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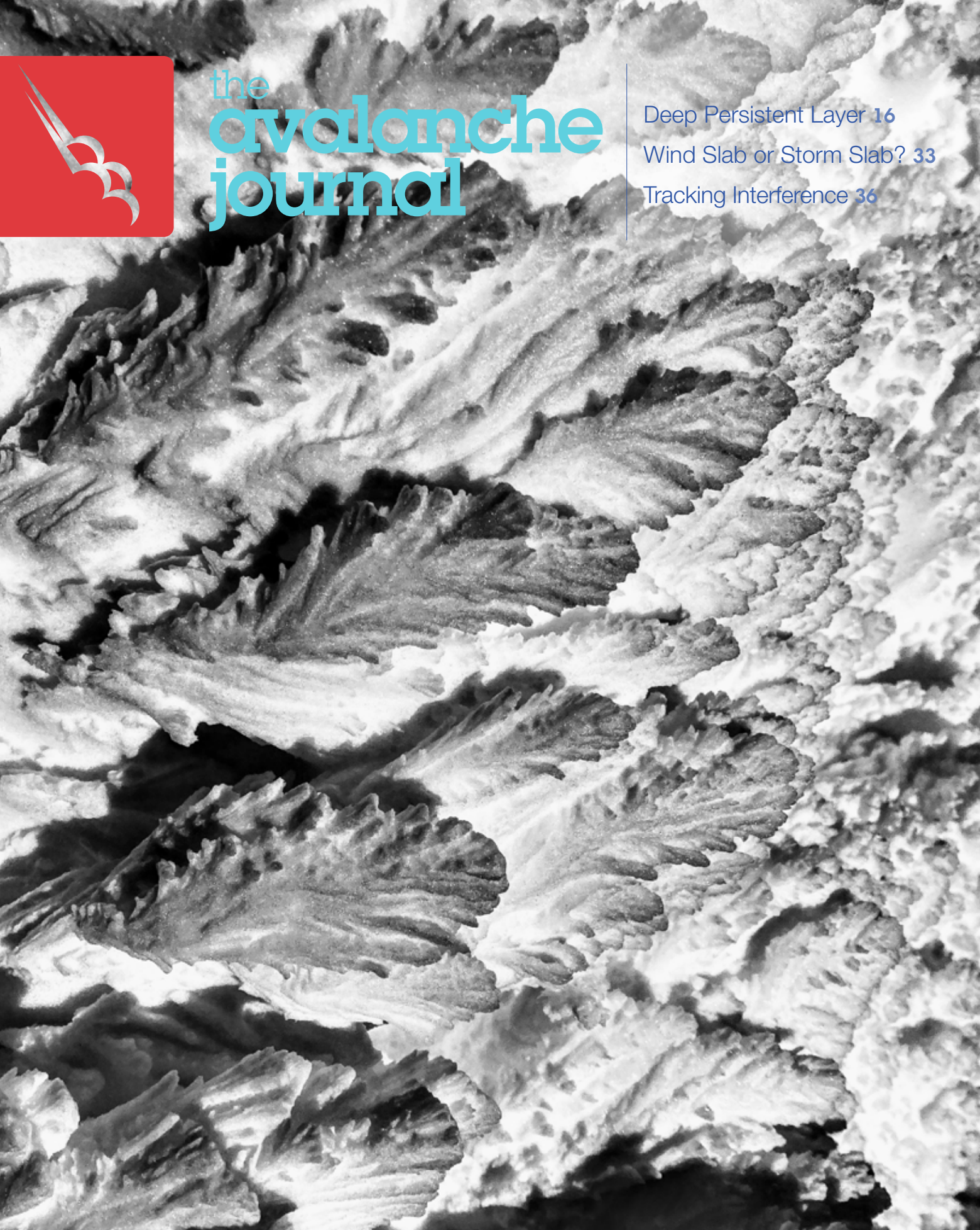

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COVER MATT MACDONALD
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FALL 2023

in this **issue**

Eirik Sharp
CAA President

CAA President's Message

FIRE AND SNOW

MY WIFE HAS BEEN deeply immersed in wildland fire management for most of her career. Our relationship, bridging her world of fire and mine of snow, has always seemed to symbolize the power of opposites attracting. Over time, I've realized our professional universes are not so different. In many ways, we tread parallel paths through challenging and often unforgiving environments that demand a high level of dedication and specialized knowledge, and a willingness to work in potentially hazardous conditions. 2023 has presented challenges in both our worlds. Last winter, avalanche workers in western Canada grappled with one of the most unpredictable snowpacks in the last two decades. This summer, wildland firefighters across Canada have battled the most destructive fire season on record.

Many of our members have a foot in both worlds, and I want to open this issue of *The Avalanche Journal* by acknowledging your efforts. I'd also like to dedicate a moment to honour the memory of the three firefighters who lost their lives this summer. If there is anyone who can empathize with what these losses mean to your community, it is avalanche workers. You have our appreciation and support.

With hope of fires easing, and snowflakes on the horizon, my attention has turned to the eagerly awaited International Snow Science Workshop (ISSW) in Bend, Oregon, this October. It's remarkable to think the last time the global avalanche community met face-to-face at a North American ISSW was in Breckenridge in 2016.

For those who have not had a chance to attend the conference previously, I encourage you to register if you are able to. ISSW is unique in its merging of theory and practice. Its synthesis of the latest research, techniques, and on-the-ground experience is of tremendous value to anyone in the avalanche patch.

Perusing the program schedule, I am excited to see CAA members are playing an integral role in the proceedings. ISSW is equally about networking, collaboration, and celebrating our shared commitment to snow safety, and I am looking forward to catching up with friends and colleagues from both near and far.

For those who cannot attend, ISSW 2026 is slated to be held in Canada. Although the host venue has yet to be finalized, the CAA is committed to supporting an emerging working group seeking to host the ISSW. We look forward to helping them foster accessible participation for Canadians and those visiting from beyond our borders.

Over the summer, the board has continued work addressing key objectives advancing our strategic plan. Here's a brief overview of what we've accomplished and what's on the horizon:

- The new Educator Membership categories are taking shape. An implementation working group has been set up, complemented by a dedicated project team. We remain on track to deliver pilot courses for the Basic Avalanche Educator category this winter. Regular updates in Member News will continue to keep you informed about this project's progression.
- To help expedite application processing, the board and Membership Committee are in the process of shifting the initial review of membership applications to paid reviewers. Final approval will be done by the committee.
- The board is working with the Technical Committee to update *Observation Guidelines and Recording Standards* (OGRS). The revised edition will update existing definitions and concepts as needed, and ensure alignment with other standards such as the American Avalanche Association's guidelines.
- The Diversity, Equity, and Inclusion Committee is up and running, and its members are in the process of formalizing its terms of reference. Thank you to those who volunteered; your contributions will shape an increasingly inclusive future for our association.
- We're searching for committed individuals to join the Discipline and Complaint Investigation Committees. Contact president@avalancheassociation.ca if you are interested in participating.
- Ensuring integrity and transparency is fundamental to effective governance. In line with this ethos, the board has ratified a conflict-of-interest policy for the board and committees. We are also developing a policy to improve the transparency of our hiring processes, especially when engaging CAA members on projects.

As we transition from summer to winter, the shared challenges and risks faced by both wildland firefighters and avalanche professionals come into sharp focus. They testify to the importance of continual learning and collaboration in our field. The CAA remains committed to elevating safety and operational standards, and I would like to thank all the members involved in the CAA's various initiatives for their consistent support and commitment.

I look forward to connecting with many of you this fall—in Bend or elsewhere!

Eirik Sharp, President

Joe Obad
CAA Executive Director

Executive Director's Report

OPERATIONAL NEWS YOU CAN USE!

THIS EDITION OF *The Avalanche Journal* likely arrives in members' mailboxes in early fall as many of you are looking to the winter ahead. We hope you had a good summer to recharge. Lots has happened over the last few months, so let's get you caught up on some of what your association has been up to.

On the InfoEx front, we want to thank the good folks at Public Safety Canada for extending the funding on our MAInEx project. As the project neared the end of its timeline earlier this year, we had only just begun working on several of the mobile features we'd committed to. Stuart Smith and the team needed to put in extensive backend work to bring InfoEx's architecture up to speed to allow for the planned mobile features. This necessary work took a good bite out of our funding. After extensive conversations with Public Safety Canada, our funding was extended to allow our team to complete the project. For this, we are very grateful, and we are excited to see the work continue to deliver the functionality InfoEx users have asked for.

On the membership front, this spring, membership voted overwhelmingly in favour of the creation of two new categories: Basic Avalanche Educator and Advanced Avalanche Educator. In July, we provided a mid-summer update on the progress made up to that point, and the steps ahead. This involves work by both the Industry Training Program and Membership Services, which I touch on below.

ITP has been busy developing courses to support the new Educator categories. Led by the Curriculum Specialist, the team is designing three courses: 1) *Avalanche Educator Foundations* (online), 2) *Basic Avalanche Educator* (field), and 3) *Advanced Avalanche Educator* (field). The foundation course will be required by both educator categories. The other courses will be applicable to their respective membership categories.

At the membership end, Membership Chair Kerry MacDonald, Operations Manager Rosie Denton, and others are working to iron out equivalencies to help ACMG and CSGA members apply efficiently by recognizing existing training in lieu of the proposed field-based courses. These processes will be extended to other organizations where possible. To assist this work, capacity has been increased by the addition of our new Membership Services Coordinator, Alec Macpherson. Welcome, Alec!

Currently, our target is to have the *Avalanche Educator Foundations* course ready by the end of November. The first beta *Basic Avalanche Educator* course is currently targeted for January 2024. A launch date for the *Advanced Avalanche Educator* course has not yet been set given the need to iron out the first two courses.

This work has been enabled by a strong team of Avalanche Professionals. Iain Stewart-Patterson, Terry Palechuck, and Lisa Larson are acting as the primary curriculum writers. They are being led by two great individuals working on the project.

We are very pleased to have hired Chris Dyck as our new Curriculum Specialist. Many will know Chris as an ITP instructor, but he has also worked on curriculum in a variety of capacities, including applying his master in Education in Columbia Bible College's Emergency Rescue Technician and Outdoor Leadership programs. Chris has a way of being both remarkably efficient and a pleasure to work with on complex files, talents that will benefit him as project manager for developing the Educator courses. Welcome, Chris!

Chris has stepped into the role previously filled by Emily Grady. After 13 years of ITP service, Emily is transitioning to working on her masters and has moved to a contract position, working on a few projects for the CAA. It is hard to call Emily's change a goodbye when we still connect on CAA work every week, but it is significant. Emily has been a blessing for the CAA, steering ITP through a variety of milestones in the role of ITP Manager for a decade, and then as Curriculum Specialist. We're glad Emily continues to be part of our team and look forward to celebrating her contributions.

We look forward to providing more updates on these and other initiatives in future issues of *The Journal* and Member News. If you need information about the CAA's projects or operations, feel free to email info@avalancheassociation.ca. Any inquiries are sent on to the right staff member to answer questions you may have.

We're excited for the season ahead and working to serve you. As you prepare for the season, the CAA is here to help, and we look forward to you being in touch.

Joe Obad, CAA Executive Director

Alex Cooper
Managing Editor

From the Editor

RAPID TRANSITIONS

IT FEELS LIKE WE JUST barely managed to send the spring/summer 2023 issue of the *The Avalanche Journal* to the printer when work began on this edition. I suppose that's the result of changing press schedules—the last one was later the usual, and this one is earlier. My intention going forward is to publish in September, December, and May, with spring and summer set aside for soliciting contributions. Hopefully the new schedule will give plenty of time for people to write in the slightly-less-busy snow-free months, in between vacations and preparing for the next winter.

Before I preview this issue, I'd like to thank everyone who heeded our call for photos. We've received contributions from 14 members so far, and they will go a long way towards making this magazine and our other publications more colourful. I'd also like to thank the people who showed up to the open editorial meeting at the end of August. It's great to get member input and hear direct feedback.

The focus of this issue is on the 2023 deep persistent slab problem. I received contributions from five individuals that look at how they confronted the challenges the winter presented. I hope you find something valuable in the lessons they impart.

Ryan Buhler writes about how Avalanche Canada managed the public forecasting challenges, while also contemplating how he interprets the danger ratings. Kate Devine, owner of Selkirk Lodge, discusses the challenges managing multiple guiding teams and ensuring everyone is on the same page regarding the operational risk band. Veteran guide Roger Atkins looks at terrain use at CMH Galena and provides advice on managing deep persistent slab problems. Finally, in interviews, Julie-Ann Chapman talks about managing the problem as a snowmobile guide and instructor; and Penny Goddard shares her perspective as an independent guide, and working at heli-ski and ski touring operations.

In the Loupe, our section on research, features Nata de Leeuw, who looks at how avalanche professionals interpret storm slab and wind storm slab problems in communications "uninfluenced by public perception." This article is a great follow-up to last issue's article by Heather Hordowick, which looked at how public forecasters used different avalanche problems in their bulletins.

We also have another look at transceiver interference. Terry Palechuk, a Ski Guide and instructor at Thompson Rivers University, used GPS devices to map the impact of interference on search tracks and signal pickup. His article presents further compelling evidence of the interference we can face with all the electronics we carry into the backcountry.

In the Snow Globe section, we introduce the first part of Brendan Martland's Avalanche Heckler series. He takes a somewhat tongue-in-cheek look at the way avalanche professionals use and abuse certain terms. It's a topic I'm fond of. We welcome others to respond and even contribute their own submissions—just remember, this series is meant to be lighthearted.

Finally, I'm happy to provide an excerpt from a lengthy interview with with Clair Israelson conducted by John Woods as part of the CAA History Project. Over the past few years, John and I have interviewed over a dozen past CAA Presidents and Executive Directors. All of this material, and more, will be online soon for your reading and listening pleasure. I'm excited to present this new website to the membership and the public.

This issue should be reaching you a few weeks before ISSW 2023 in Bend, Oregon. I'm excited to be attending and look forward to seeing some of you there in the conference hall and on the trails. The next issue of *The Journal* will come out around Christmas; the deadline to contribute is in early-November. I am hoping to present highlights from Canadian contributions to ISSW, so if you are presenting and would like to share your abstract; or attending and want to share your highlights from the conference, please get in touch. As always, I can be reached at acooper@avalancheassociation.ca.

Alex Cooper, Editor

Feedback on **Members' OGRS Questions**

CAA Technical Committee

THE CANADIAN AVALANCHE ASSOCIATION TECHNICAL COMMITTEE (TECHCOM) met during the 2023 Spring Conference in Penticton to discuss numerous questions raised by membership related to the content of *Observational Guidelines and Reporting Standards* (OGRS). One of the main responsibilities of TechCom is to ensure the scientific integrity the CAA's internal technical documents and publications, including OGRS. A major revision is currently being planned; however, its official release isn't expected for at least a year or two. Given that timeline, TechCom wanted to provide some initial feedback and recommendations to these questions raised.

GLIDE SLABS

Glide slabs are currently not listed as a "Type of Snow Failure" (Section 3.3.7) when observing and recording avalanches. Glide slabs will be defined and included in the next OGRS update. Until then, members are encouraged to observe and record glide slabs. The failure mechanism and forecasting practices are distinct compared to slab avalanches failing within the snowpack. InfoEx is already setup to record avalanche observations as glide slabs.

CRUSTS

A request surfaced for clarification about how crusts commonly observed in avalanche work should be recorded. First, some background: OGRS references the International Classification for Seasonal Snow on the Ground (ICSSG) as the technical standard for observing and recording snow. There is value in being consistent with international standards used in other industries and other fields (e.g., hydrology). Two main types of crusts are described that are relevant: "ice forms (IF)" and "melt forms (MF)." The critical distinction between these is the formation and identification of pores and individual grains. Ice forms are distinct ice layers where, *"pores usually do not connect and no individual grains or particles are recognizable, contrary to highly porous snow. Most often, rain and solar radiation cause the formation of melt-freeze crusts MFcr."* Most crusts we observe in avalanche work would fall into the melt forms category. However, ice forms have been commonly used in practice, likely due to the sub-class distinctions for "sun crust (sc)" and "rain crust (rc)," which are critical distinctions for avalanche risk mitigation because they provide information about where these layers exist in the terrain. Sun crusts are more aspect dependent, and rain or temperature crusts are more elevation dependent.

With the intention of remaining consistent with the ICSSG standard and to interpret this standard in a way that is beneficial for avalanche work, TechCom recommends classifying most crusts as "Melt Forms (MF)" and to use the sub classes for sun crust (sc), rain crusts (rc), and temperature crusts (tc) when useful for practitioners. For example, an observed sun crust (i.e., discernable grains and pores, and not a solid ice layer like "firnspegal") in March in the Columbias would be classified as "MFsc". The sub-classes are not currently available to use directly with digital profiles and observations platforms (e.g. niViz, Snow Pilot, InfoEx); however, comment fields could work.

EXTENDED COLUMN TEST (ECT)

TechCom recommends using the latest version of recording for the Extended Column Test (ECT) as defined in the American Avalanche Association's *Snow, Weather and Avalanches Guidelines*[2] (SWAG). The main difference from what is currently specified in OGRS is recording the "number of taps or the number of taps plus one." Table 1 shows the current recording description directly from SWAG.

DESCRIPTION	DATA CODE
Fracture propagates across the entire column during isolation.	ECTPV
Fracture initiates and propagates across the entire column on the ## tap	ECTP##
Fracture initiates on the ## tap, but does not propagate across the entire column. It either fractures across only part of the column (observed commonly), or it initiates but takes additional loading to propagate across the entire column (observed relatively rarely).	EXTN##
No fracture occurs during the test	ECTX

TABLE 1: RECORDING STANDARD FOR THE EXTENDED COLUMN TEST AS DESCRIBED IN SWAG.

OBSERVING BLOWING SNOW

A request for clarification was received about where one should make the observation for blowing snow—at the current location of the observer (e.g., weather study plot) or at ridgetop? The observation of blowing snow is typically made to estimate recent loading in potential avalanche starting zones with the intention of predicting the likelihood of avalanche release. Therefore, the observation of blowing snow

[1] Fierz, C., Armstrong, R., Durand, Y., Etchevers, P., Greene, E., McClung, D., Nishimura, K., Satyawali, P., and Sokratov, S., 2009. The International Classification for Seasonal Snow on the Ground. IHP-VII Technical Documents in Hydrology N°83, IACS Contribution N°1, UNESCO-IHP, Paris.

[2] American Avalanche Association, 2022. Snow, Weather, and Avalanches: Observation Guidelines for Avalanche Programs in the United States, 4th Edition. Denver Colorado.

should typically be made for operationally relevant avalanche starting zones—typically these are at ridgetop or higher. In other words, Avalanche Practitioners and Professionals should make the blowing snow observation for locations that is most important for their risk management program.

HN24

A request was received for clarification of how the HN24 board should be observed and recorded. The HN24 measurement attempts to determine the height of new snow that fell within the last 24 hours. Here is the definition currently in OGRS: *"24-Hour (HN24): The HN24 board is used to measure snow that has been deposited over a 24-hour period. It is cleared at the end of the morning standard observation."* HN24 should be recorded only once per 24-hour period, and it is recommended that this measurement be recorded at a consistent time when possible. HN24 should not be recorded two times per day.

DAISY BELL

TechCom was asked for guidance on what code should be used when performing helicopter assisted avalanche control with a gas-based device such as the Daisy Bell. Xhg is recommended, and this will be revisited during the OGRS update. The rationale for Xhg is: explosive control (X), helicopter (h), and gas (g).

DEFINITIONS FOR DEPTH, THICKNESS, HEIGHT

Questions have arisen about whether snow depth, thickness, and height should be measured vertically or normal to the slope (perpendicular). The definitions vary across European and North American standards (e.g., OGRS, SWAG), and vary for different areas of practice (e.g., engineering planning, operational field work). Depth is typically used as a vertical measurement in avalanche work likely because we relate snowpack measurements to profile observations where measurements are made vertically. However, depth is also used as a slope-normal measurement in other fields and when calculating snow creep and glide forces. A formal update to these definitions is planned for the upcoming OGRS; however, to provide some initial guidance, the default measurements should be:

- Thickness—measured slope normal.
- Height—measured vertically.
- Depth—measured vertically. If depth is used as slope-normal, it is recommended to state explicitly 'slope-normal depth.'

Lastly, we hope to formally engage the membership for areas where OGRS can be improved, clarified, and/or revised before the revision begins. However, please reach out to any of TechCom members with any questions at any time and we will provide feedback.

[3] Margreth, S., 2007: Defense structures in avalanche starting zones. Technical guideline as an aid to enforcement. Environment in Practice no. 0704. Federal Office for the Environment, Bern; WSL Swiss Federal Institute for Snow and Avalanche Research SLF, Davos. 134 pp.

CAA Welcomes **New Staff**

CHRIS DYCK, ITP CURRICULUM SPECIALIST

Chris has joined the CAA in the role of Curriculum Specialist. Chris has a master's degree in education and has spent the past 20 years working in post-secondary education as a program director, instructor, and curriculum developer for outdoor education and leadership programs. He has worked as an avalanche technician and forecaster at ski resorts over the past 14 seasons, is a CAA Avalanche Professional, and has led and instructed several Avalanche Operations Level 1 courses. Chis enjoys spending time skiing in the Coquihalla and riding the many fantastic trails of the Fraser Valley.

ALEC MACPHERSON, MEMBERSHIP SERVICE COORDINATOR

Alec has joined the CAA in the role of Membership Services Coordinator. Having spent summers sea kayak guiding and winters touring the coastal snowpack on Vancouver Island, he is looking forward to helping community members in an industry he's passionate about. He recently managed operations at a coastal lodge and is ready to apply his organizational and interpersonal experience to his new role.

CAROLINE POOLE, ITP STUDENT SERVICES

Caroline has joined the CAA to oversee student services for the Industry Training Program. Originally from Toronto, Caroline moved to Revelstoke after finishing her bachelor's degree in history and film at Bowdoin College in Maine, USA. When not in the office, you can find Caroline skiing, trail running, climbing, mountain biking, or enjoying lunchtime polar dips in the Columbia River. Caroline is excited to bring her keen organizational skills and a passion for helping others to her work in the avalanche safety industry.

Contributors

NATA DE LEEUW began her career as a ski patroller at Castle Mountain Resort, where she eventually worked as a member of the forecast team. Two years ago she moved to Montana to pursue a master's degree. Despite moving away from southern Alberta, her passion for wind slabs remains.
33 WIND SLAB OR STORM SLAB?

TERRY PALECHUK is an ACMG Ski Guide, CAA Avalanche Professional, and an Associate Teaching Professor in the Adventure Studies Department at Thompson Rivers University. He has been active playing in the winter backcountry for over 30 years and instructs both recreational avalanche courses as well as Level 1 courses for the CAA.
36 TRACKING INTERFERENCE

ROGER ATKINS has a background in the physical sciences and a passion for powder skiing. This led to a certain negligence at office work and more than 35 years as a helicopter ski guide. Roger regularly collaborates with researchers to find methods that combine technical knowledge and human behaviour to improve backcountry avalanche risk management.
24 THE ROLE OF UNCERTAINTY IN TERRAIN SELECTION

KATE DEVINE is an ACMG Ski Guide and CAA Avalanche Professional who comes by her profession pretty honestly, having grown up at Selkirk Lodge. Outside of the snowy months, Kate loves to travel, run, bike, surf, and ride through the mountains on horseback. She lives in Revelstoke with her furry sidekick, Rita.
16 LESSONS FROM A BACKCOUNTRY LODGE

RYAN BUHLER is the Forecast Program Supervisor with Avalanche Canada. He is a graduate of the ASARC program and a former CAA board member. Ryan's background includes experience as a ski patroller, avalanche technician in Rogers Pass, search and rescue volunteer, industrial avalanche technician, public avalanche forecaster, and engineering consultant. During his free time, Ryan enjoys international travel, live music, and hiking.
20 HOW THE DEEP PERSISTENT PROBLEM SHAPED AVALANCHE CANADA'S WINTER

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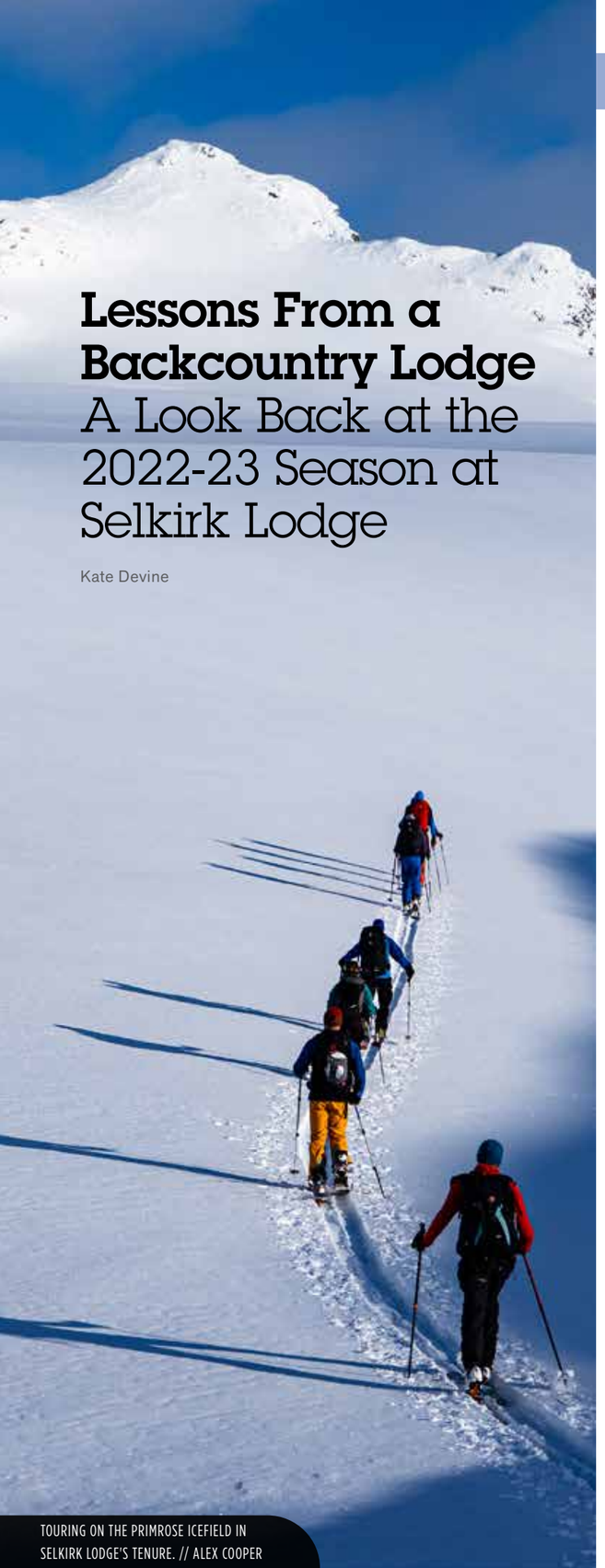
THE ROLE OF UNCERTAINTY IN TERRAIN SELECTION

in this **section**

// MATT MACDONALD



Lessons From a Backcountry Lodge

A Look Back at the 2022-23 Season at Selkirk Lodge

Kate Devine

TOURING ON THE PRIMROSE ICEFIELD IN SELKIRK LODGE'S TENURE. // ALEX COOPER

Note: This article is based on Kate's report for the CAA Avalanche Operations Level 3 program.

IN DECEMBER 2019, I took over as the owner of Selkirk Lodge, which was my family's business since its inception in 1986. I grew up at the lodge and have always felt most at home in the mountains. I knew very early on I wanted to pursue a career in ski guiding and eventually take over the business. I completed my ski guide certification in my mid-twenties and spent some time working in different facets of the industry before transitioning to running Selkirk Lodge full-time.

Although my lodge career was promptly turned upside down by COVID, the snowpack and risk management challenges of the 2022-23 season certainly gave the virus a run for its money. The following is a condensed version of my CAA Avalanche Operations Level 3 paper, which focused on the 2022-23 season.

Selkirk Lodge began its avalanche risk management program at the outset of the business in 1986. The program has evolved over the years in accordance with the evolution of the professional avalanche industry in Canada. Some changes include the creation and implementation of more structured risk management and avalanche safety plans, the adoption of the InfoEx, more comprehensive weather forecasting products, improved communication within the professional community, and easier communication in general due to technological advancements such as satellite internet. Since taking over the business in 2019, I have been attempting to create and implement a more formal avalanche risk management framework than what existed previously. As a guide and avalanche professional, I saw room for growth within our avalanche risk management program.

The biggest avalanche risk management challenge that is somewhat unique to Selkirk Lodge is the guides do not work as employees of the operation. Approximately 60% of the trips are sold to independent guides who have their own guiding companies and bring their own clients to the lodge. During these weeks, the guiding company is the client of Selkirk Lodge, and the lodge provides the helicopter flights, accommodation, and catering. The remaining 40% of the weeks are guided by myself and guides who are contracted to work for Selkirk Lodge. The challenge is figuring out a way to maintain operational continuity and to have a risk management framework that is adopted by all of the guides in order to ensure all guiding programs operate within the operational risk band.

WINTER 2022-23 WEATHER AND SNOWPACK SUMMARY

The winter of 2022-23 was atypical for the region due to lower-than-average snow amounts, particularly in the early season. The season snowpack depth reached only 81% of average in the Upper Columbia River basin. Figure 1 shows a height of snow graph from the nearby study plot at Mt. Fidelity.

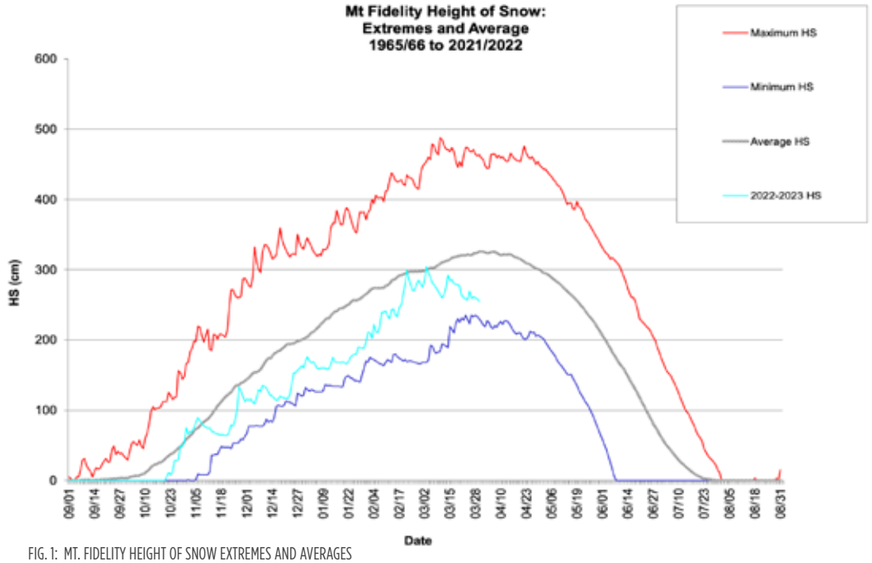


FIG. 1: MT. FIDELITY HEIGHT OF SNOW EXTREMES AND AVERAGES

It is notable how close the snowpack was to the historical minimum for much of the season. Additionally, it is my understanding most snowpack observation sites are located at or near treeline. I believe the alpine snowpack was likely even shallower relative to historical averages than most graphs illustrate due to some substantial wind events in the early-season that scoured many areas, removing what little snow there was. The majority of snowpack graphs available likely minimized the true shallowness of the alpine snowpack. This is quite relevant to Selkirk Lodge as there are often enhanced wind events and the tenure has a lot of alpine terrain.

Winter got off to an unseasonably warm and dry start at Selkirk Lodge, with no snow in the mountains and alpine temperatures above 20 degrees into the latter half of October. Some cooler, wetter weather in November ushered in the first snow of the season and the snowpack began to take shape. The weather then turned cold and dry, which resulted in the snow becoming faceted. Those facets were buried starting in mid-November by a series of storms, resulting in basal facets for the rest of the season.

In mid-December, the coldest weather of the winter arrived, with temperatures dipping to -30 C at treeline, resulting in continued faceting of the snowpack. By mid-December, there was approximately 120 cm of snow at treeline compared to 150-180 cm in a normal season. The entire snowpack felt faceted and "hollow." Next, a Christmas storm brought about 40 cm of new snow, burying the faceted snowpack.

January saw little more than dribs and drabs of new snow. December and January are typically the snowiest months of the year in this area, so this did not bode well for the snowpack, and it continued to feel hollow and spooky throughout January. February finally brought some substantial storms, with about 100 cm of new snow falling during the first week and snowpack depths inching slowly towards historical averages during the month and into March. A persistent weak layer was buried on March 11 that consisted of facets, surface hoar, and a crust. The rest of winter brought a mix of weather, until the last week of April, when freezing levels rose dramatically and temperatures reached 10 degrees at treeline. The final day of operations was April 29.

AVALANCHE ACTIVITY SUMMARY

While there were storm slab avalanche cycles associated with the bigger storms of the winter, as well as persistent slab avalanche cycles on some of the other layers of note, the big avalanche story of the season was the November basal facet layer.

The November facets began producing large avalanches near Selkirk Lodge in early-January. Three large avalanches were reported on this layer within the tenure over the season. In mid-January, a size 3.5 was recorded on Campion Peak. It was notable in that it crossed a large bench, which had not been seen in Selkirk Lodge's history. The debris ran into a commonly used ski line, in an area long considered to be out of range for avalanches from above.

Our nearest neighbour, Selkirk Tangiers Heli Skiing, reported nine avalanches on this layer throughout the season, ranging from size 1–3. In the Selkirks Mountains, there was near-daily reports in InfoEx of large deep persistent slab avalanches throughout January and February. Notably, the additional load to the snowpack in early-February appeared to correspond with an increase of deep persistent slab avalanches during the week of February 11–18. In mid-February, another notable avalanche occurred in our tenure, off of a large east face on Prudence Peak. This was estimated to be a size 3.5–4, and likely crossed the run Babes, though the debris was not observed. The suspected failure plane was the mid-November facets.

In March, deep persistent slab avalanches were reported with less frequency; however, they only slowed and did not stop. The frequency of deep persistent slab avalanches being reported in the Selkirks continued to taper off through April, with the last report submitted on April 20.

UNCERTAINTY

When uncertainty is due to difficult-to-forecast avalanche conditions such as deep persistent weak layers, I strive to manage it through careful terrain selection and, perhaps more importantly, terrain elimination. This was a prevalent theme last winter. There was terrain that was intentionally avoided all season simply because it had the potential to produce large avalanches on the November weak layer. This felt especially important due to the shallow and variable snowpack in our tenure. Although this was the overall pattern for the entire region, I believe it was compounded at Selkirk Lodge due to the enhanced impact of wind on the snowpack. Even as the season progressed and the likelihood of triggering became lower, the consequences remained high—as did the uncertainty. As such, it was deemed inappropriate to open many runs for the duration of the season. This is atypical of this region and presented a big challenge to our guiding teams.

Skiers are very vulnerable to large (size 3-4) avalanches. This is part of what made the winter so challenging. When dealing with the deep persistent problem, we were managing a low-probability/high-consequence scenario. While size 3-4 avalanches were not occurring regularly within our tenure, the possibility remained. Our risk treatment was to eliminate certain terrain from our run list. Additionally, the last scheduled week of the season (April 29 to May 6) was cancelled due to the weather forecast calling for 4,000 m freezing levels. The warm-up was guaranteed to trigger a natural avalanche cycle, with increased likelihood of DPWL avalanches. The risk treatment for this scenario was to avoid travel in avalanche terrain altogether.

The efficacy of our risk treatment is difficult to quantify, however, I believe it was successful. There was only one skier—a guide—involved in a small avalanche—a size 1.5 loose avalanche that did not result in an injury, burial, or lost equipment. We had about 2,500 skier days, including staff and guides, and we had very few incidents or near-misses overall, including non-avalanche related incidents. However, this does not account for potential non-event feedback scenarios, in which more risk-inclined behaviour results in non-events, therefore rewarding the behaviour.

THE OPERATIONAL RISK BAND

Though we cannot eliminate all risk, one of the biggest challenges at Selkirk Lodge is to create a risk management framework that allows a rotating team of guides to easily understand and operate within the operational risk band (ORB). There was one week in the spring when I felt that the guiding team operated well outside the ORB. There were no known near-misses or notable events, but I feel strongly it was a non-event feedback scenario.

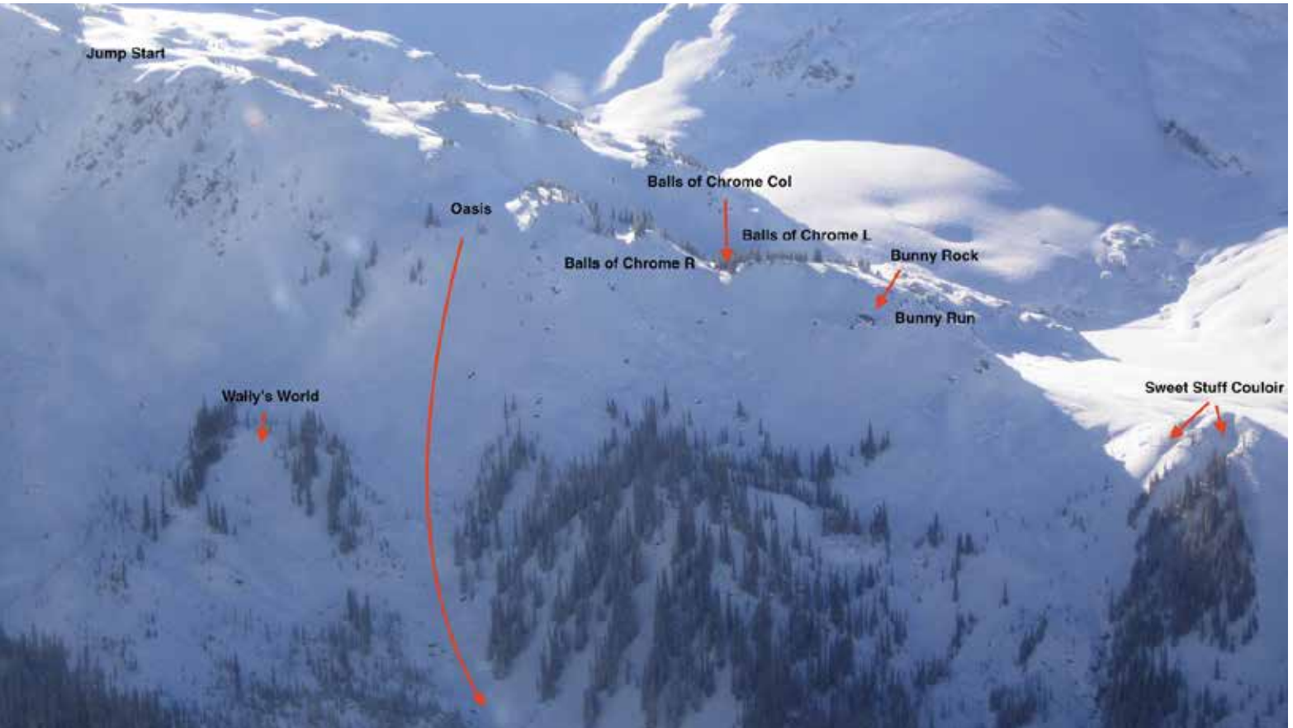


FIG. 2: SHOWS THE RUN "OASIS", WITH THE LOWER HAZARD TERRAIN TO THE RIGHT. // KATE DEVINE

One of the big challenges is defining the ORB. Many of the risk controls and risk treatments already in place aim to create consistency among the guides, but if the ORB can't be defined, then we are limited in our ability to communicate effectively about how someone might be operating outside of it. Even if we can quantify our ORB, we are challenged to implement it consistently across all guiding teams.

This brings me back to the concept of the non-event feedback loop, where risky behaviour is rewarded with a non-event. When I perceive this to have occurred, I feel as though the guiding team is operating outside of the ORB. If there is no event, the challenge of communicating this to the team can be significant. In some cases, the team may agree with my assessment, but not always. If the expected outcome of a given season is zero avalanche fatalities, then every guiding team this winter met that goal. In fact, there has only been one fatality in the 36-year history of Selkirk Lodge. Regardless, it is not always the case that I observe the guiding teams to be operating within the ORB. This is a subjective observation, of course, and one that can be difficult to communicate when there has been no incident or near-miss. If the ORB is difficult to define and effectively communicate, then we may need to rely on a robust process to create guardrails that keep guides within it as much as possible.

While defining and effectively communicating the ORB to the guiding teams is an important aspect of risk control, it ultimately comes down to creating a guiding team where this is not inherently difficult. A key factor here is "buy-in." If the guiding teams are on board with the ORB, that makes things relatively simple. Another important factor is communication skills. I have had experiences where guides do not take feedback well and discussions turn into arguments. It is a risk-control measure to choose to work with guides who are open to feedback, good at delivering feedback, and who can help to facilitate an atmosphere of productive communication.

Another facet to this is the fact that risk tolerance levels are naturally varied within the guiding community and at some point, even the best communication will not bring two very divergent tolerances into alignment. While communication should be attempted in order to bring the guiding team into alignment with the ORB, there is also value in recognizing when a relationship is not a good fit.

LESSONS LEARNED

A few key lessons from this winter stand out. The first is the overwhelming importance of the run list. I believe it is a key risk control piece that provides a tangible framework for the ski program. I can think of several times when I wanted to ski a run called Oasis (Fig. 2), but it was red. This run was closed all winter due to the DPWL even though it is typically a commonly skied run. It's considered a tree run, though it is actually very open. The start zone is substantial, as is the connectivity to some very large avalanche terrain on adjacent slopes. I feel I could have been lured into skiing Oasis due to both familiarity and motivational biases. I can recall some days in January where it was difficult to put a good ski program together due to poor visibility and limited new snow. I felt I was running out of places to ski untracked snow in the lower-hazard terrain near Oasis. The run list kept me in check and kept us out of that terrain. As is often the case with low-probability/high-consequence avalanche problems, we may have been able to ski it without incident; however, Oasis had the potential to produce a large avalanche on the basal facets.

The importance of the run list ties into my main conclusion with regard to effectively managing a deep persistent slab problem: the only truly effective way to manage one is to eliminate terrain with the potential to produce avalanches on the layer in question. These problems present us with huge amounts of uncertainty, which I feel can only be appropriately managed through diligent terrain avoidance.

The second key lesson I learned was the importance (and the challenge) of clearly defining the ORB. In order to expect others to operate within the ORB, it needs to be something that can be clearly communicated to the guiding teams. Without this definition, I am setting an unattainable expectation with no clear parameters. In order to keep guides operating within this risk band, I believe I will need to rely on a good process and policies if I am not able to define the risk band.

The third key lesson was becoming more aware of the limitations to our data collection abilities. Any time an operation is opening previously closed terrain, data points are going to be instrumental in showing that certain criteria have been met. Without data points, our decisions become entirely subjective, which could be hard to justify if there was ever an incident.

CONCLUSION

Selkirk Lodge did not experience any true notable events last winter. A big reason for this is our risk control and treatment methods are extensive. Another key factor in having an uneventful season was frequent and ongoing communication between myself and the other guides about the deep persistent slab problem we were dealing with. I feel I made it clear we would be managing the basal weak layer for the entire winter, and that I did not foresee a time when it would be appropriate to step out into the terrain we had been keeping closed. The conversations I had about this with the various guiding teams were generally productive, and we typically found ourselves aligned in our mindsets. However, even when aligned, I think it was important this was verbalized in order to alleviate pressure on the guides. We all desired to produce an amazing product for our clients, and I wanted to make it clear there was no operational pressure to step out into the bigger terrain, even as reports of deep persistent slab avalanches became less frequent.

I observed an incredibly successful season, with fantastic skiing and happy guests, all while very effectively managing high levels of uncertainty, primarily through terrain elimination. While it is important to credit our risk control and treatment strategies, we also can't overlook the role of good fortune. There will always be residual risk, and even with good processes we can still have bad outcomes. Sometimes the only thing standing between us and a bad outcome is good luck.

How the Deep Persistent Problem **Shaped Avalanche Canada's Winter**

Ryan Buhler, Forecast Program Supervisor, Avalanche Canada

THE 2022-23 SEASON in the Avalanche Canada forecast office was dominated by the complexities of public avalanche forecasting with a deep persistent avalanche problem. The season would ultimately end with 11 out of the 15 Canadian avalanche fatalities being associated with deep slab avalanches. This is comparable with other years that had notable deep persistent slab problems, such as the 2002-03 season, when 14 of the 29 fatalities were attributed to deep slab avalanches, and the 2008-09 season, when it was 17 of the 26[1]. This article outlines how this exceptional winter led to us adapting our approach to public avalanche safety messaging and the challenges we faced.

EARLY SEASON

As early as the first weeks of December, it became apparent we were dealing with an unusual snowpack. We heard concerns from the guiding community, who made comparisons to historic seasons like 2003 and 1993, and it became clear that we were about to embark on a challenging season. Low early-season snowfall, long periods of drought, and two Arctic outbreaks in early-December resulted in the formation of a prominent basal weak layer in much of western Canada.

The season's snowpack is examined more closely in my blog, "A Technical Review of the Formation of the 2022-23 Deep Persistent Problem[2]" published in early-April. Although we did not yet have a widespread slab or an abundance of avalanche activity, we understood the need to prime the public for the problems lurking in the snowpack. We issued our first blog[3] on December 9 to highlight the unusual persistent weak layer and discuss the factors that might cause a tipping point for widespread avalanche activity on this layer. A few days later, we reached that threshold and issued a second blog[4], warning about the potential for touchy persistent slab avalanche activity.

Shortly after that, Grant Statham of Parks Canada issued a blog[5] titled "Persistent to Deep Persistent – Why the Switch?" that explained why the forecast regions in the Central Rockies had already made the transition to the deep persistent slab problem. Although we had started messaging around a persistent problem, Grant's blog was the first product that alerted the public to the possibility of a season-long problem and the need for a different mindset throughout the winter. This was a signal that we needed to shift our approach to messaging for the remainder of the season. While advising an entire season of restraint and extra caution was essential, we knew it could be a hard sell to the public. Upon re-reading that blog at the end of the season, I found it was quite prescient and laid the framework for many of the concepts we would explain to the public for the rest of the winter.

NEW YEAR, NEW CHALLENGES

Avalanche activity on the basal layer began to occur in mid-December, but it was the major storm at the end of the month that marked the start of widespread large avalanches (Fig. 1). This cycle included wide propagations across multiple features and instances of remote triggering. Given the combination of this major storm and the potential for a busy New Year's long-weekend, we issued a Special Public Avalanche Warning (SPAW) with Parks Canada for most of the interior regions on December 28. During this time, many of the Avalanche Canada forecast regions still referred to a persistent slab problem with large surface hoar being a major component of a complex November weak layer throughout the Columbia Mountains.

By January 5, we had transitioned to categorizing the November weak layer as a deep persistent problem for all our regions. The exceptions were the south coast, parts of the north coast, the southern Rockies, and southern Kootenays, where a rain event in late-December formed a thick crust that capped the snowpack in those areas.

That day, Senior Forecaster Mike Conlan issued his blog[6], "The Persisting Problem," which contained our first map outlining the areas where the problem was most prominent. We later refined that map for a subsequent blog, as the extent of the conditions became apparent (Fig. 2). The first fatal avalanche incident of the season occurred on January 9, shortly after it was published. As part of the media response, many of the concepts presented in this blog were incorporated into media pieces and this formed the foundation of much of our messaging for the rest of January and February.

We saw little change in conditions until February and the snowpack remained shallow with no prominent bridging layers to improve stability. February brought an increase in storms and by the end of the month many parts of the central and northern Interior were returning to average snowpack depths. In regions with deeper snowpacks, like the Monashees, Cariboos, and Northern Rockies, avalanche activity on the deep persistent layer tapered. Despite this, concern remained for thin snowpack areas such as windswept alpine slopes (Fig. 3). Another shift in messaging was required and we now pivoted our approach to issue warnings with a more focused emphasis on terrain selection.

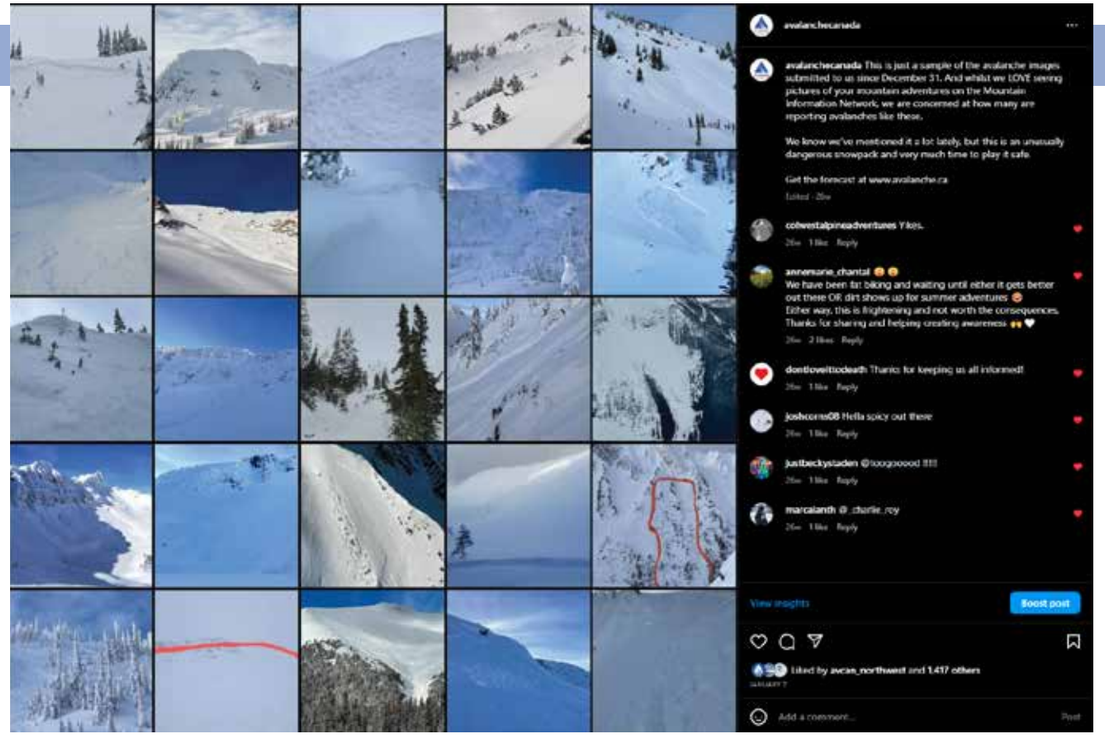


FIG. 1: A SOCIAL MEDIA POST FROM THE AVALANCHE CANADA INSTAGRAM CHANNEL CAPTURES THE SCALE OF AVALANCHE ACTIVITY. THESE WERE A SELECTION OF MOUNTAIN INFORMATION NETWORK POSTS FEATURING LARGE AVALANCHES SHARED BETWEEN DECEMBER 31 AND JANUARY 7.

FIG. 2: THIS MAP, FEATURED IN OUR BLOG, "THE DEEP PERSISTENT SLAB PROBLEM IS NOT GOING AWAY," OUTLINES THE EXTENT OF THE DEEP PERSISTENT PROBLEM IN MARCH.

In regions with thinner snowpacks, like the Purcells, we remained concerned about snowpack stability in more widespread terrain and continued to issue broader warnings in our bulletins.

MEDIA ATTENTION

Fuelled by a series of fatal avalanche accidents, high-profile near-misses, and continued strong messaging by us and other safety organizations, the first two months of 2023 brought an unprecedented amount of media attention. This heightened media interest provided us with a platform to amplify our messaging and effectively reach a broader audience, including those without avalanche training or experience. It served as a valuable tool for conveying our concerns and educating the public on the dangers associated with an unusual season.

Avalanche Canada was featured in more than 13,000 news and media pieces, a rise from roughly 5,500 the winter before. At its busiest time, the forecasting team was conducting multiple interviews daily and the communications team was triaging many more requests. We recognized the importance of maintaining a balance

[1] Cam Campbell and Matt Macdonald, 2010. A Recipe For Widespread Persistent Deep Slab Avalanche Characteristics in Western Canada. Canadian Avalanche Association, Journal Volume 94, Fall 2010.
[2] https://avalanche.ca/blogs/2022-23-dps-formation
[3] https://avalanche.ca/blogs/the-waiting-game
[4] https://avalanche.ca/blogs/managing-a-persistent-slab
[5] https://avalanche.ca/blogs/deep-persistent-vs-persistent
[6] https://avalanche.ca/blogs/the-persisting-problem

FIG. 3. AN IMAGE FROM THE MOUNTAIN INFORMATION NETWORK THAT DEMONSTRATES THE NATURE OF THE AVALANCHES WE WERE CONCERNED ABOUT. BY SAMM MATHESON

between ensuring effective media coverage and avoiding overexposure. Our focus during this time was on delivering critical information about conditions, promoting avalanche awareness, and emphasizing the importance of caution.

MODERATE OR CONSIDERABLE?

Describing avalanche danger in a period of extended elevated concerns over public safety also introduced another discussion topic to our forecast team: the use of moderate vs. considerable danger ratings in the context of the deep persistent problem. These discussions prompted us to closely examine the definitions of the danger ratings and analyze their individual components within our department. This process helped us identify which elements carried the most significance in the given situation, making it easier to assign a danger rating for a low-probability/high-consequence scenario like the deep persistent problem (Fig. 4).

Early in these discussions, I became aware of my personal bias when applying the danger ratings. I tended to lean heavily on the likelihood section of the rating. For instance, when forecasting for direct action problems like storm slabs, I leaned towards assigning a moderate rating if natural avalanches were unlikely. Conversely, if natural avalanches were possible, my bias would lean towards considerable. However, this is only one aspect of the definition and with a deep persistent problem, other components should hold as much or more importance. We also deliberated on the distribution section and debated whether the expectation of very large avalanches in isolated areas should automatically shift the rating to considerable, even if small avalanches were not expected in many areas.

One of the most difficult aspects of the problem during January and February was specifying where exactly the problem existed in the terrain. In the main danger definition, where considerable says "dangerous avalanche conditions" and moderate says "heightened avalanche conditions on specific terrain features," we found ourselves leaning towards "dangerous avalanche conditions" as the primary focus of our messaging. It was difficult to define the specific terrain features where the deep persistent problem existed in a way that was useful for the public. Roger Atkins' presentation at the Spring Conference explored part of the challenge related to certainty and where the problem existed. His presentation helped me personally reflect further on how I resolve disparities related to problem distribution, both within the terrain and at a regional level, and how we resolve our uncertainty when making decisions.

	MODERATE		CONSIDERABLE	
Travel Advice	Heightened avalanche conditions on specific terrain features		Dangerous avalanche conditions	✓
	Evaluate snow and terrain carefully; identify features of concern		Careful snowpack evaluation, cautious route-finding and conservative decision-making essential	✓
Likeihood	Natural avalanches unlikely	✓	Natural avalanches possible	
	Human-triggered avalanches possible	✓	Human-triggered avalanches likely	
Size and Distribution	Small avalanches in specific areas	✓	Small avalanches in many areas	
	Large avalanches in isolated areas	✓	Large avalanches in specific areas	
	Very large avalanches in no areas*		Very large avalanches in isolated areas	✓

FIG. 4: A TABLE SHOWING A HYPOTHETICAL BREAKDOWN OF THE APPLICABLE MODERATE AND CONSIDERABLE DANGER RATING DEFINITIONS FOR LAST SEASON'S DEEP PERSISTENT SLAB PROBLEM. ** Implied definition*

Senior Forecaster Simon Horton also provided insights on the problem by saying, "While it doesn't necessarily fit into the Conceptual Model of Avalanche Hazard or danger rating definitions, I felt a strong intuitive sense that 'dangerous conditions' described the approach needed to travel safely in the backcountry better than 'heightened.'"

REDUCING THE DANGER RATINGS

Only once we had a deeper snowpack at the end of February, with a more robust and bridging midpack, did we feel comfortable lowering the danger ratings to moderate. This decision was based on a decrease in avalanche activity on the deep persistent layer and a clearer understanding of the problem's distribution. This allowed us to be more specific in our warnings regarding where the deep persistent layer existed. The exception remained the shallower snowpack regions, such as the Purcells, where the problem remained more widespread and the danger ratings remained at considerable for a much longer period.

Spending so much time thinking about the definitions of danger ratings proved valuable during the season and provided me with a fresh perspective on how we rate danger for various avalanche problems. As forecasters, we carefully consider the rating often, but rarely do we have such an extended period where the danger could reasonably be described by multiple ratings. Since the definitions of danger ratings rarely align perfectly with every element of the avalanche danger, we must assess the significance we assign to each of the individual components and how this fits into our wider public messaging strategy. It is a worthwhile exercise to consider each of the components individually, reflect on how much weight you are putting on each part, and appraise how that may change related to the avalanche problem at hand.

HOW LONG SHOULD THE PROBLEM LAST?

The next important topic of discussion became the ongoing presence of the deep persistent problem in our bulletins once avalanche activity on the layer began to taper off in March. Typically, when dealing with a low-probability/high-consequence problem, our strategy has been to remove the problem from the bulletin during periods of low likelihood and reintroduce it when we expect it to re-emerge. This approach aims to minimize message fatigue for the public and highlight the problem when we expect it to be more severe. However, with this season's deep persistent problem, some of the forecast team felt uneasy about removing it from the bulletin for several reasons.

Most professional operations consistently included the problem in InfoEx throughout the entire season, and many of their likelihoods were above unlikely throughout March. We monitored this closely using custom InfoEx reports to assess the problem at a regional scale. Many of the hazard ratings in InfoEx also came with caveats and the terrain-travel section regularly mentioned avoiding specific types of terrain. Additionally, many guiding operations reported keeping pieces of their terrain closed for the entire season due to concerns about the deep persistent problem. If professionals remained concerned about the problem throughout the season, shouldn't we also keep it at the forefront for recreationists, even on days when the likelihood was reduced?

Given the nature of the information being supplied by professional operations and the complexities of distilling this information for public understanding, we decided to leave the problem in the bulletin and adjust the likelihood appropriately. In the later part of the season, there were many days when the problem was characterized as unlikely, yet it remained in the bulletin with messaging reminding users that the problem still existed. It is crucial to remember not all our users are seasoned in the backcountry, and we cannot expect that they have built up a mental picture of conditions as the winter progresses. We also cannot take for granted that they have context for conditions over the previous weeks or months in which to frame the forecast. Decision-support tools like the Avaluator are valuable to many recreationists and rely on the problems section of the forecast. Having the deep persistent problem remain highlighted as an avalanche problem instead of only mentioning it in the details section ensured it could be factored into the decision-making process of the average backcountry user.

As we moved through the season, we often wondered whether we were tending too far towards a conservative approach, being repetitive, or even heavy-handed. But upon balancing these concerns against the information we had and our goal of fostering public avalanche safety, this abundance of caution felt like the best approach.

IN SUMMARY

We all wanted the deep persistent problem to end. I even heard many professionals utter hopes for a high-elevation rain event in the middle of winter to alleviate the situation. The rain never came and the snowpack remained complicated for the entire season in the affected areas. Despite these ongoing challenges, this season still felt like a success in many respects.

Although the total number of avalanche fatalities exceeded the average—something we never like to see—it is noteworthy that the number of recreational fatalities was near average. In a year where the snowpack was challenging from start to finish and accidents seemed to trend towards very large avalanches with multiple involvements, this indicates our efforts were not in vain.

We must credit backcountry users for heeding the warnings and adjusting their mindset. It's not always easy to keep it conservative for the entire season, especially when the monotony of making conservative choices must have felt at odds with less obvious signs of instability. Without strong messaging, constant media attention, and buy-in from the backcountry community, it could have been a very different outcome. The lessons learned this year will undoubtedly serve to make us better forecasters and help us in our drive to constantly improve public avalanche safety. But we could all probably settle for a simpler season this coming winter.

The Role of Uncertainty in Terrain Selection

Roger Atkins

UNCERTAINTY IS CHALLENGING for a company responsible for the decisions of 170 guides with different backgrounds and different risk acceptance. In January 2023, CMH management raised a 'yellow flag' in response to uncertainty posed by the early-season snowpack. Early snow followed by clear weather had created a widespread deep persistent instability in British Columbia. Persistent weak layers of surface hoar are common in the Columbia Mountains, but deep persistent faceted layers are infrequent, only occurring approximately once every seven to 10 years. 2023 was particularly atypical—basal facets and depth hoar were widespread across the Interior, where all CMH operations are based, and even in the Coast Range.

The yellow flag sent a message to exercise extra caution, but also mandated additional procedures that introduced time for sober second thought and required extra care when opening terrain for guiding. These mandates reduced impulsive decisions by requiring an extra one-day waiting time and having a guide physically investigate runs before they were opened. The yellow flag was raised with the stipulation it would remain in effect for the remainder of the season; it would not be removed even if all indications were that the snowpack had stabilized.

The objective of the yellow flag was to influence terrain selection to reduce exposure to avalanche hazard across the entire company and to maintain this discipline for the entire season. I found it reduced the stress of guiding in these conditions; it became easy to just say "No" to even slightly uncomfortable decisions. I believe the key to its effectiveness was that the message to exercise caution came with procedural mandates that promoted behaviour for managing deep persistent instabilities.

FOUR QUESTIONS

Avalanche hazard assessment requires a different emphasis depending on the objective. For backcountry travel, the four essential questions for assessing avalanche character are: **"What?", "Where?", "How Big?",** and **"How Easy?"** These questions are all fairly easy to answer confidently and are informative for terrain selection. There is no order or priority to these questions; any one or combination of these questions may inform terrain choices. These questions can be answered by any number of methods, can be based on information from any source, and can be applied at any level of sophistication from novice to professional. Terrain selection often depends on a single detail; greater detail supports more nuanced decisions.

These four questions are essential, but there is more.

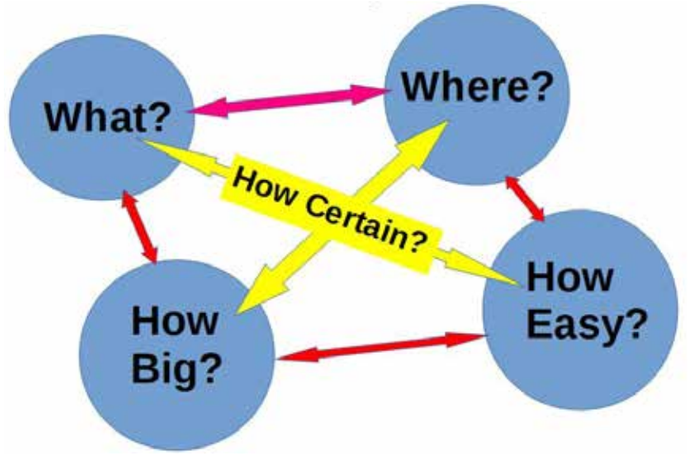
Understanding the certainty of an avalanche hazard assessment is complex but critical for terrain selection. To be useful, you need to know what you are uncertain about; it is helpful to assess the certainty for each of the four questions. The four essential questions along with their associated certainties form a network of interrelated information that is informative for terrain selection. This approach is not a linear process and any one or more of these elements may determine terrain selection. These questions are also informative for assessing and managing the avalanche hazard going forward.

Although similar—and there has been cross-pollination in the evolution of these ideas—this is not a derivation of the Conceptual Model for Avalanche Hazard. This approach emphasizes uncertainty in a manner that becomes a useful tool for terrain selection.

"What?" A basic answer can be in terms of avalanche "problems," but greater detail is possible. Even before operations began in 2022-23, "What?" was answerable with confidence—we expected deep persistent avalanche problems. Such a widespread basal weakness was very atypical for the region and unfamiliar to backcountry users in British Columbia.

"Where?" A basic answer can include region, elevation, and aspect, but greater detail about terrain characteristics and/or specific terrain features is possible. Deep persistent avalanches typically occur in alpine and open treeline terrain, and are sometimes aspect-dependant. Areas of shallow or variable snow depth are more suspect than areas of uniform deep snowpack. The 2023 weak layer was in the lower 50 cm of the snowpack, so areas of greater surface roughness were potentially less concerning than smoother terrain. "Where?" was answerable with these typical expectations, but the unfamiliar conditions created uncertainty that deep avalanches might also occur where not anticipated.

"How Big?" This can be answered in terms of the destructive potential size scale, but can be enhanced with greater details about propagation and runout potential. Avalanches failing on a basal weakness involve almost the entire snowpack. They will initially be relatively large and become larger throughout the season. In 2023, we were not certain exactly how big these avalanches would be.



"How Easy?" This refers to how easily avalanches may be triggered, but can be enhanced with details such as remote triggering potential. It was expected that avalanches would initially be easy to trigger with light loads and would become more difficult to trigger as the weak layer became more deeply buried. Minimal early-season snowfall did not add much stress to the snowpack and the lower snowpack continued to facet and weaken, but there was minimal avalanche activity. Unusually widespread large whumpfing in December raised concern for remote triggering and wide propagation once this layer became active.

LIVING WITH PERSISTENT WEAK LAYERS

Expect the unexpected with persistent weak layers, especially if the snowpack is unfamiliar or atypical for the area. Why are persistent instabilities associated with greater uncertainty?

Uncertainty about 'Where?': Persistent weak layers initially form with substantial spatial variability. This variability increases over time, making the situation more complex. The weak layer strengthens more rapidly in some areas than others (and might even weaken in some areas), will be loaded differently in some areas, and will be altered by events such as avalanches or skier traffic in some areas. Repeat avalanches may occur on reloaded bed surfaces and persistent slab avalanches may occur on very low-angle start zones. It is increasingly difficult to know exactly where the instability persists.

Uncertainty about 'How Big?': In the early stages, persistent weak instabilities may not produce avalanches until there is the right combination of slab formation and loading. Avalanches will be relatively small at first but will increase in size as the layer becomes more deeply buried. They can exceed historic runout limits and/or have surprisingly wide propagation.

Uncertainty about 'How Easy?': As the persistent weak layer is more deeply buried, it becomes more difficult to trigger (known as bridging). But this is NOT GOOD! It can still be triggered somewhere, perhaps from thin snowpack areas or super weak zones, and the avalanches will be large. It has been said, "Another word for 'Bridging' is 'Slab.'" Persistent instabilities can be dormant for long periods and can unexpectedly become active again when there are no obvious environmental stresses on the snowpack. They may produce avalanches through an entire season.

APPROACHES TO MANAGING UNCERTAINTY

Our first instinct is to view uncertainty as an obstacle to terrain selection and try to reduce it (or deny it, if that doesn't work). A technical approach for dealing with uncertainty is to open terrain by reducing uncertainty through information gathering and assessment. This works well for storm instabilities because they can be effectively assessed and the uncertainty does not persist very long after a storm. Lingering storm snow avalanches also trend toward smaller propagation and become isolated to steeper terrain as the storm snow stabilizes.

Persistent instabilities are different. Extrapolating snowpack information to assess the stability of specific slopes is unreliable and can be misleading, and uncertainty can persist for an entire season. Avalanches become less frequent but increasingly destructive, may persist on moderate-angle terrain, and may become a low-probability/high-consequence situation. Experience can work against us when coping with unfamiliar conditions. Our past experience can create an invalid illusion of certainty.

Often overlooked, uncertainty can also be a tool for terrain selection, usually to avoid hazardous terrain. A behavioural approach is to accept the uncertainty and adjust the terrain selection accordingly. Persistent instabilities require a combination of a technical approach and a behavioural approach.

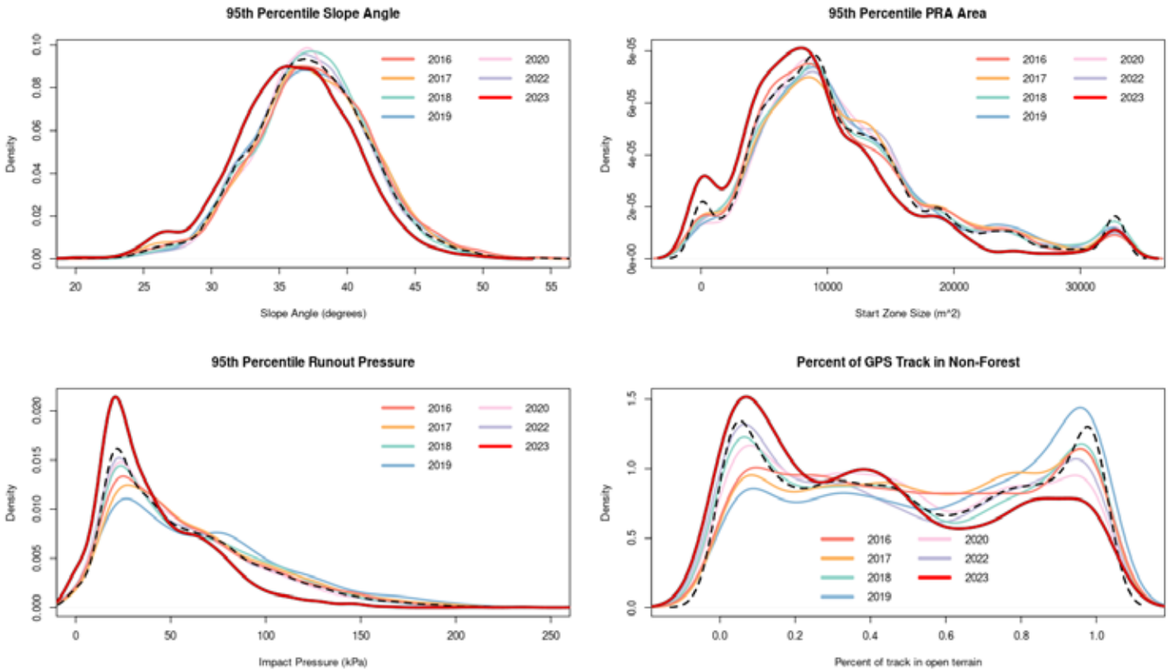
For persistent weak layers, establish a core set of proven terrain that avoids avalanche terrain except where it is certain that the persistent instability does not exist—usually where the weak layer has been destroyed by previous avalanches or skier traffic. When stability tests indicate improvement, wait a bit and stay on proven terrain. Time is on your side *("Don't try to outsmart persistent weak layers; it is best to wait it out"- Me)*. When no recent avalanches are reported and you think the layer has healed, wait a bit longer. When you are absolutely certain the instability is no longer an issue, wait some more and see what happens. The necessary discipline is difficult to sustain; be patient, this too will pass (but maybe not until next year).

If and when choosing to venture into unproven terrain, use extra caution and do not rush in. Uncertainty remains. Evaluate every slope as thoroughly as possible, choose slopes with favourable characteristics, choose favourable times, and use good travel practices. Smaller supported start zones, even if steep, are less likely to have deep avalanches. Large lower-angle slopes may be tempting, but beware—these are the common location for very large, late-season deep persistent avalanches. Pay close attention to how the snowpack reacts when exposed to heavy loads such as snowfall, cornice falls, and explosive control efforts. Reports of avalanches on a persistent weak layer after it has been dormant can be the only indication if the instability is becoming active. Watch for this and back off if it happens. Be suspicious of any weather changes, especially loading or warming.

CMH GALENA, 2023

The intent of CMH's yellow flag was not to work harder to reduce uncertainty and access more aggressive terrain; it was to shift behaviour away from expanding the terrain selection to accepting the uncertainty, making the best use of proven terrain, and not rushing into unproven terrain. GPS data shows how terrain-use shifted at CMH Galena in 2023.

In collaboration with Pascal Haegeli and John Sykes from the Simon Fraser University Avalanche Research Program (SARP), we have accumulated a large data set relevant to decision-making at CMH Galena. Using custom satellite



GPS TRACKING DATA FROM CMH GALENA SHOWS LOWER SLOPE ANGLES (TOP LEFT), SMALLER START ZONES (TOP RIGHT), MORE FORESTED TERRAIN (BOTTOM RIGHT), AND LESS OVERHEAD EXPOSURE (BOTTOM LEFT) IN 2023 RELATIVE TO PREVIOUS YEARS. THE RED LINE IS FROM 2023; THE DASHED LINE SHOWS THE AVERAGE DISTRIBUTIONS OVER ALL SEASONS.

photos, SARP created a five-metre digital elevation model and adapted Swiss models to identify potential avalanche release areas and runout zones for our entire operating area. Since 2015, lead guides in Galena have regularly carried GPS units that have provided detailed information about actual terrain selection at the scale of individual terrain features. Avalanche hazard exposure has been quantified by examining the GPS tracks relative to the potential release areas and runout zones. Operational records have included local observations and assessments of avalanche and weather conditions, run lists, and run use. We also have survey results with detailed information about the guides' perception of the risks, rewards, and accessibility of the Galena ski runs. John is now analyzing all of these data for patterns of terrain selection under different conditions.

John's analysis of the GPS tracking data shows that uncertainty about deep persistent instabilities substantially influenced terrain selection at Galena in 2023. Risk, reward, and access are all factors in terrain selection; avalanche risk is only one factor. Last winter provided a unique opportunity to isolate the influence of avalanche risk when analyzing the data. Relative to all past seasons, 2023 data shows a significant shift to lower slope angles, smaller start zones, more forested terrain, and less overhead exposure. Avalanche activity at Galena in 2023 was not very unusual relative to many previous years, which means the shift to more conservative terrain was due to the uncertainty about the hazard, not due to the severity of the hazard.

Although there were some significant avalanches in 2023, overall avalanche activity at Galena was rather unremarkable despite the basal facets. However, other operations, including some near-neighbours, regularly reported exceptional avalanche activity. Perhaps it was unnecessary to implement special procedures in Galena, but the shift in terrain selection can be attributed to uncertainty related to the snowpack, along with atypical avalanche activity reported across the province.

CONCLUSION

Persistent instabilities, storm instabilities, and spring thaw avalanches each require a different approach to uncertainty. Storm instabilities stabilize quickly and can be assessed reliably with snowpack observations, avalanche observations, and other clues. Spring thaw avalanches can be managed by avoiding exposure during the thaw phase. Persistent instabilities are different because areas of instability can still produce avalanches long after the layer appears to have stabilized. It is difficult to know when and where these avalanches might occur, and avalanches can be larger and more destructive than expected.

With persistent instabilities, uncertainty dominates terrain selection and decisions are based more on what we don't know than on what (we think) we know. We shift behaviour to evaluate uncertainty in detail and focus on avoiding uncertain terrain rather than attempting to access more terrain by reducing uncertainty.

To maintain discipline and avoid impulsive decisions, it is helpful to set criteria for approaching unproven terrain and to establish boundaries that eliminate some terrain from consideration. The use of the yellow flag at CMH shows the benefit for guiding operations to have specific procedures in their snow safety plan to cope with special circumstances.

A Ski Guide's Perspective

Alex Cooper, with Penny Goddard

Penny Goddard is an IFMGA Mountain Guide and CAA Avalanche Professional. Her career has spanned the breadth of the avalanche industry: ski touring, heli-skiing, public avalanche forecasting, industrial and transportation operations, avalanche safety book author, and more.

Note: This interview was edited for length.


// PHOTO CONTRIBUTED

Alex: Could you start by providing an overview of where you were working last winter?
Penny: I had a really varied season last winter. I worked heli-skiing and at a ski touring lodge, which were in the Rockies and the Selkirks, respectively. And then some private ski touring work closer to Revelstoke, which is my home base. I also had three overseas trips that happened throughout the winter.

Alex: OK. Were you doing any industrial avalanche work?
Penny: I was doing this as well, mostly locally to Revelstoke, north of town.

Alex: In the areas you are working, how prominent was the persistent weak layer? You're in Revelstoke, so it was around here, but how did you see it?
Penny: It was very prominent. It was really a main feature of the season and something that had to be managed right from the beginning to the end, in all of the places I worked in Canada.

Alex: Did you personally see or observe any avalanches on that layer?
Penny: I did, absolutely. Especially in the spring, things really started moving. I think the biggest cycle that I personally saw was north of Revelstoke in the Selkirks and the Rockies in the springtime.

Alex: How did it impact your approach to guiding and your other work?
Penny: It definitely caused me to have a shift in how I approached the entire season. Right from the start of the season, I blacklisted a whole lot of terrain and objectives for myself. I applied the sense of having a run list to my own private guiding work, and I decided some stuff was not going to be on the table. I tried to stick to that for the whole season. It definitely became challenging as time went on.

That was for me the biggest change. I don't normally start the season saying I'm definitely not going to ski certain peaks, certain routes or certain terrain. I normally approach it more on a day-by-day or week-by-week basis. That's how I decided to manage it. I had a, "not this year, not this season mentality," just thinking bigger picture, longer term. Maybe next year, but not this year.

Alex: Was it challenging to maintain that mindset of just staying out of that terrain?
Penny: Yes, especially later in the season, especially locally here at Rogers Pass. A lot of people were stepping into terrain I had blacklisted, and getting that negative feedback loop of nothing happening. I think the likelihood of triggering these deep persistent slabs did actually become very low for some time during the season as well. It was tempting to break my own rule and step out, but I didn't. In the end, I went back to my initial long-term view of, "not this season," and just being patient and waiting for a bit of a better year. I definitely found myself second-guessing that decision and wondering if I was being too conservative at times.

Alex: That's one thing I've heard is how hard it can be to be conservative when you're not seeing the evidence up front and the probability is that low. But I guess when you're guiding professionally, there's that much more pressure to maintain that mindset. How did you find it mentally? Was it difficult to keep focused like that?
Penny: I found it really exhausting. I found this season just tiring and a bit of a drag. It was a season where I felt like being a ski guide's not as dreamy as advertised. I was really glad every time I had a job out of the country, and I could escape and run away from this problem. That felt like a really big mental break. So, yeah, it definitely added a lot of stress.

Alex: How did you manage client expectations and letting them know what you are dealing with, and what they would be dealing with in the backcountry?
Penny: It was interesting. I found that because there was so much in the public eye, so much in the media, especially after the fatal accidents that happened, most clients came

// CRAIG HARTMETZ

pretty fearful already, sometimes overly fearful. It wasn't so much a case of reeling in their expectations as calming them down and letting them know that it was still going to be fun and it was going to be carefully managed. We were going to avoid the areas where the problem existed, and what a guide is able to do is recognize where to go and where not to go.

That was actually kind of interesting because I had anticipated having to reel in expectations and let people know we weren't going to do more ambitious objectives, but most people didn't want to ski aggressive lines because they were already scared.

Alex: All the public attention—do you feel that was a good thing or a bad thing?
Penny: Umm… It was a thing, for sure. I wouldn't say it was a bad thing, but I do think it was such a hot news story that it almost overhyped the whole thing. Even though I'm not just a member of the public, I'm a professional guide, I was still hearing this constant fear messaging from the repetition of these scary news stories, and that just added to the stress of knowing I was the one that had to go and manage this problem.

I actually found not just the stuff that was in the media, but what was going on the Informalex as well, particularly early-season, added to the stressful messaging.

Right at the very start of the winter, when the situation was setting up and people were seeing that it was going to be a tricky winter, there was so much discussion on the Informalex and a lot of it was along the lines of "Be very scared. This is setting up to be a season like 2003. This is setting up to be really dangerous." There was a lot of that kind of language, but there weren't so many people jumping on and saying, "This is how we should manage it. These are the strategies."

I found between what was on the Informalex and what was in the media, there was a lot of just fearful messaging coming my way. I found it hard to figure out if it was overhyped, if it really was the worst season we've seen in 20 years, or if it was just a bit of a tricky season.

That influenced my psyche. I was trying quite hard just to manage, trying to filter all that noise and figure out what I really thought about the snowpack and what I really thought about the level of risk, independent of all this noise coming at me. That was very simply exhausting as well.

Alex: How did you manage the stress that came with this?
Penny: Talking to other people was very helpful—other guides that I'm close with, that I respect—and shooting ideas around and seeing how other people were feeling and what they were doing. Having that community really helped, especially when I was independently guiding.

I think, this was just good luck, but leaving the situation and getting a mental break and going skiing somewhere else for a while and then coming back and having had a bit of a break was quite good.

I didn't really take on a lot of new clients either. When I was independently guiding, I pretty much stayed with my regulars who I have a good relationship with. I knew they weren't going to be trying to push for something unrealistic.

Alex: You also do some heli-ski guiding. In that context, how did you find it? Did you feel comfortable the operations had good programs in place?
Penny: I did feel comfortable when I went to work at the heli-ski operation. One thing that was really interesting when I worked with different guiding teams was that was the strategic mindset discussions were quite spicy, particularly when the word "entrenchment" came up. It was met with a lot of resistance by some people. The reason turned out that if you read the description, it's something like, you're almost on the verge of shutting down the operation. It was interesting to see such a strong reaction against using that word because in my mind, with my approach where I'd blacklisted a whole lot of terrain in December, I felt like, "Well, that's entrenchment. I'm not going to reconsider that terrain. I'm not going to step out and go back in there."

That seemed to be like how most operations were working. They had a whole lot of terrain they just weren't going to. Everybody knew you weren't going to the steep, thin alpine snowpack areas. That would just be dumb. But they didn't want to use that term.

I ended up deciding that in a season like that, there were two parallel mindsets going on. There was an entrenchment mindset, where you had a lot of terrain that you just weren't going to consider, and then what was left over was a smaller operating area. Within that smaller operating area, you were going to cycle through these normal changes, from stepping out to stepping back depending on the weather and the snowpack variances through the season.

I think this strategic mindset concept is great. I don't think it was ever designed to be used in this very prescriptive way and I think there's room to have more than one mindset. Also, I think there's room to come up with new categories and definitions that best suit different mindsets.

I found that quite interesting and I think partly why it's used in this very prescriptive way is because it's part of InfoEx, so you can only choose one. You have to choose from a drop-down menu, and then each of those choices has a definition. People just end up fighting over whether it's this definition or that definition, which was a shame and in some ways it almost defeated the purpose of the strategic mindset concept, which is to get the group discussing together and agreeing on how they feel. Being able to choose more than one, or having an editable field, might allow for the nuances of this concept a bit better.

Alex: Interesting. Did you notice any further discussion about that amongst other guides or in the avalanche community?
Penny: Roger Atkins presented at the spring meetings and he actually said it wasn't really designed to be used this way. I brought it up with different guides who work at other different operations to see how they used it and what mindset they were talking about at their meetings. Generally, it seemed like many operations didn't want to use entrenchment this season, which was quite surprising to me.

Alex: What were your biggest takeaways or biggest lessons you learned from this season?
Penny: Patience is a virtue. I think for me, in hindsight, there may have been individual days where I could have got away with more, I could have been less conservative and it would have been OK. But for me personally, and my personal risk tolerance when I'm working, I was really glad that I took the long-term view. I saw this as one season in the stream of many seasons—seasons that I've had behind me and seasons that are hopefully ahead of me. And that for me, this wasn't going to be the season for tickling that particular dragon. I wasn't going to tempt fate. I think that served me well for how I want to go about this career of mine and my life in the mountains.

Alex: Is there anything else you'd like to say?
Penny: Well, hopefully next winter's better, otherwise, I might become a surfing guide.

A Snowmobile Guide's Perspective

Alex Cooper, with Julie-Ann Chapman

Julie-Ann Chapman is a snowmobile guide, instructor, and CAA Avalanche Practitioner, based in the West Kootenays. As the owner of She Shreds Mountain Adventures, she offers snowmobile clinics, avalanche safety courses, and occupational training around B.C. I spoke with her about how she managed working in so many different areas while dealing with last winter's challenging snowpack.

Note: This interview was edited for length.

Alex: To start, can you give a quick overview of how you normally manage the avalanche safety aspect of your camps?
Julie-Ann (JA): My camps are pretty unique, seeing as I'm mostly based in the West Kootenays close to Nelson, but I also offer clinics elsewhere over all over B.C., basically Revelstoke, Golden, Valemount, over on the coast, Pemberton, all these areas. It's a little bit different as far as your general operation, where you're in one place all the time and you get very comfortable with that snowpack throughout the season. When I'm based in Nelson, where I am most of the time, we do our morning meetings with the guides under our umbrella, and we keep a close tab on the snowpack. We don't change any sort of ways we operate, we

// BILLY STEVENS

operate as per standard.

When I go to other operations, this is where it becomes a little bit different. Obviously, I'm studying the snowpack at home, but I'm also studying the snowpack throughout all these areas that I'm going throughout the whole season. Then I hire a local outfit, not only for legal purposes for land use, but I also do this for safety, knowing the snowpack, and getting the intel from the local guides in that area. That's the big difference between the home-based operation and when I travel to other locations, to get that safety aspect ticked off.

Alex: What methods do you use to monitor the snowpack in other areas?

JA: InfoEx definitely is the number one source. And then just talking with the guides from the Canadian Motorized Backcountry Guides Association in all the different parts of B.C. to get the local intel. Avalanche Canada obviously is great—avalanche.ca as well as the MIN reports.

Alex: How widespread and how prominent did you notice the deep persistent layer in the areas where you were running your camps?
JA: The beginning of the season, it was obviously a little bit more reactive than as the season progressed, but it was always there. It didn't come off the radar at all last season. As far as how prominent it was, it was more prominent in in the West Kootenays than in any of the other areas. Well, Revelstoke was pretty prominent as well. But Valemount, it was more prominent in the early-season and didn't really have anything happening later in the season. Golden, was more reactive mid-season as they had quite the shallow snowpack early-season. It was there, and more reactive at different times of the season throughout B.C. It didn't react too much in the later season.

I'd say it was prominent throughout all the areas for sure.

Alex: How did it change your approach to running your camps and guiding this winter?
JA: Comparing it to other years, with surface hoar layers or these deep persistent weak layers, they'll be on the radar and then they kind of get erased if they're not reactive. This deep persistent weak layer was on the board all season, although it was unreactive and widespread throughout the whole season, it was still there on everyone's radar. The low-probability/high-consequence was lingering in the back of my mind the whole season.

How it differs from other years was it made my spidey-senses a little bit more touchy as far as the approach to guiding. It kept my plans very conservative.

I was more aware of other people or other groups. I was more scared of overhead hazard with others around me. If other people came into the area I was teaching and guiding in, I would leave right away because I didn't want to risk anything with overhead hazard or other groups, not knowing what their education is with avalanche safety and that kind of stuff. I didn't take any risks and wanted to get my group out of the way for safety purposes.

Group management was a little bit more tight this year. In the snowmobile guide world, we call it "play pens." We'll get into an area and tell our clients, "OK, you're not allowed past this ridge, you're not allowed past this tree line." Give them a little boundary where they're allowed to play in a safe area. I was very, very strict about that. People that didn't listen, I would take their keys away and kind of punish them because it was not a year to risk that kind of stuff.

Very luckily, with She Shreds, the product I offer is an educational guided experience. They're coming for a clinic, they're coming for an avalanche course, they're coming for occupational training. It's not just guiding. The mindset my clients come for their product is a learning, an educational mindset. They're open to listening and that kind of stuff. For me, it was a little easier than maybe most guiding outfits out there because of the clientele that come to me and their mindset that they come in. As far as group management goes, it was a little easier than some other operations that I've spoken to. That was another different kind of thing for this year. I was a little bit more strict with group management and that kind of stuff.

Alex: An anecdote I heard from somebody at the Spring Conference was they found there were times they were seeing evidence that things are good, things are stable, and that it was challenging to remain conservative even if the signs were saying that things might be OK. Did you find that as well? Was maintaining that diligence challenging?
JA: It was a fine line of not getting stuck in that entrenchment mode of, "OK, the snow is getting better, I know this terrain, I think I can let my clients out," but at the same time keeping that safety aspect of this deep persistent weak layer being reactive. It was definitely tough to judge when it was safe to let clients out. And because it was such a touchy year and unpredictable snowpack, I didn't really mess around with letting my clients loose and taking risks. It was just one of those things. I was like, "You know what? This is not the year to just wing it or say, 'Oh, this is getting more safe.'" It wasn't the year for me to let loose, basically.

Alex: OK. Was there ever a point where you said, "OK, now it's time to step out, change my mindset?
JA: There was, at the end of the season, before the spring diurnal cycle kicked in, that I was a little bit more willing to step out. I needed to take each day on its own, and I needed to do more tests in the snowpack before I would let clients out. I wouldn't only just read InfoEx and look at avalanche.ca and be like, "Oh, it's getting safer." I wanted to do my own tests because it was such a widespread issue that I needed my own database in that area that day before I let my clients out.

This year, I hired more guides to be able to hang out with the clients or do tests while I'm hanging out. Whereas other years, I'd get the information and I'd do my regular tests per week. This year, it was way more everyday tests.

Alex: Did you find it stressful guiding this year?
JA: At the beginning of the season, it was more stressful because the last time we had this kind of issue was in 2003. Back in 2003, I wasn't guiding—I started guiding in 2010—so this was my first experience with a snowpack with a deep persistent weak layer. It was stressful at the beginning of the season because I was figuring out how to get my ducks in a row, to be confident with the snowpack, and that kind of stuff.

But then again, my clients, they come with a mindset of education and learning, and they're there to listen. My clients were so awesome with understanding the snowpack and being very OK with listening to me and bringing them in safe places. There are big mountain areas I have permits to operate in, but I didn't even go there this year because, whether it's access, being exposed too much, or just too "big mountain stuff." I had return clients being like, "Can we go back to this area?" And I was like, "I'm sorry, this year's not the year for that zone." We had to keep it more safe and conservative.

It was stressful at the beginning of season when I was getting a handle on the snowpack. When I accepted the fact this year's not the year to test and push boundaries, it almost was like a blanket of comfort and the stress kind of went away after that. I did get a little bit stressed when the spring diurnal cycle started to kick in at the end of the season because I wasn't too sure if that sleeping dragon was going to wake up and see some big action. I stepped it back a little bit more in the spring.

Then the season ended really quickly because it got hot. In a regular year, I'll go all the way into the end of May. This year, I think my last booking was the last week of April or the first week of May, when it started to get really hot. I didn't have to stress out too much at the end of the season because it just got hot quick and operations ended.

Alex: How were your clients with acknowledging the dangerous snowpack and the uncertainty you had to manage?
JA: In the avalanche courses, it made it for a really fun year to be able to track this layer and see the reactions on it. As far as far as the clients go, as I mentioned earlier, they all came with a mindset of education and learning, so when I teach them not only how to ride and start to teach them a little bit about the snowpack, they get really interested. I'm very lucky with the product that I offer with She Shreds, the clients that come, they are totally cool with learning and listening and that kind of stuff. I got very lucky with client expectations this year. Nobody was really upset. They all understood. You tell them, "My main goal is to get you home at the end of the day to get back to your family." As soon as you tell them that, they understand it's safety first with the backcountry operations.

Alex: Is there anything else you'd like to say?
JA: Hopefully next year our snowpack is a little bit more stable and more mellow. At the same time, as professionals, it's always good to get a little complex snowpack once in a while because it keeps us on our toes and it keeps us very in-tune with analyzing the snowpack and making decisions based on that. I appreciated the snowpack last year because it kept me on my toes and kept me furthering my education. But year-after-year of that kind of snowpack, I don't know if I want to take on the stress. But yeah, I'll take it once in a while.

JULIE-ANN CHAPMAN IN HER ELEMENT. // ALLAN SAWCHUK

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TRACKING INTERFERENCE

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// NATHAN PINCHAK

Wind Slab **or Storm Slab?**

Nata de Leeuw, Montana State University
Karl Birkeland, National Avalanche Center

INTRODUCTION

Many a meeting has run long when forecasters disagreed on which avalanche problem type is most appropriate for a given situation. I began my career at Castle Mountain Resort, known for its wind, so in our case, this debate was usually between wind slabs and storm slabs. Our team would spend the day on the same snow, see the same avalanches, and share our observations, yet during the PM meeting, we would disagree about whether to submit a storm slab problem or a wind slab problem to InfoEx. We eventually realized we were all talking about the same snow formation, and our argument was largely semantic. No one was wrong, we just interpreted the terms differently. As I ventured out into the wider avalanche world, I realized these debates were not isolated to our small corner of southern Alberta, and I became curious about the extent of this discrepancy within the industry.

BACKGROUND

Though the avalanche problem types in the Conceptual Model of Avalanche Hazard are explicitly defined (Statham, Haegeli, et al., 2018), inconsistency is observed in their practical use (Hordowick, 2022; Lazar et al., 2012; Statham, Holeczi, et al., 2018). Recently, researchers at Simon Fraser University found dissimilarity in the thresholds used by different public forecasters for adding, removing, or changing avalanche problems (Hordowick, 2022). While all forecasters interviewed stated their minimum threshold wind speed for adding a wind slab problem was in the moderate range (26-40 km/h), their maximum allowed wind speeds for a storm slab problem varied from 10–60 km/h. This large range of wind speeds highlights individual and operational inconsistency. Further, the conceptual model only considers wind in the definition of a wind slab, and not in the definition of a storm slab (Statham, Haegeli, et al., 2018). Consistent interpretation of avalanche problem type is important, as problem type largely dictates mitigation strategy (Atkins, 2004). Inconsistent interpretations could pose problems for operations that share information, or practitioners that move between multiple operations.

The conceptual model (Statham, Haegeli, et al., 2018) describes a storm slab as a "cohesive slab of soft new snow" (p. 674). It describes a wind slab as a "cohesive slab of locally deep, wind-deposited snow" formed by "wind transport of falling snow or soft surface snow" (p. 675). This explanation describes two different wind transport processes:

1. "Wind transport of … surface snow" describes redeposition, which occurs when snow that has been on the ground for a period of time is entrained by the wind, transported, and deposited elsewhere (Fig. 1a).
2. "Wind transport of falling snow" describes preferential deposition, which occurs when snow from the air column is deposited directly into a lee area without having previously touched the ground (Fig. 1b) (Lehning et al., 2008).

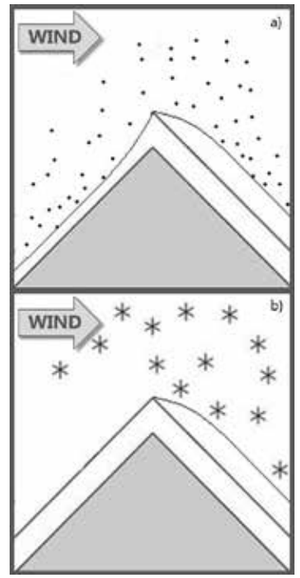

FIG. 1: WIND CAN TRANSPORT SNOW IN TWO DIFFERENT WAYS. REDEPOSITION (A) OCCURS WHEN SNOW ALREADY ON THE GROUND IS ENTRAINED, TRANSPORTED, AND DEPOSITED ELSEWHERE. PREFERENTIAL DEPOSITION (B) OCCURS WHEN SNOW FROM THE AIR COLUMN ACCUMULATES DIRECTLY IN A SPECIFIC AREA DUE TO WIND INFLUENCE.

According to the definitions of the conceptual model, both redeposition and preferential deposition result in a wind slab avalanche problem (Statham, Haegeli, et al., 2018). However, snowfall that is preferentially deposited during a storm is sometimes consciously included in a storm slab problem, as this may better describe the spatial distribution and simplify communication (Klassen et al., 2013). In practical situations, wind slabs and storms slabs exist on a continuum, which can make it difficult to distinguish between them. Public forecasters must consider risk communication when deciding which term to use, which may explain some of the noted inconsistency (Hordowick, 2022). Public forecasting has been the focus of previous terminology studies, but information is still missing on how professionals use the terms storm slab and wind slab when communicating with each other.

RESEARCH GOAL

The goal of this study was to assess the extent of inconsistency in the use of the terms storm slab and wind slab in professional communications. Inconsistencies exist in public bulletins (Hordowick, 2022; Statham, Holeczi, et al., 2018), but no one has investigated the extent of inconsistency in professional communication uninfluenced by public

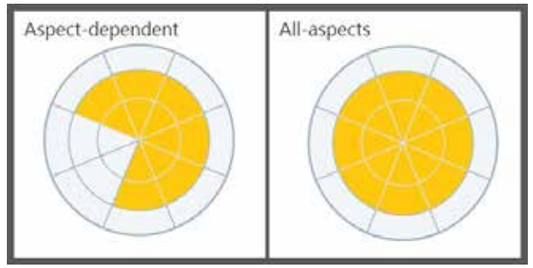

FIG. 2: COMPASS ROSES ASSOCIATED WITH ASPECT-DEPENDENT AND ALL-ASPECTS STORM SLABS AS REPRESENTED ON THE INFOEX

perception. In this study, I analyzed a sample of InfoEx submissions to determine the prevalence of operations using the term storm slab to describe an avalanche problem formed by preferential deposition, which may otherwise be described as a wind slab problem. The results provide information on professional use of these terms that is uninfluenced by the pressures of public communication. Understanding the extent of inconsistency is an important first step if we as an industry want to emphasize greater consistency.

METHODS

I reviewed all storm slab problems submitted to InfoEx in January 2022 and classified each as either aspect-dependent or all-aspect (Fig. 2). Aspect-dependent storm slabs were then labelled as preferential deposition only if the problem was located on aspects lee to the wind direction reported by that operation on that day. Comments associated with these storm slabs often emphasized the role of wind. Preferential deposition storm slabs were then grouped by operation for analysis. Additionally, many all-aspect storm slabs included a wind slab problem. This was determined from associated comments, which ranged from stating that the slab formed with wind, to explicitly stating that the problem included a wind slab. Storms slabs that included a wind slab were also grouped by operation.

RESULTS

Within the sample period, 133 operations submitted at least one storm slab problem. Of those 133 operations, 20% submitted at least one preferential deposition storm slab, and 26% percent submitted at least one storm slab that included a wind slab (Table 1). The second situation often occurred during storm cycles, and sometimes additionally encompassed a dry loose problem. Operations that used storm slab for preferential deposition are not confined to one geographic area (Fig. 3). However, based on the distribution of all operations in Western Canada, the proportion of operations that used storm slab to represent preferential deposition appears highest on the West Coast and in the Alberta Rockies.

DISCUSSION

These results show inconsistency in how the term storm slab was used in InfoEx, and indicate inconsistency in how storm slab problems and wind slab problems are applied in the Canadian avalanche industry. At least one in five operations sometimes used the term storm slab to represent a slab formed through preferential deposition, which is not consistent with the definitions of wind slab and storm slab in the conceptual model. Additionally, at least one in four operations sometimes included a wind slab problem within a storm slab problem. These situations usually occurred during storms, or when uncertainty was high such as in a morning meeting with limited snowpack data. Results of this study demonstrate the complexity of avalanche forecasting, particularly the difficulty in applying a categorical classification to a situation that in reality exists as a continuum.

The root of this semantic discrepancy may lie with the two different processes by which wind can transport snow. Most would agree that an avalanche problem resulting from redeposition is a wind slab problem. Most would also agree that snow falling straight down results in a storm slab problem. However, problem type becomes less clear when snow falls sideways, as in the case of preferential deposition. Some practitioners may call this a storm slab and some may call it a wind slab. The distinction is further complicated when these transport processes happen simultaneously.

Local weather conditions could be a reason some operations were more likely to call preferential deposition a storm slab. The Alberta Rockies and the West Coast are both known for high winds, and these areas had the highest proportion of operations using storm slab for preferential deposition. It is possible forecasters in these windy areas are more likely to describe a slab deposited by relatively less wind as a storm slab rather than a wind slab. This may be due to the difference in how soft winds slabs and hard wind slabs behave, and the different mitigation strategies applied to each. Another reason could have been the desire to use explicit terminology to distinguish between an older buried wind slab and a newer surface slab associated with a windy storm. In these cases, applying the term storm slab to a softer or newer wind slab may have better supported operational communication.

If the goal is to reduce this inconsistency, a variety of options are possible. Some have proposed changes to avalanche problem types, which range from creating sub-problems describing each type of wind slab, to limiting the number of avalanche problems by creating an all-encompassing new-snow problem type. The Colorado Avalanche Information Center addresses inconsistencies with a flow chart created to provide guidance to forecasters (Lazar et al., 2012). Another approach could be to rely increasingly on proposed mitigation strategies when determining problem type (Statham, Haegeli, et al., 2018 p. 673-680). This is applicable since avalanche mitigation and terrain choice is the end goal of an avalanche forecast (Klassen et al., 2013). More options likely exist, and if we decide to address this inconsistency, there are a number of possibilities for moving forward.

OPERATIONS THAT SUBMITTED...

	NUMBER	PERCENT OF TOTAL
ANY STORM SLAB	133	
A PREFERENTIAL DEPOSITION STORM SLAB	26	20%
A STORM SLAB THAT INCLUDES A WIND SLAB	35	26%

TABLE 1: THE NUMBER OF OPERATIONS WITHIN THE SAMPLE PERIOD THAT SUBMITTED EACH TYPE OF STORM SLAB. NOTE THAT THE PERCENTAGES DO NOT COMBINE TO 100%, AS THEY REPRESENT THE PERCENTAGE OF THE 133 OPERATIONS WHICH FALL INTO EACH CATEGORY. EIGHT OPERATIONS WERE LISTED IN BOTH CATEGORIES.

CONCLUSIONS

Avalanche forecasters and researchers have previously noted inconsistent use of some avalanche problem types. This project highlights inconsistencies between storm slab problems and wind slab problems in professional communications. The conceptual model specifies that a wind slab problem results from both redeposition and preferential deposition, but during this study period many operations designated preferential deposition as a storm slab problem. Some operations also used storm slab to describe a new snow problem that included a wind slab. The inconsistencies in differentiating between storm slabs and wind slabs warrants further discussion in the Canadian avalanche community to assess if inconsistencies pose a problem that we should remedy.

ACKNOWLEDGEMENTS

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GETTING BLOWN AWAY AT THE TOP OF CASTLE MOUNTAIN. // NATA DE LEEUW

Tracking Interference
Using GPS Tracking to Illustrate the Effects of Transceiver Interference

Terry Palechuk, Associate Teaching Professor, Thompson Rivers University

ONE OF THE ADVANTAGES of modern digital avalanche transceivers is that they are sensitive to an emitted 457 kHz signal from a buried (sending) transceiver and offer the user an indication of both range and direction to assist in making a search more effective. However, searching transceivers are also sensitive to the noise of external electronics, which may impede early signal detection (Orloff, 2016) and are increasingly common in the backcountry. While the notion and impact of electromagnetic interference (EMI) is not new to the avalanche community, its effects and the strategies for mitigation continue to be a topic of investigation.

The purpose of this research was to:

1. Explore the effect of EMI on signal detection.
2. Utilize GPS tracking to visually describe the real-world impact of range loss caused by EMI.

LIMITATIONS

It is important to note that this study only used a single brand of transceiver for both send and search, and a single brand and model of interference device. Further research involving the use of different brands and models of transceivers and interference devices would continue to contribute to the community of knowledge in this area.

BACKGROUND

As described by Finvers and Latimer (2021): "If a strong interfering signal is present alongside the weak receiving signal from a buried transceiver, it can cause the amplified signal to become saturated. The weak transceiver signal is effectively lost." This results in the searcher experiencing either no digital data to aid in the search, or "arbitrary distance and direction indications," and may compromise a search (Genswein et al., 2013).

Both the sending transceiver and EMI have their respective signals drop off at a rapid rate as the distance from each respective unit increases (Meier, 2013; Hereford & Edgerly, 2000). When in search mode, this affects both range of signal detection from the sending transceiver and the effect of EMI on the searching transceiver.

Some devices manifest EMI in different ways (Finvers & Latimer, 2021; Meier, 2013; Forrer et al., 2018; Barkahusen, 2012; Meister & Dammert, 2014). Finvers and Latimer (2021) offered an excellent summary of EMI interference and its influence while searching.

Meister and Dammert (2014) explored the effects of consumer electronics on avalanche transceivers and recommended maintaining 50 cm separation from a searching transceiver and turning off mobile phones.

A recent study on heated (electric) gloves by Troeger et al. (2022) looked at three models of transceivers and three models of electric gloves. Results varied from as little as 5 % loss of range to as much as 95 % loss of range depending on glove and transceiver combination. The authors suggested, "Avoiding the use of heated gloves… in order to avoid delay of rescue" in either on or off state.

Forrer et al., (2018) offered insight into the effects of radios on avalanche transceivers. Although there are differences in digital and analogue radios, the suggestion was to maintain at least 50 cm separation from the searching transceiver.

METHOD

A search site measuring 40 m x 80 m was used to simulate the search zone, with flagged intervals to guide a prescribed 20-metre search strip pattern beginning outside the signal detection range. Each test was tracked using the Gaia GPS app on a phone that was dragged in a sled five metres behind the searching transceiver to minimize potential interference (Gaia GPS error was noted and deemed sufficient for the purpose of this study). Signal detection (including a baseline sample with no EMI inputs) was recorded once there was stable direction arrow and number indication. It is recognized this is a subjective measure, however, as the same searcher was used for all trials, the subjectivity was consistent.

The 'buried' transceiver was placed on a tripod one metre off the surface of the ground and placed on the x-axis. The distance of one metre was based on the median burial depth as described by Haegeli et al. (2011) and Eidenbenz et al. (2021). This maintains approximately one-metre distance as one transitions into fine search.

Mammut Barryvox S transceivers were used for both send and search. The batteries in both units were changed once they reached 70% of the remaining capacity. The transceivers were set to pro search mode, delivering both an audible analog tone as well as a digital readout of the signal while in search mode.

To standardize the 10 cm, 30 cm, and 50 cm EMI test distances, a calibrated board was used with attachment points at these increments. Some items were only tested in normal wear (i.e., electric socks, avalanche airbags) as this appeared to be their most practical use.

RESULTS

The following GPS tracks illustrate the findings for the items tested. The pins represent stable signal detection.

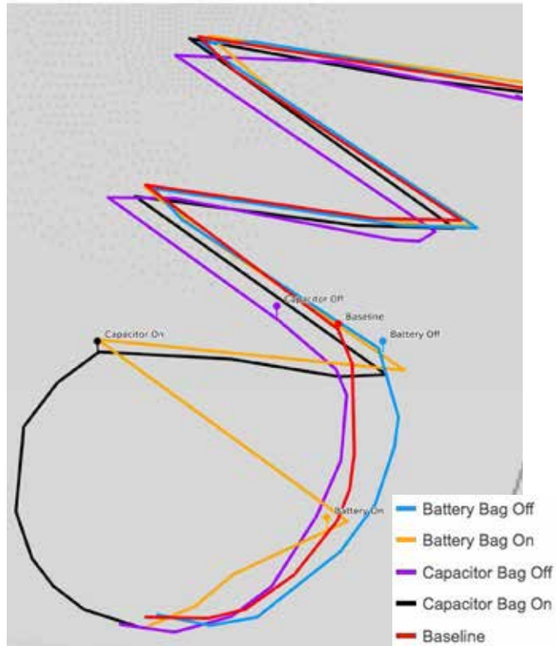

FIG. 1: BATTERY & CAPACITOR AIRBAG SEARCH TRACK

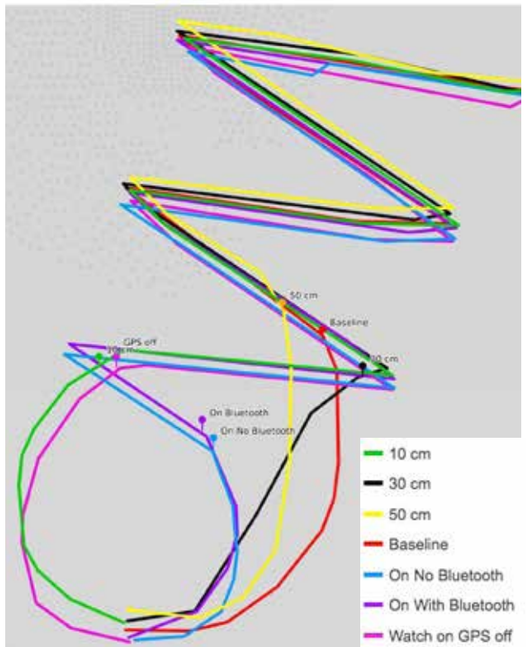

FIG. 2: GPS WATCH SEARCH TRACK

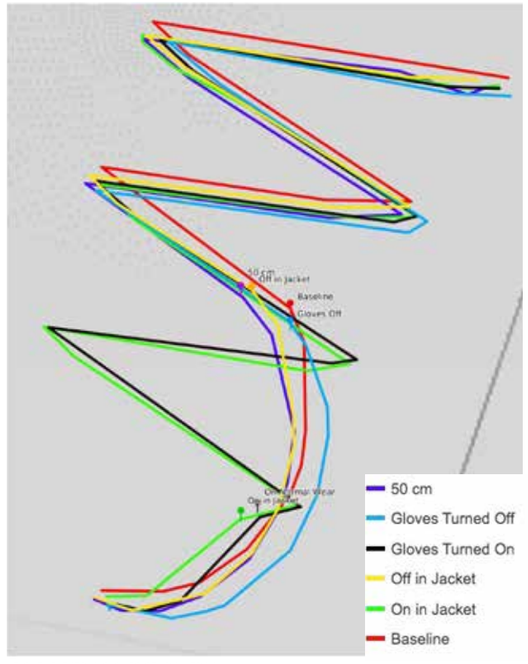

FIG. 3: ELECTRIC GLOVES SEARCH TRACK

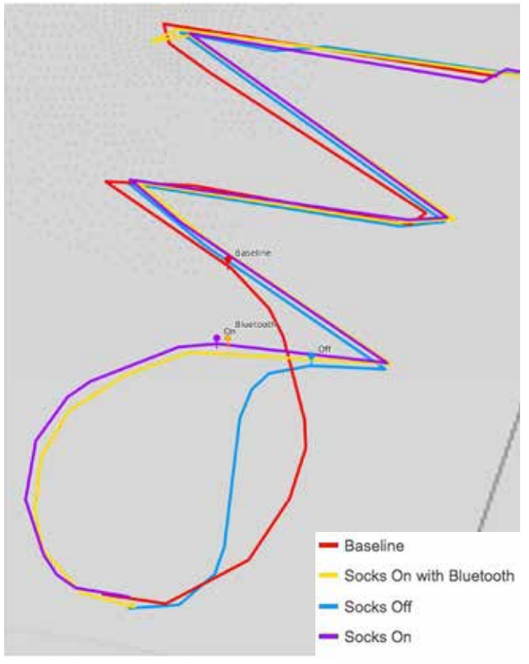

FIG. 4: ELECTRIC SOCKS SEARCH TRACK

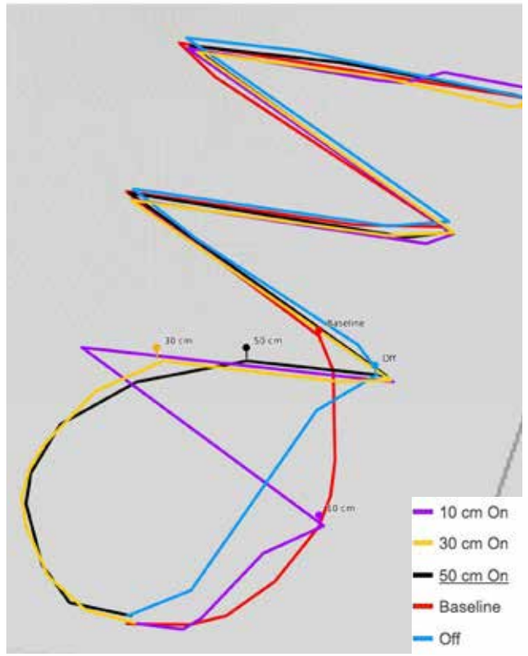

FIG. 5: IPHONE ON SEARCH TRACK

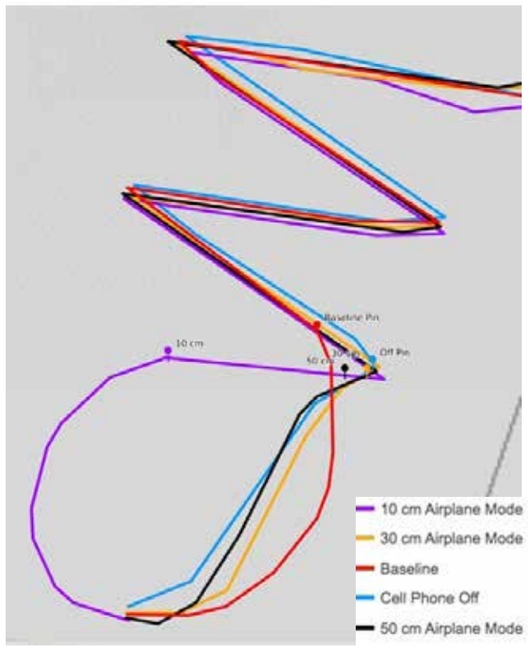

FIG. 6: IPHONE AIRPLANE MODE SEARCH TRACK

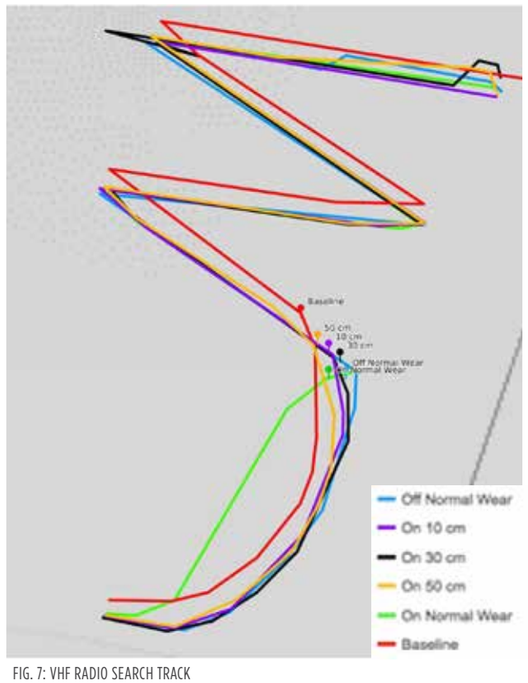

FIG. 7: VHF RADIO SEARCH TRACK

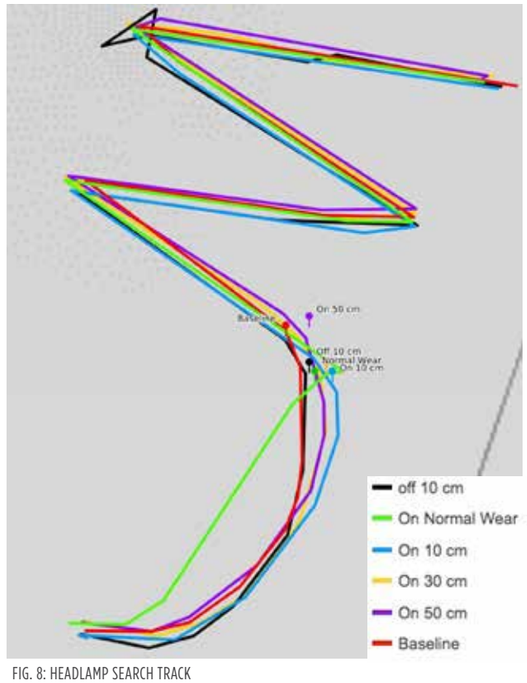

FIG. 8: HEADLAMP SEARCH TRACK

IT'S ADVISED TO TAKE HEATED GLOVES OFF TO AVOID INTERFERENCE WHEN CONDUCTING A TRANSCEIVER SEARCH. // GRANT GUNDERSON

DISCUSSION

As per the first objective of this study, the GPS pins in Figures 1–8 indicate there are scenarios where the signal detection points are clustered closely together, suggesting negligible impact of EMI. There are also GPS pins showing signal detection points that are more spread out, with some closer to the sending transceiver, suggesting a greater impact of EMI.

As per the second objective of this study, it is hoped the GPS tracks, together with signal detection pins, help illustrate the real-world impact of EMI on signal search performance.

As EMI devices are either turned off or are farther away from the searching transceiver (to the recommended 50 cm), their effect on signal search performance is reduced.

Fig. 1 shows both airbag packs tested introduced sufficient EMI to shorten the effective range of the searching transceiver (the distance from the power source to the searching transceiver was approximately 50 cm). This is problematic as there is no reasonable way to increase separation other than to abandon one's backpack, which is not desirable for other reasons. Note that both packs tested were first generation models (worst case scenario as these items are likely still in use), and in at least one case (Alpride) the interference issue was identified and a firmware update issued (this was not tested in this study).

In the case of the GPS watch (when worn on the hand holding the searching transceiver), signal detection range loss was significant as illustrated in Fig. 2. More testing needs to be done to determine if this applies to smart watches in general. If so, manufacturers, educators, and public safety agencies may consider increasing the warning over this issue.

The heated (electric) gloves had a significant impact on signal detection when worn and in 'on' mode, as well as 'on' and 30 cm away from the searching transceiver (stashed in one's jacket). The results shown in Fig. 3 reinforce the current advice that heated gloves should be turned off during a transceiver search.

SUMMARY

The GPS tracking in this study suggests that while some EMI items, such as those in Figures 4, 7, and 8 were less problematic, some had a greater influence on the searching transceiver (Figures 1, 2, 3, 5, and 6). The results support the findings of the research community, suggesting the further away the source of EMI from the searching transceiver, the greater the likelihood of early signal detection.

In all search scenarios, the searching transceiver display indicated a search strip width of 70 m, suggesting its EMI software detection did not recognize the EMI inputs tested (the function worked when placed against extreme sources of interference such as a power line). As a result, the real-world use of this functionality may be limited and may compromise one's search (search strip width may be outside the signal detection zone) if strong EMI is not accounted for by turning the EMI devices off, increasing their distance, or reducing the search strip width. More testing and research are required to further investigate the device used, as well as other devices with interference detection functions.

The search transceiver used was set to pro mode and in all cases the analog tone was heard before the distance and direction were displayed on the screen. This combination of tools may allow the professional user to establish a mental map update prior to the data being

displayed on the screen, as well as help solve erratic distance and direction information, potentially saving search time.

RECOMMENDATIONS

The results in this study support the advice of 50 cm as the recommended distance from EMI source to the searching transceiver (ICAR, 2009; Finvers & Latimer, 2021; Forrer et al., 2018; Meister & Dammert, 2014; Klassen 2021, 2022). At the trailhead, you may want to consider an interference check—a group inventory of who has active sources of interference (i.e., GPS watches), their location, and how to turn them off.

In any search scenario, consider turning off any non-essential electronics (Barkhausen, 2012). Those that may be considered essential (radios, Inreach, satellite phones, etc.) should have their distance increased from the search unit to the recommended 50 cm.

If any search anomalies appear such as erratic distance and/or direction indication, it may be safe to assume some EMI interference. One should therefore reduce the search strip width to ensure one is not outside the signal detection range (Genswein et al., 2013; Klassen, 2022; Finvers & Latimer, 2022), and follow a disciplined search pattern until a stable signal is found.

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Note: This article was shortened for the Avalanche Journal. A more complete version is available by scanning the QR code below.

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snow globe

42

CAA HISTORY WITH CLAIR ISRAELSON

in this **section**

// ALEX GEARY

CAA Oral History - **Clair Israelson**

John Woods, with Clair Israelson

FOR THE CAA'S 40TH ANNIVERSARY, we began interviewing key figures in the history of the association in order to capture our history. We are pleased to begin presenting this work, starting with an excerpt from a conversation between researcher John Woods and Clair Israelson. Clair began his career in the industry in 1971, was a founding member of the CAA, the Executive Director from 2001-09, and is an Honorary Member.

Note: This interview has been edited for length. The full transcript and audio of the recording will be available online in the coming months.

John Woods: I'd like to start by asking you about how you became interested in this whole field of avalanches and avalanche safety.
Clair Israelson: I got hired by the National Park Service in 1971 and discovered, to my amazement, they were looking for people to work in avalanche safety programs that were evolving and starting to develop at the ski resorts in the Rockies. I spent the winter of 1971-72, which was a landmark avalanche season, working for the National Park Service out of Yoho Park, monitoring and controlling avalanches that affect the highway and the railway.

It was like a light went on—here's this fascinating work in some of the most interesting conditions on Earth, I'm getting paid to go out and go skiing and ski touring and collecting snow data and trying to do some kind of analysis on it, at a time when not much was known about snow and avalanches, and there certainly weren't very many technical standards to be applied. So, I fell into it because I got hired as a national park seasonal warden and they kept me on for the winter to work in the avalanche program.

John: I take it you're a skier, a backcountry skier, before this?
Clair: I was a downhill skier, ski resort skier. Ski-touring was something I'd never done until I got to the National Park Service. It opened a whole new world to me.

John: So, you go right back to that earliest time of the Parks Canada development when things were already going on in Rogers Pass, but it was beyond that.
Clair: Things were going on in Rogers Pass because of the construction of the Trans-Canada Highway and Rogers Pass quickly became the lead operation for avalanche protection in Parks Canada. The rest of the operators of the ski resorts and Jasper and Banff tried to adopt as much of the technical material as possible from Rogers Pass. Some of it was applicable. Some of it wasn't because Rogers Pass was focused more on highway and railway protection. We took what we could use and adopted it as best we could for our uses. That's how I got started—thrown into it over my head, green kid from the city. I thought I'd hit the jackpot.

John: When did you see your first avalanche?
Clair: Oh, that winter 71-72, because it was the 1-in-100-year snow winter. We'd go heli-bombing and see these massive avalanches taking out 200-year-old timber and covering highways and railways and taking out buildings. And it caught my attention!

John: What a remarkable time to be getting into the field (of avalanche protection).
Clair: And knowing absolutely nothing. We were hired because we could ski a little bit. We knew nothing about avalanche forecasting, knew nothing about data collection. All of that had to be learned. It was a fabulous time to be thrown in over your head!

John: Can you take us back then? You're working in the Kicking Horse Pass area for national parks stationed in Yoho. Can you tell us about your interest in joining with others in the Canadian Avalanche Association that goes beyond your job?
Clair: Well, in 71-72, I was a seasonal warden and this was termed winter employment. A year later, I was hired to work in Banff as a full-time national park warden and it was noted I had an aptitude for the mountain safety and avalanche-related work. I had an interest and they were looking for people just like me who would be willing to do this kind of work because all the rest of the crew were old folks who were from the Second World War who were retiring. And they had no interest in skiing. They had no interest in forecasting avalanches. They had no interest in doing much other than trying to stay comfortable in their trucks. That just wasn't what they'd hired on for.

The National Park Service had to hire a whole new crew of young guys coming in who would be interested and willing to take on this kind of work because they realized it was coming, that those programs had to take off and had to be done properly. There was Keith Everts, Tim Auger, and myself, and a few others who kind of got pushed into this avalanche-related work. And we were thrilled to do it. We thought it was the best job in the world.

I got assigned responsibility for the Lake Louise ski area, and the highways and railway through Kicking Horse Pass, and up to Banff-Jasper Highway. I got thrown into that after only a couple of years of experience reading a thermometer and had a desperate need to try and learn more from as many people as I could. And that's where my interest in collaborating with other people came from. That was the role the avalanche association came to serve when it was incorporated in 1981.

John: How did you make that connection into this fledgling Canadian Avalanche Association?
Clair: Well, we were a pretty small group. We all knew Peter Schaerer from his work at Rogers Pass and with the National Research Council. Peter was the glue that held us all together. He'd make a little tour every winter and come by and visit everyone and try and offer encouragement and technical hints here and there about how we might do things better or to a more standardized mechanism. We had Willi Pfisterer from Jasper Park, who was a public safety specialist there, whose winter skills were exceptional, and he would take us out and teach us winter travel safety and all of that. We were being mentored by these older folks in the industry, but there were only a few of them.

Those of us who were being pushed into the frontlines came to know each other through those connections that we made through Willi and Peter and to a few other folks. We just simply maintained those connections and started asking each other: when you're faced with this kind of a problem, what do you do? How do you do this? How do you do that? We would travel to each other's operations and try and learn what we could from exchanges.

It started creating this community that expanded outside of the National Park Service itself and came to involve people who were involved in highways operations. B.C. was getting into the game then in the mid-70s, so it involved people in BC Highways, it involved some of the people involved in heli-skiing. There weren't many people who were making their living then ski-touring, but the combination of the National Park Service ski resorts, the highway people, the guiding community—we all started creating this informal network of people who had similar issues and were looking for a second opinion.

John: How did that lead to your involvement with what would eventually become the CAA in the larger sphere?
Clair: In 1980, Peter Schaerer and Willi Pfisterer convened a meeting in Banff of stakeholders who would become the founding members of the Canadian Avalanche Association. That was basically an investigative meeting to see what the common issues were, what the commonalities were, and what kind of role an avalanche association might serve in Canada to facilitate future well-being, future growth, technical standards, and that kind of thing. At that meeting, we decided we should form an association. Some draft

CLAIR GUIDING AT NORTHERN ESCAPE HELI SKIING, MANY YEARS LATER. // CAA ARCHIVES

bylaws were created by Peter Schaerer. It went on to be incorporated as a not-for-profit society in B.C. called the Canadian Avalanche Association.

John: And then you became members of that association?
Clair: We all became members of it. The first meeting was held in Vancouver, I think in the spring of 1981. The goals of the association were outlined and talked about, and some basic mechanics were set in place about annual dues and that kind of thing—you know, the usual kind of structural stuff.

The key board members of the association at the time were of course Peter Schaerer, Geoff Freer, who played a very major role in support of the CAA through its early years, Willi Pfisterer, and Fred Schleiss. And then there was attendance from a broad cross-section of the ski areas, highways, guiding community, the main people involved in avalanche protection at the time. Pretty much all the operations were represented because everybody saw that there was going to be a need for this kind of technical communication and standards development and that kind of stuff.

John: So, you're right in on the ground-floor?
Clair: Yep. I was there. I was there for the first meeting.

The Avalanche Heckler - Part 1

Brendan Martland

AS AN AVALANCHE INDUSTRY PROFESSIONAL, I regularly hear and read all the same terms that you do. As an increasingly salty mentor, ITP instructor, and CAA committee member, I regularly have stimulating conversations about how some of these common terms are actually completely incorrect, misguided or misleading. Over the next few issues, you will find a list of some of the terms that come up regularly, with some insight on how I feel they are being misused. This is an opinion piece, but it has been populated from conversations with senior course instructors, textbook authors, lead avalanche forecasters, researchers and (perhaps all of the above) well-intentioned ski bums.

With the addition of the CAA Level 3 course in 2010, many professional members suddenly found themselves learning a new set of terms in order to speak the same language as other risk management professionals worldwide, such as geotechnical engineers and scientists. We now use these terms widely and they serve a great purpose for our community. As we continue to strive for perfection (well, improvement at least...), we need to regularly re-evaluate how and why we do things in our profession.

The Conceptual Model of Avalanche Hazard has us all speaking the same appropriate language, so if I start talking about grunty windslabs, spicy conditions, and spooky facets (all terms I have used before), I will likely be encouraged to join the party, drink the Kool-Aid, and speak in an agreed-upon universal lexicon that captures and communicates these avalanche problems better. The following list is my informal extension of the Definition of Terms for Avalanche Risk Management.

And please, heckle away, folks!

1. **“Settled”** (To sink gradually; To become compact)
Yes, it’s just semantics, but it’s important! We need to be using the right terms. Even the Right Honourable Doctor of Avalanches, Bruce J., thinks so. Surely you all know better?

My sarcastic reply to fellow colleagues who misuse this term usually goes something like this:

[Well educated professional]: “We were skinning up into the bowl and had a huge settlement all around us!”

[Sarcastic unprofessional heckler]: “Fascinating. How long did you camp at that location, and what was the settlement rate over a 24 hour period?”

This term is actually quite rampant, which is why it appears at the top of this list. The InfoEx is littered with this profanity almost daily. Shame on us all. Here are some helpful terms that correctly describe the physical properties of the event being discussed:

Collapsed (Oh right, that’s what happened to that layer under the slab that made the dramatic sound and gut-wrenching drop in my stomach.)

Whumpfed (Not to be confused with the physical properties occurring within the stomach when a widespread collapse occurs. Also, very difficult to spell, so let's stick with collapsed, shall we?)

2. **“Slackcountry”** ("Slackcountry is Canadian slang for ‘easy-to-reach backcountry’, the off-piste area just beyond the fences and ropes of a resort's boundaries.” The Independent.co.uk)

“Slack” (Not taut or held tightly in position; loose)
As most of you are painfully aware of, educating certain user groups about the dangers of the winter backcountry is an ongoing crux for our association. Many avalanche near-misses and serious accidents occur within several hundred metres of ski resort boundaries. There's nothing slack about it.

By using the term slackcountry to define an area that holds a high probability of producing an avalanche involvement at some point over the winter, we are doing a disservice to all the AST instructors, ski patrollers, search and rescue volunteers, and professional rescue specialists who would all rather be skiing pow then running out to help with yet another preventable mishap. Outside the resort is the backcountry. Black and white. The ropes are there for a reason, so let's keep that message going.

[Well educated professional]: “Oh man we got 'lanched in the slackcountry today.”

[Sarcastic unprofessional heckler]: “Looks like your slacks need changing today.”

Lift-accessed backcountry can be a very scary place, more often than most people might think.

3. **"Tightening up"** (To increase grip or pressure; to pull and make straighter; to have more control over)
They LOVE this term in the Rockies—can't get enough of it. Use it all the time. Now I hear it spreading further west, too. It goes something like this:

[Well educated professional]: “Everything's tightened right up—no results with control work."

[Sarcastic unprofessional heckler]: "Were you spinning the right way? Because for most things it's clockwise to tighten, but with propane it's actually counter-clockwise, did you know that? So how do you know what snow is? I can't find it anywhere in the Avalanche Handbook that I read to sleep every night."

Maybe because it gets so cold in the Rockies, it's just too awkward to legibly verbalize the molecular dynamics at play when snow crystals and grains are faced with a significant, but not too sudden, drop in temperature, thereby slowing their molecular little heartbeats and **reducing the sensitivity to triggering**, which is what we're really talking about here, isn't it? That rings a bell... It’s become more **stubborn** and may even be **unreactive**.

That’s all for now. Stay tuned for Part Two, where I take on beacons, ski cuts, and more. I welcome your replies. Like any good heckler, I can take as much as I give.

Editor’s note: If you’d like to reply to Brendan or make your own contribution to this series, please email acooper@avalancheassociation.ca.

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