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SPRING 2015

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in this **issue**

Spring Has **Sprung**

Karilyn Kempton
Managing Editor

THIS FELT LIKE A TOUGHER ISSUE than most. For many of us, it was the winter that almost never was. It affected me—it was tough to keep the brain in winter mode when town temps crept to double digits by February and the snow banks disappeared early. I started dreaming of gardening—I had to keep remembering to cool my jets and not rush the spring. You don't want to lose your crop because you assumed that spring was here to stay and planted too early. That's where detailed record keeping, pattern recognition and heuristics comes in handy—in gardening, life and the avalanche industry. Planning for ups and downs and twists and turns helps us avoid getting caught off guard, and gives us rules to work and live by. I know I'm hoping for a hot summer followed by a snowy winter, but I'll roll with the punches as you all do.

Thanks to everyone who submitted an article even while often dealing with less-than-ideal conditions this winter. This issue casts a wide net. Some articles include: Lisa Larson's take on avalanche control at Teck, dealing with avalanche risk at freeskiing competitions by Steve Whale, and managing conditions and guest expectations at Mustang Powder by Diny Harrison.

The compaction panel at last fall's ISSW was lively, and Curtis Pawliuk's piece on how compaction affects managed snowmobile areas stems from that. Meteorologist David Jones walks us through the new mountain weather forecast that MSC posts to Avalanche Canada's website on a daily basis, and it's going to be of interest to those of you who work in wildfire management and SAR, among others.

As always, thanks for reading! If you'd like to contribute, please email me at editor@avalancheassociation.ca. Send in pieces on case studies from the past season, unusual avalanche events, rescues, training, emerging technology, research, teamwork, or anything else you have to say. This magazine is your voice.

Karilyn Kempton

// BRENT STRAND

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 relevant to those involved with avalanches. We are also seeking winter mountain photography: avalanches, terrain, touring, skiing, snowboarding or sledding.

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:
July 1 (fall issue)
October 15 (winter issue)
March 1 (spring issue)

Contributors

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Diny Harrison was Canada's first female internationally certified mountain guide. She is a past president of the CAA and the Association of Canadian Mountain Guides. She currently guides for Mustang Powder Cat Skiing and kite surfs whenever she can.
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LISA LARSON
Lisa Larson is the Senior Avalanche Technician for Teck Coal Ltd. Her love of skiing started at Fernie Snow Valley, where every weekend and holiday her family of seven jumped in the Suburban and drove from Taber Alberta to stay in a 5th wheel trailer on the hill. She spent 10 years patrolling at Castle Mountain Resort before moving to industry. She lives in the Crowsnest Pass with her husband and two hockey-loving kids.
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WAYNE FLANN
Wayne Flann is a blogger, father and avid skier. He moved moved to BC from New Brunswick in 1979 and started working on Blackcomb Mountain in 1980. He's been a ski patroller at Blackcomb since 1984. Wayne volunteers with Whistler SAR, works as a safety consultant in the film industry, and has been a paramedic since 1983. He's presently recovering quickly from a nasty fracture.
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Curtis Pawliuk lives and works in Valemount, BC. He is the General Manager of the Valemount Area Recreation Development Association, owner/operator of Frozen Pirate Snow Services (snowmobile-based AST and guiding), father to two beautiful girls and husband to an amazing wife who all share his love for the outdoors.
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STEVE WHALE
Steve Whale is originally from Wellington, New Zealand. He has been living in Canada for 15 years, and has been a ski patroller for 13 of those. A CAA Level 2, he has worked at Revelstoke Mountain Resort since 2007 and has been the ski patrol supervisor for three years. In the summers, he as a rope rescue technician and CDFL rescuer.
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COMPACTION IN MANAGED SNOWMOBILE AREAS: WHEN AND HOW TO COMMUNICATE IT?

in this **section**

// CURTIS PAWLIUK

CAA President's Message

A REGULATORY FRAMEWORK FOR AVALANCHE PROFESSIONALS PART THREE: THE LEGAL COMPONENTS

This is the third in a three-part series.

Aaron Beardmore, CAA President
Assisted by George Bryce, legal counsel

Aaron Beardmore
CAA President

INTRODUCTION

This is the final part of a three-part article describing the framework the CAA is developing to regulate the profession in the public interest. The first part described the foundation components and the second part discussed the practice components of this framework. This third part discusses the final two components, the legal components, being government regulation and bylaws. It also describes in more detail how all nine components relate to and support each other.

BYLAWS (COMPONENT 8)

A new Part 10 for the CAA Bylaws was approved at the 2014 AGM. This new part sets out:

- the rules governing the receipt and investigation of complaints,
- the process to resolve *bona fide* complaints, and
- the option to proceed to a formal disciplinary hearing should mediation fail to resolve a complaint.

As noted in the second part of this article in the previous issue, the bylaws are the legal component of the regulatory framework through which the practice standards (component 5) and the code of ethics (component 6) can be enforced. Without these legal enforcement tools, the standards and rules would have little meaning and could simply be ignored by the membership. That would not be in the public interest and could increase the risks of harm (component 2). This relationship is shown the diagram.

The CAA's bylaws are also where other components of the regulatory framework will be expressed. For example, the Association's entry-to-practice requirements for professional members (component 4) are currently set out in bylaw 13, and the continuing education program (continuing competency, component 7) is described under bylaw 15.

In the months to come, the CAA Board will be developing a strategy to revise our bylaws so that they will provide a more comprehensive and transparent governance structure. Eventually, the bylaw component of our regulatory framework will be substantially similar to that of other professions.

GOVERNMENT REGULATION ON SELF-REGULATION (COMPONENT 9)

Government regulation of a profession comes into play when the services provided by the profession involve a risk of harm. Identifying the risk and assessing whether it is sufficient to justify action by government is why there is a direct link between the risk-of-harm analysis (component 2) and this final component of the regulatory framework, as illustrated in the diagram.

Regulation will only proceed if government concludes that it should establish a "social contract" with the profession according these essential terms:

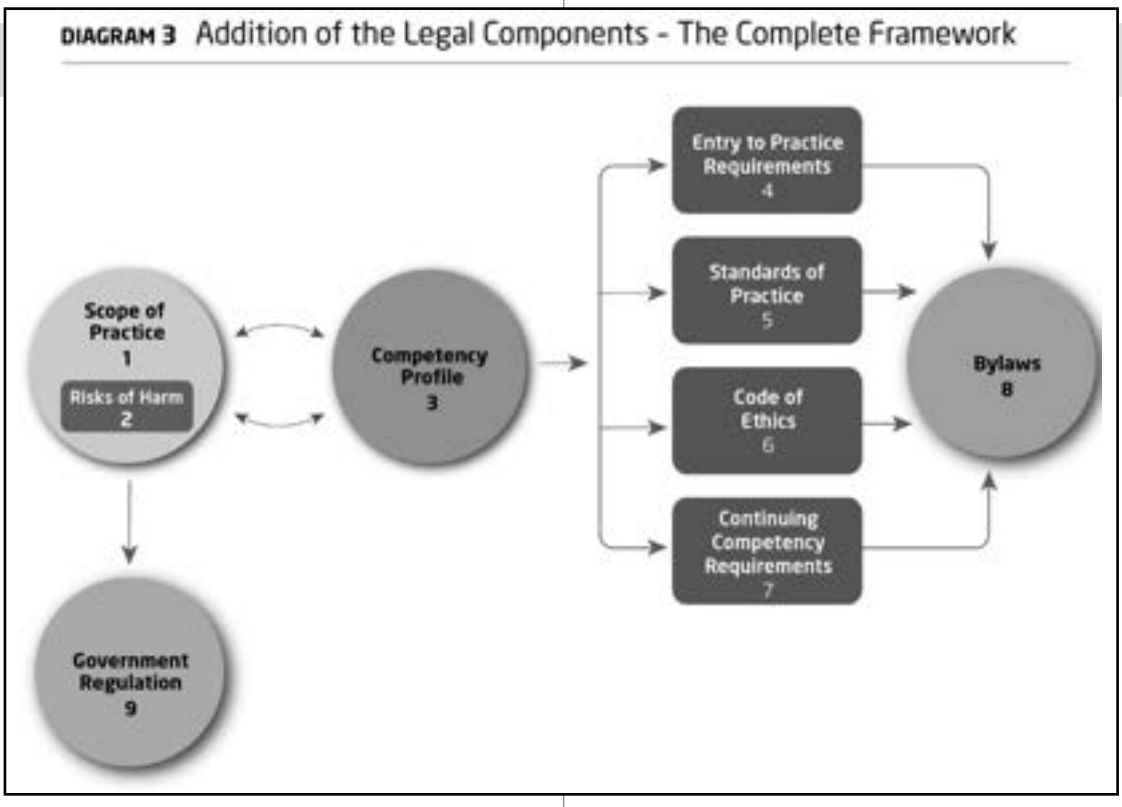
a) in exchange for
   i. control over an occupational title protection, or
   ii. the right to perform restricted professional activities,
   iii. (or both),
b) the profession agrees to regulate its members
   i. in the public interest, and
   ii. through a regulatory body funded by the membership.

Currently, government grants occupational title protection through regulations that give the profession the exclusive right to use a particular title (such as "physiotherapist" or "veterinarian" often combined with an adjective like "certified"). Persons who are not registered members of the profession's governing body are legally prohibited from using that title.

Many but not all professions are also granted some form of restricted activity, so that only members of the profession (or other professionals with the same competencies) can perform services or functions that fall within those restricted activities (e.g., dispensing pharmaceuticals or performing injections). In effect, government regulation can grant a substantial monopoly over certain aspects of a profession's scope of practice. Defining those practice monopolies (restricted activities) will be informed by the risk-of-harm analysis (component 2), which is why government regulation flows from this component, as shown in the diagram.

British Columbia is unique in Canada because, under Part 10 of our *Society Act*, a professional association with defined entry-to-practice requirements (component 4), standards of

DIAGRAM 3 Addition of the Legal Components - The Complete Framework



practice (component 5) and a code of ethics (component 6), as well as legal mechanisms within its bylaws to investigate and resolve public complaints (component 8), can be granted legal control over occupational titles unique to that profession. A title thus granted to and controlled by the profession identifies that the person who uses the title has met minimum registration requirements and is required to follow standards of practice and a code of ethics, all enforced by legal powers under applicable bylaws. Occupational title protection helps the public to make informed choices as to who they should hire to provide the required service. And title protection under BC's Society Act can be an important step toward dedicated government legislation to regulate the profession.

In the coming years, the CAA will be considering filing an application to seek an occupational title for the exclusive use of Association members in good standing. Once all the rest of the regulatory framework components are in place, the membership will be asked to approve a resolution directing that the Association apply under Part 10 of the Society Act for a unique occupational title. That would initiate the ninth and final component of the framework.

The next step along the path of government regulation could be the creation of a regulatory body (commonly called a college) under provincial legislation. That body could grant to the profession an occupational title, if not also one or more restricted activities. Again, the grant of restricted activities would be possible only if the risk-of-harm analysis (component 2) supports granting such a monopoly to the profession.

The CAA is not likely to take this final step for several years. It will be critical to involve the membership in the discussions to ensure there is broad support for this final step on our path toward full regulation through government legislation.

CLOSING COMMENTS

As can be seen in the diagram, the nine components of the regulatory framework are interrelated and work together. While the major directions of influence flow with one-way arrows in this diagram, it should be understood that any one component could also influence another in the reverse direction. So, for example, as the details of the practice standards (component 5) are worked out, it may be necessary to go back and amend the competency profile (component 3). In turn, it may be necessary to go back further and revise the profession's scope-of-practice statement (component 1).

In the months to come, the CAA will begin work on those components of the regulatory framework that remain to be completed. The last component, some form of government regulation, will be initiated only after the first eight components have been more fully developed and there is broad membership support for that final step.

Aaron Beardmore, CAA President

We trust this three-part article and the accompanying diagrams clarify the regulatory framework that the Association elected to pursue following the 2013 AGM. Members with any questions about this initiative or the framework should direct them to president@avalancheassociation.ca.

Joe Obad
CAA Executive Director

CAA Executive Director's Report

CHANGE OR BE CHANGED

Be the change that you wish to see in the world. –Ghandi
I'd rather be the weather than the weatherman. –An anxious art dealer

AS MEMBERS BEGIN TO REFLECT on a long and challenging season, it seems appropriate to reflect on changes at or near the CAA and the role of members, board and staff as we move ahead, and on ways we can respond to and shape the environment for avalanche practice in Canada.

No snow, quickly melting snow, rain and almost anything but consistent powder days was the reality for many operations in Western Canada. Sadly, these conditions showed up in a year where bookings were strong for many operations. Besides wistful thoughts of what could have been for bottom lines, many operations have scaled back funding, affecting CAA member training, participation in CPD, and consideration of InfoEx extensions. The board and staff are mindful of these effects on members as we plan for the 2015-16 season.

February 1, 2015 also marked the beginning of enforcement of WorkSafeBC's revised OHS Regulations 4.1.1 and 4.12. The passage of these regulations was stunningly quiet for all the anxiety and upheaval that characterized the creation of the previous regulation 4.1.1 and its subsequent suspension. The new regulation's cornerstone reliance on "qualified persons" to conduct risk assessment is both a relief and a new burden to CAA members. CAA members have the opportunity to sharply define who is a "qualified person" for avalanche risk assessment. The vacuum around this definition will persist and cause challenges for regulators, employers and practitioners until the CAA or other entities provide clear guidance.

This may have seemed like a distant issue for a brief time, but tragic death of Robson Gmoser has forced many organizations—the Association of Canadian Mountain Guides, Backcountry Lodges of BC, HeliCat Canada and the CAA—to take stock of our guidance to our membership on 4.1.1 and 4.1.2. This has been a painful process as so many in our community are concurrently trying to support Robson's family and friends while coping with their own grief. WorkSafeBC has been highly respectful of this context as it conducts its investigation. WorkSafeBC also gave a presentation to members at the spring meetings to help with application of the new regulations.

The CAA is developing competency profiles in part to taken to address the "qualified person" issue, frequently expressed in "who is qualified to do what?" questions from members and employers. Over 280 members responded to the Competency Profile survey in February and March. This response is heartening as Board and staff need to hear the perspective of members on the nature, pace and scale of changes the competency profiles have the potential to drive. The Industry Training Program, entrance to membership, and competency management (CPD) all face potentially massive changes based on the final competency profiles. The board has been seeking your input and will seek more. I encourage members to read President Beardmore's articles on this process and to provide feedback to the board, solicited or not.

Governing the throttle for these changes is key so CAA members move ahead with a shared understanding and plan for change. What will these changes cost? What is the most rationale way to stage changes effectively? How will members be affected? The board is working on these questions with staff and committees, but it's vital to bring your perspective to these conversations and decisions.

We used to have a similar challenge with the pace of change in InfoEx, but the picture is shifting. The past two seasons saw dramatic new changes to InfoEx software: a completely revised platform in the fall of 2013, and optional extensions for avalanche control and run lists in fall 2014.

"Hello fellow InfoEx victims!" announced one subscriber as she walked into a training session this fall, reminding me and other staff that these changes takes their toll. Some subscribers may be comforted that without TECTERRA funding our ability to provide sought after features, and the change each represents, has diminished.

That said, we are too small to control changes from Google, who announced they was phasing out support for the Google Earth plug-in, a crucial component for managing InfoEx location catalogues. We have spent much of the last few months working with the IT Committee and the InfoEx Advisory Group on options to replace InfoEx's map layer. This will consume the bulk of our summer development on the platform. So our message to subscribers is one of reduced expectations for fall 2015 regarding feature enhancements. "Lack of change you can count on!" is not quite our slogan, but we will not be canvasing for additional features so much as consolidating and solidifying InfoEx.

The Industry Training Program is poised to respond to signals from the membership and board depending on the direction offered relative to the Competency Profile. Planning for this change is challenging as staff awaits the outcome of the spring meetings and member input.

In all these areas, the staff is keen to hear your perspective. Pick up the phone, drop us an email or visit the office if you're in town. We want to make sure the changes members want come to fruition.

Joe Obad, CAA Executive Director

// MIKE ADOLPH

There's Always One: An Outlier Avalanche on the Coquihalla

Paul Harwood

FEBRUARY 2014 WAS CERTAINLY NOTABLE for snow and avalanches in the Coquihalla area. The last two weeks of the month saw several back-to-back storms that dropped over three meters of snow in the start zones. This snow fell on a widespread crust/facet weak layer that produced several significant natural and explosive triggered avalanche cycles. Although the cold, dry avalanche spell of late February delivered numerous exceptional avalanches, one event from path 36.6 Cassio stood out from the others. On the morning of February 20, Cassio released a size 3.5 natural avalanche that hit the open highway.

The first surprising thing about the avalanche was how far it ran. Cassio is one of several large avalanche paths located at the west end of the pass. The highway was designed to avoid these paths, and was built on the opposite side of the valley. The road sits 10 vertical meters above the creek, which creates a large catchment area for any debris. In 30 years of avalanche observations, the catchment has been more than large enough, with deposits from Cassio never threatening the highway. This avalanche not only reached the highway, but went right across all four lanes.

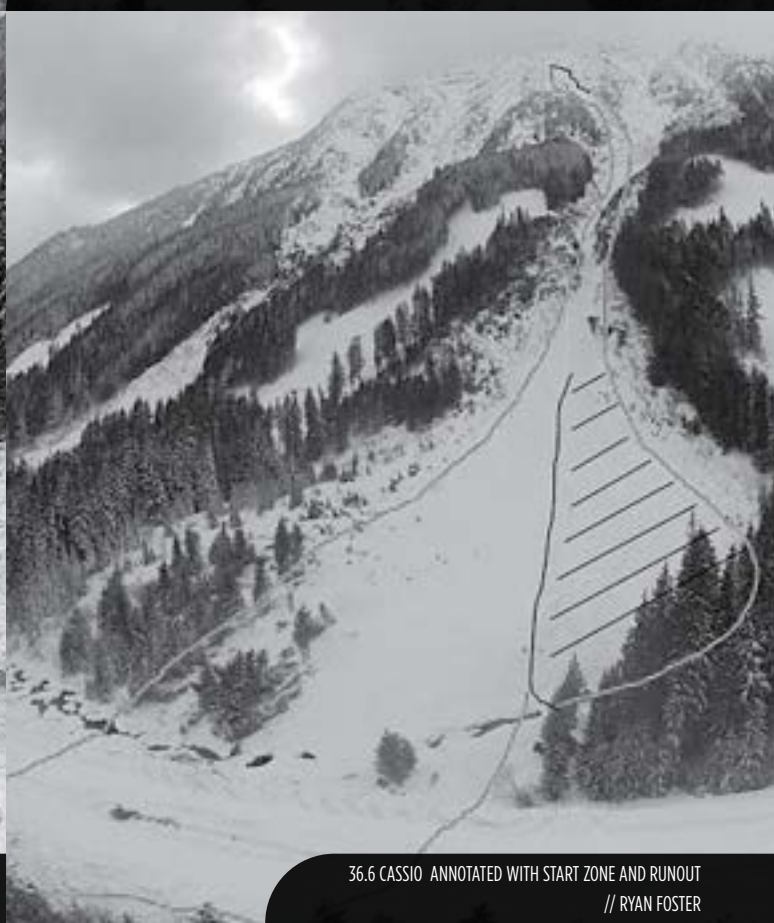
The second surprising thing about this event was that the deposit was relatively small. Historically, Cassio has produced several avalanches with significantly more mass. The avalanche came from a secondary start zone that only makes up less than 25% of the path's potential. There were two parts to the avalanche: the fast, thin tongue that jumped the creek and ended up on the highway, and the main deposit that only covered part of the fan and did not even make it to the creek.

This avalanche was a one-off event. There were no other natural avalanches observed in the 43 hours prior to the event, and the next natural avalanche was not observed until four days later. The following day, helicopter explosives control produced numerous large avalanches, some of which removed significant timber. Although several of the controlled avalanches were much larger, no other avalanche deposits affected the highway with mass, nor did they show the unique flow characteristics of the Cassio avalanche.

There's an interesting similarity between the February 2014 and similar past avalanche cycles in the Coquihalla. Each one has had an avalanche deposit on the highway from a path that has not done so before—that leaves me wondering which path it will be next time.

36.6 CASSIO, THE OUTLIER THAT COVERED THE COQUIHALLA // RYAN FOSTER

FULLY COVERED ALL FOUR LANES OF THE COQUIHALLA
// RICHARD ENNS



36.6 CASSIO ANNOTATED WITH START ZONE AND RUNOUT
// RYAN FOSTER

// DINY HARRISON

2014-15 at Mustang Powder Cat Skiing: **The Winter of Eternal April**

Diny Harrison

WINTER 2014-15 WAS THE SEASON OF THE MAI TAI: we had more pineapples than you would buy in a year. With average freezing level hovering around 1,900m, we were granted either a series of breakable crusts, instant stick-and-stop wet surfaces, or basic schmoo (with some powder and maybe even a couple of face shots). The unstoppable cycle of precipitation pulses from the south Pacific virtually eliminated our treasured tree skiing—our bread and butter, the consistently good stuff that the Monashees are known for and that people from all over the world come to indulge in.

I skied some of the most challenging ski conditions in my 25-year career in the avalanche industry. I fell more times then I have in a decade, with more double heel ejects with full somersaults than Wayne Wong—it was challenging to say the least. This year's theme was "skiable": we would get 5cm HN and ski it like it was 20 and call it a reset. We redefined what was "good skiing."

As I write this, the season is thankfully at an end. The bright light at the end of the tunnel was the sun shining on the crags of Skaha. I look back and ask myself, "How did we manage to pull off a ski product, stay sane and send happy customers home?"

Fortunately, Mustang Powder has some very decent alpine terrain in our northern tenure, which is where we lived for most of this season. Normally, we do not use this terrain until mid season, and some of it usually only in our last month of normal operations. Most of our guests had never even seen the north area. However, the long droughts with sunny weather resulted in bomber stability at times, which allowed us to play around in features that we would normally avoid, letting clients dribble over small cornices and skitter down steep slopes. It gave them a challenge; they even had fun. Warm winds and dribs and drabs of snow filled in the concavities of the alpine terrain, smoothed out the surface here and there, and with a bit of creative hunting we found some pockets of good snow. Sometimes powder, sometimes good, carvable hardpack, and sometimes bone-jarring ice and noisy breakable rain crusts, which filled the moment with the excitement of survivor skills and radical techniques.

TRYING SOMETHING DIFFERENT IN THE ALPINE // DINY HARRISON

Of course, accessing the alpine had some challenges, including a lot of explosive work to protect roads and travel through drainages and run out zones. The snow safety guide was a pretty busy man at times, assessing slope stability for jump runs to the north, digging pits, throwing bombs, sticking sleds, hunting for information to try understand the increasingly-complicated layers of crusts and facets, surviving run quality checks and passing on the most important info--where was the freezing level today? The warm, warm days following new snow, the frozen roller balls and the schmoo piles virtually transformed entire valleys into heinously unskiable terrain.

Ok, so we had long drives to get to the goods.

Fortunately, our alpine terrain lends itself well to building roads. We are blessed with talented and well-seasoned road builders, who have all had CAA professional avalanche training and also work as tail guides. Their ability to carve out roads in what appears to be unlikely terrain to the untrained eye is inspiring—and this winter was the key to the operation's success. There was a lot of probing, snow fencing and Russian army shoveling events. As the season progressed and the rain fell in the lower elevations, roads started melting out, making some sections impassable. Then logging operations began, and several kilometers of roads were ploughed, cutting off access to a coveted area of awesome glades and steep skiing. Oh well, it turns out we couldn't have used it anyway.

Mustang is also fortunate to have some talented, long-term guides who know the terrain intimately. There was a lot of creative, out-of-the-box thinking—pulling rabbits out of hats. Good thing rabbits are prolific breeders; we never ran out of them.

Our strategies included shorter runs with high pick ups; steep, short, but exciting pitches in times of good stability; building pick up roads three quarters of the way down our runs (freezing line dependent); grooming ski outs to get through that last 100mof breakable crust. In extreme breakable crust conditions we even groomed an entire low angle alpine run. And, well, eventually we just accepted it all with humour, with lots of jokes, lots of laughing, and being positive.

We prepared our guests for the worst, giving truthful and maybe a touch desperate descriptions of what was out there. Having a good day up in the mountain with friends and getting a good turn in here and there inevitably and pleasantly surprised them. “Hey, that was skiable!” they would say, and they had some good laughs at the spectacular crashes—and not just the guests were crashing. More than anything, the guests were great. Guests understood how hard it was and were happy with their experiences, impressed that the guides could find skiable terrain.

The Mustang team is the other major factor in making this pig’s ear of a winter into a silk purse (almost). We all get along; we are all friends. There are no sour apples. We tried hard, laughed hard, and carried on in high spirits. The food was outstanding, the atmosphere in the lodge stayed positive; we have a great team. The staff gets along and the guests notice—it makes a difference. Having an enthusiastic boss is key. Nick Holmes-Smith’s passion is infectious, and the characters we work with make the seemingly long days enjoyable. It’s just a happy place. Success relies on maintaining team morale, emphasizing good communication, and keeping a positive attitude.

A season like this winter can make you realize that it’s not just about the skiing—it’s about your whole operation, and how employee positivity absolutely influences the guest experience. It’s about the guiding team, their ability to look and think outside of the box for skiable terrain, and the support and encouragement from management.

Framework for Avalanche Risk Assessment and Mitigation **FARAM**

Cam Campbell, Principal Investigator and Joe Obad, CAA Executive Director

THE *GUIDELINES FOR SNOW AVALANCHE* *Risk Determination and Mapping* and *Land Manager's Guide to Snow and Avalanche Hazards* (both published by the CAA in 2002) provided an important reference point for technical and engineering practices related to the assessment and mitigation of avalanche risk. However, the period between 2002 and 2015 has seen remarkable change and growth in Canadian avalanche risk assessment and mitigation practices in technical and social domains.

Recent Canadian innovations are uniquely suited to our avalanche problems. However, formally recognized and standardized versions of these practices have not been incorporated in reference materials in Canada or elsewhere. With the wealth of innovative content generated in the last decade, the time is right to update and expand best-practice documentation to reflect current practice, and to include technical and social domains.

With the support of the National Search Rescue Secretariat's New Initiatives Fund (NIF) and our sponsor organization Parks Canada, the CAA was able to attain funds to update and revise our guideline documents. Recognizing the need to address both technical and social domains we have taken a framework approach to focus in these two areas while providing important linkages. This approach is illustrated in our project title: Framework for Avalanche Risk Assessment and Mitigation, or FARAM. The project will update and expand essential reference materials for land managers and avalanche professionals in Canada. The outcome will be robust risk-management references against which land managers and avalanche professionals can benchmark their practice.

FARAM PROJECT TEAM: PASCAL HAEGELI, SUSAN HAIRSINE, JOE OBAD, GRANT STATHAM, STEVE CINGER, BRIAN GOULD, BRUCE JAMIESON AND CAM CAMPBELL // BRUCE JAMIESON

CONTENT DEVELOPMENT TEAM

Following a competition in summer 2014, Principal Investigator Cam Campbell was hired to lead two panels of subject matter experts dedicated to content development. The first panel is tasked with researching and writing material pertaining to the technical aspects of avalanche risk assessment and mitigation (i.e., the technical domain), and includes:

- Steve Conger
- Brian Gould
- Pascal Haegeli
- Bruce Jamieson
- Grant Statham

The second panel is tasked with researching the writing material pertaining to avalanche-related regulation, law, ethics, and human resources (i.e., the social domain), and includes:

- Aaron Beardmore
- Jim Bishop
- Dominic Boucher
- George Bryce
- Ross Cloutier
- Robert Kennedy
- Bill Marshall
- Ian Tomm
- Doug Wilson

PANEL 1: TECHNICAL DOMAIN

The goal for this content is to offer technical guidelines and typical applications for avalanche risk assessment and mitigation. This material offers a risk management concept structure that draws upon current best practices in Canada, the ISO 31000 process, and other relevant approaches. ISO 31000 is used primarily as linking concept to draw together established international best practices.

Key content areas include:

- Sources of uncertainty and strategies for reducing it or factoring it in.
- Avalanche terrain identification, classification (including ATES), and mapping.
- Hazard and risk assessment techniques used during both the planning and operational stages (including the Conceptual Model of Avalanche Hazard).
- Common assessment and decision aids and their fundamental concepts.
- Avalanche risk mitigation options.
- Guidelines tying it all together on where and when to use specific assessment techniques, mapping types, and mitigation options.

PANEL 2: THE SOCIAL DOMAIN

Technical components of protection against avalanches are only part of the range of factors that can influence good outcomes. Assessment and mitigation of avalanche risks also depends on human competency, regulatory and legal context, and societal tolerance of risks. The goal of this content is to enable decision makers who generally are not avalanche practitioners but who are legally accountable for avalanche-associated risks to understand their responsibilities and how to carry them out. Key content areas include:

- Social context including corporate responsibility, stakeholders and user groups, social tolerances of risk, communications, and ethics and accountability.
- Avalanche specific-regulations, as well as general application regulations and non-regulatory policy that apply to avalanche risk management.
- Court rulings and coroners' recommendations.
- Professional regulation and best practice in human resources including competency profiles, scope of practice, and training programs.

IS THIS FOR YOU?

The project outputs for each panel will be written in enabling technical language that can be readily grasped by all avalanche practitioners; however, the application of concepts may be limited by training and experience of the reader. The material will draw from research, but the documentation will not read as research itself. Practitioner accessibility is key. Where practitioners are appropriately trained in primary concepts, the material should be readily accessible. We are moving towards the reviewing and editing phase of the project.

Safer Mining: Teck's Avalanche Program Protects Workers at Five Elk Valley Mines

Lisa Larson

AT TECK'S FIVE STEELMAKING COALMINES IN THE ELK VALLEY IN THE EAST KOOTENAY REGION OF BC, AVALANCHE SAFETY IS AN IMPORTANT PRIORITY.

THE OPERATIONS ARE SUBJECTED to the effects of avalanches of varying severity, from both natural topography and engineered landforms. The company has developed a comprehensive avalanche program which includes a safety plan and a dedicated Senior Avalanche Technician role to help ensure the safety of the more than 4,000 employees and additional contractors at the sites every day (Fording River Operations, Greenhills Operations, Line Creek Operations, Elkview Operations and Coal Mountain Operations). Teck's safety vision is that every employee goes home safe and healthy every day, and the avalanche program helps achieve that. As Senior Avalanche Technician, I have had the ability to work with the sites to continually enhance avalanche safety while learning all the different considerations that go into avalanche safety planning at a mine site.

The Senior Avalanche Technician position, established in the 2012-13 season, standardizes the practices and procedures across the coal division for central management of the Avalanche Safety Program. My role is to provide direction and mentorship to the individual sites with regards to the collection of data, avalanche control work using explosives, and hazard communication. I also conduct snow stability assessments, issue danger ratings communicating the results, manage professional consultant contracts related to the Avalanche Management Program, and organize and conduct required training courses to ensure an adequate number of trained personnel on site. To date Teck has supported the training of 26 CAA Avalanche Operations Level 1, one CAA Level 2 and one CAA Level 3.

After working for a ski resort mountain safety team, moving to a large resource company has provided many new challenges and opportunities. Teck is one of Canada's biggest companies, with many resources that are not as readily available in the recreational industry. This includes annual LIDAR data, GIS professionals and geotechnical engineers to support program development.

Understanding all of the ways workers move around in a mining environment is crucial in managing avalanche risk. Extremely large equipment can change the landscape overnight, contractors and employees move around on-site and off-site on foot, snowshoes, light duty vehicles, snowmobiles, and equipment of all sizes. Their duties can include water sampling in remote areas, performing winter wildlife surveys and even exploring bat caves. These projects on and off site can include project managers from Calgary, Vancouver, Sparwood or the five Elk Valley operations. Finding the right trigger to ensure that all levels of the organization evaluate avalanche risks proactively has taken significant work. But with the right systems in place, the season runs smoother because we can ensure the resources needed to manage avalanche risks are available.

Having an internal avalanche professional has been an advantage for the company. I am involved in the operation day in and day out, building relationships with the workers on the ground and at all levels of the organization. In this position, I can continually assess new areas and see where the changes and developments are occurring, which has helped with the continual improvement of the program.

// LISA LARSON

The avalanche program season starts in September. During this time, I connect with the mine managers, long and short-range planners, and environmental staff to get a sense of the projects that are planned and their schedules. These planned projects are first assessed using a desktop review of the area and then on-site with the project managers, engineering and safety groups to discuss mitigation plans through the winter. We generally use an active avalanche control program for mitigation and for small terrain features, ditches and catchment berms. Each year this process becomes more defined and widespread across the various departments within Teck.

At each site, the avalanche site designate monitors weather data and avalanche occurrences daily. These avalanche technicians conduct weekly snowpack evaluations at each of the sites. This information is then compiled and evaluated to assess hazards and risks. Based on this assessment, remediation requirements and possible closures of avalanche areas may be initiated.

Avalanche control using explosives is fairly new for most of the operations; using equipment to push material onto the top of a slope to induce fracture is more frequently used. There are a number of slopes where this method of control is effective, but using avalanche-specific explosives opens up more control options.

Clearing for a blast on a mine site must account for every employee and contractor within a 900m radius—which, depending on the operation, can be anywhere between 100 to 500 people. Because of this procedure, we try to time avalanche control blasting to coincide with mine blasting where possible to limit downtime to the operation. Using explosives to control avalanches more often has helped demonstrate the advantages of this method.

Avalanche forecasting has improved the overall ability of the operations to mitigate avalanche hazards; however, Mother Nature does not work on a schedule and weather variables always exist. Continual improvement of communication about avalanche hazards, proactive planning, training and annual development of avalanche control plans will enhance our avalanche safety program to maintain a safe operating environment for our employees.

Avalanche Control for **Big Mountain Ski Competitions**

Steve Whale

FOR THE PAST SIX SEASONS Revelstoke Mountain Resort has hosted the Freeride World Tour (FWT) big mountain ski event. After the FWT cancelled most of their North American venues this season, we were approached by Red Bull to host their Cold Rush freeskiing event.

Hosting events like this can be a challenging, stressful, and very rewarding experience. Over the years our comfort levels have increased with experience, but therein lies our first alarm bell—are we getting too comfortable? Like any operational resort, we always have to look at the risk versus the reward of our actions, and with events like these the risks are always high.

Our first and main challenge is snow stability and avalanche control. Our worst nightmare is an avalanche involving an athlete in our controlled backcountry area. This is where our challenge begins.

Our general practice involves knocking the slope back to our most recent weak layer or PWL. From there it is a dance of watching the weather and controlling the slope just enough to let it reload for optimal aesthetics and skiing conditions, but still having no size 2 or larger avalanche concerns. As you can imagine this can be quite the feat.

We monitor natural releases on the venues, and generally heli bomb when weather permits once per month leading up to the event. About a week before the event we will test the slope again (usually with 14kg ANFO shots) and from there we will then hand charge any suspected pockets a day or so before the event. On the day of the event, a four to six-person avalanche team will ski the event first to make the final call if it is safe to proceed.

A lot of prep time and hair loss goes into this, and even with all of our best efforts the stars still really have to align. In the case of last year's FWT mid-March, we were

NOT SURE AS TO WHAT LOCATION THIS IS DOOR 123? IS THIS THE FREERIDE COURSE ENTRANCE? // REVELSTOKE MOUNTAIN RESORT

HAND CHARGES WERE USED? // REVELSTOKE MOUNTAIN RESORT

dealing with a PWL 100cm down, which awoke with the warming temperatures the week of competition. The morning of the event we threw a 14kg shot onto a cornice next to the start ramp; the weight of the bomb dropped the cornice which propagated into a size 3 slab, scraping the entire right hand venue to crust. EVENT OVER!

This year, we had similar stability issues with the Red Bull Cold Rush event. We knocked the venues back to a comfortable stability layer, waiting for a recharge of snow. Unfortunately, that snow never really came at the right time. Instead we ended up with a series of melt-freeze cycles, resulting in 50-foot drops to boilerplate landings. This event was also cancelled.

The decision to postpone or cancel an event like this is incredibly tough and not taken lightly. As we all know, the weather and snow pack in the Selkirks can dramatically improve or decline in a matter of hours. We forecast and monitor the weather, InfoEx, Avalanche Canada bulletins and venues religiously but trying to predict what will happen a week or two into the future is a major challenge.

Safety is our number one concern, but there is also a lot of financial pressure applied. It can cost hundreds of thousands of dollars to pull off just one event. It is a hard part of the job to tell an event organizer the day of the event that we cannot proceed. That being said, this is the job we are paid to do and safety is our primary goal. If the competition venue is not stable and safe, no amount of money in the world will make it better. Presenting solid facts and data regarding the snowpack and stability is generally enough for the organizer to postpone or cancel the event.

I am very proud of the events we have facilitated here at RMR. The ones that have gone ahead have been well executed, well received and have helped put Revelstoke Mountain Resort on the map.

We have a strong snow safety and rescue team here. Combining the skills of our team and our head avalanche forecasters Troy Leahey and Chad Hemphill, we have a huge knowledge base. This group dynamic makes these hard decisions much easier to make and I can't thank them enough for our successes.

I believe we have a winning formula and a solid track record. We look forward to rising to the challenge and facilitating more of these big mountain events in the future.

Compaction in Managed Snowmobile Areas: **When and How to Communicate It?**

Curtis Pawliuk

IS CONSISTENT AND WIDESPREAD USE of more popular managed snowmobile areas creating a growing and dangerous sense of inflated experience and over confidence in mountain terrain?

British Columbia is home to approximately 85 snowmobile areas that are classified as managed. These managed areas are operated and overseen by local organizations and clubs in partnership with Recreation Sites and Trails BC, a department of the Ministry of Forest Lands and Natural Resource Operations.

Outside pressures like the Species at Risk Act and conflicts over land use are ultimately limiting motorized (snowmobile) access to many areas of the open backcountry. As access to BC's backcountry becomes more restricted, the snowmobiling public is more likely to utilize these managed recreational snowmobile areas.

The word managed may be a bit misleading. The typical agreement has local clubs or organizations maintaining a groomed trail only that may or may not lead to an alpine shelter as its final destination. Many of these access trails are mechanically groomed and are access points to a variety of areas, including treeline and alpine terrain. These "play" areas can see very heavy use by snowmobilers of all ages and riding abilities although there is no form of management beyond the end of the access trail.

Naturally some of these areas are quite a bit busier than others and some can see hundreds of users over any given weekend. Regular winter season use of these areas can begin as early as the beginning of November and continue on well into May.

One of the areas in BC I am most experienced with is Allen Creek. This is very large area that is bound on all sides by legislated wildlife closures, leaving boundaries that are quite clear. At times, especially during periods of extended drought, fresh lines can be difficult to find. Allen Creek is likely one of the most frequented managed snowmobile areas in Western Canada. The area holds a large mix of accessible terrain with ATES classifications ranging from non-avalanche terrain, simple, challenging and complex areas. All of the managed areas around BC have been ATES mapped through multi-year projects between Avalanche Canada and Recreation Sites and Trails BC.

Allen Creek holds the same features as any high alpine mountain environment, and after a busy week it is not uncommon to see 80% of the terrain within the area's relatively large boundaries resembling a parking lot, with every morsel of snow absolutely steam rolled. This phenomenon begins at the start of the snowy season (generally mid-November) and typically ends in late April or early May depending on the year.

Compaction of the annual snowpack within the area's boundaries is extensive. During times of infrequent snowfall little terrain left untouched. This includes slopes of 45-50 degrees or steeper, including concavities, convexities, creek beds, gullies, and all aspects and elevations treeline and above.

Over the last eight seasons of frequenting these areas multiple times per week and having to regularly search for that elusive unaffected location for stability tests and snow profiles, I have spent a significant amount of time thinking about the effects of compaction in these popular public snowmobiling areas. Extensive snowmobile compaction not only has relevance to stability and avalanche hazard but it also exerts an influence on the riders in the form of human factors such as familiarity and scarcity.

As riders become more skilled and push the technical limits of their sport, be it strictly snowmobiling or snowmobile assisted ski touring, it has become increasingly difficult to find a location within Allen Creek (and many other managed snowmobile areas) that hasn't

ALLEN CREEK RIDING AREA IN LOCATION KNOWN AS OLD HILLCLIMB, SHOWING TYPICAL USE.
NOTE OPTIONS FOR STUDY IN MIDDLE OF PHOTO // CURTIS PAWLIUK

ALLEN CREEK, LOCATION KNOWN AS SUPERBOWL. NOTICE THE HEAVY USE IN CHALLENGING TERRAIN // CURTIS PAWLIUK

met a season's worth of sled or ski traffic. When I am able to find an untouched location, I begin to wonder—is it truly representative of the overall snowpack condition within the region?

As an area representative, acting as the general manager and avalanche technician for the local snowmobile organization and operating a snowmobile backcountry guiding and avalanche education business, I try to regularly convey important local information relating to the snowpack and riding conditions within these managed areas to our users via email lists, social media and general correspondence.

I often think about the effects of compaction within these popular areas. Managed snowmobile areas throughout BC receive hundreds if not thousands of user days per weekend, and many thousands per season. This does have a profound effect on the snowpack and the avalanche hazard within these regions; it is likely a contributing factor to why we don't see more incidents involving snowmobilers given the nature of the terrain they travel in. The majority of the snowpack within managed areas is simply compacted to such an extent that it behaves more like a modified snowpack than it does like the less-frequented backcountry.

Much of the public rides in or travels through complex terrain. On any given winter day in BC, there are non-guided, recreational snowmobilers with unknown levels of training moving through large expanses of alpine terrain. Thankfully there are minimal reported avalanches, whether simple involvements or fatal accidents.

A few key questions come to mind regarding these managed public areas, the snowmobile use they see and the compaction that results:

- Does the extensive compaction in these heavily used managed areas result in non-event feedback, which is potentially developing a growing and dangerous sense of inflated experience and over-confidence in mountain terrain?
- Should this change our messaging to riders within specific regions?
- As professionals, how do we start to understand the role of compaction in these areas?
- When do we address this growing and likely inaccurate sense of self-confidence and complacency?
- If we do not openly discuss the idea of compaction within these areas and its potential benefits and dangers, are we withholding possibly life saving information?
- Should we communicate the effects of compaction in the public bulletin?

CLEMINA CREEK GOAT RIDGE BOWL. HEAVILY USED, PLANAR SLOPE REACHING UPWARDS OF 45°. NOTE LEFT OF PHOTO, NOT AS COMPACTED AND IS A REGULAR PERFORMER CAUSING A FATAL AVALANCHE IN THE 2013/2014 SEASON // CURTIS PAWLIUK

My personal feeling to many of these questions is yes, but how?

From my experience over the last eight years of observations, the heavily used managed recreational areas are providing a safer experience, with reduced avalanche hazard due to mechanical compaction. My feeling is that we address the idea in greater fashion. We can make our public avalanche safety programs stronger by recognizing and addressing the extensive compaction that regularly occurs at managed snowmobile areas. The question looms: how is this message most effectively delivered?

Not everyone chooses to utilize managed areas. Recreational users may seek out more elusive and secluded areas where regular compaction over a very large common area is no longer the case. This decision to push beyond compacted areas may come with time and/or the individual's progression and experience level in the activity, or simply from a desire to find fresh tracks in times of low snowfall. They could also simply be following a blind desire to go off the beaten path even though their experience level may not be there. There are many human factors that influence us all, especially newcomers to mountainous terrain.

Due to their intense use, managed areas may be best looked at and discussed as a stepping stone to gaining experience with mountain terrain—to increase personal snowpack assessment and general backcountry skills before moving into large, less compacted snowpacks which arguably present a greater hazard.

As instructors, mentors and educators, when should compaction in managed snowmobile areas come into the conversation? Currently, I have not found anything addressing the idea that popular managed recreation areas may be safer due to the compaction phenomenon. There are many points that could be argued and all need a focused attention, though I have seen the benefits of compaction within these areas for many years.

I believe our lessons and correspondence to the recreational snowmobile community need to address a stronger message on the impacts of compaction in heavily frequented areas. That message may simply be that on a high hazard day, a managed area may provide a rider with a safer experience than the untouched and raw backcountry. However, I'm left with the question of how could we effectively convey this message without causing more harm than good?

Thank you for reading. If you feel strongly about this idea one way or another, I encourage feedback and information sharing and would happily engage in further discussion. Reach me at curtis@frozenpirate.com. Ride safe.

Strategic **Mind-sets**

Roger Atkins

THIS PIECE WAS ORIGINALLY PUBLISHED IN VOLUME 33, ISSUE 4 OF *THE AVALANCHE REVIEW*. THANKS TO *THE AVALANCHE REVIEW* FOR LETTING US SHARE IT WITH YOU.

Mind-set: 1. A fixed mental attitude or disposition that predetermines a person's responses to and interpretations of situations . 2. An inclination or a habit.
-The American Heritage Dictionary, 2009.

I believe we each adopt a mind-set about a day in the mountains, formed mostly from an assessment of risk combined with our desires, but also from peripheral influences we may not acknowledge. Our mind-set is a filter that affects our perception of risk and desire, influencing our emotional response to the mountains; it is the internal context against which decisions are made. Consider entering the mountains after a storm: the sky is clear, the snow is beautiful. The slopes are full of allure, perceived as desirable and friendly places, associated with pleasure. As you approach, a large avalanche is remotely triggered on a slope you intend to ski. In that instant, your perception of the mountains changes. Instead of your desires, you see your fears. Your mind-set has changed your perceptions, and your decisions also change. A mind-set well suited to actual conditions is an influence towards good decisions while a mind-set not synchronized with conditions can lead to poor decisions. Our mind-set becomes strategic when we identify common mind-sets and deliberately adapt our mind-set to the current situation.

> There is a time to think, and a time to act. And this, gentlemen, is no time to think.
> From the film Canadian Bacon (1995)

RATIONAL THINKING AND INTUITION

Competence depends on unique human capabilities: rational thought based on knowledge, intuition based on experience, and strategies to cope with uncertainty. School teaches analytical skills, trains us in logic and fills our memory with information. With adequate training and resources, we have calculated our way to the moon. However, most of us require undivided attention and adequate time to perform even a simple analysis. Rational thought is powerful, but it is not everything; overthinking taxes the brain and brings us to a halt.

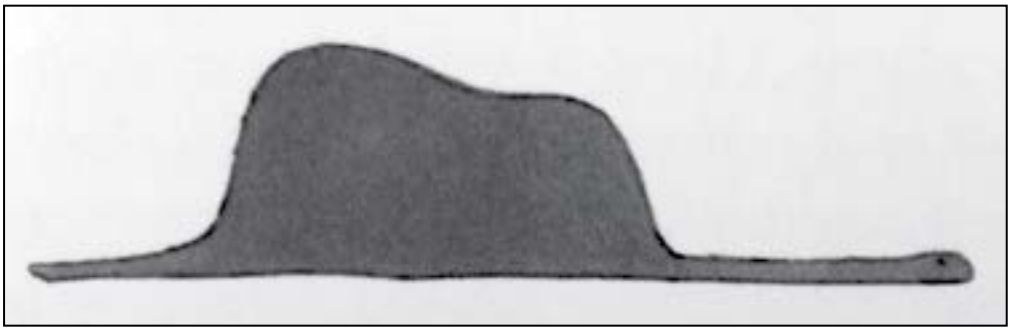
Intuition is your brain automatically processing information outside of your awareness, and it is valuable in many situations. Nonconscious processes operate all the time in complex decision-making; we overrate how much our conscious is in control. "Dual Process Theory" states that we operate on two levels: the conscious (rational, deliberate) and the unconscious (automatic, intuitive). Combining the two is most effective, but both need proper priming.

Intuitions can be difficult to explain. They are strong judgments based on emotion evoked by a perception of something external that you may not even be aware you noticed. Intuition is becoming recognized as an unconscious associative process based on fast, sophisticated mental operations. We encounter a situation and rapid automatic pattern recognition based on prior experiences causes us to react without stopping to think. A properly primed intuition associates emotions correctly for the situation, causing us to react appropriately.

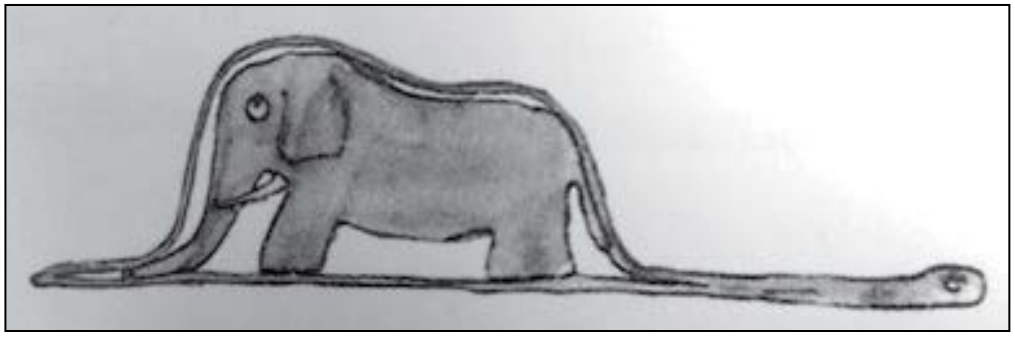
Both processes can contribute to good or bad decisions. The rational process fails if the reasoning is based on faulty or uncertain information or assumptions (garbage in, garbage out), if it is too slow (paralysis by analysis), or if it focuses on one problem and does not account for other considerations (tunnel vision). The automatic process fails if a person's mind-set biases the process in directions not well suited to conditions, or if a person lacks valid experience to train their automatic responses for the situation.

PERCEPTION

From *The Little Prince* by Antoine de Saint-Exupery:
"My Drawing Number One looked like this:



I showed the grown-ups my masterpiece, and I asked them if my drawing scared them. They answered, "Why be scared of a hat?" My drawing was not a picture of a hat. It was a picture of a boa constrictor digesting an elephant. Then I drew the inside of the boa constrictor, so the grown-ups could understand. They always need explanations. My drawing Number Two looked like this:



The grown-ups advised me to put away my drawings of boa constrictors, outside or inside, and apply myself instead to geography, history, arithmetic, and grammar…"

We are born unable to recognize faces, but we become sophisticated at facial recognition. In a crowd, we identify individual faces of people we have only met once, we identify age and gender from unfamiliar faces and we interpret emotion behind facial expressions. Facial recognition is a pattern recognition skill that happens automatically and almost instantly without conscious effort. Facial recognition skills are not infallible; sometimes we fail to recognize people we know or misinterpret emotion. Context also matters. We are more likely to recognize a movie star on the silver screen than in a chance encounter on the street.

"We do not see things as they are, we see them as we are." -Anais Nin

We recognize faces from photographs or even from caricatures. Our interpretation of a face is not the face itself, but is our association of an image we see with someone we know.

Software exists for facial recognition through image analysis. If in doubt, we may also try to analyze features to help recognize a face, but our native automatic abilities far outperform any purely analytical method. Nobody would suggest abandoning automatic facial recognition skills to rely only on image analysis to recognize each other.

Like people's faces, we develop pattern recognition skills for the mountains. We read winter mountains like we read people's faces, but what we see in the mountain snow is partly a reflection of ourselves: a projection of our desires and fears onto the terrain. In the mountains, we should not ignore intuition and make decisions only on rational thought, but we should create mind-sets conducive to appropriate intuitive response and to aid in developing that body of intuitive response (e.g., mind-set open to

learning, open to the process of examining previous decisions, and filing the cause-effect data/patterns appropriately). Emotional responses to our surroundings are not useless. Our perception of circumstance results in an instant and automatic emotional reaction that translates into action; our automatic systems allow us to perceive threats and opportunities and act quickly without analysis. Although not conscious, our automatic responses are influenced by our mind-set. It is our mind-set that creates our perception of threats and opportunities.

How we perceive the terrain strongly influences decisions—desire vs. risk. In turn, how we perceive the terrain is strongly influenced by our mind-set. The same powder-covered slope may be perceived as threatening or desirable at different times or by different people. In fact, the slope is threatening at some times and desirable at others. We make better decisions when our mind-set helps us correctly perceive the slope as threatening or desirable.

UNCERTAINTY?

"…As we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns–the ones we don't know we don't know…it is the latter category that tend to be the difficult ones." –Donald Rumsfeld

We know there is quantifiable uncertainty in measurements and assessments. There is also a subjective feeling of uncertainty about the outcome of a course of action. The possibility of "unknown unknowns" adds uncertainty about uncertainty.

"You cannot be certain about uncertainty." –Frank Knight, University of Chicago Economist

We need terrain and snowpack information, but we don't always need to know why we feel the way we do. Rational analysis of objective information reduces uncertainty about the state of the snowpack, but often not enough for clear decisions about specific terrain. Intuition responds well to qualitative information, which is often more useful than quantitative information for reducing uncertainty about choosing a course of action.

"Not everything that can be counted counts, and not everything that counts can be counted." –Albert Einstein *(attributed)*

Many grey-haired avalanche workers say they felt more certain about their knowledge when they were younger, but experience has taught them to be less certain. However, most also acknowledge becoming more competent decision-makers. Some things about the snowpack and terrain will always be unknowable, but understanding about the things we don't know helps us devise strategies to cope with them. Decisions are often based more on what we don't know than on what we do know.

STRATEGY

Strategy is an overall approach to cope with uncertainty—to satisfy our desires and avoid the consequence of risk. Complete strategies combine both rational and automatic behaviours. Some strategies are rational; we gather and analyze information to reduce our assessment uncertainty, then make conscious decisions based on a subjective probability of the outcome for different options.

Categorizing situations based on patterns carries little uncertainty and yields large returns for knowing how to respond to a particular situation. Automatic responses are not consciously controlled, but can be indirectly influenced by our mind-set. Strategic mind-set is a way to deliberately prime ourselves to automatically respond correctly for the current situation. Objectives are determined by desires. Desires that are compatible with conditions help us choose suitable objectives for the time. ***Wisdom is largely a matter of selecting desires that are compatible with the conditions.***

Most backcountry guiding operations have continuity in their terrain, which allows different strategies than situations where terrain is visited intermittently or when visiting new terrain. It is easier to adjust decisions from an established base than to start from scratch, but continuity in the terrain is necessary to maintain a baseline. Typical mind-sets for backcountry operations are about making adjustments to suit changing conditions while typical mind-sets for approaching new terrain are about choosing a strategy that suits the current conditions. Table 1 shows an example of some typical mind-sets for approaching new terrain under different conditions, while Table 2 shows an example of some mind-sets more adapted to backcountry guiding operations. Basic strategies are listed, actual strategies become nuanced and more complex with experience.

TABLE 1. STRATEGIC MIND-SETS WHEN VISITING TERRAIN INTERMITTENTLY (ALONG WITH TYPICAL RELATED CONDITIONS AND BASIC STRATEGIES).

Mind-set	Typical Conditions	Basic Strategy
Assessment	There is a high degree of uncertainty about conditions, such as when first encountering the terrain for the season, entering new terrain, following a lengthy period with limited observations, or after substantial weather events.	Select conservative terrain in which to travel confidently while more information is gathered to gain confidence in the hazard assessment. Form perception of **What** type of avalanches are likely, **Where** they are likely, **How Big** they may be and **How Easy** are they to trigger.
Storm Mind-Set	During and immediately after storms. The Storm Mind-Set varies from High Alert to Caution, depending on hazard assessment.	Avoid start zones and run-outs that may be affected by natural storm slabs.
Persistent Slab Mind-Set	Persistent weak layers are known or suspected. The Persistent Slab Mind-Set varies from High Alert to Caution, depending on hazard assessment.	Use extreme caution during reactive periods; be disciplined and maintain conservative terrain choices even when instability appears unreactive.
Wind Slab Mind-Set	During and immediately after wind events with snow available for transport.	Assess distribution pattern, size, and ease of triggering. Avoid areas with wind slab; consider ski cutting for small slabs.
Normal Caution	Storm instabilities have settled and persistent instabilities are not suspected, but avalanches may be possible to trigger in specific locations.	Use caution when travelling in run-outs and slide paths; assess start zones carefully before entering.
Freeride	The hazard assessment suggests that only small avalanches are possible in very isolated terrain features, and there is a high degree of confidence in the hazard assessment.	Any skiable terrain may be considered with due attention to the possibility of small surface avalanches-use good sluff management on larger features
Spring Diurnal	The hazard assessment suggests that the only substantial hazard is from wet avalanches during the afternoon thaw phase of the diurnal freeze-thaw cycle.	Assess for adequate overnight freeze and avoid avalanche terrain later in the day during the thaw phase of the cycle.

TABLE 2. STRATEGIC MIND-SETS TYPICAL OF BACKCOUNTRY OPERATIONS (ALONG WITH RELATED CONDITIONS AND BASIC STRATEGIES).

Mind-set	Typical Conditions	Basic Strategy
Assessment	There is a high degree of uncertainty about conditions, such as first encountering the terrain for the season, entering new terrain, after a lengthy period with limited observations, or after substantial weather events.	Select conservative terrain in which to operate confidently while more information is gathered to gain confidence in the hazard assessment
Stepping Out	Conditions are improving and/or we are gaining confidence in our assessment. The "stepping out" mind set covers a range from stepping out very cautiously to stepping out confidently. Stepping out cautiously occurs when there is limited confidence in extrapolation from the available observations, for example when persistent slab instabilities are becoming less easily triggered and for large storm instabilities in the early stages of recovery. Stepping out confidently occurs when one is confident to extrapolate from the available observations.	When stepping out cautiously, it is common to seek specific information about each piece of terrain under consideration before opening that terrain. When stepping out confidently, it is common to open a broader set of terrain with particular characteristics based on extrapolation of evidence from other sites.
Status Quo	There is no substantial change in conditions, the evidence continues to support the current hazard assessment, and the comfort level for exposure under these conditions has been reached.	Change nothing and continue operating as before.
Stepping Back	Weather changes increase the hazard or when events or observations cause uncertainty about the validity of the existing assessment. A small step back may result from minor or subtle weather changes while substantial weather events or observations of unexpected avalanches may result in a large step back.	The typical strategy when stepping back is to close terrain that has become suspect based on weather changes or evidence that creates uncertainty.
Entrenchment	Dealing with a well-established persistent instability. Entrenchment is not a preferred operating mode and requires discipline to sustain it for the necessary time; this is the last resort short of closing operations completely.	Limit skiing to a small terrain selection assessed as having acceptable risk until the situation has clearly changed. New evidence continues to be gathered and monitored for changing conditions, but new terrain is only considered for opening if there is compelling evidence that it is advisable to do so (e.g. an avalanche was observed that definitely removed the layer of concern from that terrain)
Open Season	The hazard assessment suggests that only small avalanches are possible in very isolated terrain features, and there is a high degree of confidence in the hazard assessment.	Any skiable terrain may be considered with due attention to the possibility of small surface avalanches.
Spring Diurnal	The hazard assessment suggests that the only substantial hazard is from wet avalanches during the afternoon thaw phase of the diurnal freeze-thaw cycle.	Watch closely for adequate overnight freeze and avoid avalanche terrain during the thaw phase of the cycle.

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David Jones
Meteorologist

**THE SNOW DOESN'T GIVE A SOFT WHITE DAMN WHOM IT TOUCHES.
–E.E. CUMMINGS**

THE HISTORY

In Canada, avalanches are ten times more deadly than tornadoes. For more than two decades Environment Canada (EC) provided specialized weather forecasts to support avalanche safety operations in western Canada. The forecasts consisted of a text bulletin describing winds, precipitation, freezing levels and solar radiation and were supplemented by a daily telephone call. The bulletin required three to four very intense hours in production, provided the best general weather insight of experienced meteorologists, but was not available to the public or the media. There was no formal corroboration of these forecasts, despite the fact that verification—systematic feedback—is essential to "learning" the weather, improving skill and understanding client needs.

THE PRESENT

In the spring of 2014, a plan to develop a more sophisticated Avalanche Canada Support System (ACSS) was submitted. The proposed ACSS would use imagery, graphics and live-online webinars to facilitate better communication, social media to leverage the intense production effort, and it would incorporate verification.

In November of 2014, we began publishing a daily weather forecast for the mountains of BC and a small area in Yukon on Avalanche Canada's website (avalanche.ca/weather). The Avalanche Canada Mountain Weather Forecast—the ACMWF—is a collaborative effort between weather and public avalanche forecasters. Each day via email, Avalanche Canada's public avalanche forecasters in Revelstoke identify high-risk areas or critical weather issues. Environment Canada Meteorologists at the Pacific Storm Prediction Centre in Vancouver then use a high-tech graphics system to create a picture-based weather story focussed on those concerns. The emphasis is on day two but the forecast includes days three and four, with an outlook identifying potential for significant weather through day seven. It is supplemented by a daily live-online webinar with the forecasters at 11:30 am. The webinar makes it easier to present and absorb the vast quantities of complex information that meteorologists need to share with the avalanche forecasters to help them assess risk.

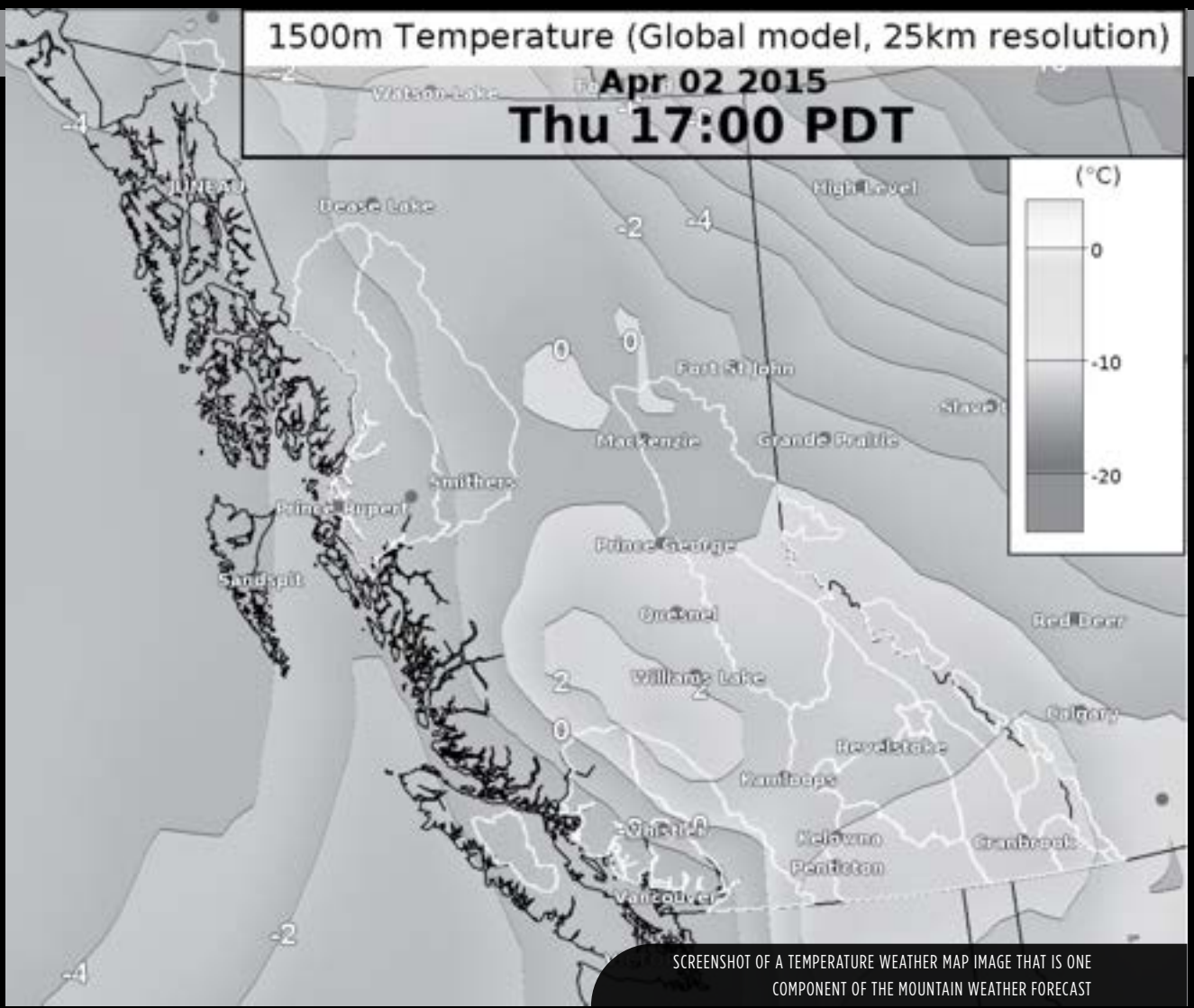
THE AVALANCHE CANADA SUPPORT SYSTEM

The ACSS has five components:

1. The Mountain Weather Forecast.
2. Live-online weather consultation.
3. Ninjo Weather Scenes: Geographic Information System depictions of weather elements.
4. Meteograms: time-series diagrams of the weather elements.
5. Weather element forecast verification.

THE GOAL

The goal of the ACSS is to provide the best meteorological information and insight possible in client-friendly, easily-understood formats to help Avalanche Canada forecasters assess the avalanche risk. A secondary goal is to fill a long-time gap in the provision of detailed technical weather information to other key clients of Environment Canada, such as the emergency planning community and the media.



SCREENSHOT OF A TEMPERATURE WEATHER MAP IMAGE THAT IS ONE COMPONENT OF THE MOUNTAIN WEATHER FORECAST

THE FUTURE

Future plans include:

- Automated production and online display of animated weather scenes to day six in six-hour time steps, and the introduction of new scenes such as hourly precipitation forecasts from Environment Canada's High-Resolution Deterministic Prediction System.
- Daily tweets, routine updates of the blog and automated tweets-upon-update.
- Writing and style improvements. Most meteorologists have no training in hosting webinars, writing or communicating with pictures. A training program that will include workshops on blogging and presentation is developing. The skills meteorologists are acquiring through the ACSS perfectly suit the weather office of the future.
- Beginning this year, the Canadian Meteorological Centre in Dorval, Quebec will systematically verify the new High-Resolution Deterministic Prediction System (HRDPS) forecasts for key variables such as wind and precipitation at some high elevation locations in BC.

And finally, a proposal to deliver a Mountain Weather Forecast year-round submitted by Environment Canada was approved. The annual spring freshet creates flooding challenges in many communities. Recreation in the backcountry continues all year. Fires, lightning and flash flooding from severe thunderstorms are serious summertime hazards. The Mountain Weather Forecast will shift focus with the seasons, emphasizing hydrological concerns in spring, and fire weather and thunderstorms in summer.

The future looks extremely bright for avalanche.ca/weather and for everyone that needs a little help making important decisions around British Columbia's wild and frequently severe weather. If the current arc of success holds, this unique blog will become the go-to site for the inside scoop on BC weather, year round.

Schedule of Upcoming **Events**

49TH CMOS CONGRESS & 13TH AMS CONFERENCE ON POLAR METEOROLOGY AND OCEANOGRAPHY

May 31 – June 5, 2015
Whistler, BC

This year's theme is Tropics to Poles: Advancing Science in High Latitudes
For more information: congress.cmos.ca

33RD INTERNATIONAL CONFERENCE ON ALPINE METEOROLOGY

August 31 – September 4, 2015
Innsbruck, Austria

Touching on all aspects of mountain weather and climate.
For more information:
uibk.ac.at/congress/icam2015/

WILDERNESS RISK MANAGEMENT CONFERENCE

October 14-16, 2015
Portland, Oregon

An outstanding educational experience to help you mitigate the risks inherent in exploring, working, teaching, and recreating in wild places.
For more information: nols.edu/wrmc

ICAR CONFERENCE 2015

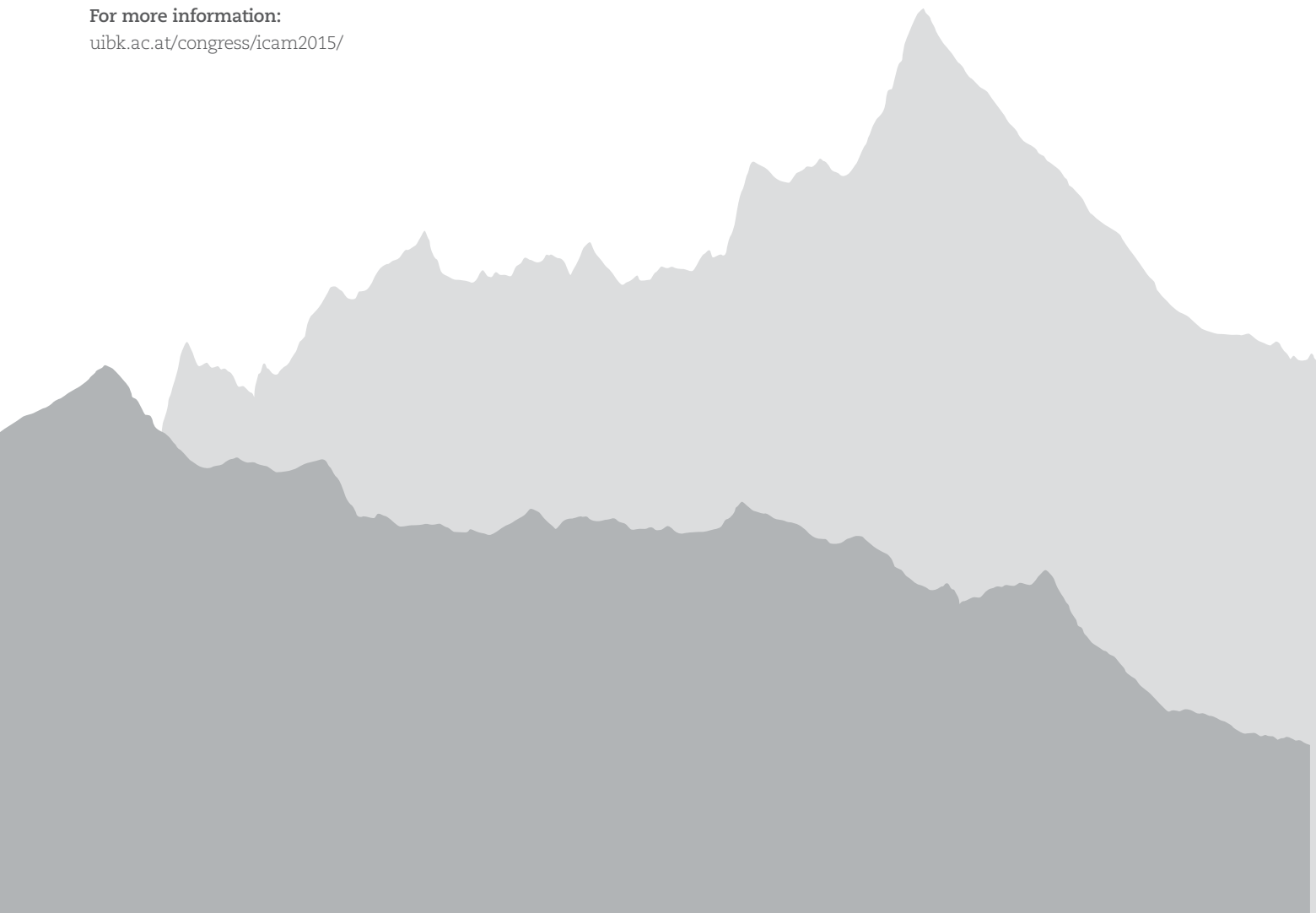
October 5-10, 2014
Killarney, Ireland

Registration is now open for ICAR 2015.
For more information: icar-2015.com

AVALANCHE CANADA ANNUAL GENERAL MEETING

October 31, 2015
Calgary, AB

After ten years of sharing the CAA's May AGM in Penticton, Avalanche Canada will hold their AGM in a different Western Canadian city each fall.
For more information:
avalanche.ca/events

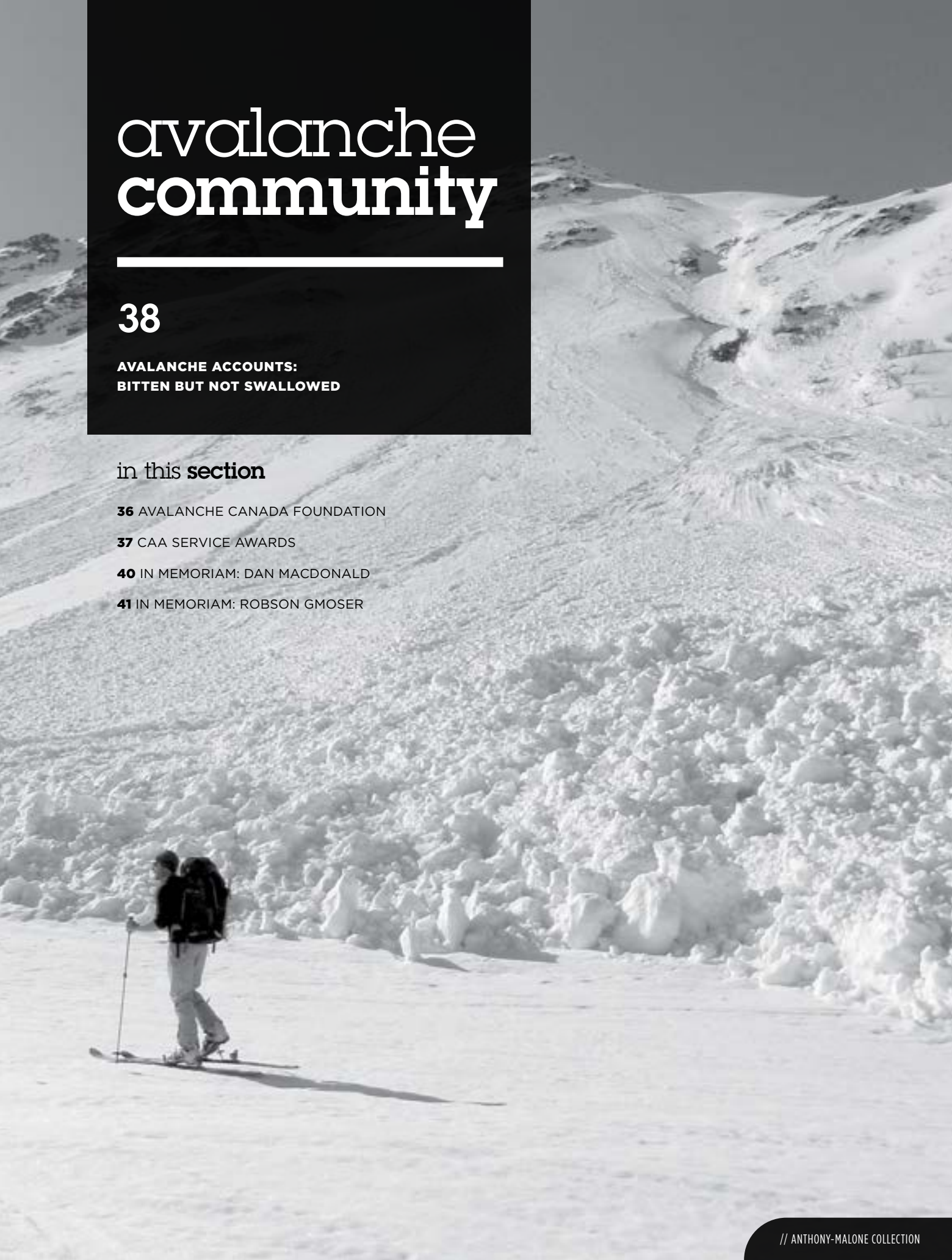


avalanche **community**

38

AVALANCHE ACCOUNTS:
BITTEN BUT NOT SWALLOWED

in this **section**



// ANTHONY-MALONE COLLECTION

Avalanche Canada Foundation

Grants From the Avalanche Canada Foundation

THE AVALANCHE CANADA FOUNDATION FUNDS projects that meet one or more of its goals:

- Information: to support public avalanche bulletins and warnings that will reduce avalanche risk through adequate regional coverage, publication frequency and relevance to user groups.
- Education: to support public avalanche safety education and awareness programs for school aged and adult learners.
- Research: to support research into topics which will reduce public avalanche risk or further knowledge of the snow avalanche phenomena in a field applicable to public avalanche risk reduction

The board of directors will review grant applications twice annually. Applications must be submitted electronically by June 1 or October 15. To download an application form, visit avalanche.ca/foundation/programs.

Cora Shea Memorial Fund Scholarship

THE CORA SHEA MEMORIAL FUND was established in August 2012 to honour the young researcher.

Women of any nationality, who are seeking to do avalanche research and/or study towards advanced avalanche practice are invited to apply for a grant from the fund to assist them with their work. This year, two grants of $750 each will be awarded. The deadline for applications is May 31. For more information about the fund and how to apply for a grant, visit avalanche.ca/foundation/programs#memorialFunds.

CAA **Service Awards**

CAA PRESIDENT AARON BEARDMORE PRESENTING THIS YEAR'S SERVICE AWARDS TO STEPHANE GAGNON LEFT AND RUPERT WEDGWOOD RIGHT // KARILYN KEMPTON

EACH YEAR, THE CAA RECOGNIZES INDIVIDUALS OR ORGANIZATIONS who have demonstrated a significant commitment to avalanche safety in Canada. This year, we awarded CAA service awards to Rupert Wedgwood and Stephane Gagnon on May 5.

RUPERT WEDGWOOD was awarded a service award for his longstanding commitment to professionalism within the CAA. Rupert has spent over a decade of service on various CAA committees and was instrumental in the restructuring of the Complaint Investigation Committee. He has also been a contributing member of the Ethics and Standards Committee since its inception (then the Professional Practice Committee)

STEPHANE GAGNON was awarded a service award for his tireless efforts to try to recover the body of CAA member Sylvie Marois, killed in an avalanche in Nepal in 2014. Without hesitation, Stephane spent six weeks offering knowledge and expertise in the field of avalanche rescue.

Avalanche Accounts: **Bitten but Not Swallowed**

Wayne Flann

AFTER 35 YEARS OF PLAYING AND WORKING IN AVALANCHE TERRAIN, YOU CAN IMAGINE THAT I'VE HAD A FAIR BIT OF EXPERIENCE DEALING WITH AVALANCHES.

PRIOR TO DECEMBER 29, 2014, I had only had one personal close call: I'd once been partially buried in an avalanche. I have successfully ski cut hundreds of size 2 avalanches, and I've gone for a few inconsequential rides in size 1 and size 2 skier accidentals. I've even skied off a couple of size 3 avalanches after deploying explosives, then ski cutting the slope with unexpected results. I credit a combination of luck and acquired skill for keeping me safe for many years.

That all changed on December 29. I was helping an old acquaintance who was working with a Russian snowboard magazine, showing the eight-person crew some of the local terrain. We were using an AStar to access some terrain in the Pemberton Valley. The afternoon had been going well; I had already ski cut several small stiff wind slabs, and we were enjoying some fairly nice turns. The group consisted of advanced riders, and the idea was to expand into some steeper terrain.

I planned a ski cut, which would lead me to a safe location, with the rest of the group in a safe area. However, halfway across the slope, I skied into some softer snow and struck a rock, which momentarily put me off balance. Before I knew it, I was headed downhill in a fast-moving stiff slab. I veered off to the right, watching my tips reach solid snow, but within a few seconds, the tails of my skis were grabbed by the rushing torrent and I was turned 360 degrees in the air. During these brief seconds, I felt my left femur spiral and facture.

Both skis came off, and I got rid of my poles. Suddenly, I was sitting on the side of the avalanche, facing downhill and proceeding at a fairly fast speed. I uttered a few words of profanity and tried some backstrokes, but quickly realized that relaxing and going with the flow would be my only chance of not hurting myself further and getting buried.

Throughout it all, there was very little time to think about anything other than, "How am I going to survive this?" The idea of dying in this avalanche simply didn't cross my mind. After what seemed like an eternity, I finally came to rest about 200 or 250 meters from where I had started. A few chunks of the debris went over my head, but I had been lucky to stop on a debris-created bench, with my left femur partially buried in a rather uncomfortable position.

I radioed to my companions, assuring them that I was not buried but that I did have a fractured femur. Next, I removed my pack, dug out my leg, and placed it gently on the packsack. The adrenaline was still rushing through my body; I felt very little pain as I tried to adjust my leg into a more comfortable position. That thought that I would see my family and friends was comforting, but first, I needed to deal with my femur.

Before long, the helicopter landed beside me, and the crew quickly got to work, pulling out a stretcher and a trauma kit. I was now in evacuation mode, directing a self-rescue with several members of the group. My plan was to head to the Whistler Clinic as quickly as possible to get some

TELL US YOUR STORY

If you have been involved in an avalanche and want to share your story, email us at: editor@avalancheassociation.ca

// DEREK RIENDEAU

WAYNE TOOK THIS PHOTO AFTER DIGGING HIS LEG OUT AND CALLING A HELICOPTER // WAYNE FLANN

much-needed narcotics before my femur started to spasm. The group tied my legs together and secured me to the Robertson stretcher, and we managed a quick load-and-go. I was at the clinic within just 40 minutes, in the company of staff I have known for many years.

By the time they got to my ski boots, I was already off in La La Land. I slept the entire ambulance ride down to Vancouver General Hospital and was in the operating room that very evening. Despite the avalanche cutting off my years of good luck, I had one remaining bit of good fortune: I was operated on by Dr. Blachut, a true craftsman in the orthopedic field. My stay in the orthopedic ward lasted for two days. The entire time, getting out and going home was my top priority: you can get sick in hospitals!

So far, my recovery seems to be going well. I would like to thank those at the scene for their help, the staff at the Whistler Medical Clinic for their care, the ambulance crews for their great work, the Orthopedic Department at Vancouver General for a new titanium femur, and my partner Suze for her care and nursing of a spoiled patient.

I am staying very optimistic and trying to maintain a positive attitude. My plan is to be back doing some easy turns by the end of March. Only time will tell, but it's good to have some goals.

December 29, 2014 was a bad day as a far as avalanche occurrences in the Sea to Sky corridor. There were three other reported events occurring the same day: one where a snowmobiler deployed his airbag, which likely saved his life; another experienced guide was caught and deployed his air bag with no consequence; and a third where a ski tourer cut off a small stiff slab but, luckily, did not get caught in the avalanche.

Avalanches happen. I may take an even more conservative approach the next time I ski cut a stiff wind slab, but I will certainly be back in the mountains skiing powder and doing what I am most passionate about. Over the years I have seen several bad injuries as the result of getting caught on stiff slabs. They accelerate quickly and there is little or no time to ski off them. Many in our industry have gone for rides, some with minor consequences, others with significant injuries such as mine. When dealing with these conditions the conservative approach is certainly the best option, especially if you are able to ski in those areas and avoid the slab entirely. Was I pushing it that day? Perhaps. We seem to want to keep everyone safe yet at times put ourselves in harm's way.

Remembering **Dan MacDonald**

DANIEL (DAN, DANNY) ANGUS MCDONALD passed away on February 11, 2015 from diabetic kidney failure. He is survived by his mother Pearleen Spanos; three children Jennie (Krynski), Parker McDonald, and Jackie McDonald; grandchildren Tynan and Ava (Krynski), and Mirra (Roberts); sisters Darleen (Edlund), Joanne (LaBelle), Tammy (Molander), Pam (McSkimming); and many nieces and nephews whom he loved dearly. He was predeceased by his father, Jim McDonald.

Dan was born in New Westminster on Nov. 7, 1951, and grew up in Surrey, BC. Most of his adult life was spent in Fernie, BC, where he became proficient in the industrial construction business. Spare moments were spent exploring the mountains with his family and friends. Dan loved to fish, hunt, ski and snowmobile. These passions inspired him to build the original Island Lake Lodge in Fernie (1988) and later the Revelstoke-based Mica Heliskiing Lodge (2003). His favorite past time was hanging out at "The Lodge" proudly wearing a ball cap or vest with logo displayed. Days would often find him driving the snowcat, while evenings were spent entertaining guests with his guitar and his gift for storytelling. As a leader in the cat and heliski industry, he was a director of the Canadian Avalanche Association for five years.

Dan embraced life with energy and vision. He was delighted to include his family and friends in his ventures whenever possible. His gentle and generous nature will be greatly missed.

In memory of Dan and to ensure the continuation of his tireless support of young people desiring to enter the backcountry industry, a memorial fund has been set up to encourage those seeking a career in this field.

DONATIONS MAY BE DIRECTED TO: DAN MCDONALD BACKCOUNTRY SCHOLARSHIP FUND

C/O ISLAND LAKE RESORT GROUP
BOX 1229 (602A – 2ND AVE)
FERNIE, B.C. V0B 1M0

ATTN: DOUG FEELY, CEO
250-423-3700 (EXT 3010)
DOUG@ISLANDLAKERESORTS.COM

In Memoriam: **Robson Gmoser**

THE LAST TIME I SAW ROBSON WAS IN MOAB LAST AUTUMN, after he, Olivia and Max had just finished rafting the San Juan River. Debbie and I had dinner with them during which we shared tales and much laughter. Max was the nexus of attention for many of the other patrons of the restaurant. They were the quintessential outdoor family, having just put paid to another adventure. Happy…healthy…loving life.

The trip to Sorcerer Lodge in March 2015 should have been just another working adventure–just one more short chapter in Robson's amazing life. It turned out to be anything but, as Robson was killed in a large avalanche late in the afternoon. While it's tempting to say that it will be his last chapter, that would be a mistake. You see it isn't possible for someone with Robson's charisma and loving kindness to fail to change the people he met. How often did his laugh draw the same response from you? How many times did you wish you could ski like him? How frequently did you suddenly feel that, in his presence, all things were possible?

We all impact those around us, but some leave greater imprints. Whether or not we realize or choose to admit it, we all profit from every relationship. Some, though, seem more beneficial than others. Honorary ACMG member and former ACMG examiner Rudi Kranabitter told me that Robson would walk through fire for you. And someone who would do that will forever be writing verses and new chapters for every life that he touched. Most of us can't fathom the depth of sorrow and grief felt by Olivia, Margaret and some of the people closest to Robson. But we can help keep the chapters in his life-book alive through memories, stories, laughter and actions we know he would approve of. What better way to ensure that Max knows how amazing his father truly was.

Peter Tucker, ACMG Executive Director

Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop off like autumn leaves.

-John Muir

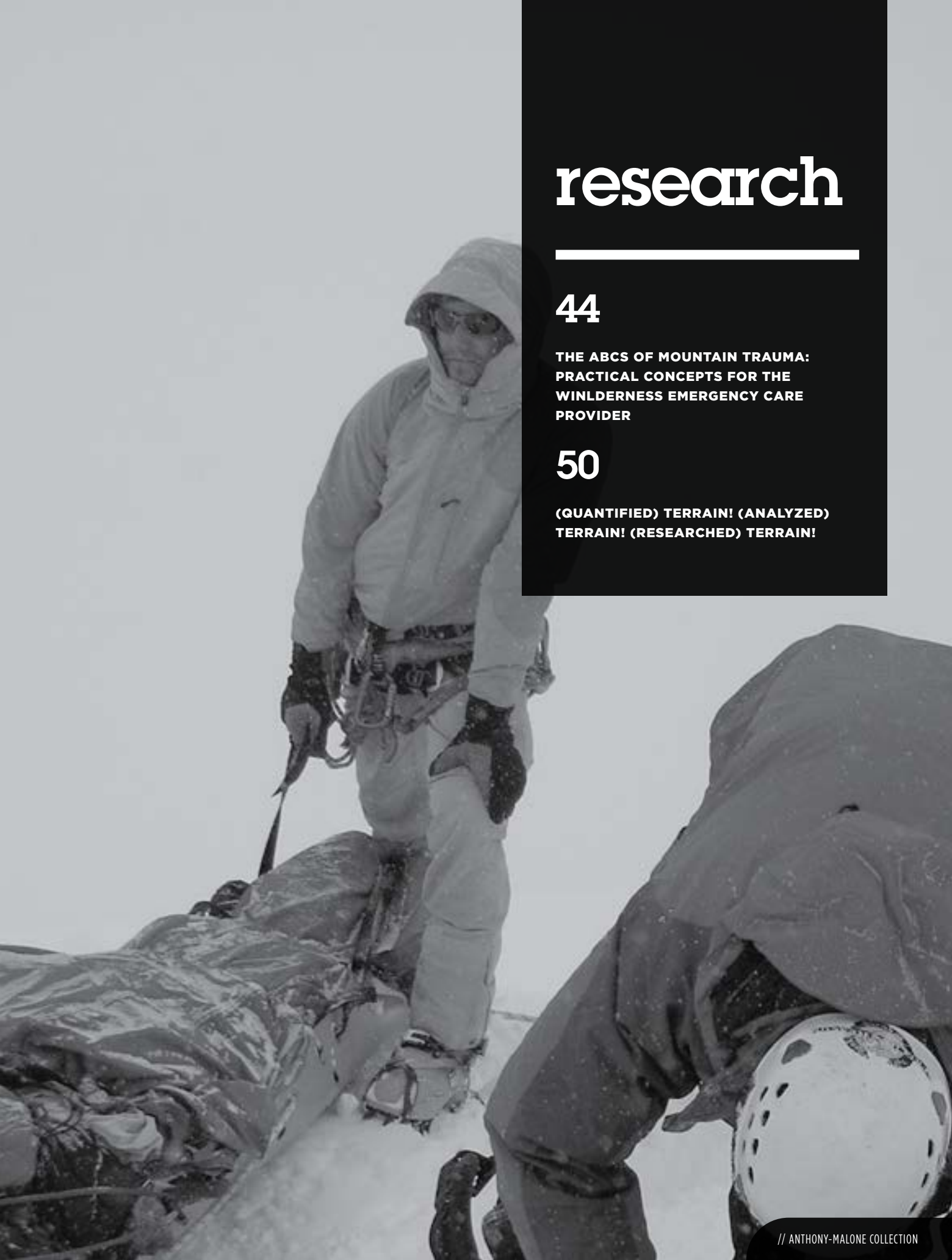
Ortovox S1+ **Recall Notice**

AT THE END OF MARCH, ORTOVOX ISSUED A PRECAUTIONARY RECALL FOR THEIR S1+ TRANSCEIVER, DUE TO THE RISK OF A DISTURBANCE IN THE TRANSMISSION FUNCTION DUE TO A COMPONENT FAILURE.

They issued a recall to replace that component and all affected devices must be sent back. The recall applies only to the Ortovox S1+.

Due to production time for the component, retrofitting will not take place until July. Ortovox hopes to have transceivers back in time for the next winter season. For detailed information about the recall procedure, please visit Ortovox's website for details: ortovox.com/4871--handling_recall.html.

research



// ANTHONY-MALONE COLLECTION

The ABCs of Mountain Trauma: Practical Concepts for the Wilderness Emergency Care Provider

Mike Inniss
MD, DiMM (ICAR)

IF WE SPEND ENOUGH TIME in the mountains, we will to be called upon to provide first aid and potentially more advanced medical care to those who have been injured. Working in the avalanche industry we understand the destructive nature of avalanches, and we know how commonly trauma results for those unfortunate enough to be caught in one. We know from studies that approximately one third of avalanche deaths in North America are a direct result of trauma.

As professionals working in the mountains we have a responsibility to provide compassionate and skilled care to the injured that safely addresses treatable life and limb issues, and expediently delivers them to higher levels of medical care. The mountains are home to inherent challenges not found in the urban environment. This article highlights some of these challenges by focusing the wilderness emergency care provider on the priorities of care far from help under austere conditions.

SCENE SAFETY AND EXPEDIENCY

The most vital concept to keep at the forefront of any backcountry medical rescue is scene safety. It is no exaggeration to consider the three most important concepts to keep in mind on a backcountry rescue are: 1) scene safety, 2) scene safety, and 3) scene safety. Centuries of battlefield experience clearly teach us that the most important factor in survival and the possibility of a good outcome for the trauma patient is the speed with which they are delivered to advanced medical care. Therefore, prior to the typical patient ABCs approach we are all taught in urban trauma care and first aid courses, it is my suggestion and teaching that the "mountainside ABCs" need to be addressed first and foremost.

MOUNTAINSIDE ABCS

A) Assess scene safety (e.g., avalanche hang fire, crevasses, rockfall, lightning). Continually reassess throughout rescue.
B) Barriers to body fluids/environment (e.g., gloves, eye protection, helmet, appropriate clothing). Rescuer and patient protection during the rescue needs to be maintained.
C) Call for help early. Initiate a front-loaded response. You can always stand down response should it be not needed but precious minutes are lost if you wait.

PATIENT ABCS AND APPROACH

The standard stepwise approach to the care of the urban trauma patient starts with a primary survey and corresponding intervention(s) of the patient ABCs (airway, breathing and circulation). This is followed by a secondary survey where a complete body exam further identifies and clarifies all life and limb issues. Interventions that address identified injuries are followed by patient packaging and eventual transport out of the field to a higher level of medical care. This approach provides the backbone to all field trauma care, but often requires modification in the mountains due to environmental conditions, distance from advanced medical care and limitations in equipment and manpower. For example, a prolonged full body secondary survey is often not possible or practical in the mountains given possible time constraints (e.g., daylight fading and helicopter inbound) and risk of compromising the patient's condition by exposure to adverse environmental conditions. Additionally, our expectations of successfully performing advanced interventions may need to be tempered. Routine urban interventions, like the placement of an intravenous (IV) line or application of oxygen, are often not possible in the mountain environment, at least initially.

MOUNTAINSIDE TRIAGE // MIKE INNIS

STAGED SCENARIO // ANTHONY CHAHAL

MOUNTAINSIDE TRIAGE

Patient care is accomplished most efficiently in the mountains by employing mountainside triage concepts. Triage is defined as the decisions one makes in prioritizing actions and treatment interventions given limitations in personnel, equipment and time. Mountainside triage combines a tactical as well as medical component (e.g., you may have to move to a safer location before you can start CPR), and is a notoriously challenging but critical skill for the outdoor care provider to master. Triage decisions often become more difficult as the number of injured subjects increases. They may also be heart wrenching, as in the decision to defer intensive attention on a desperately critically injured subject to ensure the survival of others.

BLOOD AND HEAT

Blood and heat are precious vital life necessities that, unlike in urban settings, are not typically replaceable in the wilderness. However, with appropriate and timely interventions it is hopefully possible to stem their loss and, therefore, they arguably take on the highest priority during triage decisions by caregivers in the field. The rapid and early application of external pressure or an effective tourniquet for brisk blood loss can be life saving. Commercial chemical procoagulants (e.g., QuickClot) can be found in powdered or impregnated bandage forms and can be applied to open, oozing wounds if available.

Immediate hypothermia interventions to prevent heat loss are similarly critical. These include insulation from ground and weather conditions and the consideration of application of external heat sources, most commonly panelled chemical heat pack blankets carried by many rescue teams. I would argue an extra down jacket might be the most important piece of equipment in your medical kit for treating trauma. Remember all outdoor care in cool or cold environments should take place inside a microclimate (e.g., under a tarp) that is sealed from weather, and insulated from ground/snow to prevent patient heat loss and keep first aid providers as warm (and therefore as effective) as possible.

SHOCK

The presence of the signs of shock (tachycardia, weak or absent peripheral pulse, decreased level of consciousness) as a result of trauma is an ominous situation when one is far from advanced medical care. Shock in this setting is most often a sign of blood loss (external or internal) or serious neurologic injury (brain or spinal), and requires advanced resuscitation procedures and often surgical intervention to correct the underlying cause. War theatre experience has taught us that quick field stabilization followed by "scoop and run" to the nearest surgeon provides the best outcome. Field interventions in the setting of mountainside shock include terminating any and all blood loss, consideration of pelvic binding, hypothermia interventions, splinting all fractures and horizontal (supine or lateral) immobilization with the application of supplemental oxygen (if available), followed by expeditious extraction and transport. Mountain care providers must accept that subjects in cardiac arrest as a result of severe trauma have faint hope of survival and this needs to be recognized during triage decisions where multiple subjects, safety concerns or limited resources exist. If CPR is initiated, wilderness CPR protocols generally advise discontinuing resuscitative measures in the absence of vital signs after no more than 30 minutes of CPR.

SPINAL IMMOBILIZATION

Spinal immobilization using standard hard backboards with rigid cervical collars has long been the standard level of care for patients requiring immobilization due to spinal injury or trauma. However, this form of immobilization can be very time consuming, limit transportation options, and be harmful to the patient in the form of pain from pressure points, with the possibility of developing pressure sores or life-threatening aspiration if vomiting occurs while supine. The development of lateral packaging techniques can alleviate some of these concerns. The integration of a decision algorithm (see Fig. 1) to determine the need for

FIG. 1: CERVICAL SPINE IMMOBILIZATION ALGORITHM

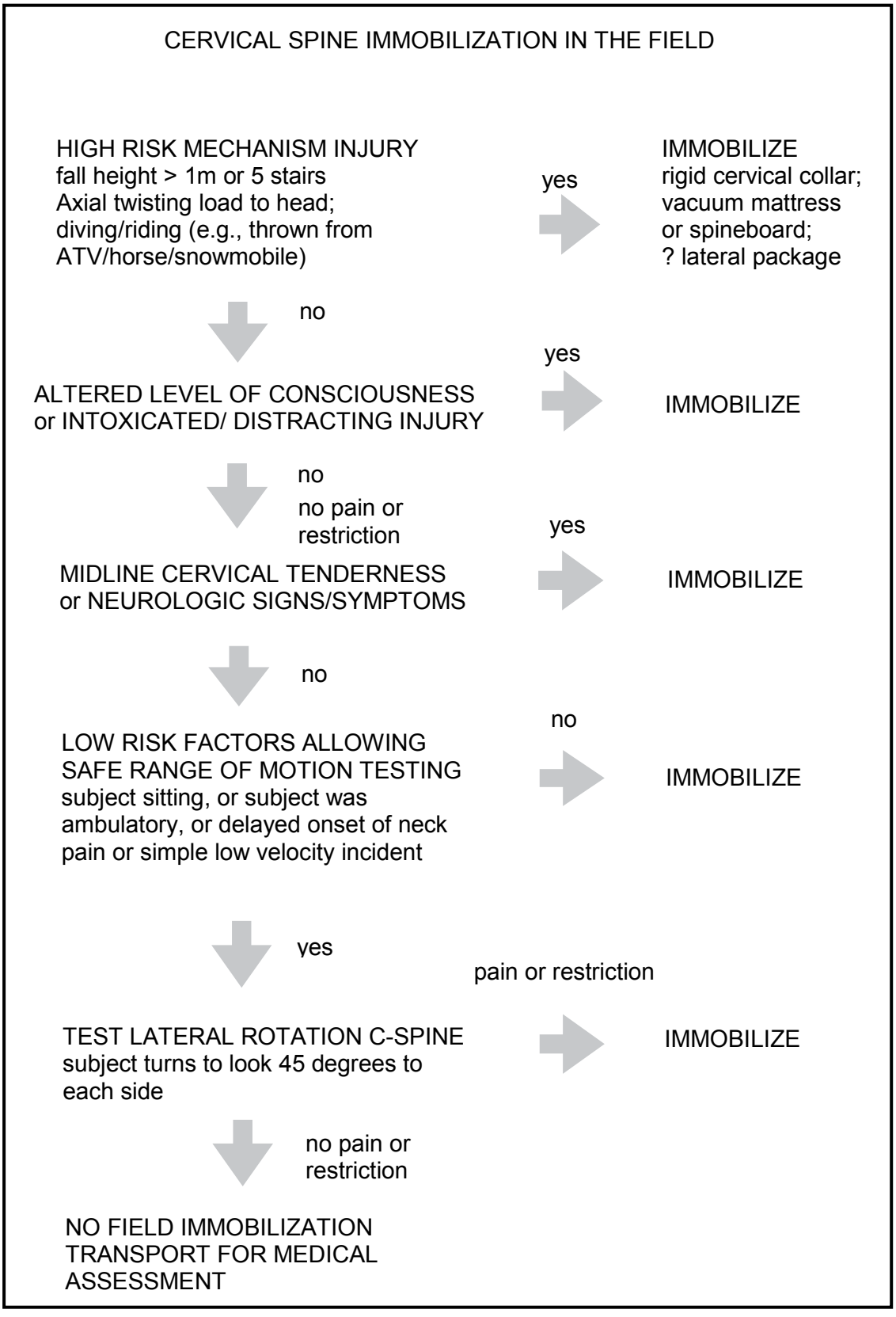


FIG. 2: VACUUM MATTRESS AS A PRIMARY SPINAL IMMOBILIZATION DEVICE

C-spine immobilization in the field has been developed by wilderness care providers based on clinical tools used in modern hospital based emergency room care designed to determine the need for spinal imaging. This algorithm has been widely accepted as standard of wilderness pre-hospital care and is a valuable tool in the decision making process. The addition of the vacuum mattress as a primary spinal immobilization device has revolutionized the transport of the injured subject and if available should be the go-to device due to its numerous advantages over rigid spinal boards (Fig. 2).

PELVIC FRACTURES

The possibility of a pelvic fracture should always be considered in the setting of trauma as a result of a high velocity mechanism of injury. Internal bleeding from such a fracture can lead to shock and therefore intervention may be life saving. The classic teaching of pressing on both hip crests to test for instability or pain is discouraged. Every provider of outdoor emergency first aid should have the equipment and skills to apply an improvised basic and effective pelvic binder. Commercially devised pelvic binders are often carried by SAR and advanced rescue teams. Clockwise from top left, Fig. 3 shows a commercial SAM pelvic binder, an improvised binder with CAT tourniquet and SAM splint, and an improvised with triangular bandage (or two) and tightening stick for mechanical advantage.

FIELD ANALGESIA

Relieving pain to limit the suffering of injured subjects and ease transport is a desirable goal, but can be challenging in the wilderness setting. Warmth, hydration and a compassionate voice are basic analgesic interventions often neglected. Cold packs and elevation of injured limbs can also reduce the burden of pain. Proper splinting is possibly the most effective non-pharmacologic intervention. Traction splinting is effective in managing the pain of mid-shaft femur fractures but is an advanced skill only for properly trained personnel. Medications may play a vital role in obtaining adequate analgesia; however, these should never preclude the above simple steps. Simple oral medications, including acetaminophen, non-steroidal anti-inflammatories (e.g., ibuprofen, naproxen) and occasionally codeine (e.g., Tylenol #3s), are often carried in basic first aid packs. Stronger medications including the opioid-based drugs (e.g., morphine, fentanyl, hydromorphone) may be carried by advanced providers licensed and experienced in their use, and can be delivered by intravenous, subcutaneous, oral, intramuscular or intranasal routes. The benefit of these stronger medications must be weighed heavily over their potential risk when used in the field and should not be used in a cavalier fashion. Side effects, which include hypotension, decreased respiratory drive, loss of shivering response and nausea, could be very detrimental, especially during transport in the field. Providers using opioid analgesic medications should always have the ability

to reverse these medications with the use of the opioid receptor blocker medication naloxone (Narcan) should the need arise.

PSYCHOLOGICAL FIRST AID

Long after the physical injuries have healed, for some survivors of wilderness trauma (and also members of the rescue team) the psychological trauma can continue to affect their everyday life. Post-traumatic stress disorder (PTSD) is characterized by intrusive memories, nightmares, avoidance behaviour, emotional lability and depression. It has been shown that the wilderness care provider can play an important role in reducing this potential burden. During the rescue it is the moment-to-moment compassionate care and mindful communication with the patient that may help reduce the psychological trauma that accompanies backcountry accidents. Early intervention in the form of formal counselling has been shown to be effective and should be sought and supported as soon as possible if the signs of PTSD are present. Offering formal critical incident stress debriefing to rescue teams is a common practice and helps some members cope with the stress of assisting with a backcountry rescue.

CONCLUSION

Providing safe and effective medical care to the injured subject in the mountain environment is challenging to even the most experienced wilderness care provider. Available time and resources are often limited, and the terrain and weather one is working in can be dangerous and daunting. It is by keeping in mind some basic principles of mountainside care reviewed in this article that optimal outcomes can be achieved for subjects and rescuers alike.

My thanks to my colleague Dr. Anthony Chahal for his review of this article.

FIG. 3: PELVIC BINDERS

(Quantified) **Terrain!** (Analyzed) **Terrain!** (Researched) **Terrain!**

Scott Thumlert

WHAT'S HAPPENING WITH avalanche research in Canada these days? The rumours are true. Bruce Jamieson's incredible ASARC research program is winding down after 25 years and exactly 3.4 million snow profiles dug. I think everyone in the avalanche community from the casual recreationist who reads the Avalanche Canada bulletins to the most seasoned avalanche head among us has benefitted from the exceptional work Bruce has spearheaded. Thanks Bruce!

When Mike Wiegele heard that Bruce's ASARC program was winding down, he investigated ways to keep the Blue River research station running and continue to contribute to avalanche safety. He approached me to run the research program in Blue River and to work as a guide. We quickly found a suitable grant from MITACS Canada that would match Mike's contribution, and then approached Pascal Haegeli to see if he wanted to work together as the academic supervisor. Since graduating from his PhD in 2004, Pascal has been conducting interdisciplinary avalanche research; and his role as an adjunct professor at Simon Fraser University would allow him to be my academic supervisor for the MITACS application. This seems like a perfect team for doing some innovative research. Pascal agreed and the three of us wrote a successful grant proposal for two years of funding.

The project is "Terrain, terrain, terrain!" During my time as a student under Bruce, I heard this phrase used over and over again, mostly by guides. Whenever the stability of the snowpack is in question, choose simple terrain. But what exactly does this mean? At what point do you move to simple terrain and what are acceptable terrain choices under different types of avalanche problems? Many professional guides and highly experienced recreationalists have gained this knowledge through vast experience, trial and error, and probably if we're honest, a little luck. Can we use an analytical approach to help understand avalanche terrain selection?

To examine these types of questions, we initiated a GPS tracking study to comprehensively record the terrain skied at Mike Wiegele Helicopter Skiing (MWHS) and Northern Escape Heli Skiing (NEH). During high season, MWHS runs up to 11 helicopters and with NEH in the mix we have an amazing opportunity to create a dataset of terrain skied in avalanche country. To date we've tracked over 6,000 runs skied and also recorded snowpack, weather, avalanche observations, skiing condition, and flying condition data. This comprehensive dataset can be analyzed in many different ways and will open new doors for avalanche safety research. For example, Mike has been operating in the Cariboos and Monashees ranges around Blue River for over 40 years and has a long-established risk management process to keep his guests safe. The data and analysis of MWHS terrain data will strengthen and improve risk management at MWHS. The NEH dataset will allow us to examine the relationship between avalanche hazard, as described by the conceptual model of avalanche risk developed by Grant Statham et al., the strategic mindset presented by Roger Atkins at the last ISSW and CAA spring meetings, and terrain choices.

If everything works out as planned, the research will help us to better understand how professionals select mountain terrain under different avalanche conditions. The research will allow participating operations to capture the terrain expertise of their guiding team and the results can be used to strengthen operational procedures to control the physical risk from avalanches. I'd like to invite everyone in the community to chat with Pascal (pascal@avalancheresearch.ca) or me (thumlert@gmail.com) to help brainstorm and contribute to this exciting project, which will open a new chapter in avalanche safety research in Canada.

Finally, it is a great honor to get the opportunity to follow Bruce's footsteps and continue the avalanche research station in Blue River. These are big shoes to fill, but I will do my best to fulfil the expectations. I would like to thank everybody who made this opportunity possible: Mike Wiegele for his trust and the financial support, MITACS for their financial support as well as Pascal for signing on as the academic supervisor.

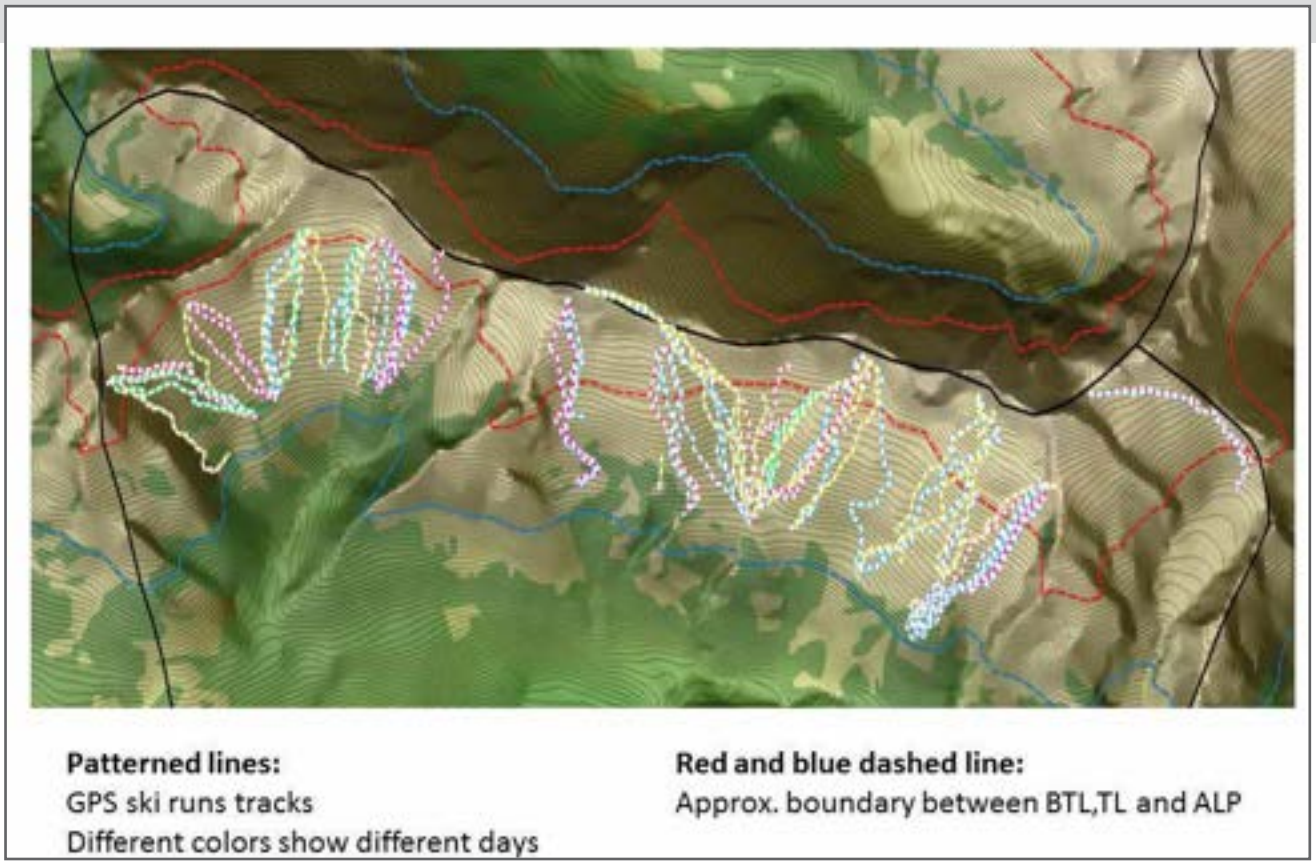
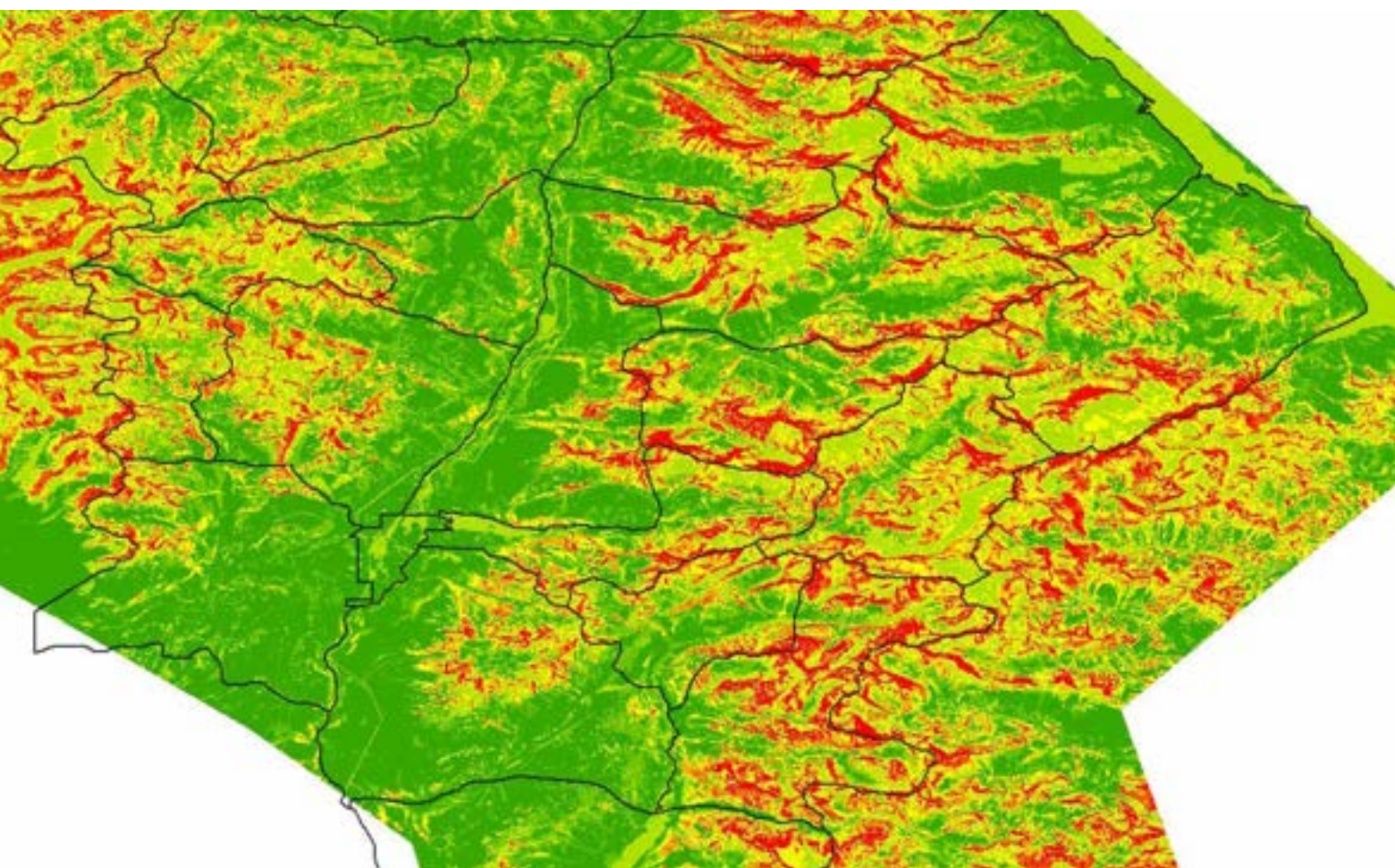


FIG. 1: EXAMPLE OF SKI RUN TRACKING AT MIKE WIEGELE HELI SKIING.

FIG. 2:MIKE WIEGELE HELI SKIING TENURE CLASSIFIED AS AVALANCHE TERRAIN BASED ON ATES. SUMMER WORK WILL FOCUS ON UNDERSTANDING THE INTERACTION OF THE GPS TRACKED SKI LINES WITH AVALANCHE TERRAIN BASED ON STABILITY FORECAST, AVALANCHE PROBLEM, WEATHER INPUTS, AND AVALANCHE OBSERVATIONS.



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