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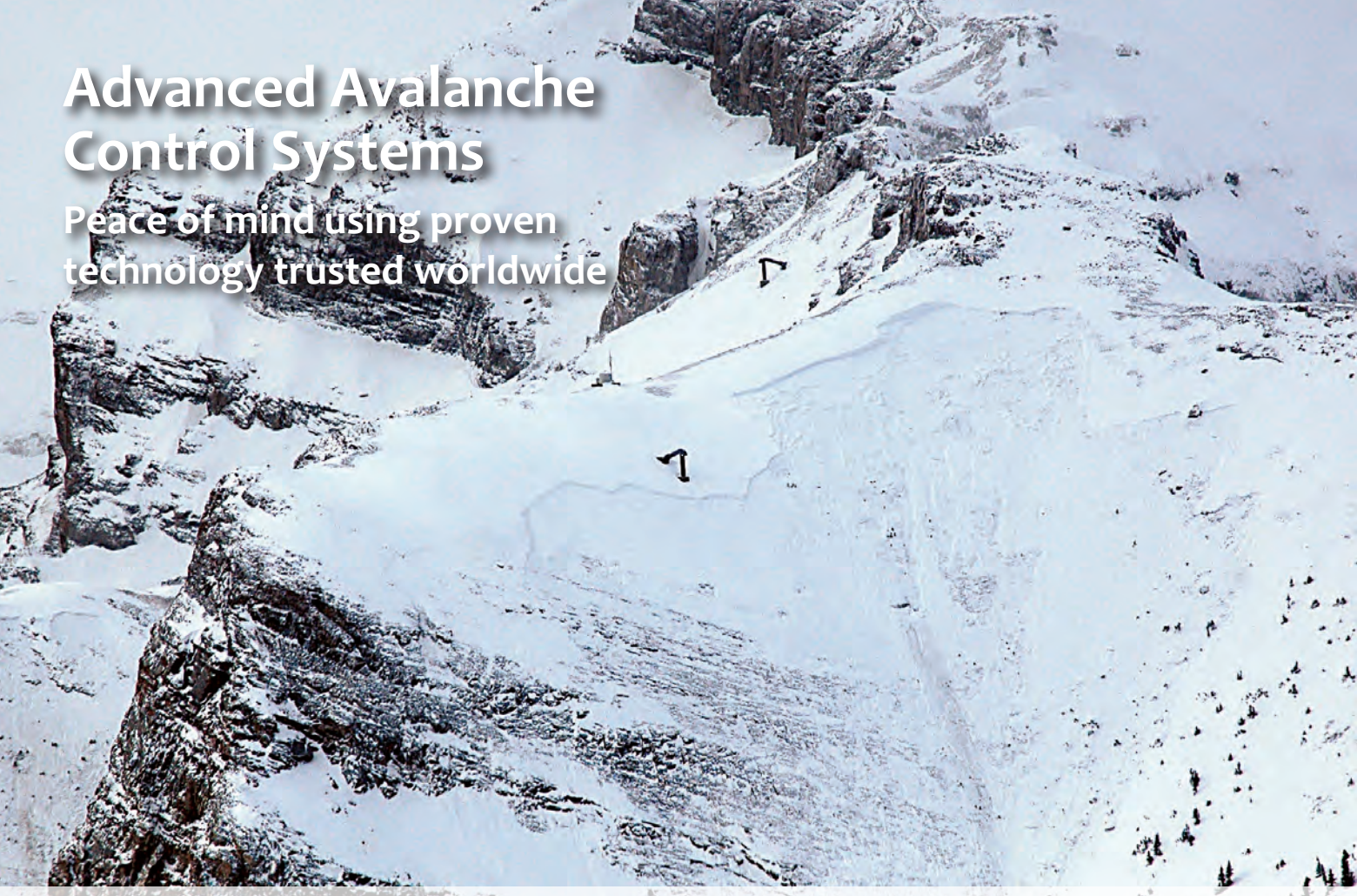

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Look Backward, **Press Forward**

Karilyn Kempton
Managing Editor

THIS FALL, THE ISSW IN BANFF brought hundreds of us together for a week of thoughtful presentations, posters and panel discussions about the avalanche industry around the world. Thanks to ISSW organizers, presenters and everyone who made the event a great success. I felt fortunate to attend and meet so many of you, and spend time with peers like Lynne Wolfe, editor of the American Avalanche Association's quarterly publication *The Avalanche Review*. I really admire Lynne, and am truly impressed by the consistently high quality of articles in that publication every issue. When have a chance to read a copy, jump at it—you can also read their back issues online.

I was involved in organizing this year's "Diva Night," a well-attended and much-needed celebration of women in the avalanche industry. Sixteen percent of attendees were women, and—to be perfectly honest—I'm surprised it was that high. Is the lack of women and diversity a problem? How can we encourage more women and minorities to join the industry? These aren't new questions. I know variations are asked year after year by some individuals and organizations, but it's important to keep asking. Thanks to everyone who attended or supported Diva Night.

The loose theme of this issue is "planning ahead" and choosing a theme like that means things are bound to go a bit sideways. We do have some good pieces on parts of the planning process—from early avalanche control methods during highway construction, snow fence installation for avalanche hazard mitigation, planning out a busy avalanche control day at Whistler, using InfoEx at Whistler Heli-Skiing, training avalanche rescue dogs, and several pieces about transceivers.

March 4, 2015 marks the 105th anniversary of the deadly 1910 Rogers Pass avalanche. That evening, the Revelstoke Museum & Archives launches a new interactive exhibit two years in the making called "The Land of Thundering Snow." Headed up by lead research Dr. John Woods, the virtual exhibit details the history of avalanche science, control and safety in Canada and includes an online and physical exhibit. If you're in the area, I encourage you to attend the opening celebration in Revelstoke.

By the time you read this, winter will have kicked into high gear after a slow start. As always, I welcome any feedback and submissions! Email me at editor@avalancheassociation.ca. Thanks for reading!

Karilyn Kempton

Letter to the Editor

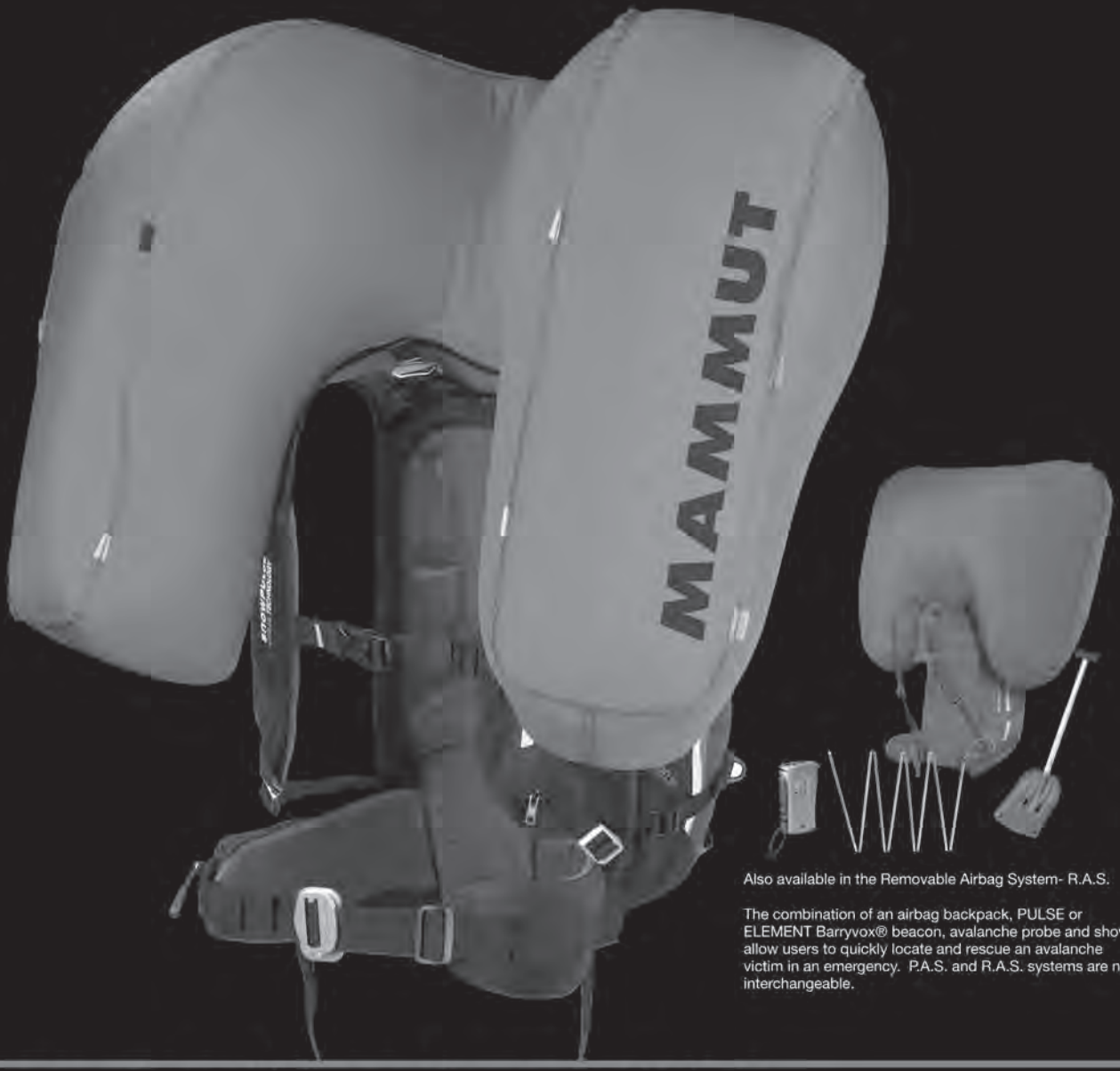
Dear Editor,

RE: HeliCat Canada Update in Fall 2014

Subsequent to my submission to *The Avalanche Journal* last year, I was advised by a respected founding member of the Canadian helicopter and snowcat skiing industry that I misrepresented a founding reason of the BCHSSOA (now HeliCat Canada) that was formed 35 years ago. It was brought to my attention that the core founding reason for the association at the time was to unify the industry in order to work with government to establish our present tenure system—it was not a result of safety concerns.

I sincerely apologize for any offence or misrepresentation I may have caused and thank the founding member for bringing this to my attention.

Ian Tomm
Executive Director



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Contributors

MIKE SADAN
Mike Sadan lives in Pemberton, BC, and is the General Manager of Whistler Heli-Skiing. Mike has had a lifelong career in adventure recreation management in one form or another, and dedicated over two decades of his previous life to river adventures.
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Steve Brushey is an avalanche technician with the Ministry of Transportation, He supervises the Northwest Avalanche Program based out of Terrace, BC.
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BRUCE EDGERLY
Bruce Edgerly is co-founder and VP at Backcountry Access (BCA), and was previously an environmental engineer and contributor to *Powder* and *Couloir* magazines. He is on the board of the Friends of the Colorado Avalanche Information Center and Project Zero. He has presented over a dozen papers on transceiver rescue, strategic shoveling, and avalanche statistics at ISSW and ICAR. A recent convert to mountain snowmobiling, he gets lots of practice "strategic shoveling."
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PETER SCHAERER
Peter Schaerer is a civil engineer who has worked with the National Research Council of Canada for 31 years. He has assisted governments and industries with the planning of avalanche control, helped to initiate the formation of the Canadian Avalanche Association and pioneered the avalanche training for industry. He is retired and lives in North Vancouver.
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ANTON HORVATH
Anton Horvath has been patrolling on Whistler Mountain since 1979, and has been a Whistler Mountain avalanche forecaster for the past 20 years. He obtained his CAA L3 in Avalanche Risk Management and served on the CAA BOD for five years. He's currently VP of CARDA, and he is an operational AvSAR Doghandler. He is working his fourth dog Zeus, an English Black Labrador Retriever.
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THOMAS EXNER
Thomas Exner lives in Kamloops, BC and teaches at Thompson Rivers University's Adventure Studies program. He holds a PhD in applied snow and avalanche science and a IFMGA mountain guide certification. Until last fall, he worked with the safety research group of the German Alpine Club in Munich.
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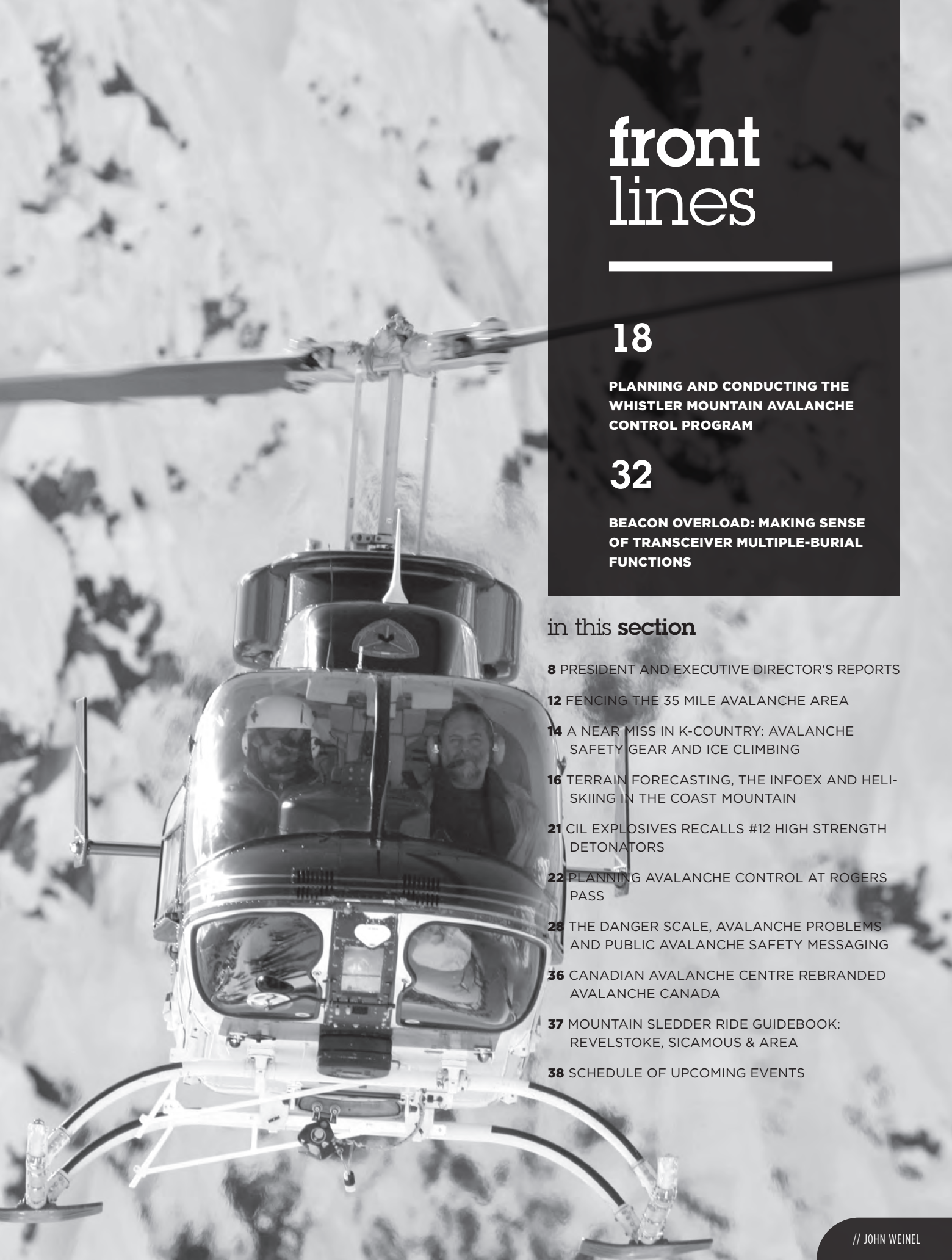

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PLANNING AND CONDUCTING THE WHISTLER MOUNTAIN AVALANCHE CONTROL PROGRAM

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BEACON OVERLOAD: MAKING SENSE OF TRANSCEIVER MULTIPLE-BURIAL FUNCTIONS

in this **section**

// JOHN WEINEL

CAA President's Message

A REGULATORY FRAMEWORK FOR AVALANCHE PROFESSIONALS PART TWO: THE PRACTICE COMPONENTS

This is the second in a three-part series. Watch for the final piece in Volume 109: Spring 2015.

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

Aaron Beardmore
CAA President

INTRODUCTION

This is the second part of a three-part article describing the regulatory framework the CAA is developing. This framework is a comprehensive program designed to regulate the profession in the public interest.

In the first part we introduced the foundational components of the framework: a scope-of-practice statement (component 1), a risk-of-harm analysis (component 2), and a competency profile (component 3). This second part considers the next four "practice" components and describes how they relate to each other and to the first three foundation components. The third and final part of this article will address the last two legal components—government regulation and bylaws.

COMPONENT 4: ENTRY-TO-PRACTICE (REGISTRATION) REQUIREMENTS

Entry-to-practice (or registration) requirements vary amongst professions, and can involve a number of separate but related parts. This fourth component of the regulatory framework may include one or more of the following:

a) graduation from educational or training programs, accredited or otherwise;
b) completion of a supervised work experience;
c) successful completion of a practical examination to assess field-based competencies.

To enter a profession, an applicant must typically satisfy each of the registration requirements. For these requirements to be justified, transparent and fair, they should flow from and reflect the core competencies for the profession as set out in the competency profile (component 3). Therefore, there is a direct linkage between these two components, as illustrated in diagram 2: Addition of the Practice Components.

Further work on the entry-to-practice requirements will be a top priority for the CAA Board and committees in the coming months.

COMPONENT 5: STANDARDS OF PRACTICE

Standards of practice can be one or more documents that set out detailed requirements for actual professional practice. Practice standards should also relate to the competency profile (component 3). In this way, these more detailed requirements bring to life those core competencies.

Practice standards should help members of the profession avoid or minimize the identified risks of harm that could result from incompetent practice. In this way, the risks of harm (component 2) addressed in the competency profile (component 3) should be mitigated by the standards of practice. This relationship is illustrated the diagram.

The association's bylaws can address failing to comply with practice standards. Remedies and enforcement may involve complaint investigation and disciplinary processes. Bylaws (component 8) will be addressed in the third part of this article in spring 2015.

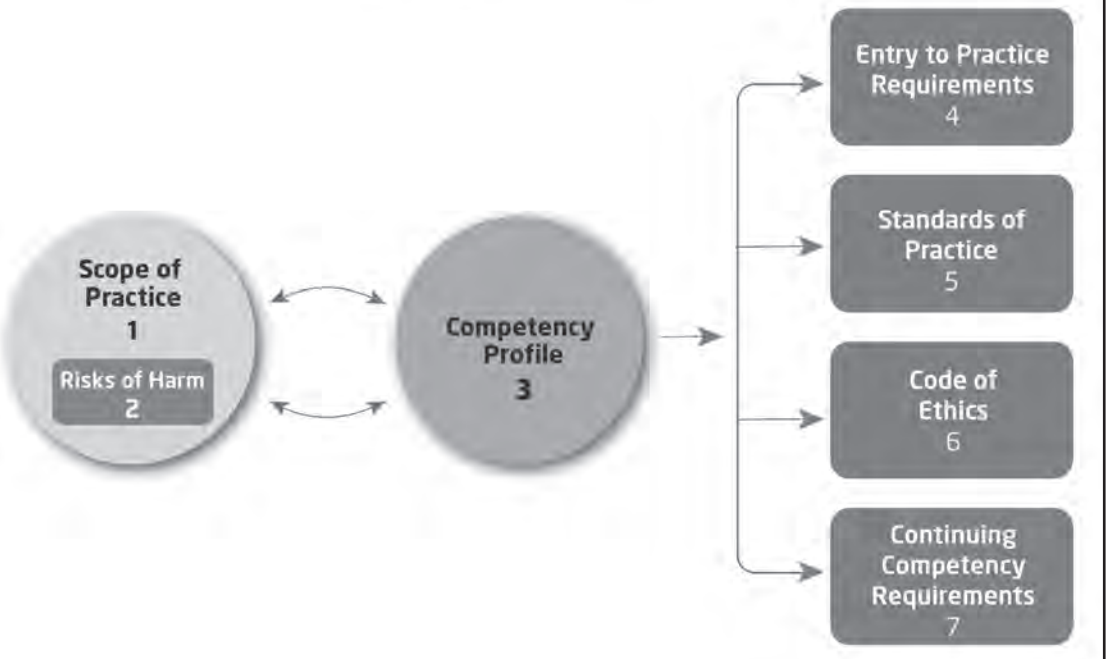
The CAA has already developed several documents that set out the standards of professional practice, and is currently working on others. The CAA's *Observation Guidelines and Reporting Standards* (OGRS) is one example of these practice standards. Another example is the *Guidelines for Snow Avalanche Risk Determination and Mapping in Canada*, currently being updated by the Framework for Avalanche Risk Assessment and Mitigation (FARAM) working group. Additionally, an ad-hoc committee is developing practice standards relating to terrain competency with the assistance of two external consultants.

The Ethics and Standards Committee (previously the ProCom) is working on a strategy to develop a comprehensive set of practice standards which will provide clear and comprehensive information that members will be able to apply in their daily practice. In the months to come, drafts will be circulated to the membership for comment.

COMPONENT 6: CODE OF ETHICS

A profession's code of ethics provides a series of value-based statements to guide the behaviour and personal conduct of members of the profession. A code of ethics is intended

DIAGRAM 2 Addition of the Practice Components



to help members avoid or minimize risks that can result from unethical practice or personal shortcomings. Because these ethical standards will also be based on information in the competency profile (component 3), there is a direct relationship between these two components, as illustrated in the diagram.

As was the case for practice standards, a breach of an ethical standard can be enforced through the complaint investigation and disciplinary processes set out within the association's bylaws (component 8). This component will be addressed in detail in the third part of this article.

Revisions to the CAA's *Code of Ethics* began in 2012. Many members and external resources contributed their efforts to complete the new *Code of Ethics*, which was unanimously approved by the membership at the 2014 AGM. The revised *Code* joins the other practice components of the regulatory framework that are already in place.

COMPONENT 7: CONTINUING COMPETENCY REQUIREMENTS

Continuing competency requirements ensure that members of the profession maintain adequate and current levels of skill and ability. Typically, these requirements apply after an applicant has become a member of the profession. Like the other practice components, and as shown in the diagram, the continuing competency requirements should be based on and reflect the competency profile (component 3).

Sometimes referred to as continuing education programs or continuing professional development, continuing competency requirements are often mandated through an association's bylaws (component 8). These requirements can take different forms within the bylaws, such as requiring members to complete a prescribed number of hours of continuing education programs within a defined period of time.

Continuing competency is already part of the CAA's registration renewal program; however, a major overhaul of this system is currently underway which, in the months to come, will involve several committees. Revisions to the current program will be presented to the membership at a future meeting.

SUMMARY

In this second of three parts, we discussed the four practice components of a comprehensive regulatory framework. The attached diagram shows the relationship between these four components and how they are integrated with the first three foundation components considered in the first part. In the third part of this article, we will discuss the last two legal components, and address in more detail the dynamic relationship among all nine components.

Aaron Beardmore, CAA President

Joe Obad
CAA Executive Director

CAA Executive Director's Report

"BEING BUSY DOES NOT ALWAYS MEAN REAL WORK. THE OBJECT OF ALL WORK IS PRODUCTION OR ACCOMPLISHMENT AND TO EITHER OF THESE ENDS THERE MUST BE FORETHOUGHT, SYSTEM, PLANNING, INTELLIGENCE, AND HONEST PURPOSE, AS WELL AS PERSPIRATION. SEEMING TO DO IS NOT DOING." - THOMAS EDISON

"YEAH, SURE! SORTA! NOT ALWAYS..." - JOE OBAD

IN THIS EDITION OF *The Avalanche Journal,* we draw upon the lessons of planning at different scales. In many ways, these pieces reflect the aspiration Edison lays out in his thoughts above. When planning, skill, experience and luck come together, amazing things happen.

And then there are the other days!

What would Edison's wife have made of his thoughts? She likely saw a thousand days where he came back from the lab with his head down because things did not go as planned. The truth is heading into any season we make the best plans we can, and adjust them as reality sets in to devour false assumptions we made, our lack of resources, and other limitations to the planning process.

The flipside of good planning is making room for resilience, adaption and faith that one's skills and experience will be enough to address all the curveballs planning could not. These traits helped Edison head back into the lab the next day. The same qualities animate CAA members facing a very tricky snowpack in Western Canada with cold clear spells rotting out the early snowpack, followed by very late rain events and crusts setting up what may be a very nervous season.

At the CAA, we have fielded challenges on behalf of members in the same spirit. Through 2013 we were asked by WorkSafeBC to comment on versions of OHS Regulations 4.1.1 and 4.1.2 to replace the previous version of 4.1.1 which was never enforced. The saga of these regulations for avalanche safety plans are a good stick in the eye to any pat aphorism about planning.

The CAA and its members planned hard and gave a great deal of foresight to working in the environment the previous version of 4.1.1 offered, in terms of creating the QAP matrix, designing and implementing ITP's Applied Avalanche Risk Management Level 3 course, and adapting to a culture of Avalanche Safety Plan requirements.

From Edison's view, much of this work might be for naught given the implosion of the earlier version of 4.1.1 and the QAP matrix. Certainly many members expressed this view to me and the board when the road ahead was unclear. But much of that "busy work" of our "plan gone wrong" has become core to avalanche practice in Canada.

The Level 3 course remains in high demand with both Canadian and international practitioners—not because WSBC demands it, but because it helps practitioners embrace and adapt globally recognized best practices to their work environments. Similarly, avalanche safety plans have been widely adapted as a industry best practice, even without the force of WSBC enforcement.

In October 2014, the WSBC board passed the new version of 4.1.1 and a new regulation 4.1.2. Learning from what worked and couldn't work in the earlier 4.1.1 , WSBC, the CAA and like-minded stakeholders have wrestled this new regulation into something applicable and workable for all avalanche environments, working closely on input to the guideline. A huge development is the shift from the QAP to the "qualified person." This shift makes avalanche practice less of an outlier and more inline with other workplaces where expert judgment is required.

Of course the regulation is not perfect. We need a long-term answer to the question of who is a qualified person in the context of avalanche work. WSBC defines a qualified person as someone who is " knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof." But what does that mean in terms of avalanche practice? President Beardmore's articles on competency continue to lay out the picture of how the CAA intends to shape competency for its members.

The development of the competency profile concept will be talked about a lot heading into this year's spring meetings. Like regulations 4.1.1 and 4.1.2 it has gone

through planning, execution, adaption and more planning! From the wreckage of the QAP concept in 2013, and the CPD session "Professionalism in Scope" that year, members offered critical feedback that has empowered the the Education, Standards and Ethics, and Membership committees to help me and the board shape the competency profile development process and how it might define a qualified person—from a field technician deciding to cross a slope, to a forecaster, to an avalanche program designer.

As we plan, lurch ahead, adjust and move forward again towards helping members define competencies for qualified persons in the context of avalanche risk assessment and management, all members should push the association to plan in the spirit Edison seeks. But we all need to backstop those planning aspirations with good faith that resilience and adaptation are also keys to ensuring the competencies that serve the public interest and member practice as we move ahead.

Joe Obad, CAA Executive Director

Fencing the **35 Mile Avalanche Area**

Steve Brushey

APPROXIMATELY 80% OF HIGHWAY avalanche road closures along Highway 16W occur in the 35 Mile avalanche area, located 56.4km west of Terrace. Compounding the problem is restrictive narrow lane width, due to a CN rail track on the south side of the highway and the 35 Mile rock bluff on the north side. Poor sight lines, and lack of a ditch and snow storage add to the 35 Mile problem. This area is also prone to ice fall, resulting in motor vehicle accidents and numerous near misses. Currently the avalanche hazard at 35 Mile is managed through preventative closures and avalanche control, which fall under the Ministry of Transportation and Infrastructure Avalanche Safety Plan. The ice fall hazard remains the responsibility of the maintenance contractor and is mitigated using a high powered rifle with limited success.

During the winter of 2012-13, an increase in ice fall garnered the attention of Ministry representatives. A consultant was hired to find a solution to both the ice fall and avalanche hazard. Thurber Engineering and Dynamic Avalanche Consulting were retained to provide ice fall solutions, rock structure mapping and avalanche fencing design.

The Thurber/Dynamic report's scope only considered avalanche fencing structures. The study did not include avalanche control products, as the Ministry of Transportation Avalanche and Weather Program preferred a longer term, more permanent solution that would eliminate the need to do control work at the East Bluffs, significantly reduce or eliminate avalanche hazard forecasting, and provide a cost effective solution. Of interest, McElhanney Engineering was retained by a regional project management team, which looked at several high level solutions which included rock cuts, tunnel, causeway and snow shed options. Costs ranged from $37 million to $140 million. Other than the snow shed option, avalanche snow fencing would be required for all of the other options. Avalanche snow fencing made the most sense economically in both the short and long term, given the scope of the initial project.

The MoT Northwest Avalanche Program was concerned about the potential for the snow fences to increase the amount of melt water through melt-freeze cycles, leading to a possible increase in ice fall. In order to further study the potential problem, the Mid-Chutes section of 35 Mile was selected for a trial fencing project. If meltwater or ice fall increased, the likelihood of falling ice impacting the highway would be negligible due to terrain configuration at the Mid-Chutes. In addition, the avalanche hazard at the Mid-Chutes would be mitigated.

During the early spring of 2013, the Northwest Avalanche Program gathered the necessary permits required to proceed with the project. These included archeological and environmental assessments, and a permit to construct a helicopter pad in advance of any required work. During this time, Thurber/Dynamic made site visits to the area to gather information and data required to complete their initial report. This report was finalized in August 2013.

Due to various delays, in the fall of 2013 the project was postponed until 2014. In December 2013, 81.7m of 3.0Dk GeoBrugg Spider Avalanche Fencing arrived in Terrace and was stored for the winter.

In the spring of 2014, the Northwest Avalanche Program began administrating a contract for the installation of the fencing at the Mid-Chutes. Retaining an Engineer of Record for the project did prove to be a challenge, however once finalized, the planning and design of the installation

BECAUSE THE SITE WAS ONLY ACCESSIBLE BY HELICOPTER, QUANTUM HELICOPTERS IN TERRACE WAS CONTRACTED, PROVIDING DAILY ACCESS TO THE SITE AND SLINGING OF ALL MATERIALS, REQUIRING A TOTAL OF 75 HOURS OF FLYING

began. This took longer than anticipated. Due to the overall cost estimate, the project now qualified as a Major Works Project and was advertised on BC Bid for qualified installers. The contract closed in early September and the contract was awarded to Pacific Blasting and Demolition of Burnaby, BC. Installation began on September 26 and was completed November 4, 2014.

The installation consisted of several phases involving site preparation and danger tree removal, fence and anchor layout, anchor drilling and grouting, anchor testing, and fence installation. During this time, technical support was provided by Geobrugg, Dynamic Avalanche Consulting and Thurber Engineering. Because the site was only accessible by helicopter, Quantum Helicopters in Terrace was contracted, providing daily access to the site and slinging of all materials, requiring a total of 75 hours of flying. A gravel pit close to the work site was used for the daily mobilization of crew and materials.

Traffic control was required throughout the duration of the project, requiring delays of up to 20 minutes to ensure public safety while Pacific Blasting and Demolition crews performed their work 350m above the highway. During the initial phase of danger tree removal, several track occupancy permits were required from CN Rail in order to safeguard the rail right of way.

Despite a very wet fall, the project was delayed for only three days when crews could not work. This proved testament to the hardy nature of the installation crew and the expert flying of Quantum Helicopter pilots.

With the trial phase fencing installation now complete, the fencing will be monitored throughout the winter of 2014-15 to determine the feasibility of the next phase of avalanche fencing for the East Bluff area. The East Bluff phase requires approximately 400m of fencing to complete the main avalanche area. Once complete, the final phase of ice fall hazard mitigation will follow, requiring an ice retaining structure and drape nets. A short, low elevation rock cut is also a possibility.

Moving ahead, the East Bluff start zones of 35 Mile avalanche area face environmental challenges which include nesting birds, bats and goat kidding areas. In addition, archaeological points of interest need to be preserved. The size of the area will also require the construction of another helicopter pad and many more track occupancy permits from CN Rail. An early analysis suggests the work can be completed over two months which if undertaken during the summer months with longer days and technically better weather, should promote efficiencies and cost savings.

PACIFIC BLASTING AND DEMOLITION CREWS PERFORMED THEIR WORK 350M ABOVE THE HIGHWAY

// KANANASKIS COUNTRY PUBLIC SAFETY

A Near Miss in K-Country: **Avalanche Safety Gear and Ice Climbing**

Mike Koppang

I WORRY WHENEVER I GET AN EMAIL from Karilyn at the CAA—I figure I have either once again forgotten to pay my dues, dated a cheque wrong, or done something else to create undue work for association staff in Revelstoke. Thankfully, this time it was simply a request to write about last winter's busy rescue season out here on the east side of the divide. The 2013-14 season was busy with responses but one event sticks out in my mind, especially in the early season.

The incident occurred in a popular early season ice climbing area known as Ranger Creek, in the Smith Dorrien region of Kananaskis. The climbs in this area see lots of early season ice climbing traffic, in part due to their short, 45-minute approach and short drive from the Calgary/Canmore area. These climbs also, unfortunately, have a long history of catching parties off guard regarding avalanche hazard, and have been the scene of a few burials and accidents. Thankfully, we have had no fatalities in this area related to avalanche accidents, but despite all the public messaging this area still seems to produce an involvement every few years.

The accident occurred in the late morning of November 2, 2013. It was during our first major storm of the season, with relatively small prior snowfalls. The request for assistance came in via a Personal Locator Beacon, which is similar to a SPOT device but transmits its signal to a different call centre coordinated by the Department of National Defence in Trenton. Through the registration details of the device, we were able to determine that it was owned by a European group who were climbing and skiing in the Rockies, and the

latitude/longitude of the emergency transmission put it somewhat close to the climbing area up Ranger creek.

Conservation officers who work within the Kananaskis Country Public Safety program responded to the area to look for cars and perhaps talk to people near the trailhead to gather some information and initiate a response. Public Safety Specialists Jeremy Mackenzie and I were unable to fly with Alpine Helicopters from Canmore due to heavy snowfall and limited visibility, and had to respond by ground. Conservation officers on site reported localized weather of S4 with moderate SW winds and 20cm of accumulation on the road since earlier that morning.

As conservation officers reached the trailhead, they observed one person walking out of the area who reported an avalanche above the routes known as Chalice and the Blade and Lone Ranger. These are two 60m grade 4 and 4+ routes located at the head of the valley in complex terrain. The reporting party informed the officer that two separate groups of three people had been walking up to the base of the two routes. As they walked toward the routes, they were discussing the avalanche danger and commenting on changing conditions in the valley due to the associated heavy snowfall. As both parties arrived at the base a few minutes later, they discussed the avalanche danger. As this discussion took place, all six people were struck by an avalanche from the overhead slope. None had any avalanche safety equipment.

Most members of the two separate parties had already put their helmets on during the discussion about the increasing avalanche danger. As a result, their backpacks were off when the avalanche occurred, and what gear they had was scattered across the slope. The slide was 40m wide and ran for 250m. We were unable to get a fracture depth or failure plane, but suspected it to be the October rain crust located just above the ground.

Of the six people hit, two remained on the surface, two were partial burials with their heads above the surface, and two were buried face down. The first person buried face down was able to self-extricate and clear their own airway, but the second was located 100m downslope with only part of a boot sticking out. This person was dug out using hands, helmets and a few ice tools that the two parties still had with them. The victim was unresponsive and the group initiated artificial respirations/CPR and pressed the emergency notification on their personal locator beacon. The victim recovered a few minutes later and amazingly was able to walk out on their own a short while later. No one in the group suffered any major injuries.

I spoke to one of the members of the group back at the trailhead later that morning. They told me that when they first left the parking lot, the terrain around them and the route was mainly gravel or bare rock with some patches of snow. They recognized as they headed up towards the route that the avalanche danger was increasing, but failed to recognize just how quickly it was changing. The contributing factors in the accident were likely this failure to adapt to the new information as it came in combined, with high levels of motivation for that first day out climbing.

Another interesting point is that all people involved were wearing their helmets during the slide, and a few of those helmets suffered damage during the event from striking rocks and other debris. Helmets perhaps minimized the extent of injuries suffered.

During follow-up conversations with two parties, they recognized that were pretty fortunate to sustain only minor bumps and bruises for injuries. They lost lots of gear on the slope, and learned lessons from the near miss. While I did not ask if they would carry avalanche gear on their next outing, I kind of assumed it. One person decided abstinence from ice climbing was an even better approach, which made me chuckle.

Using companion rescue gear while ice climbing is becoming more of a norm these days, as it is advocated by the Association of Canadian Mountain Guides and different guiding companies. If all six people involved had avalanche safety gear at the time of the avalanche, the outcome would not have been that different, as everyone was visible from the surface—luckily. However, having a shovel or shovels would have made the rescue faster and more efficient. Having said that, if the debris had buried the exposed boot just a few centimetres deeper under the surface, there is a good chance that this accident may have resulted in a fatality.

There are lots of good options for lightweight shovels and probes that can be taken ice climbing these days. For me, when the skiing get so bad that I have to go ice climbing, my gear will be with me in my pack.

Terrain Forecasting, the InfoEx and Heli-Skiing in the Coast Mountains

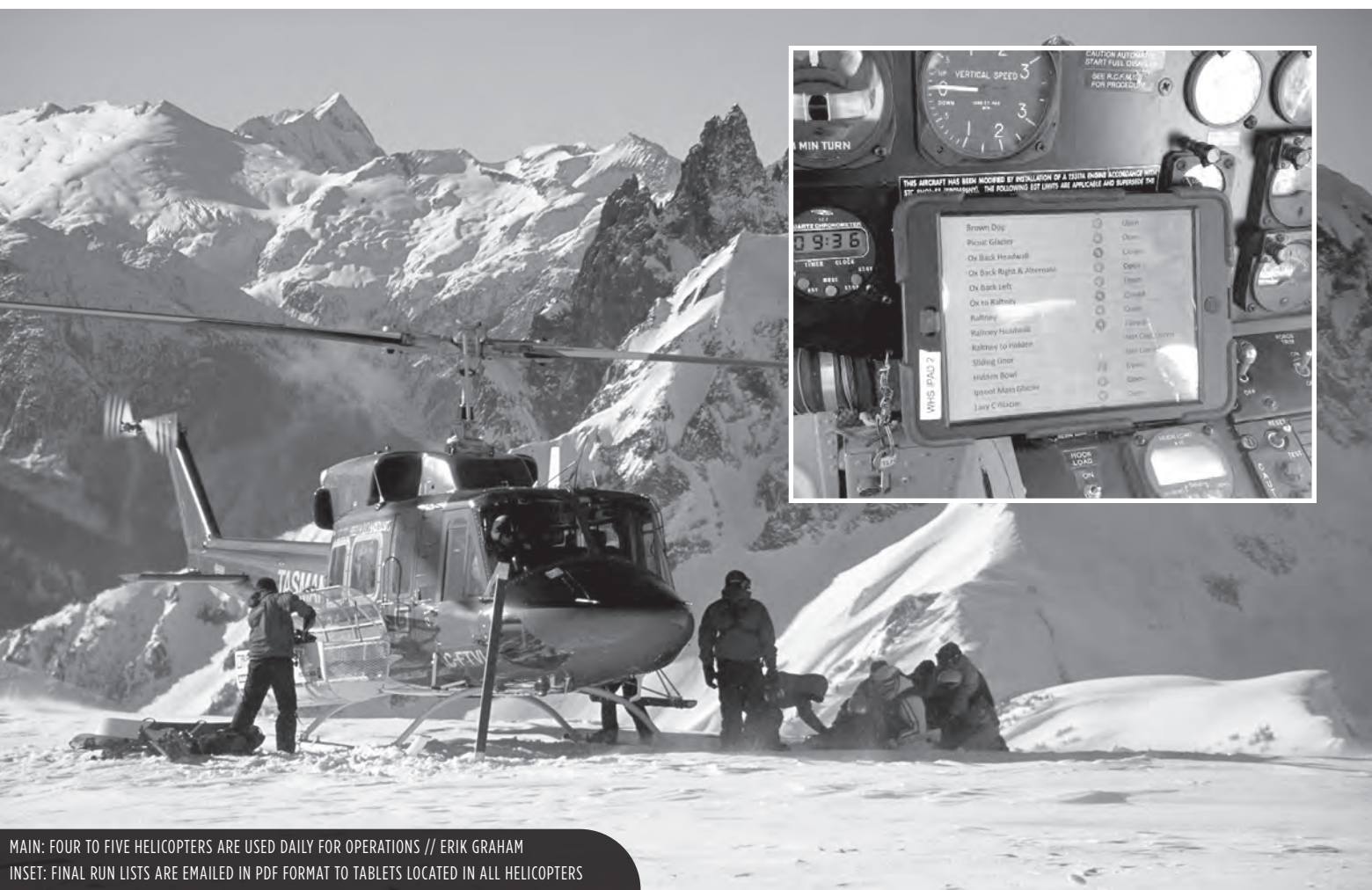
Mike Sadan

WHEN THE CAA KINDLY REQUESTED AN ARTICLE for the *The Avalanche Journal* on how Whistler Heli-Skiing uses the new InfoEx, some questions crossed my mind. These were the same questions that crossed my mind last spring at the CAA CPD day in Penticton before a presentation on the same subject. What could we add? Wasn't everyone using the same program, the same way? The answer seems to be yes and no.

Whistler Heli-Skiing is 99% day heli-skiing in the Coast Mountains: we get milder temperatures, a deeper snowpack, PWLs that heal quickly, but more storms and less tree skiing. Cancelled days can leave gaps when the avalanche hazard builds or changes. We can operate up to 100 skiers per day using four to five helicopters spread out over a large geographical area. All of these logistics and assessments are coordinated by staff who are not lodge based, and go home in the evenings. Geographically, staff can live 125km from each other and have different schedules and days off. What this all means is that our systems must be web-based.

Each day, a different guide runs the morning meeting. These can include a big team, so the culture in the room has an impact on the end result. Our assessments and forecasts lead to decisions that should be:

1. Collaborative (influenced by those present)
2. Supported (by data, information and established processes)
3. In-line (with regional or industry wide practices)



MAIN: FOUR TO FIVE HELICOPTERS ARE USED DAILY FOR OPERATIONS // ERIK GRAHAM
INSET: FINAL RUN LISTS ARE EMAILED IN PDF FORMAT TO TABLETS LOCATED IN ALL HELICOPTERS

MIKE SADAN'S TERRAIN FORECAST MODEL

INVOLVEMENT OF ELEMENT AT RISK: SKIER	VERY LIKELY	LIKELY	UNLIKELY-POSSIBLE	VERY UNLIKELY-POSSIBLE	SIZE
BASAL FACETS	nowhere	nowhere	thin, steep rocky area, north aspects, high alpine, moraines	triggered by cornice failure from above	3 (4)
FEB 10 LAYER	nowhere	nowhere	shallow snowpack, steep unsupported terrain, alpine & treeline elevations	step down fracture from a powerful trigger	2.5 (2-3)
WIND SLAB	steep terrain that is windloaded, 45 deg and up	unsupported terrain on lee loaded features, 40 deg and up	35-40 deg on small convex rolls. TL elevation where a crust had formed previously	all supported terrain but caution overhead hazard	2 (1-2.5)

We canvass nearest neighbour snowpack observations. Of particular interest is our peers' terrain usage from the previous day, sometimes described as slope angle for example. To determine the hazard from avalanches themselves, we use the industry standard conceptual model of avalanche hazard (Statham et al., 2010). We consider each avalanche problem layer independently and identify its characteristics on a whiteboard for easy visual reference. Likelihood and location in the terrain are recorded in general terms. With that, we choose the hazard rating for the day. Although the rating is established through this structured model, the end result can still retain a level of ambiguity and judgment. In 2013-14, we dropped the stability rating from our operation with no negative repercussions. The entire process is documented in the InfoEx where we maintain our database.

We move on to run selection, which is a broad-based approach to forecasted terrain usage. Once again, the conceptual model and hazard rating simply informs our decisions, which are still based on our best judgment and experience. There can be hundreds of runs on our list and limited time to consider them, so much of the process is a heuristic-based exercise. The opportunity is there to close dangerous terrain, and the group dynamic balances biases from those with a naturally more optimistic approach and who see positive outcomes against those who may see things more negatively and are critical thinkers. We email a PDF of the final list to tablets that live in each helicopter. Our assessments through group decision making is very important, but is not a substitute for judgment and terrain navigation choices by our experienced guides using real-time information observed in the field.

We are working on a new web-based "trip report" program for this winter to record runs skied, staff, snow quality, incidents or events, wildlife sightings and interactions with the public.

At the end of the day, logistics preclude us from having a team-wide afternoon meeting, so individual pods from each helicopter meet and debrief. Each lead guide enters observations and snow pack assessments into the InfoEx, and the morning meeting facilitator makes submissions for the entire company for industry use. Our IT department has been working on a new web-based "trip report" program for this winter which will allow us to record runs skied, staff, snow quality, incidents or events, wildlife sightings and interactions with the public.

We draw up, store and share snow profiles by emailing PDFs created in mobile applications and web-based programs from the USA. I hope to see a greater exchange of profiles amongst the industry in the future.

Planning and Conducting the Whistler Mountain Avalanche Control Program

Anton Horvath

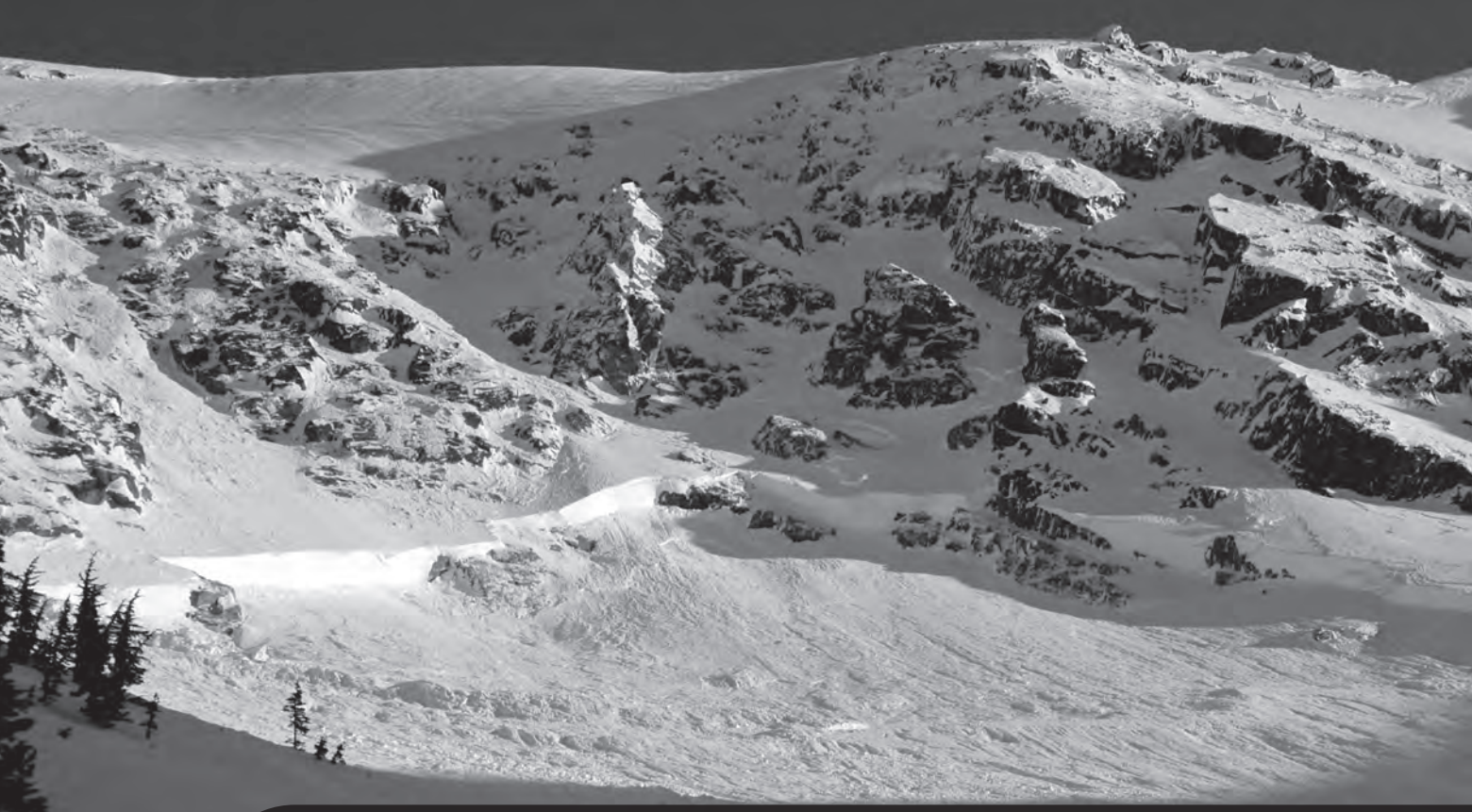
WE BEGIN THE WHISTLER MOUNTAIN avalanche control planning process in the afternoon after all of our snowpack and weather observations have been compiled, our afternoon weather forecast has been issued, and our avalanche hazard forecast has been updated. We conduct afternoon briefings with key supervisors from lift operations and lift maintenance, as well as the grooming department and the ski patrol manager.

Topics of discussion include operational objectives for the following morning based on the weather and avalanche hazard forecast, evening and overnight travel clearances on various routes of travel for the lift maintenance and grooming departments, go/no go parameters, and input on which lifts might require the chairs or gondolas to be removed from the line overnight depending on forecast winds, freezing levels, and snowfall accumulations. We may issue different clearances for the graveyard grooming shift that comes on at midnight, depending on the timing and intensity of an incoming event.

Once we meet the requirements of these departments, we then start to focus on our own personnel requirements and complete an avalanche control day preplan. The avalanche forecasters, explosives department personnel, and the gunners scheduled to fire our Gun 1 Avalauncher all require early mountain access via snowmobiles, so at this point we must inform the sweep-meister of our snowmobile requirements to ensure that enough sleds are brought down to the valley at the end of the day. A forecaster and assistant head up at 5:30am, two shot wrappers at 6:00, and the two gunners bring up the rear at 6:30. The rest of the teams head up on the Village Gondola at 7:00. Later in the season when daylight permits, additional personnel are also brought in early to operate snowmobiles to expedite access for our two Flute control teams. These teams are usually the last ones to clear their routes, since accessing this terrain after a storm cycle is usually via skins and touring gear. Getting a head start on these routes usually results in earlier clearances for opening our alpine terrain.

Our avalanche technicians and their assistants are assigned to specific control routes for the duration of each

LESSER FLUTE LOW ROLL IS IN A HIKING-ACCESS ONLY AREA WITHIN THE SKI AREA BOUNDARY. THE PICTURE WAS TAKEN IN FEBRUARY 2009. WE HAD A PWL LAYER OF FC/DH THOUGHT TO BE MOSTLY CLEANED OUT UNTIL AN AVALANCHE TECHS TESTED THIS INFREQUENT PERFORMER SLIDE PATH DURING HIS ROUTE THAT DAY // WHISTLER MOUNTAIN SNOW SAFETY



WEST BOWL LOW IS UNDER THE HANGING ROLL, A PERMANENT CLOSURE IN THE PEAK CHAIR ZONE. THIS SLIDE WAS TRIGGERED WITH A 1KG HAND CHARGE ON A PWL FC/DH LAYER IN JAN 2009, WHICH HAD BEEN DORMANT UNTIL THE LOAD ON OVERLYING BRIDGING LAYERS REACHED CRITICAL THRESHOLD AFTER AN INTENSE STORM CYCLE // WHISTLER MOUNTAIN SNOW SAFETY

season. The early morning start schedule is drawn up based on the avalanche control schedule, and any personnel who will be returning from days off must be notified of their early starts. Twelve teams are required to conduct avalanche control on the 14 avalanche control routes in the alpine. If avalanche mitigation measures are required on any of the routes at or below our tree line elevations, then these routes must be completed prior to giving clearances for any lift access from the valley. Any control work that is required in the alpine can be carried out regardless of whether the rest of the ski area is open or not.

The Peak chair is an integral piece of our avalanche control plan. In order to ensure its availability for our control team's morning access, an operator is brought in to stay overnight in our Peak Patrol Bump Station as required. We have been fortunate to have the same person available to fulfill this role for us for the past 25 years. An old ski bum from way back, he drives a cab at night and is ready to drop a shift or two on a moment's notice to spend a night or two up at the Peak. His job is to open the storm shutters on the lift, de-rime the station, and go through all of the morning checks that are required prior to lift start-up. In addition to this, he also ensures that there is sufficient clearance for the chairs at the break-over to the top station at the Peak.

Once this phase of the afternoon planning has been completed, then it's time for the forecasters to head down the mountain—which, during the first half of the season, is usually in the dark.

Morning always seem to come too soon, and the first coffee of the day is often consumed at home while perusing our remote weather telemetry and various weather products on the Internet. The mountain radio is turned on for a quick chat with the grooming lead hand on the graveyard shift to see how their night went and if they had any observations of note to report. Then it's off to the mountain and onto a sled. We need to get clearance from the grooming lead hand before we can head up to make sure no winch cats are in operation that might impact the designated routes of travel. This also gives us an opportunity to ensure that the roads to the caches and the bomb shack have been groomed, and that a pass has been made out to the gun.

Our first stop is the weather stations. Before we clear the boards, we take a density sample and read the manual thermometers. Then it's back on the sled and up to the Snow Safety office in the alpine. Down in the locker room in the valley, we decided who was going to do what; we divide our early morning routines and responsibilities in a predetermined fashion. We record weather observations, and check out additional weather products before we issue a weather forecast for the day, after which the forecast is recorded on the phone. Then we take a quick look at the InfoEx to see what our nearest neighbours had to report from the previous day. The phone usually starts ringing around this time—the mountain manager and patrol manager both want to know the day's game plan, and it's just a matter of which one calls first.

At this point, one of us will hop on a sled to poke around a bit, gather some additional observations and see what kind of shears we find within the storm snow layers. The shot wrappers will have arrived by now and have dug out

the main mag, and they want to know how many cases of emulsion and how many projectiles will be required. Things just continually ramp up from this point on. The gunners will soon be rolling in on their sled, and they will require a quick briefing before they head out. While all of this is going on, one of us briefs the lift maintenance and lift operations managers.

The rest of the crew rolls into the bump room around 7:15. Once the dust settles, we gather for a weather and avalanche hazard briefing. Although each team has their own safety meeting going over their PPE prior to departing, we will also discuss any safety issues and specific workplace hazards with the team as a whole before they head out.

Either the forecaster or the assistant will stay in the office to coordinate the avalanche control program. There is just too much going on to do this from the field. We have an AC coordinator sheet and checklist that records which routes are in progress, what sign lines are closed, as well as what clearances have been given and when. Grooming in portions of our alpine terrain can often be safely conducted in concert with our avalanche control program, and the passage of the grooming machines through key areas must be coordinated in sync with our control program. Lift and electrical maintenance personnel will also require access to the high alpine lifts to prepare them for their eventual opening, and their passage on designated routes of travel must also be safely coordinated. When things go smoothly, coordinating our program is a bit like conducting a finely tuned orchestra. Alas this is not always the case, as Mother Nature has a way of throwing a wrench into things. The coordinator must always be prepared with a plan B and C in case things go sideways, one way or another.

Each team checks in with the coordinator to report on their progress, as well as offer any observations of note seen thus far on their route. The maestro continually updates the AC sheet with each team's progress as they complete their routes and report their results. Any lingering pockets may require a second pass. At times, this may require the wrapping of some additional shots, but more often than not, just a bit of additional ski cutting is required prior to clearing the route.

Finally the last route clears. We give AC clearance all zones to the alpine office. Control teams filter back in to dry out and refuel while filling out their control sheets and preparing for the other duties assigned for the rest of their day. Unfortunately, there is no rest yet for the avalanche forecaster, the AC coordinator or the Snow Safety technician on duty. We must issue the Backcountry Advisory and post it at the top of our high alpine lifts. We've got to dig fracture line profiles and test profiles, and there is still some powder snow that has to be skied. Before we know it, it is 2:00pm and it is time to start the whole process all over again.

WEST BOWL LOW IS UNDER THE HANGING ROLL, A PERMANENT CLOSURE IN THE PEAK CHAIR ZONE. THIS SLIDE WAS TRIGGERED WITH A 1KG HAND CHARGE ON A PWL FC/DH LAYER IN JAN 2009, WHICH HAD BEEN DORMANT UNTIL THE LOAD ON OVERLYING BRIDGING LAYERS REACHED CRITICAL THRESHOLD AFTER AN INTENSE STORM CYCLE // WHISTLER MOUNTAIN SNOW SAFETY

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

CIL Explosives Recalls #12 High Strength Detonators

FOLLOWING THE CDOT INCIDENT OF MARCH 31, 2014, CIL AND ITS PARTNER COMPANIES HAVE DILIGENTLY INVESTIGATED ALL THE AVAILABLE INFORMATION AND RELATED DETAILS THAT ARE ASSOCIATED WITH THE EVENT. CIL EXPLOSIVES WILL NO LONGER PERMIT THE USE OF THE #12 HIGH STRENGTH M7MM DETONATORS WITH ANY OF THEIR SNOWLAUNCHER SYSTEMS THEY SUPPLY. THIS SAFETY BRIEFING APPLIES TO ALL USERS OF CIL EXPLOSIVES SNOWLAUNCHER AVALAUNCHER SYSTEMS.

THE USE OF ANY detonator that fits tightly onto the nose of any Snowlauncher system ferule or primer cap housing should not be used. CIL Explosives supply a dedicated detonator trade named "Avadet" for use in all CIL Snowlauncher systems. This is the only detonator that must be used. All other types of detonators should not be used in CIL Snowlauncher systems. Please discontinue use of all other types of detonators.

Please contact your local CIL Explosives distributor or CIL Explosives directly to arrange pick up of any CIL supplied detonators that are not Avadets. CIL Explosives will supply a full credit note to your corporation for price paid.

Planning Avalanche Control at Rogers Pass

Peter Schaerer
All photos Government of Canada Bruno Engler

ROGERS PASS, WHERE THE TRANS-CANADA HIGHWAY CROSSES THROUGH BRITISH COLUMBIA'S SELKIRK MOUNTAINS, HAS A LONG HISTORY OF AVALANCHES AFFECTING TRANSPORTATION AND HUMAN LIFE. THE HIGH STANDARD OF AVALANCHE SAFETY MEASURES AT THE HIGHWAY HAVE BEEN FREQUENTLY DESCRIBED IN *THE AVALANCHE JOURNAL* AND OTHER PUBLICATIONS. THIS ARTICLE DESCRIBES THE PROCESS OF AVALANCHE CONTROL PLANNING BEFORE THE HIGHWAY'S OPENING ON SEPTEMBER 3, 1962.

THE CANADIAN PACIFIC RAILWAY chose Rogers Pass for its transcontinental line. When the construction began at the Pass in 1884, engineers and surveyors soon discovered that a combination of deep snow and steep slopes produced numerous unavoidable avalanches. The last spike of the line was driven on November 7, 1885, but deep snow and avalanches soon closed the section at Rogers Pass for the duration of the winter. The following summer, the railway began building timber snow sheds at the most serious avalanche paths, and later extended that to 53 sheds. Despite the protection, the battle with snow continued; trains were blocked in snow and track maintenance crews were buried in avalanches, including 58 men in a single avalanche in March 1910. The 1910 disaster, the extensive snow removal work and the need to replace aging and damaged snow sheds persuaded the railway company to build an eight-kilometre long tunnel below the summit from 1914-16, and to abandon the track with the most serious avalanches.

The Trans-Canada Highway runs from the Atlantic Coast to the Pacific on Vancouver Island. According to the agreement in 1949, the Canadian provinces designated the route with the approval of the Government of Canada, who paid half of the cost. Across the Rocky Mountains, the highway follows the Canadian Pacific Railway. In planning the highway westwards through the Selkirk Mountains, the Province of British Columbia investigated several alternative routes, including Jumbo Pass (with a tunnel), Moberly Pass, and improving the highway around the Big Bend of the Columbia River (now flooded behind the Mica hydroelectric dam). They decided on Rogers Pass in Glacier National Park because it was the most direct connection.

The avalanche hazard at Rogers Pass was known and dreaded from the railway's experience. Therefore, protection against avalanches was an important consideration when the highway was located in 1953-56. At that time, planning avalanche safety while locating a highway was a novelty on the North American continent. The usual procedure was to build a highway where the terrain was most suitable for construction, and only after it was open to traffic and problems with snow appeared, make an effort to deal with them. Combining avalanche control planning with highway location selection at Rogers Pass received attention and praise in the United States of America and Canada even before the highway was completed, and was applied again (e.g. the construction of the Coquihalla Highway in BC).

Planning of avalanche protection at highways, as it was carried out at Rogers Pass, involves the following activities:

1. Mapping avalanche paths with frequency and size of observed avalanches.
2. Locating the roadway with the objective of minimizing the effect of avalanches.
3. Gathering weather and snow observations with the objectives of estimating the frequency of avalanches and developing experience with predicting them.
4. Designing the control of avalanches by engineered works and explosives.
5. Planning the control of traffic.

Decisions about the application of the individual means of avalanche control must be made by balancing acceptable risks, cost, demand of traffic, and often politics.

Politics played a significant role in building the highway through Rogers Pass. The governments of Canada and BC faced considerable opposition, and the avalanche hazard was quoted in arguments against

CONSTRUCTION FIELD TRIP MEETING NEAR THE SUMMIT OF ROGERS PASS, MT. TUPPER IN THE BACKGROUND. L-R PETER SCHAERER (NATIONAL RESEARCH COUNCIL); JACK LINTON (SUPERVISING ENGINEER, DEPARTMENT OF PUBLIC WORKS, BANFF); TOM FENTON (NATIONAL PARKS REGIONAL ENGINEER); RON STEEVES (SUPERINTENDENT, GLACIER, MOUNT REVELSTOKE AND YOHO NATIONAL PARKS); UNNAMED LOCAL PARK WARDEN; NOEL GARDNER (WHO BECAME HEAD OF THE SNOW RESEARCH AND AVALANCHE WARNING SECTION IN GLACIER NATIONAL PARK IN 1959). APRIL 9, 1957

the highway project. Residents in the South Columbia region, for example, wished for the Trans-Canada Highway to be farther south, and those in northern areas preferred the Yellowhead Pass. Newspapers quoted old-timers who had worked with the railway, declaring: "They will never be able to keep that highway open in the winter." Another argument was that an expected low traffic volume would not justify the hazard and cost (for example, it was claimed that all trucks in Vancouver would have to move over Rogers Pass every day in order to justify the cost).

Environmental concerns were not expressed when the highway was planned. Only during the construction and later did Parks Canada staff became concerned about the removal of trees, damage to rare plants and the preservation of historical structures of the railway.

Noel Gardner initiated avalanche path mapping in the early 1950s. A warden in Glacier National Park and a keen skier, an unusual activity for park wardens at that time, he used to cross Rogers Pass on skis where he noticed the avalanche deposits and avalanche paths. In the summer of 1953, he accompanied location engineers on a reconnaissance of the feasibility of a highway through Rogers Pass and pointed out the locations of avalanches. In order to obtain more information about avalanches, the Canada Department of Public Works (DPW), responsible for building the highway through the National Park, contracted Gardner to observe avalanches in the three winters from 1953 to 1956. Once or twice per month he skied over the proposed highway route and recorded the locations of avalanche deposits. The winter 1953-54 was a lucky one with numerous and large avalanches, and the railway recorded the highest amount of snowfall since 1910.

In 1956, Gardner obtained a full-time position with DPW to continue avalanche observations, make snow and weather observations and be the avalanche hazard forecaster during the construction and after the completion of the highway. He established his base in Glacier, which was a railway maintenance personnel settlement at the west portal of the railway tunnel.

After firmly deciding to locate the highway through Rogers Pass in 1956, the location survey began immediately. Steep terrain and narrow valleys with avalanches from both sides allowed very few options for avoiding avalanches. Where it was feasible, the road grade was placed as low as possible in runout zones, where only infrequent avalanches would reach it. The construction started in the summer of 1957 by

removing a 200-foot wide strip of forest along the surveyed line, and the grading work began a year later.

Local weather and snow observations for previous years did not exist, except for records of annual snowfalls at the railway line. When Gardner established his base in 1956, he organized standard daily weather and snow observations at Glacier (elevation 1,190m) and Rogers Pass Summit (1,347 m), and built an observatory on Mount Abbott (2,040m) above Glacier, where an observer from Garner's crew reported the weather and snow conditions by radio daily. The high-elevation weather station proved essential for avalanche prediction. This became particularly evident during a three-day storm in April 1959 that produced rain and limited visibility in the valley; the observer at Mount Abbott was able to continuously report the accumulation and stability of snow at the elevation of avalanche starting zones. When the highway opened, a permanently occupied high-level observatory was built at Fidelity Mountain, where the access was easier and there was a need for observation farther west.

Because remote weather stations for wind observations at exposed locations (essential for avalanche hazard forecasting) were not commercially available in the 1950s, the Radio and Electrical Division of the National Research Council of Canada developed equipment for measuring and transmitting wind speed and direction for Rogers Pass. In 1959, the equipment was installed at Balu Pass, where a trail allowed easy access six kilometres west of the highway. It performed well and was later moved to another location above the summit of Rogers Pass where transmission was better.

Designing avalanche control by structures and earthworks was initiated in 1957, when I was hired by the National Research Council of Canada (NRCC) for assisting DPW with the planning of avalanche control. I observed the terrain and the damage to vegetation in avalanche paths, analyzed snowfall and avalanche observations from the four previous winters and determined the most suitable protection for each avalanche path. The proposed control works were sketched on a highway location plan for the approval of senior staff. Though the resident engineer of DPW found the earth mounds a funny way of dealing with avalanches, the plan was accepted without much discussion in August 1957.

Earth mounds in avalanche runout zones appeared to be a feasible and low cost avalanche control method, and a bulldozer built experimental mounds at two locations in September 1957. They proved to stop avalanches or to reduce the amount of snow on the highway location in the following winter. Based on this success, highway contractors then built mounds on other avalanche runout zones where the slope incline above the highway was 20° or less.

Snow sheds were planned where flowing avalanches were expected to reach the highway more frequently than once per year, and firing with artillery was not possible. Five sheds were proposed and built in the National Park, and three west of the Park. The sheds were long enough for controlling flowing avalanches with a ten-year return period. The load of avalanche snow on the shed roofs was determined from instrument surveys of avalanche deposit depths in the winters 1958 and 1959, and by estimating the maximum amount of avalanche snow that could slide and be deposited. The loads were high, because the estimated snow depths were between three and eight metres. The engineers who designed the sheds in Glacier National Park who had never seen an avalanche deposit had to be persuaded about high loadings in a heated discussion. They envisioned snow sheds like building roofs, but in reality sheds must perform like bridges. Surveys of deep avalanche deposits on completed sheds in later years proved that the estimated loads were correct and were close to being reached.

Artillery application was known to be successful for avalanche control in Switzerland and the USA. Because it looked applicable at Rogers Pass, I listed the specifications for a weapon. They were submitted to the Department of National Defence with the request for assistance. The request was received favourably and in the late November 1957, a reconnaissance team of the Queen's Own Rifles of Canada regiment in Calgary visited Glacier National Park with the intention of using the 106mm recoilless rifle. The site inspections revealed that the steep firing angles would need an elevated platform or an earth mound for the weapon, but it was too late to build anything before the winter. The Army was anxious to carry out avalanche control in that winter; therefore the officers of Queen's Own Rifles determined that the 4.2-inch mortar could be used. A 12-man mortar crew with a public relations officer and photographers arrived by train in Glacier on February 19, 1958, which was the only access until the highway was finished. The Armed Forces public relations officer had notified the press and radio networks about the planned shooting of avalanches. The broadcasted news about artillery firing in a national park shocked senior Parks staff who had not been informed before, though the superintendent of Glacier National Park knew about it. The trials with the mortar had to be delayed and when the formal permission arrived two weeks later, the mortar was set up at three avalanche paths. Shots landed successfully in the avalanche starting zones, but the snow was stable resulting in only small sluffs.

When the mortar crew left, the representatives of the National Parks, DPW and NRCC concluded that there were known benefits of avalanche control by artillery, but more trials with weapons for Rogers Pass should be delayed until

COMPLETED EARTH MOUNDS AT THE SUMMIT OF ROGERS PASS IN CHEOPS 1 SLIDEPATH. JANUARY 21, 1961

TRANS-CANADA HIGHWAY UNDER CONSTRUCTION AT PIONEER AND TUPPER 1 SLIDEPATHS. NOTE GUIDING DAMS. SEPTEMBER 30, 1959

the highway was available for transportation. However, the Division Engineer of the Railway intended to control avalanches to protect the railway line at the famous Ross Peak avalanche, and he arranged for the mortar crew to be available again in the winter 1958-59. The crew arrived again in February when a snowfall with wind promised unstable snow, but after travelling from Calgary in one day, placing the mortar in a two-metre deep snowpack and waiting for trains to pass across the avalanche path, the snowpack stabilized. Shots released only small surface avalanches.

The artillery trials revealed two things at Rogers Pass: a) the snowpack rapidly stabilizes after a snowfall, therefore artillery must fire without delay; and b) a mortar is too slow for controlling numerous avalanche paths. Subsequently, Parks Canada arranged with the Armed Forces to try a howitzer in 1961, when a rough highway grade was available. The trial was successful and the 105mm howitzer became the established weapon when the highway was open.

Controlling traffic when avalanches might overcome defences or when artillery control took place was easy in the first years of highway operation, because vehicles had to stop all year round at Glacier National Park control gates where they could be prevented from entering hazardous zones.

The avalanche control and safety plan was formalized in 1961 and submitted in internal reports of the National Research Council to the Department of Public Works and the National Parks. The documents contain the estimated frequency and size of avalanches and the proposed control for each avalanche path, estimated cost, durations of highway closures and recommended snow and weather observations. This plan is further described in *The Engineering Journal* (Schaerer, 1962).

The plan envisioned three stages of avalanche safety measures. The first stage would be completed with the highway opening in 1962, and the next stages could be implemented when more experience with avalanches, avalanche control, traffic volume, and highway maintenance would be available. In the first stage, the traffic was protected by eight snow sheds, earth works including earth mounds at nine avalanche paths, three deflectors and six arresters, retaining barriers at two sites, artillery and road closures. The second stage would add defence works where uncontrolled deep avalanches could reach the highway more frequently than once in ten years. It included more snow sheds, earth deflectors and retaining barriers on short steep slopes above the highway. The third stage would provide an open highway during whole winters except for short periods when avalanches are controlled by explosives.

The first stage was in place in the first five years of highway operation, and parts of the second stage were added in the following years. They included another snow shed, joining existing sheds and improving artillery control, but the intended earth works could not be carried out because of concerns from the Glacier National Park superintendent about the need to cut trees and destroy protected plants. Over the years, artillery control became more reliable and accurate because of improved weather instrumentation and weather forecasts, skills of the avalanche technicians, and by adding a second gun. The third stage might be a dream that's neither feasible nor necessary at this time.

In conclusion, the effort and work in developing and implementing the control plan were successful. Now an unexpectedly high volume of traffic moves safely across Rogers Pass despite initial concerns about avalanche hazards when the highway was proposed.

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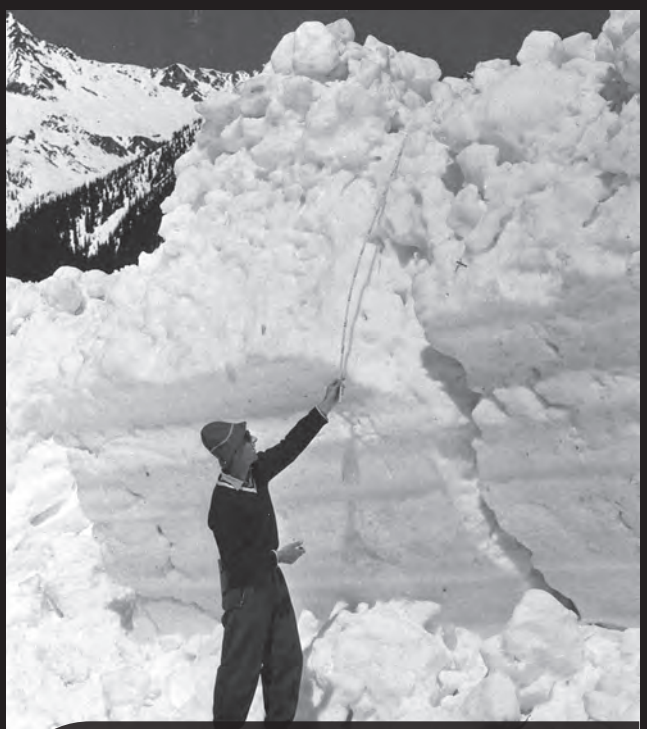


PETER SCHAERER MEASURING THE DEPTH OF A WET SNOW AVALANCHE DEPOSIT AT MACDONALD WEST NO. 4 SLIDEPATH. MAY 4, 1957

// WILLIAM EATON

Fuse News: Your Explosive Use Operational Plan—Use it or Lose it

Scott Aitken

MISTAKES HAPPEN, and explosive mistakes can be very unforgiving. Any high reliability organization will recognize signals of risk—even the weak ones—and mindfully build resilience to them.

Last season, a mid-winter spike in explosive near misses prompted a storm of correspondence. CAA Executive Director Joe Obad, WorkSafeBC Certification Officer Daryl Mellquist and CAA Explosive Committee members needed to find solutions. Seven explosive use incidents occurred between mid-February and mid-April 2014, one with potentially fatal consequences for both blasting team members. Fewer than 400 avalanche workers are certified blasters—that is about one third of all blasters in British Columbia. These were significant signals.

"What is going on, Scott?" asked Mellquist on the phone. I agreed it was a good question.

"Lack of practice during the snow drought of January?" I theorized. We needed to debrief.

In two cases, lag time for incident reporting contravened the three day requirement of the Occupational Health and Safety Regulations Section 21.3 of the Occupational Health and Safety Regulations (OHSR).

A serious explosive accident would shut down all explosive avalanche control with huge associated costs. WorkSafeBC uses a bright spotlight to investigate in the wake of an incident or accident. The first thing that will happen when a blaster's records do not match what occurred is the surrender of that blaster's ticket. The blaster must hand over his or her certificate, and be instantly less employable—or less employed.

Some of the root causes in these incidents included:

- Lack of direct supervision by the blaster of record: WorkSafeBC OHSR Section 21.5.
- Failure to secure the blast danger area.
- Not following the Explosive Use Operational Plan (reviewing the plan should be part of the plan).
- The long January drought cut avalanche control missions, and lack of use/practice dulled blasters' skills and mindfulness (see previous bullet).
- Regulatory noncompliance (e.g., relighting a safety fuse assembly).

The remedy is training. Review your Explosive Use Operational plan **often**. This will help keep teams vigilant about not allowing unsafe practices to creep into the workplace.

As blaster of record, you will be better at dealing with the stress of a mis-lit charge if you have rehearsed the procedure prior to the mis-light occurring. Let's be mindful.

The Danger Scale, Avalanche Problems and **Public Avalanche Safety Messaging**

Brian Lazar,
Karl Klassen,
Simon Trautman

AS PUBLIC AVALANCHE FORECASTING in North America has come to rely more on a combination of danger ratings and avalanche problems, guidance on how to describe real-world backcountry conditions using this approach is somewhat ambiguous. As a result, individual avalanche centres have resolved questions differently, creating inconsistency between centres in similar scenarios. Consistency between avalanche groups with public safety missions serves the public interest; there is a benefit to presenting a similar and understandable message across North America when describing similar avalanche conditions.

Over the last few years the Colorado Avalanche Information Center (CAIC), Avalanche Canada (formerly the Canadian Avalanche Centre), and Parks Canada have informally discussed some of these scenarios as they arise.

Recently, ISSW 2014 provided a great opportunity to work through some of these issues in person. We formed a working group that was big enough to foster debate, but small enough to maintain a manageable discussion. The resulting notes are relevant to the larger forecasting community, and are not intended to present final answers to these issues. Rather, our intention is to describe consensus gained amongst the workshop attendees and get some feedback from those not in attendance.

WHO WAS AT THIS MEETING?

Taking advantage of the regional and international reach at ISSW, representatives from the following groups attended:

- Colorado Avalanche Information Center
- Avalanche Canada
- Parks Canada
- Alberta Parks
- US Forest Service National Avalanche Center
- Utah Avalanche Center
- European Avalanche Warning Service Group
- Avalanche Québec (formerly Centre d'Avalanche de La Haute Gaspésie) participated via email.

NORTH AMERICAN DANGER SCALE

Low danger question:

Does low danger allow for isolated large and/or very large avalanches that are unlikely to be triggered?

The Problem:

The North American Public Avalanche Danger Scale describes low danger as "Natural and human triggered avalanches unlikely" and "Small avalanches in isolated areas or extreme terrain." It explicitly does not allow for the remote possibility of large or very large avalanches. Some forecasters and forecast centres operationally allow for this possibility based on the assumption that it is self-evident there is always the remote possibility of a large avalanche somewhere in the terrain. Other forecasters and forecast centres do not allow for this possibility under low conditions, and adhere to a strict reading of the language in the danger scale. This inconsistency in use and interpretation can and has caused confusion for both avalanche forecasters creating public safety messages and the people who use their products.

Consensus:

The working group proposes that low danger ***does allow*** for the remote (unlikely) possibility of isolated large or very large avalanches. We discussed the following measures to clarify this idea for both forecasters and the public:

- Add a footnote to the danger scale.
- Educate people that the danger rating should be based primarily on travel advice.

Discussion:

After further discussion, the authors believe that most of the debate/difficulty with the danger scale (not just low danger) stems from literal application of the likelihood and size/distribution descriptions. If used as an accessory to the travel

INVESTIGATING A DEEP PERSISTANT SLAB
AVALANCHE IN COLORADO // BRIAN LAZAR

advice, these descriptions are useful from a forecasting perspective. Conversely, for operations using avalanche problem elements, the likelihood and size/distribution can be redundant, if not confusing, to the public. Consequently, we propose that a streamlined version of the danger scale (colour, graphic and travel advice) be available to the public. In other words, we do not change the danger scale or add to it. Rather, we simply provide the public with a danger level and the matching travel advice.

Low probability/high consequence question:
When communicating risk to the public, does moderate danger adequately capture this scenario, which often involves deep persistent slabs (DPS)? What else could we do? When do we add or remove DPS from the problem list?

The Problem:
Unlikely but very large avalanches pose a special worry for avalanche forecasters. If we defer to travel advice in the danger scale, we often end up assigning these conditions a moderate danger rating. The concern is that this may not effectively communicate the consequences of an unlikely but very destructive avalanche. Another consistency issue arises when forecasting operations apply different criteria for adding and/or removing DPS to the avalanche problem list in a public forecast.

Consensus:
The working group believes the avalanche problem elements in the public bulletin, when used in conjunction with the danger rating, adequately conveys the message to the public. A moderate danger rating, with a DPS avalanche problem, and assigned unlikely probability and very large size does capture the low probability/high consequence nature of this situation.

Guidance for adding DPS to the problem list (all criteria should be satisfied):

- Buried persistent weak layer
- Unlikely (i.e., stubborn to trigger)
- Size ≥ 3 avalanches

Guidance for removing DPS from the problem list:

- Liquid water production increases to the point where the problem transitions to a wet slab avalanche.
- The likelihood of triggering becomes insignificant and there are other avalanche problems of greater concern.

Discussion:
This type of situation highlights the fact the danger scale has inherent limitations, but this does not mean the danger scale is ineffective. The application of danger ratings is a judgment-based process. Applying the danger scale literally requires forecasters to confine a highly complex set of conditions that fall somewhere on a continuum into small, fairly rigidly defined boxes. In the end, if we give the public the right travel advice, and properly describe the avalanche character using avalanche problems, the rating becomes part of a larger whole rather than the sole piece of information available to users.

Spring danger rating question:
How do we rate danger for diurnal fluctuations in predictable melt-freeze cycles? Do we rate for melted state? Do we rate for frozen state? Do we use dual ratings? Do we use no ratings?

The Problem:
Different forecast centres and forecasters apply different approaches to assigning avalanche danger when there are large diurnal fluctuations in the danger. This leads to inconsistent messaging to the public. In these types of conditions, we essentially have two approaches that use danger ratings:

1. The approached used by the most American and European avalanche centres: rate the avalanche danger to reflect the highest anticipated danger for the forecast period. For example, if the danger is low overnight due to a good solid freeze, but is expected to rise to considerable by late afternoon due to warm temperatures and/or strong solar radiation, then rate the danger considerable for that day. This approach ensures that the novice or uninitiated user receives the appropriate public safety message. The diurnal fluctuations can be described in the text of the forecast. This more complicated and nuanced message is important for the more advanced users who will have a better grasp on the temporal fluctuations inherent in spring time conditions.
2. The approached used by the Canadian avalanche centres: rate the danger for the predominant condition. For example, if the frozen state, corn snow, and good stability is expected from sunup to 14:00 or so as occurs in a fully-fledged melt-freeze cycle, rate the danger low and talk about increasing afternoon hazard in the text. If overnight freeze is minimal or none, rate considerable or high and talk about a potentially small window of lower danger very early or very late in the day.

Consensus:
Despite some reservations from Parks Canada and Avalanche Canada, the consensus, in the spirit of consistency, was to agree to rate for highest danger of the day in spring diurnal melt-freeze conditions.

Discussion:
Some avalanche centres also issue "no-ratings" information at a certain point in the spring when spring conditions have taken hold and data becomes increasingly scarce. Once the

transition to a no ratings forecast is made, policy is for most centres that use a no ratings option is to refrain from going back to a product that includes danger ratings.

AVALANCHE PROBLEMS

Terminology and guidance for determining the type, or character of avalanche and transitioning from one type of avalanche to another is relatively new and has not yet been fully adopted in all regions or facets of the business. Bringing all public avalanche safety agencies, and indeed the industry as a whole, to consensus is desirable.

The Problem:

In North America, the terms "primary avalanche concern," "avalanche problem," "avalanche character," and "avalanche type" are used. In other parts of the world, "avalanche threat" and "avalanche situation" are common (Jamieson et al., 2010). These terms are often used interchangeably and inconsistently, creating confusion.

Most North American public forecasting agencies incorporate eight avalanche character designations (Statham et al., 2010) into their forecasting procedures and public forecasts:

- Loose wet
- Loose dry
- Wet slab
- Wind slab
- Storm slab
- Persistent slab
- Persistent deep slab
- Cornice

In some agencies and operations, a ninth avalanche character (glide) is also used. Increasingly, these designations are also being adopted by commercial and industrial avalanche operations (e.g., the newest version of InfoEx allows operations to describe their avalanche problem using these designations).

Consensus:

The group proposes that the public forecasting operations use the term avalanche problem in lieu of the other terms listed above. In addition, the term avalanche problem is defined as "A set of factors that describes the avalanche hazard" and includes four elements (character, aspect/elevation, likelihood and size).

Discussion:

These elements are congruent with the conceptual model of avalanche hazard and the definition comes from the CAA's Avalanche Operations Level 3 course glossary. In this construct, the avalanche problem includes: what (avalanche character), where (at minimum elevation and aspect), how likely (likelihood as a function of sensitivity to triggering and distribution), and how big (avalanche size). Further, we suggest that the avalanche characters noted above be used as the standard when describing avalanche problems.

Good Reading:

Guidance for determining character is available on the Avalanche Canada website in the various "Avalanche Essentials" papers found here: old.avalanche.ca/cac/pre-trip-planning/decisionmaking.

The CAIC has help links on their website for each avalanche problem, and an avalanche problems web page (avalanche.state.co.us/forecasts/help/avalanche-problems/). This information is designed to bridge avalanche problem definitions with the more reference-oriented Avalanche Essential documents. They also use a flowchart as an operational tool for forecasters (*The Avalanche Review*, Dec. 2012. Vol. 31, No.2, pg. 14).

Another reference is a paper recently published in this magazine (Karl Klassen, "What's the Problem? A Primer on Defining Avalanche Character," *The Avalanche Journal*, v. 105, Winter 2012-14, p. 10.) This topic is also explored in Klassen's 2013 ISSW paper: arc.lib.montana.edu/snow-science/item.php?id=1824.

Additionally, the Utah Avalanche Center recently developed a graphics-based avalanche problem tutorial to augment public forecasts: utahavalanchecenter.org/avalanche-problem-toolbox.

CONCLUSIONS

The results are nothing earth-shattering. However, agreeing on this low-hanging fruit has important implications for public forecasting communication and public safety. It also gives us a starting point to begin to work through the rest of the tangible questions, problems, and inconsistencies that exist between and within our operations. We'd love to hear your thoughts on the consensus and discussion points. In the end, we hope that North American avalanche centres can adopt a single, consistent approach to communicating avalanche conditions.

Brian Lazar: brian.lazar@state.co.us
Karl Klassen: kklassen@avalanche.ca

Beacon Overload: Making Sense of Transceiver Multiple-Burial Functions

Bruce Edgerly

"What happens if I press this button over here?"

"How come this icon just disappeared for no reason?"

"Why do I keep coming back to this victim that I already marked?"

If you're an avalanche instructor, rescue trainer, or just plain old transceiver user, you've probably been on the receiving end of frustrating questions like these. As an assumed "expert" on the subject, you're expected to have answers. Don't fret: help is here.

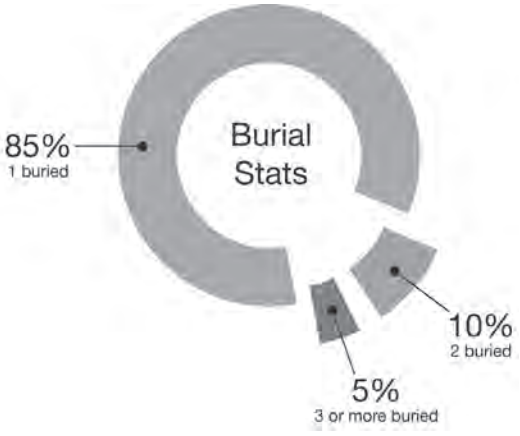
Transceivers are only part of the rescue process—and they all have weaknesses, just like us humans. In recreational level courses like the AST 1 or Companion Rescue Skills , the key is to explain the "big picture" instead of getting wrapped up in the technology. Make sure you cover the skills needed in all rescues, not just a small subset of "boutique" scenarios.

THE BIG PICTURE

Like anything else in the media, the sexiest stories get the most attention. In our case, this means the epic, multiple-burial incidents that occur every several years. One rarely hears about success stories involving live recoveries and near misses. Several studies have shown that about 40 percent of avalanche rescues are never even reported in the United States. This translates to several dozen live recoveries per year that happen behind the scenes.

So how common are multiple burials? Statistics show that as recreational backcountry use has increased relative to guided backcountry use—and equipment and avalanche education have become more widespread—the proportion of multiple burials has decreased over time. Currently in the US, Canada and Europe, about 15 percent of accidents involve multiple burials. Those involving three or more victims are decreasing, too. A 2012 report by researchers Juerg Schweizer, Dominic LeTang, and Manuel Genswein concluded that

95 PERCENT OF AVALANCHE RESCUES INVOLVE 1-2 COMPLETELY BURIED VICTIMS. ONLY 5 PERCENT INVOLVE MORE THAN THAT.



burials involving more than two people have gone from ten percent before 2000 to less than five percent since 2000.

This is a relatively low number, which means that if you're spending most of your time teaching multiple-burial techniques then you might be missing the bigger picture. Especially if you consider that most of these multiple burials are solved no differently than single burials. Only in close-proximity situations are most multiple burials solved any differently than a single burial. But research shows that only about one percent of accidents involve close-proximity burials, where the victims are buried within 10 metres of each other (see backcountryaccess.com/research).

The big picture clearly shows that "special case" close-proximity multiple burials are extremely rare. While it's important to address special cases in professional-level training, in recreational courses your time should be focused on those skills that are required in all avalanche rescues, not just a small proportion of rescues. This includes search strategy for one to two victims, shoveling strategy, treating the injured, and the biggest challenge of all, group management. Renegade signals from clueless searchers on the surface are usually a much bigger problem than multiple signals coming from the victims!

"MARKING" IS BORN

If multiple burials are such a small part of the picture, then where does all the talk come from? It comes from the guiding world. For economic reasons, large guided groups often ski together—and occasionally get buried together. If an accident occurs, the rescue expert in the group (usually the guide) is expected to find all the victims while guests act as assistants or bystanders. To become a certified guide, a candidate is usually required to find at least three victims (one more than two metres deep and two in close proximity) in a short period of time, with minimal assistance. In more realistic guiding exams, the candidate is required to find only some of the victims, but must dig them out within the time limit, usually well under ten minutes. In even more realistic scenarios, they must also administer first aid. From the world of specialized guiding exams, "marking" functions on avalanche beacons were born. Marking enables the most skilled searcher to suppress the signal of the found victim, then move on to the next victim while less skilled rescuers begin shoveling.

If you're teaching avalanche courses, it's important to tailor the content of your rescue training to your audience. Most recreational course takers are better off working on big-picture rescue skills instead of special-case rescue skills like the ones above. If you're teaching pros, then you can start getting into more detail—but only after you've truly got the fundamentals wired.

REAL WORLD BEACON SEARCHING

In the real world, beacon searching can actually be simpler than it is in some avalanche courses: probing is done for bodies, not Tupperware, and if a multiple burial does occur, the victims are usually located the same way as single burials–either "in series" or "in parallel." In the former, a single rescuer locates the first victim, digs enough to provide that victim an airway, then continues the signal search for the next victim ("in series"), preferably turning off that victim's beacon before moving on. In the latter, two or more searchers fan out across the avalanche debris pile ("in parallel") and isolate signals as they go.

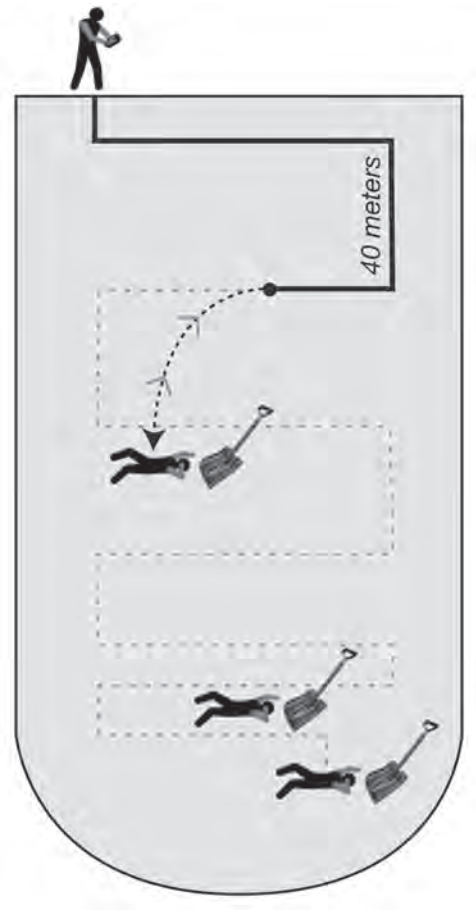
The only exception is when the victims are close together, within about ten metres of each other. In this case, it's possible to skip right over one victim's signal by charging off in the wrong direction. Or in the "parallel" multiple-searcher scenario above, one searcher might end up isolating two signals, but the other searchers might not isolate any. In rare close-proximity burials like this, special search techniques or technologies can come in handy.

SPECIAL TECHNIQUES

Proven techniques used to solve these situations include micro search strips, popular in Canada, and the German Alpine Club's three circle method. Both of these are based on using signal strength to isolate each victim. Generally, the searcher begins at the victim's last seen point and systematically travels through the debris, making sure he or she doesn't miss any areas. All modern avalanche transceivers are programmed to bring you to the strongest signal, although the ones with faster processing speeds do this a lot better than others. As long as you keep moving—and stick to a disciplined search pattern—you'll find all of them. Keep in mind that if you can't turn off the found victim's beacon, you'll have to ignore that signal as you move away from it.

These two techniques are very similar, but are customized for different scenarios: micro search strips work best in smaller deposition areas (such as guiding exams) and the three circle method works best in larger areas, preferably not very steep, since you sometimes end up moving uphill. With both techniques, the searcher takes passes through the

IN COMPLEX SCENARIOS INVOLVING THREE OR MORE VICTIMS, IT'S BEST TO STAY IN SEARCH MODE (OR USE ANALOG MODE ON SOME BRANDS) AND MOVE SYSTEMATICALLY THROUGH THE DEBRIS. IF YOU SUSPECT AT LEAST TWO OF THE VICTIMS ARE IN CLOSE PROXIMITY TO EACH OTHER, THEN USE MICRO SEARCH STRIPS THROUGH THAT AREA. OTHERWISE, SIMPLY MAINTAIN YOUR NORMAL SEARCH STRIP WIDTHS (UP TO 40M FOR MOST TRANSCEIVERS).



suspected burial area in small passes of three to five metres, always remaining in search mode, not marking or using any other signal suppression mode.

SPECIAL TECHNOLOGIES

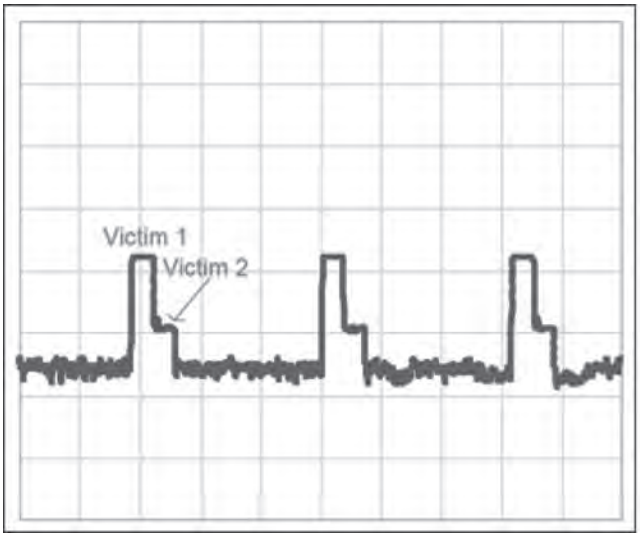
The above might seem like a lot of excess running around, especially when lives are at stake and the clock is ticking. Enter "marking," also known as "flagging" or "signal suppression." Most digital avalanche transceivers, including the most recent release, BCA Tracker3, now offer a feature that enables the rescuer to press a button that suppresses the signal of a victim that has been found, then immediately see the signal of the next-closest victim and move directly to that location.

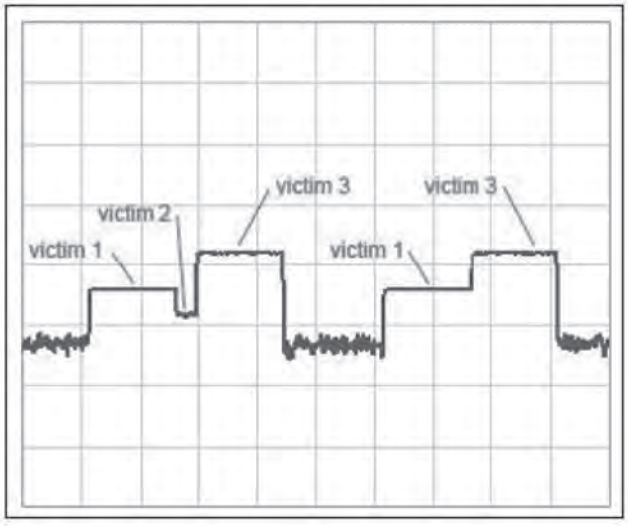
This technology can work exceptionally well, especially with only two victims. But once there are more than two, it gets increasingly unreliable. This has not gone unnoticed and has resulted in more than a few failed transceiver exams. The German Alpine Club published a "security advisory" in 2014 about the perils of marking. In their 2012 ISSW report, Schweizer, LeTang and Genswein found that with four out of five transceivers, one-third of novices using marking failed to find the third victim. In 2011, a report in *The Avalanche Review* concluded that marking functions failed up to 70 percent of the time in scenarios involving four victims (Steve Christie, "Having Problems in Multiple Burial Searches? Signal Overlap Explained," *The Avalanche Review*, vol. 30, issue 1, October 2011, p. 11).

Once marking fails, then you're usually worse off than if you simply used one of the proven signal-strength techniques above. That's because when using marking, the user abandons the disciplined signal search pattern necessary to eliminate terrain and ensure that all victims are found. Once you get off that pattern, all bets are off on a thorough search.

What causes this failure? Signal overlap. This is when the "beep" from one victim's transceiver occurs at the same time as another victim's "beep." When this happens, the searcher's transceiver no longer knows how many signals are present. If the rescuer marks a victim, then both signals could be eliminated–whether or not both victims have been located. Also, when signals overlap like this, a signal that has been marked can all of a sudden become unmarked. Other common symptoms are that the distance and direction to the next victim simply don't change as the searcher moves through the debris–or an extended "Stop" message appears in the transceiver's display. The only way to salvage your search at this point is to "reboot" your transceiver (turn it off and on again), go to analog mode with some models, or go to the "scan" function on others. But if you don't know you should do this—or aren't very good at it—then your search can quickly turn into a veritable train wreck.

WHEN SIGNALS OVERLAP, MARKING FUNCTIONS OFTEN FAIL. ON THE LEFT, TWO TRACKER DTS SIGNALS OVERLAP. NOTE THE SHORT DURATION (WIDTH) OF EACH PULSE, WHICH MEAN THE OVERLAPS TEND TO BE SHORT. ON THE RIGHT, THREE ORTOVOX F1 PULSES OVERLAP. SINCE THE PULSES ARE MUCH WIDER, THE OVERLAPS CAN BE EXTREMELY LONG, ESPECIALLY WHEN THERE ARE MORE THAN TWO PRESENT.





REALITIES

As you can see, avalanche transceivers are not foolproof in multiple burials—even the most expensive and sophisticated ones. So keep it real and remember the following:

- The biggest technical challenge in most avalanche rescues is digging. This takes far more time than the beacon search. In most recreational avalanche incidents there are barely enough shovelers to excavate a single victim, let alone two or more. Are you really going to not dig somebody up? For these reasons, in almost all multiple burial scenarios, marking is a luxury. People will die if you do not start shoveling immediately. The only exception might be in scenarios where a skilled professional might be qualified to make triage decisions on which victims get priority—or, in mechanized scenarios, where manpower can be called in to provide rescue support.
- Don't rely entirely on marking. As many of us have experienced, marking has major limitations. In most guiding exams involving three or more victims, guides generally do not use marking. They use proven signal-strength search techniques such as micro search strips. This is because there's a good chance marking will fail. This is also why some beacon brands don't allow the user to mark or suppress more than one signal at a time. Or the suppression mode defaults back to normal search mode after a specified period of time, so the user doesn't have to know to "reboot" or switch modes in the case of a train wreck.
- Likewise, do not count on the "counting" function of your transceiver. Most modern beacons have an icon that will indicate whether more than one victim is in range. If there are more than two, then these functions can become unreliable (especially when an Ortovox F1 is present, as its long pulse is often counted as several victims). This is why some brands do not attempt to indicate more than two, but will display a "+" when there are more than that. In most cases, it's preferable to have limited but reliable information rather than lots of information that may or may not be true.
- When teaching recreational-level avalanche courses, it's more important to master one- and two-victim scenarios (in series and in parallel), group management, and strategic shoveling than it is to focus on boutique, special-case multiple burials. Once the essentials are covered, then get into basic micro search strips. Ideally, marking and suppression should be taught last.
- Better yet, prevent multiple burials from happening. You can do this through smart route planning, safe travel techniques (one at a time), and effective group communication: lots of discussion, open sharing of ideas, and the efficient use of two-way radios.

There is no need for you or your students to suffer from beacon overload. Keep your eyes on the big picture and focus on those skills that are required in all avalanche rescues, not just the boutique skill set.

AVALANCHE CANADA FOUNDATION PRESIDENT GORDON RITCHIE BEING INTERVIEWED AT THE LAUNCH EVENT // AVALANCHE CANADA

Canadian Avalanche Centre Rebranded **Avalanche Canada**

Mary Clayton

ON THE 10TH ANNIVERSARY OF INCORPORATION, the Canadian Avalanche Centre introduced a new name and logo. The launch of Avalanche Canada was held on October 2 at the Banff Centre, during the ISSW, at a small media event in the Max Bell Building. Avalanche Canada will continue to use the same website address, meaning avalanche.ca will remain the best source of public avalanche safety information for Canada's winter backcountry users.

This rebranding effort is focused on eliminating the brand confusion with the CAA. The two organizations have been closely linked since the CAC was established in 2004, after the tragic winter of 2002-03 when 29 people were killed in avalanches. Staff members, board members and office space were all shared with the CAA. Both the CAC and CAA were also linked with the Canadian Avalanche Foundation, the charity established in 1999 to raise funds for public avalanche safety. All three organizations shared a logo and a website.

At the time, this allocation of resources made good sense. The CAA was, and continues to be, the source of the country's best expertise in avalanche safety. These skills and experience gave the newly formed CAC the strong foundation it needed. But over the years, the need to differentiate between the public and professional organizations became increasingly pressing.

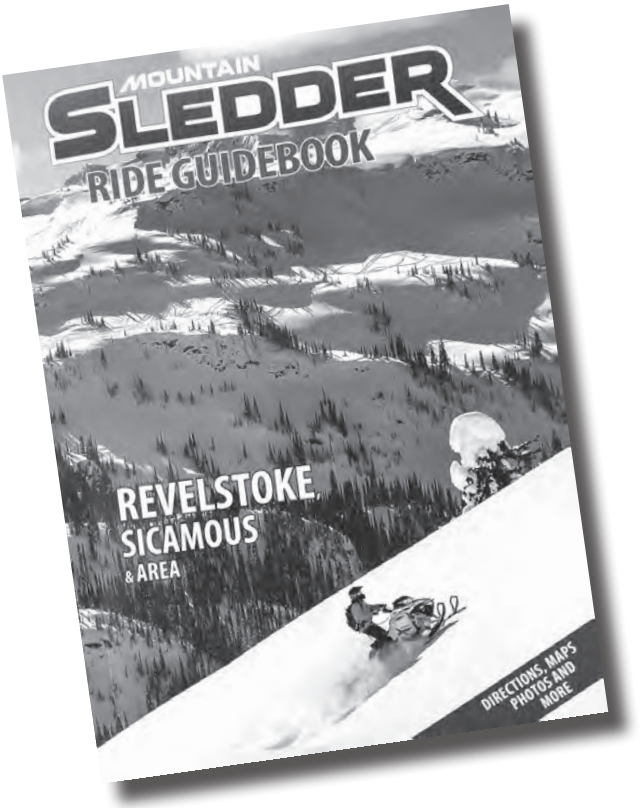
In 2010, a separate executive director and board of directors were established for the CAC. Since then, significant efforts have been dedicated to further separating the two organizations financially, even while continuing to share office space and some staff members.

Once we had identified the 10th anniversary as an ideal launch date, which happily coincided with the Banff ISSW, work began in earnest to do the most effective rebranding with the smallest budget possible. We toyed with many names and even held a contest on our Facebook page to see what people might come up with (one person suggested the Canadian Avalanche Association). Avalanche Canada came out on top for a number of reasons, not the least being it's identical in French and English.

We had no end of offers to design a new logo, all of them with hefty price tags. We ended up going the open-source route, offering $500 on a graphic-design site. It was fascinating to watch the ideas come in from around the globe. The winner was a man in Indonesia, who came up with our nice clean triangle with stylized swoops (or claw marks, depending on how you look at it).

With no money for an advertising campaign, we know we're facing at least a year of name confusion. We're doing our best to get Avalanche Canada on people's lips. Apart from our name and logo, very little has changed. Avalanche Canada will continue to provide the same award-winning and internationally recognized programs for national public avalanche safety. We will also continue our long tradition of collaborating with public and private agencies from across Canada and abroad, to develop and deliver services for winter backcountry users of all types.

Avalanche Canada



Mountain Sledder Ride Guidebook: Revelstoke, Sicamous & Area Review

Brent Strand

AT FIRST GLANCE, the *Mountain Sledder Ride Guidebook: Revelstoke, Sicamous & Areas* guidebook looks like a simple pocket-book ride guide. But it's much more than that—it has the beta you need to ride the local stashes around Revelstoke, Sicamous, Shuswap and Arrow Lakes.

Whether you are new to mountain sledding or just looking for a new zone to ride, the Mountain Sledder Ride Guidebook has something for you. It has basic information on avalanches, backcountry safety and preparedness provided by Avalanche Canada for the newbie, and encourages users to get avalanche education. The book also features countless full-colour photos to get the veteran stoked on getting out snowmobiling and finding new stashes.

With detailed access to trailhead directions, riding info and amazing aerial photos of most riding areas, you can plan your next adventure with confidence. This book is very well done, with a huge amount of information on routes, riding areas, cabins and the goods on where to eat and sleep.

Thanks to Mountain Sledder for helping get snowmobilers out there to enjoy the winter.

Schedule of Upcoming **Events**

WILDERNESS MEDICAL SOCIETY'S 23RD WILDERNESS & MOUNTAIN MEDICINE CONFERENCE

February 12-18, 2015
Park City, Utah

Leading-edge information in avalanche rescue, cold injuries, high-altitude illnesses, expedition/travel medicine and more.
For more information:
wms.org/conferences/parkcity15

CAF CALGARY GALA FUNDRAISER

March 5, 2015
CP Rail Pavilion, Calgary, AB

An annual fundraiser contributing to public avalanche safety in Canada.
For more information:
avalanche.ca/foundation/events

WESTERN SNOW CONFERENCE

April 20-23, 2015
Grass Valley, California

Now in its 83rd year, the conference aim is to advance snow and hydrological sciences.
For more information:
westernsnowconference.org/meetings/2015

CANADA WEST SKI AREAS ASSOCIATION 2015 SPRING CONFERENCE

April 27-29, 2015
Whistler Conference Centre and Hilton Whistler Resort & Spa, Whistler, BC

Spring Conference, trade show, operations & maintenance seminar.
For more information:
cwsaa.org/calendar3.html

HELICAT CANADA SPRING MEMBER MEETINGS

May 3-4, 2015
Penticton Convention Centre, Penticton, BC

For more information:
helicat.org

CAA SPRING CONFERENCE AND ANNUAL GENERAL MEETING

May 4-8, 2015
Ramada Inn & Suites and Penticton Trade & Convention Centre, Penticton, BC

Mark your calendar. You won't want to miss any of the presentations, meetings or discussions about the Canadian avalanche industry.
For more information:
avalancheassociation.ca

avalanche **community**

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BEYOND THE BORDER: INFORMATION SHARING AMONGST AVALANCHE DOG HANDLERS

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PLANNING AND PREPARATION FOR THE AVALANCHE DOG HANDLER

in this **section**

// HEATHER THAMM

Celebration and Remembrance for HeliCat Canada: 50 Years of Heli Skiing and 40 Years of Cat Skiing

Ian Tomm

IS THERE ANYTHING MORE EXCITING than guiding clients down endless swaths of untracked snow? The mere thought of fresh powder triggers images of waist-deep turns and ear-to-ear grins in anyone who has spent time on skis or snowboard, let alone the people who do it for a living every winter. In 2014-15 we mark 50 of helicopter assisted skiing and 40 years of cat skiing in Canada. Throughout the last half-century, operators in British Columbia have been at the forefront of the helicopter and snowcat skiing industry and have developed the safest and most evolved product in the world. When it comes to bringing powder to the people, BC stands alone.

Most of the province's operators can be found under the HeliCat Canada (helicat.org) umbrella, which promotes the continual improvement for all aspects of the industry including research, education, advocacy, development and overseeing operational guidelines for the industry.

BC boasts a wide variety of helicopter and snowcat ski experiences for all skill levels, budgets and expectations: from small, intimate lodges to mini-resorts; small town settings to remote backcountry lodges; exclusive, highly personalized holidays to more rustic experiences. This variety also means significant employment opportunities for trained and certified guides as well as support and hospitality staff. It's clear—after 50 years Canada not only has the best helicopter and snowcat skiing experience one can find anywhere in the world but also the most highly evolved workforce. Canadian guides have helped shape and define the industry over the last half-century and as with any good anniversary celebration a little bit of nostalgia goes a long way.

THE PIONEERS

In 1964, Hans Gmoser, an Austrian mountain guide living in Banff, Alberta, began utilizing helicopters to transport skiers into the remote Bugaboo Mountains in the heart of the Purcells. It proved to be so successful that in 1968 Gmoser built a high mountain lodge and began organizing weeklong helicopter ski trips. Bugaboo Lodge was the beginning of what, over the next five decades, became a helicopter skiing empire comprising eleven remote lodges and townsite hotels offering luxurious accommodations. Today, Canadian Mountain Holidays (canadianmountainholidays.com) takes over 7,000 skiers and riders heli skiing each winter into the most magnificent winter wilderness found anywhere.

Ten years after Gmoser, Allan and Brenda Drury utilized snowcats to access virgin powder in a remote corner of the Selkirk Mountains. Now in its 40th year, Selkirk Wilderness Skiing (selkirkwilderness.com) is at the forefront of an industry that is growing steadily every year and attracting clients from around the globe.

AN INDUSTRY THRIVES

There are now over 40 helicopter and snowcat skiing companies operating throughout the great mountain ranges of BC providing some of the best skiing experiences in the world. The industry continues to grow modestly, with new operators opening up terrain in some of the more remote areas of BC and providing new experiences for guests. Northern BC has seen a few new cat and heli operations over the past ten years and continues to be at the forefront of potential new development.

EXPERIENCE AND PROFESSIONALISM

Throughout this period, both the business of offering helicopter and snowcat skiing experiences and the work involved has evolved—at times rapidly, due to the explosive growth and pressure the industry has experienced on a few occasions. While business owners and investors refined what it took to run a successful business in this globally unique industry, workers refined their practices as well. European-trained mountain guides established the roots of the industry on Canadian ground and it wasn't long before born and bred Canadians started to make their own contributions. I'm sure there were times when the future was uncertain and events like the 1991 Bay Street accident prompted deep reflection. These events shaped, in their

own way, where we are today—boasting the largest and most successful helicopter and snowcat skiing industry in the world. The focus and dedication of those who helped shape this one-of-a-kind industry was (is!) remarkable and those of us who are active today can't offer enough thanks and respect to those early pioneers. It is now up to us, the current generation of Canadian HeliCat businesses and staff, to look to the next 50 years and overcome the challenges waiting for us so that we may celebrate more historical milestones.

Let's take some time this season to remember the past and celebrate all that the last 50 years has taught us and brought to BC. Congratulations to all who have played a role, no matter how small, in our collective success. Here's to the next 50.

HELICAT CANADA ASSOCIATION

HeliCat Canada is the trade association of the helicopter and snowcat skiing industry in Canada. HCC's primary mandate is to promote the continual improvement of the industry through research, education, advocacy and overseeing operational guidelines for the industry. Every HeliCat Canada member is periodically reviewed by HeliCat to ensure compliance with industry standards. For more information visit helicat.org.

// WREN MCELROY

SCOTT AND HIS SON MICAH
// EMILY GRADY

Remembering **Scott Grady**

Bridget Daughney

SCOTT GRADY WILL BE REMEMBERED FOR HIS DISTINCTIVE LAUGH, HIS COMPETENCY IN THE MOUNTAINS, HIS EASE WITH CLIENTS, HIS JOY AT HANGING OUT WITH HIS CHILDREN AND FRIENDS, AND OF COURSE, HIS "GRADY ADVENTURES." He had a way of making people feel comfortable and included. He was an adventurous spirit, world traveller and an accomplished backcountry enthusiast. Scott was also an inventor, tinkering away on ideas to make gear run smoother. These are the gifts we will keep to forever remind us of him.

For many of us, it was a surprise to learn of Scott's death by suicide on November 7, 2014. It is hard to connect this outgoing, loving individual with the dark pain of depression. Suicide often leaves a lot of emotions and questions for those left behind. I encourage all of you to talk to those around you and seek counselling if needed.

Scott's family has expressed that his struggle with mental illness should not be hidden away, in hope that it may help someone else who is also suffering. Scott himself felt that he had struggled most of his life with "being different." In his adult years, he was diagnosed with depression and was taking medication at times to help him with this mental illness. Over the past years, Scott hit many lows and had expressed interest in self harm. He was lovingly supported and many people reached out to him over this dark time. Unfortunately, Scott was often unable to accept the help that was available to him.

Scott "Adventure" Grady will be deeply missed. A book of his adventures is being written for his children. If you have a good tale, please send it to me at bdaughney@avalancheassociation.ca.

En l'honneur d'une **grande Dame**

Alexandre Robert

SI VOUS ÊTES DE CEUX QUI ONT EU LA CHANCE DE PARTAGER UN MOMENT AVEC SYLVIE MAROIS, VOUS AVEZ PROBABLEMENT EN MÉMOIRE SON SOURIRE LÉGENDAIRE. Peu importe les obstacles à surmonter, elle fonçait, droit devant, les yeux étincelant d'une passion sans borne. Que vous l'ayez côtoyée dans un cadre professionnel, lors d'un séjour ou d'un cours, vous avez pu être témoin de son accessibilité et de sa bienveillance.

Après de nombreuses années à guider dans plusieurs disciplines, Sylvie a acquis une grande expérience et celle-ci, jumelée à ses qualités innombrables, l'a amenée naturellement à développer un programme de tourisme d'aventure, reconnu par ses pairs. Cette enseignante avait à cœur de former des guides qui auraient comme convictions profondes le professionnalisme et le respect. Elle aura contribué au développement du métier par son implication dans l'établissement des standards de l'industrie et cela, tout en soutenant l'épanouissement des femmes en tant que guides.

Sylvie Marois a été emportée par une avalanche alors qu'elle guidait un groupe de randonneurs au Népal le 14 octobre dernier. Elle est disparue en laissant derrière elle un héritage à la hauteur des montagnes qui l'ont emportée. Celui-ci sera porté par des centaines de guides, qui continueront à promouvoir ses valeurs, sa passion, ainsi que son amour pour cette profession.

IN HONOUR OF A GREAT LADY

If you are amongst those who have had the chance to share a moment with Sylvie Marois, you probably remember her legendary smile. Whatever the obstacles in front of her, she was heading straight ahead with sparkling eyes and boundless passion. Whether you've known her professionally, during a trip or in a course, you were able to witness her accessibility and benevolence.

After many years guiding in several disciplines, Sylvie acquired extensive experience—which, coupled with her innumerable good qualities, naturally led her to develop an adventure tourism program which is recognized by her peers. As an instructor, she had the heart to train guides to hold professionalism and respect as their premier convictions. She has contributed to the development of the profession through her involvement in setting industry standards while supporting the progress of women as guides.

Sylvie Marois was swept away by an avalanche while guiding a group of hikers in Nepal on October 14, 2014. She disappeared, leaving behind a legacy the height of the mountains that took her. That legacy will be supported by hundreds of guides who will continue to promote her values, passion and love for this profession.

// SYLVIE MAROIS COLLECTION

SOME MEMBERS OF THE ISSW ORGANIZING COMMITTEE L TO R JEREMY MACKENZIE, PASCAL HAEGELI, ROWAN HARPER, SUE HAIRSINE, MIKE KOPPANG, MISCHI BOENESH, TODD GUYN, GRANT STATHAM, DAVE STARK, JOHN GILLETT // GUY CLARKSON

ISSW Review

Karilyn Kempton

YOU COULD CALL THIS YEAR'S ISSW in Banff, AB an unequivocal success. More than 800 delegates from nearly twenty countries flocked to the scenic Banff Centre from September 28 – October 3. Generations of snow science professionals came together in front of a spectacular natural setting. This was the third time ISSW was held in Banff, and it was the biggest yet. Organizers received 266 submissions for presentations.

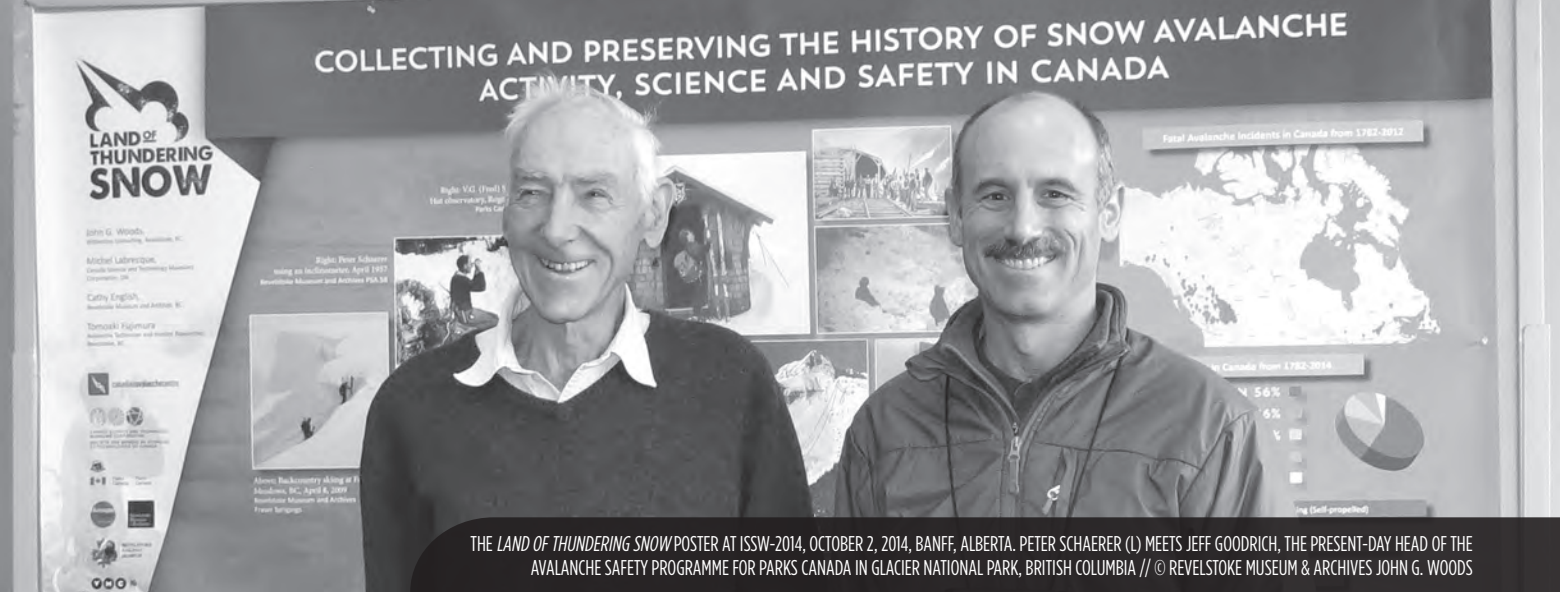
Daily panel discussions sponsored by the ACMG were packed, focusing debate on avalanche safety equipment for ice and alpine climbing; the contributions of the avalanche science; compaction; and training, certification, qualification and scope of practice. Read summary notes from those workshops here: http://issw2014.com/workshops/.

This year's theme was merging theory and practice, and researchers were encouraged to provide practical applications to their studies. Presentations were followed by thoughtful and curious questions from the audience about implications and where to go next. Attendees continued spirited snow science discussions during coffee breaks, afternoon beer-o-clock and evening events.

Evening highlights included Diva Night and Whiskey and Words. Diva Night is an important social component of every ISSW; this year women made up 16% of ISSW delegates. Diva Night aims to celebrate women in the avalanche industry and provide networking opportunities among the female avalanche community—it remains a necessary component of the male-dominated conferences.

Those lucky enough to attend Whisky and Words at the Whyte Museum were in for a treat, as Brad White and Chic Scott gave truly entertaining presentations on Banff's backcountry skiing history (including heavy involvement by Brad's family), and the early grand traverses done by Chic and his friends.

See you next time: Breckenridge, Colorado in 2016.



THE *LAND OF THUNDERING SNOW* POSTER AT ISSW-2014, OCTOBER 2, 2014, BANFF, ALBERTA. PETER SCHAERER (L) MEETS JEFF GOODRICH, THE PRESENT-DAY HEAD OF THE AVALANCHE SAFETY PROGRAMME FOR PARKS CANADA IN GLACIER NATIONAL PARK, BRITISH COLUMBIA // © REVELSTOKE MUSEUM & ARCHIVES JOHN G. WOODS

Land of Thundering Snow—Presenting Canada's Avalanche Heritage on the International Stage

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

SINCE SO MANY PEOPLE AROUND THE WORLD think of snow when they think of Canada, it shouldn't come as a surprise that living with snow, in all its forms and behaviours, is part of what helps us define ourselves. It is surprising then, how little most people know about our history of living with snow avalanches—a force of nature that, like our country, stretches from the Pacific to the Atlantic to the Arctic.

In the summer of 2012, the Revelstoke Museum & Archives boldly moved to help the public learn about our national avalanche history with the start of an archival research project that sought to bring together the many facets of our avalanche heritage—from the sad lessons of tragedy to the brilliant successes of science and innovation. Under the banner *Land of Thundering Snow*, this project has collected objects, images, oral histories, videos, unpublished documents and publications in the form of virtual museum exhibit that will soon be available to anyone with access to the Internet.

The website is divided into six sections—*Lessons from the Past, Anatomy of an Avalanche, Battling Avalanches, Staying Safe, A Natural Part of Mountain Life and Only the Beginning*. The centerpiece of the exhibit is an interactive map depicting the locations and brief details of more than 400 fatal avalanche accidents resulting in nearly 900 deaths.

Relying heavily on data from Avalanche Canada's "Incident Report Database," the *Land of Thundering Snow* project also has become a contributor to the dataset as it uncovers previously unknown incidents in the historic record and historic details of known incidents. Website viewers are encouraged to contact the website if they know more precise information (and corrections) on anything they see in the site. Verified updates to the incident dataset will in turn be given to Avalanche Canada for revisions to the official incident database where appropriate.

Recently the Revelstoke Museum & Archives made a quantum leap into the world of avalanche history with the acquisition of extensive documents and photographs owned by long-time avalanche professional Peter Schaerer. Peter's unwavering dedication to both his profession and the documentation of its history now spans nearly 60 years and he has been a constant source of energy, inspiration and detail throughout the virtual exhibit project.

- View much of the collection online at revelstokemuseum.ca/peter-schaerer-collection.
- Read our ISSW paper "Collection and preserving the history of snow avalanche activity, research and safety in Canada" at arc.lib.montana.edu/snow-science/item/2233.

While the *Land of Thundering Snow* project has made significant progress in gathering material and introducing Canada's avalanche heritage, we consider it only the start at assembling a more complete archival record of our national avalanche history.

The *Land of Thundering Snow* virtual exhibit will be launched March 4, 2015 and updated regularly for five years.

ACKNOWLEDGEMENTS:

Land of Thundering Snow is funded through the Virtual Exhibits Investment Program of Canadian Heritage and the site will be part of the Virtual Museum of Canada, administered by the Canadian Museum of History. Major partners of *Land of Thundering Snow* include the Avalanche Canada, Revelstoke Railway Museum, Okanagan College and Parks Canada with extensive cooperation and support from the British Columbia Ministry of Transportation and Infrastructure, Canada Science and Technology Museums Corporation, CP Rail and numerous avalanche safety professionals.

// HEATHER THAMM

Beyond the Border: Information Sharing Amongst Avalanche Dog Handlers

Gwen Milley

THROUGHOUT THE YEARS, Canadian Avalanche Rescue Dog Association (CARDA) dog handlers and their K9 partners have been fortunate to travel to the USA and Europe on patrol exchanges and search and rescue training courses. The consensus from all dog handlers involved has been overwhelmingly positive. These handlers had the opportunity to participate in training exercises and daily operations of other organizations. The exposure to different environments is invaluable and the amount of information exchanged in a relatively short period is amazing. Being involved with new experiences opens the door to different training methodologies, problem solving techniques, training equipment and training exercises. This requires an open mind and a willingness to learn—all attributes of a good dog handler. In turn, these handlers can incorporate new information into their own operations when they return to work at his or her home resort or SAR group.

CARDA is highly respected amongst the American avalanche dog handler community. Many of their dog handlers travel to British Columbia to attend CARDA's winter training course every year. They experience first-hand how our courses are organized, our training philosophies and progressions, and the certification process with the RCMP. The American handlers leave these training sessions full of enthusiasm and new ideas they can incorporate into their own operations.

The relationship that CARDA has formed over the years with the American dog handlers has created a unique opportunity for some CARDA instructors to travel

to areas like Colorado, California, Utah, Wyoming, Idaho and Alaska to assist with training American dog teams in SAR organizations and ski resorts. The typical training sessions are three to five days long with a mix of theory and field sessions. The dog teams are grouped according to the age of the dog and where they are in their training progression. Beginner, intermediate and advanced groups are created and field training (search and obedience) is catered to each level and the individual teams within the group. CARDA instructors provide insight and guidance during specific training exercises and scenarios in the field. During the in-class theory sessions, we share our basic philosophies, our training progressions, our search techniques and how all this relates to the final product that the CARDA organization strives for.

CARDA instructors have found these experiences invaluable; they are exposed to various philosophies of search dog training, different dog breeds, other dog program educators, and the dog-related histories and policies of diverse avalanche regions throughout the USA. These exchanges create professional development opportunities for CARDA instructors to share information, hone their problem solving skills, provide motivation and display diplomacy, understanding and professionalism.

The feedback from the instructors after their training sessions in the USA is very positive; the experiences increased their confidence as dog handlers and instructors, gave them more tools for training and handling a dog, and a renewed enthusiasm to instruct. All agreed that it is great to train with like-minded people who are all passionate about the work they do and the strong, cherished relationship with their K9 partner.

A commonality exists between dog handlers no matter where you are from. The desire to work with a K9 partner is like no other. The strong relationships that have been formed between the CARDA instructors and American dog programs are vital to the continued success of innovative training and a culture of information sharing that benefits both sides of the border.

// HEATHER THAMM

JAY PUGH AND LADDIE AT MT. NORQUAY // DERYL KELLY

Planning and Preparation for the **Avalanche Dog Handler**

Jay Pugh

AN AVALANCHE DOG HANDLER'S preparation requires so much more than just training to pass a test. The level of readiness handlers hold themselves to makes a very tangible difference—the difference between life and death. Though this seems like an obvious and simple fact, there are challenges in several key aspects.

Avalanche search dog handlers in Canada come in two basic forms. The first are professionals such as the RCMP, Parks Canada, and for the purpose of this article, snow safety professionals like ski patrollers. The second group is made up of the volunteers. While not necessarily employed in the snow safety fields, they belong to Search and Rescue Groups and are on a callout list once certified.

The key factor to preparation is mindset. This is the mental attitude that all other factors rely on. Without the proper mindset, training is inefficient, equipment is not readily available and, worst of all, the handler is mentally unprepared. Dave McGrail, a highly respected Denver Fire Department chief, writes that a poor mindset leads to poor preparation, which leads to surprise and panic, which in turn leads to poor decisions. The dangerous condition, according to McGrail, is complacency.

The reality is that the majority of handlers do not have many responses. It is not uncommon for a team to have only two or three responses during the entire working life of the dog, which can create a "nothing ever happens" mindset. Handlers start to believe they will never respond to an avalanche. Often this is compounded by rumors of missed opportunities and long periods of no contact with other handlers and agencies. Bitterness over hundreds of hours of unused training may set in.

To combat this, handlers have to make the clear cognitive decision that they will not fall prey to this attitude or conduct themselves in a manner that reinforces this mindset. This happens through training, professionalism and a mindset of "it will happen."

Training is not a means to an end. Some have trained to pass the certification test and stayed at that level. The ideal attitude is to get out and push the comfort zone. Handlers should learn the nuances of the areas they are responsible for and set up scenarios in that terrain. This gives the advantage of knowing what challenges may be present in those areas in terms of access points, trap zones and hazards. While every contingency can not be planned for, the handler will already know a lot about how they will deal with an avalanche in this area. A good piece of advice from the fire service is to imagine the worst-case scenario and how to deal with it.

Handlers also need to know the strengths of the people and systems they will work with. Cross training with the governing bodies (RCMP, Parks Canada and Kananaskis Country for Alberta Avalanche Rescue Dog Association (AARDA) members, for example) is a highly-valued privilege. Also, snow safety staff of involved ski resorts should know how the dogs work and how to facilitate their use.

It's surprising how often handlers are not in peak physical condition in the canine search and rescue world. The demands of moving through terrain and handling a fast, high-energy dog require an above-normal level of fitness. As it is completely in the individual's control (through diet and exercise), poor fitness is the hallmark of a complacent attitude. This goes for the dog as well, obviously. Handlers with an overweight dog should not be surprised when they are not taken seriously as a resource.

Mindset is not all about physical training. An effective tool is to analyze past events in a constructive manner, where the handler puts themselves in the response. The Canadian Avalanche Association's *Avalanche Accidents in Canada* books are very useful in this regard. Discussions with experienced handlers are also very valuable. Someone who has been there usually has strong convictions about what's important to know and how to be mentally prepared. Handlers with an open, non-judgmental mind can learn a lot, as well as pass on invaluable lessons learned.

Next is professional conduct, which is more than looking the part. If a team wants to be part of a rescue some things must be in place. These include a good working relationship with the governing agency. Regardless of any certification, if those responsible for coordinating a response do not trust the handler, that handler will not respond.

As previously mentioned, cross training is a privilege that AARDA handlers enjoy. The insight and experience of Parks Canada handlers have been invaluable. There is a great deal of respect and gratitude felt toward these professionals who make the time in a very busy schedule to train with AARDA. Handlers are also expected to keep governing bodies advised as to their status. If the handler cannot be available, then that should be relayed.

A common practice in fire halls is for a scanner radio to be on at all times.

Regardless of any certification, if those responsible for coordinating a response do not trust the handler, that handler will not respond.

Crews can listen in to calls and learn from them, and if they are close to a major incident they can start preparing for the second alarm. Translated to the dog handler, there is an obvious need to know what the conditions are. Following the avalanche bulletins and knowing times of high danger are important, and like the fire crews, it is also critical to know who is busy. In times of high hazard it is common for multiple events to happen within one area. Often, responses require several canine teams and/or can last days. With the latter, the relieving handlers will have to be mentally prepared for a recovery operation.

Having equipment and dog ready to go is another factor in preparation. This may present somewhat of a logistical difficulty for ski hill handlers who have their equipment at the resort even though they may be called on their days off. They must either bring their skis, packs and other equipment home or have a second set ready to go. Storage in the workplace, home and vehicle has to be organized for quick access.

Here's what we can learn from other profiles:

Rescue divers carry a "save a dive kit" which has the extra fin, mask, straps or other pieces that can salvage an operation in the case of a mechanical breakdown or human error.

FEMA disaster search dog teams in the United States have a comprehensive checklist for deployment. It's extensive—they may be deployed for weeks and it is difficult to know what exactly will be needed. Avalanche handlers have to be prepared for an overnight deployment, as well as possibly needing heli-slinging gear. All of it needs to be in good condition. There is also the need for safe dog transportation. Kennels are a must.

A final thing for handlers to know is the communications angle—how the radio works, how to program the necessary channels, and the protocols that need to be known and practiced. Spare batteries should be routinely checked and charged.

In conclusion, avalanche dog handler preparation first requires the conscious decision to have the proper mindset. The belief that a handler will go to an avalanche rescue allows no compromise in being ready to go, well trained, properly equipped, physically fit and a trusted resource. Holding oneself to this high standard is a commitment that must be as honest as it is unforgiving. Attitude truly makes make the biggest difference.

research

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AVLANCHE TRANSCEIVER TEST: 2013-14

// WREN MCELROY

DAV Avalanche Transceiver Test: 2013-14

Florian Hellberg, Thomas Exner, Sophia Steinmüller and Christoph Stelzer
Safety Research Group of the German Alpine Club (DAV)

English translation by Renate Dübell, Thomas Exner

THE SAFETY RESEARCH GROUP OF THE GERMAN ALPINE CLUB (DAV) tested all the new avalanche transceivers of winter 2013-14. Irrespective of the different technical approaches the transceivers use (number of antennas and data evaluation), all commercially available avalanche transceivers were evaluated on the basis of practice-oriented criteria, considering the ICAR search phases (signal search, coarse search and fine search) and the additional multiple burial feature. Pinpointing (i.e., probing after fine search), was not considered as this search phase does not involve the transceiver. The different test criteria weighting (low, medium and high priority, see summary Table 1) is an important factor to take into consideration when comparing the various devices. Each individual criterion was rated on a five level scale, ranging from very good to acceptable to insufficient.

In general, apart from their high-end model, most manufacturers offer a slimmed-down version in the mid-price range with less advanced technical features. These cheaper devices are less complex and thus easier to use, and provide a very satisfactory performance for the average backcountry user. The special features (e.g., mark function) of the high-end devices are mainly relevant for multiple burial scenarios (signal overlaying due to several devices in the reception range) and can only be efficiently put into practice by an experienced user.

UPDATES

Nowadays, many transceivers have updatable software. Some transceivers that have been on the market for several years are continuously refined by new software updates, not only adding new features but also improving basic search functions. It is worthwhile to check your device's software version and, if necessary, update to a current version.

STATE OF THE ART

Digital three-antennae technology may be regarded as the current standard in transceiver technology. During fine search, one of the three antennae is always in an optimal receiving orientation with respect to the transmitting antenna, so that accuracy and speed of search increase considerably. Nevertheless, Pieps still offers a Freeride transceiver, the only device on the market using outdated one-antenna technology. Particularly during fine and coarse search, the Freeride showed significant weaknesses and therefore cannot be recommended.

SEARCH STRIP WIDTH

Caution! Some manufacturers claim a search strip width of up to 60m. The test has shown that particularly when the antennae are in an unfavorable position, the claimed range is far too wide to reliably locate all transmitters. Only experienced searchers who know their device very well may deviate from the recommended search strip width of 20m; the consequences of missing a buried person during signal search are most definitely fatal.

UPDATES IN DETAIL

Arva introduced two new models: the high-end ProW and the more basic Neo. However, in our test, during coarse search and with multiple burials, the Neo performed better than the ProW.

Mammut offered a software update version 4.0 for its Pulse. The main innovation is a guided fine search which guides the user by arrows via the two axes for fine search. Furthermore, the signal maximum for pinpointing with the probe is determined by the device.

Pieps launched the DSP Pro and DSP Sport as successors in the DSP series and included new electronics and software. In signal search and coarse search, the devices are very accurate and reliable. There are still shortcomings in multiple burial scenarios. The DSP and DSP Tour are still available and being further updated.

Ortovox introduced software update 2.0 for the S1+, software update 2.1 for the 3+, and software update 2.0 for the Zoom. These updates slightly improve the fine search. All three devices are

TABLE 1. FOR COLOUR VERSION, VISIT BIT.LY/1A8ABDf

DAV
Deutscher Alpenverein

Avalanch Transceiver Test
2013/2014

DAV – Safety Research Group

Hellberg
Exner
Steinmüller
Stelzer

			signal search	coarse search		fine search			multiple burial	
			(low priority)	(high priority)		(high priority)			(medium priority)	
			reception range x/y/z-direction (meter)	approaching horizontal sender	approaching vertical sender		0.5	2.5		20°
Arva	*Pro W* NEW	Vs. 4.0	38/30/21m	●	X	●	○	●	○	○
	Neo NEW	Vs. 2.0	46/35/27m	○	○	●	○	●	●	●
	Evo3+		28/24/19m	●	○	○	●	●	X	X
bca	*Tracker2*	Vs. 04	45/19/12m	●	○	○	○	○	○ *1	*1
Mammut	*Pulse* UPDATE	Vs. 4.0	50/25/18m	○	●	●	○	●	●	○
	Element	vs. 1.0	50/25/17m	○	●	●	○	○	●	○
Pieps	*DSP Pro* NEW	vs. 1.2	40/32/27m	○	○	●	○	●	○	○
	DSP Sport NEW	vs. 1.2	36/31/27m	○	●	●	○	●	○	○
	DSP	vs. 8.2	42/37/33m	●	○	●	○	○	○	○
	Tour	vs. 8.2	43/34/30m	●	○	●	○	○	●	○
	*Freeride**2	vs. 2.6	25/7/15m	●	●	X	○	●	●	-
Ortovox	*3+* UPDATE	vs. 2.1	36/23/14m	○	X	●	○	○	●	●
	S1+ UPDATE	vs. 2.0	49/34/25m	○	X	●	○	○	●	○
	Zoom+ UPDATE	vs. 2.0	33/15/11m	○	X	●	●	●	X	-

○ very good ● good ○ acceptable X problematic ● poor

*1: Information about multiple burial can only be obtained via the complicated "SP"-mode. If you can cope with this you will be able to deal with the situation well
*2: device with one receiving antenna only and thus no directional guiding in coarse search
-: no direct tracing possible. Multible burial scenario can only be solved by three-circle method

equipped with a RECCO reflector within the housing as a backup system. Additionally, all of them detect the spatial position in order to transmit using the most horizontal antenna (smart antenna technology).

TEST CRITERIA

SIGNAL SEARCH

The range of an avalanche tranceiver's receiving antenna plays an important role when searching for the first signal. Generally, the range can be divided into three axes based on the orientation of the transmitting antennae (the x-, y- and z- direction, shown in Fig. 1). We defined the maximum range of the receiving device as the distance away from the transmitter that still resulted in a constant signal. When testing, the distance ranges in all three antennae orientations were determined. The average value resulting from the x-, y-, and z-direction as well as the respective minimum value are considered in the chart for assessing the category range.

In reality, the values of the three ranges (x-, y-, and z-direction) are mixed, since the searcher is moving across the avalanche search field, and therefore the orientation with respect to the transmitting antenna changes. Generally speaking, the maximum range of a transceiver should not be overrated. A large range is not very useful if the signal cannot be followed clearly after initial detection (see "Fuzzy Range" in the Coarse Search section of this article).

COARSE SEARCH

This search phase starts after the initial detection of a signal and ends when the searcher is approximately five metres away (see display indications). We rated the traceability of the transmitted signal along the field line with a horizontal and vertical orientation of the antenna of a buried transceiver (Fig. 2).

During coarse search, transceiver performance varied widely. Good devices are characterized by a reliable indication of the search direction after initial signal detection. From then on, clear, steady and straightforward directional guiding leads into close range of the buried transceiver, independent of the antennae orientation of the transmitter. There were big variances between the tested devices in the far range of coarse search, when the displayed distance exceeded 20 to 25m. At a closer distance, almost all devices performed very satisfactorily. It is therefore vitally important to get to know your device through practice and training.

The devices were rated according to the following criteria:

- Is the path of approach in the far range (after reception of the first signal) unambiguous and effective?
- Do time-consuming directional errors occur?
- Is the first signal lost again?
- Are distance values correct or do they show misleading increases?
- Do leaps in distance values occur (e.g., from 17 to six metres)?

FIG. 1: SIGNAL SEARCH. DETERMINING THE MAXIMUM RANGE IN ALL THREE AXES

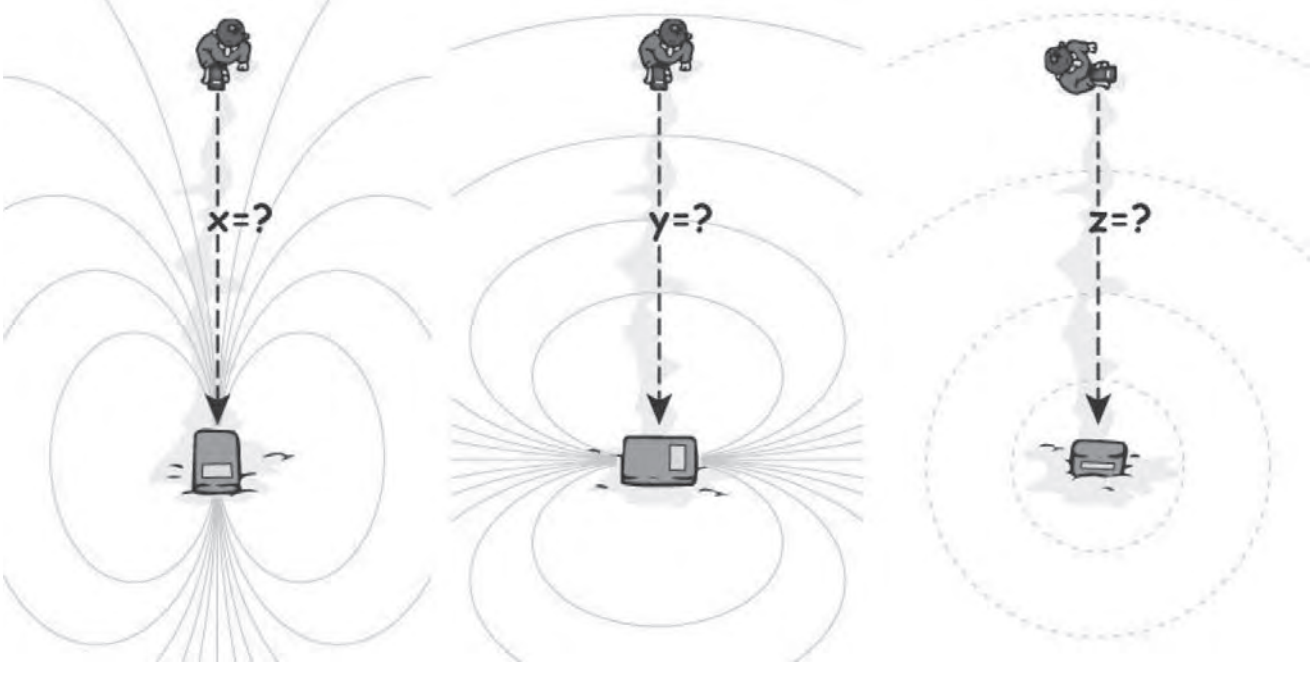
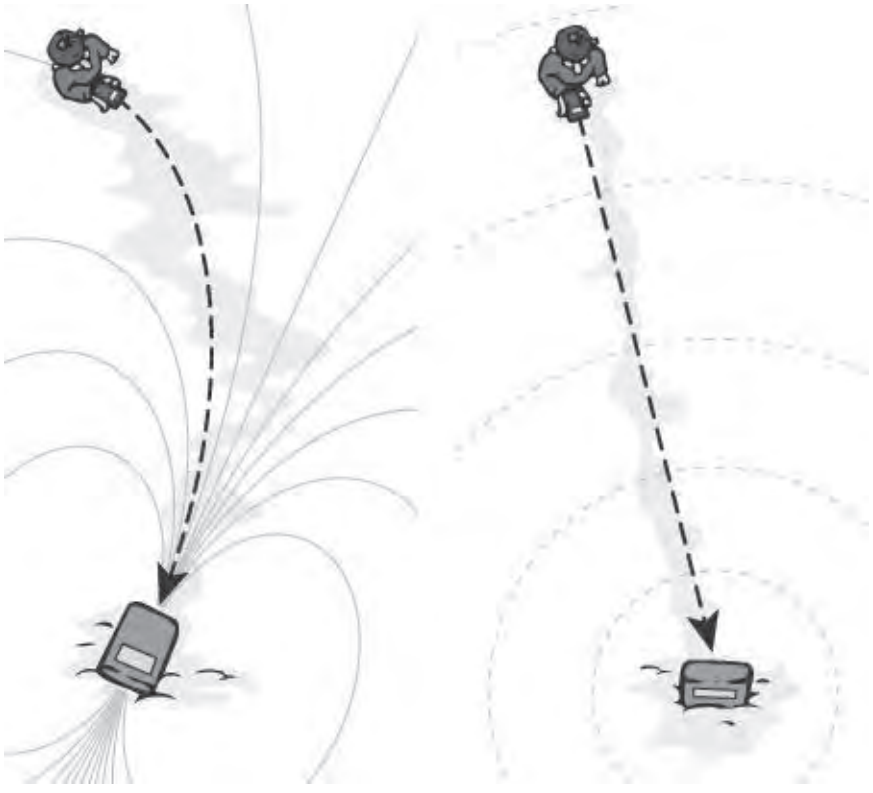


FIG. 2: COARSE SEARCH. APPROACHING A HORIZONTAL AND VERTICAL TRANSMITTER FROM THE POINT OF RECEPTION OF THE FIRST SIGNAL.



- Does the acoustic information correspond with the optical information?
- How large is the fuzzy range (range of undirectional guidance) where directional guidance is ambiguous?

To receive an acceptable rating, the approach to a transmitter offset 15m from the direct walking path had to be reliably possible.

RANGE OF UNDIRECTIONAL GUIDANCE (FUZZY RANGE)

Even if a device has a large maximum range, this does not necessarily mean that the signal can be effectively traced towards the transmitter. In particular, there are problems in the phase right after signal reception, which is why we chose to focus on this aspect of rating. To be able to evaluate this phase more precisely, we defined the "range of undirectional guidance" or "fuzzy range" as a test criterion, where approaching the transmitter is not possible in a straightforward manner. We regarded display values without directional arrows, directional guidance which does not approach the transmitter, signal loss, or any combination of above aspects as unclear or ambiguous. A small range of undirectional guidance defines a good device. Among the high-end devices, the range of undirectional guidance was well below five metres. With weaker devices, this fuzzy range of undirectional guidance could exceed 15 metres. To reach a buried person quickly and reliably under time pressure and stress, stable and unambiguous directional guidance is of utmost importance. An early signal reception is usually at the expense of clear directional guidance, and is thus not very helpful for the searcher. Particularly when the transmitter was vertically positioned, some devices still showed weaknesses in this respect.

FINE SEARCH

Using two scenarios (burial depth of 0.5m with a horizontal transmitter and burial depth of 2.5m with a vertical transmitter, see Fig. 3) the devices were rated according to the following criteria:

- Is the transition from coarse to fine search indicated appropriately?
- Are incorrect distance values displayed when cross-bracketing?
- Are there misleading directional arrows?
- How quickly do the distance values adapt when moving the device?
- Does turning or rotating the device influence the displayed values?

• Are the accompanying acoustics supportive?
• Do the display values on the search axes decrease uniformly until the device is located directly above the transmitter, and do they then increase again?

In fine search, all available three-antennae devices operate effectively and reliably, even with deep burials. Very good devices are further characterized by high-speed signal processing and a clear stepped profile of the display value on the axes of fine search, in combination with a good acoustic support.

ATTENTION

Most mistakes are made and most time is lost in the fine search phase. Frequently observed mistakes include moving the device too quickly, and not following the first straight line far enough while cross-bracketing or searching it too frequently. Particularly in this search phase, every searcher has to adapt to the optimal operating speed of their device. Again, we stress that training and experience is very important here.

MULTIPLE BURIAL

This search phase is the most complex assessment category in the test. We assessed whether a device is capable of detecting a multiple burial scenario, and whether the user is given important information in this respect (number of received transmitters, distance, direction). Further, the devices were compared with respect to their approach and functionality regarding direct tracing in a test scenario.

We assessed whether a direct tracing is possible, whether "marking" of located transmitters is done rapidly and reliably, whether marked transmitters accidentally change back into the search mode, whether all transmitters are detected, and how fast and reliable the device is in this situation.

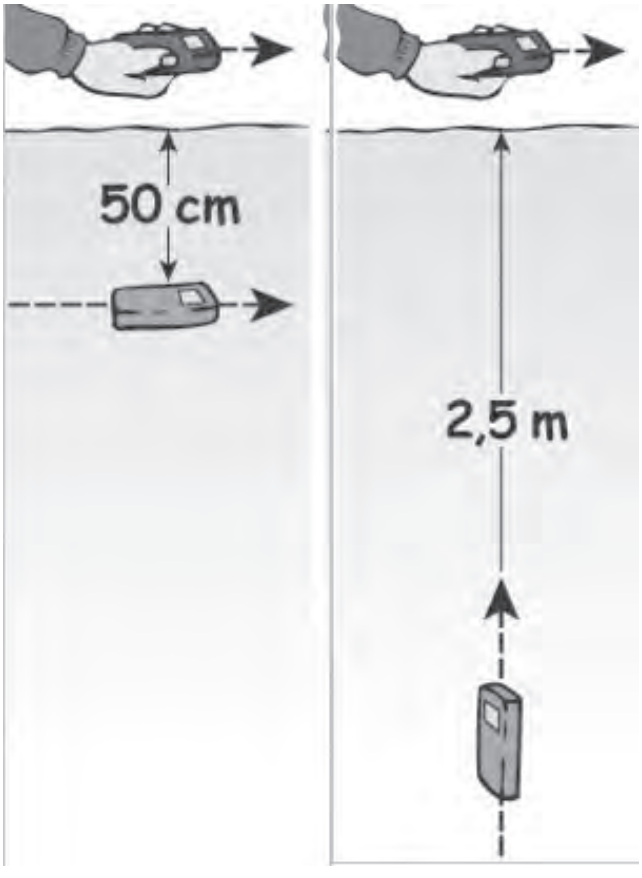
All in all, solving a complex multiple burial scenario is the most intricate technical challenge for an avalanche transceiver. The function should not be overrated; however, as according to the findings of the DAV Safety Research Group, complex multiple burials rarely occur (approximately 3% of accidents). In case of a multiple burial, different strategies may also be adequate (the three-circle method or micro search strip search). It is very important that a device provides exact information on the overall burial situation so that the user can choose the correct approach.

SUMMARY OF TEST RESULTS

In our opinion, apart from providing information whether there is a multiple burial situation, the coarse search and, in particular, the performance during fine search are the most important features of an avalanche transceiver. Above all, a transceiver must operate quickly and stably.

The table provides an overview of the performance of all tested transceivers according to the criteria described above. Detailed characteristics of each device can be found at bit.ly/14QRObX.

FIG. 3: FINE SEARCH. DETERMINING THE BURIAL POSITION BY CROSS BRACKETING WITH A SHALLOW AND DEEP BURIAL WITH A HORIZONTAL AND VERTICAL TRANSMITTER POSITION, RESPECTIVELY.



Flakes

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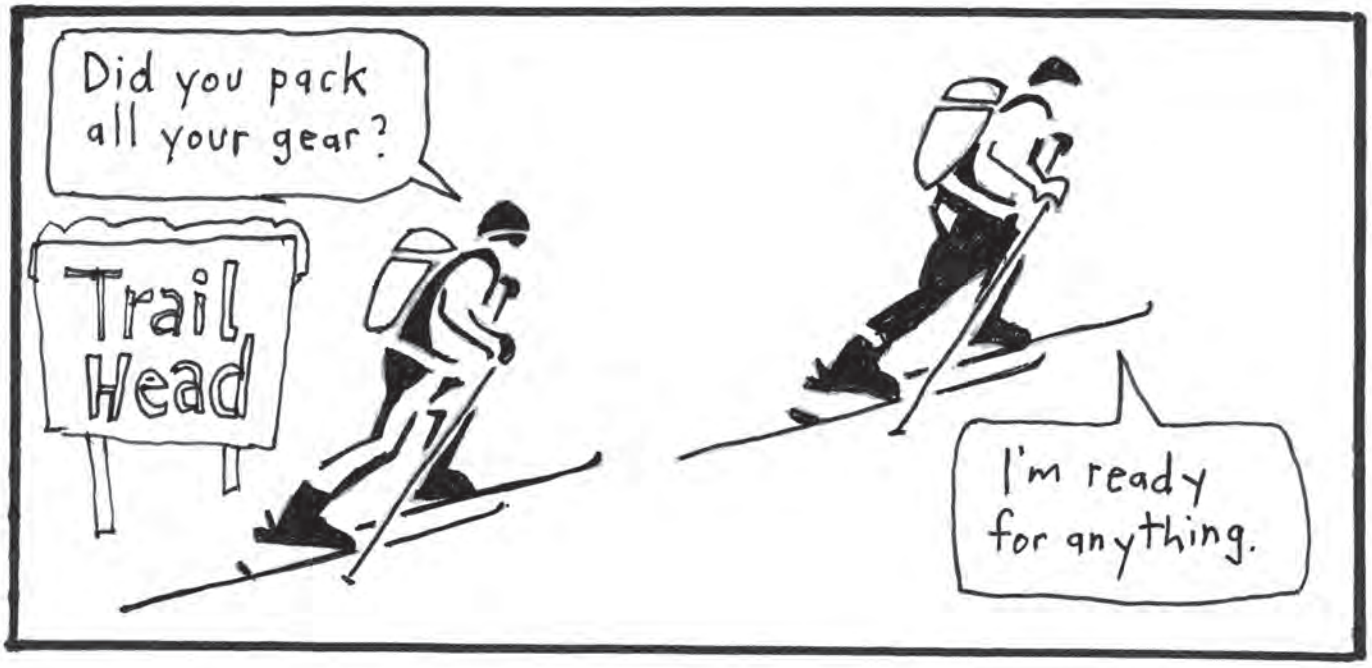

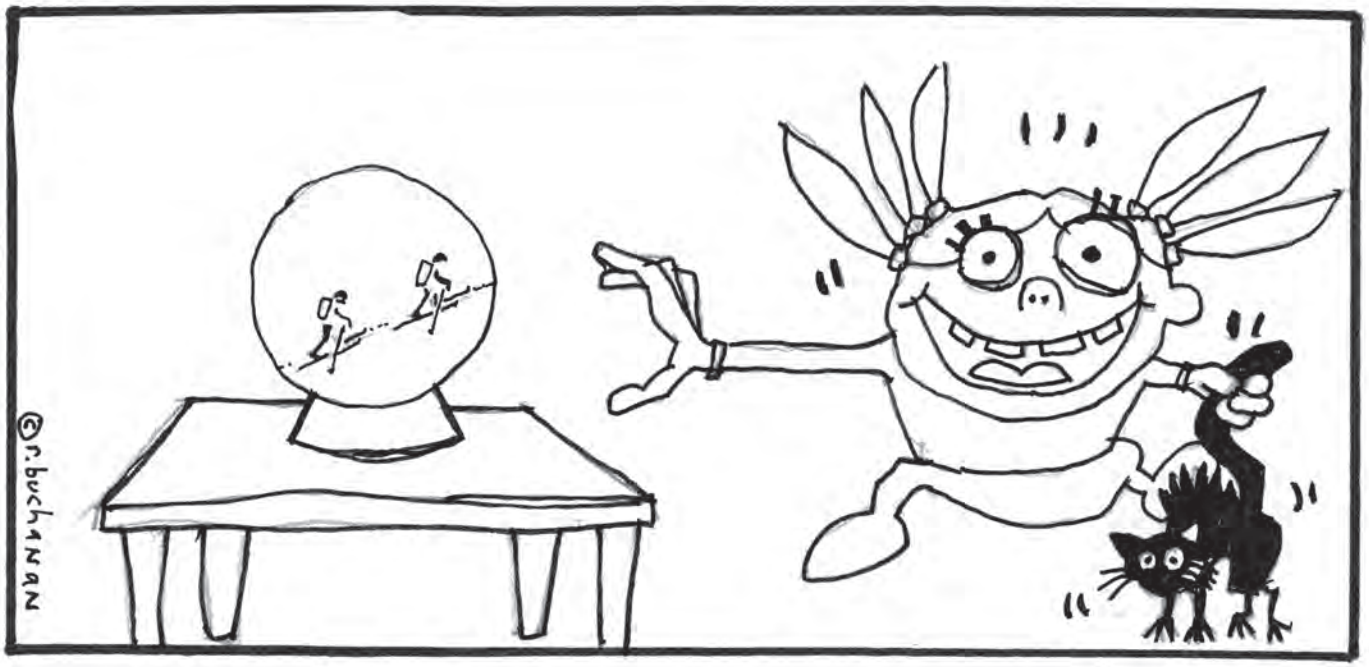

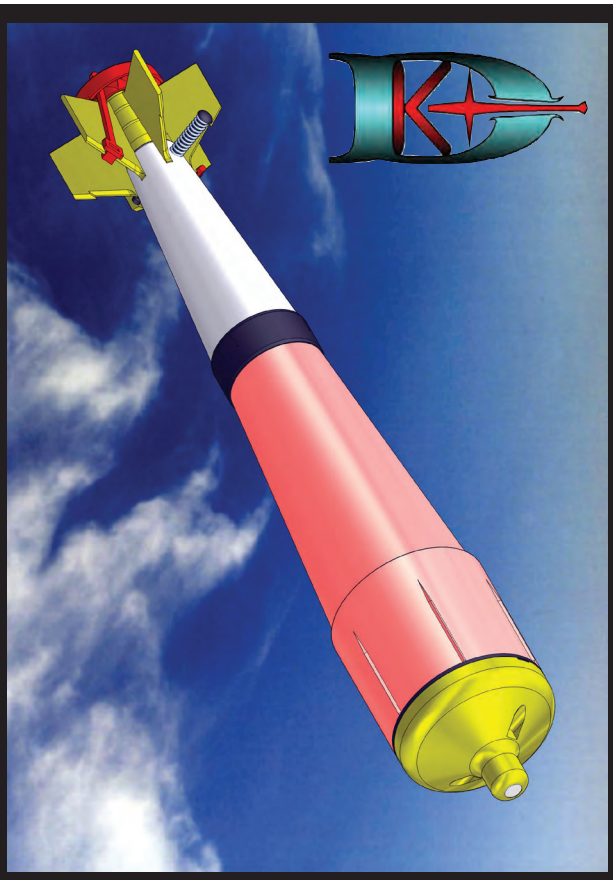

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