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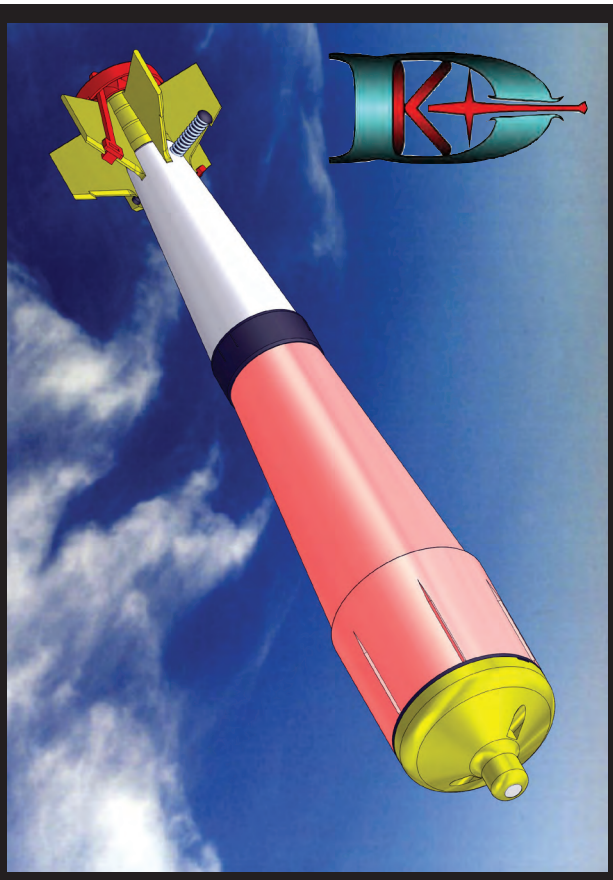

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CONTENTS
FALL 2015

COVER MARK BENDER // **CONTENTS** SCOTT WICKSON

in this **issue**

Spring Has **Sprung**

Karilyn Kempton
Managing Editor

AS PROBABLY ALL OF YOU DO, I need regular doses of alpine therapy. When it's not winter, that usually takes the form of trail running or biking one of the alpine trails around the Revelstoke area. Spending time high in the mountains offers a chance to recharge, relax, push myself and breathe a little more deeply. And accessing the same terrain in different seasons gives a fresh perspective on what's really under the snow in the winter.

This summer, a communication breakdown during a run led to a group member running an extra 20km in the dark, worried that another member of the party was missing or hurt. Heading out for an evening alpine session, we didn't discuss route options as we laced up our shoes. Running at different paces, we all missed each other by mere moments at possible muster points. It all turned out fine and only led to a few hours of waiting and some sore legs, but it highlighted the importance of starting with a plan, checking in with the group, and then debriefing.

Many articles in this issue revolve around teamwork, and what it takes to work well as a team. These range from Robb Andersen's article on governance and the underlying structures of the CAA that help the organization run smoothly for its members, to Ian Jackson's story on the multi-agency Polar Circus avalanche rescue, to Mike Henderson's take on effective communication within a team. Bruce Jamieson offers a humorous reflection on his early years as an avalanche researcher and the connections he has made throughout the years, and Madeleine Martin-Preney offers some advice for supporting teammates after a traumatic incident.

As we race towards another winter season, let's be thankful for good teammates--at work, at play, and in life.

Karilyn Kempton

// BRENT STRAND

Contributors

BRUCE JAMIESON
From 1986 to 2014, Dr. Bruce Jamieson worked on field studies of snow and avalanches at the University of Calgary. Now, when not riding a cross-country bike or sliding on snow, he consults and is co-writing a book on methods for assessing and mitigating avalanche risk.
34 ASARC: THE PREQUEL

CLAIR ISRAELSON
Clair Israelson started avalanche work with Parks Canada in 1971, and completed his ACMG mountain guide training in 1981. Over the years he has been involved in many avalanche related initiatives spearheaded by the CAA, including service as an instructor/examiner for the CAA and ACMG training and certification programs. These days, Clair works as a helicopter ski guide for Northern Escape Heli-Skiing.
39 A SUGGESTED CONCEPTUAL MODEL FOR DAILY TERRAIN USE DECISIONS AT NORTHERN ESCAPE HELI-SKIING

HALSTED MORRIS
Halsted Morris was the first education and training director for the Colourado Avalanche Information Center (CAIC). He is currently the vice president of the American Avalanche Association and an associate member of the CAA.
30 HELICOPTER SKIING: SEARCHING FOR WHO STARTED ALL THE FUN

IAN JACKSON
Ian Jackson works as a Visitor Safety Technician for Banff, Yoho and Kootenay National Parks. The Visitor Safety department is responsible for backcountry search and rescue, highway avalanche control and public avalanche forecasting in Banff, Yoho and Kootenay. He is a CAA Professional Member and an ACMG Mountain Guide. Ian lives in Canmore, AB.
12 POLAR CIRCUS: A COORDINATED MULTI-AGENCY AVALANCHE RESCUE

MIKE HENDERSON
"Hendo" is a professional CAA member and Parks Canada dog handler with 25 years of service in the mountain parks. He is stationed in Banff, multi-tasking in the Law Enforcement and Visitor Safety programs with his latest partner Cazz. Don't let the dog's shaggy looks fool you—he's a hard working professional with good success, including multiple avalanche recoveries.
18 COMMUNICATION DURING AVALANCHE RESCUE EVENTS: SHORT, CONCISE WITH ROOM TO LISTEN

IAN TOMM
As the Executive Director of HeliCat Canada, Ian has a 20 year history in the Canadian helicopter and snowcat industry as a guide, avalanche forecaster, educator and manager. Prior to his involvement in HeliCat Canada he was the Executive Director of Avalanche Canada as well as the Canadian Avalanche Association.
28 AN UPDATE FROM HELICAT CANADA

front lines

12

POLAR CIRCUS: A COORDINATED MULTI-AGENCY AVALANCHE RESCUE

18

COMMUNICATION DURING AVALANCHE RESCUE EVENTS: SHORT, CONCISE WITH ROOM TO LISTEN

in this **section**

// MARK BENDER

CAA President's Message

COMPETENCY PROFILE: 2015 AGM AND BEYOND

Aaron Beardmore
CAA President

OVER THE PAST YEAR, many people have worked very hard to help the CAA evolve as a self-regulated professional organization. This is a slow process, but an important one to get right the first time. Accomplishments on this collective evolution include modernizing and strengthening the complaint investigation and disciplinary processes, generating a modern scope of practice statement and developing a competency profile. I would like to re-familiarize the membership with the competency profile and then provide some thoughts on potential action.

We introduced the draft competency profile[1], which has yet to be formally adopted, to the membership at the 2015 AGM in Penticton on May 5. This is a major milestone; we are undergoing a fundamental shift in establishing ourselves as a self-regulating organization that works in the public interest. The competency profile will establish the minimum set of abilities that a newly-qualified member in the category is expected to bring to the workplace.

The competency profile *does not* set a new expectation that the current membership upgrades their competency sets. The BOD recognizes that the majority of CAA members are beyond entry-to-practice and in possession of evolved competency sets. This is normal in many professions. We aim to phase-in training updates and assessment requirements gradually on a go-forward basis for new members. View the future required changes as evolutionary rather than revolutionary. It is also important to remember that in our profession, like all others, on-going learning is an expectation in workplace performance.

The BOD views the competency profile as a key building block and reference point for developing our emerging self-regulatory model. Down the road we need to be confident that we can produce CAA members—at entry-to-practice—who live up to the competencies presented in the profile and meet the expectations of industry, regulators and the public.

A ROAD MAP TO MOVE AHEAD

Aligning the Competencies with Membership Categories and Entrance to Practice Requirements

Aligning membership categories with appropriate competencies is a critical first step. The competency profile working group very roughly aligned P1 competencies with active membership and P2 with professional membership. After careful consideration, the BOD has adopted this framework to build and redevelop entrance to practice standards based on this model.

Establish Competency-Based Training and Assessment

In the future, member abilities will be assessed through a more rigorous process. The board believes this process should be based on summative assessment. *Summative assessment* focuses on the outcome of a student's ability to demonstrate her or his proficiency in a given competency. This contrasts with formative assessment, which looks at the participant's development at a particular time. The goal of summative assessment is to evaluate student learning at the end of an instructional period by comparing it against a standard or benchmark, which for us is the competency profile. By introducing more rigour into the training and evaluation process, we aim to produce members who can deliver on the competencies outlined in the profile and further instill trust in the public.

Three basic questions need to be asked of ITP and the competency profile:

1. What do we teach that addresses the competency program and does it need changing to address the profile?
2. What aspects of the profile are not currently taught in ITP, but should be?
3. What aspects of the competency profile are best suited to being learned in other contexts? (e.g., first aid, helicopter safety).

These three questions will be answered through a comprehensive analysis of our current ITP program. We are scoping this work, which will lead to a formalized plan to implement a competency-based training and assessment process.

[1]The draft competency profile document is available on the CAA website at: www.avalancheassociation.ca/?page=Competency_Profiles

Defining the P3: Competency Profile for Experts and Program Designers

The BOD tasked the competency working group with developing P1 and P2 categories because these profiles cover most avalanche practice. We felt we needed to start by defining entry and mid-career competencies before describing the profile for the most advanced professionals.

The number of members potentially affected by introduction of the P3 membership category is quite small. However, it is important that we address this expert membership category since expert-level members take on enormous responsibility in defining and mitigating risk at the planning stages of projects in avalanche safety plans, emergency response plans, and more. Recently, the BOD agreed that that the most effective path ahead should begin with a facilitated focus group of existing expert members to obtain feedback on what, in their opinion, constitutes expert-level competencies in our profession.

MOVING FORWARD

Placing duty on our competency performance above self-interest is critical if we are to remain a relevant organization in the future. As we make decisions that affect our organization, we must keep public interest as the focal point of our rationale. This rationale has informed the CAA for a long time, but has increasingly become visible through the many achievements outlined above. Ongoing work on competency profiles aligns with Goal 1.6 of the CAA's 2014-16 Strategic Plan. For further detail on the Strategic Plan, please visit avalancheassociation.ca/?page=strategic_plan. Moving ahead, member involvement is paramount. If you have suggestions or wish to be involved please contact me at president@avalancheassociation.ca.

Aaron Beardmore, CAA President

// GREG PALTINGER

Joe Obad
CAA Executive Director

CAA Executive Director's Report

BALANCING ACTS

FOR A FEW NERVE-WRACKING MOMENTS this summer, the world's attention turned to a young man's attempt to set the world record for a slackline-style distance crossing over a 300m+ canyon without the benefit of safety back up. He would either make it, or he wouldn't. He did. Phew!

Tightrope walking, slacklining, whatever your preferred term, offers up some seductive metaphors about balance and commitment, even if the risk tolerance is not your cup of tea. If nothing else, it offers cheap thrills before the following riveting update on the adventures of CAA administration!

Striving for balance amid commitment has informed a lot of the CAA's challenges this past year in terms of professional development, InfoEx and the Industry Training Program.

The board of directors set out an ambitious agenda for the staff and committees, culminating in several achievements highlighted at the AGM in May. Of these, the competency profile for CAA members presents both a significant milestone and a challenge as President Beardmore outlines in his letter to members in this issue. This past July, the board and senior staff met to look at how to achieve what's needed next to build off the competency profile—a revised ITP program, an overhauled entrance to practice, and a continued competence system.

As we continue to plan out our path to achieving these goals, our mantra is balance. The board, committees and staff are pursuing a reasonable amount of change. The pace and scale of change needs to match our human, intellectual and financial capital. The board is taking the long view to achieving these goals.

Finances also affect how much change we take on, whether for the goals above or other projects. The staff have worked with incoming treasurer Rocket Miller to define our reserves so we can assess our ability to fund initiatives, like the projects following the competency profile, at a pace that keeps our slackline close to the ground—a pace with low risk tolerance!

Balance and managing risk also means looking out for factors beyond our control. We have factored into our planning the climate the membership works in. This past year's paltry snowfall left many operations struggling. With some scientists calling for another El Niño for the 2015-16 winter, the possibility of poor snow and industry performance looms. Confidence isn't helped by a flagging Canadian economy. These external pressures definitely have factored into our pricing for ITP courses and InfoEx subscriptions.

We have been lucky the past several years to have had great staff to manage our challenges, despite the many transitions. This year I faced a challenge most administrators would like to have—a surplus of good people. Luckily with some flexibility, projects and good luck we have been able to line up staff with roles the CAA needs filled.

We've welcomed back Kristin Anthony-Malone from parental leave, and her talents have shone from her first day back as Operations Manager. Many members asked me to do whatever it takes to keep Stuart Smith, our "Iron Scot," who handled the operations manager role during Kristin's leave, along with membership services. I'm pleased to let you know Stuart will be staying on as InfoEx Manager.

We also have welcomed Emily Grady back from her parental leave in a special projects role. She will be working on the AvSAR course development and the ITP assessment related to competency profiles. Luckily, Bridget Daughney has agreed to stay on another year as interim ITP Manager to allow for this arrangement, which tackles everyday and long-term ITP needs.

Despite a few wobbles to get here, the staff are well positioned to serve operations, the board, committees and members. Your voice as a member is still crucial. Wherever you have concerns or see room for improvement, we're keen to hear your thoughts. We aren't 300m off the deck, but we want to take the right balanced steps for the membership!

Joe Obad, CAA Executive Director

The Building Blocks of **Governance**

Robb Andersen, CAA Vice President

THE CAA'S GOVERNANCE STRUCTURE has been slowly changing, in order to meet the growing needs of the CAA, and to align us with other similar organizations in Canada.

In the spring of 2010, the CAA Board of Directors hired a consultant to advise the board and help create the 2010-13 strategic plan. During the process, we determined that the governance structure of the CAA should be reviewed and some basic structural changes should be considered. This started our work to restructure and strengthen the CAA's governance model.

In the spring of 2014, the board created the 2014-16 strategic plan. During this process, we reaffirmed the need to continue the governance restructuring. This is reflected in Goal 4.0 of the current strategic plan.

With lots of help from the membership, the board has been working hard to bring the governance structure in line with the recommendations brought forward during the 2010 board meetings. This has resulted in the creation of several new committees, and either resurrecting and renaming others.

The new governance committee has steamed ahead on this key work goal. Each governance committee member has been tasked to liaise with the various committee chairs—a specific priority has been for committees to update their Terms of Reference, which now include annual work goals. We have also aimed to improve regular communication from the committees to the board of directors through regular committee reports. Committee minute taking and reporting have been standardized.

All of this will help the board focus priorities for the committees, track progress better and allocate resources more effectively to support committees in their work. We have mostly completed the recommended changes to our governance structure, and all of the new committees are up and running. There was a significant amount of work required to get these new committees rolling. Please recognize and thank all the committee members for their commitment to our organization.

The following are changes we made over the last year. We changed the Audit Committee to the Past Presidents Committee, chaired by Phil Hein. We created the Governance Committee, chaired by Robb Andersen. We created the Information Technology Committee, chaired by Scott Garvin. We created the Finance Committee, chaired by Ken Bibby. We eliminated the Conduct Review Committee, and replaced it with three new committees: the Ethics and Standards Committee (formerly the Professional Practices Committee), co-chaired by Aaron Beardmore and Doug Wilson; the Complaint Investigation Committee, chaired by Rupert Wedgwood; and the Discipline Committee, chaired by Mike Boissonneault.

The Membership Committee, Technical Committee, Education Committee and the Explosives Committee remain unchanged.

These committee changes have not been insignificant. Refocusing committees and updating their Terms of References has helped the board to delegate and focus on specific work goals. This helps the board to stay on task and efficient. The board can be pulled in many directions at once, and the renewed focus helps to keep the board prioritized and spreads work load out amongst committees.

The changes to our conduct review and complaints process have been critical in our ability to clearly demonstrate to stakeholders, employers and regulators our commitment to hold professional members accountable for their actions. We do this by setting high standards with tangible outcomes, and holding professional members to those. This will be a critical component in continuing to build a strong societal culture of the expectations and responsibilities of a practicing avalanche professional.

Another key component that needs review in light of some of the governance changes are the CAA's bylaws. This has been another priority for the board. Board member John Martland has been working on updating our bylaws. Not only are we ensuring our bylaws support the association, but we are also ensuring that they are in line with best practices and support the committees and staff in their work. Although bylaw work could make most of us cross-eyed, John has done a fantastic job of identifying and recommending changes.

As the CAA continues to move forward with the competency profile, scope of practice work, and the potential effects from those efforts, these key governance updates will help support these changes. Society as a whole is increasingly holding professionals from all sectors to higher and higher standards. The CAA is trying to position itself and its members ahead of this curve. All of this work will benefit our membership as we head into the future.

As mentioned in the above article, governance aligns with section 4.0 of the CAA's strategic plan. For more information, please read the CAA's 2014 to 2016 Strategic Plan on the website at avalancheassociation.ca/?page=strategic_plan.

THE MULTI-AGENCY RESCUE TEAM ON THE FINAL DAY OF THE OPERATION. // JEREMY MACKENZIE

Polar Circus: A Coordinated Multi-Agency Avalanche Rescue

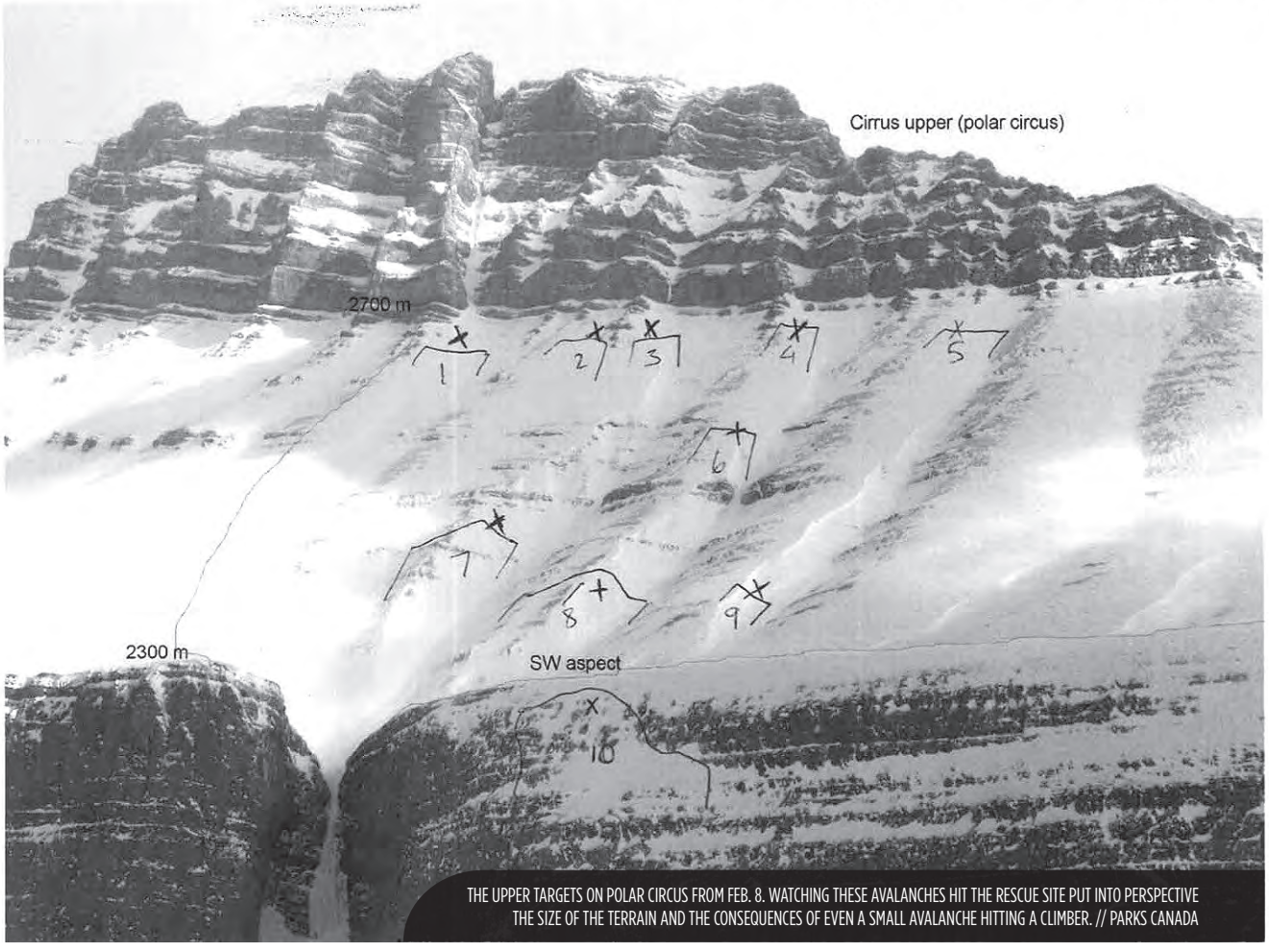
Ian Jackson

THROUGH MY WORK with the Parks Canada Visitor Safety team, I have found two main factors that contribute to how effectively and efficiently a team works together. The first is team composition: it is important to have a diverse group of people with a wide variety of skills, experience and perspectives. The more diversity in your team, the more angles you can attack each problem from. Second is flexibility; each team member must be willing to take on whichever role is needed on any given day. Our team members are highly qualified, skilled and able to take on the team leader role comfortably. Conversely, there are many days where the role of team leader has already been filled, and it is essential that members are willing to take on whatever role is necessary to get the job done. One day you may be leading a highly technical rescue, and the next day you may be in the office co-ordinating supplies and food for the team as the logistics section chief. This ability to fill whatever role is needed—whether glamorous or mundane—is critical to having an effective and efficient team in any operation.

On the evening of February 5, 2015, two climbers were descending the waterfall ice climb "Polar Circus" on the Icefields Parkway when one was swept away by a size 2 soft slab avalanche. Given the technical nature of the terrain, the climber was swept over cliffs and fully buried in a terrain trap. He was not wearing an avalanche transceiver and his partner was unable to locate him despite extended ground searching. Over the next seven days, during a warm storm and a large natural avalanche cycle, Parks Canada Visitor Safety teams from Banff, Yoho, Kootenay and Jasper, along with help from the Kananaskis Country Public Safety team, conducted avalanche control, searched for and dug out the deceased climber. Teamwork and inter-agency cooperation were essential in completing this search and recovery safely and efficiently.

This article focuses on two parts of this response: the avalanche control conducted to make the site safe for SAR teams, and the techniques used while searching for a victim without a transceiver in technical terrain.

CIRRUS UPPER (POLAR CIRCUS): DATE & TIME: Feb 8/2015 OR: ROUND 2



THE UPPER TARGETS ON POLAR CIRCUS FROM FEB. 8. WATCHING THESE AVALANCHES HIT THE RESCUE SITE PUT INTO PERSPECTIVE THE SIZE OF THE TERRAIN AND THE CONSEQUENCES OF EVEN A SMALL AVALANCHE HITTING A CLIMBER. // PARKS CANADA

AVALANCHE CONTROL

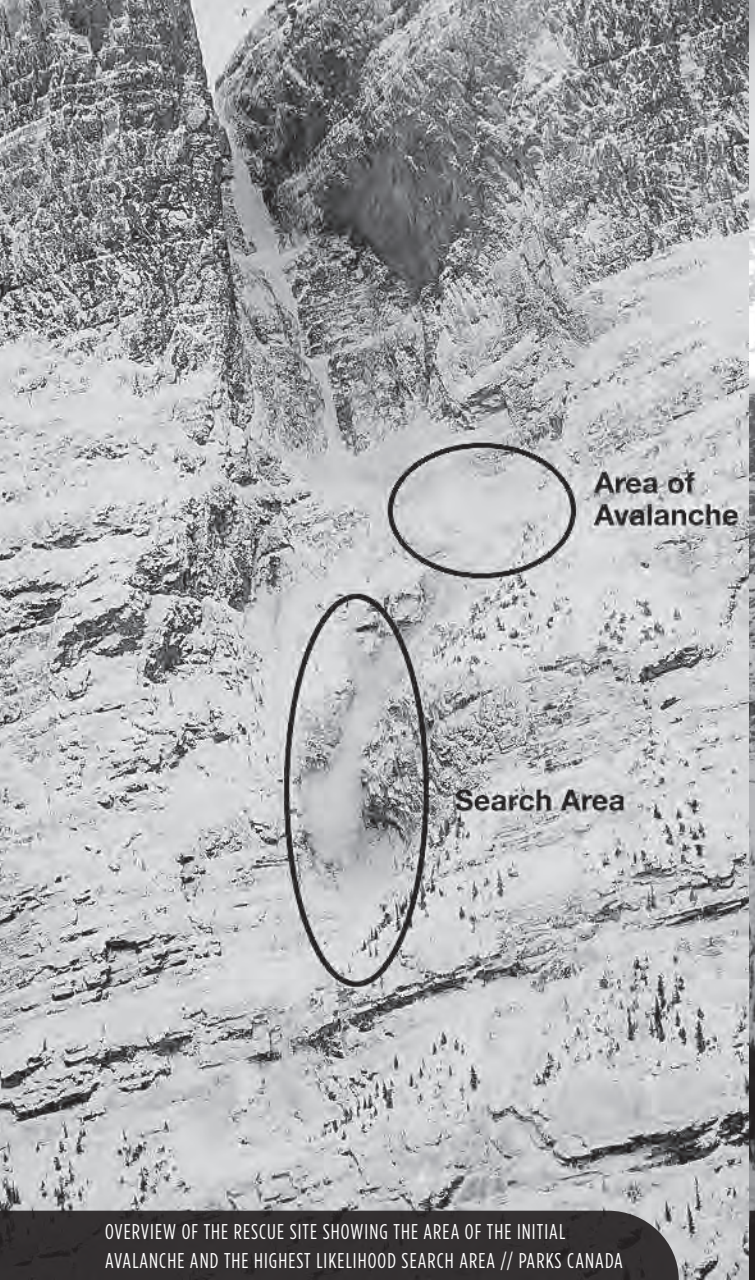
During the avalanche control phase, teamwork was essential. The incident location, though officially in Banff National Park, is roughly equidistant between Lake Louise and Jasper and is within the Jasper Visitor Safety team's highway avalanche forecasting zone, so this incident required a joint response right from the start. Once the initial hasty search phase was complete, the arrival of a wet, warm Pineapple Express made it obvious that an extended effort would be needed before the site was safe to access. On day one, the Jasper Visitor Safety team took the lead on avalanche control, and on days two and three Banff crews finished the remaining control work. In total, 43 charges were dropped before teams felt comfortable entering the site.

Communication was critical given the geographical challenges of working with teams in both Jasper and Banff, and the high level of risk for rescuers trying to access the terrain. Avalanche control teams relayed information on their results through conference calls and control sheets. In addition, throughout the duration of the incident, crews met twice daily to facilitate information exchange and plan the next operational period. Although we worked to effectively share information, the geographical distances made this difficult. This incident reaffirmed the value of having ongoing working relationships with your neighbouring agencies to help with communication and effective teamwork in stressful scenarios. Additionally, for future inter-park responses, we plan to use videoconferencing to help run these meetings and aid information sharing.

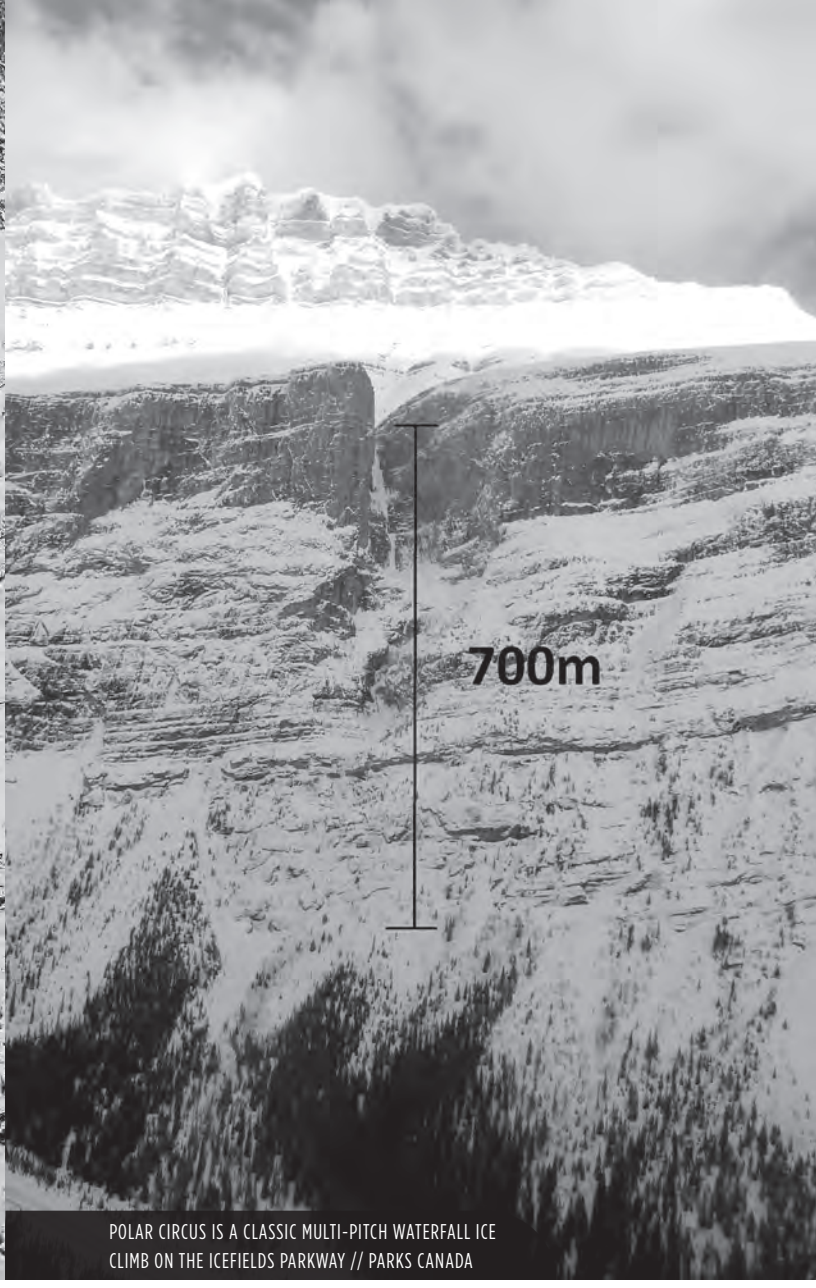
We worked together as a team to decide when the avalanche conditions were safe for us to access the rescue site. We all agreed that since the buried climber was not wearing a transceiver and was in technical terrain, rescue crews would need to spend a lot of time on the ground to thoroughly search the area. Additionally, given the nature of the climber's fall and the multiple days elapsed since burial, we felt there was little to no chance of survival. As such, the team unanimously agreed that only a very low level of avalanche risk to rescuers was acceptable on this incident. Once comfortable with the control measures and the local avalanche hazard, we further decreased our risk by starting early in the morning, monitoring temperatures and having an aerial lookout to warn us of any increase in hazard.

THE SEARCH PHASE

The search phase was challenging as the subject was in technical terrain, had no transceiver, and may or may not have been moved by avalanches created during the control.



OVERVIEW OF THE RESCUE SITE SHOWING THE AREA OF THE INITIAL AVALANCHE AND THE HIGHEST LIKELIHOOD SEARCH AREA // PARKS CANADA



POLAR CIRCUS IS A CLASSIC MULTI-PITCH WATERFALL ICE CLIMB ON THE ICEFIELDS PARKWAY // PARKS CANADA

Based on these factors, we decided to only use staff trained for technical ice climbing terrain, and to heli-sling searchers into the terrain using a helicopter long line. All searchers had the gear and ability to quickly self-evacuate from the waterfall if the helicopter could not return to the site.

When we are looking for a person buried without a transceiver, search dogs are typically our most effective tool. However, due to the technical nature of the terrain in this rescue, it was difficult for the dog teams to access the search areas. This gives an example of the benefits of a team with diverse skill sets: the search depended on the specialized skill set of the dog teams, who in turn relied on the Visitor Safety teams' technical skills to facilitate safe access to the rescue site.

Due to the length of time since burial and the amount of debris on the site, the dogs did not have enough scent to give strong indications. As a result, we used a combination of RECCO, probe and dog searching. Our team had undergone an excellent training session with the folks at RECCO Canada early in the season which proved very useful during this response. Despite our training, the search lasted several days and involved many different team members. Communication using maps and wands about searched areas and found signals was critical. The buried climber was eventually found by probing in a high likelihood area that was identified by both a weak dog indication and a weak RECCO indication.

The climber was probed 2.8m below the surface lying face down, 40cm above the ground. Confirming a probe strike was difficult as we could not use depth of burial as a clue. The “feel” of the probe and confirmation from additional probes was critical here. From the layering of the debris, we deduced that the climber had initially been buried by about 1.2m of soft slab debris, and then by an additional 1.6m added by our avalanche control. There was evidence of trauma from his fall over multiple cliffs, and although he had a clear airway and an ice mask, we believe he succumbed to his injuries quickly. Finally, it took our

CLOSE –UP OF THE ACCIDENT SCENE SHOWING THE CLIMBER'S FALL AND THE TECHNICAL NATURE OF THE TERRAIN // PARKS CANADA

team of seven rescuers approximately 45 minutes to dig the 2.8m hole to extract the climber. All of the shovelling techniques learned in training proved essential for this large excavation.

When debriefing this incident, the team was curious as to what the climber carried that caused the RECCO signal, since he had no actual RECCO chips on him. It is important to remember that RECCO receivers can locate RECCO chips very effectively, but are also able to find passive electronics to various degrees of accuracy. We did some testing with the gear that was on him and found that it was likely a Mammut X-Zoom headlamp that was in his backpack and facing the snow surface that caused the signal. Although there was also a camera and another headlamp on him, the Mammut headlamp seemed to give off the strongest signal. Additionally, the fact that it was in his backpack facing the snow surface rather than shielded by his body likely helped us pick up the signal.

This accident tragically resulted in a fatality. However, it allowed us the opportunity to work on inter-agency cooperation and teamwork in a large, complex response. The avalanche control required to access the site safely was challenging and eye-opening for all involved, and the difficult nature of the terrain and burial required that we use a variety of strategies to safely access and efficiently locate the buried climber. It was refreshing to see team members rotating through various roles in the organization chart and doing what needed to be done: one day you're leading a team, the next day you're following. Additionally, the wide range of skill sets and experience on our team—from helicopter pilots to dog handlers to rescue specialists to logistics chiefs—allowed us to engage the challenge from many different angles. The skills and experience gained on this incident will no doubt help us on future responses.

Acknowledging Vulnerability: The Importance of Emotional Support After Incidents

Madeleine Martin-Preney

IN THIS INDUSTRY, we're all very familiar with teamwork. In so many areas of our professional lives, we rely on our employers, co-workers, colleagues, mentors and students to support us in getting through all sorts of challenges. We trust that those people have our backs, and will be there for us if required. When it comes to asking for help, most of us feel at least moderately comfortable asking if it involves a physical endeavour or action of some sort. Moving stuff, cleaning stuff, building stuff, fixing stuff, doing stuff—these are within our comfort zone for asking for assistance. But what happens when what we need help with the most is intangible? If it's not visibly physical, or it requires us to acknowledge our vulnerability? What happens when we need support in *feeling* rather than *doing?*

I assume some of you reading this are squirming in your seats at the mere mention of vulnerability, maybe even thinking, "here we go again with this emotional stuff. That's fine for everyone else but it doesn't apply to me."

I encourage you to bear with me on this one and read on. It might just be of benefit to you or someone else.

In the avalanche industry we are exposed to many opportunities, often on a day-to-day basis, where we may be involved in or witness a critical incident of some sort. The definition of a critical incident is "an unexpected, shocking and personally upsetting event that may result in emotional and/or physical distress." Examples include a threat to your life, serious physical injury, feeling helpless during a crisis, witnessing a disturbing event, or being involved in an event that resulted in someone's death. The list goes on, but you get the idea. I would even go so far as to say many of you reading this are intimately familiar with these experiences.

An important thing to acknowledge is that Critical Incident Stress (CIS) is an *adrenalin* reaction, not a panic reaction. This reaction can be a combination of physical, cognitive, behavioral, emotional and spiritual symptoms. Some examples of symptoms and reactions are exhaustion, sleep disturbances, exaggerated startle response, loss of focus, difficulty making decisions, re-hashing the experience over and over, taking responsibility for things that were outside of one's control, avoiding or talking repeatedly about the event, feelings of shame, guilt, fear, or numbness. Do any of these sound familiar?

With CIS, the intensity of these symptoms will lessen over time, as there is no cure for critical incident stress. It is, in fact, a *normal* and *healthy* reaction to stress. But what happens if these symptoms and reactions persist for too long? If symptoms and reactions persist for more than a month, there is a real risk of developing Post Traumatic Stress Disorder (PTSD), which becomes a much more serious and life-altering problem. I came across the most concise explanation of how PTSD develops in a 2008 article entitled "Sleep-Dependent Memory Processing and EMDR Action." Please stay with me through the slightly more technical language—it does make sense, I promise.

Robert Stickgold explained that "PTSD develops when memories of traumatic events, encoded during an actual trauma, fail to be processed normally over time (van der Kolk, 1994). Such normal processing acts over days to months to reduce both the intrusiveness of the memory and the effect associated with such recall and to integrate the memory into the individual's

POST INCIDENT DEBRIEFING // ALICE WEBER

larger network of related memories. In doing so, it provides a meaningful and accurate understanding of both the event and its implications for the individual's future. It is when this processing fails, that PTSD develops... One possible reason for the failure of automatic processing under these circumstances could be an inappropriate encoding of the memory at the time of the trauma, resulting in a memory that lacks key components that are critical for subsequent automatic processing. For example, van der Kolk (1994) has suggested that individual features of the traumatic memory may fail to be bound together into a coherent episodic memory at the time of the trauma, producing a memory that consists of unintegrated elements that the brain/mind cannot process as a unitary event. But a second possibility is that the off-line processing system itself fails, leaving the memory frozen in its original form—raw, intrusive, distressing, and unexplained."

So now that we have an understanding of how PTSD can develop, what can we do about it? Healthy coping strategies, like symptoms and reactions, are specific to each individual. While certain ones seem to be somewhat universal, none are necessarily better than others—it comes down to figuring out what works best for each person and making sure that they get the support they need.

During my CPD presentation with Corrie Baker at this year's spring meetings in Penticton on May 6, the break out session produced some excellent discussion and captured a lot of information on what CAA members are doing to cope with traumatic events. There were also many great suggestions on what members would like to see better established within their organizations and workplaces so that they could feel more supported as members and workers.

Some common coping strategy themes emerged in the break out session: the importance of maintaining individual health through diet and exercise, establishing connection with others involved in the incident through debriefs (both formal and informal), connecting with those removed from the incident, and peer/employer support and follow-up debriefs/sessions with professionals. Many also mentioned the importance of individual practices such as journaling, meditation, spending time with pets, and craniosacral and alternative therapies. Another important point that came up during the discussion was promotion of a culture that encourages vulnerability, non-judgemental communication and active listening.

A strategy that has been proven extremely effective for mitigating the risk of developing PTSD and minimizing the symptoms and reactions related to CIS is Eye Movement Desensitization and Reprocessing (EMDR). This therapeutic technique enables us to consolidate the memories associated with a traumatic event in a way that enables us to process them in a healthy and adaptive way. EMDR is most effective when accessed within 72 hours of an incident, but is still highly effective even years later.

The most important message to come out of this exploration of CIS and PTSD is that in an operational context, it is extremely important that people have access to support immediately after an event, as well as throughout their careers. As a community, we must support each other in maintaining our mental well-being, and that comes with taking on the individual responsibility of asking for help, and the organizational responsibility of enabling access to support. Organizations and companies that see the value in establishing, enhancing and promoting a support system for their members, guests, employees, volunteers, etc. are undoubtedly leaders in our industry. This kind of proactive approach to mental well-being and teamwork will help us move our industry forward with integrity and balance.
"Remember, teamwork begins by building trust. And the only way to do that is to overcome our need for invulnerability" –Paul Lencioni

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Communication During Avalanche Rescue Events: **Short, Concise With Room to Listen**

Mike Henderson

"THIS PARKS CANADA VISITOR SAFETY WORK has long periods of boredom, punctuated by moments of sheer terror," says Reg Bunyan, retired Visitor Safety specialist and Park Warden. Those "moments of sheer terror" may include avalanche rescues, which are inherently dynamic events. They can involve high risk objective danger, complicated emotional stresses for survivors and families, and environmental factors that can influence rescue team insertion and search methods. Rescues can be stressful, difficult, time sensitive, and provide an abundance of opportunities to make operational mistakes.

What can we do to mitigate some of the stress and uncertainty? Consider communication. Simple, concise communication leads to precise actions by rescue team members, enabling them to work effectively and safely. Good communication and listening skills are essential to successful avalanche rescues.

I have been fortunate work in the snow industry for 20 years as a Parks Canada avalanche technician, CAA professional avalanche forecaster and professional dog handler. It sounds crazy, but my career has spanned almost three generations of rescue leaders—from the Augers and Israelsons of the world, to folks like Steve Blake and Lisa Paulson, and now the young guns that I most certainly can't keep up to on skis or computers. We have seen myriad changes in the industry, and have experienced plenty of avalanche rescues—some have gone well and some have been struggles. As a dog handler, I have responded to countless calls both within National Parks and with other provincial agencies. As you can imagine, the leadership styles have been as varied as the calls themselves.

With multiple responses each winter, Parks Canada has learned the absolute importance of effective

// AARON BEARDMORE, PARKS CANADA

MIKE HENDERSON, CAZZ AND LISA PAULSON DURING THE LAKE AGNES SNOW SHOEING AVALANCHE RECOVERY, MARCH 2014. CAZZ MADE THE FIND AFTER A HALF HOUR OF SEARCHING // AARON BEARDMORE, PARKS CANADA

communication during avalanche rescue. Parks Canada runs small, professional, multi-tasked rescue teams with rigorous training and a depth of experience. These teams are enhanced by a 24-hour emergency dispatch and skilled contract helicopter rescue pilots.

This paper examines the stages of an avalanche event: information gathering, planning, actioning, debriefing and the importance of strong communication. Clear, concise language, a display of calm control with a sense of urgency, and a willingness to listen with an open mind are key communication traits which must be present during every aspect of the mission to ensure success.

INFORMATION GATHERING: THE BUILDING BLOCKS

"Hendo, this sounds crazy but my dispatcher says, maybe 50, 100 people are caught in an avalanche on Boulder. You get the boys, get a helicopter, and you come here now!!!" —Sergeant Richard Gingras, RCMP Police Dog Services, Vernon, BC, gathering resources for the Boulder Mountain avalanche of March 2010.

The mountain block—Banff, Jasper, Yoho, Kootenay, and Revelstoke and Glacier National Parks—are extremely fortunate to have a 24-hour emergency dispatch to take calls, gather information, and either pass that information along or make the direct connection from the reporting person to a rescue leader.

Basic information gathering questions that we have all learned and sometimes taught hold true today:

- When and where did this event happen?
- How many people are buried?
- How many people are on the surface? Are they injured?
- Do the people have transceivers?
- Have you searched for the buried people?

How we get that information has changed dramatically. Cell phones, satellite phones, SPOT devices and satellite text messaging devices have made for more instant communication and faster responses. Gleaning the most information possible in a small window of time from the reporting person is incredibly important. The reporting person is stressed, communications can be really scratchy and there is an ever-present risk of dropping the call. A calm, empathetic listening demeanor which also conveys command and a sense of urgency is critical. The rescuers must understand the situation they are heading into, and the survivors need to know organized help is on the way. In January 2014, Parks Canada rescue leader Lisa Paulson took the call for an avalanche in

Maintenance Bowl, outside the Lake Louise ski area. Her effective communication skills allowed her to gather the important information and direct the reporting person to do a quick surface search of the debris. Lisa advised the reporting person to have someone call the buried victim's cell phone; they did so and could hear it ringing. The buried victim was pushed over in a non-critical position. Almost immediately, the buried victim was found and uncovered alive. It was a close call, and saved by great communication!

BUILDING AND EXECUTING THE PLAN

"You guys are coming in two by two—too loud and too often." --Lance Cooper, retired alpine rescue pilot and retired Park Warden

During the planning and execution stage of the response, things can get a little crazy. Resource requirements need to be analysed and requested. Helicopters, dog handlers, paramedics, gear—has anyone been to the area? Can we land at site? A lot of this thought process is done on the fly while rescuers are gearing up. In our small shop, there are plenty of questions and plenty of opinions!

Again we see the need for precise instructions, and it is critical to make sure that everyone understands the message. The rescue leader needs to ensure that team members know their roles and understand the nature of the event. The conversation tends to be oriented from the top down, with room for team members to share concerns or corrections to the plan of action. The rescue leader must keep an open mind for listening and team members need to speak plainly and in a non-confrontational manner while expressing concerns. Once the gear is loaded and the team is en route, there is a brief window to catch your breath, think through the operation and check to make sure everyone is on the same page. Too much

// AARON BEARDMORE, PARKS CANADA

scattered or irrelevant conversation can be confusing or distracting. If you are flying to a rescue site, the pilot has a lot to deal with—busy radio chatter or head set conversations can make his or her job more difficult.

Once at site, we complete a scene assessment—essentially a reality check on our plans. Now is the time when everyone can raise concerns about safety or how the search may unfold. Here everyone's voice is valid, including the helicopter pilot. Just like a Toyota car manufacturing line, anyone can hit the red stop button with a valid reason.

If the scene is a go and resources are successfully deployed, the rescue leader's job becomes very complex. New information streams in from many sources: the survivors on site, the searchers as items or people are found, and dispatch as more resources become available. It can be difficult to keep track of a dynamic search while processing that much information. What's critical are clear, short communications with an assurance that the right people have received and understood the message.

During an avalanche response in the Chickadee Valley in 2008, we experienced a short series of communication break downs which impeded the flow of the rescue and created confusion among our small team. Turning the corner into the Chickadee takes you under the shadow of some big peaks, blocking connection to network cell and Parks Canada radio towers. Subsequently, as we flew into position we lost contact with the reporting person and Banff Dispatch. Our game plan got scrambled and our team split off to manage the surviving reporting person and search for the buried victim. As we tried to find a channel to hit the radio repeater we lost internal communications, adding confusion to the response. Eventually we aligned our frequencies, sorted our tasks and got back on track, enacting the recovery. We learned a lesson: don't jump out of the helicopter without ensuring your lines of communication are established, and that everyone knows their role and where they are supposed to go.

AVALANCHE RESCUE DEBRIEFINGS: USING A SMALL VOICE AND EMPHATHETIC LISTENING

"This hot tub is pretty comfy. Can someone get me another beer?" —Mike Koppang, Mountain Rescue Specialist, Kananaskis Country during a very informal debriefing following an avalanche recovery on the Third Sister in 2009.

Debriefings for any type of rescue can be as informal or structured as necessary. As participants, this is the time to be open, non-judgemental and a good listener. Everyone may experience completely different reactions to the same event. As a dog handler I typically don't spend much time with the reporting party. I'm busy hustling over the terrain, keeping the dog moving and watching his indications. A dispatcher, however is on the phone during the darkest hour, talking the survivor through a terrible scene, trying to gather information while being compassionate to a very stressed client. I could come out of the event satisfied that my dog has made a difficult find, while the dispatcher's strongest memories are of dealing with a anguished survivor. During a debriefing everyone must really listen to what the rest of team has gone through, and how they have been affected. If we can pull together as a team during the action, we had better be able to support each other in the aftermath.

CONCLUSION

"Well, have you found him yet? What's taking you so long?" —Marc Ledwidge, retired Parks Canada Visitor Safety Specialist / SAR manager, in a tongue-in-cheek radio communication during a Burstall Pass avalanche recovery in 2009.

An infinite number of factors may influence avalanche rescues and disrupt a team, throw it into disorganization and/or exaggerate dangerous working conditions. In Parks Canada we utilise small professional teams supported by outstanding helicopter pilots and dispatchers, and rely on effective communications as key to successful outcomes. From information gathering to planning and executing the rescue to debriefing the event, a number of communication skill sets are required.

Rescuers should be able to use clear, concise language, ensure everyone on the team knows his or her roles, and be able to discuss operational issues or safety concerns. Establishing lines of communication before teams hit the ground is imperative, and all team members should listen with an open mind. We should be able to project a sense of calm professionalism while still conveying a sense of urgency to the victim. The people in trouble need to know that we are coming with the proper resources, and are not going to be judgmental about their predicament. Finally, when it comes to debriefing an event team members should listen well to the concerns of others and show support, as we all experience events in different ways.

This winter when you are practicing avalanche rescue skill sets, make sure you work on your communication skills as well. A smooth, safe deployment of resources demands it.

Avalanche Skills Training Curriculum Update Project

Peter Marshall, Project Lead

PROBING LIKELY BURIAL SPOTS // WREN MCELROY

IN THE SPRING OF 2014, Avalanche Canada surveyed Avalanche Skills Training (AST) instructors to identify what they thought were the four or five primary learning outcomes of the (AST 1) course, in order to determine the most important concepts and skills delivered during that training. Over the years, the AST 1 has grown into an excellent introductory-level avalanche course. However, a common complaint from both instructors and students is that the course is packed with so much information and detail. How much do we expect students to retain when they leave the course? The goal of this curriculum update project was to fine-tune the course content, and to update the instructor resources so that it is easier for an instructor to deliver a clean, concise progression of skills.

AST instructors commonly identified the following topics as key learning outcomes in the AST 1 course:

1. Snowpack: understanding the basics of avalanche formation and release.
2. Terrain: recognizing terrain (characteristics, or ATES ratings) and one's risk in relation to terrain choices.
3. Using resources effectively, e.g., using avalanche bulletins and the online trip planner tool.
4. Companion rescue: learning core rescue skills focussing on a basic single burial.
5. Human factors, travel techniques and group management.

Most of us recognize these topics or learning outcomes as key components of every avalanche course. For a two-day introductory avalanche course it's crucial to lay out the extent to which these principal topics are taught. What can we realistically expect students to learn and apply after a weekend course? As instructors, we are passionate about the subject matter and often find ourselves drawn into lengthy detailed discussions with our students. But is more detail necessarily better? Perhaps we can benefit more students by being clear and concise, and providing excellent links. We should make it clear to students that an AST 1 course is an introduction to avalanche safety—it's the starting point. By providing good clear links between lessons and courses, we may be able to encourage further education in the Companion Rescue Skills course and the AST 2 course, while improving the AST 1 course by keeping it manageable for instructors and students.

The key learning outcomes were used to create a new course outline which highlights the course goals and objectives. Each goal or objective in the table begins with, "At the end of the lesson/course students should be able to:" (Table 1).

The course outline provides instructor and students with more clearly defined course goals and objectives. This outline was compared to the existing course curriculum to identify any gaps, or subjects that may have unnecessarily been taught in more depth. What could we remove from the current course, and what needed to be added? We tried to adhere to a "less is more" theme, while ensuring that we were not watering down the course.

This curriculum update project has resulted in more user-friendly and up-to-date instructor materials, and a refined and slightly adjusted course flow. Some of the highlights of the project include: reformatted instructor manual; updated and reformatted lesson plans; a reduction in total lesson plans from 24 to 14; a human factors and decision-making theme with specific links embedded in each lesson (in place of a stand alone decision making competence lesson); clear lesson links helping instructors guide students to additional resources and future training courses; a new trip planning form and checklist; and an updated AST image database and image sets.

TABLE 1. WHEN READING THE FOLLOWING COURSE GOALS AND LEARNING OBJECTIVES, ASSUME THAT EACH GOAL AND OBJECTIVE BEGINS WITH THE FOLLOWING PHRASE: *BY THE END OF THE COURSE/LESSON, LEARNERS WILL BE ABLE TO:*

Course Goals		Related Learning Objectives				
		1	2	3	4	5
A	**Describe avalanche formation and release using basic terminology**	Describe the key characteristics of each avalanche type	Describe the necessary snowpack structure for slab avalanches	List common signs of instability	List common natural and human triggers	Describe avalanche size classifications
B	**Recognize avalanche terrain**	Describe public model of the avalanche terrain exposure scale (ATES)	Identify the primary sections of an avalanche path	Describe the key characteristics of starting zones and identify common trigger points	Identify terrain traps and describe their effect in avalanche involvements	Recognize evidence of past or recent avalanches
C	**Complete a backcountry trip plan using all available resources**	Use the public avalanche forecast to determine regional danger ratings and avalanche problems	Determine the ATES rating of a trip using appropriate resources	Find weather information and forecasts and describe key weather factors influencing avalanche conditions	Compare essential and recommended equipment for travel in avalanche terrain	Discuss ways to find information on terrain and conditions in areas where no public resources exist
D	**Describe techniquies to minimize risk when travelling in avalanche terrain**	Discuss human factors influencing decision-making in avalanche terrain Describe actions to take if caught in an avalanche	Demonstrate or describe good travel habits when travelling in avalanche terrain	Describe basic group management techniques to reduce risk in avalanche terrain	Use the Avaluator Slope Evaluation card to assess slope specific risk	List the factors that determine competence in avalanche decision-making
E	**Demonstrate a basic companion rescue**	Organize transceiver checking procedures	Demonstrate effective transceiver search techniques	Employ effective probing techniques	Demonstrate organized shoveling as a part of a group	Discuss basic first aid necessary to care for avalanche victims

*EACH GOAL AND OBJECTIVE MAY COMPRISE SEVERAL CLASSROOM AND FIELD BASED LECTURE.

The instructor manual and other resources will be freely available to all AST instructors online, and a companion resource CD including new image sets will be available at cost. Part of the fall AST instructor training sessions will be dedicated to the curriculum update project. The focus will be on how to get the most out of the new instructor resources. The resources provided are designed to ensure consistency throughout the AST program, but are not meant to be a "canned avalanche course." Instructors must take the time to master the subject, understand the format and requirements, and then create their own unique training course. The passion, personality, and experience that instructors bring to a course are what make the AST program so popular and successful.

Thank you to the curriculum project committee for providing guidance and feedback on all aspects of this project. The committee included: Nancy Geismar, Mitchell Sulkers, Craig Hollinger, Ken Lukawy, Jesse de Montigny, Keith Robine, Jean-Raphael Lemieux, Brian Jones and Terry Palechuk. Additionally, thank you to the many instructors who responded to survey requests and provided images for use in the updated image database.

Schedule of Upcoming **Events**

ICAR CONFERENCE 2015
October 5-10, 2015
Killarney, Ireland

For more information: icar-2015.com

WILDERNESS RISK MANAGEMENT CONFERENCE
October 14-16, 2015
Portland, Oregon

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

SARSCENE 2015
October 22-26, 2015
Charlottetown, PEI

Canada's national search and rescue conference.
For more information:
www.sarscene.ca/2015/index_e.asp

AVALANCHE CANADA ANNUAL GENERAL MEETING
October 31, 2015
Calgary, AB

Avalanche Canada is holding its AGM at the Calgary Snow Show at the Spruce Meadows Equi-Plex. The AGM is open to the public but voting is for members only. To become a member, visit bit.ly/1PyZCAH.
For more information:
avalanche.ca/events

EASTERN SNOW AND AVALANCHE CONFERENCE
November 7, 2015
Bretton Woods, New Hampshire

This year is the fifth annual Eastern Snow and Avalanche Conference.
For more information: esaw.org

ISSW 2016
October 3-7, 2016
Breckenridge, Colourado

Facilitating the interdisciplinary exchange of ideas and experiences between snow science researchers and practitioners.
For more information: issw.net

avalanche **community**

28

HELICOPTER SKIING: SEARCHING FOR WHO STARTED ALL THE FUN

in this **section**

// DAVE RICHARDS

Bound for Breckenridge: ISSW 2016 Seeking Case Study Presenters

Ethan Greene

EVERYBODY HAS AN INTERESTING STORY AND CASE STUDIES OFFER UNIQUE OPPORTUNITIES for education and shared experience. At the upcoming ISSW in Breckenridge from October 3-7, 2016, we will have oral case study presentations which are focused on operational challenges, solutions, interesting observations, and open questions. We hope to have one session with two presentations each day before the afternoon break. The presentations will be 15 minutes long with no questions, but should encourage discussion during the following break and throughout the week.

We need your help. We want to hear your story. Please write us with a tale that might fit in this session. We will help you with presentation logistics, graphics, and a short paper for the proceedings if you wish. You can reach us at casestudy@issw.org.

The ISSW 2016 Papers Committee is Will Barrett, Ethan Greene, Kelly Elder, Dallas Glass, Aleph Johnston-Bloom, Andy Lapkass and Hunter Mortenson.

SARSCENE 2015 Coming up in Charlottetown

Manon Langlois

SARSCENE CANADA'S NATIONAL SEARCH AND RESCUE CONFERENCE CHARLOTTETOWN, PEI, OCTOBER 24-26, 2015.

SARSCENE IS A NATIONAL SEARCH AND RESCUE event which brings together paid and volunteer SAR professionals, responders, incident prevention specialists, academics and industry to discuss the top issues facing search and rescue response and incident prevention. The conference is a perfect opportunity to discuss the latest trends, share best practises, network with SAR peers, and engage with like-minded people from across Canada and internationally.

This year's conference is in Charlottetown PEI, co-hosted with Prince Edward Island Ground Search and Rescue (PEI GSAR), and will include local flair and maritime hospitality. The conference includes pre-conference training opportunities from October 22-24, a SAR field day October 24, and co-host sponsored evening events.

CONFERENCE PROGRAM

This year's conference program features a balanced mix of presentations. Some of the program includes presentations on the latest techniques and best practises for targeting messaging to adults; lessons learned about cold weather survival; and emerging technologies being used for SAR alerting. All sessions are presented by speakers who are experts in their fields, including Dr. Gordon Giesbrecht (aka Professor Popsicle) from the University of Manitoba, and Dr. Vett Lloyd of Mount Alison University, who is a leading expert in tick research and Lyme disease in Canada. Visit the SARscene conference website at sarscene.ca/2015/conference-schedule_e.asp for the full conference program, speakers and presentation briefs.

PRE-CONFERENCE TRAINING OPPORTUNITIES

The mix of training opportunities at this year's conference caters to both SAR responders and incident prevention specialists alike. Some of the courses, such as "Managing Missing Person Searches in the Urban Environment," include a nominal discounted fee for the training and course materials, while other courses such as "Adventuresmart Train the Trainer," are offered for free to conference delegates. You'll find more about the courses and how to register on our website.

REGISTERING FOR SARSCENE

We offer a discounted rate of $130.00 + HST for volunteers and members of non-governmental and not-for-profit organizations. Registering for SARscene is easy. Complete the online registration form at sarscene.ca.

ADDITIONAL INFORMATION ABOUT SARSCENE

For more details on the conference program including the SAR Field Day, trade show and pre-conference training as well as accommodations and travel information, visit our website. We hope to see you at SARscene 2015.

PART OF ADVENTURESMART'S HUG-A-TREE AND SURVIVE PROGRAM TEACHES KIDS HOW TO USE AN EMERGENCY BLANKET TO STAY WARM AND DRY IN WINTER CONDITIONS // ADVENTURESMART

Helicopter Skiing: **Searching for Who Started All the Fun**

Halsted "Hacksaw" Morris

I WAS A YOUNG SKIER in the late 1960s when I first heard about heli skiing, but when I heard the term I automatically understood what it meant. As a kid watching *Whirlybirds*, a television show about helicopters, the idea made sense. I immediately knew I wanted to go heli skiing one day, and I have since become addicted. As a curious person, I have often wondered who first came up with the idea of heli skiing and I slowly started researching the early days of the sport.

In *Bugaboo Dreams: A Story of Skiers, Helicopters & Mountains*, about the early days of Hans Gmoser and CMH, Topher Donahue writes, "As early as the late fifties, skiers in Europe and Alaska had experimented with using helicopters to access untracked snow in the high Alps and the Chugach."[1] Intriguing—it made me wonder who really was the first to try it. My early research indicated the need to first start with the early use of helicopters in mountain flying. My hope was that finding out who started flying helicopters in the mountains might lead to who first heli skied.

During WWII, helicopters saw very limited use. The Germans had an advanced helicopter design with the Fa-223. It was first demonstrated to Adolf Hitler on June 12, 1944, at Obersalzberg.[2] At first Hitler reportedly acted impassive and unimpressed at seeing the Fa-223. But once it lifted off he immediately recognized its potential and he reportedly said to General-Feld Marshal Keitel, "This could be very useful for mountain warfare." [3]

There is video footage on YouTube of the Fa-223 flying the first long line flights and landing (in snow) in the Bavarian Alps. Watching the video it is clear that the Fa-223 had remarkable control and power for its time.[4] I have not found definitive proof that the German mountain troops used skis while testing the Fa-223 in the Bavarian Alps. In the video there appears to be enough snow that skiing could have been possible. One has to wonder whether there were wistful conversations amongst the German mountain troops about how great the helicopter would be as a ski lift.

After WWII, helicopter development continued in earnest, but documentation about the use of civilian helicopters in the mountains during the late 1940s and early 50s is limited. Notable exceptions are the first helicopter landings atop Mont Blanc (15,776')[5] and Pike's Peak (14,110')[6] on June 6 and in September of 1955. Helicopter technology was quickly overcoming mountain flying difficulties and limitations.

Information about heli skiing in the 1940s and 50s is limited at best. But I did find one interesting story related to heli skiing and

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[1] Topher Donahue, *Bugaboo Dreams: A Story of Skiers, Helicopters & Mountains* (Victoria: Rocky Mountain Books, 2008), 32.

[2]Steve Coates and Jean-Christophe Carbonel, *Helicopters of the Third Reich*, (Shepperton: Classic Publications, 2003), 99-115.

[3]Ibid, 104.

[4]"USMC helicopter lies: U.S. Army & Germans First Combat Use," *YouTube*, last modified March 10, 2008, https://www.youtube.com/watch?feature=player_embedded&v=ztiPjVGolXw.

[5]Mario Bazzani, "Bell 47G2 - History and Technical Description," *Heli-archive.ch*, http://www.heli-archive.ch/en/helicopters/in-depth-articles/bell-47g2/.

[6]Bob Petite, "Cessna in the Helicopter Age," *Vertical*, August/September 2013, 157.

avalanches. Monty Atwater was one of the first avalanche snow rangers for the US Forest Service, at Alta, Utah. In 1950, Atwater was working as a "snow problem consultant" on a ski area site survey. Atwater wrote about using helicopters during this job in his book *The Avalanche Hunters:*

"In Northern California I once did a job surveying a complex of ski areas of the future. My companion and I used a chopper first of all to jump over the snowbound (i.e., closed for the winter) highways. Then we used it as a ski lift with an infinite number of lines. It flew us to the top, picked us up at the bottom, flew us to a different top. In three day(s) of about three hours' of flying time apiece we did more work than we could have in a month on foot and with Sno-Cats, and we did it better. It was an aerial platform for making maps and photographs. If one of us got hurt, our angel of mercy was slurruping overhead. I have ridden helicopters from Chile to British Columbia, and I have great affection for them."[7]

It seems clear that Atwater was heli skiing. Sadly, he doesn't mention the type of helicopter, the name of the pilot or his skiing partner. For that matter, he doesn't even exactly say where he was working. I suspect it was at Walt Disney's Mineral King ski resort project, from photos in the book. The Mineral King development project seems to have been a main site for early helicopter skiing in the USA. Not only did Atwater use helicopters for snow study work in 1950, but Disney also hired the famous avalanche researcher André Roch to make a study of Mineral King in 1965.[8] Roch spent much of the winter in the area doing a study of the area's avalanche potential. On several occasions he used a helicopter to access the higher bowls, and he brought along other skiers on these trips.

The February 2007 issue of *Skiing* magazine had a short article about heli skiing, listing a timeline of events which mainly led up to Gmoser starting CMH. Their timeline stated, "1958: Bengt "Binks" Sandahl, the first known heli guide, starts guiding skiers out of Alyeska Resort, Alaska, using a Hiller helicopter with Solay conversion, but his operation doesn't last." Sandahl first went to Alta in 1953 and worked as a bartender in the Alta Lodge. While at Alta he started to become interested in snow and avalanche work. The following year he left to take a job in Alaska where he worked as a ski instructor at Alyeska Ski Area. He later became the snow safety director there. Sandahl went on to pioneer the use of helicopters to do avalanche control work in Utah. Atwater's 1950 heliskiing in California may well have given Sandahl the idea of using helicopters to carry skiers to the top of "Max's mountain" in Alaska.

A STILL FROM W. J. WELLENSTEIN'S FILM AT ALYESKA

Well known Alaska avalanche worker Dave Hamre, who mentored under Sandahl at Alta after he returned from Alaska, says that this photo was taken at the top of "Max's Mountain," which is now Alyeska Resort.[9] He thinks this picture was taken before chairlift construction while the mountain was being scouted, and lifts were sold up the mountain. This would have been about 1958. It is rumoured that a heli-lift cost $10 (approximately $80 in today's dollars). There is even 16mm colour movie footage by W. J Wellenstein on YouTube.com of this heli skiing.[10]

In 1964 Sandahl returned to Alta, Utah and was hired as the US Forest Service Snow Ranger. Sandahl was an early mentor to many in the avalanche business and heli ski guiding, and was a close friend of Mike Wiegele's. Contrary to how Skiing spelled his name, he preferred to spell his name Binx. Sandahl died September 1, 1999.

In the February/March 2012 issue of Canadian helicopter publication *Vertical* magazine, there was an article about the history of Canadian heli skiing called "Top of the Mountain" by noted Canadian aviation writer Bob Petite. In his article, Petite leads off with, "The first recorded occurrence of a helicopter being used to airlift skiers into mountains was back in 1948, by Skyways Services, which was one of three

[7]Montgomery M. Atwater, *The Avalanche Hunters*, (Philadelphia: Macrae Smith Company, 1968), 209.
[8]"Bob Hicks' Skiing Adventure," *Mineral King Preservation Society*, published June 10, 2014, http://www.mineralking.org/index.php/recollection/bob-hicks-skiing-adventure.html.
[9]Dave Hamre, email exchange with author, August 25, 2013.
[10]"Helicopter skiing during the 1950's at Mt. Alyeska, Alaska." *YouTube*, published December 28, 2014, https://www.youtube.com/watch?v=dVUA96LuzVE&feature=youtu.be.

To Ski Grounds by Helicopter

TIME REQUIRED to send news to ski grounds at Grouse Mountain has been cut this Aero Surveys helicopter. Here skiers Martin Christie and Colin Patterson of Vancouver read The Sun, just 20 minutes off press, as Paul Ostrander, 'copter pilot and aerial paper boy, watches their delighted expressions.

Date: Jan 30, 1948
Vancouver, B.C.

Helicopter Service To Mountain Tops Offered Skiers

Next: a ten-minute helicopter "ski tow" service from the centre of the city to the top of Grouse Mountain.

That's the prediction of Lewis Williams, Aero Surveys Ltd. president, who made a trial trip Sunday from Second Beach to the snowy peak.

"We're going to start packing freight up the mountain now, and it won't be long before we'll be able to take skiers up by helicopter," said Williams.

Pilot of the helicopter was Paul Ostrander.

Canadian commercial operations at the time."[11] I have looked long and hard for any information to the contrary and haven't found anything to contradict this statement. I contacted Mr. Petite for more details, and he graciously replied. This first use of helicopters to airlift skiers to the top of a mountain basically consisted of an air-taxi ride from downtown Vancouver to the top of Grouse Mountain Ski Resort just outside of Vancouver.[12] This service apparently lasted for one winter. Mr. Petite also passed along the newspaper clipping (Fig. 1).

This isn't what we have grown to expect from modern heli skiing, because it wasn't done in a backcountry setting. But this is the first time that a helicopter was used to transport skiers for the purpose of downhill skiing. Lewis Williams, the president of Skyways Services, should be credited with bringing the first heli skiing to the public. Paul Ostrander should also be credited as the first heli ski pilot. Clearly, these guys had a creative idea of how to use a helicopter. I searched diligently for any other information about heli skiing dating before 1948 and haven't found anything else to dispute this information.

By the late 1960s, Hans Gmoser had CMH up and running. Mike Wiegele, a friend and ski partner of Gmoser's, started his operation in 1970. Gmoser and Wiegele both deserve credit for being the first to create the "helicopter skiing vacation package" and turn it into what it is today. The first heli skiing operations started out as just daily heli skiing operations. Today there are vacation package and daily heli skiing operations throughout the world in 18 countries. Many folks could try to lay claim to being the first to do it. As early as 1944, German mountain troopers may have seen the potential of using helicopters for skiing—but wartime priorities obviously suppressed this idea. As far as my research shows, Lewis Williams in 1948 was the first to launch a helicopter with skiers up into the mountains so I propose that heli skiing was invented in Canada in 1948. I would like to raise my glass to Williams and thank him for starting all the fun. I wonder if he really knew what he started.

For this article I have condensed a lot of my research. Please keep an eye on my website heliskihistory.com where I will eventually compile all of my research.

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[11] Bob Petite, "Top of the Mountain," *Vertical*, February/March 2012, 165.

[12] Bob Petite, email exchange with author, October 25, 2013.

An Update from **HeliCat Canada**

Ian Tomm

IT'S OFFICIAL: FALL IS HERE, which means those first turns of the season are around the corner. This is a wonderful time of year as we celebrate a summer well spent and revel in the excitement of the approaching winter.

As the Canadian helicopter and snowcat industry ramps up for the winter, we've been asking ourselves some simple yet complex questions at HeliCat Canada about the value and impact of our sector in British Columbia. I'd like to share some of the key points we've developed to date.

- There are more than 40 helicopter and snowcat operations across BC, employing over 2,000** F/PT workers
- Helicopter or snowcat skiing tenures cover approximately 10% of BC's land base (the most of any AT sector).
- Five new operations are starting up this season: one cat, four heli.
- Over the past decade, there have been approximately 100,000 skier days per winter on average .
- In 2014-15, skier days were down by about 10% from 2013-14**, due to weather and conditions for most of the winter.
- The industry brings in $160 million per year in annual revenues*.
- Estimated winter payroll is approximately $35 million per year*.

Leading BC's Super, Natural British Columbia brand, our sector is one of the marquee adventure tourism products offered in the province today. While BC is proud to be home to a wide range of world renowned adventure tourism experiences, few match the exhilaration of guided wilderness skiing with a snowcat or helicopter skiing operator. Internationally, our sector continues to lead in international market share,** bringing much needed export revenues and international exposure to the province of BC.

So why is this relevant in a journal for avalanche professionals? For the most part, the helicopter and cat skiing sector has grown around the need for high quality avalanche risk management programs. Avalanches are the single greatest natural hazard impacting the sector and this reality has not only shaped how the sector has grown, but also shaped avalanche research and best practice in Canada. The sector is the single largest non-government contributor to avalanche research in Canada. In fact, over two million dollars has been given to various research initiatives over the past 20 years, and that support continues to this day, including significant annual cash and in-kind contributions.

The sector is also the largest employer of frontline avalanche workers in Canada, if not internationally. Operationally, the time and resources focused on avalanche risk management are significant. If anything, we've grown so accustomed to this focus that we may take it for granted in some cases. From InfoEx subscribers to ITP students to research funding, the heli and cat skiing sector is a significant industry supporting the CAA's programs and services. The CAA has fostered a world-class operating environment, which has led to our sector's success and played a key role in the success of the entire industry of avalanche risk management in Canada.

HeliCat Canada and its membership are involved in a long and multi-faceted initiative to study the socio-economic impact of our sector in Canada. Part of this project's scope includes things like the HeliCat's sectors contributions to services like InfoEx and Avalanche Canada's public avalanche bulletin. We've talked for years about the value of InfoEx but we never understood what that really meant. Over the years, in their work with the government Avalanche Canada has written internal reports about the importance of the InfoEx feed and what the cost would be if Avalanche Canada had to collect that data on its own. The HeliCat sector's commitment to avalanche risk management and public safety is a fundamental value of the sector, and that support isn't going anywhere. What we are interested in is defining and describing that support in new ways. This clear understanding will help us in many ways, including working with government on a number of fronts—whether it's the importance of industry support in public avalanche safety initiatives, SAR support and other areas we aren't even aware of yet.

We will be reaching out to all avalanche professionals in Canada to help contribute to our research efforts—in particular, a fascinating initiative through a research partner Thoughtexchange. Based out of Rossland, this company has excelled in helping industry, government and others understand the conversations around their sectors and businesses. Please consider contributing to our conversation at helicat.thoughtexchange.info/invitation. I will be sure to come up with an article in the spring on the results. You can reach me at ian@helicat.org. All the best for the winter ahead.

*CWSAA Newsletter: February 2015. http://bit.ly/1FaKqJq.
**HeliCat file data

research

// ROBIN SIGGERS

ASARC: The Prequel

Dr. Bruce Jamieson

IT WAS WEIRD. EVERY TIME I ASKED CLAIR FOR SOMETHING, HE SAID "YES." I was a wanna-be MSc student at the University of Calgary and Clair Israelson was the Parks Canada warden in charge of avalanche forecasting at the Lake Louise Ski Area. With coaching from my future supervisor, Dr. Colin Johnston, I had a plan to measure the tensile strength of snow. I was asking Clair for advice on study sites, lift tickets, as well as regular chats with the forecaster on duty since I was also interested in making measurements of slab strength at recent slab avalanches.

Every day the winter of 1986-87—at least every day that I was not attending a class—I drove from Calgary to Lake Louise or Kananaskis Country, made some strength measurements, and learned about test techniques, consistency and recording. Towards the end of the winter, Peter Schaerer came into the field with me. When he saw my technique for testing the tensile strength of snow, he said I needed a sharper tool to cut the notches in my snow specimens more gently. I doubted him (though never should have!), but was soon back in the field doing tests, alternating between the older cutter and a new sharper one. Based on a statistical comparison of the results—that was also new to me—the newer sharper cutter gave higher (less disturbed) and more consistent strength measurements. I adopted the new cutter and discarded my first winter of field data!

Doors that I didn't know existed were opening for avalanche research!

With this experience and some engineering courses completed (the math and physics courses from my undergraduate degree were insufficient), I was ready to enter the MSc program in Civil Engineering. Well, not quite. I had Colin Johnston as a potential supervisor but no funding to study snow strength. Fortunately a research grant application I had written was funded by the Alberta Government—not because it was a good application (it wasn't), but likely because avalanches were in the news in spring 1987 when the committee met to review applications.

After more courses and a second winter of field studies with better measurement technique, I wrote a MSc thesis, learning a lot from Colin about scientific writing. That fall I gave a forgettable presentation on snow strength at an avalanche conference in Edmonton. After the presentation, Mike Wiegele enthusiastically approached Colin Johnston and me, wanting to host avalanche research at his heli skiing operation in Blue River, BC. Doors that I didn't know existed were opening for avalanche research!

While working as a weather station technician for a Calgary company after my MSc, Colin and I teamed up with Mike Wiegele's operations manager, Ivan Somlai, to write an application to Natural Sciences and Engineering Research Council of Canada (NSERC, the research arm of Industry Canada) for three years of funding. This included some industry funding from Mike Wiegele, which, in hindsight, was a game changer.

NSERC approved the grant in December 1988 and I became employed as a research associate. We soon started field studies in Blue River with Mark Shubin as the first research technician. Mark and I observed and then later began to participate in the morning and afternoon guides' meetings. Peter Schaerer visited to coach us on the Rutschblock and shear frame tests. Most days we spent hours getting an aging snowmobile up the Mount St. Anne road to the study area. In one of my dumber decisions, I chose to work weekdays in Blue River, drive

AN ARRAY OF RUTSCHBLOCK TESTS ON A WEAK LAYER OF SURFACE HOAR FROM 1991. MARK SHUBIN AND BRUCE MADE THE THIRD ROW OF TESTS AFTER THE PHOTO WAS TAKEN. NOTE THAT A SINGLE TEST IN THE TOP LEFT PART OF THE ARRAY GIVES A MISLEADING INDICATION ABOUT LOCAL STABILITY // BRUCE JAMIESON

to Calgary on Friday night, and then back to Blue River on Sunday afternoon and evening. At the spring 1989 Canadian Avalanche Association meetings, I presented first results from field studies with the Rutschblock test—which later resulted in the nickname Reverend Rutschblock.

The next winter, Colani Bezzola from Canadian Mountain Holidays (CMH) approached Colin and me, asking if there would be a role for CMH in the research program. Well, yes! Initially CMH, and then the association of helicopter and snowcat operators began to contribute funds and advice.

In spring 1992, Colin and I wrote an application to NSERC with financial support from Mike Wiegele, the CAA, and the helicopter and snowcat skiing operators. When the avalanche community heard the words "avalanche research" and "field studies," they stepped up to the plate. Soon avalanche researchers from other countries were remarking on the participation of industry in Canadian avalanche research.

The main research objective of this proposal was to track persistent weak layers with profiles, shear frame and Rutschblock tests. The term "persistent weak layer" was new and starting to replace "old snow instability." In addition to continuous field studies in Blue River and at CMH Bobbie Burns, weekly observations were planned at Jasper, Yoho, Banff and Glacier National Parks as well as at the BC highways operation at Kootenay Pass. Each of these operations was to observe a weekly profile and do a couple of Rutschblock tests on a study slope. I was to visit each operation once per month. It was a demanding schedule requiring widespread field supervision—with which I had limited experience—and way too much driving.

When NSERC and others reviewed the proposal in August 1992, they identified one major weakness: no graduate students! The application deadline for graduate school had passed but Colin Johnston worked some supervisory magic and I became a PhD student. That included taking more graduate engineering courses—what I needed was a course in time management.

I struggled to supervise two technicians in Blue River and rotating technicians and volunteers in the Bobbie Burns (Colani Bezzola organized the volunteers), and make monthly visits to the national parks and Kootenay Pass. Also, I had been elected CAA president in spring 1992, but it was too much for me. CAA board members Jack Bennetto, Colani Bezzola and Dan MacDonald frequently filled the gaps until I stepped down in 1995.

PETER SCHAERER DEMONSTRATES A SWISS RUTSCHBLOCK TEST DURING ONE OF HIS EARLY VISITS // BRUCE JAMIESON

At the field stations in the Bobbie Burns and Blue River, we were tracking persistent weak layers and developing new techniques. Perhaps more importantly, an assortment of avalanche practitioners (too many to name) were working for the research program, spending a winter or two with their heads and hands in the snow, and discussing their results twice a day with guides. Many of those practitioners are now guiding, forecasting or managing avalanche operations. The integration of research with operations worked so well thanks to the commitment of managers and operational staff at Mike Wiegele Helicopter Skiing and CMH Heli-Skiing, as well as the patience of the support staff for oddball researchers.

Throughout the winters of 1993, '94 and '95, the remarkable people and field work kept me going. I'd roll into a cheap hotel in a small, wet BC town, get some sleep, usually meet the field staff for a big breakfast and too much coffee, then ski tour, sled or fly to treeline. There we would observe snow profiles and test the snowpack, and talk about weak layers, slabs and avalanches, before skiing down to the road. I was learning from the mountain snowpack and many remarkable guides, forecasters and technicians.

I recall one snowy day at Kootenay Pass with Will Geary. We were at a treeline study slope doing Rutschblock tests. In the afternoon the snowfall picked up. Willy became eager to patrol the highway and check on a particular path that was "loading up." I didn't see anything critical in our tests and started yet another Rutschblock test. Then I heard Willy snap into his bindings and say "I gotta go." His experience with the local weather and terrain trumped the results of a few closely spaced Rutschblock tests. The patrol from the highway, looking up through the snowfall into the start zones, was the appropriate scale for observations and a decision about closing the highway. Although I considered myself a practitioner with experience at two ski areas, these field days in many snowpack conditions with experienced practitioners from diverse operations were shaping my outlook and the research program.

Doors were opening internationally as well. During a visit to Alta in 1991, I stayed at the famous Lower Guard Station with Binx Sandahl and Duane Bowles. They shared amazing stories about avalanches and explosive control in the Little Cottonwood Canyon. During dinner one evening, Rod Newcomb dropped in, and the remarkable tales about avalanches shifted to Wyoming. Throughout this visit, I wasn't allowed to pay for a lift ticket or a beer, largely because Mike Wiegele had "made a few phone calls." I also met with Peter Lev and Bruce Tremper, who talked about forecasting and its challenges. Tremper drove me to the Salt Lake airport. When I confessed to having forgotten my passport, he was worried that this poor Canadian graduate student wouldn't be leaving Utah!

In the spring of 1992, I was back in Utah for a small conference at Alta, mostly to celebrate the retirement of Ed LaChapelle and Binx Sandahl. Ron Perla spoke about the questions for avalanche research, one of which was the need for a "slab bug" that could be tossed onto the start zone, where it would detect the onset of instability. Twenty-three years later, small interconnected geophones are finally close to meeting Ron's vision.

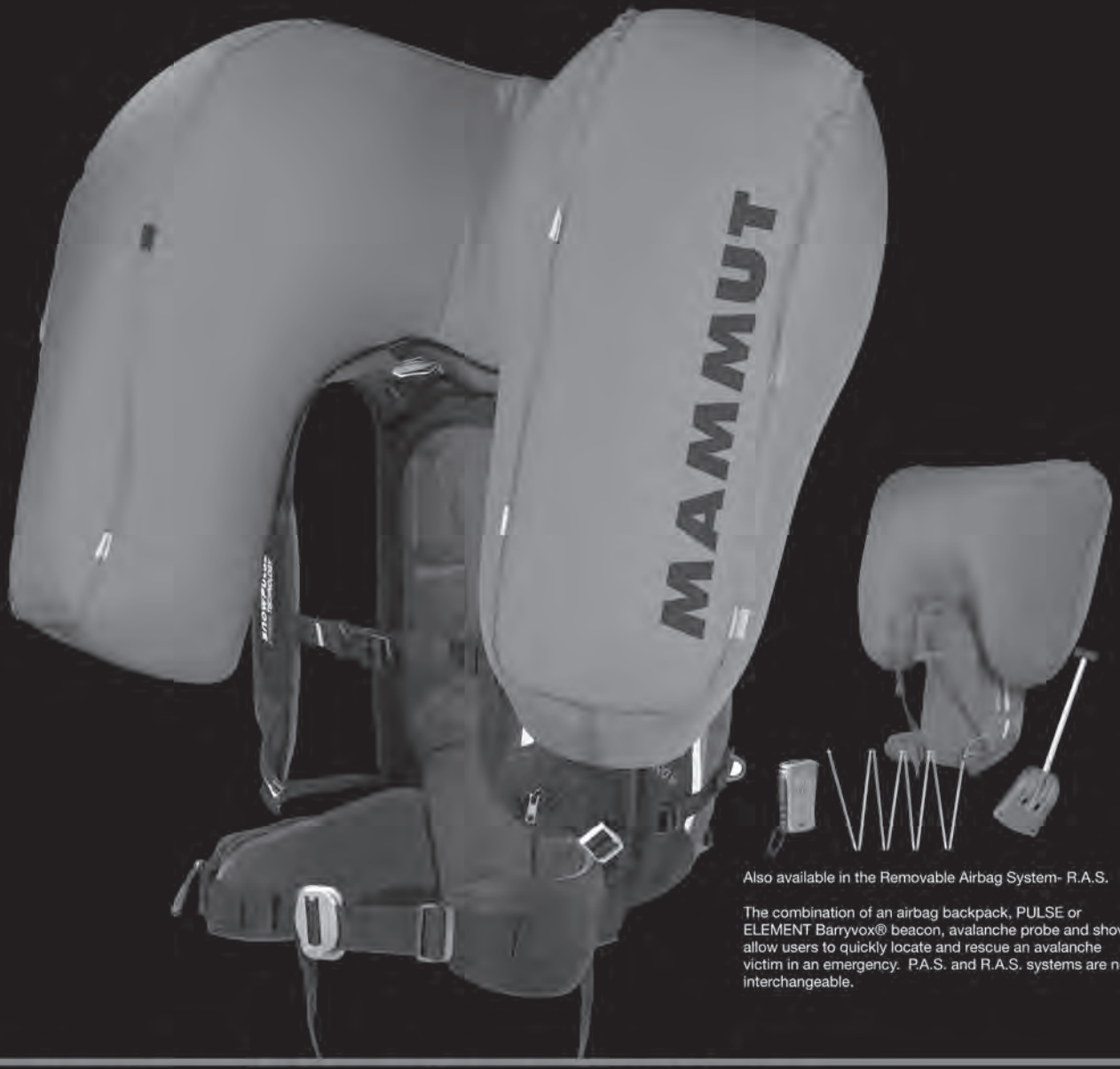
LEANNE ALLISON AT ONE OF THE MANY SLAB AVALANCHES THAT ASARC STAFF USED TO CALIBRATE THE RUTSCHBLOCK TEST AND SHEAR FRAME STABILITY INDICES. THIS ONE WAS REMOTELY TRIGGERED BY A SNOWMOBILER SAFELY RIDING ALONG THE RIDGE // ASARC

The results from the winters of 1993 to 1995 included tracking persistent weak layers, refinement of the Rutschblock test and the shear frame stability index for skier triggering, as well as the first arrays of Rutschblock tests. Looking back at the presentations from these years, it was clear that the conversations with practitioners had us thinking about a couple of concepts:

- The variability in snowpack tests on a slope—which we were excited to have mapped on a few slopes—wasn't telling us much about the variations in stability between different aspects and different drainages, which was important to the decisions of lead guides and forecasters.
- There was an important difference between a fracture starting in a weak layer under a skier and that fracture propagating away from the skier. The appearance of the fracture, sometimes called fast or slow, clean or dirty (which later evolved into fracture character) was telling us something about the potential for fractures to propagate.

These were formative years for what would later be called the ASARC program. Practitioners were sharing their experience and observations, the Canadian avalanche community was providing logistical and financial support, and international avalanche researchers were taking note of the remarkable collaboration between industry, government and university researchers.

In the sequel to this prequel, I'll talk more about the growth of the ASARC program and collaborations that made it work.



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A Suggested Conceptual Model For Daily Terrain Use Decisions at Northern Escape Heli-Skiing

Clair Israelson

FOR SEVERAL YEARS, Dr. Pascal Haegeli and I have talked about the potential for research in to avalanche safety decision processes in heli skiing. Specifically, we were interested in how the inputs to our morning avalanche hazard evaluation and run list decisions—taken in the safety and isolation of our office—correspond to the terrain we actually use when we get out into the mountains that day.

By the beginning of the 2015 winter season, the pieces for the pilot project were in place. Pascal had the time and interest to take the project on. Northern Escape Heli-Skiing (NEH) had some innovative operational procedures and documentation in place to generate daily data for analysis. Importantly, our guiding team had bought into the operational value of these procedures, and had a couple of years of experience using them. Data from GPS units carried by our lead guides closed the circle, generating data to track our movements through the mountains with a high degree of precision. From these data we hope to address the following questions:

1. At our morning guides meetings, what are the key factors that drive the avalanche hazard evaluation and risk management decisions to produce our run list?
2. Can analysis of our daily operational records and GPS tracking data offer insights to improve the avalanche safety decision processes used by heli ski guides in the field?

HOW WE GOT HERE

When I started trying to forecast and control avalanches for Parks Canada in the early 1970s, avalanche science and professional practice were in their infancy. Ed LaChapelle, a leading US researcher at the time, said avalanche forecasting was an iterative, experience-primed intuitive process that defied description. We threw a lot of bombs and hoped we were getting it right. Since then, collaboration between researchers and practitioners meeting around the table of the CAA and elsewhere has significantly advanced professional practice.

Technical communications with colleagues and the arrival of computing required a Canadian data standard, and the Observations Guidelines and Recording Standards (OGRS) was born. Computers brought us the internet, propelling InfoEx from a labour intensive faxed paper product to a comprehensive real-time database that invites analysis. Over the years Dr. Dave McClung, Dr. Bruce Jamieson and their research colleagues have contributed immeasurably to our understanding of avalanche science. Thierry Cardon at CMH pioneered the run list concept for heli skiing. With ATES, Parks Canada staff showed it is possible to classify mountainous terrain into categories of potential avalanche severity. Roger Atkins introduced the concepts of avalanche character and strategic mindset. The conceptual model for avalanche forecasting, now fully integrated with InfoEx, was developed by a group of American and Canadian avalanche experts led by Grant Statham. These foundations set the stage for our pilot project.

THE CONTEXT ISSUE

From the outset, we realized avalanche hazard was only one of many factors that influence terrain use decisions in heli skiing. When interpreting our GPS tracking data, analysis of avalanche safety decisions would have to consider the operational context, a conceptual framework for terrain use decisions in heli-skiing. Unable to find any satisfactory description of such a framework in the literature, what follows is my attempt to articulate a plausible decision hierarchy. If this description is reasonable, then experienced heli ski guides should find what follows is common sense and self-evident. If not, I've got it wrong and we need to get it right. I invite your comments and suggestions for improvements.

THE DECISION FILTER CONCEPT

I suggest heli ski guides use a series of decision filters to consecutively eliminate terrain from our menu of possible choices each day (Fig. 1). The end product of this filtering and elimination process is the terrain we actually use, as captured by the GPS tracking data.

Filter 1: Terrain Inventory and Assessment. At NEH we sell heli skiing. If we're going to sell this product we need to know what we have to offer and where it is within our operating tenure. Early in the life of the company, we explored our tenure to identify and map skiing zones with relatively similar geography, climate, glaciation, forest cover, spatial relationships to lodges, fuel caches, highway accessible staging areas, and the density and character of potential ski runs.

NEH has twelve skiing zones encompassing 7,000km^2. Economics and skier satisfaction dictate that zones closest to lodges and fuel caches with a good mix of alpine and tree skiing and lots of ski runs in close proximity to each other get used first and most often (e.g., Promised Land), while more remote zones with fewer ski terrain options (e.g., South Shore) are used when conditions in the more accessible ski zones are unsuitable due to avalanche hazard, ski quality or other reasons.

All possible ski runs are explored, named, mapped, and the various ski lines on each run are classified for potential avalanche severity using a green/blue/black rating system overlaid onto photos in our run photo catalogue (see example on page 45). The potential avalanche severity rating is determined by consensus within the guide team based on our personal experience in that terrain. This is an ongoing process as new ski runs continue to be developed. NEH maps, run photo catalogues and run list formats are updated annually as part of our pre-season planning. At NEH this terrain inventory is the foundation for the avalanche risk assessment required under the recently revised WorkSafeBC regulations.

Filter 2: Hazard Evaluation and Risk Management Processes—AM Guides Meeting. Our AM guides meeting of guides and pilots generates three key products which build on each other to produce a tentative operating plan for the day.

2.1 AM avalanche hazard forecast. Using the InfoEx workflows, this is an iterative process reflecting the change from yesterday's AM forecast. Key inputs are yesterday afternoon's InfoEx now-cast, 24-hour snow and weather actuals and forecasts, and InfoEx subscriber reports. This assessment is a combination of data analysis and intuitive, experience-based gut feel. A goldmine of input data and assessment conclusions are captured in the InfoEx database for future analysis.

2.2 Strategic Mindset and Run List. For years I have been advocating for some sort of tool to help our guide team reach a shared mental model for the rationale and extent of the stepping out (greening) or stepping back (redding) we do on our run list each day. The eureka moment occurred when Roger Atkins gave his strategic mindset talk at ISSW in Banff last fall. We combined some of his ideas with some of our own, and the resulting product works well for us (see Fig. 2). This strategic mindset exercise only takes one or two minutes and saves us time in the long run by streamlining our run list discussions that follow. Our guiding team is sold on the concept; you may want to try it out in your workplace.

Next we create the run list for the zones that we plan to use that day. The sequence of photos in our run photo catalogue mirrors the order of the run list for each ski zone. As we scroll through the run photos, the green, blue or black lines on each run are considered. Decisions to open or close a line for the day are by team consensus; if consensus is not reached the line is closed by default. On the run list, lines determined to be safe for skiing that day are colour coded green (see Fig. 3). Lines closed for avalanche hazard are colour coded red. Lines closed for other mountain hazards (crevasses, open creeks, ski quality, etc.) are colour coded black. Ski runs in zones not being considered that day are undiscussed and colour coded white. Company policy decrees that only the green lines on the run list are options for our guides to ski today. Everything else is off limits.

A copy of the day's run list is printed for each helicopter. Run photo catalogues are downloaded to phones or tablets so guides and pilots can cross reference and confirm they are operating within the criteria established during the AM guides meeting. New runs are not on the run list; the NEH operations manual specifies criteria for exploring and skiing new runs.

2.3 Daily Operations Planning. Lead guides and pilots discuss who will go where in which helicopter. Considerations include the number of helicopters operating, weather, anticipated snow conditions, previous terrain use, etc.

The Filter 2 decisions are consensus-based guiding team decisions made at the morning guides meeting, before going out into the field. They are best guesses based on all available evidence, factoring in uncertainty driven in large part by the time elapsed since we were last in the field.

Filter 3: Weather and Flying Conditions. Guides are responsible for terrain choice decisions, and pilots are responsible for flight safety. Using real-time observations and forecasts, pilots and guides collaborate to decide where/if we can heli ski on a given day. Bluebird days are easy, since visibility is unlimited. However, bluebird days aren't the norm. Commonly, at least some of the terrain we would like

FIG. 1:FILTER LAYERS CHART

NEH GUIDE TEAM - DAILY STRATEGIC MINDSET STATEMENT - JAN 22 2015

MINDSET CONDITION		COMMENTS	DESCRIPTORS
INITIAL ASSESSMENT			Collecting data to establish baseline
ROUTINE OPERATIONS			Situation normal (snowpack, weather, confidence)
HIGH ALERT	X	Heavy precip, warm temps and wind	Unusual, unpredictable dangerous conditions
ENTRENCHMENT			Known persistant, dangerous slabs
OPEN SEASON			Most terrain is safe, we're going for it
SPRING DIURNAL			Adjust terrain use to daily MF cycle

IMPLICATIONS FOR SKI TERRAIN USE				
←	conservative	status quo	aggressive	→
STEPPING BACK	←			STEPPING OUT
"Going Redding"	*"trend change from yesterday"*			"Going Greening"

COPY & PASTE → SYMBOL CHOICES

X
→
←

FIG. 2 DAILY STRATEGIC MINDSET

to get to is unreachable due to cloud, snowfall, fog layers or wind, eliminating that terrain from our list of options. Last winter we kept a daily flying weather log to document how much of our terrain was unusable each day due to inclement weather.

Filter 4: Flight Economics. Most guests purchase a ski package with a specified amount of vertical feet of skiing. Guests get refunds if they fail to reach this specified number, and pay extra for skiing in excess of their package's vertical promise.

Production is the ratio between flight hours used and the number of vertical feet each guest group skis in a day. A guide's job is to optimize production while giving our guests the best possible skiing experience. The helicopters we use cost $30 and $40 per flight minute. If a helicopter costing $40/minute is servicing three groups of skiers and burns just one minute of unnecessary flight time per lift, over the course of a twelve run day our helicopter cost increases by almost $1,500. Multiply that by a one-hundred-day operating season with three helicopters and it becomes apparent that if I'm a lead guide who burns helicopter time frivolously, I won't have a job for long.

NEH provides standing written guidance to our guiding team stating that our operational priorities are safety first, guest satisfaction second and economics (i.e., helicopter costs) third. We need to be safe and keep our guests happy without bankrupting the company.

The closest good skiing gets used first, and as those runs become skied out we move further afield to terrain that requires more cost (flight time) to access. Most days, this precludes routine use of areas on the far fringes of our tenure. Fortunately, there is little correlation between ski quality and distance from the lodge, so there is seldom pressure from the guests to launch off into the remote reaches of the tenure in a faint hope search for blower powder. When those excursions do occur, it is usually by private groups who pay for flight time rather than by vertical feet of skiing. Decisions regarding production and terrain use are made on site in real time by the individual lead guides.

Filter 5: Safety and Skiing Quality. Subject to decisions prescribed for the day at the AM guides meeting, each lead guide inherits accountability for the run choices they make. Safety concerns, primarily avalanches, remain our priority. Our morning avalanche forecast and run list are created before we go out into the field. Just because a ski line is green on our run list today does not necessarily mean that we really should go there. Conditions in the mountains may be dramatically different from what we had envisioned back in the office. The decision for the lead guide is "should I land here or not?"

It is common practice for lead guides to start on a safe, "standard" first run to feel out that day's snow and avalanche conditions before embarking on their intended circuit. As we move through the mountains, we observe terrain-dependent variations and patterns in snow quality, structure and stability. We look for runs with acceptable avalanche risk and the best possible skiing conditions. Once on a run, we feel the snow structure and quality, and take our guests to the micro terrain features where the best skiing is. We're guiding—using our knowledge, experience and judgement to provide the best possible experience for our guests. Decisions about where we will ski next are driven by everything that we have observed prior. This is the classic Baysian updating process described by McClung.

Extensive local experience and pattern recognition skills are required to put together a good heli skiing day. Decisions are made on site, in real time. A lead guide's skiing plan for the day often has a very short shelf life.

Filter 6: Guest Preferences. Not all guests want the same heli skiing experience. Snowboarders and skiers often prefer different types of terrain. Some groups want to charge the steep and deep, racking up vertical as fast as they can. Others want to ski less challenging terrain at more leisurely pace. We're in the customer service business, so we try to take our guests to the type of terrain that's best for them. On any given day, we may consciously avoid going to a ski line or run that has safe, good skiing because it's just not the right fit for the that particular group of guests.

CONCLUSIONS

I suggest the pilot project data collected at Northern Escape Heli-Skiing during the winter of 2014-15 might be interpreted in the context of the decision filtering processes described above and shown in Fig. 3. Each of the filters described above consecutively eliminates more and more of the terrain from our menu of choices for that day. We ski what remains after all filters have been applied.

I hope the Canadian avalanche community will let me know if this conceptual approach works for them (or not) and how it might be improved. Please contact me at clair@neheliski.com with your feedback. If your organization is interested in becoming part of this research project please contact Dr. Pascal Haegeli at pascal@avisualanche.ca.

Northern Escape Heli-Skiing Run List										END SKIING TIME				1800
					Today's strategic mindset is:			HIGH ALERT						
CAT ZONE ROADS					ZONE 3: Promised Land					Faceshot West			3	
The Y	1				Molybdenum Creek					Miss Robinson	1	2		
Switchback	1				Shrek		2	3	ski quality	Mrs Robinson			3	icefall
The Notch		2			Donkey	1	2	3	ski quality	Schnackselhuber	1	2	3	Crevasses?
Hatha's Hill		2			Poison Apple			3		Pillow Talk		2		
Machete	1				Poison Beauty		2	3		Steep and Easy			3	
					Sleeping Beauty Bl		2	3		Lava Life			3	Crevasse, LL
ONE 1: First Nations					Sleeping B Ridge			3		Back Door		2		
Exstew River					Sleeping B Gully			3		Nelson River				
How			3							Alder Patch			3	ski quality
Tomahawk			3		Erlandsen Creek South Fork					East Ridge	1	2		
Vision Quest		2			Bitter End	1	2	3		Boot Camp	1	2		
Deep Pow Wow		2	3		White Horse			3		Chupete	1	2		
Shaman			3		The Riddler			3	LLZ	Pacha Mama	1	2	3	HPU
					Joker	1	2			En Fuego	1		3	
Exchamsiks River					Tinkerbell	1	2	3	East LZ/ HPU	El Diablo	1	2	3	
Mukluk			3		Kermit		2	3		Sun Dog			3	

FIG. 3: RUN LIST

AN EXAMPLE OF TERRAIN INVENTORY

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