old kick-glide and skate, but in order to build momentum and save energy on steep and sustained sections, consistent small but quick strides definitely made us move fast. I like to think of it as the beat of your favorite dance song."

If you'd seen us that day you may have thought we looked a little goofy in spandex suits and 160cm "kids" skis snorting and wheezing our way through the mountains, but the freedom to travel this way opens many doors for what's possible in a day. In the end it was simply a beautiful day spent in good company skiing through the high country.

DO YOU HAVE A HOT ROUTE TO SHARE?

Email hotroutes@avalanche.ca

Bringing ISSW Back to **Banff**

Grant Statham, Parks Canada

THE BANFF CENTRE, LOCATED ON THE SIDE OF TUNNEL MOUNTAIN, UNDER MT. RUNDLE AND ABOVE THE BOW RIVER // DON LEE, THE BANFF CENTRE

THE INTERNATIONAL SNOW SCIENCE WORKSHOP 2014 COMES TO BANFF, ALBERTA

From September 29 to October 3, 2014, the International Snow Science Workshop returns to its roots in Banff, Alberta for what promises to be another amazing gathering of avalanche professionals from around the world. This will be the third time the ISSW has come to Banff: the first ISSW was held in Banff in 1980, and then again in 1996. Clearly there is a draw to this place.

Parks Canada is proud to be the key conference organizer, but there is no shortage of good help for conference planning and management due to all the avalanche professionals living in the area. Most of the local ski areas, national and provincial parks, highway operations and guiding companies are chipping in to organize the conference, and to proudly show off our backyard. Many people have asked about volunteering in exchange for reduced conference fees; while we have not yet sorted out deal specifics, those interested in volunteering are asked to visit volunteersignup.org/LPKCD to register.

What is happening now is behind-the-scenes business such as securing the venue, creating a logo and website, and recruiting an organizing team. In the fall of 2012, we will be studying the ISSW 2012 conference in Alaska closely to see how it is done there. We have also been getting good advice from the Whistler 2008 crew. We expect to get busier after the Alaska conference, but we have lots of shoulders to stand on and are looking forward to hosting you all in 2014 for another ISSW *Merging of Theory and Practice,* this time in Banff.

The conference will be based at The Banff Centre, an excellent conference facility known for hosting the Banff Mountain Film Festival each year. Located among the trees on the side of Tunnel Mountain, The Banff Centre offers quality, affordable accommodations, great meeting facilities, a recreation centre with a pool, gym and climbing wall, numerous options for eating, and a short walk to downtown Banff. The Banff Centre's location and facilities are perfect for hosting the ISSW.

Another draw is Banff National Park and the amazing Canadian Rockies. Banff is known for big, steep mountains and cliffs, vast forests, azure blue lakes and abundant wildlife—if you have never been here, then it is time you checked it out. The last week of September is one of the best times to visit, with minimal crowds and autumn colors spread across the mountains. There is no doubt that the world class rock climbing, mountain biking, golfing, hiking, fishing, canoeing and kayaking will all be a serious threat to conference participation. We suggest you plan some time on either side of this conference to get out and enjoy Banff.

CMH HELI-SKIING

Avalanche Awareness Days at CMH

CMH MCBRIDE LODGE WINS STEWARDSHIP AWARD FOR AVALANCHE AWARENESS DAYS

IN MAY 2012, CMH Heli-Skiing and Summer Adventures awarded a Second Nature Award for Community Stewardship to CMH McBride Lodge for the development and execution of McBride Avalanche Awareness Days in December 2011 in partnership with the Canadian Avalanche Centre. The CMH team in McBride gathered together backcountry enthusiasts—skiers and snowmobilers alike—in a full-day AAD event that drew approximately 50 people.

Dave Butler, CMH's Director of Sustainability, says that CMH likes to award ideas where colleagues develop and implement a solution to an issue they see. Organizing a successful community-building avalanche awareness event fits the bill: "this project not only has the potential to keep people alive, but it has begun to transform—in a very positive way—the relationship between CMH and snowmobilers in the McBride area," notes Butler. "It's a great example of one of our teams working together to really make a difference in their local community."

CMH McBride area manager Kevin Christakos, along with guide Andi Kraus and Cariboo Lodge Manager Erin Tunissen, organized the all-day McBride Avalanche Awareness Days event. CMH McBride has held an Avalanche Awareness Days event for the past several years attended by about twenty people, but "we always felt we could do something more," says Christakos. The organizers based December's event out of Lucille Hut and invited backcountry users to join in for a practical, hands-on day that included representatives from the local Search and Rescue team, the McBride Big Country Snowmobile Association, the BC Ambulance Service and the BC Forest Service.

"We knew that there was an appetite in the local backcountry user groups (skiers and snowmobilers) for more information on travelling safely in the backcountry," comments Christakos. "What we tried to do was come up with some really basic tips that people could take away and knowledge of how to use the tools available through the CAC. . . to help people make safer decisions."

The day included practice rescue scenarios and coaching with avalanche safety equipment. The BC Forest Service discussed the rationale behind wildlife closures. The BC Search and Rescue Association was there to help recreationists understand the rescue process, and to stress that organized help may not be immediately available should something go wrong in the backcountry.

CMH McBride plans to host another full-day event next year to reach more people in their area and continue fostering positive relationships among backcountry users. "With all user groups there seems to be a stronger sense of community - real "We are all in it together' camaraderie," says Christakos. "We all understand the risks and the need to be better prepared and to work together to keep spreading that word."

CMH has been presenting Second Nature Awards since 2004 to individuals or teams who show significant commitment in community stewardship and environmental initiative. "Our staff more often than not just go out and quietly do good work, and don't look for (or do it for) any kind of exposure or recognition," says Butler. "But we feel that it's important to do that so we can say 'thank you' and so that others will be encouraged to do more."

Butler notes that stewardship is an important aspect of CMH's foundation. "We have moral and ethical responsibilities to take care of these special places that we share with people from all over the world," says Butler.

research &education

ROBIN SIGGERS

Avalanche Balloon Packs—Current Status at the Canadian Workplace: A Study Brief

Pascal Haegeli, PhD

WHILE AVALANCHE BALLOON PACKS HAVE BEEN PROMOTED IN EUROPE SINCE THE EARLY 1990S, A STREAM OF REGULATORY HURDLES SIGNIFICANTLY DELAYED THEIR INTRODUCTION TO THE NORTH AMERICAN MARKET.

UNLIKE OTHER avalanche safety devices that aim to accelerate the search and extrication phase of an avalanche rescue (transceivers, shovels and probes), prolong the survival of a complete burial (AvaLungs) or protect from trauma (helmets), the goal of avalanche balloon packs is to prevent burial in the first place. Since the time window for extricating a completely buried avalanche victim in Canada before their chance of survival drops dramatically is only about 10 minutes (Haegeli et al., 2011) and asphyxia is responsible for roughly three out of four avalanche deaths (Boyd et al., 2009), staying on top of the avalanche has great potential for reducing the number of avalanche fatalities.

Avalanche balloon packs prevent burial through the process of 'inverse segregation'—also sometimes called the 'Brazil nut effect'. Avalanches can be viewed as granular flows composed of particles of different sizes. Under the influence of gravity, granular flows tend to segregate in a way that larger particles are more likely to be found near the surface while smaller particles move towards the base of the flow—similar to what happens in a bag of mixed nuts or breakfast cereal box. The effectiveness of this process primarily depends on the relative size difference of the particles within the flow. Once the avalanche airbag is inflated, an avalanche victim, who is already a rather large particle in an avalanche, becomes an even larger particle that can take full advantage of the segregation effect. As long as the user of the airbag is flowing freely within the avalanche debris, the separation effect will be moving the victim towards the surface despite its higher density and thereby minimizing burial depth or even preventing burial completely. The scientifically inclined can find more information on the process of 'inverse segregation' in avalanches in Kern (2000), Kern et al. (2005) and Gray & Ancey (2009).

The practical effectiveness of avalanche balloon packs is supported by various credible scientific studies, which included field experiments where crash test dummies with inflated avalanche airbags were exposed to artificially triggered avalanches (Tschirky & Schweizer, 1996; Kern et al., 2002; Meier & Harvey, 2010) and statistical evaluations of accident records comparing the mortality rates of avalanche victims with and without avalanche balloon packs (Tschirky et al., 2000; Brugger & Falk, 2002; Brugger et al., 2007).

Whereas the majority of these studies were conducted in Europe, experience and numerous studies have shown that the avalanche safety context in Canada differs significantly from the situation in Europe. Examples include the higher significance of trauma in avalanche fatalities (Boyd et al., 2009), the shorter survival phase in the Canadian avalanche survival curve (Haegeli et al., 2011), but also the higher prevalence of helicopter use in avalanche work, the greater access to forested terrain and general differences between amateur recreationists and professional avalanche workers. These differences unfortunately prevent the direct adoption of the European recommendations on avalanche balloon packs without a thorough examination of their strengths and weaknesses within the local Canadian context.

The goal of the present project was to address this significant knowledge gap

by compiling a comprehensive overview that assesses the value of avalanche balloon packs for Canadian avalanche workers and explores the challenges and barriers for their adoption within the complete context of integrated risk management at the workplace in avalanche terrain. More specifically, the research project examined the following three research questions:

1. How well do avalanche balloon packs perform in Canadian avalanche accidents?
2. Would the use of avalanche balloon packs have likely made a difference in the outcomes of recent avalanche accidents involving worker fatalities?
3. What are the existing concerns about the operational use of avalanche balloon packs in the professional avalanche community in Canada and how do they compare with the experience of operations that have adopted avalanche balloon packs?

This article provides short summaries on the methodologies and research findings for each of the three research questions. More detailed research reports on all three research questions can be downloaded from avalancheresearch.ca.

PART I: ANALYSIS OF CANADIAN AVALANCHE INCIDENT RECORDS

The goal of this part of the study was to collect detailed information on Canadian avalanche incidents involving avalanche balloon packs and to conduct a statistical analysis on the effect of avalanche balloon packs on the survival rate of individuals seriously involved in avalanches in Canada.

Information on avalanche accidents involving avalanche balloon packs was collected using a variety of sources including existing records of avalanche incidents involving avalanche balloon packs at the Canadian Avalanche Centre (CAC), reports from the British Columbia Coroners Service, InfoEx reports, accident report submissions to the CAC and incident related questions in the online survey about the challenges associated with the operational implementation of avalanche balloon packs. Any indications about a relevant incident were followed up with personal interviews with the accident party, rescue personnel, or accident investigators to confirm the involvement of an avalanche balloon pack and gather detailed accident information. In total, the data collection effort resulted in 43 well-documented incidents with avalanche balloon packs between January 1999 and March 2011. A total of 92 individuals were involved in these avalanche incidents.

For the present analysis, only serious involvements were considered, which were defined as individuals who were considerably involved in the flow of the avalanche (i.e., were unable to remaining standing or ride out during the involvement) and/or were buried by the avalanche. This criterion ensured that the evaluation only included cases where a deployed avalanche balloon packs actually had a realistic chance to affect the outcome of the involvement. This strict inclusion condition reduced the dataset to 34 avalanche incidents involving a total of 71 individuals. Within this dataset, 64% (46 of 71) of the involved individuals were wearing an avalanche balloon pack at the time of the accident. The overall survival rate in the dataset was 73% (52 of 71).

Thirty-seven percent (17 of 46) of the individuals wearing an avalanche balloon pack at the time of the accident were unable to successfully deploy the safety device. Following the approach of previous studies on the effectiveness of avalanche balloon packs, these cases were combined with the successful deployments and then compared against avalanche victims who were not equipped the safety device. This perspective provides a more comprehensive evaluation of the safety device as it views improperly deployed avalanche balloon packs as failures of the safety device and includes the consequences of these failures in the overall evaluation of the device.

A univariate comparison of the survival rates between users and non-users of avalanche balloon packs in the complete dataset reveals that the use of this safety device results in a statistically significant increase of the survival rate from 56% for non-users to 83% for users (Pearson's chi-squared test; p-value = 0.03; 95% confidence interval: 4% to 49%). The 27 percentage point improvement is substantial, but the use of an avalanche balloon pack is not the only aspect affecting avalanche survival in the present dataset.

Additional factors that significantly affected the survival rate in the complete dataset included avalanche size (Wilcox rank-sum test: p-value = 0.006), terrain character (alpine, treeline, and below treeline; Pearson's chi-squared test: p-value = 0.036), relative location of victims when avalanche released (start zone, track, and runout; Wilcox rank-sum test: p-value = 0.020) and marginally whether the victim was an avalanche professional or not (Pearson's chi-squared test: p-value = 0.094). Only a multivariate analysis would be able to control for the additional influences and properly isolate the effect of avalanche balloon packs, but the small size of the current dataset prevented such an analysis.

Detailed information on the degree of burial was only known for 93% (66 of 71) of the involved individuals. A Wilcox rank-sum test indicated significant differences in the degree of burial (p-value = 0.002) with users of avalanche balloon packs experiencing significantly shallower burials. No significant

differences were observed in injury rates among avalanche survivors with and without avalanche balloon packs (Pearson's chi-squared test: p-value = 0.863). In an attempt to control for the additional influences, the complete dataset was reduced to only include incidents where both users and non-users of avalanche balloon packs were involved. This reduced dataset consisted of only six incidents with a total of 35 involvements, which represented 49% (35 of 71) of the complete dataset. Within this sample, victims who were wearing an avalanche balloon pack had an 80% survival chance, 24 percentage points higher than the 56% survival rate of non-users. Even though this improvement is in the same range as the previous estimate, it is statistically not significant due to the small sample size (Pearson's chi-squared test: p-value = 0.347; 95% confidence interval: -8% to 56%).

Even though the described results indicate that avalanche balloon packs are able to reduce the severity of burials and increase survival rates, critical burials (i.e., burials with impaired airways) and fatalities do occur even with completely inflated avalanche balloon packs. In the complete dataset, 24% (7 of 29) of the individuals with a fully deployed avalanche balloon pack were critically buried and 17% (5 of 29) did not survive their avalanche involvement. While this dataset is too small to offer conclusive statistical evidence, a qualitative examination of these incidents indicates that the effectiveness of avalanche balloon packs is reduced in larger avalanches, when victims are caught in the track or runout zone of the avalanche and when terrain traps are present.

Overall, the results of the present univariate analyses confirm the positive results of existing scientific evaluations of avalanche balloon packs (Tschirky et al., 2000; Brugger & Falk, 2002; Brugger et al., 2007). However, only a multivariate analysis would be able to control for the additional influences on avalanche survival and properly isolate the effect of avalanche balloon packs. Furthermore, the qualitative analysis of avalanche incidents that resulted in fatalities despite fully deployed avalanche balloon packs clearly highlighted that there are also important limitations in the effectiveness of this safety device.

I am currently working with colleagues from Switzerland, France, Austria, the United States, Italy and Slovakia to compile a much larger dataset of avalanche incidents involving avalanche balloon packs to conduct such a multivariate analysis on avalanche balloon packs to provide more detailed insight into the effectiveness and limitations of avalanche balloon packs. The results of this study will be presented at the International Snow Science Workshop in Anchorage in September 2012 and the associated paper will be available at avalancheresearch.ca.

PART II: WORKER FATALITIES

Even though there are no published studies to date explicitly contrasting the characteristics of fatal avalanche incidents involving workers versus recreationists, it is reasonable to assume that there might be considerable differences between these two user groups. Avalanche professionals are generally integrated in a more advanced assessment system for avalanche hazard, they are more familiar with the avalanche phenomenon, and have more advanced rescue resources available in case of an avalanche involvement. All of these differences make it problematic to draw conclusions about the effectiveness of an avalanche safety device for worker safety exclusively based on studies that examined incidents of workers and amateur recreationists together. The goal of the present study is to examine the characteristics of recent avalanche incidents that resulted in worker fatalities to provide a better understanding of the potential benefits of avalanche balloon packs for the safety of workers.

The primary source of information for the present analysis is *Avalanche Accidents in Canada Volume 5: 1996-2007* by Jamieson, Haegeli, and Gauthier (2010). This publication offers the most comprehensive description of fatal avalanche incidents in Canada between the winters of 1996-97 and 2006-07. The term "worker fatality" was defined as an individual who was killed in an avalanche incident while pursuing their

primary job responsibilities in avalanche terrain. They could either be getting paid at the time of the incident or could be actively training to obtain certification for future employment. According to this definition, there have been 11 worker fatalities in ten avalanche incidents in Canada between October 1996 and December 2011.

Using results of Part I of this study as a foundation, the present analysis examined the identified avalanche accidents involving worker fatalities with respect to the following four indicators for the performance of avalanche balloon packs:

- Relative location of victim when avalanche released. Being located in the track or runout zone of the avalanche is less favourable.
- Distance carried by avalanche. Being carried for only a short distance is less favourable.
- Character of runout zone. The presence of terrain traps in the runout zone is less favourable.
- Cause of death of victim. Avalanche balloon packs are not explicitly designed to prevent trauma fatalities.

The total number of negative indicators present in an accident description was used to assess the potential impact of an avalanche balloon pack for the outcome of the incident: The absence of any negative indicators was interpreted as a sign that the use of an avalanche balloon pack might have had a positive impact on the outcome of an incident. Incidents with only one negative indicator were assessed as inconclusive and incidents with two or more negative indicators were interpreted as a sign that the use of an avalanche balloon pack would likely have not been able to make a difference in the outcome of the incident.

The present examination of avalanche incidents revealed that only in two of 11 fatalities, a deployed avalanche balloon pack might have been able to prevent or reduce the severity of the burial and therefore positively affect the outcome of the incident. In five of the 11 cases, it is likely that an avalanche balloon pack would not have made a difference. However, that there are no indications that any of the victims would have been worse off during their involvement had they worn an avalanche balloon pack.

PART III: EXISTING CONCERNS AND EXPERIENCES WITH THE OPERATIONAL USE OF AVALANCHE BALLOON PACKS AMONG CANADIAN AVALANCHE PROFESSIONALS

Even though the effectiveness of avalanche balloon packs in avalanche involvements has been demonstrated in numerous studies—including this one—the consequences of their operational use in avalanche safety operations are much broader. Prior to the present study, these indirect consequences of the operational use of avalanche balloon packs had not been examined systematically. This part of the study aimed to close this significant knowledge gap by assembling a comprehensive overview of the experiences and concerns regarding the operational use of avalanche balloon packs within the professional Canadian avalanche community.

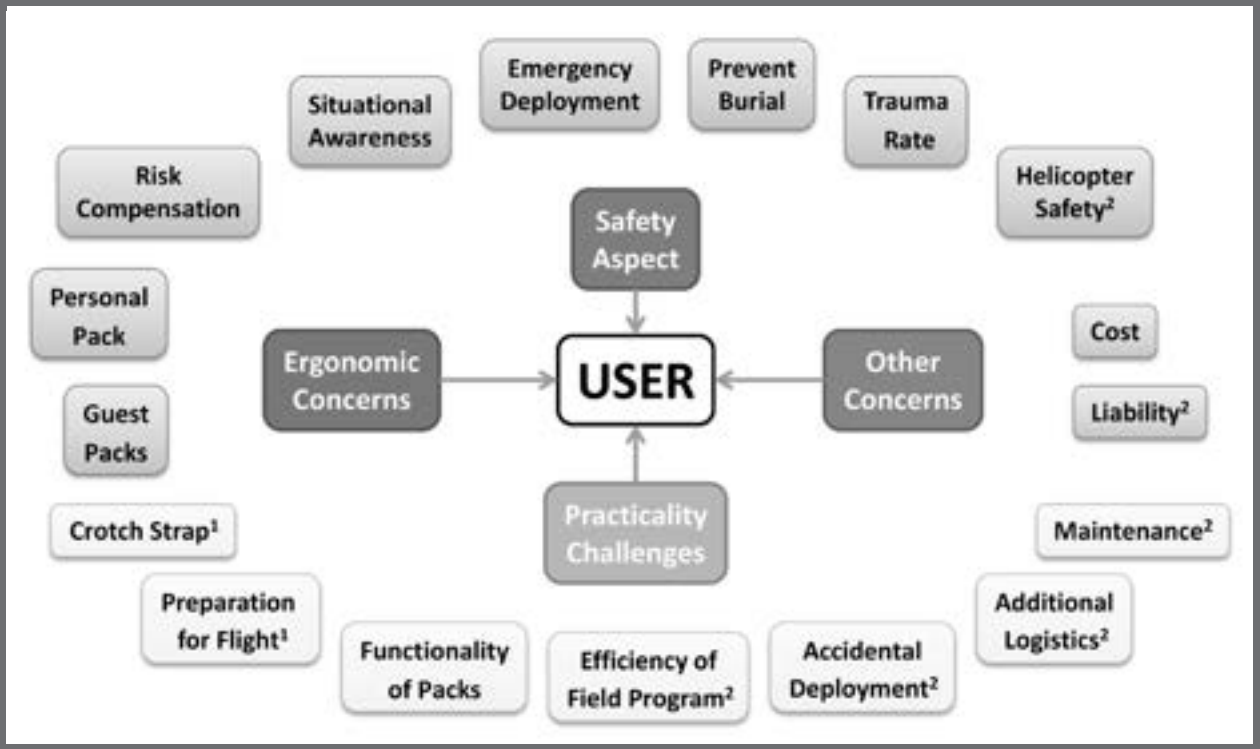
This study used a mixed method approach with two distinct research phases. The first exploratory phase of the research used open-ended personal interviews with key informants (n=24) representing all segments of the Canadian professional avalanche community to develop a comprehensive overview of the existing concerns about the operational use of avalanche balloon packs. These interviews revealed 16 additional indirect issues that fall into four main categories: safety aspects; ergonomic concerns; practicality challenges; and other concerns (Fig. 1).

In the second phase of this research, a detailed online survey was developed to quantitatively examine the level of concern of the identified issues with a broader participation of the avalanche community. Survey questions differed between individual avalanche professionals and operators of avalanche safety operations as well as between participants who regularly use avalanche balloon packs at their workplace and participants who do not use avalanche balloon packs. One hundred and fifty individual avalanche professionals and 90 operators completed the survey during the summer of 2011. For the analysis, survey participants were categorized into five industry segments: guiding; control work; other field programs; avalanche training; and search and rescue.

The survey results show that the use of avalanche balloon packs among Canadian avalanche professionals has grown considerably since 2000 and the adoption rate is increasing. At the time of the data collection, 23% of the individual avalanche professionals participating in this study reported regularly or always using avalanche balloon packs. In addition, 30% reported that while they believe that avalanche balloon packs offer considerable benefits for their personal safety at their workplace, they have not yet made the step to regularly use them.

Survey participants who do not regularly use avalanche balloon packs were most concerned about the cost of acquiring them and their possible ergonomic impacts, primarily due to the additional weight. The practicality of avalanche balloon packs in the workplace was another significant concern. However, the type and level of the practicality concerns varied considerably among industry segments. Concern levels were consistently higher within the guiding community, particularly heli-ski guides and operators. Concerns about the possible impact of avalanche balloon packs on the safety of other operational aspects (e.g., helicopter safety) were generally less of a concern. However, similar to the practicality concerns, the ratings varied significantly among industry segments and the guiding

FIG.1: IMPACTS AND POSSIBLE CHALLENGES WITH THE OPERATIONAL USE OF AVALANCHE BALLOON PACKS IN AVALANCHE SAFETY OPERATIONS
[1]PRIMARILY RELEVANT FOR INDIVIDUAL AVALANCHE PROFESSIONALS ONLY; [2]PRIMARILY RELEVANT FOR OPERATORS ONLY



community generally expressed higher levels of concern. In both the practicality and safety considerations, the higher levels of concern reported by the guiding community are most likely related to the fact that this industry segment not only deals with the personal use of avalanche balloon packs by professionals, but needs to accommodate and supervise the use of avalanche balloon packs by their guests, which adds considerable operational complexity.

Survey participants who regularly use avalanche balloon packs at their workplace were significantly less concerned about their possible operational impacts and consistently rated their benefits more favourably. However, it is difficult to conclusively determine whether the adopters of avalanche balloon packs simply have operational conditions more favourable for their use or whether the current non-adopters typically overrate the level of concern of the related impacts.

Overall, the results revealed an avalanche industry that is highly diverse with a wide range of different operational needs and challenges. The risk management of avalanche safety operations is a multi-faceted challenge that involves much more than just avalanche involvements. While the study documented the general level of concern of non-users about the use of avalanche balloon packs and compared them with the experience of users within the same industry segment, the factors that influence their pros and cons for individual avalanche safety operations depend on their specific circumstances.

The recent increase in the use of avalanche balloon packs among Canadian backcountry recreationists and avalanche professionals is encouraging and has resulted in additional outdoor gear companies entering the avalanche balloon pack market and investing considerably into research and development. The current development efforts and the additional push in innovation from the increased competition among manufacturers will likely soon be able to address some of the most pressing concerns regarding cost and ergonomic issues. As these primary issues are addressed adequately, the use of avalanche balloon packs within the Canadian avalanche community will naturally increase further. Finding meaningful solutions to some of the practicality and safety concerns will likely require more significant changes to existing operating procedures.

CONCLUSIONS

The present study represents one of the most comprehensive examinations of the effectiveness of avalanche balloon packs and their operational impacts to date. A more detailed description of the research methods and results of the entire study is beyond the scope of this article, but the in-depth research reports are publically available at avalancheresearch.ca.

Despite the substantial improvement in the survival rate among the users of avalanche balloon packs presented in the first part of this study, it is important to point out that the use of avalanche balloon packs is no 'silver bullet' for protection from avalanches. As shown, there are circumstances that prevent the segregation process from occurring and even under ideal conditions, there is no guarantee that the wearer ends up on the surface of the avalanche. The avalanche balloon pack can get damaged during the involvement or the victim can sustain life-threatening injuries. As a consequence, avalanche balloon packs can only be viewed as a complementary tool in additional to the standard avalanche safety equipment trio of transceiver, shovel and probe. The best way to survive an avalanche is still not to get into one in the first place.

As Canadian avalanche professionals and recreationists increasingly adopt avalanche balloon packs, it is crucial to thoroughly document any avalanche incidents involving avalanche balloon packs. Future analyses building on the present research will further improve our understanding of the capabilities and limitations of avalanche balloon packs in emergency situations. Please report any relevant incident either to the CAC or directly to me at pascal@avalancheresearch.ca. Equally important will be studies that examine the indirect impacts of avalanche balloon packs, such as their impact on the risk taking behaviour of their users, their effect on situation awareness during guiding, or their long-term ergonomic impacts. The studies will offer important insight as to whether the use of avalanche balloon packs results in a net benefit for the safety of avalanche workers and recreationists.

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Field Testing
Avalanche Airbags in Slovakia

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Photos by Gabriel Liptak

ON APRIL 3, 2012 AT 9:36 IN JASNA, SLOVAKIA, 50KG OF PLASTIC EXPLOSIVES CREATED A ROARING AVALANCHE THAT TOOK OUT EVERYTHING IN ITS WAY. WHEN IT SLOWED, IT REVEALED THREE BODIES, THOUGH NONE WERE HUMAN—DUMMIES WERE PLACED IN AN AVALANCHE PATH IN ORDER TO TEST THE FIELD PERFORMANCE OF AVALANCHE AIRBAGS.

AIMS

An avalanche airbag's purpose is to prevent complete burial. There are currently three different shapes of avalanche balloons on the market. One system uses a dual bag (ABS), while the other two systems are mono bag (Mammut/Snowpulse and Backcountry Access (BCA)). The three brands differ in shape and location from which they inflate. The aim of the field test was to observe how the differently shaped avalanche airbags behave in avalanche. Specific attention was paid to the grade of burial. Previous field trials used: (i) ABS mono airbags (Tschirky and Schweizer, 1996); (ii) ABS mono airbags, ABS double airbags and Avagear collar mono type airbag vest (Kern et al., 2002); and (iii) ABS dual airbags and Snowpulse collar type mono airbags (Meier and Harvey, 2010).

TEST SITE INSTRUMENTATION AND METHODS

The following packs were chosen because of their differences in shape. The Mammut Lifebag is a collar-type mono balloon backpack. When the pack is inflated, it creates a balloon around the backside of the neck and shoulders. The aim of this system is to prevent burial and simultaneously provide trauma protection to the head and neck. The BCA Float is also a mono-balloon pack with the balloon positioned behind the head. Besides preventing burial, it provides some trauma protection for the head and neck. Both mono bag systems have a 150L volume. The dual airbag system tested was the ABS Vario, which consists of two balloons located at the sides of the backpack for a combined volume of 170L. Both of the balloons are independent; if one fails to inflate, the other still can.

The field test took part in Jasna, Slovakia, where numerous easy, approachable gullies and couloirs can be found. The test site was instrumented with three crash test dummies each weighing 80kg. The joints were adjusted to simulate the flexibility of real humans.

The dummies were placed on a northeast-oriented slope 40m below a snow cornice with the help of a ropeway system. Each dummy was instrumented with an avalanche balloon pack, and they were placed side by side in a line. One dummy was wearing the Mammut Lifebag Guide 30L pack, while the other two were equipped with BCA Float 18L or ABS Vario 25L, respectively. All three backpacks were deployed 60 seconds prior to the avalanche release.

The upper part of the avalanche path was 37 degrees. The release areas consisted of snow cornice, with height ranging from 0.5m to 3m. The track was 37 degrees, and the run-out was smooth with no depressions or terrain traps.

The position of the dummies was measured with sub-meter GPS accuracy before and after the avalanche. Several cameras and point-of-view cameras were placed either in the field or across the field to shoot the movement of the dummies. Photographers took their positions prior to the accident to document the field test.

RESULTS

The pyrotechnician-triggered explosion blew the large cornice into pieces which then sped down the steep slope; additional snow masses were loaded in the main flow and formed a sizeable avalanche. The turbulent front hit the dummies with decent speed four seconds from initiation. The first dummy to be hit was wearing the BCA Float backpack; in the following 0.25 second, all other dummies were hit. Immediately, all the dummies disappeared in to the snow mass and were rotated and twisted before falling over a lower cliff. All dummies were then almost immediately visible, and floated on the avalanche surface. The BCA Float dummy was the first to stop, and within the few seconds ABS and Mammut Lifebag dummies stopped in the runout area. Immediately after the avalanche stopped moving, the position of the dummies was measured with GPS and a grade of burial and position was assessed. The movement of the dummies was also video analyzed. The grade of burial was classified according to Observational Guidelines for Avalanche Programs in the United States (Greene et al, 2010).

The dummy wearing the Mammut Lifebag airbag was dragged for 132m in 20 seconds by the avalanche. The average speed was 6.6ms^{-1} (23.76kmh^{-1}), and it reached a maximum speed of 17.8ms^{-1} (64.08kmh^{-1}). The dummy accelerated on the track for 89m, reaching its maximum acceleration of 3.56ms^{-2}. When the avalanche stopped moving, this dummy was buried from the hips down. The lower part of the body was anchored in the snow deposit and whole body was partially buried in a tilted position. The partial burial was not critical. Airways were not obstructed and the head was not impaired by snow. The Mammut Lifebag balloon pack was clearly visible on the avalanche surface.

The dummy equipped with ABS Vario system was carried 123m in 18 seconds. The maximum velocity reached by this dummy was 18.6ms^{-1} (66.96kmh^{-1}) while the average speed was 6.9ms^{-1}(24.84kmh^{-1}). The avalanche hit its maximum speed nine seconds in. The dummy accelerated for a distance of 93m, reaching acceleration of 3.36ms^{-2}. The avalanche left the dummy in a horizontal, face-up position with its head pointing downslope. The dummy had piece of snow approximately 70cm in diameter on its abdomen and some snow surrounding it. The grade of burial was between partially buried and not buried. It is questionable whether a human would be capable of freeing him or herself from this position without additional help. It is important to note that the airways were not obstructed and the head was not impaired with snow. One leg was visible and the balloons were clearly visible.

The dummy wearing the BCA Float balloon pack was carried 114m, the shortest distance, at an average speed of 8.1ms^{-1} (29.16kmh^{-1}). It reached its maximum speed of 16.8ms^{-1} (60.48kmh^{-1}) after 84m, with an acceleration of 3.72ms^{-2}. From this moment the avalanche started to decelerate

ABS VARIO 25L

BCA FLOAT 18L

MAMMUT LIFEBAG 30L

until it stopped and the dummy was lying on its back. The head and the airways were free of snow except for a few small pieces of snow around the dummy. The least amount of snow was deposited on this dummy, and it is likely that a human could free him or herself with no additional help. The burial was classified as not buried. The airways were unobstructed and the head was not impaired by snow. Both legs and one arm were sticking out from the snow deposit. The balloon was clearly visible on the snow surface.

Prior to the snow deposition, all three dummies were segregated from main flow and floated on top of the avalanche. When snow deposition started and the avalanche slowed, the dummies were segregated on the side of the avalanche path. The grade of burial differed. The dummy that travelled farthest was the most seriously buried; the dummy that travelled the shortest distance had the least serious grade of burial. The dummy with the Mammut Lifebag was closest to the main flow, and was therefore transported further to the front of the deposition zone. The BCA Float dummy stopped 116m from the front of the deposition, the ABS Vario 96m and Mammut Lifebag 88m.

It is important to note that none of the dummies' airways were obstructed, and their heads were free of snow. The extremities of the dummies were twisted and positioned unnaturally; humans would likely suffer serious injuries. However, dummies are not able to replicate human behaviour in an avalanche, who would likely be trying to actively escape the main flow.

ABOUT THE AVALANCHE

The avalanche was triggered by a falling cornice that loaded underlying snow. The cornice was 40m long with a height of 0.5m to 3m. The maximum width of the avalanche was 60m, and its width was restricted to 25m in a confined area of the path. The predominant snow that created the avalanche was moist. The initial volume of the snow mass used to trigger the avalanche was estimated to 280m^3. The avalanche travelled for 250m. According to numerical simulations, the avalanche reached a maximum speed of 18.6ms^{-1} (66.96kmh^{-1}) and maximum impact pressure of 125.13kPa. The deposition area was 30m wide and 130m long, with an average depth of 1.5m.

CONCLUSION

The field testing consisted of only one trial, and a reference dummy without an airbag was not used. It is probable that the reference dummy would be buried, but we cannot be sure. The results of the test are only applicable for this particular avalanche (and terrain and avalanche conditions). An important, positive note is none of the dummies were completely buried. In all cases the airways were not obstructed and balloons were clearly visible on the surface of avalanche. In this particular trial, the grade of burial became more serious the farther downslope the dummy was. This can vary in other cases and real life situations. In this field test, none of the dummies were completely or partially critically buried. Even when wearing an avalanche airbag backpack, one can be completely buried. It is therefore necessary to regularly review the effectiveness of avalanche airbags by conducting retrospective studies on real avalanche situations. A short video of the test can be found at youtube.com/watch?v=xRd-tDos5Vg.

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The following institutions and people deserve great thanks: Gustav Kasanicky and Igor Dirnbach from the Institute of Forensic Engineering for providing the dummies, Lukas Neklan from Singing Rock for support, Rado Michalica from the Institute of Forensic Sciences, all the staff of the Avalanche Prevention Centre and the Mountain Rescue Service in Slovakia, Rasto Hatiar for shooting video and Gabriel Liptak for taking photos.

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Testing 1, 2, 3
Changes in Stability Test Usage By SnowPilot Users

PROFESSIONALS AND RECREATIONISTS UTILIZE STABILITY TESTS AS A PRIMARY TOOL FOR EVALUATING SNOW STABILITY ON SUSPECT SLOPES. THESE TESTS AIM TO EVALUATE AVALANCHE POTENTIAL BY TESTING SMALL BLOCKS OF SNOW CUT OUT OF A SNOW PIT. THE DEVELOPMENT OF DIFFERENT TESTS IN RECENT YEARS HAS ADDED NEW TOOLS TO OUR TOOLBOX. THE GOAL OF THIS PAPER IS TO DETERMINE WHETHER OR NOT PEOPLE ARE CHANGING THE TYPES OF TESTS THEY CONDUCT FOR THEIR STABILITY ASSESSMENTS.

TO DO THIS we utilized the dataset from SnowPilot, a free software program that allows many different users to enter, graph, and database their snow pits at snowpilot.org (Chabot et al., 2004). These data have been used for several past studies (e.g., Birkeland and Chabot, 2006; Simenhois and Birkeland, 2009). The advantage of SnowPilot is that it allows us to collect a great deal of data from diverse sources in all snow climates at a low cost. The data come from all over the United States, and from several different countries, including Canada, New Zealand, Norway, and Sweden. The disadvantage of SnowPilot is we cannot test whether or not our data are statistically representative of all people doing stability tests. Indeed, there is certainly a bias toward users from the United States, and certain groups or geographic areas within the U.S. are likely over-represented. However, it is still interesting to see the trends that exist in these data. Our study uses over 3,600 snow pits from nine winters, and about 83% of these pits were dug by people who identified themselves as avalanche professionals.

There have been some fairly dramatic shifts in the tests preferred by SnowPilot users since 2004. In the following we summarize the trends for each of the tests:

Compression Tests (CTs): Compression tests involve isolating a 30cm by 30cm block, placing a shovel on top of it, and tapping the shovel vertically with progressively stronger taps until the weak layer fails (Greene et al., 2010; Jamieson, 1999). By the time our data start in 2004, CTs were well established, having been used for over 30 years in some areas. The data clearly show their consistent popularity, with users conducting CTs in about 75% of all pits in 2004. Peak CT use occurred in 2007 (85% of pits), but they continue to be popular today, used in over 65% of pits.

Rutschblock Tests (RBs): Originally developed in Switzerland, rutschblock tests involve isolating a 2m by 1.5m block and having a person on skis progressively load the block (Föhn, 1987; Greene et al., 2010). Though the test of choice for some U.S. avalanche professionals, RB usage peaked in 2005 when they were conducted in a little more than 40% of the SnowPilot pits. Since then RB usage has dropped steadily, and in 2011-12 they were used in less than 2% of the pits.

Shovel Shear Tests (STs): Shovel shear tests have been around longer than most of us old grey hairs can remember; they were the test of choice in the U.S. at least as far back as the 1970s and 1980s. STs involve isolating a 30cm by 30cm block, inserting a shovel behind the block, and pulling in a slope parallel direction until the block fails on a weak layer [Greene et al., 2010]. In our data, ST usage peaked in 2006 when they were used in almost 30% of the pits. Since then their use has declined steadily to less than 10% in 2011-12.

Karl Birkeland is the Avalanche Scientist for the USDA Forest Service National Avalanche Center. When not doing avalanche work, Karl tries to spend as much time as possible on rivers and in the mountains with his wife and two daughters.

Doug Chabot is the Director of the Gallatin National Forest Avalanche Center and the developer of SnowPilot. In the summers, Doug does as much climbing as possible and works with his wife at Iqra Fund (iqrafund.org), a non-profit organization they founded to help women and children in remote villages in Pakistan and Morocco improve their quality of life through education.

Karl and Doug work in adjacent cubicles in their offices in Bozeman and they enjoy giving each other a hard time about whatever happens to be crossing their minds at the time.

COMPRESSION TEST // WREN MCELROY COLLECTION

Stuffblock Tests (SBs): Stuffblock tests are a variation of the CT. The same 30cm by 30cm block is isolated, but instead of loading the block with taps, a stuff sack filled with snow is dropped from known heights until the weak layer fails (Birkeland and Johnson, 1999; Greene et al., 2010). The idea is to better standardize the force being applied to the block. SBs gained popularity in some areas of the U.S. in the 1990s, but in our data we can see their steady decline in usage since their peak in 2005, when they were conducted in about 18% of SnowPilot pits. By 2011-12 they were used in less than 1% of the SnowPilot pits.

Extended Column Tests (ECTs): Extended column tests aim to test fracture initiation and fracture arrest by isolating a column that is 90cm wide and 30cm upslope and then tapping one side of the block (Greene et al., 2010; Simenhois and Birkeland, 2009). Along with the propagation saw test the ECT was the first to specifically try to index the propensity of a crack to propagate. The ECT was introduced to the avalanche community at the 2006 International Snow Science Workshop in Telluride, and has been extensively studied and tested in several countries since that time (e.g., Moner et al., 2008; Ross and Jamieson, 2008; Winkler and Schweizer, 2009). The ECT was first implemented in SnowPilot in the 2006-2007 season. The popularity of the ECT has risen steadily since its introduction, and it has become the most popular stability choice in SnowPilot pits in the past two years, being conducted in almost 80% of the pits.

Propagation Saw Tests (PSTs): The propagation saw test involves isolating a block 30cm wide and varying length (but at least 100cm) upslope (Gauthier and Jamieson, 2008a; 2008b; Greene et al., 2010). Along with the ECT, the PST was the first to attempt to index crack propagation propensity, and it was also introduced to the broader avalanche community at the 2006 International Snow Science Workshop in Telluride. It was first implemented in SnowPilot in the 2009-10 season, but prior to that people put it in the "Notes" section so we have data on it since the 2006-07 season. In general, the PST has seen steadily increasing usage, and this latest season it was used in 15% of SnowPilot pits, making it the third most popular test behind the ECT and the CT.

CONCLUSIONS

Although we cannot show that our data are statistically representative of the larger avalanche community, it is interesting to see trends in stability test usage over time. The past nine seasons have seen a dramatic shift in the tests we use to assess snowpack stability. We have moved away from RBs and SBs and moved more toward ECTs and PSTs, while still maintaining a large number of CTs. Not surprisingly, this shift toward ECTs and PSTs has coincided with an increasing emphasis on the importance of propagation potential in our stability assessments.

The reduced use of SBs makes sense given our broadened view of snow stability. When the SB was developed, the general consensus was that it was important to know just how much force was applied to get weak layer failure. Of course, this is still important. However, research continues to show that the force necessary for crack initiation varies dramatically across slopes (Birkeland et al., 2010a; Schweizer et al., 2008). As such, an exact value has less meaning in stability evaluation and the more approximate values of the CT are typically adequate.

The reduced use of RBs likely comes from the amount of time they take to prepare and conduct in relation to the other tests. They can be used to help determine crack propagation potential, especially when noting the amount of the block that slides (whole block, most of the block, or part of the block (Greene et al., 2010)). However, with the introduction of faster tests that are more focused on propagation, such a use is not always necessary.

The increased use of tests developed to index propagation is a remarkable shift in the way we assess the snowpack, and a graphic reminder of the importance of propagation in most assessments. In particular, the ECT became the most commonly used test in the SnowPilot dataset only five seasons after it was introduced. Further, despite a more muted acceptance, the PST has become the third most common stability test used. Our results mirror our own experience. We have found the ECT, which provides an index of both crack initiation and crack propagation, to be an excellent (though certainly not perfect!) test to provide information for our stability assessments. Further, the PST has proved useful for some situations, especially with deep slabs over the top of fragile weak layers. The results from both tests have been shown to be largely independent of slope angle (Birkeland et al., 2010b; Gauthier and Jamieson, 2008b; Heierli et al., 2011), an extremely valuable characteristic for safely assessing unstable snowpacks. Finally,

both the ECT and PST provide a much more graphic view of the current conditions, a quality that is especially important when attempting to communicate avalanche conditions to the public in videos.

We have undoubtedly not seen the last innovations in stability test development. As we learn more about snow and the way it fractures, newer and more effective tests might well be advanced. Our results from this paper demonstrate that when new tests are useful, and are scientifically validated, our community will quickly adopt them.

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The Avalanche Journal wants you!

WE'RE ACCEPTING submissions for upcoming issues of *The Avalanche Journal*. We welcome articles relating to the professional avalanche industry or public avalanche safety, teaching tips, research papers, avalanche accounts, book reviews, historical avalanches, gear reviews, hot routes, global updates, event listings, interviews, letters to the editor, humorous stories, and anything else interesting or relevant to those involved with avalanches. We are also seeking winter mountain photography: avalanches, terrain, touring, skiing, snowboarding, sledding, and backcountry recreation or avalanche awareness activities.

Please email Managing Editor Karilyn Kempton at editor@avalanche.ca with your ideas and submissions.

The Avalanche Journal is published three times per year in April, September and December.

UPCOMING DEADLINES:
October 15 (winter issue)
February 15 (spring issue)
July 15 (fall issue)

Great Debate Response: **Sea to Sky Social Media**

LAST ISSUE'S "GREAT DEBATE" question asked whether there should be a public information exchange program. While that is being discussed among professionals, one of us has taken the lead and jumped into the intimidating and exciting new world of a public avalanche information exchange.

Wayne Flann has capitalized upon a great void in public avalanche information exchange—the 50,000+ visitors to his blog will attest to this. Flann shares avalanche information between public and professionals by using a daily blog, connected to social networks like Twitter and Facebook (wayneflannavalancheblog.com). It was initially meant to report on avalanche conditions within the South Coast Mountains in the Sea to Sky Corridor, but has grown to include a much larger scope of information related to avalanche education and entertainment.

Flann has had critics ranging from coworkers, to heli ski guides, to members of the public. Even he agrees that this electronic medium is a daunting new platform, and no one fully comprehends where social media may take the avalanche community and professional avalanche industry. Flann sat on the first CAA committee to establish the InfoEx; he recounts "initial resistance" from many of his peers. He believes we are seeing the same resistance now towards social media.

Flann's employer Whistler Blackcomb showed initial resistance, but now accepts and supports his efforts to put quality avalanche information into the hands of the public and professionals. As a result, the Blackcomb avalanche forecasters have had better access to public occurrence reports outside the area.

To ensure the blog's success, Flann has amassed a pool of capable contributors who provide eyes in the field. Even when Flann broke his leg in January and went to Maui, his blog continued to be our valley's best source of class one avalanche information. Every chance Flann gets he includes a link to further reading, providing even the lay person with the opportunity for further knowledge.

To keep interest up during periods of low avalanche activity, Flann references groups like the Utah Avalanche Center or Gallatin National Forest Avalanche Center, who, at least last winter, had quite active avalanche conditions during our slow periods. In an attempt to include even armchair avalanche enthusiasts, Flann also shares daily point-of-view videos of individuals getting caught in or having close calls with avalanches. Cameras are everywhere these days and Flann includes photos and videos into his reports.

If we open up a public InfoEx to unknown sources, a question that arises is how to qualify a reporter's validity. Fortunately, this question has already been solved in the Internet world. Google calls it 'ranking,' which is based on user hits or hyperlinks. YouTube gives users the option to give every video watched a thumbs up or thumbs down, depending on the quality of content provided. Society in general has a way of ensuring that good wins out over bad, because the majority of people are good. I believe that will be the case in a public InfoEx (perhaps with a little bit of initial refereeing).

Very few professional InfoEx subscribers are likely aware that an avalanche destroyed a helicopter this year during a heli-ski pickup. I am not breaching InfoEx confidentiality because the incident was never reported. There is a pervasive reluctance to report avalanche incidents that stems from the fear of inciting media frenzy; there can be a tendency to misrepresent information surrounding events and, in some cases, sensationalize the incident. Daily public avalanche reports could overwhelm the mainstream media until the media, and public, come to the realization that avalanches are almost an everyday occurrence.

In my opinion, it is essential that we, as a group, pursue a so-called public InfoEx similar to our existing professional InfoEx. Technology is moving at an ever-increasing rate—it is essential for us to embrace technology and learn to harness its potential to serve the greater good. Let's act on Flann's realization that we—the professionals—and the public are set to benefit immensely from more class one information, which is still considered the most valuable information in forecasting. We work in a field of uncertainty; it is my hope that we can use our experience and apply it to the uncertainties that exists with the future of technology. I encourage you to form your own opinions by scrolling through the pages of Flann's blog at wayneflannavalancheblog.com.

In 2010, **Ryan Bougie** received his CAA Avalanche Operations Level 2 and his first iPhone, and has not looked back. He is an assistant avalanche forecaster at Blackcomb Mountain, where he has been a pro patroller since 2004.

ASK THE **EXPERT**

Q: IS TERRAIN REALLY THE ANSWER TO STABILITY?

A. WHEN WE DEVELOP AVALANCHE RISK assessments at the Canadian Avalanche Centre we are evaluating the likelihood of avalanches occurring and estimating the consequences of those avalanches. The element at risk is the skier, sledder, or climber who is vulnerable to the effects of the avalanche if it occurs. The amount of risk that a person is exposed to is always changing. The risk changes due to the amount of time that a person is exposed. The level of avalanche risk also changes with the exposure to terrain that is more likely to produce avalanches.

When we perform stability tests in the field, we identify layers of concern and we estimate the sliding qualities and fracture characteristics of those layers. Stability tests results may show a great deal of spatial variation, even within the same slope. Some areas of a slope are more likely to produce avalanches than others. We need a mechanism to allow us to deal with our uncertainty when test results are variable, and the mechanism that we use is terrain selection. We plot a course through the terrain that avoids the areas that are more likely to produce avalanches.

We use the travel advice section of our forecasts to describe some of the terrain features that should be avoided, or that should be used to reduce exposure to risk. The travel advice in the forecasts is issued on a regional scale, and it may not describe the terrain features that affect you on an individual slope scale. Using terrain features to avoid areas of instability and to reduce exposure to risk is a learned skill.

Is terrain the answer to stability? It would be better to say that terrain selection is the answer for dealing with the uncertainty of stability.

DO YOU HAVE A QUESTION TO ASK AN EXPERT?
Send it in to expert@avalanche.ca.

Tom Riley is a Public Avalanche Forecaster at the Canadian Avalanche Centre.

Transitions

AMANDA AUSTIN
NETWORK ADMINISTRATOR

Amanda is an addition to the CAA/CAC Information Technology department, joining the team as Network Administrator. Amanda grew up in Cumbria, United Kingdom and now lives in Revelstoke, BC. Amanda has a degree in IT and Communications, and is a Microsoft professional. She has nearly ten years in network administration experience.

Her interests include world travel, free diving, reading, hiking, caving and skiing. Working at the CAC, Amanda has enjoyed the opportunity to "experience a new environment and meet lots of new and amazing people."

BEN SHAW
SOFTWARE DEVELOPER

Hailing from Canberra, Australia, Ben recently joined the CAA/CAC as Software Developer. Ben is happy to be in Revelstoke, because his passions include mountain biking, snowboarding, rock climbing and photography.

Armed with a Bachelor of Engineering in Software Engineering, Ben spent five years developing software for a research and development firm. He looks forward to the "chance to make a difference to public safety whilst working with amazing people."

DEBBIE GARNEAU
BOOKKEEPER

Debbie joined the CAA/CAC this summer as Bookkeeper. From Rossland, BC, Debbie has a background in tourism and accounting, and has several years of experience bookkeeping and banking. Prior to Revelstoke Debbie was working on yachts.

Debbie loves the mountains, and spends time skiing, hiking and mountain biking. She also loves the ocean for scuba diving and boating. She wants to keep traveling and exploring.

Debbie is excited to work for the CAA/CAC because of what the organizations represent, and to work in a field that she is passionate about.

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