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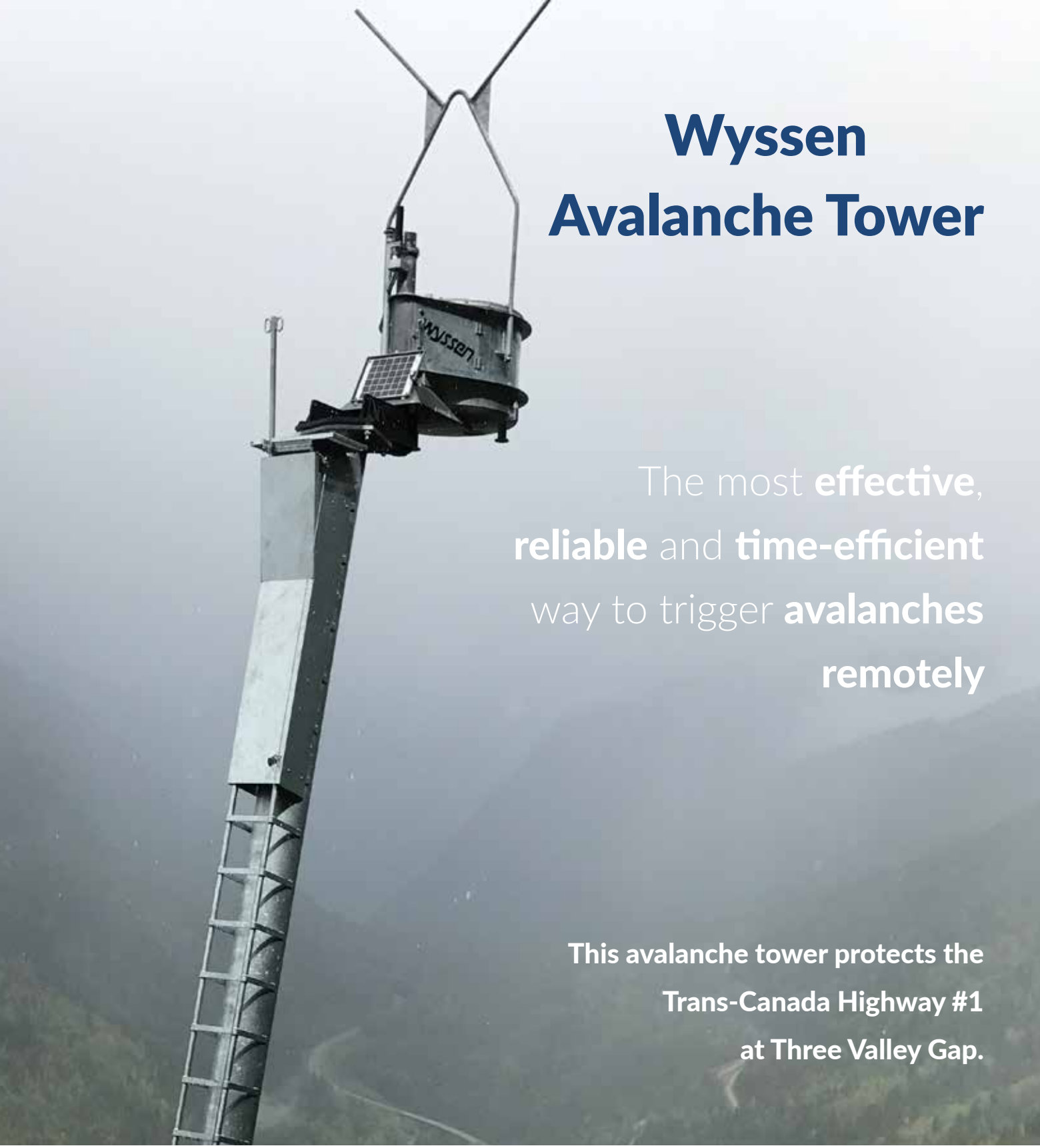

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Return undeliverable Canadian addresses, change of address and subscription orders to: Canadian Avalanche Association PO Box 2759, Revelstoke BC V0E 2S0 Email: info@avalancheassociation.ca
Publications Mail Agreement No. 40830518 Indexed in the Canadian Periodical Index ISSN 1929-1043

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Eirik Sharp
CAA President

CAA President's Message

I'M WRITING THIS COLUMN from the 2024 International Snow Science Workshop in Tromsø, Norway. Once again, I've been struck by the strong Canadian representation on this international stage and the ongoing influence of Canadian innovations and research in avalanche science and operations. As a Norwegian emigrant, it's also inspiring to see how much the Norwegian avalanche industry has developed over the last 20 years.

In Canada, avalanche risk management has evolved from locally implemented solutions based on the recommendations of a few dozen experts, to a nationally coordinated, multi-agency system. This system now employs hundreds of researchers, engineers, forecasters, and technicians who provide comprehensive risk management across the country. As a Canadian immigrant, I am proud to recognize how much of this growth has been supported and guided by Canadian expertise, including contributions from the CAA, the Ministry of Transportation and Infrastructure, Avalanche Canada, Parks Canada, and our university research programs. As we look ahead to ISSW 2028 in Whistler, it is evident the CAA continues to lead the way in setting the global standard for professionalism and avalanche education.

PREPARING FOR THE FUTURE

One of my key takeaways from ISSW was the exciting convergence of ever-improving weather, snow, and avalanche modelling techniques with increasingly accessible remote sensing technologies such as satellites, UAVs, and avalanche detection systems. These advancements promise to provide avalanche workers with new tools that will help us do our work more efficiently. This year's conference hinted at a future where innovative sensors and data processing platforms will provide us with a better understanding of snowpack and weather conditions; advanced predictive avalanche models will help us assess when and where avalanches will occur; increasingly sophisticated detection systems will monitor avalanche activity on a larger scale, providing almost real-time feedback; and connected devices will enable ever more effective and timely risk mitigations.

It's clear the nature of avalanche work will change dramatically in the coming decades. The CAA must be forward-looking to ensure our members are equipped to thrive in this evolving environment. We will need to balance integrating new technologies with cultivating the critical thinking and decision-making skills that have always been at the core of avalanche work.

Over summer, the board was hard at work collaborating with various committees on important technical and governance projects that will ensure our Association continues to grow and evolve. The Governance Committee remains focused on exploring voting rights for Avalanche Educators so they can have a say in the Association's future. The Technical Committee completed an update to OGRS that keeps standards clear and relevant. The Education Committee is formalizing new processes to inform the regular review and update of the ITP curriculum. Additionally, the Ethics and Standards Committees is developing scope-of-practice statements for Practitioners and Professional members. These statements will be crucial as our membership becomes more diverse, and will help define professional competence, promote accountability, and build trust among stakeholders by clearly outlining the areas in which avalanche workers are qualified to operate.

Looking ahead, it's evident the CAA's role in shaping avalanche practice and professionalism, both at home and abroad, is crucial. I urge all members to stay involved, share their expertise, and seize opportunities for growth, innovation and advancement. Together, we can ensure Canadian avalanche workers continue to lead the way, establishing standards that have a global impact on the avalanche community. As always, I value your input and suggestions.

Here's to a safe and fulfilling season ahead for all our members and the broader avalanche community.

Eirik Sharp, President

Joe Obad
CAA Executive Director

Executive Director's Report

AT SEPTEMBER'S ISSW in Tromsø, Norway, several presentations were skewed towards the challenges of the host country, where avalanche hazard frequently threatens an extensive road network that serves remote settlements and travel corridors. Norway has often favoured tunnels to manage its avalanche problems, but is now increasingly looking to remote sensing tools and monitoring systems to complement its avalanche workers and decision-makers.

To their credit, the presentations of these tools and systems were very accessible, even if the immediate use-case in North America was not always obvious. The perpetual conversation between human judgement and the limits of the tools pervaded question periods and conversation in the halls. No doubt some of these systems will come to Canada through brave early-adopters.

READY OR NOT - TECHNOLOGY IS COMING

I found myself thinking about how the presentation and experience of these tools influences their adoption. A decade ago, when we hosted training sessions for InfoEx 3.0, I recall one participant leaning back in frustration saying, "I didn't get into guiding for all this computer ****!" Like it or not, the technology ****, er, stuff is going to keep coming. The sweet spot of knowing what to adopt early and what to wait on remains an art and shifts depending on which corner of the snow and avalanche business you are in. The anxiety about these choices is a constant even as the choices themselves evolve.

At the CAA, we can't escape these challenges either. Our aging membership management system is now a decade old. In technology terms, is that like driving a '57 Chevy, or a Model-T? Whatever the case, Membership and ITP staff have stretched the system about as far as it can go. Over the next year, we are exploring alternatives to find an option that meets the needs of members, students, InfoEx subscribers, and the CAA staff tasked with serving them. We don't make this choice lightly—we need a system that helps everyone with their needs, rather than one that acts as a barrier and requires several workarounds for common functions.

With InfoEx, Stuart Smith and his team face similar choices to ensure the platform keeps up with the ever-changing web environment the product must operate within. Thankfully, we have been blessed with some external funding to help provide additional resources to the development of InfoEx. We owe many thanks to Public Safety Canada, who supported us with the original three-year MainEx project and added an unprecedented (as far as I know) fourth year of funding that concluded this summer. Transport Canada has stepped up with funding that will assist development until the end of 2025. We are grateful for these resources to support the InfoEx community.

The choices above occur in a resource-constrained environment. Canada has seen inflation ease, but as we've all learned at the checkout counter, prices are not going down. As I write this, staff are proposing a slightly better than break-even budget to the Board of Directors. Even with the dues increases voted in by members, the rise in costs the last few years has put pressure on the budget. Staff believe the proposed budget allows us to continue offering services members want while avoiding sticker price shock where we can on courses, InfoEx subscriptions, and membership.

We can do this in part because of the prudent savings of our modest surpluses the last few years. With less confidence in a return from our core budget, we'll need to be careful how we spend reserves to best serve the interests of the association. This is an ongoing conversation between the staff and board.

In the meantime, there is the season ahead. We wish all members, students, and operations the very best in training and preparations for the work that awaits. As ever, please reach out to us for any needs, questions, or concerns you may have. Email info@avalancheassociation.ca and we will ensure your message gets to the right person. If you're sure that you need to get a hold of me, don't hesitate to reach out to jobad@avalancheassociation.ca.

We look forward to hearing from you and serving your needs. I hope you have a great season!

Joe Obad, CAA Executive Director

Alex Cooper
Managing Editor

From the Editor

I'D LIKE TO THANK everyone who responded to the questions about *The Avalanche Journal* in the CAA membership survey this summer. I'm happy to see 70% of respondents consider it an important part of their membership, 90% read some or parts of every issue, only 0.8% of respondents never read it, and only 0.5% (two people) considered the quality of *The Journal* "poor." (Happily, no one rated it "very poor.")

Generally, there were positive comments about the variety and quality of articles, but also some criticism about some of the articles being overly technical or dry. There were requests for more technical articles on advancements in snow science, while others want a focus on articles that are useful for practitioners.

RECEIVING FEEDBACK

A recurring request was for more case studies—and I agree. I would love to publish more case studies, and I encourage you to submit them, or let me know of events you think would make for a good case study—I can always follow-up with people to see if they're interested in writing.

Case studies do not have to be lengthy, detailed analyses, like the one on a size five avalanche near Revelstoke in the summer 2023 issue. They don't have to be about major accidents or massive avalanches—even a minor near-miss that offers some learning lessons is worth sharing. One person suggested a section of "avalanche shorts" that would be a compilation of shorter articles. Coincidentally, I recently published a 2014 feature on cornices on avalanchejournal.ca that features several short case studies on cornice incidents. The potential is there to do something similar on other topics in the future. I am open to suggestions.

There were requests for product reviews. If you are familiar enough with a new product or technology and would like to write about it, please let me know. Many of you also asked for regular member profiles, which is definitely something we've talked about in the office but have not made happen. I'd really like to showcase members who aren't regular contributors or presenters at the Spring Conference—the people who are doing amazing work and you think more people should know about.

We also asked what stops people from contributing. The Number One reason was lack of time, which is understandable. A few people said they felt they had nothing interesting to write about, or they didn't feel advanced enough in their career to contribute. One of my big concerns with *The Journal* is relying on the same dozen-or-so people for articles, so I am very welcoming of new voices. I'm a pretty forgiving editor and I'm happy to work with anyone on shaping an article for *The Journal*. I recognize few of you are professional writers and are working on articles on your own free time. I don't want contributions to be a burden. I will almost never reject an article and I'm happy to work with new writers.

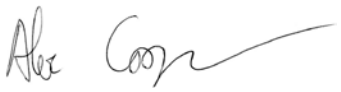
***

This issue has a strong focus on mental health. Brian Lazar from the Colorado Avalanche Information Centre contributed a piece on mental health programs that have been instituted south of the border, and I interviewed Wren McElroy about moments in her career that led her to implement a mental health program within MOTI. Later is an excerpt from the CAA History Project interview I conducted with former CAA President Steve Blake, where he talks about the 2002 avalanche that took the life of his long-time friend and work colleague, Mike Wynn.

Mental health also comes up in Colin Zacharias' article on what happens after you've had an accident. His presentation was standing-room only at the Spring Conference and we're happy to publish it here for everyone to read, and preserve it for future generations as it's such an important subject.

Up front, Membership Services highlights some findings from the membership survey, and the Technical Committee sums up changes in the new edition of OGRS. We've also got some great photos from the Canadian contingent to ISSW 2024 in Tromso, Norway.

Future issues will look at ATES 2.0 and the Conceptual Model of Avalanche Hazard. If you'd like to contribute an article on either of these topics, or anything else, please email me at acooper@avalancheassociation.ca.



Alex Cooper, Editor

CAA Membership Survey: **What We Heard**

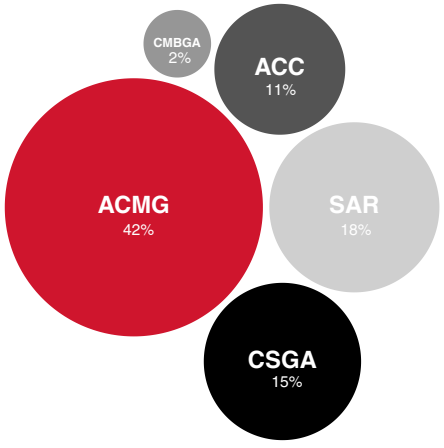
Rosie Denton, Operations Manager
Makayla Hogan, Membership Services Coordinator

THIS SPRING, WE CONDUCTED A SURVEY TO BETTER UNDERSTAND member interests and what kind of benefits members find value in. We are using this information to shape and direct initiatives such as diversity, equity, and inclusion, and our partnership program.

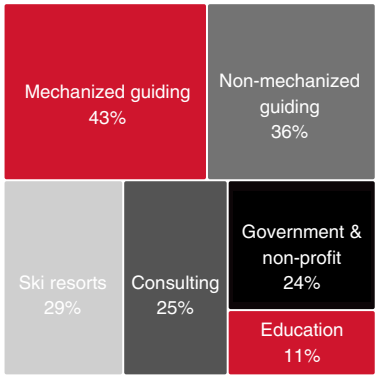
Many thanks to everyone who took the time to respond to our survey. A total of 412 members responded, which is more than 30% participation rate. As we move forward, we will use our findings from the survey to better guide our efforts to meet the needs of a growing membership and industry.

Here's a look at what your CAA membership looks like in 2024:

Members who hold memberships with other organizations



Membership by industry type



CAA Members work in 26 countries around the world.

"I like CAA membership for the community, bringing guides, ski area forecasters, and corridor forecasters together."

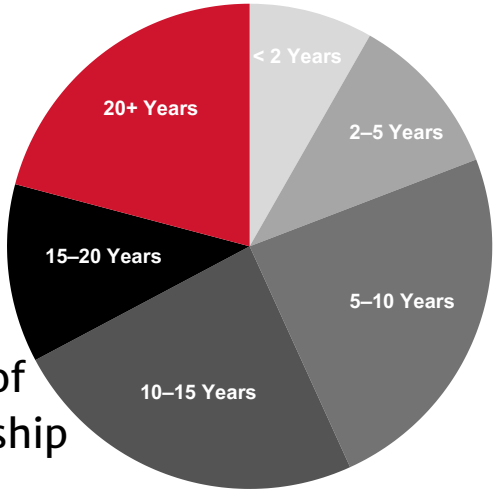
"Fantastic work has been done by the CAA in ITP over the past 30 years. Truly world class."

Does CAA Membership provide value for the amount you pay for your membership?

THREE QUARTERS OF MEMBERS AGREED THAT CAA MEMBERSHIP PROVIDES VALUE FOR THE AMOUNT PAID. RATIONALE FOR DISSATISFACTION VARIES SIGNIFICANTLY. STAFF AND BOARD ARE LOOKING INTO SOLUTIONS FOR COMMON FRUSTRATIONS.

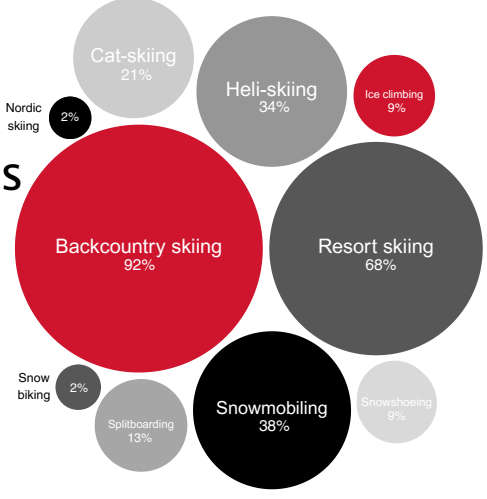
Members live or work in 11/13 provinces & territories

Years of membership



"As long as I've been out in the mountains in winter, my money has been well spent on a CAA membership."

Winter activities members participate in



WHAT WE'RE WORKING ON:

- Group benefits plan for members
- More ways to connect members
- Easier to navigate website and more usable member portals
- Updates to CPD policy
- Support for minorities
- Social media communications

MEMBERSHIP FUTURE WANTS:

- Mentorship opportunities
- More networking and job connections
- Updates to best practices
- More scholarships

IN THE NEXT ISSUE: SELF-REGULATION SURVEY

Members also responded to a survey on self-regulation. We'll focus on findings from this survey in the next issue of *The Avalanche Journal*.

2024 OGRS Update: **What you Need to Know**

Scott Thumlert, Chair, CAA Technical Committee

THE CAA TECHNICAL COMMITTEE recently completed the 2024 revision of the *Observation Guidelines and Recording Standards for Weather, Snowpack and Avalanches* (OGRS). This article provides a summary of the changes, insight into the review process, and discussion about some of the more substantial updates.

What is OGRS? As defined directly in OGRS: ***"This manual describes the terminology, techniques and data codes recommended by the CAA for taking and recording observations of avalanches, snowpack and mountain weather."*** Put another way, OGRS is a set of guidelines commonly used for operational avalanche risk management based on science and best practices, which are to be applied with professional judgement. OGRS should not be considered a bible to be followed verbatim regardless of situation. As mentioned, OGRS is based on both fundamental scientific principles and industry best practices. As science and practice evolve, we should expect that OGRS will also evolve.

This revision is the seventh edition of ORGS, which was first published in 1981 by a dedicated group of researchers and practitioners led by Peter Schaerer. The reviewers for this update were the current members of the Technical Committee: Dave McClung, Bob Sayer, James Floyer, Scott Garvin, Rob Whelan, Steve Conger, and Scott Thumlert. Mike Conlan coordinated the revision and compiled the final changes. Significant input was provided by Pascal Haegeli, Nata de Leeuw, Bruce Jamieson, Karl Klassen, Peter Marshall, Mike Smith, and Grant Statham.

REVISION PROCESS

Two fundamental principles formed the basis for reviewing any proposed changes to OGRS: 1) the proposed change is based on fundamental scientific principles; and 2) it adds value for operational risk management.

This revision process began with an active solicitation phase where the Technical Committee requested proposed changes, clarification, additions, and subtractions to the document. The general CAA membership, Industry Training Program instructors, CAA Education Committee, and InfoEx Advisory Group were all directly contacted, and a running list of proposed changes was formed. The list spanned over nine pages, with approximately 84 suggested changes that ranged from substantial additions to minor wording changes.

The committee then employed a review process similar to what occurs for scientific peer-reviewed journal articles. First, the committee members voted on the proposed changes to determine whether they should be considered. This gave Mike the go-ahead to incorporate the proposed change into OGRS. Then, like the scientific peer-review process, each reviewer could "Approve", "Reject Outright", or request "Minor Revisions" or "Major Revisions" for each of the changes that Mike made to the document based on the running change list.

DISCUSSION ON SUBSTANTIAL CHANGES

Type of avalanche problem

The addition of "Avalanche Problems" to OGRS was one of the most debated of the proposed changes. The committee

TechCom - OGRS Update - Proposed Change List

Topic	Approve	Major Revisions	Minor Revisions	Reject	Request Discussion	Comments
Substantial Changes						
Avalanche Problem Types			JF, ST, SG	DM	JF, ST	JF: I'm not certain the Guidance hits the mark ar
Remote weather station programming		ST	JF, SG, DM		DM: Commented "?"	JF: I like the simple approach and the table in Se
Avalanche Terrain Exposure Scale (ATES)	ST, SG			DM, JF		ST: ALthough I'm not sure ATES belongs in OGRS
Avalanche Size	ST	DM	JF, SG			JF: We should not include the prefix "D" in the si
Avalanche Size - Relative Scale				JF, ST, SG, DM		
Air and Snow Temperature Measurements	JF, ST, SG, DM					
Profiles - test vs full and other changes	ST, SG		JF, DM			JF: The hand-drawn full profile still shows 0 at th
Avalanche hazard		DM	JF, ST, SG, DM			JF: The most recent version of the NAPADS shou
Minor Changes						
Section 1.4.18 Blowing snow	JF, ST, SG, DM					
HN24	JF, ST, SG, DM					
2.5 Graphical snow profiles	JF, ST, SG, DM					
ECT update to AAA guideline	JF, ST, SG		DM			JF: Very minor point: In the Equipment section, 7
Glide slabs - add to problems or type of snow failure	JF, ST, SG, DM					ST: Consider removing "Type of snow failure" an
Crusts					Already approved 2023	
Height, Thickness and Depth					Already approved 2023	
Daisy Bell code			JF, ST, SG			JF: I don't like the description only referencing a
Deposit on road / rail			JF, ST, SG			JF: I think this would be better as "Deposit on roa
Avalanche occurrence time	ST, SG, DM		JF			

FIGURE 1: EXAMPLE OF THE RUNNING LIST OF PROPOSED CHANGES SHOWING THE REVIEW PROCESS.

members recognized the obvious value of using avalanche problems for forecasting, communicating, and mitigating avalanche risk. They are widely used for public avalanche forecasting, are a mandatory data entry field in InfoEx when recording an avalanche observation, and guide risk mitigation strategies. However, there was debate about the fundamental physical differences between certain problems. For example, storm slabs and wind slabs are physically both dry slabs on non-persistent weak layers; and differentiating between deep persistent slabs and persistent slabs can be difficult.

Pascal Haegeli, Nata de Leeuw, Karl Klassen, and Grant Statham all reviewed the new problem descriptions and suggested some changes based on the last approximately 14 years of experience using them, as well as recent research. We also added data codes, a guidance column, and some limitations of using them.

"Avalanche Problems" are really another way of describing different types of avalanches based on their formation and persistence. We now see substantial overlap in OGRS between the "Type of Snow Failure" table and the "Avalanche Problems" table. The committee considered simply replacing the "Type of Snow Failure" table with a new table—"Type of Avalanche"—representing the nine avalanche problem types; however, it was ultimately decided this would be too drastic of a change. It will be considered during the next OGRS revision.

Avalanche size scale

Suggestions for changes to the avalanche size scale were proposed and considered by the committee. Slight modifications to the destructive potential descriptions for size three and five were made (i.e., removal of "largest snow avalanche known" and addition of "mature").

Typical deposit volumes were added primarily because volume provides a good visual reference for size classification. Volumes for each size were estimated by Jamieson et al. (2014) using density estimated from mass by McClung and Schaerer (1981). Lengthy discussion occurred about deposit volumes, but unfortunately there are not many databases with measured volumes of varying avalanche sizes. The volumes that are applied best link to the "Typical Mass" values, but they may be too low for larger sizes. More research is needed to confirm typical deposit volumes.

Lastly, a table displaying the destructive potential for typical impact pressures was added in Appendix C based on publications by Jamieson, 2018, and McClung and Schaerer, 2022.

Avalanche Terrain Exposure Scale

The Avalanche Terrain Exposure Scale Version 2.0 was recently introduced, and the committee discussed whether it should be added as an appendix to OGRS. The committee decided not to add it to this revision since some of the technical aspects of the scale were still being discussed at the time of the revision project. The committee will consider adding it in the next revision.

Snow profiles

The committee was asked to review the definition of a full profile versus that of a test profile. The committee agreed a full profile observes the full column of the snowpack to the ground and that the characteristics recorded may vary between operations (e.g., not all operations measure snow

TABLE 1: MODIFIED AVALANCHE SIZE SCALE.

Size and data code	Destructive potential	Typical mass (t)	Typical path length (m)	Typical deposit volume (m^3)	Typical impact pressure (kPa)
1	Relatively harmless to people.	<10	10	50	1
2	Could bury, injure, or kill a person.	10^2	100	500	10
3	Could bury and destroy a car, damage a truck, destroy a wood-frame house or break a few mature trees.	10^3	1,000	3,000	100
4	Could destroy a railway car, large truck, several buildings or a forest area of approximately 4 hectares.	10^4	2,000	25,000	500
5	Could destroy a village or a forest area of approximately 40 hectares.	10^5	3,000	200,000	1,000

NOTE: SIZE 1 IS THE MINIMUM SIZE RATING. IN GENERAL, HALF SIZES ARE NOT DEFINED, BUT MAY BE USED BY EXPERIENCED PRACTITIONERS FOR AVALANCHES WHICH ARE MIDWAY BETWEEN DEFINED AVALANCHE SIZE CLASSES (I.E. SIZE 2.5).

THE DESTRUCTIVE POTENTIAL OF AVALANCHES IS A FUNCTION OF THEIR MASS, SPEED, AND DENSITY, AS WELL AS THE LENGTH AND CROSS-SECTION OF THE AVALANCHE PATH.

TYPICAL IMPACT PRESSURES FOR EACH SIZE NUMBER WERE GIVEN BY MCCLUNG AND SCHAERER (1981).

TYPICAL DEPOSIT VOLUMES FOR EACH SIZE NUMBER WERE ESTIMATED BY JAMIESON ET AL. (2014) USING DENSITY ESTIMATED FROM MASS BY MCCLUNG AND SCHAERER (1981). MORE RESEARCH IS NEEDED TO CONFIRM TYPICAL DEPOSIT VOLUMES.

density). Minor additions included modifications to the equipment lists, discussing ruler placement, discussing site characteristics and profile objectives, removing symbols for water content and density, and improved discussion on snow hardness and density measurements.

The revision includes updated examples of snow profile field book pages, including a graphical snow profile page, and drafted profiles.

Lastly, the ram resistance profile was removed from OGRS due to a lack of usage in Canada.

Avalanche hazard and snow stability

Changes to avalanche hazard rating schemes occurred since the last revision. The committee agreed to add the Avalanche Hazard Rating Scale used by avalanche professionals in InfoEx and to update the North American Public Avalanche Danger Scale to the latest version. OGRS also now references *Technical Aspects of Snow Avalanche Risk Management* (CAA, 2016) as the source for discussion on snow avalanche risk management. A few minor wording changes on avalanche hazard and snow stability are also found throughout OGRS.

MINOR CHANGES

Many other changes are found in the updated revision, including:

- addition of a section on automated weather data, including programming and recording;
- clarifying when HN24 is recorded;
- removing the recommendation of recording snow surface temperatures;
- clarifying where blowing snow is measured from;
- removing grain size terms;
- where to measure foot penetration when on a slope;
- recording thickness and resistance information for a surface crust;
- clarifying how to record wind direction;
- additional discussion on field weather objectives;
- updating the results of the extended column test based on recent research to match American Avalanche Association guidelines;
- improved guidance for snowpack summaries;
- modifying avalanche occurrence time to match InfoEx entries;
- adding glide slab as a type of snow failure;
- changes to the cause of avalanche releases, such as adding snow bikes as an example for motorized vehicles, and adding helicopter-deployed gas exploders as a trigger type;
- removing the additional terminus codes for paths with well-defined features;
- adding subclasses for melt-freeze crusts based on their formation;
- updating the Incident Report Form in Appendix B; and
- clarifying the differences between height (measured vertically), thickness (measured slope-normal), and depth (measured vertically).

FUTURE REVISIONS

The Technical Committee continues to seek feedback from CAA membership for future improvements based on fundamental scientific principles and value for operational risk management. Please submit any comments or suggestions to ogrs@avalancheassociation.ca.

The new version of OGRS can be found on the Guidelines & Standards page of the CAA website. A CPD session on the OGRS update was scheduled for Nov. 4 at 6:30 p.m. PST. The recording will be made available for free for all members who are not able to attend.

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Of Jellyfish and Remote Arctic Roads
Reflections on ISSW 2024

Joe Obad

THE INTERNATIONAL SNOW SCIENCE WORKSHOP returned to Europe this year, with the conference hosted in Tromsø, Norway, from Sept. 23–29. Between the northern location (Tromsø sits at 69.6°, well inside with Arctic Circle) and the new hosts (first ISSW for Norway and Scandinavia), this year's ISSW promised to hold something new.

Each ISSW reflects a mixture of the hosts and the input from visiting participants. ISSW Tromsø was no different. Many presentations reflected the Scandinavian approaches to avalanche monitoring, mitigation, and public risk communication. Several presenters were affiliated with the organizing committee that included the Norwegian Water Resources and Energy Directorate (NVE), Norwegian Public Roads Administration (NPRA), the Arctic University of Norway, and the Norwegian Geotechnical Institute (NGI). The committee was led by the NVE's indomitable Rune Engeset.

These various bodies play different roles managing Norway's geographic and user challenges. Running 1,750 km from north to south, Norway is blessed with a beautiful but challenging coastline of over 100,000 km, only second to Canada's in total length. The NPRA manages a range of avalanche-affected roads across the country, with a surprising volume of roads to remote locations in and around Tromsø and areas even further north.

With its small population and many remote, sparsely populated settlements, Norway emphasizes systems and technology—even Norway can't push tunnels through everything. They have invested heavily in remote monitoring, modelling, and other technologies to manage their challenges. Presentations were offered on satellite, radar, and lidar systems, which in some cases connect to automatic gates that close roads when avalanches are detected. The level of monitoring and remote sensing was impressive.

For the North American context, it is uncertain which of these technologies will find a use on our side of the ocean. That said, we are blessed with many early adopters who help sift the wheat from the digital chaff. I'm confident we'll see programs in Canada tease out the best of these new technologies. Don't be surprised if they extend beyond highways into other applications.

Canada was well represented at ISSW 2024. Presentations like Chris Argue's *50 Shades of Blue: Risk Gradients Within Avalanche Hazard Zones* and Scott Thumlert's *Assessing and Communicating the Likelihood and Probability of Snow Avalanches* were well received. Kudos to Scott, who survived a jellyfish sting (acquired by diving in the harbour waters after a sauna) to recover for his presentation. All ISSW 2024 paper abstracts are now available in the full Montana State ISSW Archive at arc.lib.montana.edu/snow-science/index.php.

A SCENE FROM SVALBARD DURING A POST-CONFERENCE TRIP TO THE REMOTE ISLAND. // GEOFF FREER

CAA MEMBERS SCOTT THUMLERT, EOIN TRAINOR, EIRIK SHARP, JEROME DAVID, AND CAM CAMPBELL ENJOY A SOCIAL MOMENT AT ISSW. // NICOLE KOSHURE

Perhaps no Canadians were better received than the organizers of ISSW Whistler 2026. Tim Haggerty, Nicole Koshure, Jerome David, and the rest of the committee impressed the ISSW steering committee with their progress, and got the world excited to come to Canada in 2026, when researchers and practitioners will once again gather to explore the ISSW motto of merging theory and practice.

SCAN FOR MORE PHOTOS FROM ISSW.

Farewell Tromsø, **Here Comes Whistler**

Tim Haggerty and Nicole Koshure, ISSW 2026 Organizing Committee

TAKK FOR SIST! Thanks for last time! That sums up ISSW Norway 2024 pretty well. Thank you to the Tromsø organizing committee for such a special event in an amazing place!

Highlights included scientific presentations, RACS and detection system presentations, great audio visual, and buffet lunches on site. Social events included a local snow and local problem presentation, Diva night, roller-skating and live karaoke, and, of course, the banquet with keynote speakers talking about Arctic history.

There were also some great presentations from our Canadian contingent. We recommend signing up for the virtual registration to receive access to all the presentations until December 31. That's $207 for four days of professional development!

As we look to hosting ISSW Whistler 2026, the organizing committee and scientific committee are aiming to create a more accessible way for practitioners to submit their work in order to balance out the theory and research side. As such, we will be offering two abstract submission styles to choose from: the classic research paper layout, and a new practitioner-focused layout for case studies and discussions. We are also developing a sub-committee with some heavy hitting CAA professionals who have offered to provide mentorship for those interested in submitting. More to come in the next *Avalanche Journal*.

The Whistler Conference Center will be the main venue for the festivities, which will run from Sunday, Sept 27, through to Friday, Oct 2, 2026. We have booked out the Aava Hotel across the street from the conference centre for the best rates in town. Plan to come early, bring the family, and enjoy all that Whistler has to offer during the "quiet" season! Check out our website to book now.

Thank you for the support so far from the CAA and Avalanche Canada Foundation, as well as our title sponsors Wyssen and Arcteryx, and our safety sponsors CIL and MND. We aim to make 2026 the most affordable event since Banff in 2014.

With lowering cost for attendees as one of our main goals, we are actively looking for supporting sponsors and exhibitors. Check out issw2026.com for more information on how you can support this event.

For ongoing updates, follow us on Instagram: @ISSW2026Whistler.

ISSW 2026 ORGANIZING COMMITTEE IN TROMSO, FROM LEFT: JEROME DAVID, TIM HAGGERTY, AND NICOLE KOSHURE. // CONTRIBUTED

Contributors

BRIAN LAZAR
Brian is the Deputy Director of the Colorado Avalanche Information Centre. He began working in the mountains in the mid-1990s and has worked in a variety of snow climates on both sides of the equator as a mountain guide, avalanche educator, and curriculum developer. Brian earned a M.S. in engineering, studying snow and ice mechanics in Alaska's Chugach Range. He worked for many years as a consultant investigating snowpack runoff and potential changes to seasonal snowpacks as a result of climate change. He joined the CAIC in 2010 and lives in Carbondale, Colorado, with his wife and two kids.
22 STRESS MITIGATION IN AVALANCHE WORK

BRAD ROACH
Brad is a split monoboarder and ski poet hailing from Golden, B.C. He loves digging in the snow, talking heuristics, and following fine folks in the high country. He has worked for eight years patrolling and one year as an avalanche technician at Rogers Pass, and is pursuing his ACMG Ski Guide certification.
35 THE IMPORTANCE OF FOLLOWERSHIP

COLIN ZACHARIAS
Colin is an ACMG Mountain Guide and consultant in both avalanche and guiding operations. This includes recent work for HeliCat Canada, Heli-Ski U.S., the Association of Icelandic Mountain Guides, and the American Avalanche Association. He has been involved with the CAA as an ITP instructor and has sat on committees developing curriculum and the worker competency profiles. Colin has also been involved in guide training, was the technical director of the ACMG, and member of the ACMG Technical Committee. He has worked as a subject matter expert for Farris LLP and Lawsen Lundell LLP.
30 SO, YOU'VE HAD AN ACCIDENT—NOW WHAT?

CAA **Scholarships**

WE WOULD LIKE TO CONGRATULATE ANDY GABRYS, MARIA PARKES, AND RILEY WILCOX, the recipients of this year's CAA Membership Scholarships. Andy (left) is the recipient of the CIL Blasting Scholarship, which covers the course fees for attending the CAA's Avalanche Control Blasting Course. Maria (middle) was awarded the Everett Clausen Bursary, which provides $500 towards the course of the recipient's choice. She will be putting the funds towards her Avalanche Operations Level 2 Assessment. Riley received the Women's+ Scholarship, which covers the costs of attending the CAA's women's only Ops 1 course. The CAA is proud to work with our partners to offer scholarships to our members. For more information, please visit the Scholarships & Grants page on our website.

front lines

30

SO, YOU'VE HAD AN ACCIDENT—NOW WHAT?

in this **section**

// BEN JACKMAN

Stress Mitigation in Avalanche Work **And Lessons Learned**

Brian Lazar, Gabi Benel, Laura McGladrey, and Ian Fowler

IN THE 2022-23 WINTER SEASON, the Colorado Avalanche Information Center (CAIC) and the Snowmass Ski Patrol Snow Safety Team (SSP) worked with Responder Alliance to implement a stress mitigation framework consisting of several tools used to identify and respond to stress impacts in avalanche workers.

This work began after we identified the need for operating procedures for chronic and acute stress exposure. It included processes for the predictable exposure to traumatic events, such as responding to and investigating avalanche fatalities, near-misses, and injury and death of friends and acquaintances. Our work was presented at the International Snow Science Workshop in Bend, Oregon, last October (Lazar et al, 2023). This article looks at how our program was developed and implemented throughout the winter.

PROCEDURES FOR CHRONIC STRESS SUPPORT

In advance of the 2022-23 season, the CAIC and SSP created internal resilience teams and codified stress injury prevention planning into workplace manuals by providing definitions and procedures. The resiliency program and mitigation tools were reviewed at fall staff meetings and refresher trainings prior to the onset of the busy operational season.

Additionally, the CAIC, in collaboration with Responder Alliance, modified the US Marine Corps stress continuum in the style of the North American Public Avalanche Danger Scale (Fig. 1). As a concept already familiar to avalanche workers, avalanche danger proved to be an easily understood metaphor for stress accumulation. The adapted North American Avalanche Stress Continuum (NAASC) created a common operational language for avalanche workers to be able to discuss stress accumulation, emphasizing the impact of the stress exposure instead of the feelings surrounding the stress reaction. The latter had proven to be a barrier to transparency in other high-reliability organizations.

The NAASC was introduced to staff and used as an identified common language to recognize, monitor, and mitigate stress levels in avalanche workers throughout the season and at the moment and aftermath of critical events, such as avalanche fatalities or near-misses.

It was used to prevent and monitor chronic stress accumulation through regular surveys and check-ins between peers and supervisors, with the stated goal of promoting self- and other-awareness, and a culture that supported positive mental health choices in the workplace.

The survey used by CAIC was a modified version of the monthly survey developed by the Eldora Ski Patrol. Eldora had been using stress continuum language to capture overall team health and was sharing the findings back to the patrol, coupled with mitigation practices. In the survey, CAIC staff answered a series of questions on a scale from 1–10, as well as written questions regarding factors contributing to depletion and

NORTH AMERICAN AVALANCHE STRESS CONTINUUM

Stress Level	Behaviours, Traits or Feelings	Travel Advice
4 **High**	Inability to sleep without sleep aid No possible time to take a break Avoid forecasting/don't care No exercise No Desire for growth Avoid Communication	Seek Professional Help
3 **Considerable**	Sleepless nights thinking about problems Checking workplace chats and email when on break Barely on time/late for forecasting/don't care Minimum exercise needed for the job CEs only when expressly ordered Communication aggressive and defensive	Talk with spiritual advisor/counselor/trusted friend Schedule some personal time
2 **Moderate**	Getting tired but still able to sleep Occasional short breaks Just enough preparations for forecasting Occasional exercise as time allows Take part in minimum of CEs Defensive communication, shorter fuse	3-3-3 Check-in after action review Create a plan to make more green choices
1 **LOW**	Well rested and ready Scheduling and taking good breaks Psyched, early and well prepared for forecasting Exercising and healthy Seek out personal development Communicate openly and professionally	Continue to make green/good choices Exercise, Meditation, Journaling, Socialization etc

Adapted from North American Public Avalanche Danger Scale by CAIC & Responder Alliance

FIG. 1: THE NEWLY CREATED NORTH AMERICAN AVALANCHE STRESS CONTINUUM (NAASC).

FIG. 2: SSP'S DAILY APP RESPONSES FOR A WEEK FOR FOUR TEAM MEMBERS. THE COLOURS REPRESENT THOSE OF THE NORTH AMERICAN AVALANCHE STRESS CONTINUUM.

recharge. The survey was issued at the beginning of each month and could be completed in 10 minutes. The results were then archived in a spreadsheet and reviewed at monthly staff meetings.

SSP took a similar approach, creating a mobile app to facilitate anonymous daily check-ins of stress levels. This allowed SSP to monitor the team's daily assessment of stress impact as the season progressed. The survey was completed as a ritual at morning meetings and took less than a minute for the entire team to complete. The app would then display the team's stress accumulation for the past week (Fig. 2) and entire season, allowing the team to reflect on stress accumulation in real time. This information proved helpful in decision-making at the interface of incident stress, allowing team members to quickly assess the team's experience of stress when incidents occurred.

PROCEDURAL SUPPORT FOR ACUTE INCIDENT STRESS

Recognizing the need for changing the paradigm, CAIC and SSP created an incident support framework, with tools from Responder Alliance, that was used in advance of major incidents. This allowed for the staff to have a pre-established procedure to appraise the expected exposure and mitigation support needed prior to incidents. This proactive process represented a departure from the custom of waiting for an incident to occur and monitoring for stress impact in the responder after the fact. This practice also followed occupational health models of appraising for exposure, and screening and treating as evidence of impact occurs, much like that found in HAZMAT practices.

The incident support framework began with assigning the skill of traumatic stress exposure appraisal in the field by avalanche workers. This allowed for both improved speed and accuracy of determining with precision which snow workers may have been at higher risk for stress injury such as PTSD. The mechanism for incident appraisal was called the Incident Support Tool (IST). It was developed by Responder Alliance with support from Teton County Search and Rescue. It was used in this instance by the CAIC, with an accompanying screen-and-treat model named the 3-3-3 Exposure Protocol, for those identified at high risk for injury due to exposure to potentially traumatic events (PTEs).

The IST and accompanying scoring guide (Fig. 3) were used simultaneously by incident commanders and workers. They were designed to support increased awareness of risk exposure, with objective findings following PTEs such as avalanche accidents and investigations.

Functionally, the tool was used following an exposure to a PTE, when the event was retroactively evaluated based on factors that increased the risk of injury (e.g., disturbing images, conflict during the mission, perception of helplessness, involvement of children or animals). Avalanche workers then rated personal factors associated with increased risk of stress injury (e.g., extended contact with grieving family, pre-existing depletion, personal connection with the event or victim, novel exposure, perception of responsibility for the event). The IST allowed for individualized assessment of exposure risk, differentiated numerically, for each responder.

SCREEN AND TREAT MODEL FOR STRESS MITIGATION

If IST appraisal scores reached or exceeded values considered "moderate exposure" (≥ 40), and/or if staff expressed a desire, this triggered the implementation of the 3-3-3 Exposure

INCIDENT SUPPORT TOOL (IST)

Responder Appraisal		Incident Appraisal	
Personal Identification		Extremes of Exposure	
Depletion / Overwhelm		Mission Injury / Helplessness	
Family Contact		Incident Involving Children/ Animals	
Novel Exposure		Complexity of the Mission	
Personal Responsibility / Duty to Act		Conflict During Mission	
Responder Score:		Incident Score:	

RESPONDER + INCIDENT = TOTAL SCORE:

0	5	10
Little or No Exposure	Moderate Exposure	Significant Exposure

< 40	**Connect:** • Revisit Resources & Stress Mitigation Tools • Monitor Stress Levels
40-70	**Consider:** • Implement Mitigation Tools • 3-3-3 Protocol • Follow Up Gathering
> 70	**Recommend:** • After Action Review • 3-3-3 Protocol for Individuals & the Team • Follow Up Social Gathering

RESPONDER APPRAISAL

SCORING GUIDE	
Personal Identification	**0** - No personal identification **5** - Moderate association with subject/scene **10** - Significant personal identification
Depletion/ Overwhelm	**0** - Green & Resourced **5** - Stress Impacted & Moderate Depletion **10** - Exhausted, Depleted or Overwhelmed
Family Contact	**0** - Minimal/ None **5** - Witnessed family grief or questioning **10** - Significant time spent with family
Novel Exposure	**0** - Familiarity with this incident type **5** - Have done this at least once **10** - Never seen this before
Personal Responsibility / Duty to Act	**0** - No sense of personal responsibility **5** - Felt somewhat responsible for this subject/mission **10** - This subject or mission was my responsibility
Total	

INCIDENT APPRAISAL

SCORING GUIDE	
Extremes Of Exposure	**0** - Minimal exposure disturbing images **5** - Moderate exposure **10** - Extremely disturbing images
Mission Injury/ Helplessness	**0** - Strong sense of accomplishment **5** - Concern for tactical errors **10** - Public scrutiny, blame, tactical errors with significant outcomes
Incident Involving Children/ Animals	**0** - No children or animals involved **5** - Adolescents or minimal involvement **10** - Serious injury/death, involvement of a child or an animal
Complexity of the Mission	**0** - Straightforward **5** - Multi-agency or prolonged **10** - Ongoing, complex or currently unresolved
Conflict During Mission	**0** - Witnessed Team Cohesion **5** - Minimal internal conflict or fighting or involving only a few members **10** - Conflict involving the team
Total	

FIG. 3: THE INCIDENT SUPPORT TOOL AND CORRESPONDING SCORE CARD.

Protocol. Used in conjunction with the IST, the protocol was designed as a treat-and-screen protocol to allow for scheduled review and mitigation at the three-day, three-week, and three-month waypoints. The protocol promotes early recognition and early mitigation based on exposure, rather than the more traditional approach of waiting for snow workers to demonstrate signs of impact and injury. In addition, the protocol was designed to increase awareness and mitigation of depletion stress; forward connection by increasing frequency of check-ins with the use of operational language; and validate the predictable trajectory of exposure stress.

Those with high-risk exposure profiles completed a trauma screening questionnaire at the three-week point, with recommendation of clinical support for scores over six (Brewin, et al., 2002). These objective screening tools allowed responders to seek support for exposure. They provided early indication of traumatic stress injury by identifying and applying early-intervention tools, following public health and early-intervention models used by high-reliability workers, such as fire service, law enforcement, and aviation programs.

OVERARCHING THEMES

Overarching themes for avalanche centres, schools, and guiding outfits seeking to integrate new skills for individual and collective stress management into operational culture include:

- Traumatic stress appraisal and mitigation is a skill set that is not offered in standard avalanche training and must be added with intention by avalanche operations in current environments.
- Stress awareness and mitigation must be efficient and not add more stress to operations or leadership.
- Embedded incident appraisal is best used with the beginning-of-the-year training and as an embedded ritual throughout the avalanche season, anchored in pre-established procedures for review, assessment, and support.
- Stress awareness and mitigation is intuitive to the avalanche community, given the shared goals of increasing awareness and mitigating risk, and the need for skill acquisition for planned exposure to avalanche terrain.

For more information about implementing stress management protocols, visit www.responderalliance.com or contact support@responderalliance.com.

To review full article submission for ISSW including findings, visit arc.lib.montana.edu/snow-science.

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Brewin, CR., Rose, S., Andrew, B., Green, J., Foa, E. Brief Screening Instrument for Posttraumatic Stress Disorder. British Journal of Psychiatry. 181:158-162., 2002

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Lessons **Learned**

Brian Lazar, Deputy Director, Colorado Avalanche Information Center

- We worried implementing a stress mitigation program was going to be labour intensive and add to an already overloaded operational season. This was not the case. The majority of events did not qualify as PTEs. Even among PTEs, the majority did not require a 3-3-3 follow-up. Indeed, only a fraction of PTEs led to stress injury. This highlighted that the utility of the resiliency programs lay in identifying the few periods and instances of concern. Most of the time, programs can proceed normally, even after PTEs.
- It was evident younger staff members were more comfortable and fluent using this new language around stress management, but even the grizzled veterans picked it up quickly, if more reluctantly.
- Given the ease of collecting the data, it would be useful for programs to collect both daily and weekly or monthly data, if feasible. More data in future years will be instrumental in understanding correlations between weather, hours worked, avalanche events, and other factors to team stress levels. This will allow supervisors and managers to better forecast when accumulated or activated stress might reach critical tipping points, and better prepare them to mitigate stress before it results in stress injury.
- Staff from both organizations commented that even though they personally might be in a green state, they did not realize that other members were in the yellow or orange states, and the reviews made them aware of team members that could use support.

Creating an **Operational Resiliency Toolbox**

Alex Cooper

Wren McElroy has spent over 30 years in the avalanche industry, holding a variety of roles throughout her career, including multiple leadership positions. Currently, she is entering her third year as the District Supervisor of the North Cascades Avalanche Program for the B.C. Ministry of Transportation and Infrastructure.
At the 2024 Spring Conference, Wren presented alongside Sydney Badger, a Registered Clinical Counsellor, about the mental health program she implemented in her program last winter. In late-July, I interviewed her over video about her journey to that point. What follows in an edited transcript of that interview.

Alex Cooper: You've been in the avalanche industry 30 years, starting as a ski patroller. I wanted to talk about the mental health piece when you started your career, and how you learned to manage mental health over time.

Wren McElroy: When I first started, there wasn't really any talk about mental health. I was fortunate to work with a solid group of people at Whitewater. We were a very small team, and we spent a lot of time working hard, but then playing hard. At the start and finish of every year, we would do a ski traverse together. Doing things like that, that sense of community, helped foster a team you trusted and supported.

At the same time, we didn't talk about mental health. There was a lot of colleagues I watched go through scenarios where there might be a fatality or recovery, and there was no real talk or no debrief, other than go to the bar and drink a bottle. That was it. Then things started to surface years later. The team I worked with, we naturally would debrief things, but we never got in too deep in terms of feelings or emotions or ongoing impacts of that stress.

When did your mindset start to change on this topic, become something you wanted to address more directly?

With the various positions I've held, different leadership roles, different high-consequence, high-pressure situations I've worked in, it's just been a gradual build up of experiences.

The first fatality/recovery I ever dealt with was a very close friend of mine at the ski hill. He was skiing alone outside the boundary and went into a tree well, hit his head, and we weren't able to find him until the next day. Like many in this industry, I've dealt with a lot of loss. As we went into these scenarios, you put your head down, get the job done, and put your emotions to the side and carried on. That's the job we're trained for and that's how we do it. As time has gone on and those experiences built, you realize maybe there are situations that could have been dealt with better.

You started with the North Cascades program, as the District Supervisor in fall 2022. First, can you talk about some of the pressures you face with the MoTI program that can lead to stress buildup and mental health challenges.

With highways, the big thing is it's 24/7. It's not like at the ski hill where at 4 p.m., the lifts are shut and everyone goes home, and you don't have to worry about any exposure overnight.

With the transportation corridors, there's always people on those highways, so you never really switch off. I relate it to wildfire firefighting. I used to be an initial attack firefighter, and you give yourself over for the season. We do that with highways. You never know when the storms will happen.

We run with pretty small teams. When it's a big storm cycle, it's all hands on deck. There is no rest or no sleep—you just get it done. We have other programs and we have Senior Avalanche Officers that can come help, but you have to be on all the time.

When you started in this role, what made you want to make sure mental health was built into the program and the operation?

I think that goes farther back. A couple of years ago, I experienced my first post traumatic (reaction). It was 24 years after dealing with a big accident up at the Silver Spray in Kokanee (Glacier Provincial Park).

A couple years ago, in amongst my industry work, having dealt with some very big avalanches, and then a couple notable avalanches around Whitewater, I was cat-skiing and it was the anniversary of the Silver Spray accident. The conditions were prime for an avalanche cycle and things came flooding back to me. I hadn't actually cried about this incident in 24 years. I had worked on the recovery. There were some close friends in there. In fact, two of them lived in town, one of which I had climbed Mount Logan with the spring before. We lived very parallel lives in terms of our work and our play. It easily could have been me as it was her.

I think I was 24 when I worked on that accident. It was quite mind-blowing to have these images come back, have some tears about it, and even step back from skiing that day. That was very eye-opening. What happened in that time? Could I have done things better? I think it was just survival mode. That was such a big incident that when some of the debriefs happened, I had to disconnect and go to memorials to connect to the human side of that rescue as well.

The second part of that answer would be I started to recognize how I was behaving in high-stress situations and with fatigue, and being pushed to my limits. I really wanted to behave better. I've done some things I haven't been proud of, especially as a leader.

In the bigger picture, I want to provide a better experience for myself so it's sustainable for me and my team. Now I'm in a role where I provide mentorship to new employees, I hope to minimize—or at least help people cope—if they experience stressful situations so the impact of those stress injuries is lessened.

Going into how you developed the program. You worked with Sydney Badger on this. How did you connect with her and why did you want to talk to her?

I saw her presentation at the spring 2023 CAA meetings and I thought it was very interesting, but I was so new in my role, I didn't have the capacity to delve into it.

Then, at ISSW in Bend, I was very impressed with all the work the Americans were doing (see page 22). There were so many different options that were presented, I didn't just have a simple take home.

Then the (fall 2023) CPD sessions came out. I signed up for Sydney's talk and it totally resonated with me. Because she was local in B.C., I thought, "This is somebody I can connect to." I asked if she would be interested in talking to us at our pre-season staff training to see if there's something we can implement. That was the beginning of that relationship.

What were some of the things you did, or you put in place, after working with Sydney?

It's a hard thing to implement. We did a team session with her with three highway programs. She ran us through some exercises and some visualizations, and then we talked about different strategies.

From the work we saw in the States, how they put the stress continuum (Fig. 1) into the danger scale, that seemed to really make sense to us. It's a very familiar format, so it's easy to relate to. We work in a very specific operation, so we brainstormed and filled out those columns as a team (Fig. 2).

One of the really important things that came out of that was the Do's and Don'ts (Fig. 3). Recognizing we're not professionals, we're not clinical counselors, we're not psychologists. When we're trying to support our team members, you have somebody that's into that yellow, or the orange, or even going into the red—how do we support them? She helped us create some really good guidance to support or help encourage if somebody needed professional help. Even just day-to-day things like, "What can I do to support you?" as opposed to say, giving somebody advice.

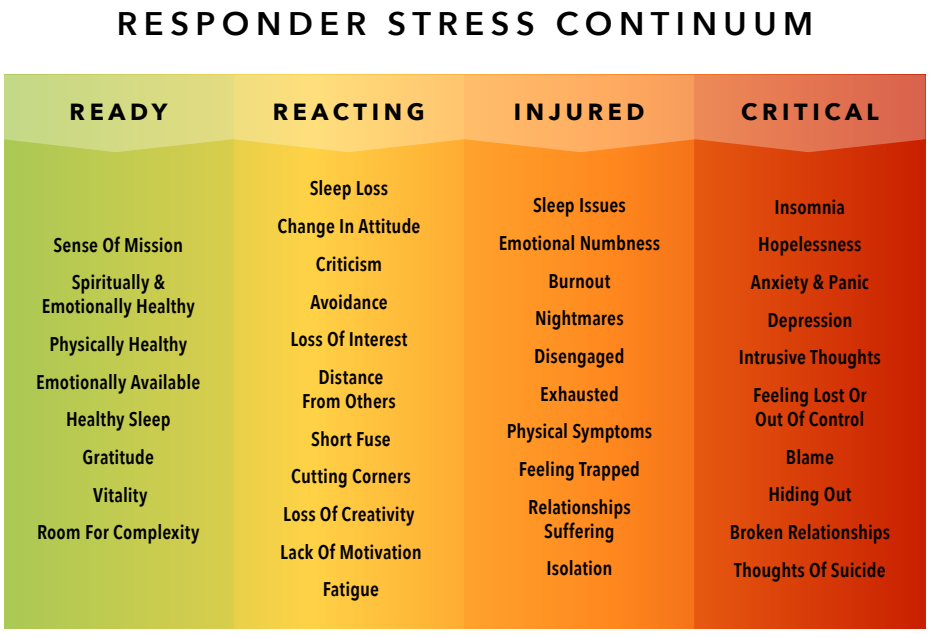

FIG. 1: THE STRESS CONTINUUM IS A TOOL FOR SELF-AWARENESS THAT ALLOWS RESPONDER'S TO MAKE INFORMED DECISIONS AND MANAGE RISKS. IT WAS CREATED BY THE US MARINE CORPS FOR USE IN COMBAT SETTINGS, BUT HAS BEEN ADAPTED FOR USE IN MANY INDUSTRIES. INDIVIDUALS CLOSER TO GREEN ARE READY TO RESPOND WHEN STRESSFUL SITUATIONS ARISE. THE ABILITY TO COMMUNICATE STRESS LEVELS AT THE BEGINNING OF AN INCIDENT HELPS TEAMS MANAGE RISK BY DISTRIBUTING STRESSORS INTENTIONALLY THROUGHOUT AN INCIDENT. | ADAPTED FROM COMBAT AND OPERATIONAL FIRST AID BY LAURA MCGLADREY FOR THE RESPONDER ALLIANCE

MoTI Program - Individual Danger Scale
V 2.0

Stress Level	Behaviors, Traits or Feelings	"Travel Advice"
LOW	Refreshed, energized, ready to go	Get some exercise, take things off someone else's plate, foster relationships.
MODERATE	Low patience, irritable, juggling tasks	Prioritize sleep, take space, communicate needs to team.
CONSIDERABLE	Overwhelmed, accomplishing bare min, supporting too many others	Talk with colleagues, slow down and be deliberate, ask for support
HIGH	Fear of judgment and fault, overriding personal concerns, doing the job anyway	Ask for support (colleagues or professional), make green choices
EXTREME	Lid on it, container closed, falling apart	Unfit for work, take space, seek support.

FIG. 2:THE MINISTRY OF TRANSPORTATION & INFRASTRUCTURE'S INDIVIDUAL DANGER SCALE IS BASED ON THE NORTH AMERICAN AVALANCHE STRESS CONTINUUM DEVELOPED BY THE COLORADO AVALANCHE INFORMATION CENTRE AND RESPONDER ALLIANCE. IT WAS MODIFIED BY MOTI AVALANCHE WORKERS FOR THEIR SPECIFIC CIRCUMSTANCES IN DECEMBER 2023.

Peer to Peer Team Support	
DO'S	**DON'Ts**
DO recognize that this takes trust and vulnerability, especially on small teams. **DO** support each other to 'do less' and take care of oneself. Even do so up the chain of command. **DO** create a safe space for people to say 'I have something going on' without telling specifics unless they want to. **DO** ask "What can I do to support you?"	**DON'T** change the way that someone is allowed to operate at work based on their disclosure. **DON'T** fear the Yellow! Green all the time is not realistic. **DON'T** pressure team members to disclose the specific reasons for their stress.

FIG. 3: THE DO'S AND DON'TS CREATED BY MOTI, WORKING WITH SYDNEY BADGER, TO GUIDE THEIR PEER-TO-PEER SUPPORT

Then we got into our seasonal operation, and it was hard to figure out how we put this into the workflow. How do we adapt this? I wouldn't say we got it perfect and have an actual format or recipe. It was very much a work in progress. And then, as the spring came up, the team I was working with last winter was great, we had some really good sessions.

For those that are familiar with the stress continuum and the colours, that expectation we're always supposed to be in the green, well, that's not realistic. Sydney allowed acceptance of being in the different states. We do need to be able to mobilize in the yellow, and we might even be in the orange, but that's OK. We can operate in those states, and we do it often, but having permission to operate in those states, we used that to calibrate and come in and out of them.

One of the things Sydney talked about at the Spring Conference was going into survival mode, where you're just trying to get through. Survival mode happens, but if you get stuck, that's when you can see problems. You eventually go into what she called shutdown mode, where you can start engaging in some destructive habits.
What are some tactics you implemented to prevent people from going into that extended survival state or even into shutdown mode?

One of the exercises she did with us that was really helpful was there was a visualization where you picture a place you felt safe, you felt secure, you felt supported. For one person that might be in the forest on the top of the mountain. For me, hanging out with my big fluffy dog brings me a lot of happiness.

She would talk you through this scenario and actually have you think about what does the sky look like, or what are the smells, or what are the noises you hear? She encouraged you to have a space that didn't involve people, because people are complicated, as she says. Having something like that, when you're in those heightened states, knowing you have a safe place to go to, even if it's momentarily, was really helpful.

You talked about giving people time where they can switch off, not be on-call, and turn off notifications. How helpful did you find doing that?

I think that's super important. Like I said, we're small teams, and when it's on, it's on. When you have quieter times, being able to provide some flexibility. If my counterpart is on tonight, I'm going to turn my notifications off. If stuff goes sideways, he can phone me.

Also, flexibility in the workday. We know we're going into night shifts, so sending people home during the day to take a nap. Because it's so demanding when we're on, having that flexibility is important.

You mentioned the adoption of the danger scale into the stress continuum by the Responder Alliance in the United States. What did you like about using that? And how did you use it in your program?

It's just because we're so familiar with it. In the one we did, we put travel advice so when things are happening there's some travel advice you can do, and it correlated to the levels of where you might be. If you were in the green, or if you're in

WORKING FOR MOTI CAN MEAN LONG DAYS AND ALWAYS BEING "ON." // WREN MCELROY

AVALANCHE WORK OFTEN MEANS BALANCING OPERATIONAL OBJECTIVES WITH MENTAL HEALTH. // WREN MCELROY

the yellow, these are some of the things you can do, or things we can support. Sometimes I found you can see it in other people more than in yourself. I might have a worker who's in the yellow, into the orange, but they're so in it, they can't see it. What are the things we can do to provide support for them?

How do you think things went last winter doing this? What did you learn?

One of the biggest things I learned is just about my own self-awareness. Recognizing I'm not in a great state today for whatever reasons and that I need to keep myself in check. My goal is to make better decisions in these high-risk environments, so, providing that framework for myself, and being able to help create that environment for my team so they feel safe, they feel supported, they feel encouraged. We talked about taking breaks and time off, but also keeping morale high. So, the importance of having interesting projects, having things that engage people's minds.

A few of the things I learned is clearly communicating about hazard and risk is an art. Not taking things personally—sticking to the facts. I have 365 kilometers of road I now manage. Two of the highways, the Coquihalla and Highway 1, have contractor and Ministry boundaries, so there are a lot of different people I have to communicate with. Keeping the communications clear helps keep it all in check.

You have to balance managing your own mental health, you've got your team's mental health, and then you also have the operational challenges where you have to get the highway open. How did you balance those different challenges?

For myself, I'm really trying to work with the concept of wellness. So, recognizing when I don't get enough sleep. Sure, when we're in an extended storm period, you're not going to sleep and you've got to make that up, but when you're not in that period, trying to keep that battery bank full. Getting healthy exercise, getting movement in. Sometimes we'll take a team meeting and instead of sitting in chairs talking to each other, we might go walk around the block.

Last winter, I didn't drink for close to three months and that was incredibly good for my wellness. I had a ton of energy, I felt great, I felt I could communicate better. Not that I drank lots, but just culturally, that's been a part of our thing.

For myself, taking time to connect with my family when I can, and trying to take good care of my mind and my body. For my team, we talked about allowing breaks and having some flexibility, keeping the morale high, keeping them interested.

Operationally, not taking things personally, sticking to the facts. Keeping emotions in check, especially when fatigued. Sticking to those facts is helpful with any kind of communication.

One thing you mentioned at the Spring Conference is you had to learn how to make yourself vulnerable. I expect there might be a lot of people in the industry who face that similar challenge of being vulnerable, and just letting people know when they're not doing well. Do you have any advice you could share?

I think being honest with yourself and understanding what your limitations are and where you're at is really important. It might be that I didn't sleep well, or something's going on in my personal life, or I've had a conflict with a co-worker. Being able to say, "Hey, I'm in the yellow today, but I don't want to talk about it." I realized, it's easy for me to ask my co-workers to tell me; I'm the supervisor. But realizing I didn't want to, because I'm the leader, I have high expectations of myself that I'm always on and ready to go. That was a key thing that hopefully allowed everyone to relax a little bit, that it's OK to be in a vulnerable state. It doesn't mean you can't do your job, but if we're aware of it, we can take care of each other better.

I think early on in my career, I had this fear of not being good enough. I'd spent most of my career as the only female and so there was always that added pressure I have to be tough and I've got a thick skin, and I prided myself on that. I think now I'm later in life and it's OK, I can be vulnerable, and just the strength that comes out of that. I think there's a lot to be said for that in terms of being open with your team.

What advice do you have for other operations?

We aren't professionals in this. There are lots of resources, there are courses. I recognized I didn't have those skills, nor did I have the capacity to orchestrate the whole thing. Working with somebody who's professionally trained is really important. If you're really trying to set up something that has structure, there are simpler things you can do. There are resources from the Responder Alliance you can incorporate. I wanted to provide a bit more structure and I wanted to continue learning about it as well.

Is there anything we missed or anything you want to add?

You asked how to manage the stress personally, operationally. I realized a bunch of years ago, my whole life was around skiing. At some point when I was running the snow safety program for Whitewater, I realized I started dreading winter. I talked to an old friend and colleague, Jason Rempel from Stellar Heliskiing. "What is this? I love skiing, this is my passion, but I really like summer. I'm anchoring on summer." He said, "Well yeah, in the summer you're not responsible for anybody's life."

It dawned on me the importance of recharging my batteries in the summer. Now I do have a year-round job, but I don't have avalanches in the summer, so there's way less stress. I'm able to take more time off. For me, I charge the solar panels in the summer and take care of myself, knowing I'm setting myself up for success physically, mentally, so I'm ready to go at it again.

Visit avalanchejournal.ca for the complete video and transcript of the interview.

PART OF THE MOTI STRATEGY IS TO HAVE INTERESTING PROJECTS FOR STAFF TO WORK ON TO KEEP THEIR MIND'S ENGAGED. // WREN MCELROY

So, You've Had an Accident—**Now what?**

Colin Zacharias

FOLLOWING AN ACCIDENT, especially one involving a serious injury or death, avalanche operations immediately find themselves part of agency and insurance investigation that can involve a series of daunting interactions.

This discussion is not meant to define your incident command system or your response plan. It targets how to engage with the various outside agencies that, despite their intention and support, may complicate your operational response and debrief, and your follow-up and return to work. Your preparation needs to include a list of agencies that may become involved, the information they may need, what type of questions they might ask, what can you do to help them, and how can they help you.

This article is based on my presentation at the 2024 CAA Spring Conference and my experience as an external accident investigator for various agencies, including Robert B. Kennedy, Farris LLP, Vancouver; Kaerus Group Risk Solutions, Calgary; and Peter J. Roberts, Lawsen Lundell LLP, Vancouver. This content was also reviewed by several operators to get their perspective on what it was like when they had an incident and what worked best when dealing with the circumstances. It is focused on British Columbia, where most Canadian avalanche operations are located.

YOUR NEAREST NEIGHBOURS

Your preparation should begin by knowing who are the local rescue experts, and how they can respond and help. This could be everyone from a neighboring heli-ski company, to the local search and rescue team, to guides and rescuers who are on their days off and can come in to help. Your questions are:

- Who can help and what are their skills?
- What is the protocol for engaging their assistance?
- How long will it take for their team to mobilize and arrive at your location?
- What resources can they bring?

Most operations can internally handle an incident involving one or two casualties. In the unfortunate case of a compounded multi-casualty incident, most operations will require multi-agency support providing additional resources. This could include additional helicopters, Autopulse resuscitation systems, AED's, vacuum mattresses and splints, oxygen, blankets, stretchers, toboggans, extra rescuers, paramedics, and overnight kits.

A tried and tested solution suggests that prior to each season, plan a coordinated mock rescue response during your training week that engages two or even three of your nearest neighbouring operations. Ask them to attend your preseason training and if you can attend theirs. This can help you assess your ability to respond to a multi-casualty situation. This exercise will help you determine what resources you need in addition to your own. It will test and iron out issues with your internal and external communication strategies. It will ensure that you gain familiarity with each other's terrain and logistics. If you have a Class D helicopter response as an option (long line evacuation), engage this type of rescue during your practice.

Air ambulance is another potential responder. If you have access to air ambulance in your region, talk to them prior to the season and learn their auto-launch criteria. Find out if you can contact them directly, or if you initiate through RCMP, can you follow up with their dispatch? Exchange radio frequencies so you can talk to each other easily during a response. Ensure your operation's radios are programmed with their emergency frequency. It's good to know what kind of helicopter they will dispatch to your operation, that helicopter's minimum landing zone criteria, and what medical support they can provide.

PROVINCIAL AND FEDERAL AGENCY INVESTIGATIONS

Following an incident, one or more provincial or federal agencies may show up to investigate depending on the severity of the accident, whether it involved a worker, or whether it is was an aviation accident. Agency investigators represent WorkSafeBC, the RCMP, the Coroner Service, and the Transportation Safety Board of Canada (TSB). It helps to know something about their jurisdiction and authority. These investigations can involve direct and intimidating questions, but most often the investigators are skilled at what they do and they can be supportive and understanding.

Operations have told me that their best decision has been to appoint a safety officer to deal with these agencies. This is an appropriately trained senior representative who is prepared to make time for the investigator and isn't off-putting or dismissive. The investigator usually prefers to talk to one person who will supply them with the required documentation or reports, and arrange staff interviews as requested. Your safety officer needs to be generous in letting them know you will make time for them as soon as is feasible given the situation.

- Your safety officer should be ready to answer some questions on the first day.
- Make sure to only answer the questions that are asked; more may follow later.
- Be aware of what you know, what is being internally investigated, and when more information will be available.

- Do not assume or speculate. My experience investigating these accidents over the last 15 years is somebody always speculates about the characteristics of the accident or sequence of the event.

RCMP

Usually, your first call out is with the RCMP. Make sure that they're in the same jurisdiction as the accident site, because it can complicate the RCMP response if they're from a different jurisdiction. The RCMP can dispatch SAR, air ambulance, and themselves to the site.

- The RCMP will respond to a serious accident involving critical injuries or fatalities. They will dispatch the coroner in the case of a fatality.
- When your operation is currently conducting triage and evacuating the injured, the RCMP may wait at the helicopter staging area until the evacuations are complete.
- The RCMP may request to access the accident site prior to granting access to any other investigators.
- In the case of a fatality, the RCMP usually closes access to the site. This may preclude your operation being able to return to the site to retrieve equipment or conduct an investigation.
- They may use their own helicopter or contract a helicopter, with the assistance of the SAR team, to retrieve the deceased, and refuse use of your team, your helicopters, and equipment.

Obviously, it is important to work with the RCMP and keep them up to date with the response. One operation told me they've found it useful if their insurer's legal counsel is at the helicopter staging area to talk with the RCMP during the rescue response.

CORONER SERVICE

The coroner will be dispatched by the RCMP to investigate any incident with a fatality. Reportedly, the coroner's medical examiners mostly work well with the local operation, and are happy to go with one person as their contact.

DURING YOUR INTERNAL INVESTIGATION, INCLUDE PHOTOS WITH A VISUAL REFERENCE (I.E., A SKIER OR PROBE) TO SUPPORT YOUR FIELD MEASUREMENTS AND OBSERVATIONS. // COLIN ZACHARIAS

DON'T SPECULATE WHEN ASKED QUESTIONS. YOU MAY FIND THAT WHAT ACTUALLY HAPPENED IS NOT WHAT YOU INITIALLY THOUGHT HAPPENED. // COLIN ZACHARIAS

The medical examiner will want to identify the deceased. Family may come in to help identify the deceased, but sometimes they're fine with the operation conducting the identification if there is 100% certainty.

The RCMP will usually handle notifying next-of-kin and cross-border repatriation of the remains. Be patient as reportedly this may take days or even weeks.

WORKSAFEBC

WorkSafeBC (WSBC) will be involved following an employee injury and death, and may need to access the site once the RCMP has reopened it to investigators. WSBC involvement depends on the seriousness of the circumstances or injuries, how many employees were involved, and whether the same industry has had repeated employee injuries.

- When a worker injury occurs, the operation logs in to the WSBC Employee Illness and Reporting (Form 7) portal. The worker often files their own injury claim in addition to the employer's report.
- When an employee is injured, WSBC expects the operation to conduct a full internal investigation, and to post the report so any employee who's involved in a similar job or activity can read and discuss that incident.
- In the case of a serious injury or fatality, the employer must immediately report to WSBC by calling the Prevention Information Line. This is in addition to reporting an injury related to a claim. This is a 24-hour toll-free line and the number needs to be in your incident response plan.
- Note that unless directed to do so by the RCMP, WSBC requires that you not "disturb the scene of the incident, except to attend to the injured or killed, or to prevent further injury or death."

TRANSPORTATION SAFETY BOARD

The Transportation Safety Board investigates aviation accidents. This has occurred within most sectors of the avalanche industry including highway avalanche operations, heli-ski companies, ski areas, and ski touring operations. In my experience, the TSB is amicable and experienced in conducting accident investigations.

While aviation accident investigations primarily involve the helicopter company, the TSB will involve your organization. You will be asked for a copy of your emergency

plan, avalanche safety plan, safety meeting, and weather, snow, and avalanche documentation. They will ask for all photos and videos, your dispatch log and audio recording, and flight following GPS data logs if different than the helicopter company documentation.

They will ask questions about daily planning and team decision-making that involves the guide and pilot; and about maintenance decisions, flight manifest documentation, and operational logistics.

They will ask standard questions that you would expect, and they will probably ask the helicopter company the same questions. Your operation is required to make time for the investigation and must be willing to supply the necessary documentation.

INSURERS AND LEGAL REPRESENTATIVE

Your legal representative and insurance company will expect to be notified immediately. Together, they will contract at least one investigator—if not several—to provide an expert perspective and to provide a documented summary of the event. You will want to get the investigator to the site as quickly as possible to conduct their information gathering and complete their reports. The investigator is usually a senior member of the guiding and avalanche community whose investigation will benefit both your operation and the community. The investigator will want to visit the site, conduct snow and avalanche observations, interview those involved, take photos of the site, and review all existing documentation relevant to the event.

INTERNAL INVESTIGATION

Ensure your key staff is trained to begin the process of securing the site and documenting the event *immediately* following the rescue and evacuation. This is often difficult given the stress, exhaustion, and trauma experienced post-event. Just do what you can within your operation. The supervising guides or lead forecasters are going to be the ones who are collecting this information. Imagine what you need to collect—it's basically everything. Conduct staff interviews to get the sequence and timing of the event as soon as is practical. Diplomatically and politely ask for and secure originals or copies of all photos and videos taken by staff, guests, guides, control team members, and rescuers.

Note, it is a good idea during preseason rescue practices to train dispatch to scribe all radio transmissions, not just those directed at dispatch. Ensure they have an audio recording that also records the time of day. During this training, ensure rescuers are practiced at taking photographs of the event during the rescue. Weather may move in during or shortly after the response. Never assume you will be able to conduct a proper investigation "tomorrow." When I investigate accidents, I always wish there were more images from more angles and perspectives.

Create an event file so you can hand a complete copy to external investigators when they ask for it. Meanwhile, plan to get to the site to conduct your own follow-up investigation. This may be at the same time as the external investigation; however, consider you should have your own measurements and documentation of the avalanche, your own fracture line profiles and near-site snow profiles, and your own set of photos of the event.

CRISIS COMMUNICATION

Crisis communication involves several key levels:

- Have a trained media person on staff. This could be the owner-operator or their second-in-command. Whomever it is needs to be articulate, practiced, and trained to speak to the media.
- There are communication organizations that exist to help with strategic messaging to media. One organization that Helicat Canada deals with is Coast Communications. These agencies exist to help your organization provide strategic messaging to media and to family during a developing crisis.
- Strategic messaging is required at different levels of engagement such as with media, family, and inter-operational communications.

MENTAL HEALTH COUNSELLING

We have observed there are three phases to post-event mental health counseling. First is trained peer support, second is professional counsel, and third is long-term mental health resiliency training. All three phases are incredibly important. The professional associations such as Helicat Canada (HCC), the Association of Canadian Mountain Guides (ACMG), the Canadian Ski Guide Association (CSGA), the Canadian Avalanche Association (CAA), and WSBC all offer support or provide connections to the various agencies that provide support.

The guide associations, HCC, and the CAA all have trained peer responders involved in the Canadian Mountain Community Critical Incident Stress Management (CISM) program. This program is supported with 24/7 dispatch, trained responders, and a professional clinical director, and the support can be linked to professional mental health counsellors for longer-term intervention through the WSBC CISM program.

Professional counsel is critically important and encouraged soon after the incident. The last incident I responded to, the operation brought in both the peer responders and professional counselors at the same time. Both conducted different, complementary sessions that seemed helpful to the staff. Again, the professional associations and WSBC all provide access to professional counsel.

Operations should look at providing or supporting employees in long-term mental health resiliency. If a guide,

pilot, or avalanche professional is planning on putting several decades in this business, it's important to recognize the risk associated with injury or accident is high enough that participation in some form of long-term mental health resiliency support is likely needed and welcomed.

INCIDENT REPORTING

A lot of people have questions about the reporting process. Should we submit if we don't have all the data yet? Why submit to Avalanche Canada—can't they get the data from InfoEx? A few helpful suggestions include the following:

- Submit basic data to InfoEx as soon as possible—same day, when practical—to warn neighbours of potential instability and hazard. Keep the data basic if you haven't had the opportunity to complete your follow-up investigation: drainage, elevation, aspect, type, size, weak layer (if known), trigger (if known), number involved (if known). Then state that the incident is being investigated and more information will be forthcoming as soon as available.
- Do not speculate. Given the priority of the rescue response, observers may not have had time to conduct accurate observations. Resist providing a "best guess" when estimating the avalanche or event characteristics. During investigation, and after a closer look, it is not uncommon to find the "known weak layer" wasn't the culprit and the number involved was different than originally thought. It may take several days to identify the facts. Once published it is difficult to retract information.
- Give the same information you provided to InfoEx to Avalanche Canada and to your media contact person to ensure no matter what the source, the info is the same.

Operations have reported to me that if the news media covers the event well, then there's less public pressure to get additional follow-up event details to Avalanche Canada. When the news doesn't pick up an accident, or it's just posted without any detail, then there's more pressure from within our own industry, from our nearest neighbors, and from the public to get info on the event. People are just asking what happened, which is a fair request.

EMPLOYEE ACCREDITATION AND CPD

Each season, employers review their employee's professional certificates and CPD for currency to ensure they are appropriately qualified and experienced to take on their assigned tasks.

As operators use individual employee certifications, professional association, and affiliation to demonstrate they are adhering to common and best practice in the industry, the onus is on the employer to annually review the employee qualification and continued professional development. According to our professional associations, accreditation can be used to justify the scope of operational risk management; and CPD currency helps to demonstrates individual professionalism.

LITIGATION

During litigation all documentation is considered "discoverable." This means no documents, photos, or videos are confidential. All forms of written or recorded operational logs or files are discoverable, including all staff's personal texts, emails, social media, photos, or videos. Operations need to train all staff how to respond, including being professional, factual, and avoiding any speculation or uninformed opinion. Incident reports must be succinct and factual, avoiding improper, speculative statements.

RETURN TO NORMAL OPERATIONS

After a traumatic event, the operation needs a strategic plan to return to normal. It is a challenge because you have to recognize it can take time. Your staff can be stressed and traumatized, and may have lost confidence in their ability to safely do the job. The post-event follow-up and questions from the insurer or RCMP can be ongoing for weeks. Return-to-normal procedures require thorough debriefing and counselling with your staff who have been affected by the event. Employees may question whether or not several of their colleagues are ready to go back to work.

Answers depend on the individual staff member. As an operator, you may need a workable metric or professional counsel to help individuals determine for themselves if they are able to go back to work, whether they need more time off, or whether they need to take a break for the rest of the season.

Except financially, it's never a bad idea to shut down temporarily and reflect on what it will take to get back to normalcy. The intent of operational reflection and debriefing is improving the operation and reducing the likelihood of a future accident. The return to normal plan should include contacting each employee to help them determine whether or not they are ready and able. Most employee contracts state, or preseason training infers, that no employee is ever expected to take on work they feel is unsafe. It is important that those involved in post-incident debriefs walk away with a private strategy that improves their confidence. One bottom-line metric when returning to normal operations is that the staff—from the owner/operator to the first-time employee—feels safe enough to agree that "there are hazards, they are being managed, and I'm ok with this."

The Importance of **Followership**

Brad Roach

// JAMI KRUGER

AS I ASCENDED THE SLOPE, the gut dropping whumpfs reverberated through the soles of my feet. Kinetic energy was converted to electrical impulses, shooting straight to the stress centre in my brain. My amygdala lit up, and instantly every part of my body screamed to run away.

I casually expressed concern to our team leader. My body pulsed with fear and stress, but my mind and ego contained my physiological dread. I was an avalanche worker after all, sent to investigate an avalanche problem. As a team, we had discussed this problem, chose terrain to minimize exposure, and made a plan to ensure our risk margins were acceptable. As we climbed closer to our profile site, the unease grew. I wanted to get out of there, but I said very little. I took pride in getting the job done and did not want to disappoint my team.

As an avalanche survivor, the feeling when the slab broke above me instantly carried me back to that powerless moment 10 years ago when I was almost killed. Again, I was carried down the mountain, skins on and helpless, knowing that with enough momentum I would be taken off the ridge and into the main path. It could be over, but it wasn't. Our terrain choices and risk assessment saved us. It was a near-miss—a size one—and nothing bad happened. Yet I felt guilt and shame, a deep unease with the separation of mind and body. I wanted to say no, but lacked the ability to express my concerns.

Digging into my workplace near-misses over the last decade, thankful that they were just that, I noticed this theme persisted. As avalanche workers, we spend much of our time dealing with avalanche problems. We expose ourselves to keep others safe, and when we are given objectives, we take pride in our ability to achieve them. While avoiding incidents is always a priority, downplaying our physiological red flags, environmental clues, and surrendering to task saturation is easy in the field. Often, when given an objective in the office, the story is only the beginning; as workers, we strive to bring it to completion. New information that changes this story, especially if it causes complications, can be intimidating. It is hard to say "no." Fear of reprimand, of loss of respect, or the martyr-like complex of "someone has to do this so it should be me," can be easy lures into the trap of an avalanche accident.

LEADERS VS FOLLOWERS

As I read through case studies and books dedicated to big accidents, it became clear many of them stemmed from discord between the leader and the follower, but the focus of the reports was on leadership errors. This came as no surprise. The importance of leadership and the skills that make a good leader are taught in many levels of education on the journey to becoming an avalanche professional. However, little to no education addresses our role as followers.

As a society, we often admire and respect our leaders, whereas followers are cast in a negative light. Descriptors such as lackey, underling, henchmen, or minion are often used. Images of cultists and mobs often accompany the idea of the follower. We ignore the reality that followers greatly outmatch leaders in numbers. Many of us will spend far more time in follower roles as opposed to leadership roles, yet followership takes a backseat to leadership.

This perplexing dichotomy between leader and follower sells the follower short. A leader is nothing without followers, and in our industry, a good follower can be the keystone to preventing avalanche incidents. In addition, a good leader must know how to follow and when they should take on a follower role. External organizational pressure is exerted on most leaders, and adopting the follower mindset with a simple goal can have great value. Rigid hierarchy can often stifle followers and isolate leaders. In a cohesive team, a follower with specific experience or expertise can step forward and then step back when needed.

Where there are many potential objectives, such as delivering a guest experience, protecting workers and the public, or opening terrain, our goals as workers remain static:

- to avoid involvement in an avalanche large enough to injure or kill you; and
- to avoid unnecessary injury or incident from the many other hazards in the mountain environment.

In the mountains, the leader of a group has many things to focus on: weather, group dynamics, the daily objective, communication, decisions, and responsibilities. Meanwhile, the follower has a great advantage—a lower cognitive load, which can be dedicated to the goal.

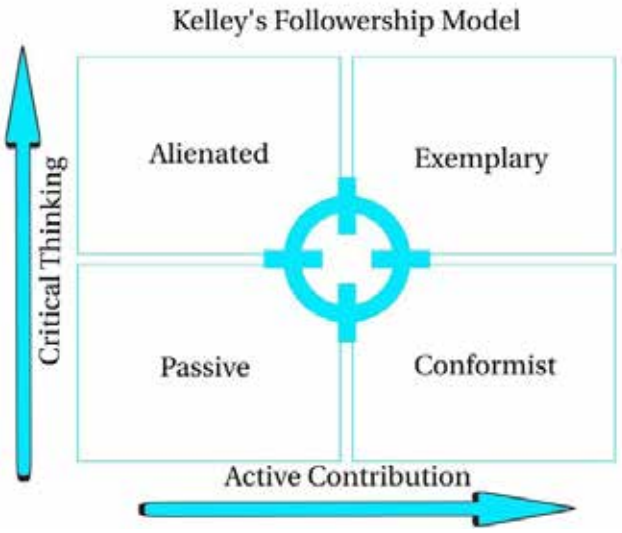

FIG. 1. KELLEY'S FOLLOWERSHIP MODEL (1988). FOR KELLEY, THE IDEAL FOLLOWER IS A CRITICAL THINKING CONTRIBUTOR: THE EXEMPLARY FOLLOWER. HE ARGUES THAT MOST LEADERS PREFER CONFORMISTS BECAUSE THEY ARE EASY TO CONTROL. ALIENATED FOLLOWERS ARE CRITICAL BUT DO NOT CONTRIBUTE AND PASSIVE FOLLOWERS HAVE LITTLE TO NO VALUE OTHER THAN BEING PRESENT.)

TYPES OF FOLLOWERS

What makes a good follower? Kelley's followership model (Fig. 1) breaks followers into four main categories (alienated, exemplary, passive, and conformist), with two key variables (critical thinking and active contribution). For Kelley, the finest follower is a critical thinking contributor who does not simply acquiesce to their leader, but instead plays the role of contrarian if needed. This "exemplary" follower is happy to challenge the leader if the goal is being compromised, but if they are in an environment where such behaviour is not encouraged or has negative impacts, they will not speak up, and instead become passive and/or alienated. A critical thinking follower who is alienated is far more likely to be a negative team member.

Often when negative examples of followers are cited, passive and conformist followers are the prime examples. While both of these follower-types are easier to lead due to their compliance, it places all the decision-making on the observations of the leader. It is interesting to note that during a survey by Kelley, the conformists, often called "yes people," were most desired by CEOs and leaders.

Conformists do what they are told and do not object. In emergency situations, conformist followers are essential. Under stress, we rely on our fast processing power of intuition, what Kahneman calls "system one". This system is free of critical thought. In stressful situations, often the first thing to be lost is our upper level cognition, we disassociate and run on our intuitive systems. It is why we train and embed algorithms into our minds. The slower processing but more astute "system two" is essential for fine-tuning these intuitions. The more time spent as an exemplary follower, the better we can be when a stressful situation calls on us to become conformist.

ENCOURAGING STRONG FOLLOWERS

As followers, the crosshairs often wander. In a stressful environment, we can execute tasks intuitively without thinking (conformist), we can become defensive, stop contributing and shut down our critical thinking skills (passive), or silently criticize the leadership without objection in the moment (alienated). Followers in these states can be victims in an avalanche incident. Without participation and active critical thought, followers play no part in the decision-making process and in doing so, take no responsibility. In the mountain environment, with minimal feedback, one member of a team could be receiving several signs of instability, whereas the leader could be blissfully unaware of the potential for an incident.

Workplaces are often environments of rigid hierarchy. Senior staff have often gained the experience and skills to lead effectively over time. As an industry we also value algorithmic thought, which can help prioritize and triage tasks, but leaves little time for critical thinking. While these elements are essential, making room for exemplary followership can help increase safety margins. Often it is difficult for followers to speak up due to hierarchy, fear of reprimand, or a work environment that does not encourage critical thinking and active contribution. Furthermore, our collective obsession with leadership means the coveted role of leader can be something sought after, not to be given away. Instead of fostering teams of strong followers, we often focus on our leaders. If an incident occurs, the leader is to blame when many individuals were involved to reach that outcome.

How as an industry, do we value and teach followers to keep us safer in the mountain environment? With its myriad of uncontrolled factors, guaranteed safety is impossible, but we can increase our margins. While we cannot control the mountain environment, we can create a workplace environment that encourages open communication by allowing all team members to speak up when they feel uncomfortable. The workplace must be one that puts the goal above objectives and makes every team member feel valued and heard. Everyone should be encouraged to contribute and think critically.

We should recognize that under stress, it is difficult to think critically; making efforts to decrease stressors in the workplace are all good steps. Most importantly, the follower role should be valued. A follower is not below the leader but rather a separate, integral part of a team. While seniority, experience, and familiarity are all important tools, they can be heuristic traps in their own right. Having a varied team all contributing, all thinking critically to increase safety margins, can greatly help the odds of avoiding accidents in avalanche terrain.

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MUCH DISCUSSION FOCUSES ON LEADERS, BUT FOLLOWERS ALSO PLAY A CRUCIAL ROLE IN PREVENTING AVALANCHE ACCIDENTS. // ALEX COOPER

in the loupe

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SLOPE MEASUREMENT FOR HUMANS

// SERHII ICHENETS

Slope Measurement **For Humans**

Ian McCammon

"WHAT'S THE SLOPE ANGLE?"

It was day two of a hut-based avalanche course in Idaho and our small group was ascending a sparsely wooded ridgeline. As we entered a small glade, an open slope came into view on our left, perfectly framed between two aspens. Seeing an opportunity to practice inclinometer skills, I asked the students to measure the angle of the slope. To ensure consistency, I showed them the spot where I wanted them to stand when they made their measurement.

But rather than say their measurement out loud, I asked the students to write it on a scrap of paper. Once everyone had a turn, I tucked the results into my parka, and we went on to have a fine day.

Back at the hut, I unfolded the scraps of paper and arranged them in order. This is what I saw in the lantern light: 30°, 32°, 32°, 32°, 33°, 34°, 34°, 36°, 38°.

Two students came over and now it was their turn to ask me how steep the slope was. By way of an answer, I showed them the results. They weren't impressed. They wanted to know what the slope angle really was. They wanted a single number, just like we instructors had taught them.

I realized if I was being totally honest, I didn't actually know the answer. Was it the measurement I had made as the instructor? Was it the average of all our measurements? How useful were those answers if they wouldn't have instructors or nine inclinometers on their post-course tours?

I had always assumed people could easily translate advice like "avoid slopes steeper than 35 degrees" into good terrain choices, but now I wasn't so sure. If slope measurements were off by three, four, or more degrees, what did this mean for sound decision-making in avalanche terrain?

In this article, I'll examine three aspects of this question:

1. How well can people measure slope angles?
2. Does slope measurement error affect risk management?
3. Can simple decision strategies overcome these problems?

SLOPE ANGLES AND INCLINOMETERS

In the seasons following that course, I wanted to find out how well people measured ideal slope profiles in a projected image (Fig. 1). To minimize parallax errors, I asked folks to make their measurements while standing on a line perpendicular to the centre of the screen. And to minimize peer pressure, I asked them not to share results until everyone handed in their written measurements.

I collected data between 2002 and 2019 at avalanche courses and workshops. Participants ranged from novice recreationists to professional guides, avalanche educators, rescue personnel, and ski area professionals.

I was most interested in each measurement's deviation from the group average, an approach that eliminated the effects of image projection differences between groups such as tilting, keystoning, or other distortions.

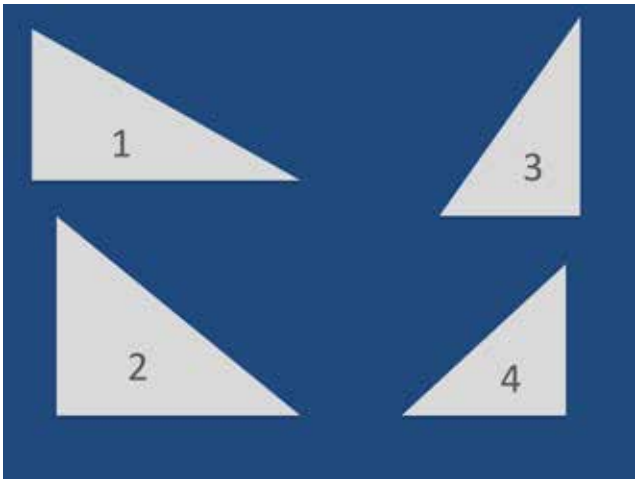

FIG. 1. PARTICIPANTS MEASURED THESE SLOPE ANGLES PROJECTED ON A FULL-SIZE SCREEN. MEASUREMENTS WERE MADE ALONG THE CENTRAL AXIS TO ELIMINATE PARALLAX DISTORTION.

Inclinometer types fell into six categories: ball-in-track devices, compasses, digital/smartphones, string/plumb bobs, and Life Link Slope Meters (no longer produced). A final category was reserved for devices with fewer than 10 samples or illegible or blank entries.

All devices showed significant spread around their subgroup mean (Fig. 2). Random errors ranged from ±3.2° to ±5.7°. Gross error rate (likely due to user mistakes, device damage, or manufacturing defects) ranged from 1.6% to 4.4%. Systematic error (bias) of almost 1° was apparent in string inclinometers. Results are summarized in Table 1, but you can find a full analysis in my companion ISSW paper (McCammon, 2023).

Although all three types of error are important, the most relevant for this article is random error, also known as measurement uncertainty. This error represents the range a single, non-defective measurement is likely to fall within. In health and safety applications, this range is typically expressed as ±2 times the standard deviation (Taylor and Kuyatt, 1994), which corresponds to approximately 95% of measurements. In other words, about 19 out of 20 measurements of a specific slope will fall within this range.

So, how wide is the measurement uncertainty range for our community as a whole? Assuming one of three common devices is being used (ball-in-track, compass, digital), we can pool the results into the "community error model" shown in Table 1.

The results are somewhat alarming. The pooled standard deviation of the model works out to 2.1°, corresponding to a 95% uncertainty range of around 8.4°. Even more disturbing is that only about 20% of people would correctly measure a slope within 1° (±0.5°) of its true value. In other words, advising people to avoid 35° slopes will, on average, result in 20% of them getting it right and 40% underestimating the

Inclinometer type	n	Gross error	Systematic error*	Measurement uncertainty*
Ball-in-track	51	3.9%	0.848	±4.1°
Compass	222	4.1%	0.383	±4.5°
Digital	63	1.6%	0.548	±3.2°
LLSM	90	0.0%	0.139	±4.3°
String	68	4.4%	***0.012***	±5.7°
Other	67	3.0%	0.674	±3.9°
Error model	-	3.2%	-	±4.2°

*outliers excluded

TABLE 1. RESULTS OF CLASSROOM INCLINOMETER MEASUREMENTS SHOWING SAMPLE SIZES, GROSS MEASUREMENT ERRORS (OUTLIER RATE), SYSTEMATIC BIAS IN STRING TYPE INCLINOMETERS, AND MEASUREMENT UNCERTAINTY BY DEVICE TYPE.

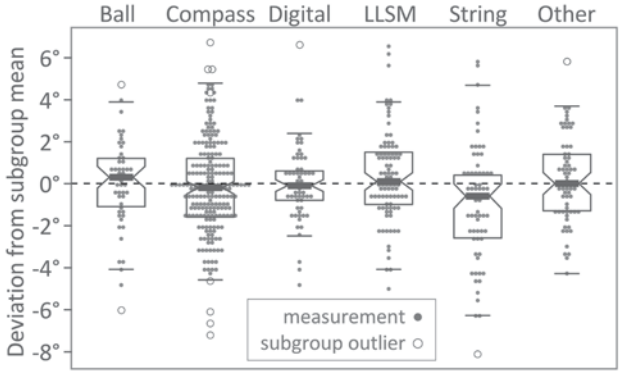

FIG. 2. SLOPE PROFILE MEASUREMENTS BY DEVICE TYPE. BOXES INDICATE CENTRAL 50% OF DATA AND WHISKERS EXTEND 1.5 TIMES THE INTERQUARTILE RANGE. LARGE OUTLIERS FOR COMPASS, STRING & OTHER DEVICES ARE NOT SHOWN FOR CLARITY.

slope angle, in some cases by 4° or more.

Note our error model was derived from ideal slope images. Real slope measurements, where breakovers, foreshortening, parallax effects, and wishful thinking are present, will almost certainly have greater uncertainty ranges.

My avalanche course in Idaho was a case in point. Measurements from nine students had a standard deviation of 2.4°, making their 95% uncertainty range almost a full 10° for a near-perfect view of a slope profile.

But what does this measurement uncertainty mean in avalanche terrain? To understand that, we have to take a close look at how avalanche risk depends on slope angle.

SLOPE ANGLES AND AVALANCHES

In reviewing U.S. avalanche accident records since 1972, I was able to find 436 cases where the start zone was reported as measured. After correcting for data anomalies (so-called heaping, see McCammon, 2023), I was able to generate a reasonable fit to the data on the rising edge of the distribution where most people are deciding to enter a potential avalanche slope. The resulting cumulative curve for start zone steepness appears in Figure 3.

To fully understand the effects our measurement error, we also have to account for slabs that pull into lower-angle terrain. Within the accidents I reviewed, there were 180 cases where the range of entrained slope angles was also measured by investigators. The results indicate that most slabs extended five or six degrees onto shallower slopes, but a significant

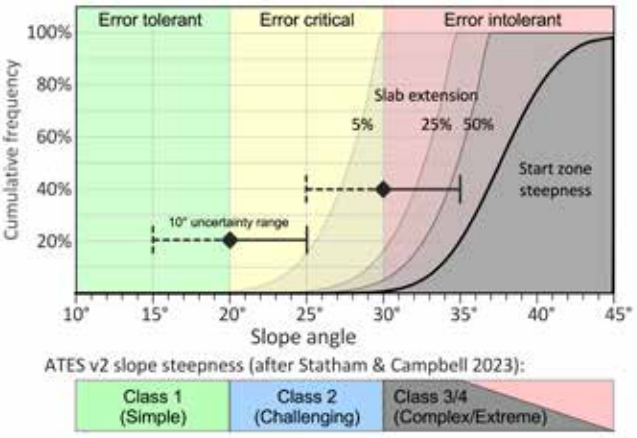

FIG. 3.CUMULATIVE FREQUENCY OF SLAB EXTENSION BY SLOPE ANGLE OVERLAID WITH REGIONS BOUNDED BY SENSITIVITY TO SLOPE MEASUREMENT ERROR. SLAB EXTENSION PERCENTAGES REFLECT THE PROPORTION OF BACKCOUNTRY ACCIDENTS. ERRORS OF GREATEST CONCERN LIE ON THE RIGHT (NON-DOTTED) SIDE OF THE 10° ERROR BARS. ATES V2 CATEGORIES BASED ON SLOPE ANGLE WERE FOUND TO ALIGN WELL WITH THIS ANALYSIS.

proportion (around 5%) extended 10° or more (Fig. 2). These cases most frequently involved persistent, deep, or wind slabs, a finding that mirrors the results of a study I conducted a number of years ago (McCammon, 2009).

Now let's add in measurement error. Ideally, we should be able to divide slope angles into regions that have a common relationship between measurement error and avalanche risk. Since inclinometers have an approximately 10° uncertainty range and we want to avoid compounding or overlapping errors, this means no error region should be less than 10° wide. Using this logic, avalanche prone slope angles can be divided into no more than three regions of error sensitivity: 1) error-insensitive slope angles where measurement error will not hide meaningful risk; 2) error-sensitive slope angles where measurement error has an increasing overlap with risk; and 3) error-intolerant slope angles where measurement errors can completely obscure large differences in avalanche risk. As is typical with discussions of slope angle, these three regions exclude exposure to avalanche runout hazard.

From a risk management perspective, green slopes (less than 20°) are not only free of avalanche release and almost all slab extension danger, they are also robust to inclinometer error. These are suitable slopes for folks wishing to avoid almost all direct avalanche risk, subject to the runout disclaimer above.

Red slopes are on the opposite end of the risk spectrum. Slopes 30° and steeper exhibit such a steep risk gradient that even small measurement errors will result in unintended exposure. On these slopes, angle-based risk management alone appears to be an exceedingly poor strategy.

Yellow slopes (20° to 30°) represent a transition zone where measurement errors can hide risks that rise from near zero to critical. Although these slopes are often favoured when avalanche danger is elevated, it appears careful measurements and wide margins are crucial, especially as slopes approach 30° (Tremper, 2018: 77). Strategies such as multiple measurements (described below) can reduce the

risks resulting from measurement errors on these slopes.

One implication of this analysis is that inclinometers appear to be more useful for staying out of avalanche terrain than for actively managing risk in avalanche terrain. Parsing risk on a 30°+ slope based on a few degrees difference in measured slope angle appears to be a rather dangerous gamble indeed.

But maybe we've known this all along. In a happy coincidence as I was concluding this work, Grant Statham informed me that he and Cam Campbell had arrived at precisely these same boundaries in their latest revision of the Avalanche Terrain Exposure Scale (Statham and Campbell, 2023). And perhaps more to the point, Mark Staples (2022) argues persuasively that 30° represents the "door to the avalanche casino," beyond which lies a world of risk where slope angles are only a small piece of a bigger puzzle, and even the most informed decisions can't eliminate the role of luck.

SLOPE ANGLES AND HUMANS

We know from too many tragic accidents that avalanche education is not a golden ticket to safe travel. It's a safe bet that avalanche-trained victims had seen graphs of slope angle versus avalanche frequency in their classes and perhaps, armed with an inclinometer that measured in single degrees, believed they could safely navigate avalanche slopes with a similar precision.

But one thing we know about risk management is it tends to get worse when our uncertainty increases. So, simply telling avalanche students their slope measurements have errors will do them no favours. Instead, perhaps we can reduce uncertainty about avalanche slopes by applying what we've learned in this analysis, starting with our inclinometers.

My students on that avalanche course so many years ago still deserve an answer. Today, I would acknowledge their measurement differences as normal variation and a reminder slope measurements are, at best, approximate. Then, I would refocus the conversation on how much uncertainty we had about the snowpack and what terrain margins we needed to build in to have a safe and fun day.

And if there was time, I'd slip in the quote from investor Warren Buffett: "It's better to be approximately right than precisely wrong," as a reminder that keeping an eye on the big picture is one of the keys to a long life in avalanche terrain.

Action 1: Check your inclinometer
Step 1: Using a pocket level (a few bucks at most big box stores), find a level surface or edge and check that both directions show as level. Step 2: Cut out a triangle from a square corner of cardboard where the diagonal is exactly twice the length of the shortest side. Step 3: Set your triangle on the level edge and your inclinometer on the sloping edge. It should read exactly 30°. If it doesn't, write down the correction you will need to make in your slope measurements (e.g. "Add 1.5°") on the back of your inclinometer.

Action 2: Improve your accuracy with multiple measurements
Instead of relying on a single slope measurement when making a critical route-finding decision, average two or three readings made by different people using different inclinometers. The result can reduce your measurement uncertainty. However, getting much below ±2° probably isn't practical.

Action 3: Good risk management is about the big picture. Small differences in slope angle are the little picture.
Many inclinometers for the backcountry display slope measurements in single degrees, resolution that invites the illusion that avalanche risk can be managed with that same precision. However, measurement error can easily hide large differences in avalanche risk. Rather than being drawn into the small world of slope angle differences, it's worth reminding our students the bigger picture is more important.

LIMITATIONS

The results presented in this article are preliminary. Happily, this opens the door to follow-up research that the author sincerely hopes others will pursue. Ideas for future projects are described in the companion ISSW paper.

ACKNOWLEDGEMENTS

The author sincerely thanks the National Outdoor Leadership School, American Avalanche Institute, Utah Avalanche Center, Sun Valley Trekking, Sun Valley Avalanche Center, Colorado Avalanche Information Center and the many forecasters and accident investigators who provided archival data for this study. The author extends his deep appreciation to Don Sharaf, Bruce Tremper, Mark Staples and Lynne Wolfe for valuable comments and suggestions.

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snow globe

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AWARE

in this **section**

// ALEX GEARY

CAA History Project
Steve Blake on the Death of His Friend and Colleague, Mike Wynn

Alex Cooper

ON JANUARY 12, 2002, MIKE WYNN and two other Park Wardens were conducting routine snow and avalanche observations in the Parker Ridge area near the northern boundary of Banff National Park. At approximately 2:30 p.m., Jasper Emergency Dispatch received a broken radio transmission: an avalanche from above had overtaken all three men.

One of the wardens was able to free himself from the debris and he immediately began rescue efforts. He located one of his colleagues in about five minutes, unconscious and not breathing. He immediately started artificial respiration and the man started breathing.

Mike Wynn was not so fortunate. He was uncovered 25 minutes after the avalanche hit, buried under 1.5 m of snow. CPR was initiated and an organized rescue response followed. Despite tremendous efforts at the scene and later in hospital, he died from his injuries. Mike was only 37; he left behind his wife and two-year-old son.

MIKE WYNN, WITH HIS SON JOEY. // CONTRIBUTED

Steve Blake met Mike at university in Ontario in the early-80s. The two of them hitchhiked out west and worked at Lake Louise's Temple Lodge together, then went on to develop careers as wardens with Parks Canada. Steve was the head of Visitor Safety in Jasper National Park when Mike died. We spoke about the incident and the impact it had during an interview for the CAA History Project. What follows is an excerpt from our conversation that has been edited for clarity and length.

When did you start getting involved with the CAA?

I was a keen attendee of the meetings. I always thought the CAA, their Spring Conference, was an exceptional venue for exchange of ideas. I did a couple of talks in the early-2000s before I got on the Board, and they were very satisfying to me. I did a fairly raw talk on the top 10 reasons why you don't want to have a workplace fatality due to avalanches, which was all related to Mike Wynn.

Again, that was important work for me. I was the program manager at the time. He was the guy I hitchhiked out to Banff with in the first place, to tie the ribbon together, and then he died while I was the boss. That was very hard for me on many levels. So, from the CAA perspective, to be able to talk to our people, my people, and lay out the seriousness of this work, as a reminder, that was really important to me to do that, and valuable for me. And I think it was well received by the membership as well.

I was going to ask about the Mike Wynn avalanche, especially now knowing that he was a friend of yours. Can you talk a bit about that incident and how it impacted you. It was January 2002—can you say what happened and the fallout?

Again, Mike and I basically thumbed our way to Banff, got jobs. We worked at Temple Lodge together. We met at university, and we studied together. He became a Park Warden in the Prairies, and I went back to Ontario after our first winter in Lake Louise. He kind of forged the way to getting me into Parks, in the warden world specifically.

His story is, we had a forecasting team out doing snow-study work around the Parker Ridge area and they were caught by an avalanche that came from quite high through the trees and buried or caught all three people. The one who was partially buried got the second person uncovered, saved their life because he was not fully buried but his head was covered up. Then they got to work and got Mike out. He survived for several hours before succumbing to his injuries. He had a two-year-old son at the time. It's as heart-wrenching

as an incident can be, to lose someone that close to you.

I was away from Parks the summer he started in Jasper. I was on some work assignment, so I wasn't there when he showed up, but I arranged his coming to Jasper. When I got back, I was just blown away that he knew more people, had better friends in Parks Canada in three months than I had for being there for 10 years. He was just that kind of guy.

That accident, it had a high degree of impact on Parks Canada, from an internal perspective. From a worker safety perspective, there was a new Canada Labour Code, which was the nationally focused labour laws that had a lot of teeth. So, there was so much uncertainty what the outcomes would be.

I was putting all our cards on the table for the investigation. I was putting all my efforts into caring for our staff, and Mike's family, and so on, in terms of critical incident stress management—the follow-up and everything that needed to take place. That purpose was really helpful for me at the time. I can tell you now that I under-emphasized the impact on me, and that did have some negative spin-off down the road, but it redoubled my commitment to enhancing avalanche safety at the same time.

I know Mike got tons of joy from being outside and the activities we did together over the years: paddling the Nahanni when he was a Park Warden there, the ski tours we did, the canoe trips, the mountain biking, endless sources of joy being out in nature. I just knew that he wouldn't want that to be written off for his family, for anyone. That message of, "Be in nature, do cool things," had to persist, and so the avalanche safety part just became again, super important for me to maintain and to keep that message alive in his memory, and for our greater good.

What would you say were the big changes that happened afterwards, within Parks and even within the broader industry?

It was followed soon after by the Strathcona-Tweedsmuir avalanche in Rogers Pass (in January 2003), so some of the things probably get quite blended together in terms of the broader avalanche awareness and safety picture. But by all means, Parks Canada definitely refocused its hiring practices around specific levels of certification. The ACMG credentials that I talked about having, they became entrenched in policy rather than nice-to-haves for many of these positions.

There was also the Al (Evenchick) and Al (Munro) avalanche that happened—two men killed in a B.C. highways avalanche (in January 1999)—and so a lot of the occupational health and safety changes that were emergent from that one became very solidified in practice following Mike's death. Check-ins, the types of terrain you go to, the types of teams you go with, the radio comms, the checks and balances even before you undertake field work—it really became more formalized following that. We started avalanche safety plans.

Again, this was all happening in reasonably quick succession, but the need for avalanche safety plans from WorksafeBC, that's a worker safety initiative. The Rogers Pass accident, and the two Als, and Mike's accident, these were all leading us up to converting avalanche work to a profession, really tightening it up in terms of how we do that work. Take it out of strictly a gut and a black art, and turning it into formalized, structured approach to doing the work. These were not the sole events that converted us to that approach, but they were definitely catalysts that helped accelerate moving the whole profession along, I guess.

You also mentioned the critical incident stress management and your own PTSD, if that's the right term. How cognizant were you of that fallout. People talk about that a lot today, and there are a lot more programs today, but is that something you thought about a lot afterwards?

Oh yes. The word I twigged on was how cognizant was I of that, is very interesting. I was absolutely intellectually aware of what was going on and what needed to be done. It took me a long time—I will say 12 or 15 years—to understand, to take it from just the intellectual part to connecting the emotional layer and turning that into one factor.

For Parks Canada we did lots of critical incident stress management training. I was instructing on that, peering that, leading that, bringing in paid psychologists, and advising others on it. It became a sub-speciality of mine, but it was a cognitive specialty for me. Excellent coordinator, excellent trainer, excellent purveyor of information, but it took me a long time to personally reconcile the head and heart, the gap between those two. That had a long legacy. To tip my hat to Mike, he taught me lots of lessons when he was alive, but he still teaches me lessons today.

Thanks for sharing this. I'm sure a lot of people will listen to this and take it to heart and reflect on their own experiences.

For the full interview, visit avalanchejournal.ca. You can read Steve Blake's 2002 article on this incident, "Organizational Implications of Avalanche Fatalities," in Volume 64 of Avalanche News at avalanchejournal.ca/archives.

Aware
A Memory of Art Twomey

Gord Ohm

THE OTHER DAY I HELD MY GRANDDAUGHTER and watched her infant eyes, quietly searching, just beginning to notice and observe. My mind drifted to one week in 1988. The winter backcountry and its possibility.

Art called it his Level 2. The helicopter shuddering through a tight mountain pass, rotor blades grazing a gun-metal sky. Twomey, three miners, and a ski patroller. At Sawtooth Hut, we shovelled out, lit the wood stove. Strong male voices and the snap of the fire. Chirping pots of melting snow.

By morning, snowing lightly at -6 C. Musty mattresses and chinked logs, coffee and oats. I laced my chainsaw-nipped plastic hiking boots and headed outside. The outfitter's message was scrawled into the wood of the cabin door. Something about respecting this place and the business end of a 12-gauge.

Weather obs, their symbols. A profile, its crystals. The following day, we ski toured south on Dewar Creek 82 F/16. Beeje clicked out of a ski so we pole probed and dragged ski tails 'til the light was down and it was time to move. With a step back, a softened gaze, the ski appeared. Over there! A fluorescent green glow.

At Ptarmigan, we clumped into the hut and unpacked, split wood, hung our skins. After dinner and the p.m. meeting, a molten sauna and submersion in a mountain stream.

It was a big walk to Boulder Hut, as I recall, contouring our up-track, studying terrain. Margie is there. With a clearance, a big snow slope appears. "Do you ever ski that?" I ask.

"Well look what's above it, and what's below." The answer is straight forward, a full chapter in her response.

Date, time, sky. Max, min, present temperature. We measure height of snow, height of storm. It's mid-winter, but Nowicki, a Sudbury boy, needs only a ball cap. We take interval readings off his brim. Twomey's mirth. His ski-jump beard and pearly grin.

I know that Art spoke that week. He surely did. Detailed instruction, deciphering questions. But his voice is not appearing in my memory here, his wisdom more than words. A sage presence perhaps, as one might expect from a grandfather.

Bergenske bursts into the lodge, he's freaking out. "My friend, my friend!" He surges and grabs the other Sudburian. The only one who could possibly keep up. Skins on, they race away. A rescue scenario, we load our packs and follow their track.

ART TWOMEY // CONTRIBUTED

The site is stomped and shovelled. Gear-strewn. For full chaotic effect, the manic witness tackles Longston, slams him to the snow. We post a guard, pick an escape route. Hitch-pin shovels and screw together probes. Pieps and Skadis, we search, strike a dummy backpack, and dig it out. These reps, imperative for the years ahead.

Saturday, our week is up. Pack loaded, I scrape my clunky bindings, cinch-strap my boot cuffs. Art looks on, an open hand to his leather tele boots. He smiles, 'we ski in slippers.' We ski away. In the high country, our mentors stay on.

Farmer meets us at Matthew Creek FSR. We tow out, at one point bailing hard and piling up on a sharp corner. The snowmobile disappears down the road. Groaning, laughing, we disentangle. Who's ski? Who's leg? By the time we're up and dusted off, the sled has returned. We grab the rope and glide out to St. Mary Lake Rd.

Memory, served up in images. My grandchild, her eyes shifting softly at first light. If there's one thing, it's our lessons. To understand them. To pass them along.

Art Twomey was an accomplished mountaineer, avalanche professional, photographer, and environmentalist. He was hugely influential in the East Kootenays and the avalanche community. He died in a helicopter crash on his way to teaching a CAA course in January 1997 at the age of 52.

Flakes

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