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129 // S 2022

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SPRING 2022

in this **issue**

Walter Bruns
CAA President

CAA President's Message

SWAN SONG

THIS IS MY LAST message to you as President of the Canadian Avalanche Association. Let me start with some words about Joe, the handsome guy on the next page.

First, he will NOT be forgiven for his part in my becoming president. In a seemingly innocuous phone call some six years ago—perhaps at the behest, or at least with the tacit endorsement of then-secretary-treasurer "Rocket" Miller—he very subtly and craftily leveraged my sense of duty to our profession and to our association to prompt me to step up.

Second, you should know how valuable Joe is to the CAA. His advocacy for the varied interests of all members is unwavering. His selfless dedication in the role of Executive Director for 10 years now is commendable, admirable, and even worrisome at times. His impressive intellect and critical thinking, as applied to the host of challenges that attend our association, has talked me off the cliff and dissuaded me from wanting to send in the cavalry many times.

It has been an absolute pleasure to work with Joe. Knowing what it takes to manage a complex organization, and finding it hard to resist the temptation to get on the shop floor, when I strayed there, he always steered me back to the strategic oversight level of the board, gently, and with kindness. Thank you, Joe.

Now have a look at the right-hand column on page five. That's the team that makes the CAA function. To long-haulers like Audrey and Brent, to the senior managers, to the newer folks: let me say thank you to all for your contributions. And to CAA Members: when you connect with any staff for any reason, expressing your appreciation for what they do will go a long way.

On the same page are the names of the current directors. To everyone on the board, and to all past directors over these last six years, it has been a delight to collaborate with you. Below them are the names of the committee members. As with directors, please know that almost all of these folks are juggling their volunteer service on your behalf with full-time careers, and many of them have family obligations. Finally, in the bin at the bottom, you'll see the names of our past presidents. Thanks, everyone.

FINAL MUSINGS

Snow avalanche risk management has been the foundation and at the very core of my entire professional career. For 30 years, it was my privilege to work with amazing people and on behalf of wonderful clients. This last decade with the CAA has been just as fulfilling.

We are a curious lot. Not too many people seek out sports where getting yourself killed is a very real possibility. Even fewer people then turn their passion for those sports into jobs and careers. And only a very few, special people in those careers rise up to accept stewardship over the lives and safety of others.

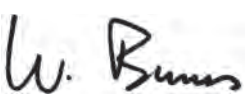
We are a special lot. There are strong, enduring bonds that form between folks in the avalanche community. The act of willingly and knowingly accepting avalanche risk, sharing it with like-minded friends or colleagues, or, most crucially, managing it on behalf of others who are less aware—this confers a staggering amount of responsibility onto the practitioner. Our Code of Ethics, Scope of Practice, and various other guidelines and codes of conduct are in essence a BOND of conduct.

We are bonded indeed to strive for the greatest degree of professionalism and to exercise the absolutely highest possible standards of practice. It has always saddened me when people complain about the commitments of professional membership, when they cut corners, or claim they can operate at a lower standard than what is commonly accepted or generally applied. Please, rise up.

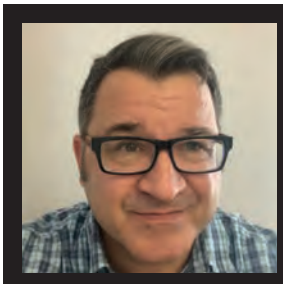
The CAA has been instrumental in defining and developing avalanche professionalism and proper practice for over 40 years. It has been a massive collective effort by a raft of scientists, technicians, engineers, educators, consultants, patrollers, guides, staff, volunteers, and others from Canada and abroad. You will have read the names of many of them on page five.

But what will the CAA become as it continues to evolve? Well, it will be all of you, and all those who have yet to come aboard. As more of us old dogs fade into the dustbin of history, it will be for you folks to step up.

It has been my honour to be President of your association.



Walter Bruns, CAA President



Joe Obad
CAA Executive Director

Executive Director's Report

"NORMAL TIMES," IT WAS NICE KNOWING YOU

I CAN'T HELP BUT WONDER if in 100 years, will the anthropologists not yet born pinpoint a date around which "Normal Times" ended? Will they point a finger at the five minutes between the end of the Omicron wave and the outbreak of war in Europe after 80 years of peace? Or the moment the world stopped looking to Canada for maple syrup and hockey stories, but instead looked for stories of floods, protest, and emergency measures? Maybe those learned future folks will point out that the arc of history is mostly a bumpy one and we have been blessed to live in several decades of relative harmony.

In any case, this season has presented all of you with a lot of stress before you even pulled on your boots to get to work. So, kudos to you for finishing the season in one piece.

Like you, the CAA has ridden the waves of Omicron and flood-related impacts, and worked to avoid getting dragged over the rocks. Staff have adapted to the latest rules while trying to serve members and students.

ITP staff in particular have traversed the snakes and ladders of masks, distancing, and vaccines to avoid course disruptions and cancellations. We are blessed with dedicated staff and instructors who made this happen in a whirling carousel of changing rules and guidelines. The ingenuity and adaptation of staff and instructors helped students advance their learning and careers in these uncertain times.

ITP creativity is also forward-looking. Over the coming months you'll hear more from them about the online weather course currently in development. This will allow for course delivery liberated from travel, allowing another option for students.

InfoEx staff continue to advance the MAInEx project. We are starting to see the fruits of server-side updates implemented to support new frontend functionality. Phase 2 of the InfoEx mobile application was released and the project working group is testing the initial desktop phase. This has been a long, hard effort. Thanks to the InfoEx team and subscribers who are testing the product.

There is some change on the InfoEx Advisory Committee as well. After 15 years of leading the committee through a variety of changes, Brad Harrison is stepping down. Brad strongly represented subscribers' interests and aided InfoEx Manager Stuart Smith countless times. Thank you Brad for all that you've done!

As the season comes to a close, our Spring Conference helps us crystalize what we've learned from the past year, and to look forward.

We'll step towards a historic delivery, with a shortened in-person conference that will offer options for remote participation. The pricing for these options will be the same. On the surface this might surprise some members. It is important to take into account that the technical challenges of delivering this blended model are considerably more challenging and costly than an all-online conference.

We will also be able to recap our progress on educating members towards the implementation of Guidelines for Instruction in Avalanche Terrain (GIAT). To date, Implementation Coordinator Iain Stewart-Patterson has led several introductory webinars on GIAT. He'll offer several more sessions on developing avalanche safety plans and other tools in advance of the Spring Conference.

At the annual general meeting, members will be able to vote on the proposed category names, with an opportunity for members to approve or reject the proposed names outlined on page 11 of this issue.

The spring also marks Walter Bruns' last AGM as CAA President. Being President is no easy gig. Your Executive Director calls you up and floods your ear with a problem requiring board consideration. In that moment, you must take it in, reserve judgement, and consider what is best for the membership and public they serve, all with an eye to keeping the wheels on the organization.

We've been lucky to have Walter as a leader and advisor these past six years. We've laughed, fought, thought, fought, and laughed again, all with the goal of improving what the CAA does for its members and the public. Walter, thanks for all you've done the last six years, supporting staff and members, and enduring me. Enjoy some well-deserved free time.

The snapshots above remind us that change is constant. Normal times, farewell! You were probably only an illusion anyway. We are ready and steady for whatever comes next!

Joe Obad, CAA Executive Director

Alex Cooper
Managing Editor

From the Editor

TWO YEARS AGO, in mid-March, I celebrated my 40th birthday with friends and family at the dawn of the COVID-19 pandemic. It was the only topic of discussion and the next day, it felt like a terrible mistake. At the time, it still felt appropriate to gather—we just bumped elbows instead of shaking hands. For two weeks after, I stressed about hosting a super spreader event, only relaxing once it was confirmed no one caught COVID. Over the next few months, my only contact with friends was outdoors and online. We were even afraid of biking side-by-side.

My 41st birthday was celebrated amongst a small group of friends with an outdoor bonfire. Vaccines were rolling out and some restrictions had eased. For a few weeks that summer, mask mandates were lifted and it felt like the pandemic was winding down. Then Delta happened, followed by Omicron. As year two ends, another birthday is here, and it will forever be associated with the pandemic. I'm not ready to call it over, but, like almost everyone, I am looking forward towards a return to a new "normal." I look forward to having one less stress in my life, and one less impact on my mental health. I still fret about climate change and, now, the possible end of the global order spurred by Russia's senseless and horrific invasion of Ukraine. Will life return to "normal," or is "normal" no longer a thing?

WHAT IS NORMAL?

There is a small focus on mental health in this *Journal*. We're happy to publish research by Eric Haskell and Darcy Solanyk on occurrences of PTSD amongst both recreationists and professionals in alpine sports. Their research sheds light on the prevalence of PTSD in people who spend a lot of time in the mountains. Meanwhile, Erin Tierney's article looks at ways to build resiliency into your operation by creating a critical incident stress management plan to help people deal with the mental health issues that come with working in this challenging industry.

Elsewhere, Eliot Brooks writes about the challenges for working night shifts, which, truth be told, is something I did not know existed in the avalanche patch. On the technology front, Jeffrey Goodrich looks at the avalanche detection network in Rogers Pass. These systems are becoming more common and his article is a great overview of using one operationally.

In the Snow Globe section, Sarah Hueniken has written about the Ice Climbing Atlas she has spearheaded for Avalanche Canada. Her article looks at the steps the ice climbing community has taken to address avalanche safety in recent years. We also have two articles looking back in time from long-time industry stalwarts. Jim Bay wrote about his first year in the avalanche industry way back in 1971-72, a winter when Canadian snowfall records were set around Revelstoke. I'm also grateful to Alan Dennis for allowing us to publish an excerpt from his book, *Snow Nomad: An Avalanche Memoir*.

I hope you enjoy this issue. I'm looking forward to seeing everyone in Penticton for the first time in three years, this time as a more familiar face. I hope to come away with enough story ideas to fill another year's worth of issues.

Alex Cooper

Guidelines for Instruction in Avalanche Terrain (GIAT)

Joe Obad

MEMBERS WHO TEACH AVALANCHE COURSES should be preparing to adhere to Guidelines for Instruction in Avalanche Terrain (GIAT) in the 2022-23 season. A variety of resources can be found on the CAA website via the GIAT link under the Resources tab on the main page. These include GIAT 2.0 itself, templates for avalanche safety plans, emergency response plans, and AM meeting forms. Along with these text resources, there are video links to webinars on specific topics. These interactive sessions with members asking the same questions you have are lively and informative. Lastly, members with any questions on implementing GIAT in the coming season are welcome to email Iain Stewart-Patterson, GIAT Implementation Coordinator, for help at giat@avalanceassociation.ca.

Proposed Changes to **Member Category Names**

Joe Obad

IN 2021, FOLLOWING A LONG PROCESS to revise membership requirements, the board of directors requested that the Ethics and Standards Committee (ES Com) provide options for new names for two membership categories: Practicing Professional Member and Active Member.

ES Com completed its work and provided recommendations to rename these categories. These new names require changes to the bylaws to come into effect. Notice of a special resolution will be given to members in advance of the 2022 annual general meeting and members will vote on the resolution at the AGM.

PROPOSED CHANGES

Following extensive work by ES Com, the following changes to membership category names will be brought to the membership for a vote at the 2022 AGM:

CURRENT NAME	PROPOSED REPLACEMENT
Practicing Professional Member	Avalanche Professional
Active Member	Avalanche Practitioner

RATIONALE

The board of directors provided criteria for potential naming conventions. ES Com's rationale for the proposed membership category titles are detailed below.

REVISIONS SHOULD HIGHLIGHT THE DIFFERENCES IN SCOPE OF PRACTICE AND AUTHORITY BETWEEN THE VARIOUS COMPETENCY LEVELS.

This is arguably the most challenging criteria for the proposed naming convention. The term "Professional" implies a large scope of understanding and responsibility for decisions and advice given. Conversely, the term "Practitioner" is often associated with doing and practicing, which is consistent with what are currently Active Member competencies. Further, we researched seven other self-regulating professions that follow the new Professional Governance Act and reviewed their membership class naming conventions. We found it is common to use "Professional" as the higher competency class. Examples include:

- The Association of BC Forest Professionals uses Registered Professional Forester and Registered Forest Technologist;
- The BC Institute of Agrologists uses Professional Agrologist and Technical Agrologist; and
- Engineers and Geoscientists BC uses Professional Engineer and Engineer in Training.

These other professions provide good solid descriptions of what competency and education requirements these names refer to, and make them readily available to the public. The CAA should ensure similar descriptions are developed and communicated to the public.

REVISIONS SHOULD BE CONCISE AND STRAIGHTFORWARD.

Out of all the evaluated options for the naming convention, these terms are the most concise and straightforward.

REVISIONS SHOULD RECOGNIZE THE PROFESSIONALISM OF ALL MEMBERS.

ES Com believes these terms communicate professionalism and are closely related to the underlying competencies they refer to. Further, we are aware that some members/business owners have expressed concern about the terms "Assistant" and "Apprentice," which imply further development is required. The proposed options avoid this challenge.

REVISIONS SHOULD AVOID TERMS THAT ARE SECTOR-SPECIFIC, IMPLY RIGHT OF TITLE, AND AVOID IMPLICATION OF A SPECIFIC CAREER PATH.

The options suggested are easily transferable to any practice type in the avalanche industry and do not suggest Right to Title or Right to Practice.

LIMITATIONS

The suggested titles are offered as replacements for existing member class names. The committee believes they are the best options available, but recognize there are limits to the ability of the suggested title names to address every situation. Incidents may arise where the suggested titles create confusion. For instance, student researchers may seek to become Avalanche Practitioners to assist their research paths. In this instance, practitioner and researcher may be confused. Similar contradictions or confusing uses of title may occur. This is expected given the variety of situations members may face. It is likely that other professions face similar challenges, but that these issues are minor inconveniences relative to the benefits afforded by appropriate member title. ES Com believes the benefits of the suggested alternatives outweigh these limitations.

Avalanche **Observation Time**

Karl Klassen, InfoEx Advisory Committee

AVALANCHE CANADA IS DEVELOPING an avalanche observations data aggregation and visualization dashboard for use by its forecasters. The dashboard ingests avalanche occurrence data from InfoEx and Avalanche Canada's Mountain Information Network (MIN).

Early in the design process, we found numerous instances of anomalous and confusing avalanche occurrence time data. As a result, we ran into significant challenges interpreting, normalizing, and displaying accurate, understandable information about when avalanches had occurred. While we've come up with solutions for the most common issues, outlier and edge cases continue to skew the visualization, resulting in uncertainty with respect to the accuracy of avalanche occurrence time.

We believe the problem is rooted in the InfoEx user interface, which is somewhat unintuitive and provides no help for users who are unsure how to use the observation date/time and age range fields. And we're quite certain that inaccurate occurrence time data also exists in the InfoEx tables and map view.

Avalanche occurrence time is critical, especially when conditions are dynamic and the snowpack is in balance between stability and instability. The avalanche date and time fields are slated for an overhaul in the next version of InfoEx, but in the meantime, this article offers some guidance for how to provide more accurate information using the current system.

In the following examples, I describe how to enter data to describe a few common scenarios:

1. I saw an avalanche(s) in motion.
2. I did not see the avalanche(s) in motion but observed evidence of previous activity. I estimate the avalanche(s) ran more than 72 hours before the time I observed the evidence.
3. I did not see the avalanche(s) in motion but observed evidence of previous activity. I estimate the avalanche(s) are no older than 72 hours prior to the observation time and may have run more or less right up to the time I observed the evidence.
4. I did not see the avalanche in motion but observed evidence of previous activity. The avalanche(s) are no older than 72 hours prior to the observation time but ran more than 12 hours before I observed the evidence.

Four data fields are used to answer the questions posed above.

1. *Obs Date:* The date the observer saw evidence of avalanche activity. NOTE: This may be the date the avalanche actually ran or it might be the date on which evidence of a past avalanche is observed. **It is not the date the data is being entered into InfoEx.**
    - This field is a mandatory entry and is found in the Avalanche Observation's main screen.

The following three data entry fields are found in the observation time and avalanche age section of the Avalanche Observation section of InfoEx. These are not mandatory, but using the following for all avalanche observations is strongly encouraged.

2. *Obs Time:* The time on the observation date the observer saw an avalanche run or saw evidence of a past avalanche. NOTE: This may be the time the avalanche actually ran or it might be the date on which evidence of a past avalanche is observed. **It is not the time the data is being entered into InfoEx.**
3. *Occ Time From*
4. *Occ Time To*

Addressing the first two points above is relatively straightforward, but dealing with the third and fourth can be somewhat confusing. Describing avalanches that occurred within 72 hours of the observation time can be seen as describing a window in which an avalanche ran. This window opens and closes at certain times in the past. The *Occ Time From* field defines the *latest time* an avalanche has occurred—that is when the occurrence time window **closes**. The *Occ Time To* field defines the *earliest time* an avalanche has occurred— that is when the occurrence window opens.

There are many possible combinations of *Occ Time From* and *Occ Time To* that can be used to define when the occurrence window opens and closes, and it's not practical to describe them all in this article. The following scenarios provide a few specific examples of how to answer the questions posed above. Based on these examples, users can determine how to select the data that most appropriately describes the occurrence window they are trying to define.

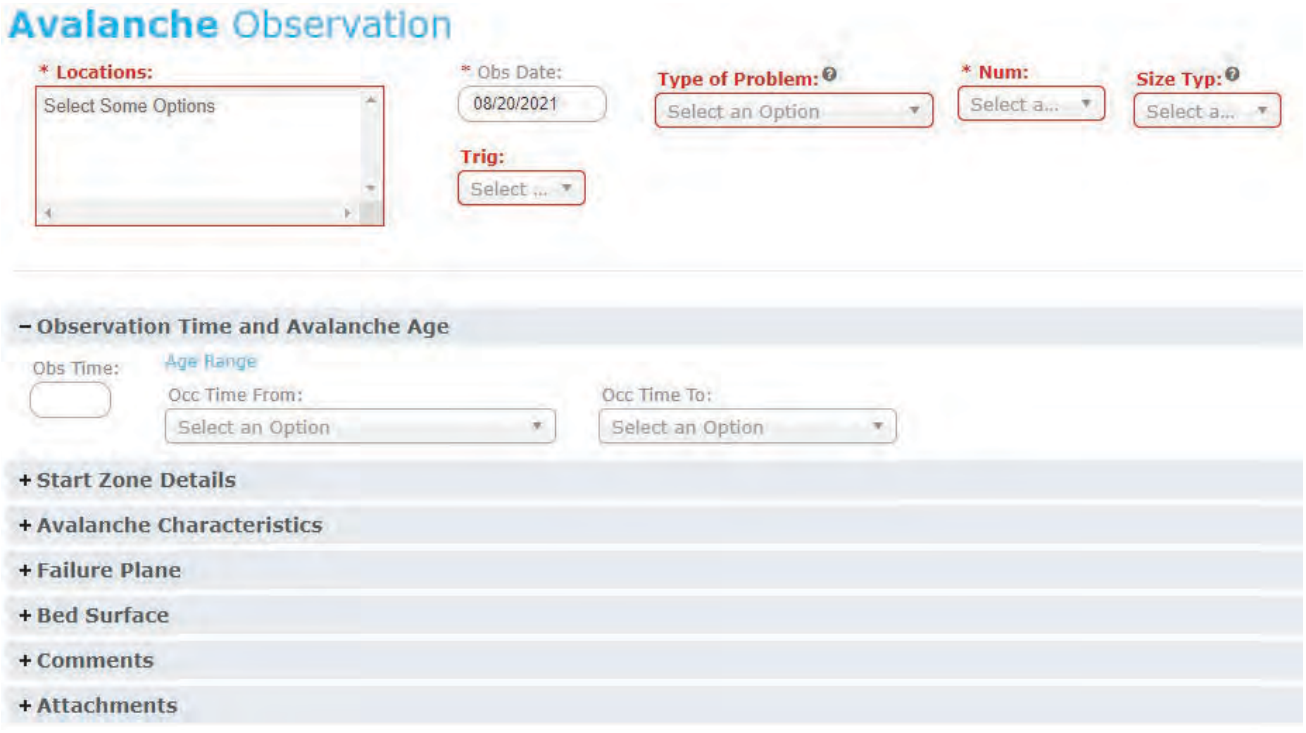


FIG. 1: INFOEX AVALANCHE OBSERVATION SECTION WITH OBSERVATION TIME AND AVALANCHE AGE OPEN.

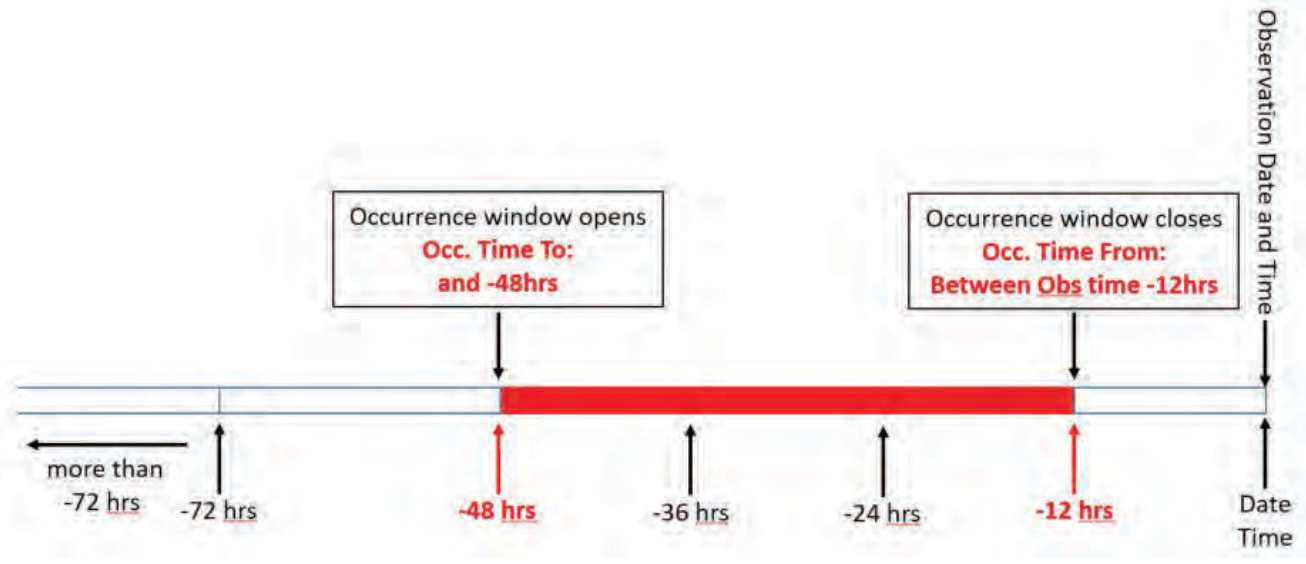
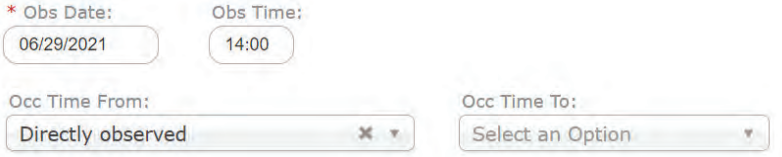


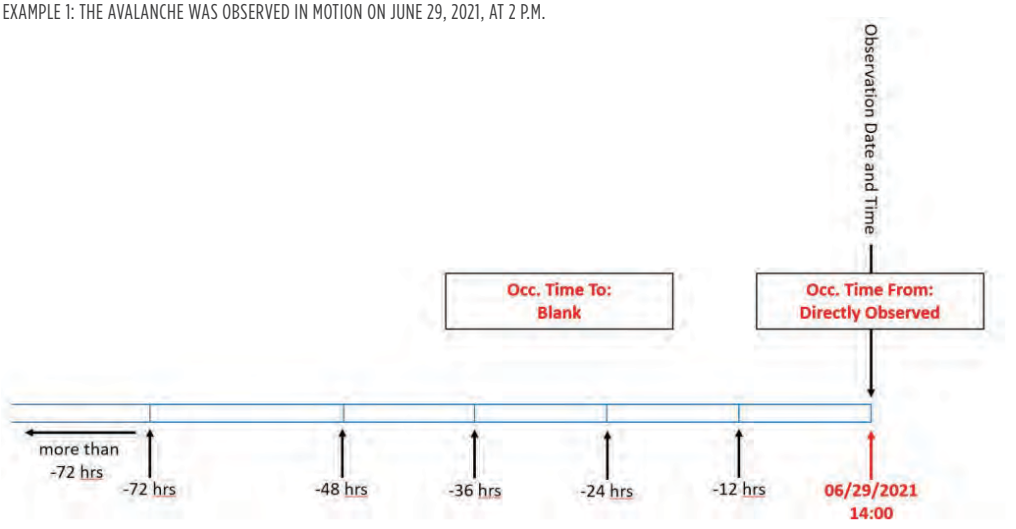
FIG. 2: AN AVALANCHE WAS NOT OBSERVED WHILE IN MOTION. THIS PAST AVALANCHE IS ESTIMATED TO HAVE OCCURRED BETWEEN 12 AND 48 HOURS PRIOR TO THE OBSERVATION DATE AND TIME.

Scenario 1: I saw the avalanche in motion. This could be a naturally triggered avalanche and the observer happened to be in the right place at the right time. More commonly these are human-triggered avalanches where the observer was on site when an avalanche was triggered by them or someone on their team.

Data Entry:
Obs Date: Select the date on which the avalanche was observed in motion.
Obs Time: Enter the time at which the avalanche was observed in motion.
Occ Time From: Select "Directly observed"
Occ Time To: Leave blank

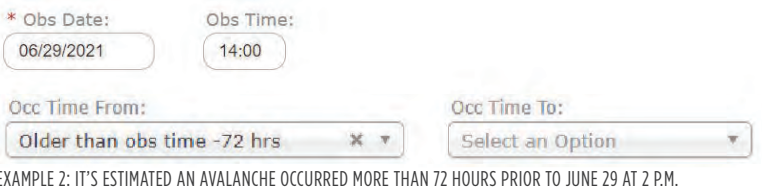


EXAMPLE 1: THE AVALANCHE WAS OBSERVED IN MOTION ON JUNE 29, 2021, AT 2 P.M.

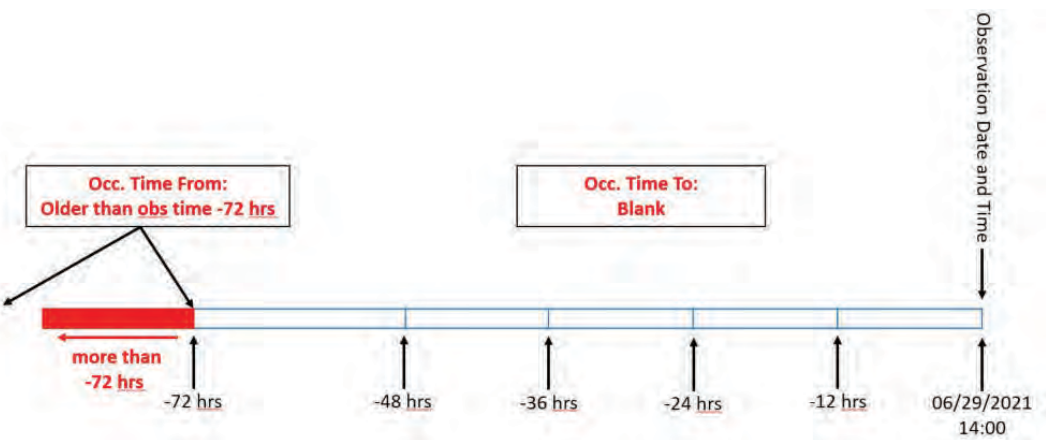


Scenario 2: I did not see the avalanche in motion but observed evidence of previous activity. I estimate the avalanche ran more than 72 hours before the time I observed the evidence. In this scenario, a down avalanche was observed at some point after it ran but it's more than 72 hours old.

Data Entry:
Obs Date: Select the date on which the evidence of a down avalanche was observed.
Obs Time: Enter the time at which the evidence of a down avalanche was observed.
Occ Time From: Select "Older than obs time -72 hrs"
Occ Time To: Leave blank.



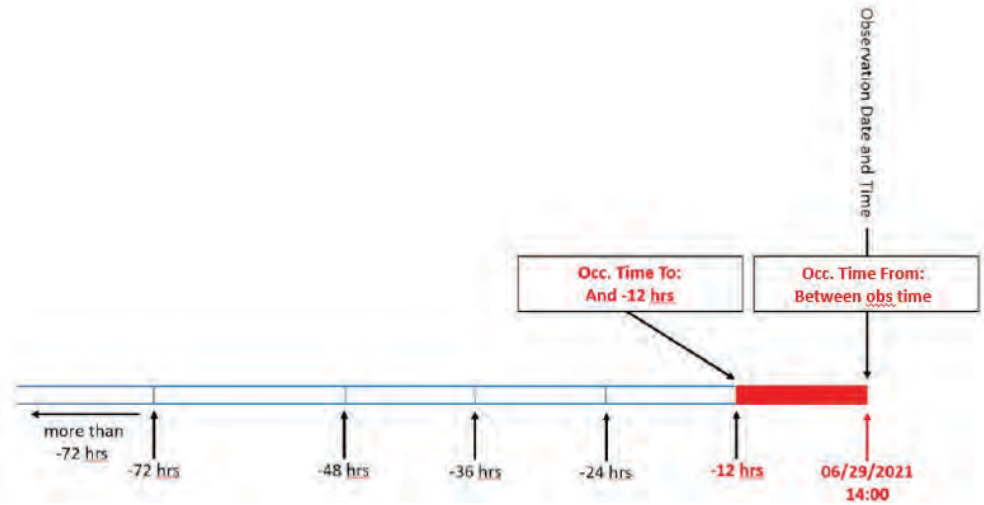
EXAMPLE 2: IT'S ESTIMATED AN AVALANCHE OCCURRED MORE THAN 72 HOURS PRIOR TO JUNE 29 AT 2 P.M.



Scenario 3: I did not see the avalanche in motion but observed evidence of previous activity. I estimate the avalanche ran during a window of time that opens no more than 72 hours prior to the observation time and closes at the occurrence time. In this scenario, the avalanche ran between the observation time and 12 hours prior to the observation time.

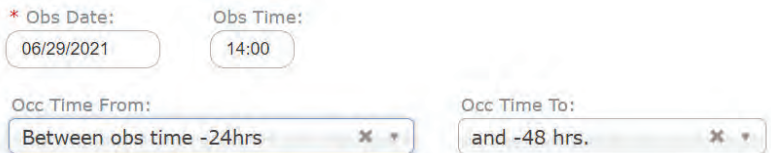
Data Entry:
Obs Date: Select the date on which the down avalanche was observed.
Obs Time: Enter the time at which the down avalanche was observed.
Occ Time From: Select "Between obs time:
Occ Time To: Select "and -12 hrs"

EXAMPLE 3: AVALANCHE OCCURRED BETWEEN JUNE 29 AT 2 P.M. AND 12 HOURS PRIOR TO THAT TIME.

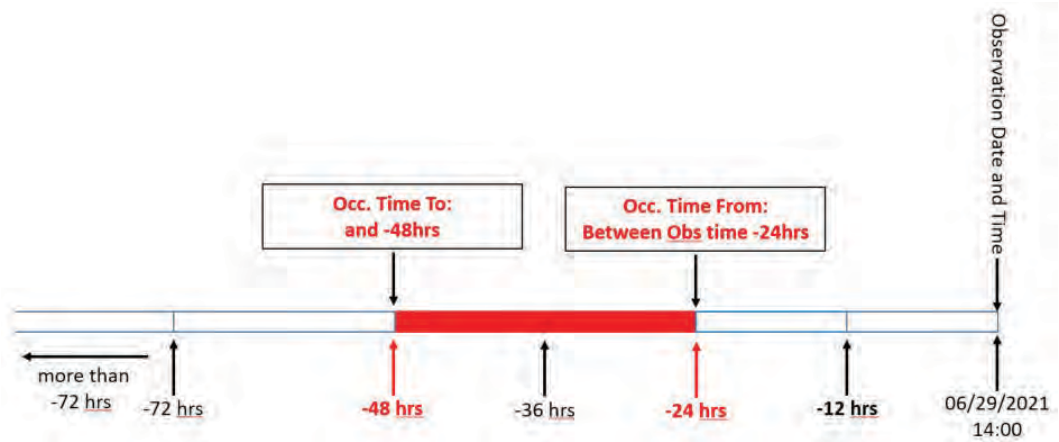


Scenario 4: I did not see the avalanche in motion but observed evidence of previous activity. I estimate the avalanche ran during a window of time that opens no more than 72 hours prior to the observation time and closes no less than 12 hours prior to when I observed the evidence. In this scenario, the avalanche is older than 24 hours before the observation time but newer than 48 hours before the observation time.

Data Entry:
Obs Date: Select the date on which the down avalanche was observed.
Obs Time: Enter the time at which the down avalanche was observed.
Occ Time From: Select "Between obs time -24hrs"
Occ Time To: Select "and -48 hrs"



EXAMPLE 4: AVALANCHE OCCURRED BETWEEN 24 HOURS PRIOR TO JUNE 29 AT 2 P.M. AND 48 HOURS PRIOR TO THAT TIME.

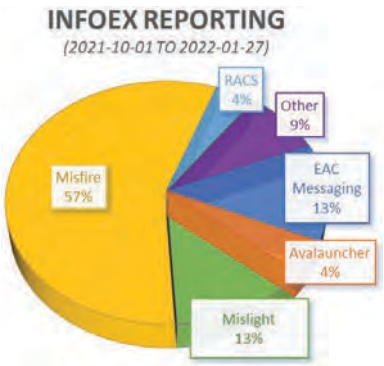


Fuse News

Steve Brushey

THE LAST FEW MONTHS have primed the Explosive Advisory Committee (EAC) to update the membership. The mid-season InfoEx reporting statistics reflect a high-level visualization of the current EAC work topics.

The level of reporting of explosive-related issues into InfoEX continues to grow, with 23 reports as of mid-February this season compared to 13 total last season. These reports help the EAC follow trends in our industry. Front and centre are the challenges with safety fuses this winter—no one supplier escaped problems with their fuse product. The good news is both suppliers, CIL and Dyno-Nobel, continue to provide excellent support to the avalanche industry. I certainly appreciate the candid conversations I can have with Braden Schmidt at CIL and Todd Lenzi at Dyno-Nobel when product or procedural discussions are warranted.



EAC UPDATE

As EAC chair, I am grateful for the well-rounded representation from all avalanche sectors on the committee. When questions come up, I can reach out to one of several experienced professionals for valuable and timely feedback.

The EAC met virtually in late-January. We discussed the number of safety fuse reports received to date, the new RACS forum on the CAA website, and upcoming changes to ski hill explosive magazine locks and regulations. Key points from the discussion include:

- One of the takeaways from recent safety fuse issues was tracking date/batch codes. The EAC recommends users DO NOT mix date/batch codes. A box should be discarded in appropriate fashion when emptied and not re-used. Stock/product consolidation IS NOT recommended so batch/date codes aren't mixed up. Users should also track date/batch codes as they are used in control missions.
- Operators should immediately stop using products that have been recalled by the manufacture.
- With some safety fuse assemblies, pull-wire ignitors may not fit well. This should be noted with focused training so users are trained with the specific product their operation is using. Pull-wire ignitors must be stored in a dry, cool location and kept in good condition right up to when being used.

ISEE MEMBERSHIP

The International Society of Explosive Engineers (ISEE) is welcoming membership from avalanche professionals in Canada and hoping more avalanche control blasters join its ranks. This past fall, the EAC was invited to the ISEE Western Canada Chapter AGM in Kamloops. Unfortunately, like everything COVID, it was postponed until Sept. 22-25, 2022. A preferred room rate using booking code GFT-10519 is available from the Coast Hotel for CAA members who attend. Finally, the ISEE has scholarships available to its members. For details, visit iseewest.org/Scholarships.

BLASTING CERTIFICATION UPDATE

We have been told by the BC Ministry of Energy, Mines and Petroleum Resources that the blasting certification process will transition to an online format. The ministry hopes this will alleviate some of the lengthy delays caused by the past process. Additionally, the WorkSafeBC Blasting Certificate examination for both new certifications and re-certification is now done online. This has definitely resulted in cost savings and improved efficiency for CAA Members. Nice work WSBC!

WORKSAFEBC CPD UPDATE

WSBC updated its requirements for continuing professional development. It originally recommended eight hours of training, while the EAC suggested four was sufficient. According to Section 21.8.1 of the OHS Regulations, six hours of annual CPD is required. It can be delivered by employers, blasting product manufacturers, external third-party agencies, or through attending conferences; and can be done online or in-person. It should focus on general best practices for the type of blasting covered by the holder's active certificate, and may also include more general topics such as safety talks, explosives storage, and transport. For more information, contact WSBC.

EXPLOSIVE REGULATORY UPDATE

Some of you know by now that some issues related to guideline G06-03 (ski hill magazine storage) are back on the table. Few hills have sufficient area to allow the explosives used in avalanche control to be stored at normal quantity/distances. The guideline seeks to balance the risks of storing explosives closer than normal to the public against the benefits of an effective avalanche control program.

Through the past work of the CAA, EAC, and Canada West Ski Areas Association, the Explosive Regulatory Division (ERD) agreed to grandfather in existing hill storage magazines that were not in compliance with distances specified in G06-03. In a nutshell, the ERD is now requesting all hill storage magazines are made compliant with the guideline. As magazine licences are renewed, ski hills may find themselves in a similar predicament as when G06-03 was first issued. A collective approach involving the EAC, the CAA, and the CWSAA will be pursued with our regulatory agency.

Contributors

Over the last 24 years as a heli-ski guide, CSGA instructor, and more recently as an avalanche technician, **ERIN TIERNEY** has been honoured to hear a lot of people's stories and shared a few of her own, which includes healing from PTSD following a helicopter crash. She is the current president of the CSGA and chair of the Education Committee, and a Professional Member of the CAA, where she sits on the Membership Committee.

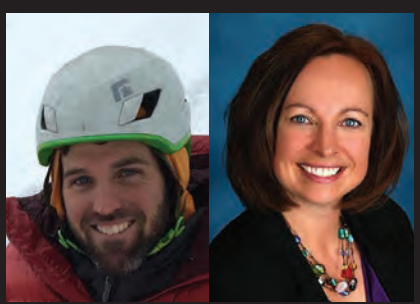
27 FIRST AID FOR THE BRAIN—THE IMPORTANCE OF A CRITICAL INCIDENT STRESS MANAGEMENT PLAN

JEFF GOODRICH began his avalanche career as a ski patroller and avalanche technician at Sunshine Village. He made the move to Parks Canada in 1991, joining the avalanche program in Rogers Pass. He has served as the Program Manager for the Avalanche Control and Visitor Safety Program in Glacier National Park since 2012. He is retiring at the end of this season after 34 years in the industry.

20 AVALANCHE DETECTION IN GLACIER NATIONAL PARK—AN OPERATIONAL PERSPECTIVE

ELIOT BROOKS is a 10-year resident of Revelstoke, B.C., and a ski patroller of seven years. He recently made the move into industrial avalanche safety, and is new to working night shifts in the snow. During the off season he works for the BC Ambulance Service and enjoys hunting, fishing, and riding his bike.

24 NIGHTSHIFT—A REFLECTION ON WORKING NIGHTS AND TOOLS FOR MANAGING RISK



ERIC HASKELL is a third-year Physician Assistant student at Rocky Vista University. He is also an AIARE instructor with experience guiding human-powered and mechanized skiing.

DARCY SOLANYK, MS, PA-C, received a Master of Science from CSU and her Physician Assistant Certificate from the CU's Child Health Associate/PA Program in 2007. She practiced in Pediatric Gastroenterology at Children's Hospital Colorado in Aurora, Colorado before transitioning to PA education in 2010.

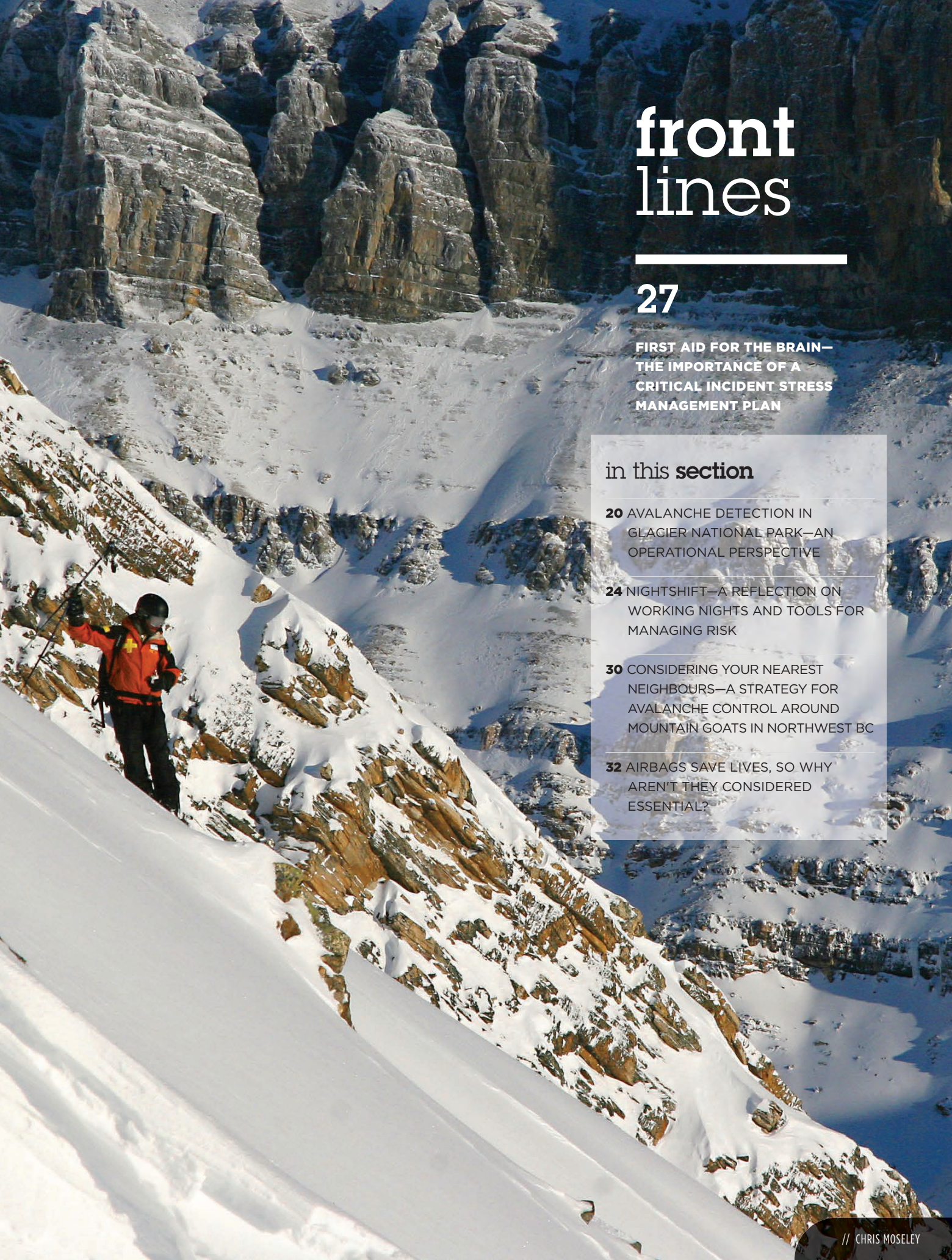
35 POST-TRAUMATIC STRESS DISORDER PREVALENCE IN RECREATIONAL AND PROFESSIONAL ALPINE SPORTS—A RETROSPECTIVE STUDY

CHRISTOPHER VAN TILBURG is a physician and rescue mountaineer with Hood River Crag Rats and Portland Mountain Rescue in Oregon. He is first author of the Wilderness Medical Society's Avalanche Practice Guidelines and author of 11 books, including two mountain rescue memoirs. He is chair of the Mountain Rescue Association's Medical Committee and a USA delegate to the International Commission for Alpine Rescue.

32 AIRBAGS SAVE LIVES, SO WHY AREN'T THEY CONSIDERED ESSENTIAL?

SARAH HUENIKEN has been alpine/ice guiding in the Canadian Rockies for 16 years as an ACMG Alpine Guide and Instructor and Examiner for the Training and Assessment Program. With the loss of her dearest friend to an avalanche while ice climbing, Sarah understands the risks of the mountains with the greatest respect. Her new focus is to help build awareness to both the inherent risks of avalanches for ice climbers and the healing process after trauma through founding the Mountain Muskox Peer Mentorship Program.

38 ICE CLIMBING ATLAS



front lines

27

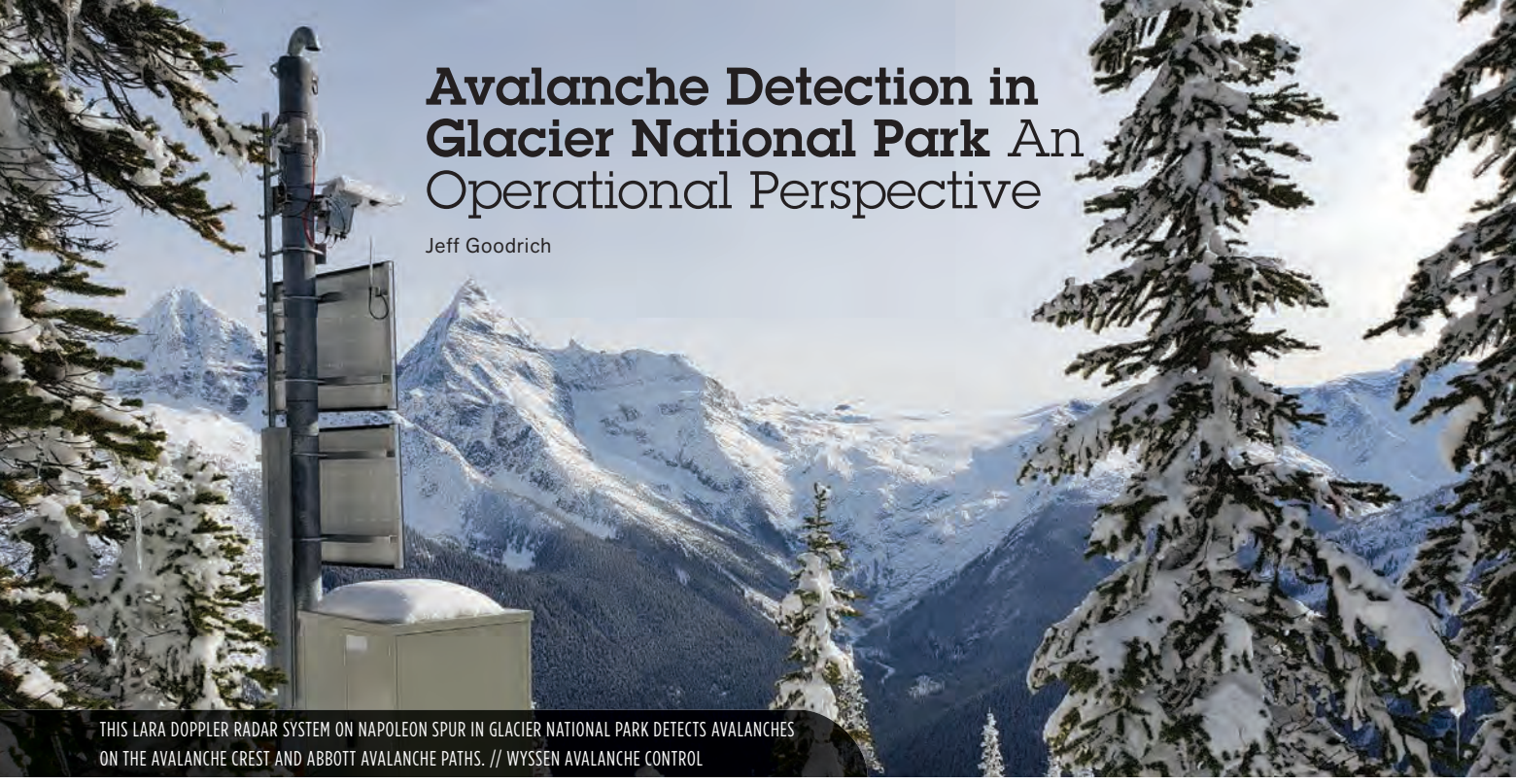
FIRST AID FOR THE BRAIN—THE IMPORTANCE OF A CRITICAL INCIDENT STRESS MANAGEMENT PLAN

in this **section**

// CHRIS MOSELEY

Avalanche Detection in Glacier National Park An Operational Perspective

Jeff Goodrich



THIS LARA DOPPLER RADAR SYSTEM ON NAPOLEON SPUR IN GLACIER NATIONAL PARK DETECTS AVALANCHES ON THE AVALANCHE CREST AND ABBOTT AVALANCHE PATHS. // WYSSEN AVALANCHE CONTROL

MY SMARTPHONE CHIMES notifying me I have a new text message. It's an automatic alert from the avalanche detection network in Glacier National Park, British Columbia. The message: an avalanche just occurred in the Gunners/Mannix sector of the park.

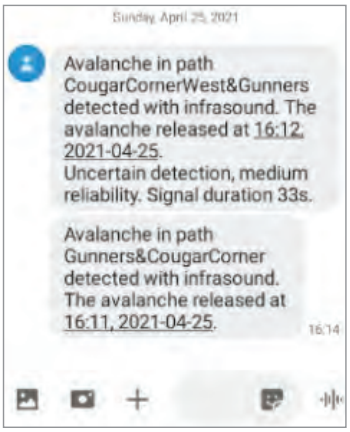
Avalanche activity has been picking up in the last few hours but visibility has been poor all day and it's been difficult to see what's happening on the ground. I check our web platform and see the avalanche initiated in Gunners #1 slide path and stopped well above the road. This latest alert still fits with my current assessment of gradually rising avalanche hazard and the need for avalanche control later this evening. If the detection network showed the avalanches getting too close to the road, I might have needed to consider an earlier start for avalanche control work. For now, the detected activity is consistent with what is typically seen leading up to a road closure and avalanche control. I continue planning the shoot and wait to see what the next detection might tell me. A relatively new addition to the suite of avalanche forecasting and control tools in Rogers Pass, the avalanche detection network (ADN) is proving its worth.

Over the past five years, the ADN has been delivering real-time data to Glacier National Park's Avalanche Control Section. This information is used to assist with operational decision-making. This article looks at my experience with the network in Rogers Pass and how the avalanche control team is incorporating this information into daily operations.

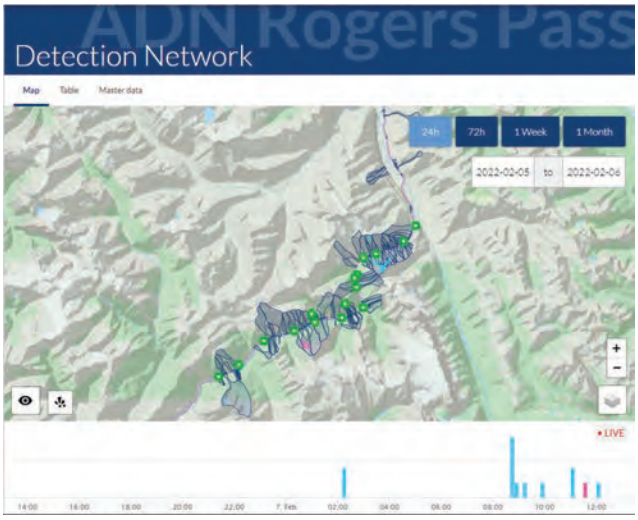
The ADN in Glacier National Park was one of a number of avalanche mitigation projects realized through the Government of Canada's Federal Infrastructure Investment Program. ADNs were initially proposed as one of the measures to improve the reliability of the Trans-Canada Highway in winter in a study by the BC Ministry of Transportation and Infrastructure. Parks Canada contracted McElhanney Engineering and Dynamic Avalanche Consulting to assess the feasibility of an extensive ADN in Rogers Pass and to develop a request for proposals. Wyssen Avalanche Control was the successful bidder to design, supply, and install the network. What started as a pilot project in 2016-17 with one detector, now consists of 13 infrasound arrays (IDAs), four doppler radar installations (LARAs), one short-range radar (SARA), one laser scanner (LIA), and an integrated web-based platform (WAC.3). This project represents the largest avalanche detection network in the world.

HOW THE ADN WORKS

When the ADN picks up avalanche activity, it sends out notifications. Text messages are the go-to method of receiving the first alert that an avalanche has occurred. Email notifications are also available, but texts are generally found to be more immediate and are received within minutes of an avalanche being detected on our smartphones or tablets. I have even received text notifications before being able to see the avalanche coming over a snowshed during



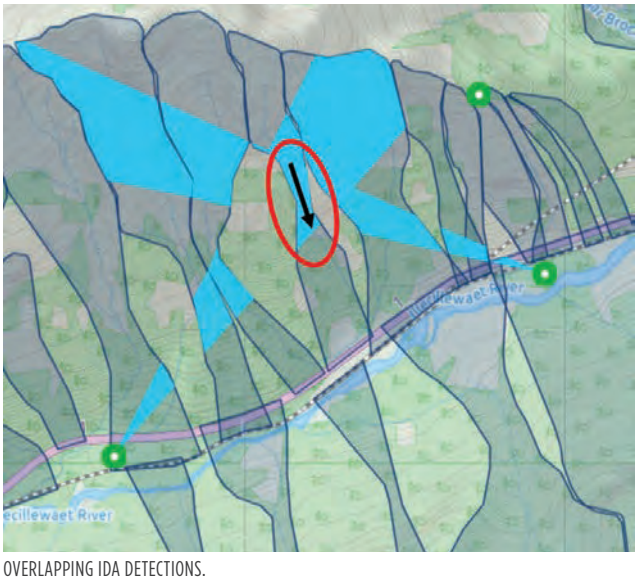
A TEXT ALERT FROM THE AVALANCHE DETECTION NETWORK.



THE AVALANCHE DETECTION NETWORK MAP.

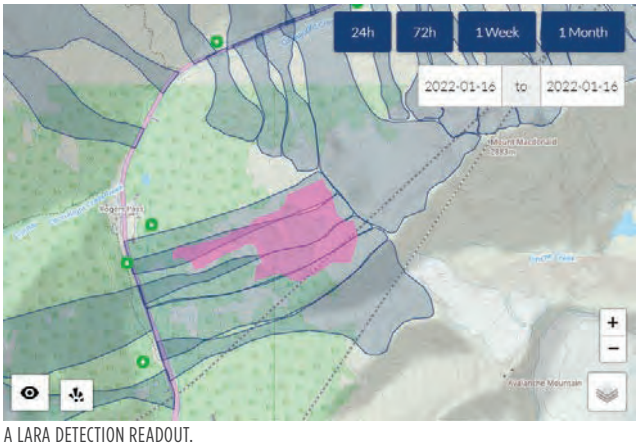
avalanche control at night. Alerts are received for all forms of detection and the message includes the group of avalanche paths covered by the infrasound detection, the "reliability" or confidence of the detection, and the time and date of the detection.

In Glacier National Park, the IDAs generally pick up size 2 avalanches and greater; however, the position of the sensor array in relation to the individual avalanche path and the terrain characteristics in the area can increase or decrease the minimum size of the avalanche detected. A sensor array close to an avalanche path with no intervening terrain will detect smaller avalanches than a sensor farther away with terrain shadowing the avalanche path. Signals from large avalanches are not as affected by terrain and are usually well detected, with multiple arrays making detections.


OVERLAPPING IDA DETECTIONS.

After the initial alert is received, we can look at the WAC.3 web platform to get more detailed information on the detection to help us interpret what is going on. The platform displays a map of the area with the outlines of our avalanche paths. The locations of the IDA and LARA detectors are also on the map and any avalanche detections are displayed. The default view shows the last 24 hours; however, any time or date range can be selected.

The IDA detections are displayed on the map as a triangle radiating out from the detector. One leg of the triangle indicates the direction where the avalanche signal was picked up and the other leg indicates the direction where the avalanche signal was no longer heard. When two or more IDAs detect the same event and their triangles overlap, the avalanche can be localized to a single avalanche path. If the avalanche



A LARA DETECTION READOUT.

is detected with only a single IDA, the avalanche can only be localized if the detection points to a single path. For single IDA detections that cross multiple paths, the individual avalanche path may not be localized, but useful information can still be gained about how far the avalanche ran.

LARA dectections from the doppler radar are usually easy to interpret and can give a good rendering of the avalanche when properly calibrated and working well. The SARA and LIA detectors are located on the Wyssen avalanche control towers and detect if an avalanche was triggered from remote explosive control.

The transportation corridor in Glacier National Park through Rogers Pass has 135 avalanche paths that have the potential to affect the highway or railway. Having good situational awareness of avalanche activity in the transportation corridor is key for creating avalanche assessments and timing avalanche control activities. Visibility, in terms of weather, daylight, and geographic area, can hinder the ability of avalanche forecasters

to obtain accurate and timely avalanche observations. The ADN has been found to greatly assist the team in decision-making and it continues to be incorporated into daily operations.

DAILY OPERATIONS

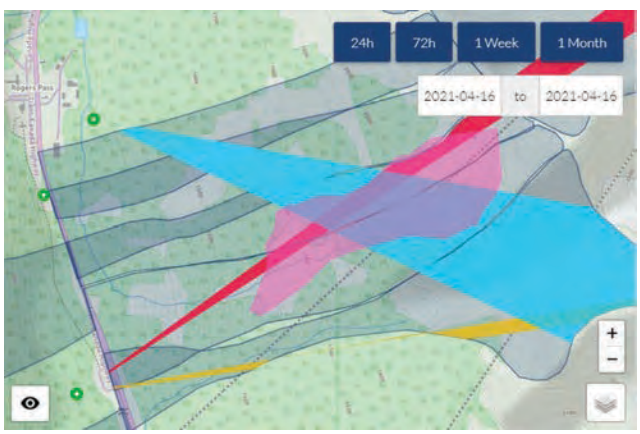
ADN information from the overnight period is incorporated into our morning avalanche assessments on a daily basis. Having an indication of overnight avalanche activity—or lack of activity—is an asset first thing in the morning, before avalanche forecasters have had a chance to get out and visually look for any new avalanches. This information can give us greater confidence in our decisions and assessments as we prepare for the day's operations.

During the operational day, the detection network can help us target our patrols in terms of timing and geographical area. When visibility is poor, it helps us focus in and pick out events we might have missed otherwise. This greatly assists with the forecasters' situational awareness and can give an early alert to deteriorating avalanche conditions.

Every night during the winter, Glacier National Park has a duty forecaster on call who may need to give advice for work or incident management in avalanche zones along the highway. Having the detection network as an additional tool gives increased confidence in making these decisions. Before installing the ADN, we would set alarms on weather telemetry as a proxy for when avalanches might be running or conditions were changing. Now, we also have reliable alerts on the avalanches themselves.

AVALANCHE CYCLE AND CONTROL

Going into an avalanche cycle and timing control activities is always an intense and stressful period.



MULTIPLE DETECTIONS OF THE SAME EVENT DURING HOWITZER CONTROL. RED IS A CONTROLLED AVALANCHE, BLUE IS AN AVALANCHE, PINK IS THE RADAR, AND YELLOW INDICATES GUNFIRE.

During this time, we watch the ADN closely to help us with closure timing and alert us to changing conditions.

In the pre-shoot phase, we monitor rising hazard to ensure the closure timing and avalanche control strategy are still reasonable or if we need to make adjustments. In this phase, the forecaster is monitoring the frequency of avalanche activity and how far the avalanches are running. Traditionally, darkness, poor visibility, and the limitations to being out on the road have been challenges. With the aid of the ADN, the forecaster can remotely monitor avalanche activity and follow up if any significant events are detected.

During the shoot, which is often at night or in the middle of a storm, assessing the results can be difficult due to visibility, environmental conditions, or the character of the avalanches. The detection network can either confirm a lack of results or that avalanches are indeed running, but unseen. This is very valuable information the forecaster can use when deciding how many or few targets to shoot.

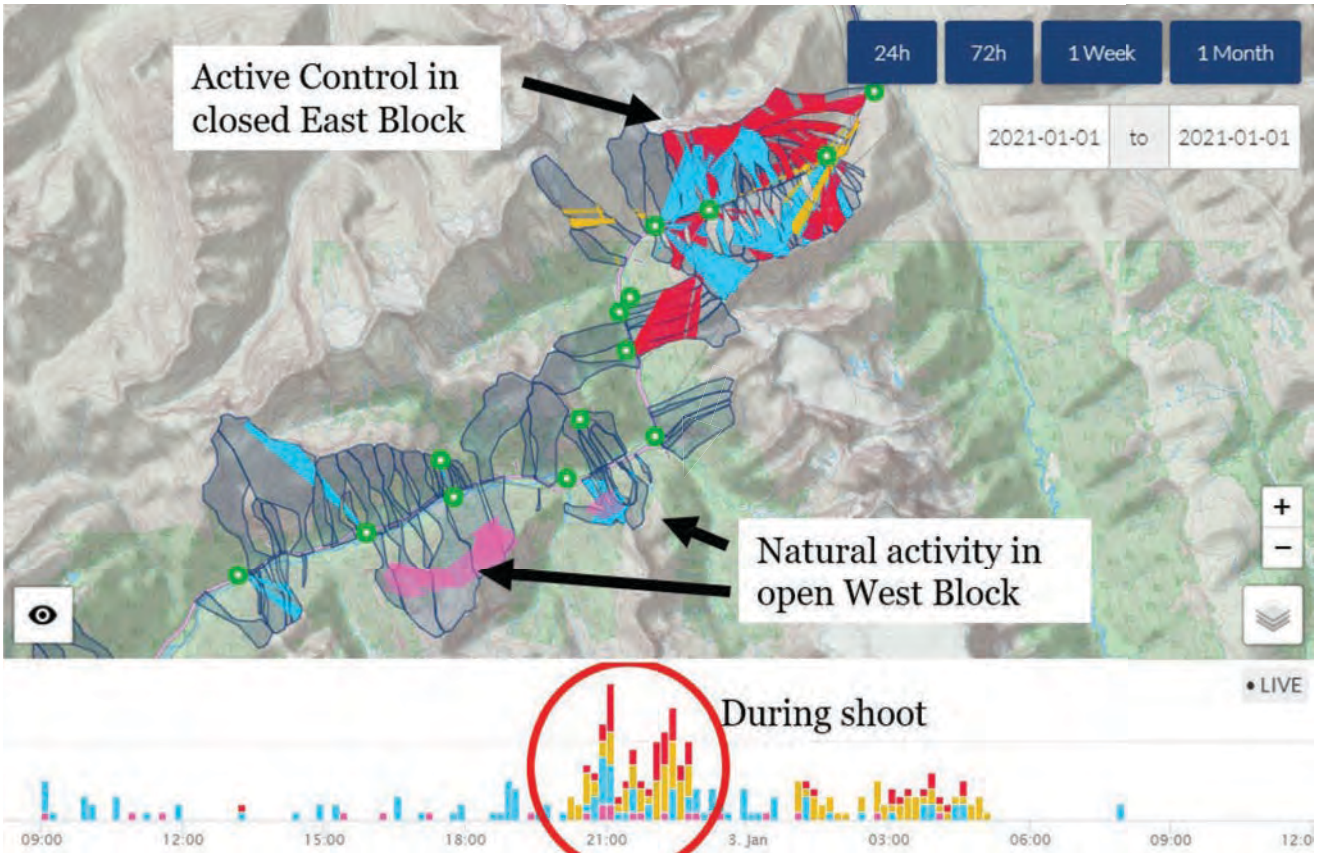
Another valuable use of the network during avalanche control is to monitor avalanche activity in other areas of the transportation corridor outside of where active control is taking place. For example, the highway may be closed while we are shooting in our east block, but traffic is still flowing through our west block. Avalanche activity can be monitored remotely in the west to determine if and when a preventive closure may be required in that area.

After the shoot, especially if it is at night, it is beneficial to have the confirmation of a lack of avalanche activity from the detection network. This gives confidence in the effectiveness of the control or, alternatively, it can give an alert to changing conditions if detections are starting to increase in the post-control period. The next day, we can review all the detections throughout the avalanche cycle to help us compile our database record of shoot results and natural activity.

Reviewing the detections can also help assess the risk reduction to the transportation corridor on a path-by-path basis by indicating avalanche events that may have been obscured by snowfall or subsequent avalanches.

CHALLENGES AND OPPORTUNITIES.

One challenge is the sheer amount of information forecasters are receiving during busy times such as an avalanche cycle with control operations. During a shoot, the forecaster is directing the artillery, observing avalanches, deciding on targets, and moving to the next observation location. Often, as the text alerts come in, the forecaster does not have time to look at them all



DURING ACTIVE CONTROL, NATURAL ACTIVITY OUTSIDE THE CLOSURE AREA CAN BE MONITORED REMOTELY

and follow up on the web platform. Having a second forecaster to check the detections can be a big help.

A small number of false alarms have also been seen. Though not enough to degrade the overall performance of the system, Wyssen is looking at ways to filter these out. For example, several false alarms from the doppler radar sensors may be attributed to weather effects meeting the radar's threshold to classify them as avalanches. The false alarm can often be recognized in the WAC.3 interface by looking at the heat map of the detection, which does not look like the outline of an avalanche. With the infrasound sensors, we have had a recurring false alarm that points to the portal of a snowshed, presumably from vehicles or strong winds. The ADN also detects when the howitzers are fired but has picked up a number of false gun firing detections, most likely from train and traffic noise.

One area of opportunity is to better understand the effects of terrain on avalanche detection. It seems that some avalanche events are more easily detected in certain paths than others. Having a better understanding of how the characteristics of each path affect the infrasound signal would help us better interpret the information the detection network is providing. The goal is to follow up and continue to tune and refine the resolution of the avalanche detection.

CONCLUSION

The avalanche detection network has been found to be immediately useful and beneficial in helping Parks Canada's Avalanche Control Section do its job. I personally appreciated the data provided to assist with critical decisions and it has been embraced enthusiastically by our forecasting team. Getting real-time information when avalanches are running is a huge benefit to reducing uncertainty in our hazard assessments and increasing our situational awareness. The ADN helps us make decisions that impact avalanche control operations and any other work that takes place in Glacier National Park's avalanche zones. The results of this project have helped increase the safety to the public and to our team members, and the reliability of the Trans-Canada Highway in winter.

Nightshift
A Reflection on Working Nights and Tools for Managing Risk

Eliot Brooks

AN AVALANCHE WORKER INSPECTS THE RESULTS OF A CONTROL SHOT ON NIGHTSHIFT. // NICK COMSTOCK

I CAN BARELY HEAR MY PARTNER on shift yell "Heads up!" as he takes another tentative step out towards the cornice. The 10 short-bus sized generators that power our worksite are humming too loudly. Between that and the wind, communication isn't great. It is the darkest time of night, and a moderate wind is blowing consistently from the east. With the floodlights of the generators behind me, trying to make out my partner isn't easy. Thankfully, he has fresh batteries in his headlamp and I can see it wiggle as he makes his way across the cornice. One big stomp and the slope is scattered with washing machine and microwave-sized chunks of snow.

We are three-quarters of the way through our shift and hustling to get this lap done so we can complete our 3 a.m. explosive control on time. We have been going steadily since our shift started at 5 p.m. and I am totally zonked. My partner is mid-rotation and already fully transitioned to the vampire life, while I have only been on site for a couple days. Thank heck for that, because in my state of exhaustion, I am a warm body at best.

Busy shifts like this one are what most folks in the avalanche patch live for or, at the very least, tolerate. Bad weather, tight deadlines, and hazardous terrain are ubiquitous in avalanche work and should not be a surprise to anyone. I'm a former ski patroller, so explosives and ski-cutting are tasks I am familiar with. However, I am new to industrial avalanche work, so working in avalanche terrain in the dark is a novelty. Apart from the odd alpine start, I have had minimal experience navigating avalanche terrain and making decisions at night. The growing pains of a new employer are slowly beginning to fade, but sleep deprivation remains an area of interest to me.

It is easy for me to say I will just be extra careful and conservative when I'm tired, but we are all human. Eventually, external or internal pressures and job complacency will conspire to push me towards making a bad decision or a mistake. How can I continue to work confidently and safely in the dark, exhausted? How do we recognize this increased risk? How do we mitigate it?

With all the interest in human behaviours and workplace accountability these last few years, it seems relevant to address this small, high-risk group of avalanche workers. To help me begin to wrap my head around this, I reached out to several avalanche professionals, all of whom have worked or do work nightshift. I would like to iterate that this article is not meant to reach any sort of conclusion regarding best practices or to pass judgement on any of the operations I had the privilege to learn about. It is just meant as a lubricant for us to talk about our increased risk, and perhaps shed some light (*wink, wink*) on our differences.

CIRCADIAN RHYTHM

The circadian rhythm is our body's natural response to a 24-hour cycle of light. This diurnal cycle controls or heavily impacts a wide range of body functions including, but not limited to, mood, diet, metabolic function, immune function, and sleep. This control is largely through two hormones: melatonin and cortisol. Melatonin is a hormone that makes you sleepy. It is produced more heavily in the night and is suppressed during the light of day. Conversely, cortisol makes you alert and is produced heavily in the morning. Irregular exposure to light can disrupt the release of these two hormones. Not surprisingly, people experiencing circadian disruption, such as night workers, are at an increased risk for mood disorders, cancer, diabetes, obesity, and cardiovascular disease.

ALERTNESS

Long-term effects aside, sleep deprivation impairs many types of performance. It reduces the ability to concentrate, slows reaction time, and reduces the ability to remember and learn new facts and motor skills (Goel et al., 2009). Sleep deprivation also leads to irritability, bad mood, reduced communication skills, and reduced ability to cope with the emotional demands of the workplace. Researchers report that decision-making ability deteriorates and risk-taking behaviour increases (Killgore, Grugle, & Balkin,

2012). Additionally, researchers found that sleep-deprived participants did not recognize how poorly they were performing; they tended to think they were doing better than they were (Van Dongen & Belenky, 2009).

Despite what we may tell ourselves, it doesn't get better with experience. Studies of medical residents suggest that training and longer experience living with restricted sleep do not make a person more resistant to the negative performance effects of sleep deprivation (Arnedt, Owens, Crouch, Stahl, & Carskadon, 2005; Van Dongen, Maislin, Mullington, & Dinges, 2003).

THE NUMBERS

All of these negative effects do have a consequence. Compared with day shifts, risks of injury or worker error resulting in an incident are 15% higher for evening shifts and 28% higher for nightshifts. When compared with eight-hour shifts, 10-hour shifts increased the risk by 13%, and 12-hour shifts increased risk by 28%. Risk increased by 17% for the third consecutive nightshift and 36% for the fourth. Risk starts to decrease after night four as the body adjusts to its new schedule (Folkard & Lombardi, 2006).

When we think about the types of hazards avalanche workers are exposed to, we must consider carefully our increased risk of incident due to exhaustion. Our hazardous tasks may result in avalanche involvements, mishandling of explosives, and under-forecasting a problem. These are all objectively dangerous to the worker, and also tend to have larger implications for an operation or other workers.

OPERATIONAL CONTROLS

Through talking to professionals in a variety of avalanche safety roles, I was able to identify a few areas of practice where we can lower some of our workplace risk. Firstly, what operational controls can an avalanche program put into place? Next, what kind of training is most valuable, and how do you go about it? Third, how does experience play into this equation? Lastly, what kind of equipment can you invest in to help your cause?

Scheduling strikes me as the area with the largest potential to decrease risk. A staggered shift rotation seems to be the best operational control I see. We know that the risk of worker error peaks on night four and steadily decreases as we adjust to nights. If we spend the first four to five nights working with someone who is in the middle to end of their shift, say nights seven to 10, we at least have one mostly-operational brain on slope. A major downfall of this method is that it only really works for a workplace with rotational shift-work. It also seems that a recurring pattern is a nightshift being short-staffed. I suspect this is because they tend to have less responsibility than dayshift, often doing just the minimum to keep the operation running safely. Ironically, working while exhausted should warrant more workers to ensure best practice is being adhered to.

Other operational controls could include a tool like the Response Assessment and Decision Making Support tool. This is a standardized workflow with a series of scored, controllable factors to help track and lower risk. Critical factors include training, experience level, resources available, and more. Something like this can be useful for complex night ops but doesn't seem terribly convenient for regular use. Maybe only on nights one to five? I am uncertain of the best application for something like this, but it is a good potential tool.

TRAINING

While it is sometimes difficult to motivate at night, I must advocate for training during nightshift. This includes skiing, sledding, and travelling through the terrain when not operationally necessary. This is a topic of contention with many folks I talked to. While increasing your exposure to avalanche terrain at night seems counter intuitive, being comfortable and well trained for that environment is key. If you need to do a control route on skis because a rain event decided to show up at midnight and is threatening a building, you had better be intimately comfortable with that terrain. The same way my old ski patrol supervisor made us tie knots behinds our backs with wet gloves on to prepare for real rescues, we should train for night ops in the night.

Another relevant issue with training is that those who work nights tend to miss a lot of extra-curricular training. I will use helicopter long-line rescue training as an example. If your dayshift rotation has bad flying weather, you likely aren't going to be able to get signed off for it. This means that if the dayshift responds to an incident and decides from the scene that a long-line is in order, their closest resource—you getting called out of bed to respond—is no longer an option.

Solutions for training gaps seem to be a hang-up for a few operations. Rotational shift-work schedules certainly make it difficult to get everyone on the same page, especially with seasonal work where folks are working summer jobs. While there are ways to close this gap, most involve pre-season training, more personnel, and extra workload for management. All options seem expensive and solutions are specific to the shift pattern and workplace. Nonetheless, it is something for team leaders to think about moving forward.

EXPERIENCE

Experience is tied into training, scheduling, and operation controls. We know that being a long-term night worker doesn't lessen your likelihood of having of an incident due to exhaustion, but that doesn't mean experience at night counts for nothing. Four seasons of ski patrolling will help if you need to go rescue someone in avalanche terrain after dark, but it is exponentially more valuable if you have experience moving through that terrain in the dark, without the added stress of a critical task. Don't throw the rookies into a new environment together and expect a totally smooth program. That should be obvious, but a crew member with a couple seasons of experience on dayshift is not a substitute for a seasoned snow vampire to make sure everything runs as it should.

TOP: AN AVALANCHE TECHNICIAN PREPARES A SHOT MID ROUTE, BY HEADLAMP. // NICK COMSTOCK; BOTTOM: SNOWPACK STUDY IS LESS CONVENIENT AT NIGHT, BUT STILL NECESSARY. // BRENDAN MARTLAND

EQUIPMENT

Light plants, headlamps with long battery life, and good reflective gear are your friends. I find the reflective gear particularly peeving. I recommend GORE-TEX patches slapped right onto a ski jacket and pack so you are still using equipment you are familiar with. While not critical, most workers seem to have a system for keeping tools in the right place—e-tape here, crimpers there, radio here, etc. It is mostly a nicety, but I tend to find switching back and forth from a separate high-vis vest to a regular ski jacket annoying for moving gear around. If it means one less forgotten pull wire a year, it may be worthwhile; it's one less hole in the Swiss cheese.

CONCLUSION

There are many other tools that can be used that I did not talk about. Operations often have different risk tolerances, which is legitimate. Basically, all I can conclude is that nightshift is NOT just dayshift in the dark. It's exhausting, bad for the health, and presents a unique challenge in risk management. I hope this article at least stimulates conversation and raises some awareness for the good things, which do exist, and the bad about working nights.

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First Aid for the Brain
The Importance of a Critical Incident Stress Management Plan

Erin Tierney

THE CONVERSATION ABOUT MENTAL HEALTH is a tricky one to start in our industry of mountain professionals. Historically, when it was raised, you were taking a risk. Stoicism, the endurance of pain or hardship without the display of feelings and without complaint, was the dominant mindset. Though stoicism certainly has its place at times, there is also a need for resiliency, which is the ability to draw on personal strengths as well as the support of the community. Developing resiliency creates the awareness to acknowledge and the opportunity to work through emotions when impacted by an event, especially one that is outside of your day-to-day norm.

Patrollers and dedicated rescue teams aside, we are not first responders. We train extensively for rescue scenarios, but they fall under the category of an abnormal event in our regular duties and, therefore, a wide range of reactions are considered completely normal. The probability of experiencing a traumatic event is almost certain if there is enough exposure, like in the case of a lengthy career. This reality is often acknowledged. What has been harder to say is that sometimes, after the debrief is over and the world has moved forward, some of those that experienced the event are still grappling with what happened and it doesn't feel good. The impacts of these exposures on an individual can vary widely—from an experience you are able to acknowledge, and move on from with little after effect; through to an event that stops you in your tracks, shatters your belief system, and leaves you with a constant sense of foreboding.

The ability to recognize, acknowledge, and manage stress after a traumatic incident is a sign of strength and awareness of critical incident stress (CIS). CIS refers to the range of physical and psychological reactions one may experience after an incident. It can, and does, affect anyone regardless of experience, gender, or age; and is a completely normal reaction to an abnormal event.

PSYCHOLOGICAL FIRST AID

Getting psychological first aid for your brain is akin to getting physiotherapy for a physical injury. How many times have you tweaked your back, knee, or shoulder and limped through the healing phase without admitting the injury? How often have you said, "It's fine," because it was high season or you just didn't want to show weakness by admitting something in life can slow you down?

In our industry, whether it's guiding, patrolling, highways, or industrial work, we play a heady game every day, trying to outmanoeuvre the weather and manipulate the snowpack so we can achieve our professional goals. The challenge is what makes our jobs so fun and exciting, and one of the reasons why we leave family, friends, and a life of normalcy behind every winter. Admitting to gaps in the armour, whether mental or physical, puts us at risk of weakening our identity, our reliability, and our capability. At least that's where our culture has sat for a long time.

I've told myself all those things indirectly and subconsciously many times over the years, from both sides of the table. I've been an operations manager who called a professional counsellor to run a debriefing after an incident and then expected everyone to jump back into action once that box had been ticked. And I was a guide who experienced a traumatic event and couldn't "suck it up" and get back out there no matter how strong my will was.

The route to recovery from a psychological injury is not well understood in our industry and to embark on that path as an individual can be a scary proposition. Fortunately, our community is uniting to encourage conversations, get the stories out there, and let those people trying to find their way know that they are not alone.

OUR CIS STORIES

Last year, during the fall CPD sessions, the CAA, CSGA, and ACMG provided focused sessions on mental health education and awareness. As a presenter for the CSGA, I spoke about the value of creating a more proactive and preventative critical incident stress management (CISM) plan. A CISM plan is commonly a reactive plan that centres around responding to the incident rather than trying to get ahead of it before it even happens. The extent of most plans acknowledges that CIS can exist after an incident and offers outside resources to support individuals.

A proactive plan is one that educates the team about stress and how it can manifest its way into your life. The plan emphasizes the importance of staying connected to your community and how to talk to a teammate who is experiencing CIS. The National Institute for Health reports that the number one

predictor for how someone will recover from a traumatic event is based on how safe they feel in their relationships. Our teammates are integral relationships in the healing process. Having a community around that is educated about what someone may be going through is some of the best therapy there is.

I felt nervous sharing my story, wondering how I would be received after admitting I had experienced severe PTSD. In the years prior to my accident, I had witnessed many peers suffer from CIS and PTSD and I now realize I had had no idea how to help them. Until I had lived through it myself, I didn't truly understand the hurdles one must face on the path to healing. I also realized that a lot of those hurdles could be knocked down with a few simple proactive steps.

Each person's CIS story and response is unique. Sharing our stories lets people pull pieces out that they can relate to and build their own paths to healing. The other benefit of sharing is that it becomes apparent pretty quickly that these stories aren't one-off events. The impacts of both accumulated and acute stress are felt widely throughout our community of mountain professionals.

So, how do we create a more proactive CISM plan? Mental health care does not need to be solely associated with negative connotations and illness. We need to create a proactive environment that encourages our community to recognize, acknowledge, and manage the stressors faced in our line of work through education, peer support, and operational procedures. Currently, we operate in a reactive state. We don't recognize accumulated stress and, when faced with a traumatic event, we are on our heels, calling a counsellor for support to help get our world back in order and contain the damage.

We have an opportunity to change this reactive approach. Knowing that healing is possible and that these are normal reactions to an abnormal event empower a person and help stop them from withdrawing into a cocoon of isolation. Creating a community of peers that is aware of the range of normal CIS reactions and developing language to support those affected is a lifeline to recovery.

KEY STEPS IN CREATING A PROACTIVE CISM PLAN

Education: Providing educational sessions at staff training on how to recognize, acknowledge, and manage stress creates a common language and a level of understanding in the workplace. It normalizes the fact we operate in a stressful environment and creates a culture that promotes inclusion of these factors in our daily conversations. It also aids in the management and support of an individual or group that has been exposed to a critical incident. It gives your team the language to know what to say, keeps the conversation open, and allows those affected to feel empowered to stay connected to the team and seek additional supports if needed.

Peer support: When a critical incident occurs in an operation, there is no one who can understand what you may be going through better than a teammate. You may or may not want to talk, but having someone that just gets it is so much better than having to explain how your job works before you can get to what really matters. Developing a group of trained peer support people on your team allows for that to happen. It also means you have direct access to a team that can run a defusing session immediately after a critical event and provide opportunities and connections for internal and external support. Investing in this resource demonstrates a dedication to psychological first aid and a proactive and healthy culture.

Operational integration: Whether it is a training event or an actual critical incident, a technical debrief is an entrenched component of the emergency response plan process. Add a psychological debrief to your workflow, too. After the technical debrief is complete, before everyone disperses, a member of your peer support group can step forward and announce there will be a confidential, psychological debrief for those directly involved. This process doesn't have to actually occur after a training session but should still be verbalized so that it becomes part of the operational process. Verbalizing the action means that when a critical incident does occur, the psychological debrief is just the next step and not an awkward call out. It becomes just another step that you take in your procedures.

Critical incident exposure tracking is another tool that aids in awareness and recognition of psychological first aid. It also helps with documentation to aid in receiving outside support through an agency such as WorksafeBC. Creating a simple form where individuals can make note of their exposure to any type of critical incident provides a tool to track potential impacts of a singular event and the accumulation of exposure from multiple events, which can be a harder pattern to identify.

Challenges: Adding more tasks to a long list of operational requirements can seem daunting, add costs, and take up valuable time that always seems to be at a premium. Pre-season training schedules are already bursting and paying employees to be on site when there is no direct revenue gained is always a tightrope walk to find the balance between benefit and return. Staff can be transient. Some operations are quite small, which means a critical incident can affect your whole team and leave you without the use of your peer support team because they need support too.

You would never consider a start to your season without training for the worst case scenario such as avalanches, rope rescues, and first aid. You are being proactive by making sure those skills are sharp should you need to react to a situation gone wrong. Psychological first

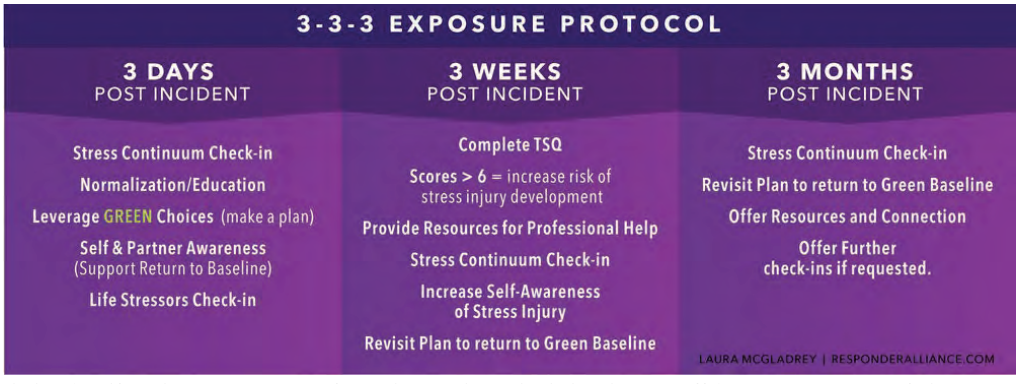
aid is an extension of any and all incidents. Anyone, regardless of experience, gender, or age can be affected by accumulated or critical incident stress. Having the skills to dig someone out of an avalanche of psychological trauma will always prove to be more successful than having to learn how to turn the transceiver on once they are already buried. Investing in this knowledge will save employee time loss, create connection to the workplace, and produce a resilient workforce.

THIS IS A GREAT TOOL FOR SELF AND TEAM AWARENESS AND MONITORING THROUGHOUT THE SEASON. CHECK IN WITH YOURSELF AND SEE WHERE YOU SIT ON A REGULAR BASIS. USING THIS TOOL WITH YOUR TEAM ALLOWS A COMMON LANGUAGE TO DEVELOP WHERE A TEAMMATE CAN UNDERSTAND WHERE YOUR HEAD MAY BE AT VERY QUICKLY. IT IS A GREAT AID FOR RECOGNIZING, ACKNOWLEDGING, AND MANAGING STRESSORS BEFORE THEY BUILD.

FUTURE GOALS

We are a community that is connected. It does not require a long conversation to find acquaintances, colleagues, and friends in common. People move between operations and different arms of the avalanche industry. Some operations are tiny.

What if we came together as an industry and provided access to education about psychological first aid and resiliency training? A first aid course is required for just about any job out there. How about a psychological first aid course that supports both proactive and reactive response tools? One that educates on how to recognize potential stressors, acknowledges when those stressors are affecting us, and manages those stressors so they don't build up to the point where our capacity to deal with life is diminished. When things do go wrong, it teaches tactics for how to talk to each other, a common language that offers support and understanding, and pathways to heal, all from within our community.



FOLLOWING EXPOSURE TO A TRAUMATIC EVENT, IT IS VITAL TO KEEP A CONNECTION TO YOUR COMMUNITY. ASSIGN A TEAM MEMBER THAT WAS NOT DIRECTLY INVOLVED IN THE INCIDENT TO REACH OUT TO ALL TEAM MEMBERS WHO WERE INVOLVED AT SET TIMES: THREE DAYS, THREE WEEKS, AND THREE MONTHS POST INCIDENT. THREE DAYS POST ALLOWS A RECOGNITION OF THE EVENT, EDUCATION OF POTENTIAL REACTIONS THAT CAN OCCUR, RESOURCES, AND OPPORTUNITIES FOR THE TEAM TO OFFER ASSISTANCE WITH DAILY TASKS. THREE WEEKS POST MAINTAINS THE CONNECTION AND CONTINUES THE OFFER OF SUPPORT AND OUTSIDE RESOURCES. THREE MONTHS POST IS VITAL, ESPECIALLY IN A SEASONAL WORKFORCE. IT ALLOWS A CONNECTION TO THE TEAM AND ENVIRONMENT WHERE THE INCIDENT HAPPENED, ESPECIALLY IF THAT WORK SEASON HAS ENDED. IT ALLOWS THE TEAM MEMBER TO KNOW THAT THERE IS STILL SUPPORT FROM THE PEOPLE WHO KNOW WHAT HAPPENED.

A course like this, taught by our peers, would mean that if an employee moved to a new spot, the next hire would likely have this training too. It would mean that a small operation could call on its nearest neighbour just as they would if resources were short in any other type of rescue. The neighbour could send its peer support team over to assist in those crucial hours after an incident before a trained counsellor could be called in.

There are a few programs like this in development and my hope is to continue to work with our industry partners towards a common goal of creating an accessible, affordable course that has us all climbing this mountain together, because, as cliché as it may have become lately, we are truly all in this one together.

Considering your Nearest Neighbours
A Strategy For Avalanche Control Around Mountain Goats in Northwest BC

Steve Brushey District Avalanche Supervisor, Northwest Avalanche Program
Amanita Coosemans, Senior Ecologist, Balanched Ecological Management Company

INFOEX IS AN INTEGRAL PART OF ALMOST every Canadian avalanche program's daily routine. The premise of InfoEx is about keeping your nearest neighbours informed of what you're seeing with respect to weather, snowpack, avalanche occurrence observations, avalanche summaries, and avalanche hazard.

The BC Ministry of Transportation and Infrastructure's Northwest Avalanche Program, which is based in Terrace and covers several northern highways, shares information almost daily with roughly 22 operations. However, in the Skeena, Nass, and Bowser corridors, there is one neighbour that doesn't share or provide information but can be negatively impacted by our daily operations. This operator can be challenging to see, yet operates year-round in the same mountain environment.

This past year, after discussion with the Ministry of Environment, our program commissioned a biologist to develop a goat mitigation strategy. Certainly, many provincial operators have goat mitigation strategies, some that are more robust than others, but our program operates in one of the foremost goat habitats in British Columbia, in particular the south aspects of the Skeena and Nass River corridors. We encounter goats on a regular basis as most of our work takes place on southerly aspects, and we have modified control missions and field work on numerous occasions due to wildlife. It was time for us to consider our silent neighbour.

This article presents an adaptive strategy for working around mountain goats. It describes relevant background information on mountain goats and their habitat, and discusses the known effects of specific disturbance types. This background knowledge informs the presented suite of options, methods, and protocols that can be used to reduce or avoid harmful effects on goats during essential avalanche control activities.

GOATS AND THE LAW

Most of the world's mountain goat population lives in British Columbia. Goats are scattered throughout nearly all of the province's mountainous terrain, with most found in the northwest portion of the province. Mountain goats are a blue-listed species in B.C., meaning they are vulnerable because their populations are particularly sensitive and because human activities may put individuals and populations at risk.

B.C. protects mountain goat populations and their habitat through a range of legislation, guidance documents, and best management practices . The BC Wildlife Act deems it illegal to herd or harass wildlife. The legal definition of harassment in the act includes, "Worry, exhaust, fatigue, annoy, plague, pester, tease or torment."

WINTER RANGE

Winter habitat is the part of the home range used for the longest duration in the year and is considered the most important habitat given how difficult it is to survive during the winter season. Winter means reduced access to food and higher energy costs. In winter months, mountain goats inhabit windblown slopes or ridges that have sufficient food and warm (south or west) exposures. They also move to lower elevations where the snow is not as deep and more food is available. Ready escape terrain such as rocky outcrops, cliffs, or bluffs within 400 m is important in winter ranges as escaping predators is more difficult in snow.

Winter range may include a variety of habitats that, together, provide accessible food, protection, and relative ease of mobility. For example, snow-shedding, south-facing slopes may provide forage and escape terrain, while nearby old-growth forest areas provide thermal and security cover, reduced snow depth, and access to arboreal lichens and understory vegetation.

FLYING AROUND MOUNTAIN GOATS

The critical period for mountain goats is from mating to kidding, which is roughly November 1 to June 15. During this period, goats are physically stressed and vulnerable. During the late-winter and kidding periods, disturbance to goats increases mortality and reduces births. Virtually all subalpine and alpine terrain in British Columbia should be considered goat habitat at all times of year.

Mountain goats are considerably more sensitive to human disturbance than other ungulates, and show a particular sensitivity to aerial disturbances. Disturbance effects can be particularly difficult to observe in this species as mountain goats frequently do not show a flight response. Still, individuals and populations respond negatively to disturbance over the longer timeframe by showing increased mortality, reduced fitness, and reduced kidding rates. Females with kids appear to be even more sensitive to disturbance than other adults.

MOUNTAIN GOATS ARE AT THEIR MOST VULNERABLE DURING THE KIDDING PERIOD, FROM NOVEMBER 1 TO JUNE 15. // CONTRIBUTED BY STEVE BRUSHEY

When goats are in the safest or best habitat around, or if snow is too deep, they may tolerate disturbance, but still be stressed. Goats are often described as "habituated" to disturbance, but evidence shows this is rarely the case, particularly when disturbance stimulus is strong and unpredictable and/or irregular. In fact, goats may instead become sensitized to disturbance, meaning their stress level increases with each subsequent disturbance event.

Mountain goats are easily disturbed by low-flying aircraft—especially helicopters. Low-level flights cause physical and emotional stress, which increases indirect and direct mortality in both the immediate and longer term. Impacts from helicopters and other human disturbances such as aircraft, avalanche control, and field work depend strongly on the timing (season), frequency, and duration of disturbance. For helicopters, in particular, flying distance is the key factor affecting the degree of disturbance. Behavioural responses range from increased vigilance and wariness at farther distances, to severe fright or flight responses at close distance.

Extensive scientific research supports helicopter buffer areas on the order of two kilometres horizontal distance and a vertical separation of 400 m. Decreased distances sharply increase stress responses and strong to extreme stress responses are common within 500 m horizontal distance of helicopters.

AVALANCHE CONTROL IN GOAT HABITAT

Avalanche control work is clearly different from other industrial, commercial, or recreational activities in mountain goat habitat. For public safety, it is understood that goats will, in some cases, need to be disturbed during the critical period. Where no other options exist, it is preferred to herd goats away from an avalanche zone rather than to allow them to remain in the direct line of danger. This can be done by approaching carefully with the helicopter and attempting to move them out with a slow and gradual approach. As every avalanche control area in the province is unique, an adaptive approach is required to mitigate and minimize negative impacts to mountain goats in their winter habitats.

When undertaking avalanche control work, helicopters are often obliged to fly close to or within active goat habitat during the critical winter period. Advance planning and communication with teams and pilots for flights and control activities can dramatically reduce harm to mountain goats. Where flights within two kilometres horizontal distance or 400 m vertical separation are necessary, pilots can use several strategies to reduce stress and potential harm:

- Absolutely no explosive training in goat sensitive areas.
- Is avalanche control essential? Consider other options.
- Know where goat habitat is located and plan around it wherever possible (e.g. flight path).
- Whenever possible, maximize separation distance from goats, particularly if they are reacting to disturbance (ideally >2 km horizontal distance and/or >400 m vertical distance).
- Keep helicopters below mountain goats; approach from below every time.
- Use topographic barriers to separate helicopters from mountain goats.
- If unavoidable, travel at low speeds, particularly when approaching animals.
- When avoidable, do not fly directly towards, hover near, or land near mountain goats.
- Minimize the number of flights and time spent within disturbance space.

For most helicopter-based activities, it may be possible to completely avoid disturbing mountain goats year-round using two simple strategies:

1. Stay at least two kilometres (horizontal distance) from mountain goats and their habitat.
2. Maintain at least 400 m vertical distance from mountain goats and their habitat.

While the nature of avalanche control activities means that disturbance cannot be completely avoided, good route planning with the helicopter pilot to the avalanche area will reduce negative effects on goats using other nearby winter ranges.

An adaptive approach will inform how avalanche control is done, ideally reducing impacts to goats over time as better approaches are developed. For areas that are known to be of high risk, or that have high mountain goat values such as the south aspect of the Skeena River corridor (i.e. a significant population concentration, presence of kids, or struggling population), consult a biologist for developing specific mitigation plan for these areas.

Airbags Save Lives, **So Why Aren't They Considered Essential?**

Christopher Van Tilburg, MD

WHEN I FIRST BEGAN WEARING an avalanche airbag in 2011, they were clunky and refilling the canister was a chore. Now, a decade later, they are lighter, less expensive, better designed, and we have good data on their effectiveness. Yet, despite their proven life-saving value, airbags are still not standard safety equipment in the backcountry. Why?

AIRBAGS AND STANDARD EQUIPMENT

Avalanche professionals and organizations tout avalanche transceivers, shovels, and probes as the Holy Trinity of safety, but transceivers don't work very well to prevent death. Brugger et al and Hohlrieder et al both showed burial time is reduced from 120 minutes to around 30 minutes with the use of transceivers, but the chance of death only decreased by around 15%. One study showed decrease in mortality from 68% to 54%, and another from 70% to 55%. One reason for this is because one quarter of those caught in avalanches died from trauma. Another issue is that 30 minutes is usually not fast enough to rescue someone. Haegeli et al showed with Swiss and Canadian data that the chance of staying alive when buried drops quickly after just a few minutes. It should be noted that these studies on transceivers were done before digital, three-antenna devices were common, which likely improve search speed.

These findings demonstrate that if an avalanche occurs, avoiding burial is vital. Both Haegeli et al and Brugger et al showed airbags decrease risk of death by around 15%. Brugger showed a decrease from 19% to 3% and Haegeli showed a decrease from 34% to 11%. Haegeli showed almost half of all avalanches produce critical burials and this can be cut in half again with an airbag. In another study, Meyer and Harvey set off avalanches with crash test dummies equipped with and without airbags. Of the 14 with airbags, 100% were visible from the surface and had a mean burial depth of 15 cm. Of the five dummies without airbags, only one was visible from the surface and the five had a mean burial depth of 43 cm. Said another way: none of the 14 airbag dummies required a transceiver to be located, but 80% of the non-airbag dummies did.

In addition to preventing burial, airbags likely prevent trauma. We have several anecdotal cases demonstrating this, but no studies to validate. Finally, one airbag brand and model deflates after inflation to potentially create an air pocket to prolong survival once a user is critically buried, as demonstrated by McIntosh et al.

AIRBAG RELUCTANCE

No main avalanche organization in North America recommends an airbag as a standard avalanche safety tool. Instead, airbags are called "adjunct," "secondary," "recommended," and "optional." Given the data, why is this so?

Airbags are heavy. Give a mountain professional an airbag for free and they still may not use it due to weight. But water is heavy, too. If you're on a two-hour ski and you've gulped two litres of herbal tea before the tour, you probably don't need water to survive an avalanche. Guide staples like a Brooks Range Rescue Sled weighs 706 gm and an Edelweiss 30 m x 8 mm rope weighs 1,260 gm. Are they more important than an airbag, the lightest of which is 1,280 gm?

Airbags are costly. But everything is costly in outdoor winter recreation. Dynafit Hoji Free boots clock in at $999, for example. And consumers are often not deterred by price in this sport when they want the latest high-tech equipment.

Airbags are bulky. I presented this airbag conundrum at the International Commission for Alpine Rescue in Zakopane Poland, in 2019. One professional said he wouldn't use an airbag because it's too bulky when shoveling. But you can't shovel if you're dead, bulky pack or not.

Airbags require extra training, practice, and maintenance. This is important because two studies showed user error effected successful deployment of airbags. But user error occurs with transceivers too. And if you're on snow 70 days a year, most gear needs maintence. Skis need waxing, radios need fresh batteries, and boot liners need to be washed. Similarly, change can be difficult for people who have a life-long touring routine that doesn't adapt well to an airbag.

Airbags increase risk. Two studies support this idea, but so do studies on helmets and anti-lock brakes on a vehicle for that matter.

THE QUESTION

So really, the question isn't if airbags save lives or maximize safety in avalanche terrain. Both of those are clearly affirmative. It's more perplexing that organizations and professionals are not giving consumers more clear advice. Based on the data, if consumers want to maximize safety, airbags should be standard safety equipment alongside a transceiver, shovel, and probe.

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AIRBAGS ARE CONSIDERED HEAVY AND BULKY, BUT THEY ARE SHOWN TO SAVE LIVES. // CONTRIBUTED BY STUART SMITH

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POST-TRAUMATIC STRESS DISORDER PREVALENCE IN RECREATIONAL AND PROFESSIONAL ALPINE SPORTS—A RETROSPECTIVE STUDY

// TROY GRANT

Post-Traumatic Stress Disorder Prevalence in Recreational and Professional Alpine Sports A Retrospective Study

Eric Haskell and Darcy Solanyk

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INTRODUCTION

Risk is inherent to alpine sports. Most research regarding accidents and alpine sports has focused on fatal events and, in particular, avalanches. These studies are of great importance to us as a community; however, the lack of investigation into less-than-fatal events and into the broader costs of accidents beyond the loss of life leaves room for inquiry.

Misfortunes in the mountains exert both physical and psychological tolls on those involved. A recent study from the Alps followed participants for one season, looking at rates of injuries from ski touring. As a group, participants experienced an average of 2.5 injuries per 1,000 hours of skiing. Of those injuries, seven per cent were classified as severe. Another study looking at the morbidity of winter sports reported a mortality rate of 1.83 per 100,000 alpine ski tourers in the Alps. In addition to physical harm, the loss of a climbing or skiing partner, witnessing a scary accident, suffering a serious injury, or surviving a natural disaster can also lead to psychological harm, including post-traumatic stress disorder (PTSD). Research investigating alpine sports and PTSD is few and far between.

PTSD research is a growing field that began with its inclusion in the Diagnostic and Statistical Manual in 1980. Initial investigation of the condition looked at Vietnam veterans and has expanded over the years to include victims of sexual and violent crimes, natural disasters, and, more recently, high-risk professions such as firefighters and police officers. As our understanding of PTSD expands, it has been found there are many other groups who have increased exposure to trauma and are at risk for PTSD.

PTSD is a disorder that develops in some people after experiencing or witnessing traumatic events. Symptoms of PTSD manifest in four major categories:

- intrusive symptoms such as flashbacks and nightmares;
- avoidance symptoms such as resisting certain places and things that remind them of the event;
- alterations in cognitions and mood, such as the inability to remember an event or distorted beliefs about oneself; and
- alterations in arousal such as being easily startled or indulging in self-destructive behavior.

In addition to these symptoms, the event must cause dysfunction in important aspects of life. PTSD has been linked to increased rates of substance abuse, depression, anxiety, suicidal ideation, and suicidal attempts.

Lifetime prevalence of PTSD has been shown to be around 6.1 percent and has a higher prevalence in certain groups such as survivors of sexual violence, interpersonal violence, exposure to combat, and exposure to other life-threatening traumatic events such as motor vehicle collisions. It is estimated that the prevalence of PTSD in those exposed to life-threatening events is around 12 percent.

Professional guides, rescuers, and avalanche forecasters are a unique subset of alpine sport participants since they expose themselves to the hazards of mountain travel on a regular basis. In addition, they regularly respond to accidents and help with rescue. Their increased exposure to the mountain environment and other parties' accidents increase their chances of experiencing physical and psychological trauma. A group of researchers looking at Swiss mountain guides found that on average each guide was exposed to two to three traumatic accidents during their career. They assessed participants for symptoms of PTSD in the month leading up to the study and found low rates of prevalence of symptoms.

STUDY DESIGN

In this study, an online survey was used to assess participants' relationship to alpine sports, their exposure to accidents, and screen them for PTSD using the Breslau scale. The Breslau scale is a seven-question empirically derived screening tool; it is not diagnostic of PTSD. A positive response on four or more of the items results in a positive score. This study looked at lifetime experience of PTSD symptoms related to accidents during alpine sport activities. Alpine sports included in this study were backcountry skiing, rock climbing, ice climbing, and mountaineering. Professional participants were compared with recreational participants.

RESULTS

- Recreationists reported an average of one life qualifying traumatic event (a positive life qualifying traumatic event was defined as one that resulted in hospitalization, permanent disability, or was fatal).
- Professionals reported an average of two life qualifying traumatic events.
- 61.5% of respondents had been injured themselves while participating in alpine sports.
- 53% percent of all participants were witness to or have close contacts involved with fatal accidents in alpine sports.

- Both guides and avalanche forecasters had significantly more individuals who experienced four or more life qualifying PTSD events while participating in alpine sports than recreationists, and witnessed significantly more fatal accidents or had them occur to close friends.
- The most severe accidents experienced first-hand or second-hand occurred while backcountry skiing for all groups except climbing rangers, who experienced the most severe accidents rock-climbing.
- Professional alpine sports participants were found to be 3.2 times more likely to screen positive using the Breslau scale than recreational participants.
- Experiencing more traumatic events and severe accidents was associated with a greater likelihood to screen positive using the Breslau scale.

TABLE 1: COMPARISON OF RECREATIONAL AND PROFESSIONAL ALPINE SPORT PARTICIPANTS BRESLAU SCREENING SCORE. TOTAL PARTICIPANTS = 327

Category	Negative Breslau	Positive Breslau (number, percentage of total)
Recreational participants	115	7 (5.7%)
Professional participants	212	48, 18.5%

TABLE 2: COMPARISON OF PROFESSIONAL SUBCATEGORIES BRESLAU SCREENING SCORES. TOTAL PARTICIPANTS = 212

Category	Negative Breslau	Positive Breslau (number, percentage of total)
Guide	125	35, 21.9%
Avalanche forecaster	43	5, 10.4%
Search and rescue member	19	7, 26.9
Climbing ranger	11	1, 8.3%
Other professional	14	0, 0%

WHAT CAN WE LEARN FROM THIS?

Experiencing traumatic events while participating in alpine sports is a common occurrence. The physical cost of such tragedies such as changes to mobility are quickly tangible. The emotional toll can be much more obscure. While the number of backcountry users is skyrocketing, we are still a small community and the effect of serious accidents reverberates through our group. Recognizing these effects in ourselves and our friends is essential to maintaining our well-being.

Stress injuries exist on a continuum from minor to life-debilitating, as described by Laura McGladrey. She has created an awesome resource with the help of the American Alpine Club (AAC) for anyone affected by grief and trauma in the mountains. It is available at https://americanalpineclub.org/psych-ed. The Canadian Avalanche Association has assembled a list of mental health resources that can be found at www.avalancheassociation.ca/general/custom.asp?page=MentalHealth.

Given the high lifetime incidence of positive PTSD screening in alpine sport professionals, it is recommended that professionals familiarize themselves with ways to recognize that they or a peer may have a stress injury and what resources are available to help them out. The AAC's grief resources are an awesome tool for all alpine sports participants even though it was built for climbers. Also keep your eye out for the Avalanche Resiliency Project which is in the works.

PTSD is at the severe side of the spectrum. If you believe you may be struggling with severe stress injury or PTSD, you should seek the help of a therapist or health care provider experienced in treating PTSD. Restoring health and function in your daily life is possible and essential.

A huge thank you to all who shared their experiences and participated in this study, and to Mark Payton, PhD, for help with statistical analysis.

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snow globe

42

SNOW NOMAD: AN AVALANCHE MEMOIR

in this **section**

// BOOSTED IMAGERY

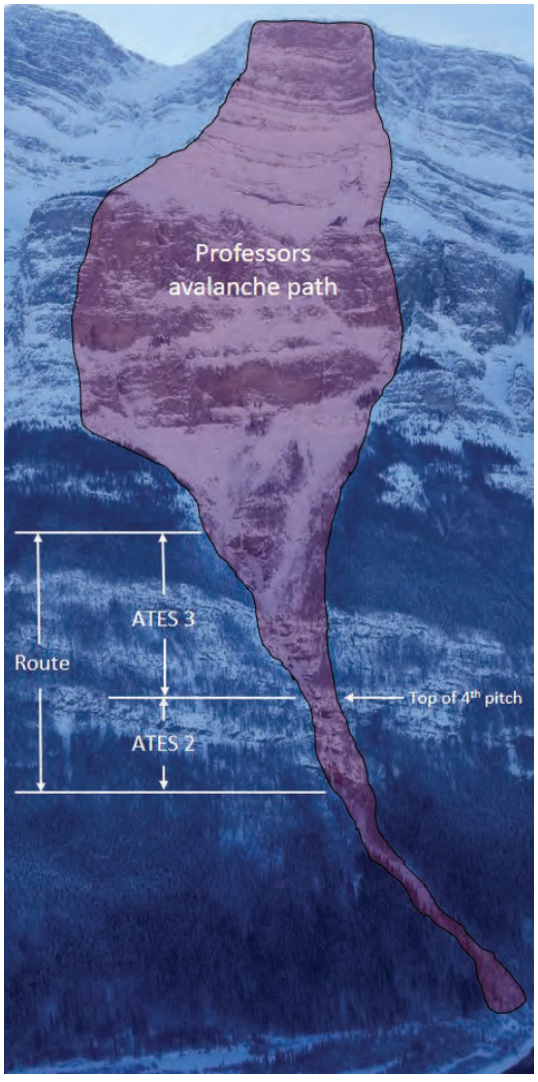
Ice Climbing **Atlas**

Sarah Hueniken

ON MARCH 11, 2019, myself and several others lived a nightmare I hope no one has to experience.

For 10 years, I've run a women's ice climbing camp in Field, B.C. In 2019 the conditions were good, with a forecast of Moderate avalanche danger in the alpine, Low at treeline, and Low below treeline. A group of five guides made a plan for the day and two went to climb Massey's with a great group of women. Just as they were finishing their day, a size 2.5 natural avalanche released far above them and roared over the climb. The avalanche completely buried one woman and partially buried another. The group was wearing transceivers and carrying avalanche rescue gear, but the slide came just as the group had packed their bags and everything was swept away. I witnessed the avalanche as I was returning from my day of guiding and, along with other guides and clients, rushed to the scene to help with the recovery. Despite everyone's heroic efforts, Sonja Findlater, my good friend, camp manager, and all-around awesome human, died that day.

This event changed many lives: Sonja's family and friends, the other woman who was buried, the participants and guides who experienced the avalanche or ran in to help, public safety workers, ambulance and hospital workers and the entire ice climbing community at large.



THIS PAGE: ANNOTATED IMAGERY OF PROFESSOR FALLS CLIMB, SHOWING WHERE THE TERRAIN RATING INCREASES ON THE CLIMB. OPPOSITE PAGE: A LOOK AT THE HAZARD ON CASCADE WATERFALL, A POPULAR CLIMB NEAR BANFF. // GRANT STATHAM, PARKS CANADA

AFTER MASSEY'S

Sometimes the greatest change and learnings come from the most horrible events. Nothing we can do will bring Sonja back and her loss will always be a tragedy of epic proportions. What we do and what the industry does moving forward is the only way to honour her loss. To the pain and constant reminder for the guides involved that day, Massey's has forever changed how ice climbers look at terrain, their choices, their preparedness, and their willingness to accept risk. It is no longer a question of "if" something were to happen, but "when," "why," and "how often." In fact, statistics show that more climbers have been killed by avalanches in Banff, Yoho, and Kootenay National Parks over the past 25 years than any other backcountry winter user—even more than skiers.

Never before has the discussion around avalanche safety, awareness, and realities been more prevalent on the social media sites where ice climbers discuss conditions. Avalanche hazard and one's accepted risk is no longer a secondary conversation amongst ice climbers; instead, it is as important as how hard the climb is and if one is able to climb the grade. It has grown into a normal part of the ice climbing conversation in a matter of three years. It's hard to fathom the idea that bringing avalanche gear on a climb was greatly questioned when Parks Mountain Safety raised the idea years ago. The guiding industry seems to also have taken a huge step back in what is normal risk and what is better left for individuals to do on their own.

FIRST STEPS

In the fall of 2020, Avalanche Canada invited me to the role of ice climbing ambassador, adding to its team of athletes that advocate for backcountry avalanche safety. I was unsure I wanted the position after my involvement with Massey's and my lack of desire to ever return to avalanche terrain. When invited, it didn't feel like an option to say no. My life experience made me highly motivated for change and for the work ahead.

That fall, several steps were taken to raise avalanche awareness in the ice climbing community. Grant Statham and me delivered the first ever webinar on avalanche safety for ice climbers. Over 400 people tuned in to the live event and hundreds more have watched the recording since. That winter, a short video was created to increase avalanche awareness for ice climbers, with the help of many of my peers and Heather Mosher.

Simultaneously, Grant envisioned that the Mountain Information Network could be a resource for ice climbers. We worked with Avalanche Canada to add the ability to submit

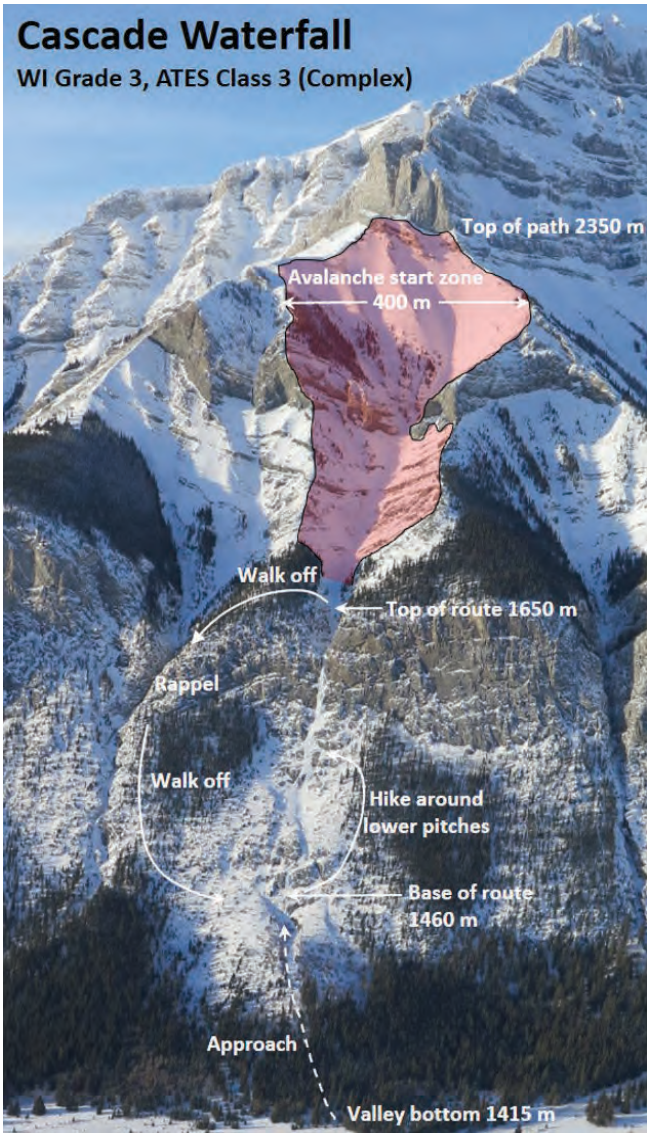
ice condition reports to the MIN to make it relevant for climbers. From December 2019 to April 2020, 48 ice climbing MINs were submitted. The following season, 282 reports were recorded—a huge increase. I steadily tracked these to maintain a historical database moving forward, but I also thought, "How about looking backward?"

THE ICE CLIMBING ATLAS

With no new snow in the past four days and a public and professional forecasts of Moderate, Low, Low, the Massey's accident surprised and saddened many. It is a climb that is attempted frequently and considered to avalanche less frequently than some of its neighbours despite the very obvious terrain above it. Historically and forecast-wise, this climb seemed appropriate for the day, but perhaps our known avalanche history didn't match Massey's real history?

This year, I wondered what we could do to keep improving our collective information. As ice climbers, we have limited observations compared to a skier who can feel the snow underfoot as they ascend and dig a pit on the slope they want to ride. The biggest threat to an ice climber is usually natural avalanches from above in terrain we never actually go into.

The best way to understand this danger was to look at how the transportation and ski industry have increased their avalanche knowledge. These industries have substantial resources that allow for a thorough understanding of their terrain. Most of these industries have run lists and historical information based on years of observations and experience. They have more information to base their decisions on because of the data they have collected. As ice climbers, we have none of this. Until the recent use of the MIN, our information-gathering was limited to fatal accidents. The MIN continues to be that ongoing resource moving forward, but looking back, it felt like a missed opportunity to not obtain data from the entire community based on its collective decades of recreating on these popular routes.



This is how the Ice Climbing Atlas was conceived. I approached Avalanche Canada with the idea and they agreed to help and host it on their website. Classic climbs were selected and surveys were created and have been filled out by anyone willing to offer their experiences on these climbs. Both the public and the guiding industry have been encouraged to participate. The data has been tabulated and summarized and recorded within the atlas. Photos have been purposefully obtained by Parks Canada to better show the terrain above each climb and Grant has worked diligently to map the avalanche terrain. This is the first true study of the avalanche terrain, historical incidents, and observations of avalanches on ice climbs within the Canadian Rockies. Prior to this, a simple line in a guidebook stating, "This climb is under significant avalanche terrain," was all people had to look at.

As of March 1, we have added seven climbs to the atlas, with the hopes of completing another five this season. We have learned a great deal in the process and some of the Avalanche Terrain Exposure Scale ratings were even changed due to the results of the surveys. The ice climbing community has embraced the project and it has sparked more conversation and awareness of avalanche hazard on social media and between climbing partners. There is also a section for additional comments and many respondents have offered their approach to decision-making, mitigation strategies, and other human factors.

We are still a long way off from the understanding a ski hill or heli-ski company has of their runs, or highway patrol has of their avalanche paths, but it is a start. To quote a Tanzanian proverb: "Little by little a little becomes a lot."

Ice climbing is no longer an activity of a few hard mountain men. It is a growing sport that will continue to increase in popularity. Small steps towards more understanding and inclusion of everyone in the discussion and information gathering will only help us all for the future.

Thank you Avalanche Canada for recognizing the need and supporting these projects.

71-72: The Unrelenting Winter

Jim Bay
Intro: Alex Cooper

"When future CPR old timers talk about bad winters, they'll talk about the winter of '71 - '72." The Revelstoke Herald, Feb. 2, 1972.

Living in Revelstoke, you often hear old-timers bring up the winter of 1971-72 whenever there's a heavy snowfall. That winter, it snowed 779 cm in town. On nearby Mount Copeland, a mining operation recorded 2,446.5 cm of snowfall, which remains a Canadian record. On Mount Fidelity in Glacier National Park, a maximum snow depth of 493 cm was recorded by the Snow Research and Avalanche Warning Section. In January 1972, the highway was closed for almost five days and a passenger bus was stuck at the Pass for three days. According to the paper, the avalanche control team fired 203 rounds and had to bring in a second 105 mm howitzer to deal with the snow load. The line quoted above was written after a 55-hour railway closure.

For Jim Bay, this was his introduction to the avalanche patch. He wrote about his experience that winter:

I SAID I HAD GROWN UP IN 'SNOW COUNTRY' but that winter was very impressive, particularly in Rogers Pass. I started working in Glacier National Park for the Snow Research and Avalanche Warning Section in early October of 1971. It was already snowing up there and there was already a significant snowpack at treeline well before the end of the month. From then on it just seemed to always be snowing. For sure there were some good weather spells, but they were short-lived. There were no long dry spells and I don't recall talk of persistent weak layers—not that this term was in the vocabulary at that time. We had big storms and big avalanches for sure.

I remember at least a couple multi-day closures with the public trapped at the summit staying in the Northlander Hotel, before it was renamed Glacier Park Lodge. People were shovelling snow around the hotel and doing dishes to help pay for their food and rooms. After the lengthy storm cycles and shoot periods, there were often numerous large avalanches across the highway with many of them hundreds of feet wide and two to three metres deep.

Back then, once a single lane or two was opened they would release traffic and the public would have a good view of the carnage, with vertical walls sometimes three to four metres high on both sides of the driving lane. It was impressive and felt like we were driving through tunnels. Nowadays, the roadway is usually fully cleared and even the banks are pushed back before they let traffic through. I'm sure many people drive through wondering what all the fuss was about.

Up on Mt. Fidelity it was almost a full-time job just keeping the station from being totally snowed in. Between shovelling and plowing with the small John Deere tractor we had up there, it was an endless task. I remember snowshoe-packing the trails out to the study plot around 4 p.m. and then wading out into a storm through windblown, thigh deep snow at 3 a.m. to do shear tests and weather readings under the floodlights for the forecast team in the valley. It was actually pretty magical and something I'll always think of fondly.

I remember one particular snow profile we dug at the Mt. Fidelity station plot. I think it was sometime in March, the snow was 485 cm deep, and it took almost the entire day. Even with the steel shovels we used, it was tough digging in that west Columbia snowpack!

One thing that only occurred to me some years later was that in 1971, the formal avalanche program was less than 10 years old. For an area as large and complex as Rogers Pass, in many ways the program was still in its infancy. What the Schleiss brothers (Walter and Fred) managed to do there was remarkable. The system they and their predecessors had developed for avalanche prediction worked surprisingly well and, as far as I know, continues to be the basis for the current program.

As a neophyte in Rogers Pass I really had no idea what to expect so by the end of the winter my thought was, "Wow! If this is the avalanche business, count me in!" It was pretty full on and, oh yes, the skiing was pretty epic on most days. Although we never did a trip without breaking trail, which is much different than today.

Some of the years blur together. We had some pretty epic storm and avalanche cycles in other years which were also pretty memorable. What made '71–'72 special was that it was pretty unrelenting, with one storm after the other and the number of larger avalanches as a result.

REVELSTOKE REVIEW

The Alpine City of British Columbia

Vol. 59, No. 48

THURSDAY, January 27, 1972

SINGLE COPY 15 CENTS – $5.00 PER YEAR

Two and one half days . . .

Motorists Trapped In Slide

Late last week four men and a woman were trapped in a snowslide at twenty one mile north of Revelstoke. At 1 a.m. Friday morning a cat was dispatched in an attempt to free them but was unsuccessful.

As the weather cleared a helicopter was dispatched to the area to assess the magnitude of the slide in which they were trapped and how best to proceed. The highways department then enlisted all available equipment and at 10 a.m. Saturday morning success crowned their efforts and the motorists were freed.

Their two and one half day ordeal was over. They were taken to Queen Victoria Hospital treated and dismissed.

Other motorists from Mica experienced difficulty in driving over the week-end but were able to reach Government camps or dwellings along the way.

By Monday the road was declared open to all traffic.

Winter Conditions Continue

Weather conditions continue in the same pattern set early in the season; high

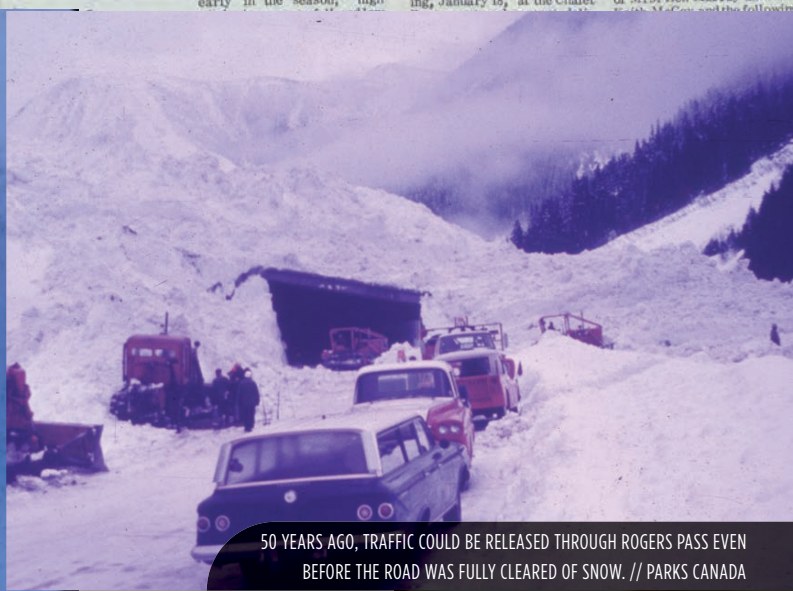
JUNIOR HOSPITAL AUXILIARY . . .

Mrs. Harry Sayers Elected As President

The annual geneeral meeting of the Junior Hosp. Auxiliary to Queen Victoria Hospital was held Tuesday evening, January 18, at the Chalet

be participating in this work.

Election of officers for the coming year was conducted by the nominating committee of Mrs. Ken Murray and Mrs



50 YEARS AGO, TRAFFIC COULD BE RELEASED THROUGH ROGERS PASS EVEN BEFORE THE ROAD WAS FULLY CLEARED OF SNOW. // PARKS CANADA

REVELSTOKE HERALD, WEDNESDAY, FEB. 9, 1972

EXTRA 105-GUN NEEDED

Highway closure sets record

Last month's snowstorm which closed Roger's Pass for a record four days, 21 and a half hours caused 35 avalanches which deposited more than 210,000 cubic yards of snow on the highway.

During a five day period starting Jan. 19, 74 inches of snow fell on Rogers Pass.

The average snowfall for the month of January is 76 inches, so the storm deposited about a month's snow in less than five days.

The highway was closed at 1:30 p.m. Jan. 20 and re-opened at 11:00 a.m. Jan. 25.

The widest avalanche to reach the road blocked 1,600 feet of highway.

The biggest slide to reach the highway came down MacDonald gulley Jan. 23 and dumped about 40,000 cubic feet of snow on the Trans-Canada.

A total of 203 rounds of 105 m/m shells were fired into the avalanche trigger zones to stabilize the avalanche hazard during the five days.

The Park had to bring in an extra 105 m/m Howitzer from the east to help with the stabilization program.

With the extra gun, the park staff could shoot from the east gate toward the pass as well as out from the pass in both directions.

Many of the Park staff worked round the clock to keep up with the emergency situation and finally got the upper hand as the elements relented.

The Park telephone line was taken out by an early slide forcing parks personnel to use radio communications for eight days.

One slide came across the Illecillewaet canyon and up into a snowshed, packing snow into the shed.

This is a very unusual occurrence which park officials say could only occur during a storm so severe that the highway would be closed anyway.

The storm did have humorous sidelights in the park.

Horses being transported across the pass were stranded at the summit and hay had to be sent up from Revelstoke via CPR.

Also, a park ski school had to be cancelled because of excess snow.

Revelstoke Herald

NOW PARALYZES AREA

Revelstoke isolated, travellers stranded

Community activity slowed to standstill

AT A GLANCE

Local ski meet plans altered

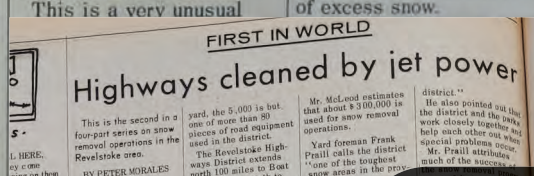
Budget adopted

Revelstoke Herald

SLIDE CAUSES 55-HOUR RAIL CLOSURE

AT A GLANCE

Speed of avalanche estimated at 100 mph.



FIRST IN WORLD

Highways cleaned by jet power

This is the second in a four-part series on snow removal operations in the Revelstoke area.

BY PETER MORALES
Herald Reporter

The jet engine whines and screams louder, your back is pressed against the seat as jet power

yard, the 5,000 is but one of more than 80 pieces of road equipment used in the district.

The Revelstoke Highways District extends north 100 miles to Boat Encampment, south to Trout Lake, east to Glacier National Park, and west 26 miles to Perry River.

Mr. McLeod estimates that about $ 300,000 is used for snow removal operations.

Yard foreman Frank Praill calls the district "one of the toughest snow areas in the province."

district."

He also pointed out that the district and the pass work closely together and help each other out when special problems occur.

Mr. Praill attributes much of the success

NEWSPAPER CLIPPINGS FROM THE REVELSTOKE HERALD AND REVELSTOKE REVIEW PROVIDED BY THE REVELSTOKE MUSEUM & ARCHIVES

Book Excerpt
Snow Nomad: An Avalanche Memoir

Alan Dennis

ALAN DENNIS, A 50-YEAR VETERAN OF THE AVALANCHE INDUSTRY AND FORMER EXECUTIVE DIRECTOR OF THE CANADIAN AVALANCHE ASSOCIATION, RECENTLY PUBLISHED *SNOW NOMAD: AN AVALANCHE MEMOIR*. THE BOOK CHRONICLES HIS FIVE-DECADE CAREER WORKING IN CANADA, NEW ZEALAND, SCOTLAND AND ARGENTINA. HERE IS AN EXCERPT THAT LOOKS AT WORKING AT THE GRANDUC MINE IN 1979. THE BOOK IS AVAILABLE THROUGH FRIESENPRESS.

CHAPTER 10: CANADA WIDE MINES (GRANDUC)

The following winter, in 1979, the mining operation and avalanche program were back at the Granduc property. This was still in the days when avalanche programs were seen in the resource industry as an even more unnecessary cost than now. (We didn't decide to put a mine there.) Robin Mounsey moved on to greener movie pastures and I, somewhat by default, became the avalanche control supervisor. It wasn't made any easier by another one of the avalanche controllers thinking that he should have been appointed. There was added fun when the highly qualified woman, Liz Horne, was hired over friends of the discontented. It was good to have checks from above, the recalcitrant mine management, and below from workmates. There was a bit of a schmozzle with Emil Schnabl, our office-based boss (there's a name never to forget among the presumptuously named Canada Wide Mines, the ill-fated foray into mining by the oil patch owner Exxon), although he did have the first Commodore 64 in the village.

LOOKING AT TERRAIN OUTSDIE THE LEDUC VENTILATION PROTAL. // ALAN DENNIS

Liz Horne was by far the best qualified candidate for the available position on the avalanche control crew. A ski patroller at Red Mountain, she could ski. She had a real blasting ticket. She had guided on Denali. She was probably the first woman to do the Association of Canadian Mountain Guides winter assistant guide course, but she never needed to say so. We naively had no idea the deep pool she was diving into by being a woman doing avalanche control on the road, and a woman controlling traffic and directing snow clearing at avalanche sites by radio; she was in the hot seat, under the microscope. I was in the hot seat for hiring her. Liz did a fantastic job, better than anyone; all the miners wanted her back. She'd had enough. Another small step for those who followed. She stayed on the surface of the deep, dark pool and kept her sense of humour in difficult circumstances. Liz and I talked after the season and wondered if it was worth it. Well, the pay was good and she met her husband. I don't think any of my predecessors would have hired a woman. She's one of my few heroes.

On the Granduc Road, there were occasional snow profiles with two roadside weather stations. The higher one at the road summit was as high as some of the lower start zones. We kept a monthly time profile in the field station at 10.5 mile. Thinking back, it reinforces for me that giving someone a magnifier to look at metamorphism should not be happen until they've done one hundred field days. Concentrate on layers, hardness, weak zones/ layers, temperatures, and field tests first. Anything before that is too early for the use of the magnifier. It only encourages the 'nodding' syndrome, first identified at New Zealand Met Service shift change.

After the drive from Stewart for a shift change at the field station (mile 10.5), the avalanche forecast briefing was usually a summary of where we would need case-charge blasting. It

GRANDUC ROAD AROUND TROJAN HORSE. // ALAN DENNIS

got a bit competitive for a while. I think someone got fifty bags in a shift. There was never any complaint from mine management about using too many explosives. The artillery, first the 75 mm rifle, later the 105 mm and avalauncher, were rarely used at night, although there was blind firing data. The 75 mm rifle, when used at night, made for some fine photos and for shooting up the Salmon Glacier. In daylight, it was good range-finding data. Shooting up the glacier also helped calculate the 'wobble' factor. As the breech assembly wore out, the tube wobbled and the same firing data gave different results, so bracketing was used to make sure the target was on. The old wooden gun mounts were getting rickety, so that was another factor as the recoil(less) factor shook the whole gun mount. Brown stains on the glacier were a good indicator of the wobble using the same firing data for two or three shots. I often wondered about what happened in real military use at night, where the source was easily seen by the enemy when the flash went off. Fortunately, that was not our problem. That fun stopped when artillery rounds got to be in short supply, notwithstanding Herb Bleuer's delivery driving around the province in an unmarked cube van with a load of ammunition.

The magazines were very rough wood-frame huts (approximately eightby-four feet) in three roadside locations; the plywood on the doors was a favourite scratching post for porcupines. There were lots of keys around just in case some got lost. The shift-change advisory usually included suggesting watching a movie that was on at Tide Lake, self-projected if you crawled in the loft to the theatre on the graveyard shift, or having a snooze at the field station after road patrol. Do be aware that Emil Schnabl may do a radio silence road patrol and don't forget to feed Amex, the martin. Please at least gas up the truck and put away your sleeping bag. The equipment operators had a cabin next door and pursued their own quiet graveyard shift activities. One guy set up his mini vise and made lovely fishing flies. Very productive.

Canada Wide Mines narrowed, Exxon euthanized its mining folly, and the deposit had been cherry-picked to be useless for further mining. Copper hit bottom—Chile did it cheaper. The location under Leduc Mountain was always fantastic, surrounded by glaciers and the ten-mile access tunnel from the road end and concentrator site. It was ski-touring paradise up the Salmon: heli-assisted drop off for the Scottie dogs, then ski out from Texas Creek, down from Happy Valley Camp, to Bowser Lake. There was some other semi-authorized heli-assisted ski touring as well and no spider tracker (gps tracker) with management watching the heli's every move.

Another option in a day's work was to get dropped off by the Mitsubishi train, hike through the underground maze with skis to the Leduc Portal, and ski back via Salmon Glacier to the mine road. Living in the shadow of avalanche history with the worst Canadian mining-related avalanche disaster at Leduc in 1965 led to other memorable avalanche

personalities on-site: Eric Lomas, Norm Wilson, Herb Bleuer (more of his legendary stories, events), Geoff Wyatt, Bruce Jenkinson, Alan Derbyshire, and Howie Richardson— the discontented in a malcontent mining world. Howie had wiser pursuits to follow with post-graduate crow research on Mitlenatch Island off the east coast of Vancouver Island.

Allan Derbyshire went on to lead college outdoor pursuits and continued climbing to a high exploratory standard. We did an Outward Bound group trip to Yosemite National Park in fall 1972. Allan was very keen to get on El Capitan and found a unilingual Greek called Dimitrios to be his partner. We could hear him up the cliff shouting, "Hey, Dimmy . . . " in his broad Mancunian accent. That wasn't his most successful trip on El Cap. His driving skills were legendary.

There was an active New Zealand part to Granduc history: Beryl and Geoff Wayatt went back and forth to New Zealand. Bruce Jenkinson, a super-strong New Zealand climber, died inexplicably on a small crag at Mount Cook village. Bruce wrote a book that included a chapter about the Granduc Road, complete with depressing in-camp photos. I don't think anyone makes a career choice of working avalanche safety in a mining world. It just happens.

CREW BUS ON THE GRANDUC ROAD IN POOR WEATHER. // ALAN DENNIS

Still on the Granduc Road, Caroline clearly remembers the date, January 8, and the wild coastal storm. She was working radio room dispatch and as an industrial first aid attendant at the mill building. Dispatch monitored all the traffic on the road and the number of people in each vehicle. There were designated call-in points for north- and southbound traffic to remain separated. Head-on collisions and close calls were usually blamed on the faulty radio or someone not calling their location. During the day, she could hear the development of the storm cycle as snow clearing equipment was just keeping up with the storm snow. Blasting was in progress.

The afternoon shift buses and light vehicles made it to Tide Lake. By this time, snow accumulation, wind, visibility, and avalanche hazard forced a road closure. The only one I remember. The storm eased a bit, but the road was plugged with storm snow and avalanches. The day shift wanted to get home.

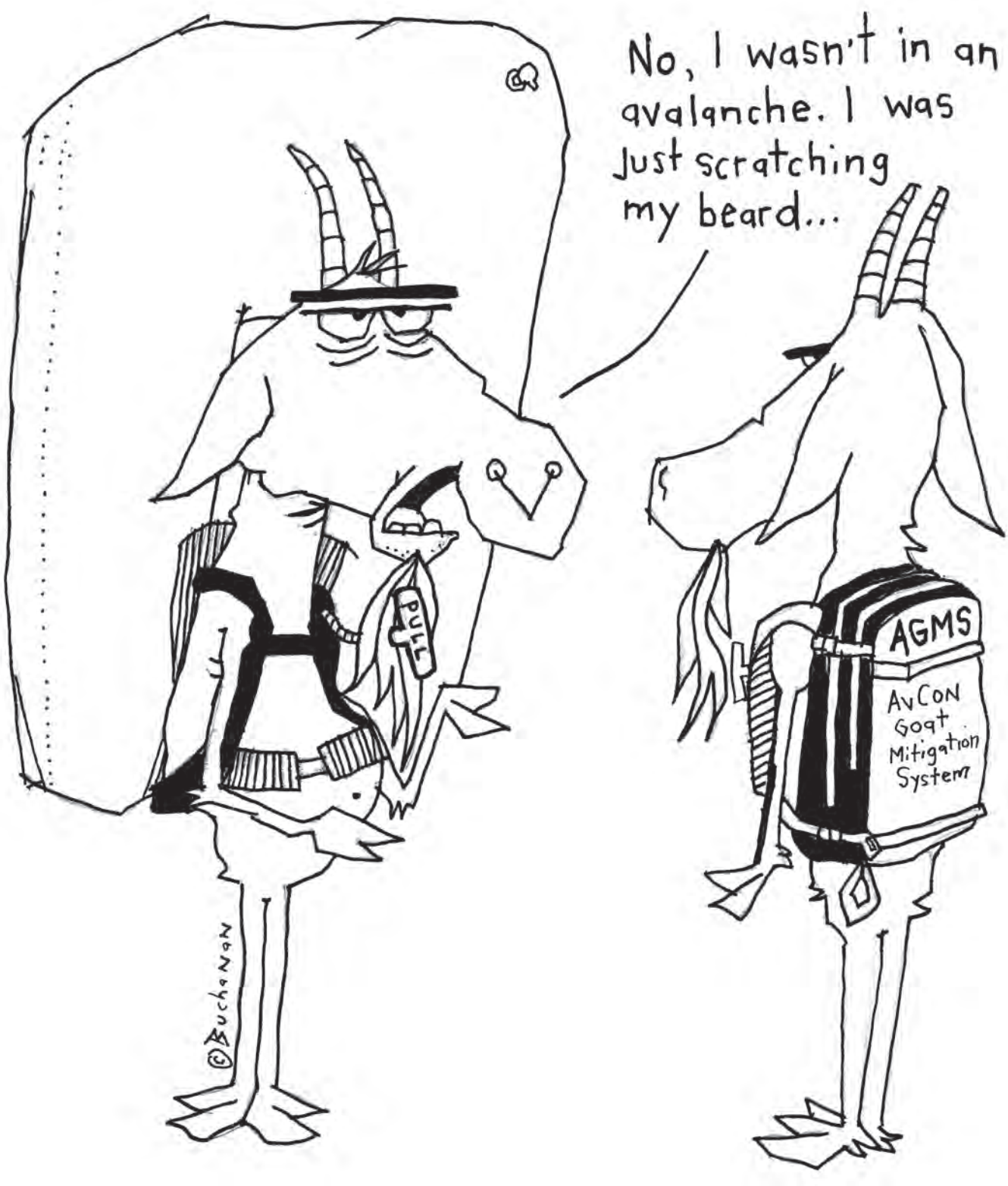
We started a dreaded convoy. A convoy leaves you far more exposed because you're going as slow as the slowest, strung out under avalanche paths. We left Tide Lake to blast and clear a single lane through the critical nineteen miles to the Salmon River flats. A Cat 988 loader punched a hole through avalanches and storm snow on the road. A smaller loader pushed ahead of the avalanche truck up to the avalanche paths so we could get charges out, the avalanche truck re-loading at magazines along the way.

Caroline and all the bus passengers could hear on the bus radio the slow progress as the convoy crawled down the hill. I think the day shift made it home in the midnight hours. Who cares? The rest is a blur. Everyone made it home safe. The storm eased. The heroes of the night were the bus drivers creeping between the occasional bamboo marker wands. There is a little more definition at night but still the same big drop off to a glacier three hundred metres below.

After a good sleep, there was a fun ski-touring oddity close to the field station. The old Big Missouri mine near the field station had not been sealed off. After a dig through the winter snowpack to find the portal among collapsed timbers, we carried our skis through the mountain, picking our way past shafts. Throw a stone down the shaft and you would sometimes hear it hit the bottom, bouncing along the way. Don't step in one of those. After what seemed like forever in pitch black with headlamps, but probably less than a few hundred metres, we dug out at the other end of the tunnel and skied back to the lower road. Not quite the same as the short lap through the well-lit mountain of the Aiguille du Midi in the French Alps, followed by the Mer de Glace (aka Mer d'Or), but there were no crowds either.

Flakes

ROB BUCHANAN



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O'bell x

MND SAFETY

Remotely controlled hazard reduction devices using powerful gas airblast technology.

- Fixed and mobile solutions for every need
- Combines ease of use with 24/7 reliability
- No residue or unexploded duds to manage
- No explosive storage or transportation issues
- ***Daisybell*** – mobility and efficiency – 50+ shot capacity
- ***Gazex*** – powerful and permanent – shot supply for season
- ***O'Bellx Options+*** classic model and new innovations, removable
- **2,800+** Gazex/Gas-blast exploders in use worldwide

AVATEK Mountain Systems

AvaTek Mountain Systems Inc.

250.344.2122 www.avateksystems.ca

Golden, British Columbia, Canada

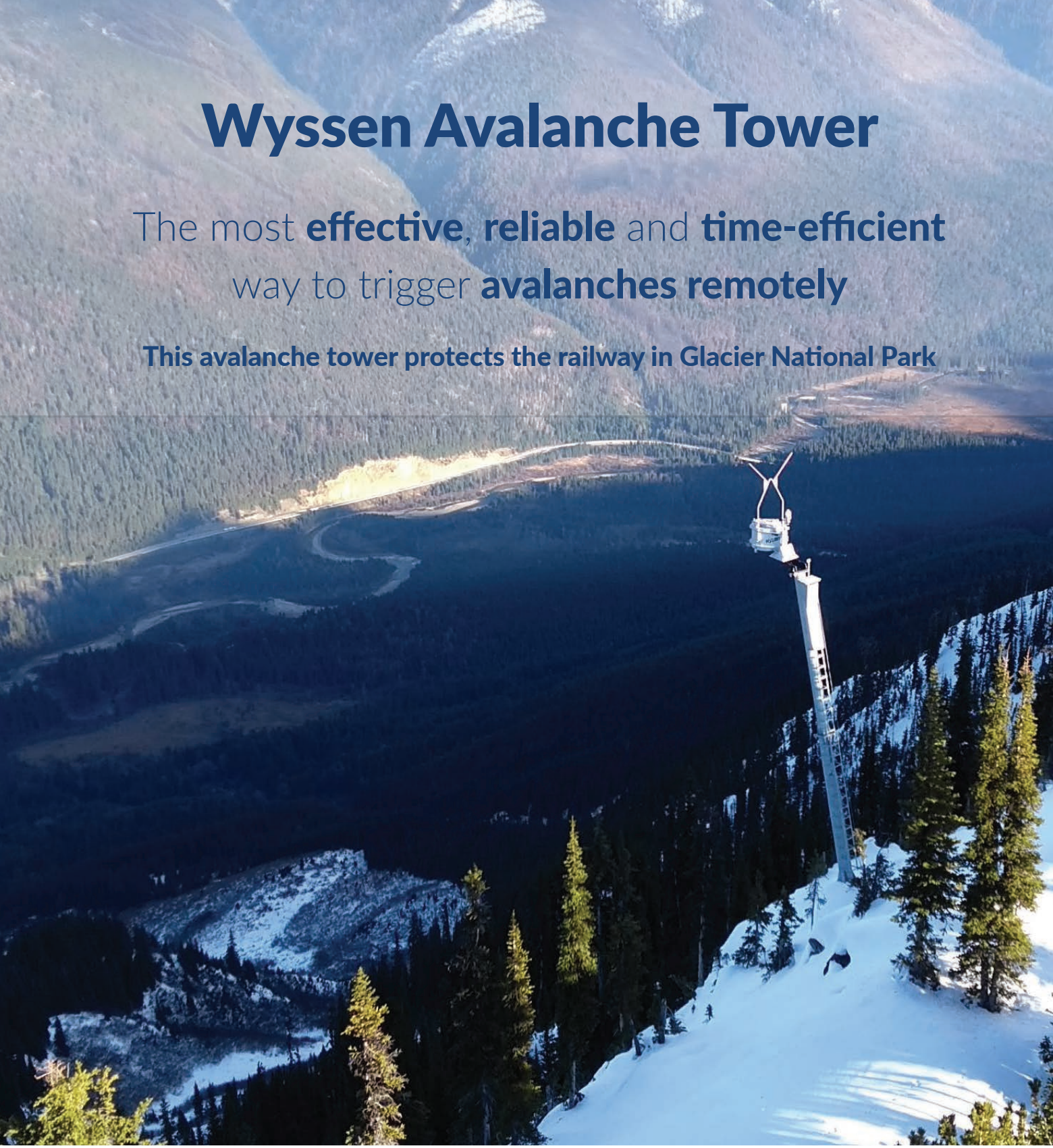
info@avateksystems.ca

Canadian Distributor for MND Safety - Avalanche Control Technology

Wyssen Avalanche Tower

The most **effective**, **reliable** and **time-efficient** way to trigger **avalanches remotely**

This avalanche tower protects the railway in Glacier National Park



wyssen switzerland avalanche control

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