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Towards **Competency-Based Membership**

Walter Bruns
CAA President
Lisa Porter
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Joe Obad
CAA Executive Director

THE CAA'S STRATEGIC PLAN is committed to enabling members at all stages of practice to demonstrate their competencies to ensure we maintain the public's trust in our work. For the past few years, the CAA has been pursuing initiatives to achieve *Goal 1: The Professional Path*. In particular, making significant progress toward building a new competency-based process for future CAA members.

ADDRESSING ALL LEVELS OF PRACTICE

What are newly minted members of the CAA competent to do? How do members demonstrate their experience and training qualifies them to competently lead or develop complex avalanche programs? The CAA has received many calls from members, employers and the public asking variations of these questions. The membership model the CAA is building seeks to help members demonstrate competency at key junctures.

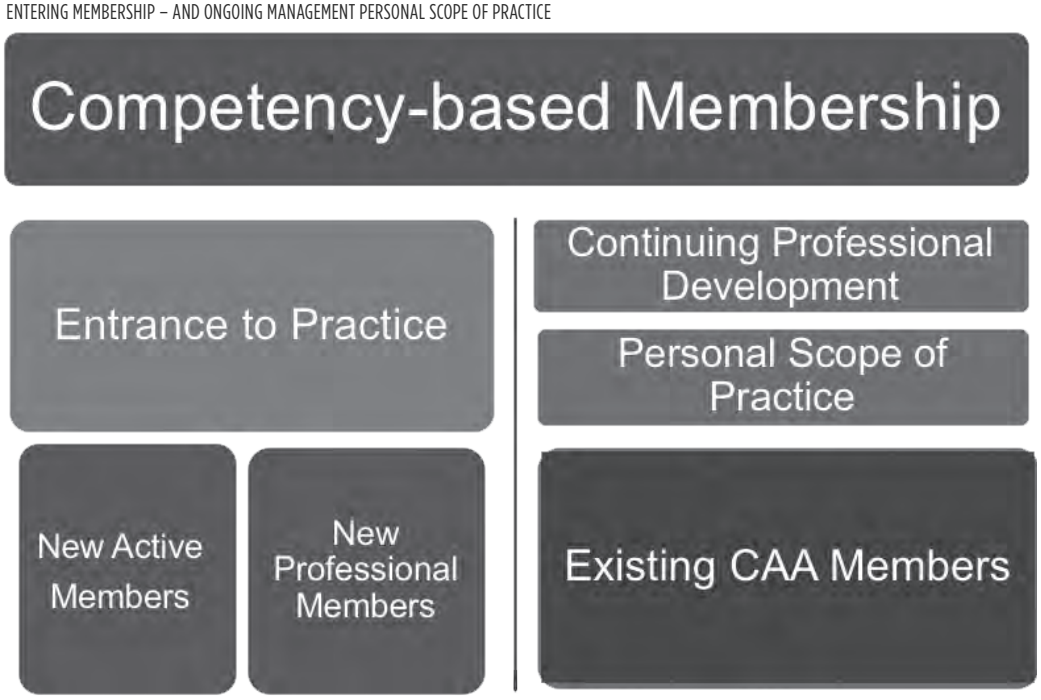
CAA COMPETENCY-BASED MEMBERSHIP MODEL

CAA Competency-based membership requires strong tools to assess incoming members (Entrance to practice) and tools to help existing members to develop and expand the scope of their personal practice.

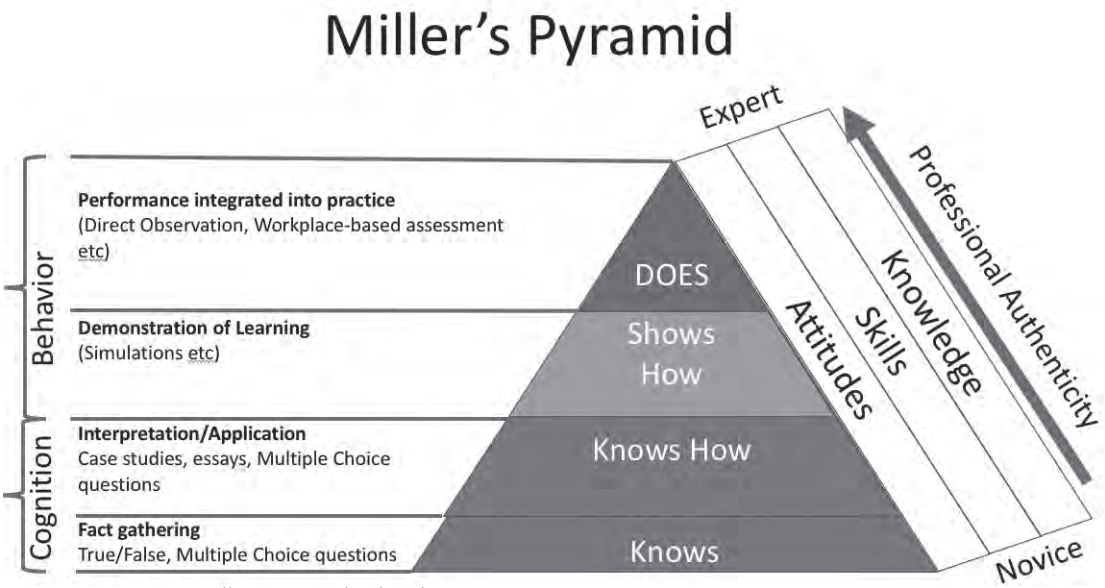
The first obvious point is when individuals become members. The CAA competency profiles released in 2014[1] define required member competencies when entering two levels:

- Practitioner 1 (P1) correlates most closely to current Active membership;
- Practitioner 2 (P2) correlates closely to our concepts of Professional membership.

(We say correlates because these changes may offer an opportunity to relabel member categories with names less confusing to the public. The CAA board voted to explore alternate name several years ago.)



[1]CAA Competency Profiles are accessible via the Members only section of the CAA website.



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The profiles for P1 and P2 are snapshots of the *minimum abilities* for each member category at the time the applicant enters the membership category. Clearly articulating these abilities helps members, the public, employers and regulators understand the capabilities of new CAA members. By assessing new members against the competency profiles, various stakeholders will know to what degree new members are "knowledgeable of the work, the avalanche hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof," to use WorkSafeBC's terms, with regards to avalanche risk.

Of course, members continue to grow their skillsets after joining a membership category. The Ethics and Standards committee is working on tools to help members demonstrate new skillsets acquired through mentorship, experience, and other continued professional development. These tools are intended to assist in defining individual scope of practice, and to expand that scope judiciously over time as warranted by new experience and training. The Membership committee's supervision of member audits ensures these tools are used judiciously.

Competency Assessment - Gap Analysis

Competency Area	Primary Assessment Venue
Professionalism	Online Course
Communication	Application
Organization & Decision Making	Portfolio
Terrain Use	Portfolio
Managing Operational Avalanche Risk	Portfolio
Observation and Recording	Level 1
Education	Portfolio and L1
Emergency Response	AvSAR Course

ASSESSMENT FOR ENTRANCE TO MEMBERSHIP

Historically, the CAA has relied heavily on ITP courses as a membership prerequisite along with quotas of working days in the winter seasons preceding the application. Moving toward a competency-based model, significant changes will be required.

Current CAA competency profiles illustrate the competencies members should have in eight domains of competency. These new profiles *do not prescribe how* the CAA should assess applicants wishing to attain membership.

To understand what competencies are best suited to be assessed in ITP, the CAA conducted a gap analysis to understand which assessment of member applicants might remain in under ITP and what areas would require new methods of assessment. The gap analysis used Miller's Pyramid, a widely accepted model for delineating assessment levels, as a method for categorizing the assessment currently available in ITP.

Under Miller's Pyramid, assessment at the "Shows How" or "Does" levels are optimal. Where ITP assessment did not reach this level, or likely could not, other assessment methods were considered. The summary of results is illustrated below.

The *Avalanche Operations Level 1* course is well suited to assess competencies in *Observations and Recording*. Likewise, the competencies identified under *Emergency Response* were the basis for the development of the *Avalanche Search and Rescue Advanced Skills* course developed in 2015. While *Professionalism* could be taught in ITP, participants agreed moving it to an online course would allow ITP related courses to maintain a tighter focus. Likewise, *Communication* will be a component of the application process itself and be assessed in the process.

The competencies in the domains of *Organization & Decision Making, Terrain Use, Managing Operational Avalanche Risk*, and elements of *Education* are not well suited to ITP course assessment. Representatives of the board and subject matter experts agreed the workplace is the optimal venue to address competencies in these areas. Discussions followed, noting that the burden of effort should rest on the applicant rather than the employer. So, all agreed a portfolio should be explored as the optimal method for assessing competencies demonstrated in the workplace.

To build a portfolio template for future CAA members, the CAA secured the services of Jan Johnson. Many CAA members will know Johnson from her time at the BC Ministry of Transportation, her work on the Avalanche Operations Level 2, Module 1, and her adult education work at UBC and more recently, University of the Fraser Valley.

Johnson defines a successful practical workplace portfolio to include:

- Tools for candidate to document achievement of CAA competencies
- Tools to allow the candidate member to demonstrate evidence related to performance
- Opportunities to demonstrate learning/achievement in various ways using different kinds of evidence
- Simple documentation procedures for the candidate to take responsibility for his/her portfolio
- Clear mechanisms to share the portfolio with those mentoring the candidates or assessing candidate's competencies

This summer the CAA will complete the draft P1 workplace portfolio to be reviewed by industry and test driven by prospective candidates and existing Active members. The CAA envisions the portfolio to be ready for in 2019 for use in tandem with the other elements required to assess prospective members in a revised application process based on the CAA's competency profiles.

Future updates in *The Avalanche Journal* will focus on work towards the revised Professional membership application as well as developments related to Continuing Professional Development and development of personal scope of practice.

Who is Qualified? A bit of history – but not too much

OVER TIME, the laws and regulations of British Columbia dominate the discussion of who is qualified to do avalanche risk assessment and mitigation work in Canada. Certainly, BC's laws and regulations only apply within its borders, where most of Canada's avalanche practitioners are active. However, other provinces with less pervasive avalanche hazard and more generalized laws and regulations are likely to borrow from BC's evolving framework. In short, satisfying BC's regulators will go a long way to addressing other jurisdictions in Canada.

Many CAA members will recall the long and painful journey towards the first iteration of *Guideline* 4.1.1 under BC's *Occupational Health and Safety Regulation*. This version of 4.1.1 was held in abeyance and was never enforced.

While the first version of 4.1.1 failed, its development provided several positive outcomes that have lasted. WorkSafeBC (WSBC) committed to defining clear requirements for avalanche risk assessment in the province which it did extensively in an updated version of guidelines 4.1.1 and 4.1.2 released in 2015[2]. The CAA developed the Industry Training Program's *Avalanche Operations Level 3: Applied Avalanche Risk Management* course initially in response to 4.1.1, but demand and need for the course has persisted long after the initial rationale faded.

The 4.1.1 journey also pushed the CAA to address who is qualified to provide avalanche safety services. WSBC defines a *qualified* person as someone who is *knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof.*[3] In many ways, this definition of qualified is closer to what many CAA members want because it recognizes training and experience. Competency-based membership in the CAA seeks to satisfy who is qualified or competent to perform avalanche work in BC and beyond.

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[2]*Occupational Health and Safety Regulation Guidelines - Part 04 - General Conditions Guideline 4.1.1* https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-guidelines/guidelines-part-04#SectionNumber:G4.1.1

[3]*Occupational Health Safety and Regulation Part 1 Definitions. 1.1* https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-01-definitions

New **Board of Directors**

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President's Message

I HOPE YOU ARE FINALLY in summer mode! It sure took a while, in fits and starts, to get going!!

For those of you that missed our spring AGM and conference, here is what I reported to the membership:

MOMENT OF REFLECTION

All of us in the avalanche community are exposed to the possibility of loss to some degree. Loss can range from being far away, to close to home, and from minor incidents to catastrophic disasters, including loss of life. Loss can be suffered by persons working in the avalanche sector themselves, by their coworkers, peers or clients, or by the public at large. The public does entrust its safety to many of our members, often without even knowing it.

Sad to say, but there has been loss again this year. Whether it was a relatively close call, or a more serious accident with injuries, or a catastrophic event, some form of loss this season has affected many of our members and the public, some of them very deeply. Let me propose a brief moment of reflection, for each of us to think back on what we may have lost, and for each of us to offer our thoughts with respect and support to those in our community and beyond who have suffered…thank you.

Now, loss also presents opportunity. We heal, we learn, we improve. That is in part why we gather here.

DILIGENCE

Joe and the board have been dealing with a sensitive and complex matter on behalf of our association for some time. We would like to brief you on it today.

In October of 2012, Patrick Desmarais, a surveyor working for a mining contractor in the Stewart area, died in an avalanche. A report on his death was completed by the Chief Inspector of Mines. Note that mine safety is not overseen by WorkSafe BC. The report found conditions leading up to the death "were unforeseeable and unknown".

Several of our members took issue with those findings. This led the CAA to file a brief with the coroner, the Ministry of Mines and the Engineers and Geoscientists BC, stating that the report had significant flaws. At present, our understanding is that the lead coroner has filed his report with the chief coroner for review. We will keep you informed of developments. This is just one example of many, serving to demonstrate professional diligence by the CAA and its members.

The CAA is well underway on its path to professionalism. It is spelled out in our strategic plan as goal #1. We are working hard to earn recognition as a self-regulating society which advances avalanche safety across Canada. The CAA advocates for best avalanche practices. A component of this is accuracy in reporting all avalanche fatalities. This is just one reason why we were concerned with report on the death of Mr. Desmarais.

As part of our mission, we define professional diligence through our scope of practice, code of ethics and documents like Observation Guidelines & Recording Standards for Weather, Snowpack and Avalanches and Technical Aspects of Snow Avalanche Risk Management (TASARM). This afternoon's reports will touch on these areas.

STANDARD AND DUTY OF CARE

In 2016 we released TASARM as a framework for best practices. It is in effect a standard. It compiles what the best in our business have agreed upon, and what they define, as the required steps for planning and executing avalanche risk management.

Since the release, we probably could have done more to promote and support adoption of this standard. In all likelihood, for those of you working in organizations with a comprehensive avalanche safety plan, your plans and actions already align with, or perhaps even surpass, the elements contained in TASARM.

But are you sure? Because if it is commonly accepted that this is our standard, then it is also our duty to conform to that standard. Anyone that may be called upon to scrutinize us from outside our organization will be looking at everyone and everything under a microscope. Furthermore, they may well sit in judgement of us while having little understanding of the subtleties of our craft.

So, please be sure. Review your own procedures and ensure that they conform. If you identify errors or omissions, please bring them forward. As our best practices evolve, TASARM will come up for periodic revision.

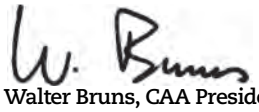
INVESTING IN CAA PROFESSIONALISM

Another component of professional diligence is ensuring that entrance to CAA membership is competency-based. We'll hear about progress towards that goal as well.

By now, you may be asking "What will all this cost?" In discussions with staff, we anticipate investing $35k annually over the next three years to support competency-based assessment for entrance to Active and Professional development.

Strong fiscal management allows us to make this kind of investment. Mark Bender and Kristin Anthony-Malone will provide more details on our financial situation.

Best wishes for the summer!



Walter Bruns, CAA President

Joe Obad
CAA Executive Director

Executive Director's Report

WHEN THE SNOW MELTS, everyone in our industry, CAA board and staff included, hopes for sunny days to replace the long winter. Come early May however, when members have to choose between attending the CAA Annual General Meeting or climbing and biking in Penticton's arid splendor, we hope for a few clouds and precip to give the AGM a fighting chance. Having said that, once again members proved our anxiety to be unfounded; this year 129 members committed to attending.

Getting to the spring conference remains a challenge for many based on cost, geography, timing of summer work and so on. Nevertheless, spring conference news and AGM decisions affect all CAA members. With that in mind, I have rounded up a couple items here for those who did not get to Penticton.

PENTICTON TO THE PEOPLE

In his article, President Walter Bruns remarked on the 2012 death of Paddy (Pat) Desmarais. Since the AGM, the BC Coroners Service has completed its report. In our submission to the coroner, we noted the absence of an investigation regarding proper steps being taken to ensure that avalanche hazard was addressed prior to the work that ended Mr. Desmarais's life. We argued the Senior Mine Inspector's report did not examine whether the employer adhered to Part 9.7.1(1) of the Mining Code, which requires that *Exploration activities shall be designed and implemented by a qualified person to minimize the risk of those activities causing any of the following events…[including] e) snow avalanche.*

The coroner's report echoed the CAA's submission on this and several fronts, all but saying the original report by the Senior Mines inspector was deficient. The coroner concluded with his recommendation that in Mr. Desmarais's name, the Ministry of Mines, Energy and Petroleum Resources, WorkSafeBC, Engineers and Geoscientists British Columbia and the CAA convene to study the gaps between WorkSafeBC standards for avalanche safety and those in mining which may require additional "avalanche safety standards, requirements and guidelines with a view to improving mine worker safety."

It remains to be seen where this recommendation will lead. Finally, nearly 6 years after his death, Pat Desmarais's death and the surrounding work circumstances have been more accurately described. We look forward to working with the other agencies to increase mine worker safety. I would be remiss if I did not mention the tireless efforts of Professional member Christoph Dietzfelbinger, whose tireless persistence with the BC Coroner Service, Ministry of Mines, the CAA and other agencies ensured a stronger review of Mr. Desmarais's death. Thank-you Christoph.

Another key update from Penticton was the vote to increase member dues. Dues have not been adjusted since 2012. Since then the Bank of Canada national inflation rate has increased by 9%. Staff have worked aggressively to bring new sources of revenue online and to offset expenses wherever possible to reduce the need for any increase. Ultimately, we brought a recommendation of 4% increase to the Board, which Treasurer Mark Bender presented to the membership. After a spirited discussion the increase was passed unanimously. Some members rightly noted staff and board should have communicated more about the vote in advance. At a recent meeting of the board and staff we discussed treating dues increases similar to bylaw changes - giving 21 days' notice to members in advance of any vote on increases.

The spring conference is of course much more than the AGM. The CPD sessions, technical presentations and case studies form the heart of the week with the richest exchange of ideas and experience amongst members. Many members told us this was the best spring conference ever – surely for those who did not attend it is worth a few clicks and some time to check out what happened?

Yes – just a few clicks. Again in 2018, we recorded many of the spring conference sessions to bring Penticton to your laptop. These sessions can be found in the *Members Only* section of the CAA site under *CPD Videos*. This year we worked with Professional member Doug Latimer's Shadow Light Productions to dramatically ramp up production quality. Whether you need more CPD points, want to know about an incident, or are looking for new perspectives to refine your operations, these videos are another resource in your toolbox to ready yourself for next season.

Until that season arrives, on behalf of all the CAA staff, I wish you all a warm and happy summer.

Joe Obad, CAA Executive Director

Contributors

LILLA MOLNAR AND MARC PICHÉ
Lilla and Marc live in Canmore, Alberta with their daughter Ella. They are both mountain guides and Marc is the Technical Director of the ACMG. They guide private ski touring trips in Canada and internationally. This was their second trip to Hakuba, Japan.
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ANDREW JONES
Andrew studied biology and environmental science at the University of Guelph and Royal Roads. Andrew has been avalanche technician with the Glacier National Park Avalanche Control Section since 2011. He lives and plays in Golden with his wife Linley and their two little girls.
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MATT MACDONALD
A meteorologist with Environment Canada since 2003, Matt is from Montreal. He has spent the last 10 years trying to understand the weather in the mountains of western Canada and believes he might just be starting to figure it out. When not staring at computer screens, he squeezes in the odd splitboard tour. Matt is an Active member of the CAA and a new addition to the CAA Board of Directors.
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LISA DREIER
Lisa has an engineering degree in information technology and a masters in geography. She worked at the Swiss Institute for Snow and Avalanche Research and is now employed as project manager for Wyssen Avalanche Control in Revelstoke, BC.
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Professional member **LEE GREEN** has been in the ski industry for 11 years. Starting out at Sunshine Village as a ski patroller and member of the snow safety team, he then moved to White Wilderness Heli Skiing for its first two years of operation. Currently, Lee is part of the mountain safety department at Brucejack mine.
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Spring Conference and AGM 2018

Full Situational **Awareness**

Jill Macdonald
Managing Editor

The first time I encountered this term was during a marketing brief-in on new tactical product. The source in question was ex-special forces, used to doing security duty for prime ministers and overseas missions that we will not discuss. He handed me a lexicon, so I could follow the presentation and its tangle of acronyms. For me, the meeting was so I could write about the products with an informed voice. My learning curve was steep and shocking. I loved it.

Tactical missions rely on training. Outcomes and methods are defined at the outset; what happens in between is the stuff of life and story. I was naïve, fascinated and went in with opinions based on what I thought to be truth, but they weren't based on facts per se, much less experiential insight. We spent several hours in a room discussing the merits of flame retardant fabrics and the importance of carrying a concealed weapon in what appears to be a civilian bag. Having a dry pack that can survive being tossed out of an aircraft, towed in water and carried overland, without compromise or failure. Everything in its place, exactly where it is expected to be, regardless of weather, darkness, or conditions. All this with the understanding that although you are in charge on this mission, you may also be a target the entire time. A familiar metaphorical scenario for avalanche industry professionals.

Full situational awareness means being both humble and confident, apprentice and observer. The best mentors stretch their emotional latitude and put themselves back into the shoes of beginners. Those at the peak of their careers recognize the tipping point of knowing too much and are afraid in ways they did not previously understand were possible. We have to embrace new and absorb old and diligently monitor nuances of each day and sometimes each hour, to pledge to be fully and deeply present in the now.

"We're not having fun here." Possibly my favourite line from that tactical marketing meeting, which started at 09:00 IPhone time, in case anyone dared to be late. It was all business and the business at hand was saving lives. Politics are not part of that game. Good and bad have no roles either. It is survival and believing in what we do to the fullest of our knowledge.

For a short while I held onto full situational awareness, and then like everything, it proved impermanent. That beautiful, succinct feeling gave way to the watery wash of imperfect recall, my illegible notes and a persistent shadow of something almost grasped.

But in knowing that I had been given the information, and they trusted me to write as if I knew, when my words made their way to paper, they were convincing. I did know. How to write from my experience as a person, through the vehicle of my craft. Study, listen, empathize and remain awake. With these tools, we can all continue learning and not miss any part of this intense, bumpy and rewarding ride.

It's hard work. On down days, I allow myself to feel frustrated and blind, groping for some ray of insight. Other days I feel accomplished. Being aware of where I am on that curve is part of an ever-evolving scale of perception.

Jill Macdonald

Letters to the Editor - **Correction**

Acknowledgement goes to Kelly Elder for her work on submitting an article about the 2018 ISSW, co-authored with Susan Hairsine. Apologies Kelly for the inadvertent omission.

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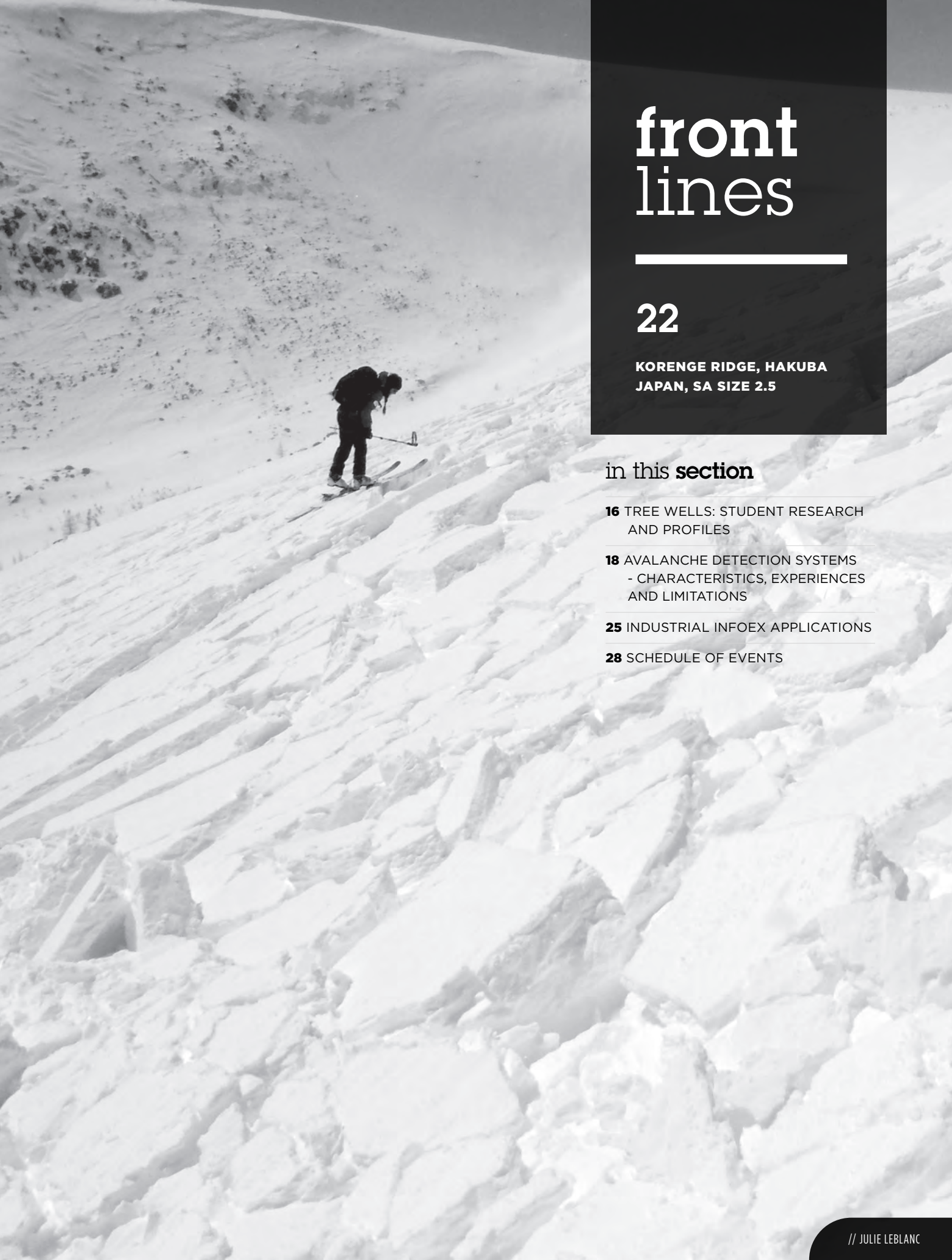

front lines

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KORENGE RIDGE, HAKUBA JAPAN, SA SIZE 2.5

in this **section**

// JULIE LEBLANC

Tree Wells: Student Research & Profiles

Brian Bell

IN WESTERN CANADIAN AND US ski areas, up to 20% of fatalities are related to tree well phenomena; in 2018, five fatal incidents were reported. Last winter, students of the Mountain Adventure Skills Training program at College of the Rockies: Fernie campus, collaborated with CMH Nakusp to conduct research on best practices.

Over 50 tree wells were investigated and 22 mock rescues performed. Using two dummies:, 'Woody,' weighing 220lbs including ski boots and Colani' weighing approx. 70 lbs, various scenarios allowed the students to investigate the efficacy of techniques, shovels and the structure of the tree wells.

METHODOLOGY

The research team was dropped off on top of a run called Fractured Fairy Tales – elevation 1800m. Over two days, the two dummies were transported slowly downhill utilizing a rescue toboggan. The main objective of the research was testing digging and rescue techniques, rather than searching, therefore the teams arrived in downhill ski mode, with avalanche gear, adjacent to the victim.

The students dug one full profile across the fall line and one with the fall line of tree wells to fully explore the snowpack and look at snow densities. Aside from the rescue digging research, 28 separate tree wells were surveyed to determine well depth, shape, and orientation around the tree trunk.

It was found that there were three overall shapes of tree wells:

1. Vertical tube: Smaller tree wells generally presented a vertical tube shaped well, which presented the greatest possibility of a full vertical pin and the most hazardous potential for a victim. As most vertical tubes were associated with smaller trees, the victim was easier to spot.
2. Funnels: Easier to execute a rescue than vertical tubes as the hauling angles are less acute and allow for faster initial pulling.
3. Clumps: Multiple'clumps' of tree wells can be hazardous to rescuers and slow the rescue drastically.

FINDINGS

Through a methodical survey of tree wells within the study site it was found that due to snow creep the tree wells were small to non-existent on the uphill side of the tree trunk. The shape of the canopy of branches does effect the width of the tree well but not necessarily the depth. In fact it was found that many seemingly small trees (minimal overall diameter including branches) had very deep tree wells that can be as dangerous or more dangerous because of the tight space and therefore little room for victim to wriggle around into a better self-rescue position.

DIGGING

The average tree well depth was 2.3 meters and height of snow ranged from 210 to 250 cm.

- Fastest rescue time: 1.47
- Slowest rescue time: 17.45
- Average rescue time: 5.19

The students discovered that using a well organized V conveyor digging system on the downhill side of the victim proved to be the fastest overall way to excavate snow to reach the victims waist. As many of the tree wells were quite vertical, with acute angles and firm snow around the lip of the tree well, it was impossible to pull the victim straight up and out.

Shovels with deeper sides and a hoe mode offered improved ergonomics and moved more snow, similar to Schindelwig et al found in their 2017 study, *"Does Avalanche Shovel Shape Affect Excavation Time: A Pilot Study."*

Unless the victim is clearly being held up by the skis or snowboard, the equipment should be removed and set aside as quickly as possible so as not to impede the shoveling process.

In post-storm conditions the snow would likely be less dense and angles of the tree well lip less acute. Therefore, it may be possible to pull victims out on the downhill side with minimal digging. More research in variable conditions is needed in this regard.

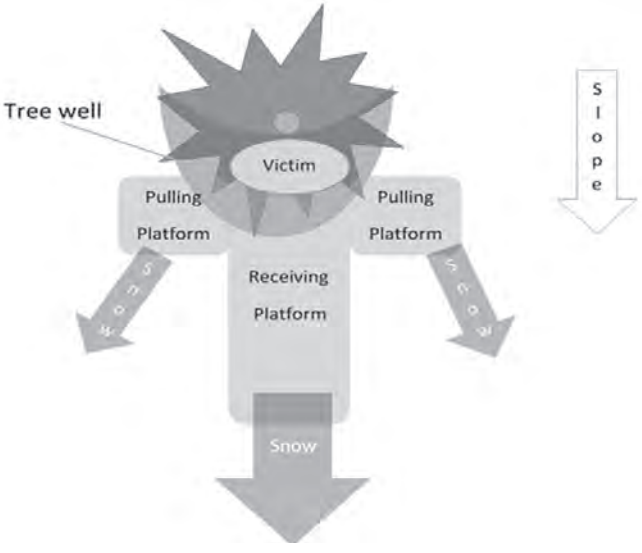
LEARNING

Through the 22 mock rescues the students gradually developed systems that allowed for more efficiency. With the direction of CMH guide Rob Whelan, a "T Rescue" system evolved and proved that the most effective rescue actions tested were a combination of:

1. Digging
2. Platform preparation
3. Pulling

T RESCUE

- Start 1-2 meters downhill of victim, similar to V conveyor
- Minimum of 3 rescuers works best
- 2 rescuers focus on digging "pulling platforms" (1 m square platforms at the lip of the tree well on each side of victim)
- 3rd rescuer digs "receiving platform"
- Additional rescuers can be added to the back of the receiving platform ramp
- Platform diggers can carefully remove skis as soon as possible. Victims did not sink deeper without skis
- Dig until receiving platform is level, wide enough and reaches just below victim's waist
- Leave shovels in position when rotating people
- Pull victim out onto receiving platform and assess airway.



RECEIVING PLATFORM

- Should be large enough for rescuers to perform CPR once victim is out
- As level as possible ie: not sloping down to victim = too hard to pull up hill
- Do not initiate pulling until platforms have reached the victim's waist
- The use of a sling seems intuitive but we found that it was not as effective as the hem of the coat. Also with the sling, the temptation to begin pulling too soon was increased

GUIDELINES FOR SUCCESSFUL RESCUE

Initial speedy assessment of airway and responsiveness through verbal contact is key. Let the victim know they are being rescued and prompt them to stay calm.

Try to communicate without getting too close to tree well, being careful not to knock further snow down on top of victim.

If verbal communication is possible, it may be established that using an 8 m webbing to stabilize the victim is a good idea. Or, if it is possible to get the webbing girth hitched around the waist, it may be possible to extricate (pull) the victim out with minimal digging.

If the victim is unconscious, it is likely that digging at least to the victim's waist is necessary before any pulling should take place. Going straight for the airway, before proper digging is done, is tempting but usually ineffective unless the victim is not buried deeply or is in a funnel shaped well with more room to move around.

The bottom hem of the jacket proved to be the ideal grasping point for the following reasons:

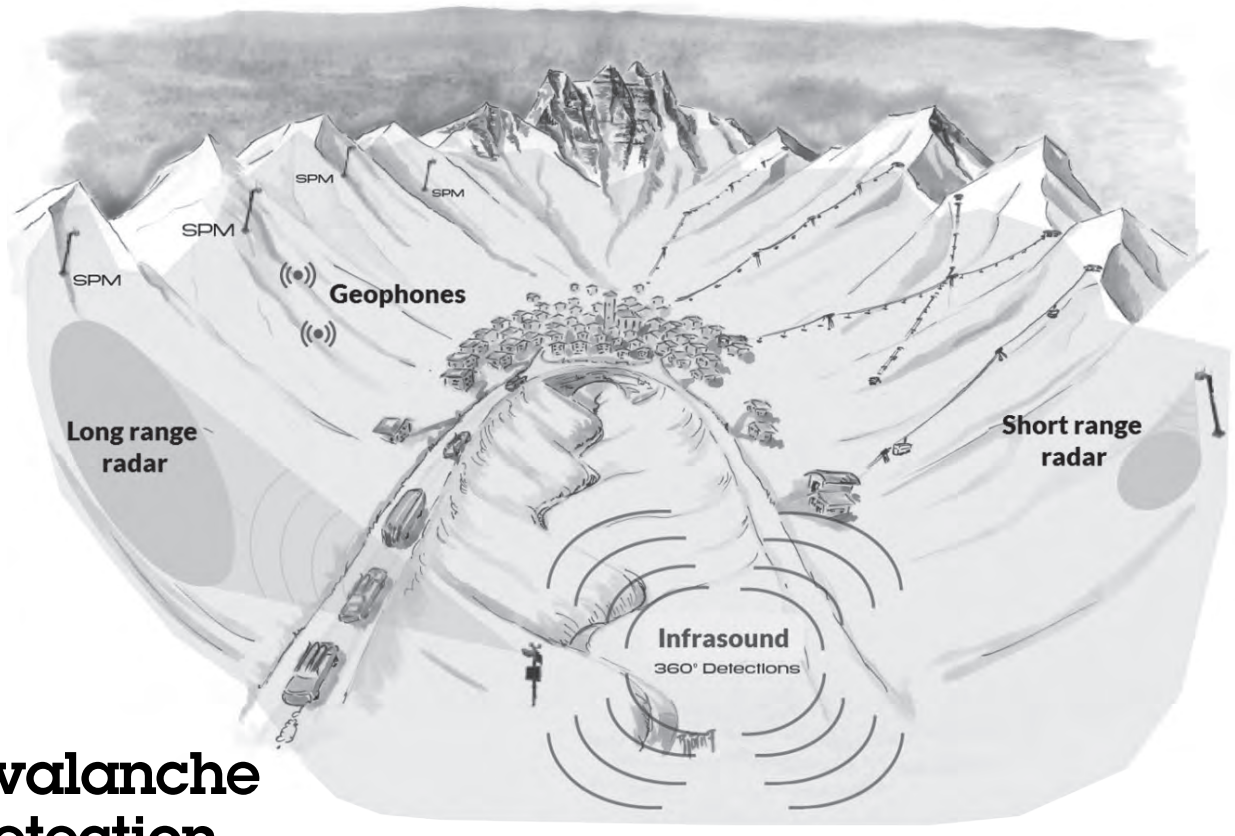
1. Easily reached by both rescuers
2. Usually strong enough to take the forces involved
3. Pulls on the victim's torso instead of stretching the ski pants

CONCLUSIONS

Although there were few controls and a true 'scientific approach' to this project was difficult, the main findings are clear. Tree wells are extremely dangerous. With 5 fatalities this year it is evident that self extrication cannot be counted on. Therefore any true successful rescue needs to be extremely rapid. This can only occur if a ski partner is close by and can initiate the rescue.

Our research was about figuring out the safest fastest way to pull someone out once they are found. But it seems the true success in surviving a headfirst fall into a deep tree well lies in the search phase of the rescue and more education and research should be focused on this element.

Rob Whelan will utilize these findings to further develop safety instruction protocols for CMH staff and guests.



Avalanche Detection Systems - Characteristics, Experiences and Limitations

Lisa Dreier

EDITOR'S NOTE: In keeping with the topic of this issue, the intent of this article is to provide insight into technologies less commonly used in North America. In no way does the CAA endorse any particular technology or application mentioned.

Lisa Dreier is a representative of Wyssen, which has commercial interest in some of the technologies discussed. See Lisa's full bio on page 4.

SNOW AVALANCHES pose a hazard for people and infrastructure during the winter season. Permanent measures (tunnels, steel structures, etc.) and/or active and passive temporary measures (e.g. road closures, evacuations, preventive avalanche release, avalanche forecasting, etc.) are used to mitigate this hazard. The preventive release of snow avalanches along traffic routes is often used where permanent measures are too expensive or not feasible to construct. Reliable feedback on the success of triggers makes preventive avalanche release more effective as knowledge of occurrence, frequency and size of avalanche events assists personnel responsible for avalanche control and forecasting.

A variety of detection systems are available and have been tested in operational use. Depending on the aim of the operation, the most suitable system should be selected (Table 1).

RADAR SYSTEMS

Radars have been applied for the detection of avalanches for many years. In most cases Doppler radars are used, emitting electromagnetic waves at a certain frequency, which are then reflected and travel back to the radar (Gauer et al., 2007). Thus the radar requires line-of-sight of the avalanche paths in question. The radar can discriminate between moving and static targets and therefore measures the velocity of the avalanche front.

Experience with Radar

A long-range avalanche radar was installed in Ischgl, Austria in 2011, with the purpose of i) verifying the controlled release of avalanches and ii) gathering information about spontaneous avalanche activity. The radar is a standard operational tool of the safety staff (Steinkogler et al., 2018). The big advantage of the radar is the accurate detection of even small avalanche events. The shorter the distance to the radar antenna and the better the weather conditions (i.e. no rain, no snowfall), the smaller the detectable avalanches are (events of a few 100 m^3 in a distance of 1.5 km were detected).

Since radar systems provide data in real-time, alarm thresholds can be

TABLE 1: AVALANCHE DETECTION SYSTEMS AND THEIR SUITABILITY FOR DIFFERENT OPERATIONS.

	PREVENTIVE AVALANCHE RELEASE	ALARM SYSTEMS	AVALANCHE WARNING
	VERIFICATION OF BLASTING RESULT	AUTOMATIC CLOSING OF TRAFFIC ROUTES	VERIFICATION OF AVALANCHE ACTIVITY
INFRASOUND	✓	X	✓✓
LONG-RANGE AVALANCHE RADARS	✓	✓✓	✓
SHORT-RANGE AVALANCHE RADARS	✓✓	X	-
SEISMIC SYSTEMS: SEISMOMETER, GEOPHONE	✓	✓	-

defined which allow using the system for the automatic closure of traffic lines. Power can be provided by fuel cells or by permanent power supply if available.

Based on the success of the avalanche radar, the short distance avalanche radar with a 500 m range and less energy consumption was developed (Table 2). They are mounted directly on remote avalanche control systems (RACS) to get immediate information about the success of the avalanche release. This is a much-needed feature for verification of preventively released avalanches. Last winter a short-range radar was installed in Glacier National Park, Canada. The system detected 10 avalanche events triggered by the avalanche tower it was installed on, as well as by the adjacent tower. Other uses of this radar type, such as the detection of persons moving in the area endangered by avalanches, were also successfully tested (Video: http://gpr.vn/PETRA).

INFRASOUND

Infrasound waves are low frequency (<20 Hz) sound waves that are not perceived by the human ear. The infrasound technology is widely used for the detection of different natural (e.g. volcanic eruptions) and artificial phenomena (e.g. nuclear explosion). For avalanche monitoring, infrasound technology has significantly improved in recent years in terms of sensor design, noise reduction and processing algorithms (Ulivieri et al., 2011).

Typically, an infrasound detection system consists of a 4 to 5-element infrasound array, with a triangular geometry and an aperture (maximum distance between two elements) of approximately 150 m (Marchetti et al., 2015). During the winter season, the sensors are covered with snow, which helps to dampen ambient noise. This setup allows monitoring of the avalanche activity from all directions within a radius of 3 - 5 km (Table 2).

Experience with Infrasound

To gather information on avalanche activity of a larger area and to assist

TABLE 2: SUMMARY AND TECHNICAL CHARACTERISTICS OF RADAR, INFRASOUND AND SEISMIC SYSTEMS.

	LONG-RANGE RADAR SYSTEMS	SHORT-RANGE RADAR SYSTEMS	INFRASOUND SYSTEM	GEOPHONE SYSTEMS
MEASUREMENT PRINCIPLE	DIRECT DETECTION OF MOTION WITHIN ANTENNA COVERAGE		INDIRECT DETECTION OF INFRASOUND CREATED BY AVALANCHE	DIRECT DETECTION OF GROUND VIBRATIONS INDUCED BY AVALANCHE MOTION
OPERATIONAL RANGE	UP TO 5 KM	APPROX. 500 M	3 – 5 KM	APPROX. 50 M
MEASUREMENT ANGLES	UP TO 90° HORIZONTAL AND 15° VERTICAL	UP TO 90° HORIZONTAL AND 20° VERTICAL	360°	360°
MAX. DETECTION RANGE[1]	5 KM	-	14 KM	APPROX. 100 M
SMALLEST AVALANCHE SIZE DETECTABLE IN OPERATIONAL RANGE	SMALL AVALANCHES (~100M^3)			-
DETECTION OF WET AVALANCHES	YES			

[1]OF A LARGE AVALANCHE

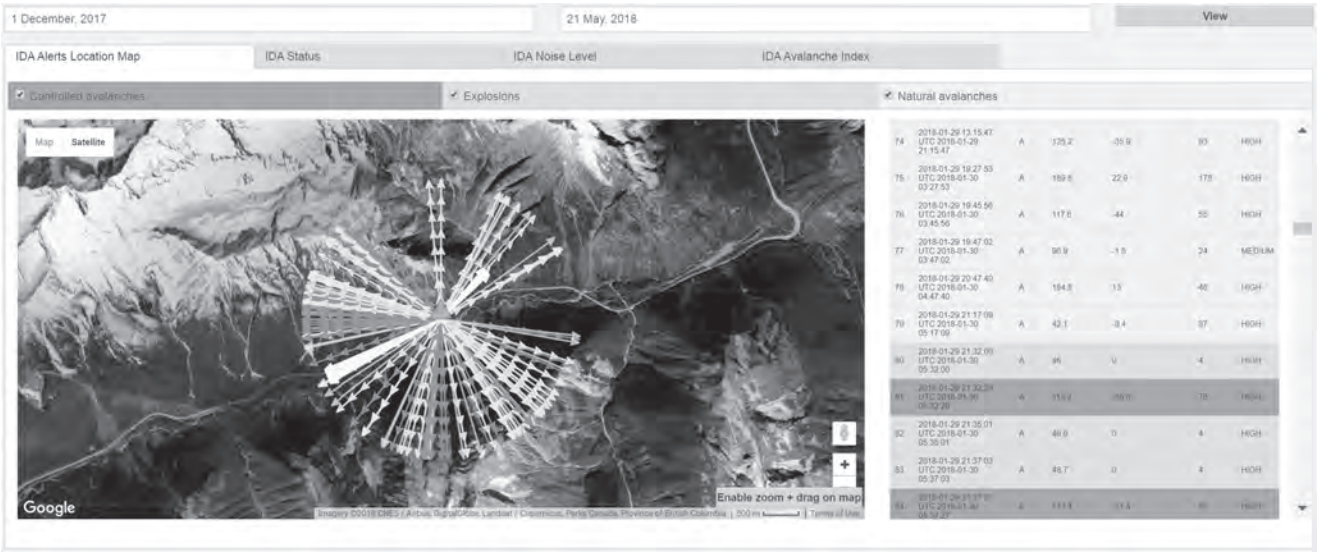


FIG. 2: EXAMPLE OF INFRASOUND DETECTIONS IN GLACIER NATIONAL PARK, CANADA. THE SYSTEM DETECTS NATURAL AVALANCHES (LIGHT GREY), CONTROLLED AVALANCHES (DARK GREY) AND DETONATIONS OF REMOTE AVALANCHE CONTROL SYSTEMS (RACS) OR ARTILLERY (MEDIUM GREY).

the local avalanche control team, an infrasound was first installed in 2012 in Ischgl, Austria. The goal was to gather information about avalanche activity from all avalanche paths in the area. Currently, nine systems are used operationally in Switzerland, Norway, Canada and USA (Figure 2). In Canada, an infrasound avalanche detection system has been operated in Glacier National Park for two winter seasons. Last winter the system detected 136 natural avalanches, 137 artillery explosions and 59 controlled avalanches. The detection system notified the forecasters of the onset of natural avalanche cycles and whether artificial avalanche control was successful. This information allowed the forecasters to plan and execute control sessions even more efficiently and thereby reduce closure times of the Trans-Canada Highway.

In Switzerland, Canada and Norway extensive verification campaigns have been conducted over the last years (Steinkogler et al., 2016). The infrasound system was used to monitor certain avalanche paths which endanger local roads and to define the smallest avalanche size which can be detected. Although the system detected many of the smaller slides (size 1-2), they were not automatically visualized and identified as avalanches as they were below the defined thresholds. Mid-sized and large dry slab avalanches were correctly detected. Additionally, large dry avalanches could be detected up to 14 km away from the system.

Infrasound systems have been deployed in a variety of climatic conditions, ranging from a maritime climate in Norway, to lower elevations and high inner-alpine regions in Switzerland and Canada. At one of the locations, more than two metres of dense (250-300 kg/m3) snow with several ice layers covered the sensors which influenced the quality of the signals. Yet, a generally thick snow cover without ice layers has shown to filter out unwanted frequencies (e.g. traffic noise) and enhance the reliability of the system. Strong ambient noise, such as wind, has shown to complicate the identification of the avalanche signal.

The infrasound system proved to be a very valuable tool for gathering information about avalanche activity of multiple avalanche paths in a larger area. Since it is continuously monitoring it also provides data on spontaneous avalanche activity, which can be very useful information for the local avalanche control team (Figure 2, green arrows).

GEOPHONES

Geophones detect the ground vibrations induced by an avalanche in rather close distance to the sensor. So far, the installation of geophones was mainly done very close to the flowing path of the avalanche and the release areas. Avalanches can be reliably detected with approximately 50 m distance to the sensor (Table 2).

Experience with Geophones

Seismic sensors have been applied for operational and research purposes for many years (Perez-Guillen et al., 2016). Figure 3 shows an example where three geophones are deployed in the release area of a high alpine bowl. RACS allow for avalanche control to be performed during day or night and the geophones detect if an avalanche was released.

CONCLUSIONS

From an operational point of view, all systems have reached a technological level at which they work reliably both in terms of system stability and avalanche detection performance (Table 2). All

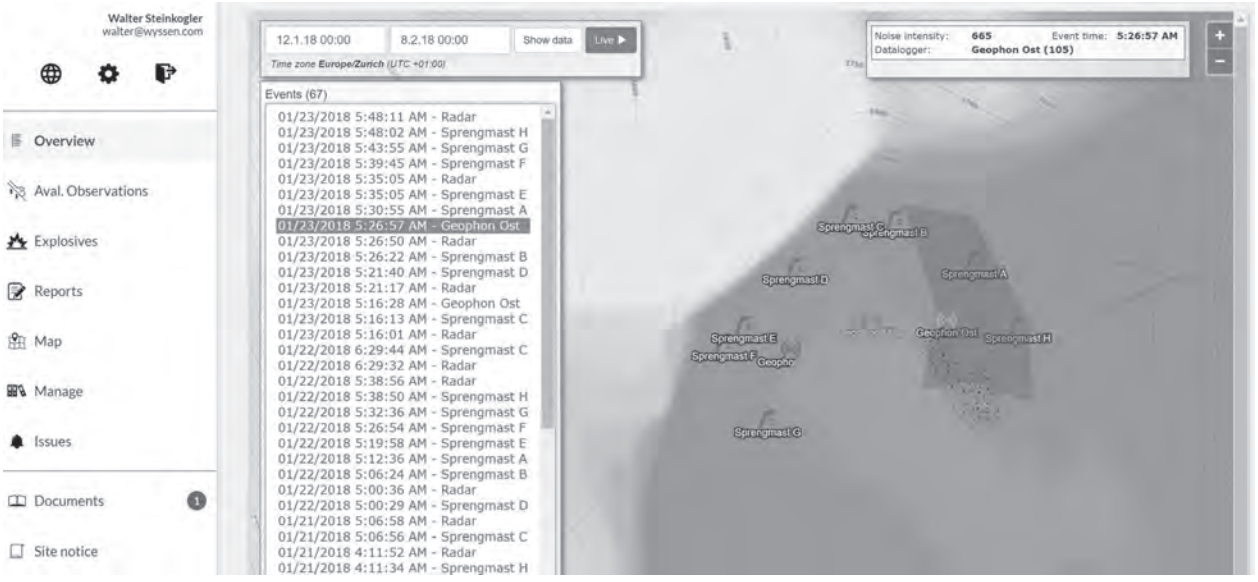


FIG. 3: INTEGRATION OF REMOTE AVALANCHE CONTROL SYSTEMS (HERE "SPRENGMAST") AND GEOPHONE AND RADAR DETECTION SYSTEMS IN ONE USER FRIENDLY WEB-PLATFORM.

three systems need a calibration period (a few avalanches of typical size for the avalanche path) to optimize the parameters and to be fine-tuned to the local conditions, minimizing false alarms. Generally, an intensive and well-prepared planning phase is essential to achieve the desired functionality and accuracy of the systems.

For authorities operating several avalanche release and detection systems, simplicity is one of the key demands. The integration of all relevant information from RACS and detection systems in one practitioner-friendly and easy to operate platform is crucial. A visualization of the results in a clear, simple way provides a good overview using a mobile phone or laptop (Figure 3).

Experiences with the short-range radar system and infrasound system installed in Glacier National Park, Canada, were recently presented at the CAA spring conference in Penticton by Jim Phillips (Parks Canada) and the author of this article. The presentation can shortly be viewed in the member section of the CAA website.

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Korenge Ridge, Hakuba Japan
Sa Size 2.5

Marc Piché & Lilla Molnar

// JORDY HNEDRIKX

THIS PAST JANUARY, Lilla and I guided three separate ski touring groups in Hakuba, Japan. While with our second group, on the last day of their trip, we witnessed an avalanche involving one snowboarder. Our group was first to respond. This report details how the event unfolded and the lessons we took away from this tragic event.

We were a group of 11 skinning up the Korenge Ridge (blue line on attached photo) and were approximately at the blue 'O' when we witnessed an avalanche running down the face to our left. We looked up and saw two people standing directly above on the ridge. Initially we assumed they had cut a cornice to test the slope. The avalanche was very fast moving and the debris flow was not particularly thick. We had not noticed anyone in the avalanche, but after a few moments we realized that there was a track leading into the fracture line, but no exit track was evident.

We watched the two snowboarders (from here on I will refer to them as the friends), ride down beside the debris and stop approximately 200m from the terminus. They stood there for a few minutes before it became clear that they were starting a search. I immediately skied over and began searching above them, while Lilla gave instructions to our group to initiate our rescue plan and to stay on the ridge until we gave them further instructions. Lilla then followed me over to the debris and started searching as well.

TRANSCEIVER SEARCH

Upon starting our transceiver search both Lilla and I had numerous erratic signals. We had digital signals ranging from 55m to 13m without moving; as soon as we moved the signals became more erratic or disappeared altogether. We both turned off our phones, but the ghost signals persisted. I checked the friends' transceivers to make sure that they were in search mode, which they were at the time. I also asked them to turn off their phones, but they did not understand, despite several attempts to make ourselves clear.

Ghost signals aside, from the outset of our search we had not heard any analogue signals. I worked my way to the top of the debris grid searching in analogue mode and spot probing any deep sections in the track while Lilla grid-searched the toe. We determined there was no signal and decided we would need to start probing.

PROBE SEARCH

At this point we realized more manpower was required to initiate an effective probe search. One at a time, our group traversed over to the toe. Lilla organized them into a coarse probe search as each person joined, while I spot probed the deeper piles. Meanwhile, despite trying to engage them in our efforts, the friends kept searching with their transceivers higher up on the debris.

We were looking for a needle in a haystack. Given that and the odd ghost signals we had observed earlier, we decided that Lilla would take a group and search the entire debris with transceivers once more. The friends had been pleading with us to do so, despite not understanding that there was no signal. Lilla positioned her group 10m apart, while the rest of us continued with the probe search. By this time, other skiers in the area were aware of the accident and joined us as well.

Lilla's croup completed their transceiver search and confirmed that there was no signal, nor were there any ghost signals. By now there were almost 30 people on the scene, including a Swiss mountain guide and his group, another Canadian group from Whistler and many others. We organized a fine probe line search, starting at the toe of the debris. After approximately 20 minutes, we had a probe strike. The person who got the strike saw an object through an old footprint in the debris prior to confirming with a probe strike. The object turned out to be the victim's helmet.

ENSURING THE SAFETY OF THE GROUP

The avalanche problem encountered by the snowboarder was isolated to the immediate lee or very steep convex features above treeline. Our uptrack followed a ridge feature away from the bowl that avalanched. We felt that is was safe to access the debris of the avalanche from this ridge. Since we knew our group well and they were experienced backcountry skiers, they knew to follow our tracks down to the debris when we called them over. We were initially concerned about other skiers and boarders coming to help, entering the bowl from the ridge as the snowboarders had done, and we did appoint one of our guests to be the "guard". Once we had determined that the victim's transceiver was non- functioning, we had everyone switch their transceivers back to send mode.

RECOVERY

It took only a couple of minutes of digging to expose the victim's face. He was facing downhill in a seated position with his chest tightly pressed against his legs. His snowboard was detached and beside him. His airbag had deployed, but the bag was deflated. It took several more minutes to dig him out enough to lay him down.

FIRST AID

There was no ice lens or obvious air pocket in front of his mouth, nor was there any snow or ice inside his mouth. He was unresponsive, pulseless and non-breathing. Thankfully we had several physicians in our group. The victim was given two rescue breaths before CPR chest compressions were started. CPR was performed by several alternating rescuers until the police helicopter arrived and we were told by police to vacate the area around the victim, so they could assess the rescue and access the site. CPR was done for approximately 60 minutes.

OUTSIDE RESCUE

Police were notified through our communications with Morino lodge and eventually by the friends. Timelines are fuzzy, but we believe it took about two hours for the helicopter to arrive after the initial call. It was windy and the visibility was marginal. After a few fly-bys, they decided not to lower rescuers to us and abandoned the rescue until conditions were better.

By this time, it was getting late and the weather was deteriorating so we needed to focus on getting people back to the Tsugaike ski resort. The friends initially wanted to stay with the victim overnight. With the help of some translators over the phone, we were able to convince them that this would be too dangerous and that they should follow us down. We marked the location with a probe, GPS waypoints and left the victim's transceiver turned on. The police recovered the victim by ground the following morning.

OUR RESCUE PLAN

Our rescue plan was detailed in a folder that we shared with each member of our group carrying android/SmartPhone devices. We explained the details of our rescue plan prior to the first day of skiing, as part of our avalanche rescue training. We emphasized the potential unreliability of outside rescue resources compared to Canada.

For reference, our first point of contact in an emergency situation was Craig Oldring, owner of Morino Lodge in Hakuba, where we were based. Craig was reachable 24/7 on his mobile device and speaks both fluent English and Japanese.

VICTIM'S TRANSCEIVER

While we were starting CPR, the friends removed the victim's transceiver, presumably to understand why it was not working. We met with them the day after the avalanche and they confirmed that the victim's beacon was indeed turned off when the avalanche occurred. They had not done a beacon check prior starting their trip.

THE AVALANCHE

We were never near the crown and have no snowpack info. Dimensions are estimated.
SA Size 2
Aspect - SE
Elevation - ~2550m
Width - ~30m
Depth - ~20-70cm
Length - ~800m (vertical drop of ~250m)
Angle - ~35+ degrees (possibly up to 40 degrees in start zone)

There were M-S NW winds cross-loading the slightly concave feature. There was evidence of the slope being skied in previous days but there were no other tracks on the new slab. Extensive wind effect was present, with all high points in the terrain being scoured or sastrugi and all low points being loaded, often with a hard slab.

THE AVALANCHE

THE AVALANCHE

SIZE: 2.5

TRIGGER: Skier Accidental

ASPECT: South East

ELEVATION: ~2550m

WIDTH: ~30m

DEPTH: ~20-70m

LENGTH: ~800m (vertical drop of ~250m)

SLOPE ANGLE: ~35 degrees (possibly up to 40 degrees in start zone)

TIMELINES (APPROXIMATE)

AVALANCHE OCCURED: 12:30

RESCUE CALLED: 12:40

FINE PROBE SEARCH STARTED: 13:30

VICTIM RECOVERED: 13:50

CPR STARTED: 13:50

CPR FINISHED: 14:45

HELICOPTER ARRIVED: 14:45

HELICOPTER RESCUE CALLED OFF: 15:00

LAST PERSON TO LEAVE SCENE: 15:30

TIMELINES

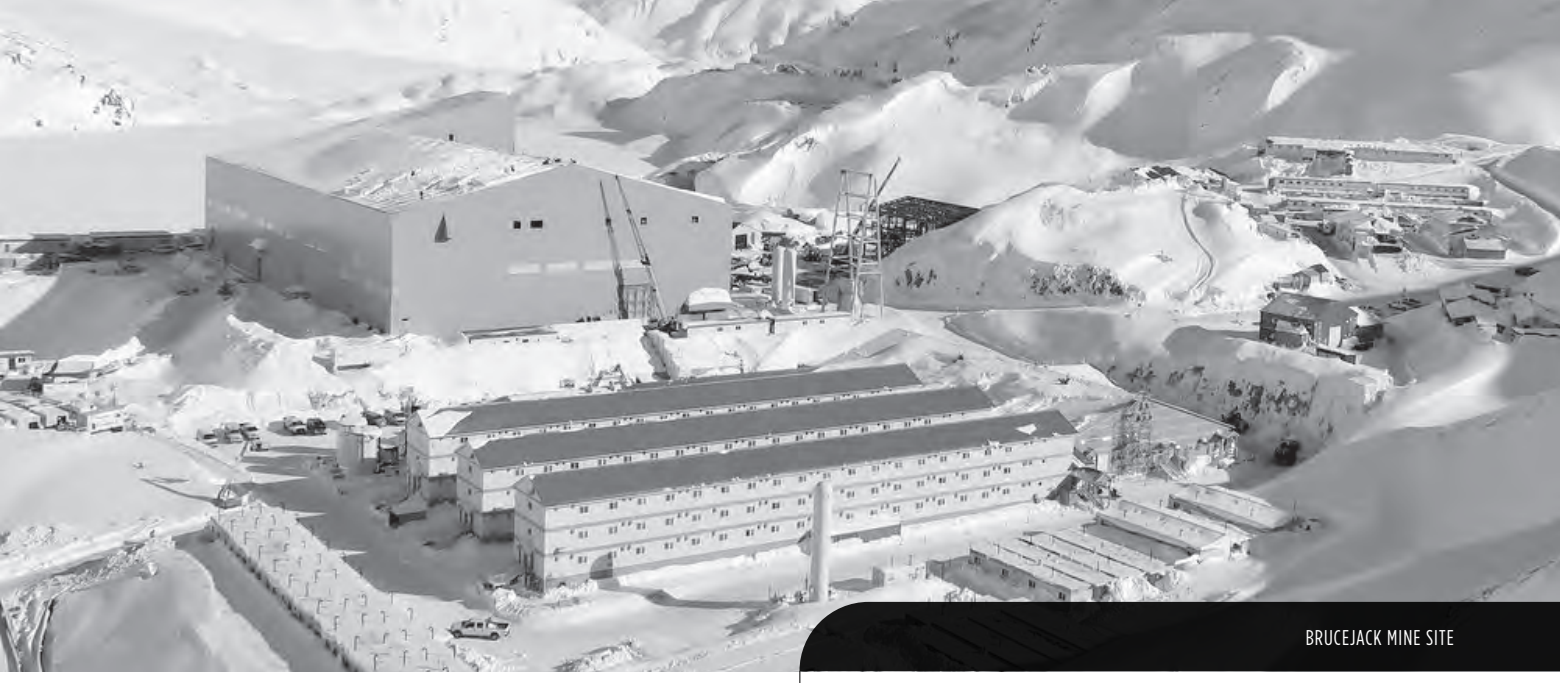
These are approximate and based on some recollection, time stamp on photos as well as my GPS track.
Avalanche Occurred - 12:30
Rescue Called - ~12:40
Fine Probe Search Started - ~13:30
Victim Recovered - ~13:50
CPR Started - ~13:50
CPR Finished - 14:45
Helicopter Arrived - 14:45
Helicopter Rescue Called Off - ~15:00
Last Person to Leave Scene - 15:30

LESSONS LEARNED

- The importance of a realistic emergency rescue plan and having the group

understand it well

- Having a translating resource in place was very helpful. Craig Oldring at Morino was our go-between which helped a lot when communicating with the friends
- Spare batteries to charge our phones during heavy use - this was critical
- Outside rescue should only be considered a bonus. This was the second helicopter rescue we assisted with in Japan. They have strict safety protocols, and rescuers will not be deployed unless the flying conditions are ideal
- From our experience with the police helicopter rescue, first aid will not be done on board. In our case we were told to move away from the patient and abort CPR. In another case, though already splinted on a thermarest mattress, a patient with a later diagnosed broken pelvis was winched into the helicopter in a sit harness
- The ghost signals were very confusing. There is no way to know what caused them but some of our theories are as follows:
  - The friends may have switched back and forth from search to send while trying to determine why there was no signal
  - To our knowledge the cell phones of the friends were never turned off
  - Possible electronic interference from the three Japanese; they were wearing numerous electronic devices including radios. One had an electronic cable connecting some sort of device to his goggles
  - Guides generally train for events where everyone is wearing a functioning beacon. What was ultimately a relatively small and simple search area suddenly seemed enormous once we were certain there was no transceiver signal. There is no way of knowing if the outcome would have been different had the victim's transceiver been working, but there is no doubt that it would have gone much quicker.



BRUCEJACK MINE SITE

Industrial InfoEx Applications

Ryan Vrooman, Brendan Martland, Ken Black

OBJECTIVES

In the spring of 2017, the Brucejack project made the decision to fully move all of its avalanche risk management over to a single platform: InfoEx. Our experience with InfoEx at other industrial and highways operations, as well as in the guiding and resort industries, led us to postulate that with some adaptation, all of our pre-existing specialized risk management tools could be ported into the InfoEx.

With the support of the CAA and some repurposing of existing modules, we were able to greatly streamline our risk assessment process. Given the diverse backgrounds of our technicians, and planned upgrades to further enhance the usability and capabilities of the platform, we envision other industry groups will see expanded possibilities for their operational risk management programs.

PROJECT OUTLINE

The Brucejack project is a gold mine and mineral exploration project on 122,133ha of land, 65km north of Stewart, BC. It lies in the Boundary range of the Coast Mountains and receives an average annual snowfall in excess of 10m. In exceptional years, snowfall can exceed 20m.

The project has four camps and almost 80km of road, intersected by multiple sections of avalanche hazard, ranging from cutbanks producing up to size 2 avalanches to runouts of size 4.5 overlapping paths. The mine site and main camp sit in the alpine at 1400m and have a combination of micro avalanche terrain features and several large paths capable of producing size 3.5 avalanches.

Currently the winter program employs a supervisor, a lead hand, two senior technicians and 14 avalanche technicians maintaining a 24 hour/day winter mitigation program. There are two camps that have separate avalanche zones to forecast and mitigate: an alpine camp at the head of a glacier and a treeline/below treeline camp.
Primary management tools include:

- Extensive helicopter, case, and hand charge explosive control program
- 6 RACS Gazex exploders
- A snowcat-based avalauncher (rarely used)
- Manual (ski, shovel) and machine (excavator, loader, snowcat) hazard reduction

PREVIOUS FORECASTING TOOLS

During the exploration stages of the project, several Excel-based documents were created to encapsulate our forecasting workflow. These included a stability assessment, an assessment rating for each avalanche path, and an extensive Dropbox-based filing system for record keeping. We maintained both PDF and hard copies of our records. The InfoEx platform was used primarily as an information exchange.

TRANSITION TO INFOEX

During the winter of 2016-17, the build phase of the project necessitated a large expansion in the avalanche hazard management program. This ramp-up in operations was accompanied by an increase in required paperwork and filing, with some redundant record keeping practices. To streamline process, the decision was made to attempt to transition to a single platform for all of our avalanche hazard communication and risk management.

The InfoEx platform expansion and evaluating capabilities gave us confidence that it could capture our many needs. Having the modularization and customization functions available, complete data storage and near

universal buy-in from the industry made InfoEx our obvious choice.

There were some growing pains associated with individual path assessments, full document transfer and the nature of our 24 hours/day program, but we were able to fully transition our hazard assessments over to the platform.

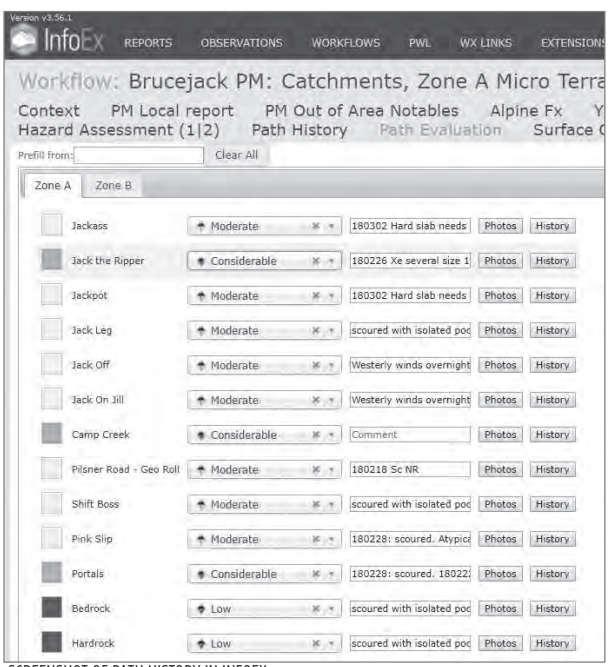
ADAPTATIONS AND NOVEL USES WITHIN INFOEX

Runlist

We were able to repurpose the runlist module into an individual path assessment tool. This involved changing the Runlist Status Configuration to match our customized icons, colors and our site specific hazard scale.

Much like a mechanized skiing operation, we divided our paths into geographic zones and separated them into individual tabs. The avalanche paths were then given an individual hazard rating correlating to our in-house hazard scale (adapted and modified from BC MOTI). These path assessments were prefilled from the previous day, allowing for continuity from the previous shift and capturing trend.

The comments section of the individual paths within the zone is used to track last control date and results, natural activity, and path specific comments. A report with the last 7 days of path history was seeded into the workflow as a preceding step. This allowed for a snapshot of the history and trends for each individual path.



SCREENSHOT OF PATH HISTORY IN INFOEX.

A second runlist was built with tabs for the various micro terrain features around the minesite and upper camp, avalanche control roads, and the status of the defensive catchment berms. This was again defaulted to prefill from the previous day. The comments section is used to convey hazards, status of the terrain feature and/or instructions for maintenance crews. InfoEx allows us to directly email this portion of the runlist to the Surface Operations department for consideration in their planning and for easy reference to avoid any miscommunication.

There are some planned additions to the functionality and customizations of the Runlist module that will allow for multiple columns with various prefill and heading options, an expandable comments box and the ability for multiple email lists to be attached to different runlists. Having multiple columns will allow us to capture trend and to mark individual paths for control or as areas of concern without losing the assigned hazard rating.

Avalanche Control Module

The purchase of the Avalanche Control module allowed us to greatly reduce our paper records, improve internal communication and modernize our operation. It also acts as an easy reference for explosives deployment records. However, for forecasting infrequent paths we're still working towards the ideal solution. Many of our technicians are accustomed to keeping shot sheets on the wall, but during storm events this could mean printing and posting as many as 30 updated sheets during a shift, which has obvious drawbacks. The current solution to this is seeding an avalanche control history into the workflow, but it doesn't quite have the same impact as shot sheets on the wall.

The photo overlay tool allows for a historical review of control work in a specific path, but it currently lacks the capacity to review an entire zone without creating duplicate records. It is expected that changes can be made to allow recording results into a single large zone photo and also looks promising that this extension will soon include the ability to have results displayed alongside the

photos. This would allow for a quick overview at the zonal/bowl/mountain scale and storing individual results at the path level.

MOVING FORWARD

With the hiring of a second developer by the Canadian Avalanche Association (CAA), several planned upgrades are in the works for this summer. Highways and industrial users have engaged strongly with CAA InfoEx staff to propose enhancements and these have augmented feedback from guiding operations and ski hills. Fortunately, there are often synergies between the suggestions from the different sectors so there should be mutual benefit when these enhancements come online.

Photo overlay

Fully replacing manual shot sheets will require more accessibility and integration with the observations and avalanche control modules. Fortunately this is in the works. Planned upgrades include the ability to pick standard colors (size 1 = green, Size 2 = yellow, etc.), the ability to set one zonal overview photo for the control route, integration with avalanche observations, and control results/observations displayed alongside.

Columns in the Runlist

Adding a second column in the runlist will allow us to capture trend and a third column will be used for marking a path for possible control. With the planned full customization and creation of numerous prefill options, various operations (in different sectors) will be able to customize these columns to meet their specific needs.

Email list

Having multiple email lists will allow each separate runlist to be emailed to the relevant and affected users. Outputting specific runlists/path assessments/hazard assessments to targeted groups seems to have increased uptake and absorption of those summaries.

Path History listing

The ability to organize the customized report geographically as well as alphabetically will streamline the workflow process further.

Comments box

Comment boxes that automatically expand or can be expanded to a desired size will prevent scrolling for large comments in the runlist module.

Time Profile

Building up this function into a modern, functional wall profile replacement will take some time. There is a strong industry desire to move to a modern digital platform but the functionality and visibility of a large wall-based time profile has yet to be surpassed in our opinion. Current plans include a linear interface, full customization of values, and the ability to display it independent of InfoEx (such as a PDF to a large wall monitor). This will be a huge leap forward in functionality and will further streamline the daily record keeping process. Weekly, monthly and end of season reports would also be just a few clicks away with accurate, customized, up-to-date and well graphed data.

THE BIG PICTURE

Since we moved our entire hazard management workflow over to InfoEx there have been significant efficiencies gained. We estimate a time savings of greater than 30 min per shift and an overall clearer picture of hazard. As an experiment it has been an overwhelming success. This platform - and specifically the runlist module with its communications functionality and customization - holds great promise as a management tool far beyond just avalanche hazard for industrial and highways use. We see ski hills benefiting greatly from the streamlined record keeping and hazard communication between various affected departments, and other sectors can customize these extensions to meet their needs, such as heliskiing outfits sending emails of their Runlists to various users.

Working closely with Stuart Smith, Luke Norman and the CAA team has been a very productive and positive process. As a busy 24-hour forecasting and control program with two separate offices and 18 staff, we have been putting InfoEx to the test all winter long. Our hope is that our many requests and feedback from extensive trial and error will help make InfoEx even more user-friendly and customizable for existing and future users of the product.

Schedule of Upcoming **Events**

WILDERNESS RISK MANAGEMENT CONFERENCE

October 3-5, 2018
Portland, OR
Gain practical risk management skills, network with others in the industry.
For more information:
www.nols.edu/en/courses/risk-services/wilderness-risk-management-conference/

INTERNATIONAL SNOW SCIENCE WORKSHOP 2018

October 7-12, 2018
Innsbruck, Austria
A Merging of Theory and Practice.
For more information:
issw2018.com/en

ICAR 2018 CONVENTION

October 17-20, 2018
Chamonix, France
Jointly hosted/organized by all French ICAR Members: ANENA, ENSA, FFME, GSM.
For more information:
www.alpine-rescue.org

BANFF MOUNTAIN FILM AND BOOK FESTIVAL

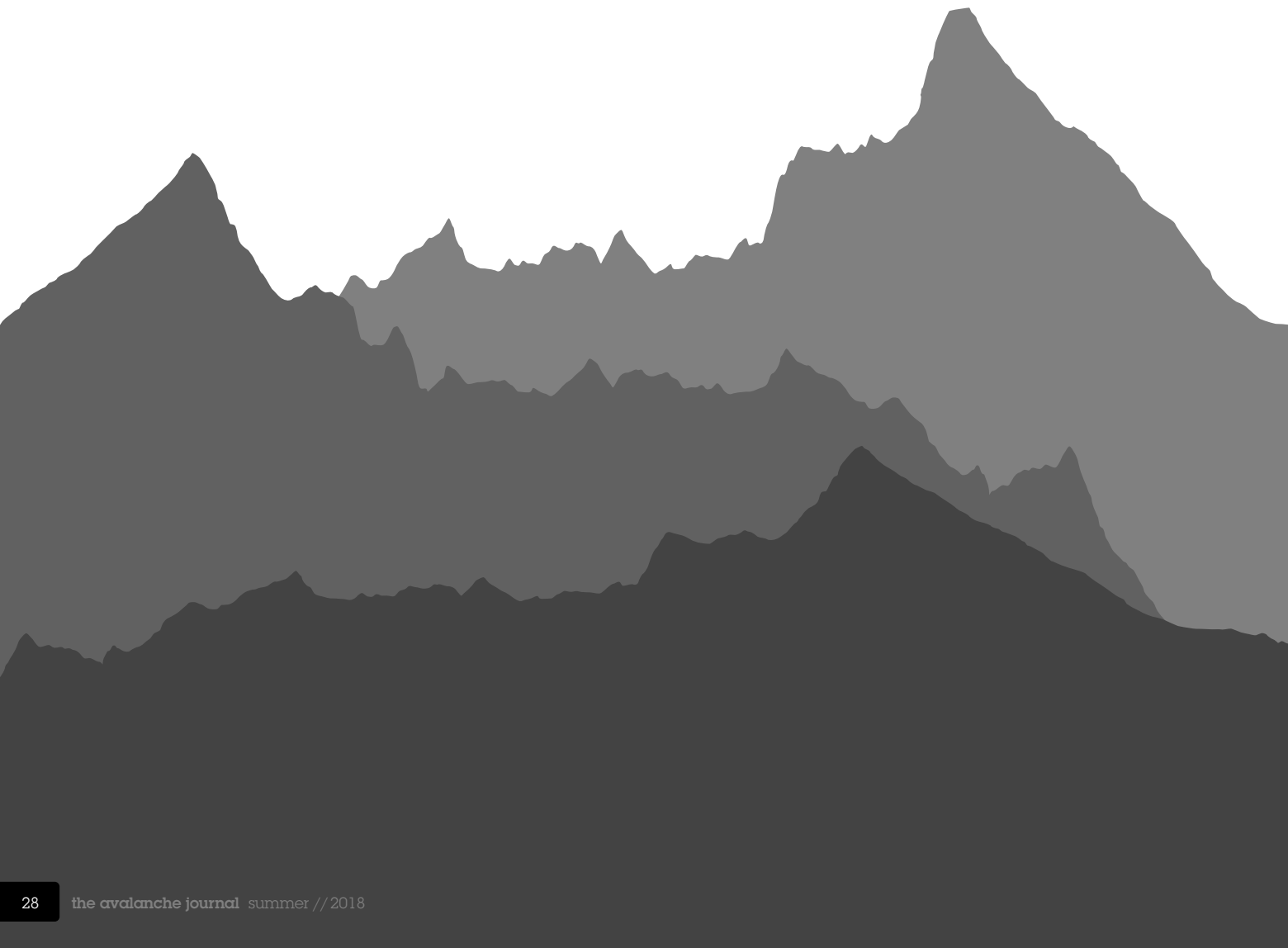
October 27 - November 1-9, 2018
Banff, AB
The Banff Mountain Festival brings you the world's best mountain films, books and speakers.
For more information:
banffcentre.ca/mountainfestival/

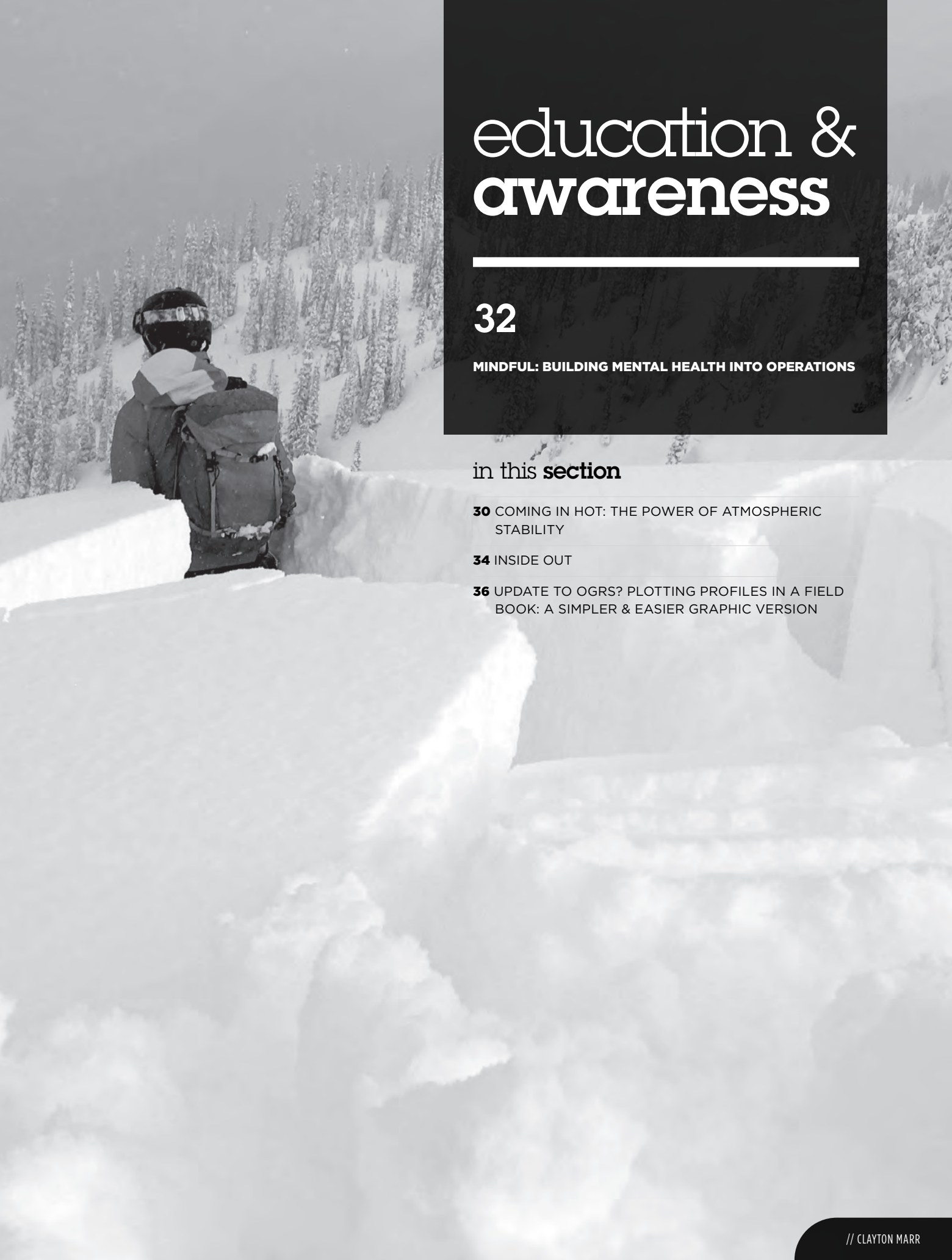
WORLD EXTREME MEDICINE CONFERENCE AND EXPO

November 23-25, 2014
Edinburgh, UK
Three days of knowledge, insight and innovation in the field of remote medicine.
For more information:
extrememedicineexpo.com/

ICELANDIC ASSOCIATION OR SEARCH AND RESCUE CONFERENCE

October 12-14 2018
Reykjavik, Iceland
For more information:
www.rescue.is/conference





education & **awareness**

32

MINDFUL: BUILDING MENTAL HEALTH INTO OPERATIONS

in this **section**

// CLAYTON MARR

Coming in Hot:
The Power of Atmospheric Stability

Matt MacDonald

IF YOU'VE EVER TAKEN a CAA Intro Weather course, then you might recall the meteorological jargon term "tephigram," or perhaps its American cousin the "Skew-T diagram". These complex thermodynamic diagrams are typically met with blank stares and yawns from even the keenest of students. Ultimately, most students are left asking themselves, "why should I even bother with tephigrams?" Well, if you've ever been challenged with the "go or no go" dilemma when trying to fly, then atmospheric stability can be one of your best forecasting and decision-making tools. So while you don't necessarily need to waste your time deciphering the various lines on a tephigram, understanding the powerful concept of atmospheric stability is well worth your time.

Tephigrams are used by meteorologists to visualize a variety of atmospheric parameters including temperature, dew point temperature, wet bulb temperature, wind speed and direction at various levels of the atmosphere. Plotting the temperature profile from a balloon sounding onto a tephigram allows us to ascertain the atmospheric stability over a given location at a given time (when the radiosonde was launched, typically every 12 hours at 00Z and 12Z). We can also calculate a variety of important reference levels including the freezing level, the snow level, cloud base and top, the level of free convection, etc. If you really want to geek out, one can calculate surface areas to figure out how much energy is available for the growth of a cumulus or perhaps even a cumulonimbus cloud, something meteorologists refer to as convective available potential energy, or more simply CAPE. Fully grasping all these indices and the various lines that make up a tephigram requires a university course, maybe even two. So how can the average avalanche professional get a sense of the atmospheric stability du jour without delving into the infamous tephigram? Answer: *Flow baby, flow!!*

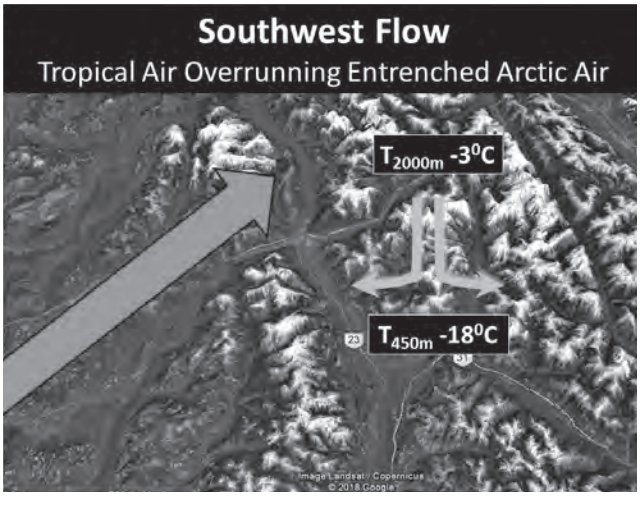
I'm almost certain every reader of this fine journal has heard or even talked about 'flow'. In the world of weather, the term flow is used to describe the general direction of winds in the middle atmosphere, typically around 500 hectopascals or 6000 metres above sea level during Canadian winter. While reading a synopsis or perhaps attending a morning guides' meeting, you'll mostly likely hear mention of the flow such as northwest flow, westerly flow, or the dreaded Pineapple Express, which is essentially a strong southerly flow with plentiful moisture. Now, in order to infer atmospheric stability from the flow pattern, we must first understand what defines a stable or unstable atmosphere.

Simply put, without referencing the dreaded tephigram, a stable atmosphere is defined as an atmosphere that resists vertical motion. An unstable atmosphere, on the other hand, is one that allows and even encourages vertical motion. To understand atmospheric stability, we need to respect a few fundamental laws of thermodynamics, namely:

1. Hot (less dense) air rises and cold (more dense) air sinks - known as the ideal gas law.
2. When relatively warm air overlies colder air, the atmosphere is deemed stable and mixing is supressed. Think temperature inversions.
3. Conversely, when relatively cold air overlies warmer air, the colder more dense air will sink and mixing is favoured.

So how do we get warm air to overlie colder air and create a stable atmosphere? Simply add a southerly component to your flow and the air moving in aloft will be relatively mild. If for example, Arctic air has been entrenched in your favourite mountain valley and a mild southwesterly flow kicks in (Figure 1), thereby delivering warm air aloft, then you will inevitably stabilize the atmosphere and supress or even kill all vertical mixing. Stable atmospheres and temperature inversions are therefore not favourable to dissipating valley cloud, stratus and/or fog.

If, on the other hand, the upper flow takes on a more northerly component compared to recent patterns, then you



will likely end up with cold or even frigid air overrunning relatively warmer air below (Figure 2). This temperature profile will yield an unstable atmosphere and encourage vertical mixing. Turbulent mixing and convection are your friends when it comes to burning off moisture and

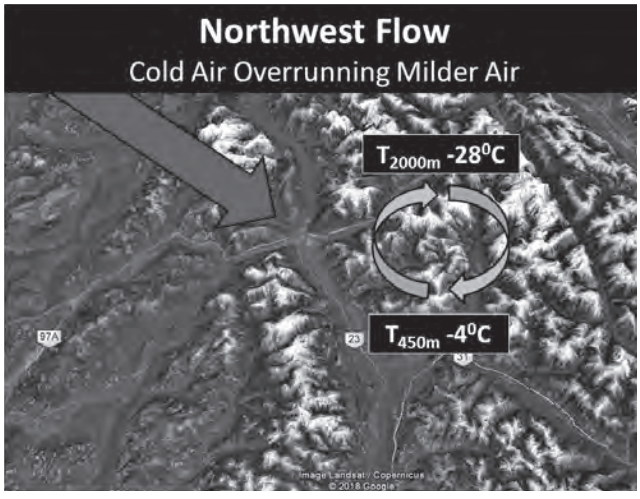


FIG. 2-NW FLOW CREATING AN UNSTABLE ATMOSPHERE FAVOURING MIXING.

dissipating stubborn stratiform cloud.

Not only does atmospheric stability determine the amount of mixing and therefore the chances that low level clouds may break up but its also super useful for determining the type of clouds and therefore the quality of precipitation you might expect. For example, an unstable atmosphere will support convective or rather cumuliform clouds be it cumulus, towering cumulus, the elusive alto-cumulus castellanus or the almighty cumulonimbus. These unstable, puffy, cauliflower-like clouds yield showery type precipitation; the kind that turns on and off in an instant and can be very heavy for short periods. Therefore, by analyzing a northwest flow during your weather analysis, you can start painting a pretty accurate picture of what it might actually look like in the mountains that day. And if you're thinking cumulus, you should also be thinking turbulence and icing.

Contrary to unstable cumuliform clouds are their less exciting conterparts stratiform clouds, which include the likes of fog, stratus, valley cloud, alto-stratus, etc. Stratiform clouds are much less dynamic than cumuliform clouds and typically the adage "what you see is what you get" is a fair forecast. Temperature inversions often accompany stratiform clouds and any stratiform precipitation will be relatively light and usually steady.

It's worth noting that the difference in temperatures between the Earth's surface and the mid-atmosphere will determine just how unstable an air mass will be. The stronger the temperature contrast, the stronger the instability. This explains why cumulonimbus clouds are mostly confined to summer months when surface temperatures can exceed 30oC while mid-level temperatures can still dip below -20C, yielding a 50 degree spread. During early winter when solar radiation and heating is weakest, convection tends to be rather shallow and weak. As we enter spring and the sun angle steepens, the temperature contrast also increases. This gives way to cumulus and towering cumulus, making for some dynamic spring weather. Mixing out that stubborn stratus layer is therefore a lot easier in late March than in early December.

In summary, if you were to look at nothing else than nearby valley and alpine temperatures, the flow direction

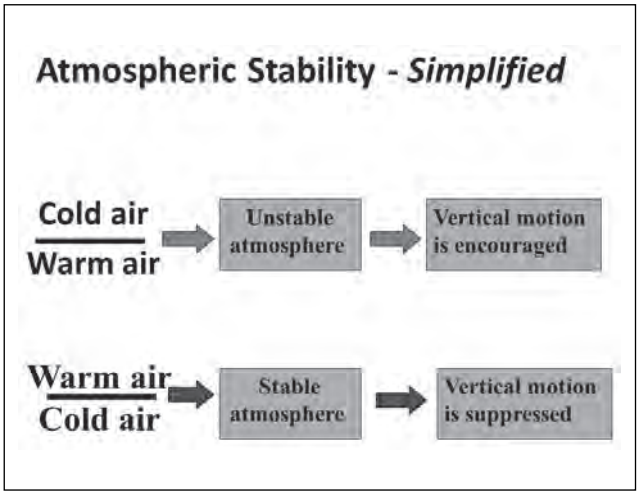


FIG. 3 - A SIMPLE WAY OF LOOKING AT ATMOSPHERIC STABILITY (SANS TEPHIGRAMS).

and perhaps a glance out the window, you'd be able to assess atmospheric stability to help make the go-or-no-go decision with greater confidence. Assessing the flow direction and contrasting upper air temperatures with low elevation temperatures will yield an excellent assessment of the atmosphere's stability. Tying the stability back to cloud types and their associated precipitation intensities will help put the final touches on your portrait of today's weather. And there you have it, atmospheric stability without tephigrams!

Note: an excellent source for identifying the flow pattern is the 500mb animation on the Synopsis tab of the Avalanche Canada Mountain Weather Forecast at avalanche.ca/weather

MINDFUL: **Building Mental Health Into Operations**

Andrew Jones

ONE YEAR AGO this spring we lost our friend and co-worker, Dean Flick, to suicide. I think of Dean every day and he will always be missed by our group in the avalanche control section at Rogers Pass. After losing Dean, our team decided to take a close look at how we can improve our approach to mental health issues.

In addition to the myriad of day-to-day stressors that are inherent to life, avalanche and search and rescue professionals are exposed to stressful and potentially traumatic events that impact mental health. As professionals it is our aim is to have long, healthy and fulfilling careers. Mental health is universal to all of us; it influences the way we think, the way we feel and the way we act. I cannot stress enough the importance of including mental health in operational planning. This article is not meant to be prescriptive, but it is my hope that other operations might benefit from learning about our process.

To keep our scope focused, our working group's learning was guided by three questions.

1. What mental health supports do we currently have in place?
2. What is the best practice when it comes to supporting good mental health?
3. How can we change to implement these best practices?

WHAT MENTAL HEALTH SUPPORTS DO WE CURRENTLY HAVE IN PLACE?

There are three main mental health supports already in place at Parks Canada: employee assistance program; critical stress debriefs; and informal peer support.

The employee assistance program (EAP) provides anonymous access to a professional counsellor over the phone for employees and family members. Through EAP it is also possible to set up one-on-one counselling sessions in your hometown. EAP programs are common in larger organizations and they tend to provide limited long-term support.

At Rogers Pass, critical incident stress debriefs are regularly provided for team members following exposure to traumatic events, with follow up sessions if appropriate. These debriefs are typically group sessions facilitated by a professional mental health clinician. This program is well supported by management, but the group session format does not work for everyone.

Informal peer support exists in a trust-based culture where those who have experienced stressful situations together can offer support to one another, free from the stigmatized world of professional mental health clinicians. Informal peer support is limited by that fact that often our peers have little or no mental health training, and there is no formal process for initiating this type of support.

WHAT IS THE BEST PRACTICE WHEN IT COMES TO SUPPORTING GOOD MENTAL HEALTH?

To find best practices, we looked to other first responder occupations including police, fire, ambulance and military. The most progressive approach to mental health planning typically comes from provinces with presumptive legislation where, "mental illness diagnosed in first responders is presumed to be work related." The province of Ontario has one of the most comprehensive presumptive legislation; consequently, Ontario has a great online resource for helping organizations create mental health policy and protocols called *firstrespondersfirst.ca*.

We used the First Responders First resource to guide the development of our mental health strategy, focussing on the core principles of anti-stigma training, resiliency training, and improving access to care. Stigma is the number one barrier to care for people living with declining or poor mental health. Resiliency is our ability to bounce back from stressful events and maintain good mental health in the short and long-term. In addition to stigma, access to care for mental illness is limited by logistical issues at the organizational and personal levels.

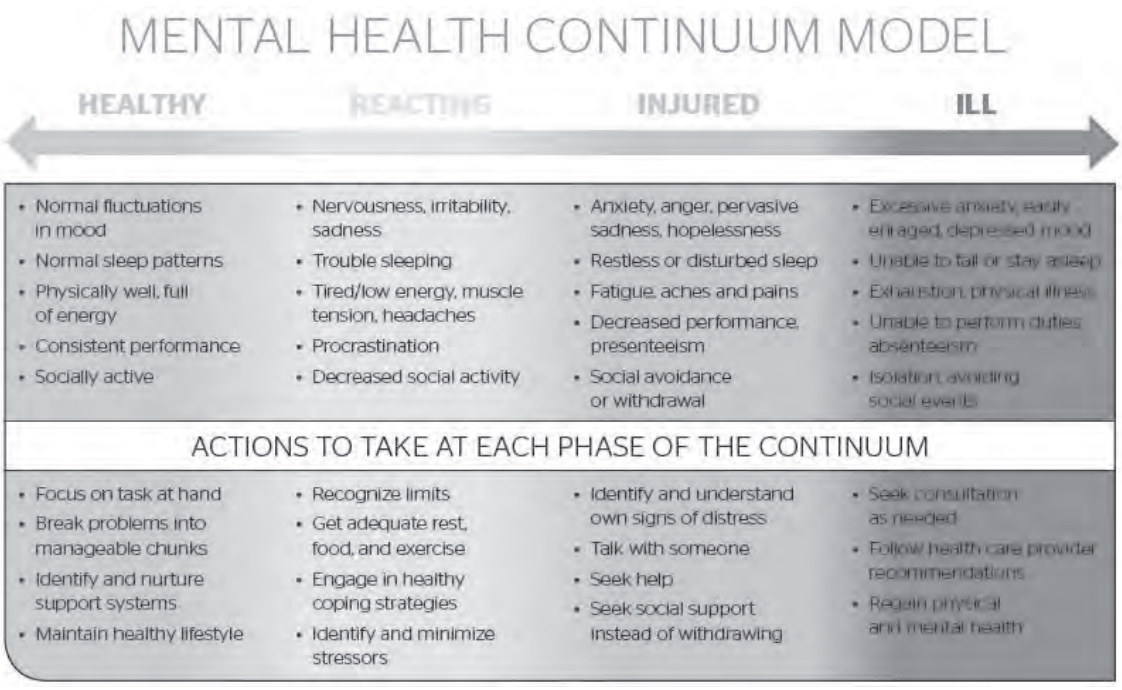
HOW CAN WE CHANGE TO IMPLEMENT THESE BEST PRACTICES?

Anti-Sigma and Resiliency Training

To address anti-stigma and resiliency training, we adopted the Road to Mental Readiness (R2MR) program which is administered by the Mental Health Commission of Canada. R2MR was originally developed by the Department of National Defense to provide practical knowledge and skills to address mental health and mental illness in organizations. R2MR is already mandatory training for several organizations including Alberta ambulance and the Calgary police service.

The R2MR includes a four-hour primary course covering de-stigmatizing mental health and mental illness, a self-assessment tool called the mental health continuum model, and providing skills to build mental health resiliency. The R2MR eight-hour leadership course covers the same content as the primary course, with an additional focus on supporting workers, conducting ad hoc incident reviews, and return-to-work considerations.

The mental health continuum model allows individuals to identify indicators of declining or poor mental health in



themselves and others with a system of non-stigmatizing terms (healthy, reacting, injured and ill). Below the model headings is a bidirectional arrow which stresses that individuals can move along the continuum; if one ends up in the "ill" phase, he or she can move back towards the "healthy" phase. The model teaches appropriate actions to take for oneself and for others at each point along the continuum.

R2MR teaches the "Big 4", which is a set of evidence-based cognitive behavioural techniques that help individuals cope with stress and improve their mental health and resiliency. The Big 4 are positive self-talk, visualization, tactical breathing, and SMART goal setting.

Earlier this spring, R2MR instructors from the Mental Health Commission of Canada put on training in Mount Revelstoke and Glacier National Parks. 50 staff members from the Park received either the R2MR primary or leadership training. At the beginning of June, two staff members from the Avalanche Control section participated in a 5-day R2MR Train-the-Trainer program, and are now certified to provide the R2MR training in-house.

Improving Access to Care

Peer support programs have been shown to be a well-used and accessible means of getting support, likely because there may be fewer stigmas associated with talking to our peers instead of clinicians. A formal peer support program provides peer-nominated individuals with the training needed to help their peers and connect them with the required care. The law enforcement branch of Parks Canada has contracted a consultant to develop a peer support program. The consultant's job includes program and protocol development, conducting the peer nomination process, and training peer supporters.

In provinces without presumptive legislation, it can sometimes prove difficult to access work related benefits for mental health issues. In some cases, worker compensation boards may ask for proof that mental health related claims are the result of work place exposure. For many, documenting exposure to traumatic events during a time of crisis would lead to more anguish. As a precautionary action, many firehalls and police services encourage their staff to document exposure to traumatic events at work in the same way that they would document physical injuries. At Rogers Pass, we have started an optional program where people can use a generic check-box style form to document exposure to traumatic events. If an individual requires access to care at any point in their career, the hope is that having these files on hand will streamline the process.

A MOMENT IN OUR INDUSTRY

In the not-so-distant past, human factors in avalanche operations gained widespread acceptance. Avalanche training curriculums were changed to reflect the new information. Avalanche operations reworked their protocols, and there was a collective awakening to a new way of doing things. It is my hope that we are at a similar moment in our industry with our approach to mental health.

Our mental health working group was able to work through a detailed and somewhat technical process to come up with some positive changes. The reality is that this stuff is not technical at all. It's very simple. We need to recognize the signs of declining and poor mental health in ourselves and others. We need to acknowledge that it's okay to not feel okay, and ultimately we need to get the help we need to get back to healthy.

Inside **Out**

Ken Wylie

OVER THE LAST TEN YEARS there have been fantastic advances in the field of avalanche safety through research and technical development. Additions made to snow stability evaluations, terrain assessment tools and avalanche response technologies deepen our awareness of the snowpack, our decision-making skills and our response times. Yet when I look at these intense efforts, it frustrates me that people are still dying out there each winter. Even some of the best: Robson Gmoser. How do we make ourselves safer?

Ian McCammon's work with heuristic traps is helpful. He discusses how decision-making shortcuts work against us, like familiarity. As if a past experience will predict a future one. Or by seeking acceptance from others socially, yet not sharing what we know to be true for ourselves. Great steps toward the notion that our decisions are often flawed, but I propose that we go deeper and come to better know our situation inside.

Yet when I look at these intense efforts, it frustrates me that people are still dying out there each winter

Casting light on our character flaws frightens most human beings. In our industry, my observation is that we try to replace looking at ourselves with technical solutions. If Icarus (from Greek mythology) was plummeting to the sea, (and he was an avalanche professional), he'd say: "Daedalus should have used epoxy to glue the feathers to these wings instead of wax." When really the lesson was about hubris. When tragedy strikes, we often point to and wonder about technically obvious factors that were ignored, and we ask: Why?

In *"Transforming Your Dragons,"* Dr. Jose Stevens lays out seven archetypes that can afflict humans. His work is a powerful tool for putting language to our internal situational awareness in a way that we can easily identify, if not fully admit to recognizing in ourselves.

- Arrogance
- Self-Deprecation
- Impatience
- Martyrdom
- Greed
- Self-Destruction
- Stubbornness

According to Stevens, each of us is particularly plagued by one of these seven dragons and they surface, or gain control, in the presence of fear. However, it is also important to keep all of them in our awareness. Let's take a closer look at each one of these and see how they can play out in the backcountry skiing paradigm.

Arrogance. There is a big difference between confidence and arrogance. A confident winter backcountry guide or enthusiast also listens to input. There is a willingness on the part of the confident individual to welcome new information from anyone in the group. Conversely, a person with the arrogance dragon will say, "I am/know the best," and believe it. This individual is incapable of receiving input from others. The root of this behaviour is insecurity.
Arrogance in avalanche terrain can and does lead to information gaps. Individuals have blind spots, a limited perspective grounded in biases and perceptions. If we invite others into the process, the scope of available information broadens, which can impart the choices we make.

Self-Deprecation. Self-deprecation is a lack of confidence to the point that we forfeit our voice. We may possess the most relevant piece of information, but we are too afraid to share it because we carry no value in our perceptions. If we consider that all parties exposed to the hazard of an avalanche are risking the same thing – their life – then we need to master social courage and speak up.

Impatience. People with the impatience dragon are stricken with the fear that if things are not happening quickly, something bad will happen. However, being in a hurry can lead to a failure to take the required time to do a task safely and efficiently. In the mountains there are many instances when going more slowly can help us maintain a higher level of diligence and therefore safety. Think of crossing an avalanche slope one at a time. It can be uncomfortable to travel slowly if we fear worsening conditions, but only time will tell if the conditions worsen. Rather than rush through a critical piece of terrain, explore other options and terrain choices.

CAN YOU DENTIFY THE DRAGONS?

Martyrdom. Martyrs are victims; they feel that they do not have the power of choice. Others make decisions for them and they are oppressed. This differs from self-deprecation in that martyrs have good ideas, but they are not heard or heeded by colleagues or friends. A martyr follows a leader onto a suspect slope, despite knowing the potential consequences of withholding their knowledge and information. We say, "Oh, I don't think this is okay, but they want to go there, so I guess I'll go with the flow. I don't want to make waves." In this case, the fear is about standing in one's truth and living it to the full, regardless of social fallout.

Greed. Greed is an easy dragon to understand, especially on a powder day when the sun is shining. The statistical fact that more avalanche tragedies happen on sunny days with new snow underpins the concept of greed. After a long period without any snow it becomes more likely that we may undermine our own ability to make rational decisions, making going for it easier and escalating our tolerance for risk. Our greed dragon also comes into play when we race ahead of other groups in order to get first tracks. Our focus on the race can erode good decision-making.

Self-Destruction. Self-destruction may be fuelled by a general propensity for self-hate, depression, or a sense of despair. This does not make for good decisions in avalanche terrain. It brings a devil may care attitude to an activity that requires great care and diligence to preserve the well-being of self and others. This behaviour often creates drama and subconsciously encourages poor outcomes. The underlying fear is one of success and the responsibility that it brings. Ironically, these individuals may have a long list of successes in the mountains, but the intention behind those successes is suspect. Were they reckless and lucky?

Stubbornness. When afflicted by the stubbornness dragon, we refuse to cooperate. It may be that we are afraid to be wrong, or we are so fixed on the objective of the day that we can't shake ourselves from achieving the goal. Single mindedness can be a required strength in hazardous environments, but the game is about seeking the best solution to the challenges we face.

Fear fuels these archetypes. Be it the fear of not being as good as we claim, our own self-efficacy, not enough time, personal responsibility or simply being incorrect, each of these fears is a hazard to the avalanche professional, as it is to human beings traversing through life. I believe I have been gripped by every one of these dragons at one time or another. However, mostly I have tripped on being a victim to others: martyrdom. What I can do to remedy my fear is to be aware of it.

There is a place for fear in the avalanche game. Fear keeps us on our toes and brings focus to hazardous situations. In the case of tragedies, rather than point out what appear as obvious flaws, let's instead try to understand what lead to the mistake. Let's identify that process within ourselves. That is the cure for fear of any unknown: facing it with full situational awareness.

Note: A version of this article first appeared in Powder magazine, in November 2015.

Update to OGRS?
Plotting profiles in a field book: A simpler & easier graphic version

Bill Mark

THE CAA STANDARD for documenting snow profiles in field notebooks uses a numeric system, as described in *Observation Guidelines and Recording Standards for Weather Snowpack and Avalanches* (OGRS), OGRS[1] (2016) and pictured in Figure 1 below. However, in practice we find that some people and organizations have instead been using a graphic method, pictured in Figures 2, 3 & 4. My suggestion is that the graphic method , also be included as OGRS standard and consequently taught at both industry and recreational courses.

CURRENT OGRS SYSTEM FIELD BOOK PROFILE

The current OGRS system is purely numeric and not visual (see example in Fig. 1), compared with the proposed more graphic version (see example in Fig. 2).

PROPOSED GRAPHIC PLOT

With the graphic system, in essence you plot the profile as you visually observe it. Since notebook formats vary, below are two further examples of the graphic system.

Fig. 3 uses a *Write in the Rain* surveyor's level book. Fig. 4 is courtesy of the American Avalanche Association, from Snow Water Avalanche Guidelines. Fig. 2, appears courtesy of Mike Wiegele Helicopter Skiing, a commercially printed version.

SUMMARY OF GRAPHIC METHOD

- Easy and quick to plot
- Simple to read and interpret in the field and share with co-workers
- Layers are easily added, as are results of small column tests, shovel shear, CT etc. without having to squeeze in numbers etc. as with OGRS system
- Left to right system
- Can use a pre-printed booklet or standard surveyor's notebook
- No loss of data when compared to the current numeric method

PROPOSAL

I would suggest that it is time this method is adopted into OGRS as a legitimate method of plotting profiles and we teach this method in CAA ITP courses.

WHICH ONE DO YOU FIND EASIER TO INTERPRET?

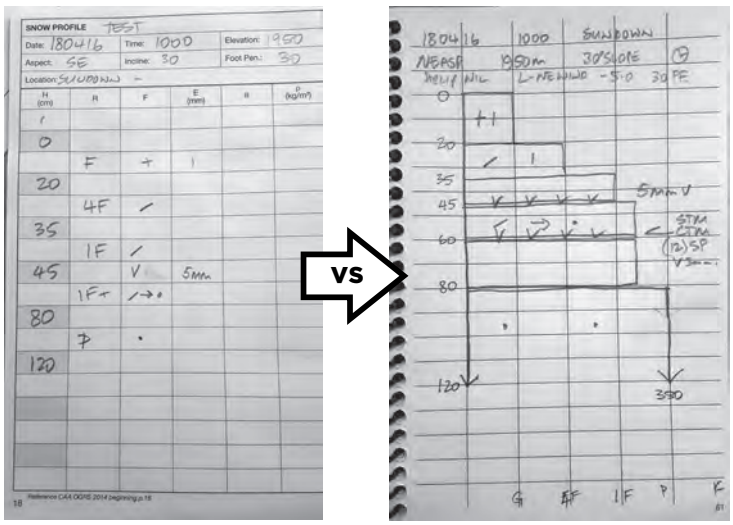
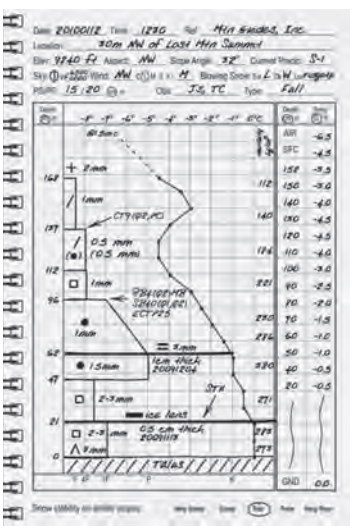


FIG. 1 FIG. 2



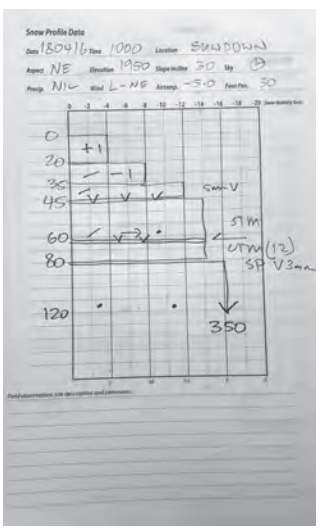


FIG. 3 FIG. 4

[1]Observation Guidelines and Recording Standards for Weather Snowpack and Avalanches, 2016, Canadian Avalanche Association

avalanche **community**

40

MIRROR MIRROR: THOUGHTS ON MENTORSHIP

in this **section**

// DOMINIC BOUCHER

Hot Spot: Rogers Pass Interactive Map

Markus Siivola
Parks Canada

ROGERS PASS IN Glacier National Park is a hot spot for backcountry skiing in western Canada. Averaging over 13m or snowfall annually, the consistent snowpack and steep terrain attracts backcountry users from around the world. As the area grows in popularity, Parks Canada continuously looks for options to enhance tools and information available to backcountry users to ensure their safety.

UNIQUE CONTEXT

Unique to the park is the winter permit system. While the system successfully solves a problem of avalanche mitigation and skier access, it also can be difficult to understand upon initial exposure, given that a familiar conceptual model that would help generalize and explain the system does not exist.

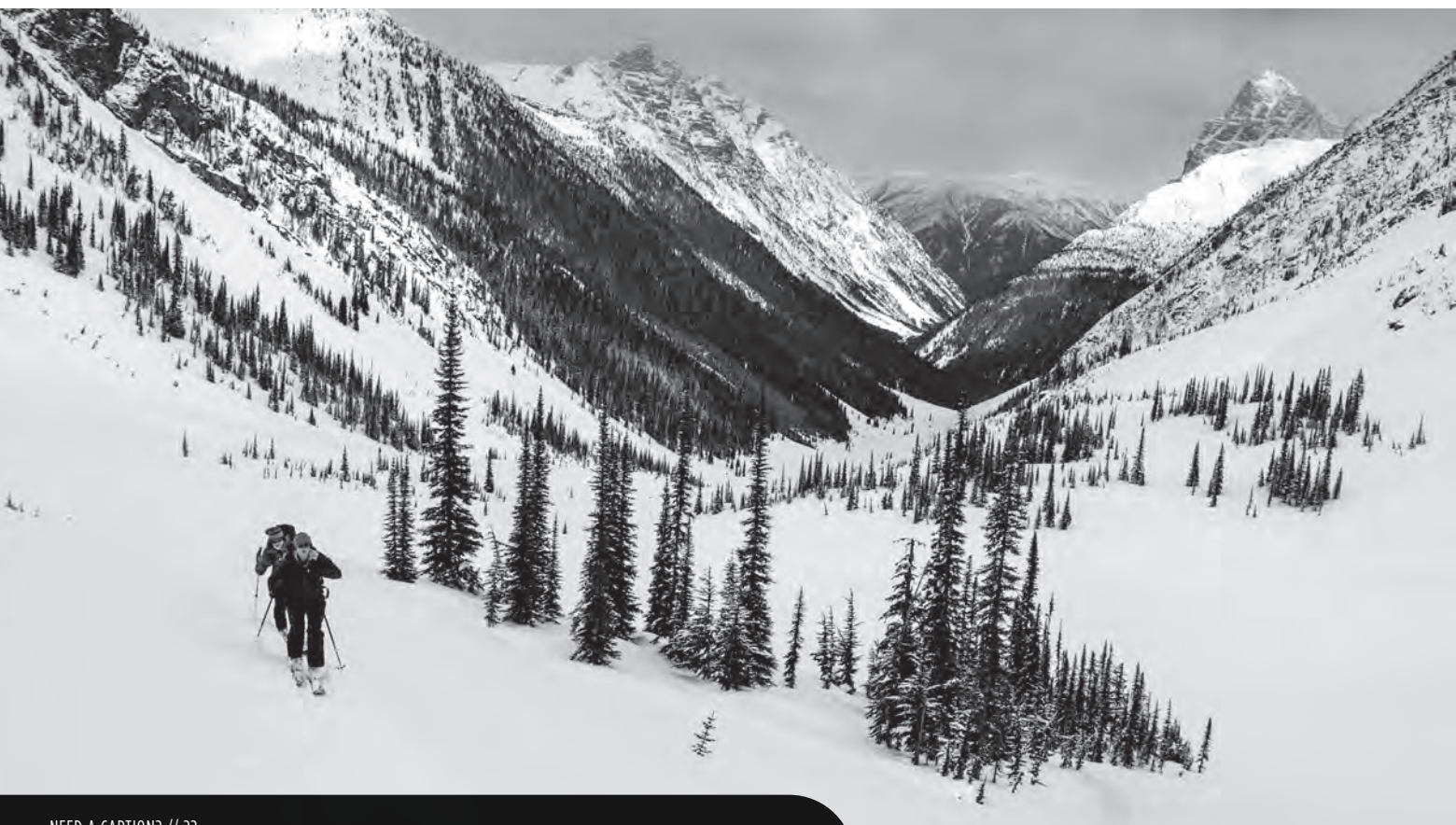
With support from Public Safety Canada's Search and Rescue New Initiatives Fund, Parks Canada launched a new electronic tool project in 2015 to help user groups who were inexperienced with the WPS. The goal of the project was to help ensure continued compliance by providing a new digital service to assist visitors with trip planning and real-time decision making.

RESEARCHING THE USERS

In the summer of 2017, user research was conducted to gain insights on Rogers Pass backcountry users to better understand their motivations, goals and behaviours. This information was a strategic necessity in designing a product for this audience.

The purpose of the research was to test Parks Canada's assumptions about the users and learn about users' actual versus assumed needs. The methodology consisted of stakeholder interviews, user interface/user experience audits, moderated interviews and usability tests.

Research findings suggested that users would like to see a trip planning process that offered a quick visual for a broad overview. Further, they wanted an ability to drill into the overview for more specific details, communicated in a cohesive step-by-step system.



NEED A CAPTION? // ??

Comparatively, products such as Trailforks were appreciated and respondents found the user experience in these products to be very good. In contrast, interviewees found information available on the Glacier National Park website difficult to navigate, overloading them with information and making it challenging to obtain key information quickly.

Users also wanted user-generated content that would tell them a story, including content such as trip reports and photos. A subscription-based system with automated notifications on status updates, conditions and forecasts was desirable, as was the option to turn notifications off.

Both the inexperienced and the experienced winter backcountry users interviewed were not fully aware of the unique risk associated with the avalanche control in the park. In general, experienced users had a more realistic assessments of the inherent risk of backcountry skiing while the inexperienced group underestimated these risks. When asked to rate their level of backcountry experience, the inexperienced group tended to rate their level of knowledge higher than the experienced group. Experienced users also had a more systematic approach to obtaining information.

The respondents preferred native mobile applications over browser-based web applications.

A NEW INTERACTIVE MAP

Parks Canada launched a new web-based interactive map tool in March 2018 for Rogers Pass backcountry users. The map displays the WPS area boundaries and provides daily updates on which areas are open or closed. Each morning, Parks Canada avalanche technicians in Rogers Pass publish the status of restricted areas. This information is immediately posted to the interactive map.

When viewed on a GPS-enabled smart phone, the user can track their location on the map and immediately see their position, helping ensure they stay out of closed areas. The tool can provide notifications upon approaching or entering closed areas. Permit requirements, parking locations and webcam images are accessible via simple interactions on the map.

The tool uses abstraction and a simple but effective visual to explain the status of the system at a glance. The map and its interactive features are intended to help an inexperienced user to understand the state of the WPS until a better conceptual model has developed. The tool is also an opportunity to try and convey a conceptual model to the users by way of design.

Based on initial feedback, the users are excited about the product but would like to see more content such as images, uptracks and downtracks. The tool was developed as a browser-based application due to government accessibility guidelines, but a mobile app would be preferred by the users. Parks Canada is looking into specific techniques to address this.

From the avalanche control's perspective, the system has removed bottlenecks in communicating WPS status information to the public. However, Parks Canada does not want the visitors to become completely reliant on smart phone tools while in the backcountry as those tools may fail or be lost in action.

Parks Canada is committed to continuously improving the product. Do you have feedback? We'd love to hear it. Send comments to RevGlacier.reception@pc.gc.ca.

The interactive map is only updated during avalanche control season (November through April) but is available for viewing at pc.gc.ca/accessrogerspass.

Mirror Mirror:
Thoughts on Mentorship

Lee Green

"ACTIVELY SEEK GOOD MENTORSHIP" is a phrase that gets thrown around, at work and in life. But what exactly does that mean, and if we say this in the context of teaching avalanche courses, how do we tell a person where and how to find a mentor? Some thoughts on what mentorship looks like in the workplace, our best chance of tapping into it and how can we cultivate fertile conditions.

THINKING STYLES

Thinking styles are a way to help explain how we learn, synergize in the workplace and expose ourselves to risk. Incorporating these concepts into our daily discussions and forecasts helps us round out our perspective.

People process data and form conclusions in different ways. If we look at the CAA curriculum, Level 2 Module 1: a series of questions helps narrow down your strongest thinking styles into five main categories. From those results you can see which thinking styles may work well with others. For example, an Analyst may be challenged by a Synthesist as they may butt heads while coming to a conclusion because they are processing data differently. Understanding how you think and how your colleagues think is valuable as you can learn how to approach them with the questions you want to ask, and understand their strengths and weaknesses. Balanced work relationships build trust, friendship and aid learning. A very healthy environment to find and encourage mentorship.

LOOK IN THE MIRROR

Frustration with coworkers happens. A positive starting point in any personality conflict is to look inward and challenge yourself to find solutions. What can you do on your side of the equation? This takes extra effort, but if we are *actively* seeking out good mentorship, there is leg work to be done. Try to identify the personal traits of your colleagues; this helps you create a low friction path through the workplace. You will learn more from someone you get along with than a person with whom you are in constant conflict.

Ask yourself the relevant questions: Are you working in an environment where your personality fits in? Do you feel comfortable approaching your colleagues with questions and how do they respond? Have you gone in prepared or peppered them with birdshot?

Defining concepts and challenging ideas is important, but a humble and malleable approach to learning is most likely going to mesh with any mentor's personality type.

EDUCATION AND OWNERSHIP

"There are no stupid questions, only stupid answers." This may be true, however there is something to be said about asking informed questions. Taking the time to read new studies, research papers, ISSW findings, and keeping up with changes in the industry is important. Learning on your own time not only allows you to stay current, it gives you the opportunity to learn in your own way.

To receive the best mentorship, ask good questions. Making an effort goes a long way. Mentors will be more inclined to engage when you demonstrate knowledge and are seeking clarification. Be a person worth their investment of time.

THE TIME CRUNCH

When a season is in full swing, it can be challenging to find time to reach out and ask questions; most of our real world learning is on the fly. Pay attention to details and take advantage of small moments in between the chaos to reflect, form an idea, and turn that into a question you can ask later. Write it down if there is no one to answer immediately. The best we can do is to be diligent with the time that we do have and constantly be looking for ways to learn more and master our craft.

FRACTURE LINE PROFILE AT BRUCEJACK MINE // LEE GREEN

PERSONAL REFLECTION

Being a decent person is too often overlooked in importance, not only in looking for mentorship, but in life in general. You need to ask yourself, "Would I want to teach me?" What kinds of attitudes am I projecting, and how do people view me? This can give you a really good idea of how receptive people may be when you ask for help. The simplest things like manners, hard work, ambition, and likeability should go without saying. Put yourself in the other person's shoes; will anyone make an effort if they think that they may get ego or a negative response in return? Professionalism is a skill that starts from simple etiquette. Be situationally aware and sensitive; everyone has other things going on in their lives aside from work.

WHERE, OH WHERE

It takes a village to raise a child. This traditional African proverb explains mentorship. Learning opportunities are everywhere. Structured programs at work are a start, but so are ski tours with friends, dinner conversations, practicums, volunteer programs, reaching out to other operations and generally being a part of the community and industry. By connecting and engaging on a daily basis, the likelihood of finding answers to our questions increases. We find more like-minded people, we make friends, and we become a part of the progression. We are only limited by how much we put into this process, and if we are not feeling as though we are moving forward, it's because we are standing still. This is what actively seeking means: to be in a constant state of learning, having ideas and being open to adjustment. With the technology today, we have a wealth of knowledge that is only an email away. We have a very active community with a passion for the snow. We need only to reach out and ask. Finding mentors who understand you and your thinking style is about shopping around.

INVESTMENT ADVICE

Financial rewards are often at odds with learning curves. The goal is to make a living at our practice and monetary return influences our choices. One thing to consider when choosing the right work for your goals is to evaluate the true cost of finding, or not finding, mentorship.

Sometimes the best opportunities to find good mentorship are not the highest paid offers. It may be necessary to take a financial hit in order to move forward, or even years of hits.

Weigh the options carefully. Actively seeking could mean taking a lesser paying position because it relates to the current stage of your career. Give it some thought. There is no defined perfect choice. The good news is that hopefully the money you have not made becomes experience you would not have gained otherwise, and you are building your career.

IT'S COMPLICATED —WE ARE HUMAN

Mentorship was once built into our society and the proverbial passing of the torch happened naturally, from generation to generation. In our times we have to be more conscious of both actively seeking and becoming mentors ourselves. Building good habits and skill sets is the foundation. Further down the road, this will take us into leadership roles where we can return the favour. Mentorship is not only time and cost-effective, it's the future of our industry.

Hi Tech or Lo-Fi:
Digital Tools on Long Ski Traverses

Martina Halik

IN THE WINTER OF 2017, I spent 5.5 months ski traversing much of the Coast Range between Squamish and Skagway, Alaska. Before leaving, we had to make certain navigational choices: maps, apps, forecasts and/or phones. Based on the experiences and observations gained from this trip, I formed some ideas for managing avalanche risk more effectively on long and remote ski traverses.

We encountered many challenges and human factors new to us along the way, such as dealing with food caches. The placement of these, sometimes many weeks in advance, meant that we were committed to reaching a specific spot within a certain amount of time if we didn't want to starve. Limited resources of food and fuel also meant we tried to move as quickly as possible using the shortest routes. There was not always a safe or comfortable option; often our route was simply the lesser of two evils. If we delayed too long waiting out a storm or trying to find alternate paths, it meant going hungry later. We ran out of food a couple of times during the trip and had to go days without eating. Low blood sugar or the early stages of hypothermia seemed to significantly affect our ability to make good decisions. Hunger, cold, and exhaustion compounded in these scenarios. Without an intake of calories, we were cold and spent sleepless nights shivering. The upside to no food of course was that our packs and toboggans were lighter!

Complacency was another issue. After a few months, risk was a normal part of our lives. We adjusted our expectations and personal risk tolerances throughout the trip, always weighing the consequences of worst case scenarios. It was easy for emotions to overwhelm us when we were handicapped by hunger, cold or lack of communication. Our mindsets and situational awareness were tuned towards recognizing the signs of the above factors in ourselves, and in each other.

Perhaps the closest call we had during our traverse was when I was caught in an avalanche a couple of weeks before reaching Terrace. Looking back, so many of the warning signs were there: a lack of communication, hunger, and exhaustion. The avalanche was over in seconds. Continuing on safely was the bigger challenge, beginning with climbing free of the debris, skiing to a safe spot, and digging for the next 2 hours to set up camp out of the extreme wind. The next day, and the day after, for many months, I had to just carry on trying to make better decisions.

Outside resources and information tend to be extremely limited on big traverses and ours was no exception. We doubled up on satellite communication beacons like the Spot and InReach, each of us carrying one. The premise being that if the person with the device was the one in trouble, the other could still call for help. We also kept them in our pockets (along as our avalanche transceivers), in case a pack were to be lost in an avalanche, crevasse or river crossing.

Following optimistic routes based on advice from other adventurous souls, maps and Google Earth was another constant challenge. This was at times a real trial in the face of global warming melting icefields at a spectacular rate. Many of our topo maps were 40 years old, showing glaciers that had since retreated several kilometers. Even Google Earth imagery could be remarkably different after only a few years. It required a lot of situational awareness, rapid problem solving, and a frequent adjustment of expectations. Navigation app technology proved invaluable. While we still

ran into issues with the maps and satellite imagery the app used, it felt a hundred times more effective. After the first couple months of the traverse, we understood that that our topo maps were of absolutely no use to us. Truly the best part of having them was ceremonially burning them after finishing a particularly difficult section.

Given frequent whiteouts and the poor weather we encountered, night travel was often our safest option. Crevasses were clearly visible in the satellite imagery on our phones, thereby making them far easier to avoid while using the tracking feature. At night, edges of crevasses showed up with greater clarity and contrast by headlamp than during the day. With a quick glance I could see if we were approaching potential runouts or entering avalanche terrain. Had we been route finding by map alone, we likely would not have considered this option.

I look at it this way: for centuries the washboard was an effective laundry tool. Time consuming, arduous, but clothes came out clean. Then along came the washing machine. It probably took some decades, but everyone embraced its ease of use eventually. Arguments against GPS apps are abundant, such as the expense, reliability and difficulty of charging batteries. I suspect people argued similarly against those darned washing machine contraptions at the beginning too.

Deciding to navigate without an app like Gaia would have worked, but I believe it would have been exponentially more difficult, time consuming, and dangerous. As with any tool, I found there was a learning curve and certain compromises needed to be made. We travelled with both of our smartphones for redundancy. The expense of a year-long subscription to the Gaia app is currently about the same as two to three topo maps and it's free for SAR members. Re-charging was easy with a lightweight solar panel and battery bank. Knowing certain phones are more weatherproof and have longer lasting batteries, we put a little research into selecting the right phones as well.

Admittedly, we likely exposed ourselves to more risk at times by relying on all this technology, much like people often end up driving faster with a 4 wheel drive vehicle in icy conditions. Using paper maps or an older GPS model alone, we likely would have sat out a lot of the conditions we found we were able to move through. I think there's a fine balance with how much you can rely on your equipment to keep you safe, and I personally suspect it all needs to be combined with the right mindset and good situational awareness.

Flakes

ROB BUCHANAN

Repair is a Radical Act

Andy Cook fixes one of the nearly 50,000 garments repaired at our Reno facility last year. TIM DAVIS © 2017 Patagonia, Inc.

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