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FALL 2022

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REVIEW





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The American Avalanche Association promotes and supports professionalism and excellence in avalanche safety, education, and research in the United States.

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the **AVALANCHE**
REVIEW

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Notice something different? Due to supply chain issues, our printer ran out of our standard paper at our large format size and we had to substitute with thinner paper. We will return to the quality you know and expect for following issues.

—TAR Team



ON THE COVER

SAWTOOTH AVALANCHE CENTER: Galena Summit, Idaho. This avalanche was triggered remotely by a skier on December 14. It failed on a December 11 facet/crust layer; the most prevalent and longest-lasting weak layer of the season. See TAR 41.2 for the second part of 2021-2022 Avalanche Center Season Summaries, including SAC's in-depth summary. ■ ETHAN DAVIS

Wyssen Avalanche Tower

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Photo credit: Jasper Thompson
Snowbird, Utah



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FROM THE EDITOR

Human Factors are the baseline of all avalanche accidents. They are always decisions that went wrong. They are all situations that we have put ourselves into. ■ DREW HARDESTY



Back in May, I had 24 hours in Bozeman before flying out to see my dad in Nashville. I made sure to stop over for a much-postponed (thanks Covid) visit with one of my mentors, longtime avalanche pro **Don Bachman**. We traded stories from his career for stories about biking, skiing, and TAR, and I left with three boxes of his TAR archives. I have a full set now, by the way, if you are looking for a story. What stuck with me, however, was how much I appreciate Don's perspective and his longtime support of me and of TAR. I still reach out for his counsel on avalanche-related questions.

In this issue, you will find obituaries of four different members of our avalanche community, some of whom left us too early, and some after a long, fruitful career. Each time I read one of those life stories I recommit to the tenet of valuing my friends and mentors and extracting nuggets of perspective and practice while I can still ask questions and build on their experiences. This tenet is echoed in the theme for this issue: **Evolving the Way We Think**, which takes inspiration from our great mentor Ed LaChapelle and his metaphor of the ascending spiral. Through critically examining our current practices, we can aim for greater clarity, which then breeds quick, efficient, and accurate decisions. Regardless of whether our outcomes are optimal or aspirational, we pick apart our processes and keep trying to improve. Standing on the shoulders of the pioneers, we try not to make the same mistakes twice.

In this TAR you will find a number of stories whose details add to our collective knowledge and practice by building on and refining current concepts. Let's start with Dave Richards of Alta, who is never afraid to question current practice, updating our stability analysis with a way to score snow-pits (page 36). Under the Decision-Making header, Mike Austin makes connections between research, culture, and experience in his essay about intuition, Moving on from the Moneyball Mindset, on page 31. Sara Boilen, Liz Riggs Meder, and Emma Walker inform us of their project to build on Ian McCammon's FACETS; join them in the conversation at a SAW near you. Kelly McNeil introduces us to her upcoming series of essays in this volume of TAR; she'll expand and structure our conversation by taking us into the vocabulary and structure of avalanche education as public health.

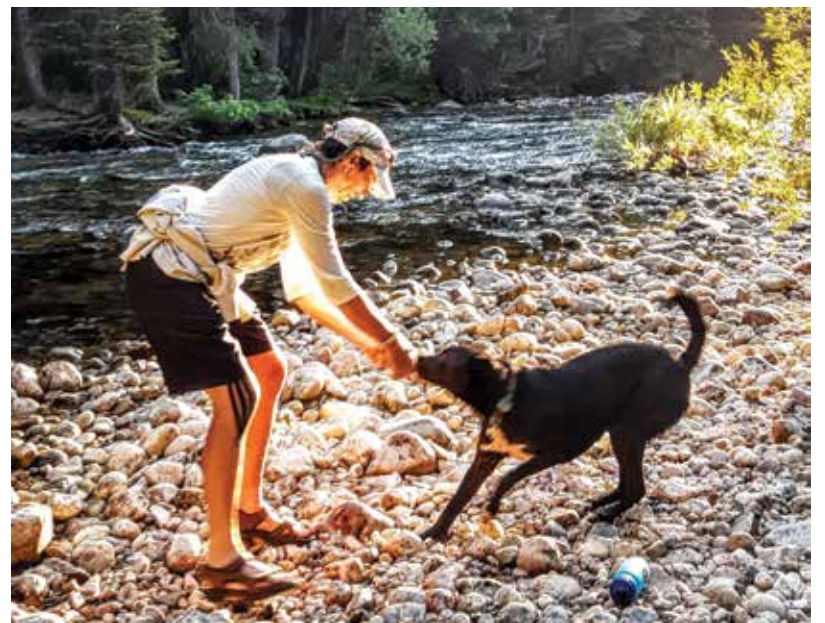
In the rescue realm, Jake Hutchinson reconsiders the classic parts of "Observed Avalanche Rescue"—another example of the evolution of thought and practice through paying attention over time. This issue's case study comes to us from guide/forecaster Jonathan Preuss (JP) of Sun Valley, where missing a weak layer in a winter snowpack that is disguised as spring leads to a well-considered "free lesson." Then you will find the first installment of Avalanche Center Season Summaries, alphabetical this time around. Look for the second portion in the December TAR.

As you're thumbing through this issue of TAR, stop and take the time to reach out to one of your mentors, ask what they're thinking about these days, and tell them how you've used their lessons.

Thanks
LYNNE WOLFE

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THE
DATE**

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FROM THE EXECUTIVE DIRECTOR

Members and Friends,

The last year at the American Avalanche Association (A3) was busy. Following the development of our strategic plan, the A3 board and staff re-committed to our mission of *promoting and increasing professionalism, expertise, and knowledge within the avalanche industry*. In the following months, we set to work expanding existing programs, wrapping up important long-term projects, and planning for the future. I'm proud of the work we accomplished—work made possible with your support and partnership—and I'm also proud of the transparent nature in which we are reporting it to you now.

Below is a summary of the impact that you helped us make last season. This includes a review of A3's financial performance during our most recent fiscal year (July 1, 2021–June 30, 2022). As you can see, A3 exceeded our revenue predictions for the year. This additional funding will ensure the long-term financial sustainability of our organization and support expanded programs starting this winter (including additional scholarships and research funding, Avalanche.org updates, and Resilience Grants).

Since we're looking backwards, I want to extend a personal thank you to the following individuals for their support last season: To the avalanche community and A3 members as a whole, thank you for welcoming me into the A3 fold so warmly. To Halsted Morris and the dedicated A3 Board of Directors, thank you for providing important guidance and direction this year, especially as we developed the strategic plan. To A3's many advisors, but in particular, Simon Trautman, Ethan Greene, and Scott Savage, thank you for your sound,

valuable, free, and often last-minute advice. To every A3 donor, as well as the partners and advertisers listed within these pages, thank you for providing so much of the financial power that moves A3 forward. To the extremely talented group of women who operate A3 from behind the scenes: Jen Reddy, Erica Engle, Lynne Wolfe, and McKenzie Long—thank you for every molecule of effort you put in to making A3's year a success. And finally, to Emma Walker, who seamlessly oversaw the transition between Dan Kaveney's leadership and my own. Emma, thank you for sharing your skillset and bright light with our team. You are a valued friend to A3.

I look forward to connecting with each of you this fall at regional Snow and Avalanche Workshops and at the A3 member meeting during the Colorado Snow and Avalanche Workshop on October 14, 2022. As always, please feel free to reach out to me with any questions or concerns. Thank you for a great year!



Warmly,

Jayne Thompson Nolan
Executive Director
Jayne@avalanche.org

A3 2021–2022 IMPACT REPORT

Financials: July 1, 2021–June 30, 2022

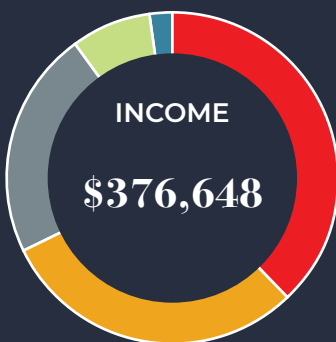
38% | \$144,599
CONTRIBUTIONS, GRANTS, & EVENTS

30% | \$114,434
MEMBERSHIP DUES

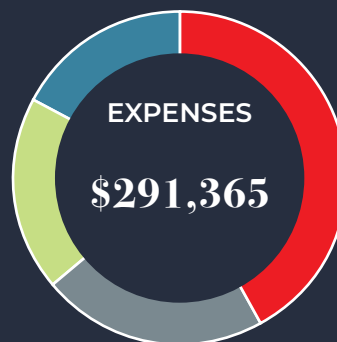
22% | \$81,139
*AVALANCHE.ORG REVENUE

8% | \$29,836
PUBLICATION REVENUE

2% | \$6,640
PROGRAM REVENUE



*restricted funds



42% | \$122,272
MANAGEMENT & OPERATIONS

22% | \$63,210
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PUBLICATION EXPENSE

17% | \$49,576
PROGRAM EXPENSE

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 - Understanding Environmental Controls on Hard Wind Slab Properties and Formation

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- Mental Health
- Workplace Safety
- Women's Leadership

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- 54 education sessions
- +9,669 virtual attendees
- +718 in-person attendees

Special Projects

LAUNCHED THE RESILIENCE PROJECT

- Mental Health Provider Directory
- Individual and Group Resilience Grants
- Mental Health Tools/Resources

CREATED AVALANCHE DOG MEMORIAL LIST

FROM THE PRESIDENT

My Final Column

BY HALSTED "HACKSAW" MORRIS



Hacksaw and Steve Conger

This is my last column as President of A3. I'm stepping down as I'm term limited to two terms. It has been an interesting four years! There is much I feel proud of accomplishing.

In April, Steve Conger dropped by for a short visit from Canada. Steve is a former editor of *The Avalanche Review* (TAR), longtime avalanche educator, and current AIARE Technical Director. Steve asked me what I was most proud to have accomplished while being President of A3. I thought for a moment and said, "Keeping A3

afloat during the Covid pandemic." A3 was in a very tight financial situation when I first became President. Covid was like a roadrunner cartoon anvil falling out of a clear-blue sky on A3. Thanks to some extremely fast work on behalf of the then Executive Director, Dan Kaveney, we were able to keep A3 afloat. It was close. Learning about PPP (Paycheck Protection Program) and Small Business Administration loans was challenging. By comparison, depth hoar is easier to understand and explain than Covid governmental regulations.

What I am also proud of is a considerable list: A3's first strategic planning program, the start of the Inclusivity Project, and the Resilience Grants

program. Along with these achievements, A3 also went through the hiring and training of the new Executive Director, Jayne Thompson-Nolan, who brings an outstanding skillset from her previous work in the nonprofit sector. I am happy to be leaving A3 in good hands. I will continue to work with A3 as the chair of the Awards and Memorial Committee.

I have one last request here. The A3 is an association of the members. Please continue to support it and recruit more members to join us. Especially more new women members.

I would like to say thank you to all the A3 members, staff, and Board of Trustees; you have been there through thick and thin. And of course, special thanks to the one and only amazing Lynne Wolfe, editor of *The Avalanche Review*; as well as the talented McKenzie Long, TAR/*The Snowy Torrents* layout/graphic artist genius.

I would be remiss if I didn't thank all of A3's generous sponsors: Arc'teryx, BCA, Black Diamond/Pieps, Caltopo, CIL Explosives, ON X Backcountry, Gaia GPS, MND Safety, Wyssen Avalanche control, Snowbound Solutions, Patagonia, Queen City Coffee, Mammut, Flylow, RECCO, SKI, Ortovox, IPA Connect, Snake River Brewing and Sweet Protection. These folks really have been genuine partners. Thank for all your support.

Most of all, I would like to publicly say thank you to my wife Barb. She has always been there for me with her love, support, and patient editing skills. Thank you so much.

Best to my successor and see you on the slopes!
Hacksaw

P.S. Sorry Allen H., I can't be President for life.



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LIVES WELL LIVED:

JAMES ALLEN BROWN



James Allen Brown, known as “JB” by many of his friends, beloved husband, father, brother, and friend, passed away unexpectedly on Friday, May 20, 2022, at age 43.

JB will be remembered not only for his incomparable backcountry skill, and grand ideas, but for his sarcastic wit, warmth and companionship. JB’s caring spirit and generous heart were felt by everyone he met. His appreciation for the outdoors was a defining trait, only surpassed by the love he had for his family. His greatest joys in life were his wife, Emily, and daughter, Susannah. JB was deeply proud of Emily’s accomplishments and she of his. In the truest sense of partnership, Emily and JB supported each other’s passions and dreams, working towards them together.

Born in Houston, Texas, he attended Texas A&M where he began working as a paramedic before relocating to Jackson Hole, WY. After a summer apprenticeship as a mountain guide, JB discovered the perfect fit for his appreciation of the backcountry, passion for skiing, and talents for mountaineering and climbing, along with his background in rescue. Throughout his career, JB climbed, skied, or guided in almost every significant mountain range in the United States as well as on four continents. He was co-owner of SWS Mountain Guides and California Ski Guides, and served as President of the Sierra Avalanche Center. He was an AMGA Certified Ski and Alpine Guide, and the 2007 recipient of REI’s Guide of the Year. Despite his many successes, JB found the most satisfaction teaching, mentoring, and sharing his love of the mountains with clients and aspiring guides.

Most recently, JB lived in Reno, NV, with his family, but his heart was always in Wyoming. He was looking forward to ultimately retiring on their property looking out at Glory Mountain. Every image of JB with his family, whether at home or in the mountains, was marked by an enormous smile that radiated to those around him, and is mirrored in Susannah’s face. JB will be deeply missed, but his family and friends will always cherish his adventurous spirit and the unforgettable times they spent together.

A celebration of life will be held in Jackson Hole in the fall. In lieu of flowers, the Brown family would appreciate donations in JB’s honor to the Sierra Avalanche Center scholarship fund and to Ducks Unlimited, www.ducks.org/get-involved/memorial-giving. ●

JILLIAN WEBSTER



BY MEAGHAN ALLSOP

Jillian Elizabeth Webster, 32, died June 6th on Mount Shasta due to head trauma from a climbing accident. Conditions were unseasonable while she was guiding a glacier travel course for Shasta Mountain Guides. At 8:30 AM, while making their way up to the red bank, the lead guide above her group made the call to turn around due to unsafe conditions. As they traveled to a safe turn-around spot, her rope team lost their footing and slid approximately 2000 ft. down avalanche gulch. Jillian was able to self-arrest (evidenced by her axe and its markings on the fall path). Still, she sustained a closed head injury, resulting in her death approximately 60 minutes before Search and Rescue helicopter arrived. Her two clients sustained multiple injuries, fractures, and compound fractures. We are grateful for their survival and Jillian’s efforts to bring them to a life-saving stop.

Jillian Elizabeth Webster

November 24, 1989–June 6, 2022

Age 32, of Redmond OR.

Mother Patricia Webster and brothers Jordan (sister-in-law Alana + nephew Manila), and Tanner.

Born and raised in Thousand Oaks, CA, Jillian’s life of adventure began with homeschooling and extended family road trips. Later, she volunteered in Africa and Mexico and studied for a semester in India. While completing her degree in nutrition at Cal Poly in San Luis Obispo, her devotion to sustainable farm-to-table food access led her to volunteer and work for farms, farmer’s markets, and free meal services. After college, she through-hiked the PCT, where she earned the moniker Radish, and continued to complete numerous backpacking trips in the American West throughout her adulthood. In winter, you could find her in the mountains on skis, becoming an expert skier and instructor. She was a humble student of the wilderness and anyone she encountered.

Jillian’s love of skiing and moving through the mountains started early at Mammoth Mountain Resort. As an adult, she set roots in central Oregon and became a beloved ski instructor for several seasons at Mt. Bachelor. She was hooked when she discovered that her two favorite things, the backcountry and skiing, could be combined into an all-in-one adventure. After completing an AIARE 1 course in the Three Sisters Wilderness,

she embarked on numerous tours in Oregon, Montana, Canada, Idaho, California, Wyoming, and Alaska. Jillian recently completed her Rec 2 avalanche course with Yostmark in Feb 2022. As a seasoned ski patroller for Hoodoo Ski Resort, she received the award of Patroller of the Year in 2022. At Shasta Mountain Guides, Jillian is remembered as a gentle yet tremendously strong lead guide, inspiring both her clients and colleagues. True to her nature, her community continues to be guided by her loving, generous, and goofy light in spirit.

Jillian aspired to be not wildly independent but wildly capable as a woman and person. While she could (and would) travel through any terrain anywhere in the world by herself, she valued community and created a powerful, loving family around her by nurturing and supporting those in her life. Through nourishing meals or conversations, work trades, or handmade/thrifted thoughtful gifts, Jillian gave her love and genuine presence wholeheartedly. Jillian’s nature was that of a sage guide; by just being herself, her legacy of living simply, cherishing wild places, living life to the fullest, and treating herself and others with kindness was impressed onto anyone she met. Jillian was both a student and a teacher in every interaction, present to those needing guidance and support while deepening her skills and wisdom through ceaseless curiosity.

Jillian’s biggest backcountry lessons she’s left her ski partners and fellow patrollers are these:

- Your gut feeling should not be dismissed
- Ask questions, especially to those in positions of power
- Take damn good care of yourself and your gear
- The extra weight of comfort snacks is worth it
- Speak up. Share your concerns and your stoke!

In 2020, Jillian decided to write her beliefs and values distilled into a manifesto. She highly recommended we all give writing our own manifesto a try.

THE MANIFESTO

Say what you mean

Cry often and without restraint

Don’t eat shit foods!

Eat the whole ones, the colorful ones, the simple ones.

If you think someone is great, tell them!

If you think someone has crossed a boundary of yours, also tell them!

They will respect you more for it.

But in general, speak kindly.

Words leave imprints, why not be the one known for kind words?

But beyond words, take value in

L I S T E N I N G

Mourning the loss of friends & colleagues

We have two ears, and one mouth for a reason.
Listen twice as much as you speak.

Do the work to be comfortable in your own skin
For that is true beauty
Learn to breathe from your heart and your belly

Don't forget to exhale fully.
Sigh every once in a while

It is good for the parasympathetic nervous system

Learn to be okay with silence
For silence is a most loyal companion

—Jillian Webster

MIKE HAMILTON



■ JEDD WORKMAN

BY BROOKE EDWARDS

Mike Hamilton made the most of the 46 years he was given on earth. He didn't waste any time chasing his dream and making sure everyone came along with him for incredible adventures. He was welcoming and large; his booming laugh carried with it an invitation for all time. If you answered yes then you were in for the ride of your life, be it down a river or the fall line of your skiing dreams. When you are here to live life to the fullest, it is imperative to be in your most authentic form and this was Mike. No bullshit, no pretense, just Hambone. He invited you, he guided you, he mentored you, he helped, he loved, he welcomed, he rallied. He was another legend, now left to the history books and all of our hearts.

His beloved soulmate Sunny matched him in his vigorous approach to life. She even dropped in on him, shouting, as he opened the infamous Meteorite in Valdez. He paused and looked up, staring into the base of her snowboard as she clung to a single edge on the 55-degree entry. "What the hell are you doing?" shouted Mike to his then-girlfriend. Sunny yelled back: "I just wanted to ask you to marry me!" "OK!" shouted Mike in response, followed then by a "What am I supposed to do now? Hike back up to you?" "No!" shouted Sunny, "Go send it!" And so he did. For 20 years these soulmates sent it together, flying their adventures around the world and showering their generous spirits on Argentines, Alaskans and every human they guided and came in contact with.

On April 25, 2022, while guiding for Valdez Heli Ski Guides, Mike Hamilton was swept off a cliff

when an avalanche broke above him. He was not buried, but died instantly from trauma. Mike's loyalty and passion impacted everyone who knew him and his community was nothing short of global. Having spent the last three decades traveling from Las Leñas to Valdez in search of eternal winter, Mike's extended family of friends spans continents. He leaves behind his wife and soulmate, Sunny Hamilton, his parents Bob and Ruth Hamilton, his brother Bobby, niece Ruby, and nephew Austin.

Jed Workman remembers him as a colleague and a dear friend: "He lived a magical life with Sunny, the love of his life, roaring down mountains and rivers all over the world—Alaska, Argentina, Chile, Turkey. He lived life on his own terms 100% of the time. He was real and authentic. If you knew Mike, then you KNEW Mike. There was no pretension. No posturing. His honesty, love, and strength were startling, humbling, and inspiring."

If you'd like to contribute to his wife Sunny after his passing, some of his past clients have started a Go Fund Me: <https://gofund.me/20f21f87>.

BY DOUG KRAUSE

Mike's life was pretty full when I met him in 2001; by the time 2022 rolled around, it had been positively overflowing for decades. Summarizing a full life in a few paragraphs is a fool's errand. One does not just reach out to grasp the setting sun, or cover Hendrix, or narrate the sublime.

He was the loud guy at the back of the plane from Santiago to Mendoza. It was late by the time we got into town, but in those days, dirt-bags could still wrangle a night van up to Las Leñas without destroying a full season's budget. We arrived well after midnight. There was a couple feet of new on the ground and it was still coming down hard. Mike went out behind the apartment my girlfriend and I had rented, dug a snowcave, and went to sleep. He, and Jason, and Danny, and Wayne had already done a season or two back there. Mike had a couple more in him before graduating to the luxury of a bunk at the gas station, the back of a friend's van, or the palatial splendor of Eddie's old bus. Twenty years later he was a Los Molles local and driving the development of Argentina's newest heli-ski operation.

Mike liked big shit. It fit his personality. Before we met, he and Wayne were one of the first groups to explore the couloirs on Baffin Island. They spent an approach day humping guns and gear over broken fast ice and sastrugi, proving how tough they were, before using the sat phone to call for a snowmachine bump. We'd hook up with José and go on road trips in October (after the Leñas winter) and tag Andean volcanoes one after another. I remember looking across a broad valley and talking about some distant lines for a few minutes before I realized he was talking about a pair of giants next to the mini-golf I was looking at. It was never enough. We could spend a morning flying around Valdez teeing off—Python, East Peak, Meteorite, The Wall, The Gunbarrels—and after a sandwich and a smoke he was looking for a way to step it up in the afternoon.

I think Mike met his twin loves, Sunny and heli-skiing, at around the same time. Maybe 2006? He made best friends with Hannes, who was running the new Leñas heli-ski program, got a job with Dean at H2O in Valdez, and showed up in South America that summer with a raven-haired fireball. The rest is history, so to speak. Not really for me though, I prefer the little memories. I hold them close. But they come and go as they please. It's like trying to catch the wind.

That time he came to visit Silverton—I put the tail end of a p-cord strand in his hand then chucked a 15lb sack of ANFO over the cliff we were standing on—I could have warned him better. That time Dean told him "Christ Hamilton, you could fuck up an iron ball." X2O for life. Horses, hot springs, Jack Daniels, and guiding without clients. Countless buglers while chuckling and marveling at the endless shit show that is heli-skiing.

There is a line between tough talk and asshole. Mike never said anything overtly, but a telltale glance always let me know when I had strayed too close to the boundary, one of the few boundaries he never crossed. He is one of only a small handful of people in my life that genuinely taught me how to be a better person.

Sunny said it best, "Everything was going so perfectly." Until it wasn't. And now we're all left here crying, and holding the memories close, and trying to narrate the sublime, like a half-drunk SRV hacking up Castles Made of Sand.

We are not lost

*You may mourn me, but do not mourn my loss.
We are not lost.*

*I am the raven that surfs the ridge. The condor
patrolling the valley. The eagle on the branch.
And you are at my wing*

*You are the laughter that fills the night. The love in
the firelight.*

Firing the glint in my eye. Always at your side.

*The sky is heavy today and the mountains weep
into the sea*

*The path is shrouded in tears, but we are not lost.
We are never lost.*

*We move forward together, you and I
I am with you, and you are with me. Forward.
Together. Always. Forever.
We are not lost.*



Mike and Jose Beccar playing cards at Refugio Cajon Grande. ■ DOUG KRAUSE COLLECTION

PETER SCHAEERER: THE PATRIARCH

BY ALEX COOPER



Peter heli-skiing in his 80s. ■ JOHN SCHWIRTLICH

Alex Cooper is editor of the *Canadian Avalanche Journal*. These essays first appeared in their summer 2022 issue and are reproduced by permission.

In 2007, when the Canadian Avalanche Association presented its 25th Anniversary Outstanding Achievement Award, Peter Schaeerer was honored as the “Patriarch.” It is a fitting title for the Swiss-born engineer whose lengthy career impacted all aspects of the Canadian avalanche industry.

Peter passed away on May 16, 2022, in North Vancouver at the age of 95. This article provides a summary of his career. On the following pages, Bruce Jamieson, David McClung, and Chris Stethem, three of our industry stalwarts who knew him best, share their own memories.

Peter Albrecht Schaeerer was born Sept. 21, 1926, in Berne, Switzerland. Growing up, his father Max would take him skiing and hiking. He and his brother Marcus developed a passion for mountaineering together.

In 1950, Peter graduated with a diploma in civil engineering from the Federal Institute of Technology (FIT) in Zurich. As part of his education, he learned about snow mechanics and avalanche control from Dr. Robert Haefeli, one of the world’s leading snow scientists at the time. He went to work as a research assistant with the FIT, where he studied snow removal and ice control on roads. Peter worked out of the Institute of Snow and Avalanche Research in Davos, where he began to develop his understanding of snow science.

In 1956, Peter was working for the Neutral Nations Supervisory Commission in Korea (through the Swiss army) when he heard from Marcus, who was living in Toronto, that the National Research Council of Canada (NRCC) was looking for researchers in its snow and ice section. “Because I had snow research and did snow work and snow removal work in Switzerland, I jumped at the opportunity and simply applied for it,” he said in a 2006 interview.

On his way back from Korea, he stopped for a tour of western Canada before traveling to Ottawa for his interview. He was offered one of two projects. One was to look at the weight-bearing properties of ice to see if trucks could drive over frozen lakes. The other was designing avalanche control defenses for the new Trans-Canada Highway over Rogers Pass. The decision was an easy one. He jumped at the latter opportunity and moved to Canada in 1957 to begin his work.

The task in front of Peter was to determine the active and static defenses that would keep the road open as much as possible as it crossed under

130 avalanche paths. “My job was simply to do the engineering work and decide for each avalanche path what type of control would be most feasible,” he said with Swiss workmanlike modesty.

From 1957 until the spring of 1961, Peter, working with Noel Gardner and several others, advised the Canadian Department of Public Works during highway construction. He suggested changes to the highway alignment to avoid the worst avalanche paths and set out the locations of the snow sheds, mounds, and deflector dikes. He established snow study plots and devised the avalanche control program using a howitzer. He also enjoyed skiing and mountaineering in the Pass, claiming the first ski descent of Mount Rogers during these years.

In 1961, his work in Rogers Pass complete, Peter returned to Switzerland to work as a highway engineer. Three years later, he was offered a new position with the NRCC developing snow removal and ice control techniques for highways. He returned to Canada, this time for good. Then, in 1966, his directive changed. Instead of looking at snow removal, he would research avalanches.

Based in Vancouver but often working out of Rogers Pass, Peter studied avalanches for the NRCC until 1991, when he retired. He published over 90 papers, reports, and book chapters on topics such as snow stability tests, avalanche impact forces, avalanche speeds and runout distances, avalanche zoning, snow loads for buildings, and avalanche accidents.

Peter became the preeminent subject matter expert on avalanches in Canada and was asked to provide his expertise after several notable incidents. In the winter of 1972–73, he advised the Whistler ski patrol following a serious avalanche incident the previous season. He was also appointed to the Avalanche Task Force that was formed after seven people died in the North Route Café avalanche on Jan. 22, 1974. The task force’s recommendations led to the establishment of the BC Ministry of Transportation’s Avalanche Control Program.

In 1970, as the demand for skilled avalanche professionals grew, Peter developed and taught the country’s first avalanche courses. He wrote the original student manual and training materials, and helped train other instructors. These courses were attended by workers from mines, highways, and railways, ski guides, ski patrollers, and national park staff. The first courses were run through the NRCC, but as their popularity grew, the administration was assumed by BCIT. This work formed the foundation for the CAA’s Industry Training Program.

Peter was instrumental in building Canada’s avalanche community. In 1975, he was a founding member of the Canadian Avalanche Committee, which was established to foster information sharing amongst Canada’s fledgling avalanche industry. This grew into the Canadian Avalanche Association, which formed in 1981. Peter was the CAA’s first president. He led the creation of the first edition of the *Guidelines for Weather, Snowpack and Avalanche Observations* and developed the CAA Code of Ethics.

Peter officially retired in 1991 after his research program was ended by the NRCC, but he continued working part-time as a consultant for Chris Stethem & Associates and an ITP instructor for many years. In 1994, he and David McClung co-authored *The Avalanche Handbook*. The second edition was published in 2006 and a third

edition is due out this fall. It remains the definitive textbook for avalanche professionals and has sold over 50,000 copies.

Peter was married for almost 40 years. He met his wife Jean in the fall of 1957, when he was hospitalized with the flu in Revelstoke; Jean worked there as a nurse. They fell in love and got married in Switzerland in 1960. Together they had three children, Martin, Gillian, and Yvonne. Peter and Jean remained together until her death in 1999. He was an avid skier into his late-80s and was hiking up to his death. He also enjoyed kayaking and gardening.

Peter is an Honorary Member of the CAA and American Avalanche Association. In 1999, he received the ultimate recognition for his leadership and accomplishments when he was made a Member of the Order of Canada. The announcement heralded his many contributions to Canada’s avalanche industry.

“Of particular note, perhaps the most enduring contribution of Peter’s long involvement in the avalanche safety profession in Canada, was his continual fostering of the collective and co-operative spirit of all persons engaged in the avalanche field,” proclaimed his nomination. “Peter never missed emphasizing the importance of promoting and recognizing everyone’s collective contributions in the avalanche safety community, and in encouraging the high standards of practice that are followed today.”

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PETER SCHAEERER: GRAND MENTOR

BY BRUCE JAMIESON

Peter: “Your column is too wide for the shovel test.”

Bruce: “But my shovel is wider than most.”

Peter: “Doesn’t matter. The column should be about 25 cm wide.”

This was at the Fernie ski area in 1981. Think about it. The senior avalanche researcher for the National Research Council of Canada was visiting a ski area! (Peter somehow visited many avalanche operations.) And coaching the newbie on the ski patrol! Peter was committed to mentoring avalanche practitioners and had time for the greenest practitioners.

PLAIN LANGUAGE

Decades later, at the afternoon guides meeting at Mike Wiegele Heliskiing, one guide questioned whether the crust in another’s snow profile was a melt-freeze crust or a rain crust. Peter stood up and said: “A crust is a crust is a crust.” He memorably simplified the four types of melt forms and five types of ice formations into plain language that met the needs of ski guides.



Peter observes the incline of an avalanche path in Rogers Pass in April 1957.
 ■ PETER SCHAEFER ARCHIVES, COURTESY THE REVELSTOKE MUSEUM & ARCHIVES.

HUMOUR

Around 1996 when Peter, my wife Julie, and I were starting to pack our sea kayaks for a trip in the Discovery Islands, Peter asked me: “Bruce, do you know why the bow of a sea kayak is pointed?”

I hesitated and noticed the twinkle in Peter’s eyes. “It is for storing a bottle of wine!” he exclaimed. He then leaned into the bow and stashed a bottle of wine.

Peter loved to laugh, and he laughed a lot!

HUMBLE

I’m guessing Peter could have had any role he wanted at the 1988 ISSW in Whistler. Instead, he chose to check that people entering the main room had name badges.

He considered declining the Order of Canada because he didn’t feel he deserved it. Considering his vast contributions, that’s off the end of the humility scale!

PRACTICAL

In a 1991 paper entitled “In-situ investigations for shear strength of snow,” Peter reviewed the shovel test, rutschblock test, and shear frame test, comparing the information they provided about instability *and the time required to gather that information*. (This and some of Peter’s other unpublished contributions are available at www.snowavalanchearchive.com/peter-schaefer.) Nineteen years later, when Jürg Schweizer and I reported on test efficiency versus information about instability, readers thought it was new ground, but we had simply updated Peter’s results.

Peter was the lead instructor on my Level 2 course at Lake Louise in 1982 and when I first instructed a Level 1 course in Blue River in 1992. On the first field day of that course, when we could hear the helicopter approaching, the other instructor, Bob Sayer, pointed out we had not yet assigned students into groups. Peter paused, then said: “Everyone with mostly rented or borrowed gear move over here. Everyone with all their own gear move over there.” Including the students who had not moved, we had three groups of eight as the helicopter landed for the first lift.

Peter taught on CAA courses, including Avalanche Mapping, until 2005, when he was in his late-70s.

WORK-LIFE BALANCE

For a decade or two, I was a stressed-out road warrior. Peter advised me to keep cross country skis in my car so I could break up the long drives with a lap on skinny skis.

MY HAZARD MAPPING APPRENTICESHIP.

Peter was my primary mentor for hazard mapping in the 1990s. Although some of the analytical methods have improved, the experience that Peter shared has stood the test of time. On an early project after the helicopter dropped us off in the runout zone, Peter asked me: “What should we do first?”

Eager to impress, I said: “Locate the beta point on the ground.”

Peter (patiently): “No, try again.”

Me (still eager): “Locate the trim line we saw on the air photos and take core samples to date the trees.” Peter (smiling, still patient): “No, we should

sit on this rock, drink tea and visualize what large avalanches would do in the path.”

Starting with the big picture in the field is still important advice but it was crucial at the time because the avalanche dynamics models were one-dimensional and of limited value for complex terrain.

PETER’S GEMS

During several hazard mapping projects in the 1990s, I was wowed by the gems of unpublished ideas Peter was sharing with me. I wrote these down in a file called “Peter’s Gems.” Later, when I was the lead hazard mapper on projects, I repeated Peter’s advice to younger hazard mappers. Peter was the mentor to the mentor—really, the grand mentor to many avalanche practitioners today.

Peter also passed his expertise on to the next generation through Brian Gould and Alan Jones.

In addition to being both a student and co-instructor with Peter on the CAA mapping courses, Brian would visit Peter in North Vancouver occasionally. Peter was always more than generous with his thoughts and opinions on new projects, handing Brian copies of his notes and passing on old avalanche dynamics textbooks from the early days. “I’m glad to have had a bit of time later in Peter’s life to soak up some of those gems, and certainly pass those on to both my staff as well as the up-and-comers on the CAA mapping courses,” said Brian, “The methods he developed and passed on to our community over the years put us into the top tier of alpine nations in terms of avalanche know-how. I look forward to remembering him as I sit on a rock in an avalanche path somewhere this summer.”

Alan Jones worked closely with Peter in the early 2000s on a number of projects with Chris Stethem, as well as teaching CAA mapping courses. This was during Peter’s “transition” from consulting to full retirement, which took almost a decade before he could truly focus on gardening and skiing. Alan continues to apply Peter’s practical, judgment, and experienced-based approach to modern avalanche problems, and to pass along Peter’s gems to developing avalanche practitioners and engineers.

Perhaps in the years to come, we should all take the time to sit on a rock in the mountains and reflect on what we have learned from our mentors. I’ll be remembering Peter Schaefer, his humour, and the practical wisdom he humbly shared. ●



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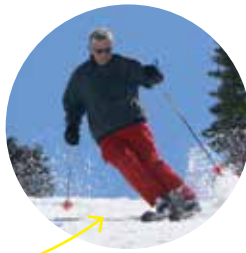
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JOHN E. SIMMS

(1937-)

INTERMOUNTAIN SKI HALL OF FAME



Skiing since a toddler in western New York, **JOHN SIMMS** migrated west in 1959 after majoring in English, studying non-Euclidian geometry, and then a tour with the US Navy monitoring the North Atlantic DEW line during the Cold War. A professional ski patrolman at Arapahoe Basin and Vail, John moved to Jackson Hole in 1966, the first year the Aerial Tram opened, where he was a member of the professional ski patrol. He subsequently served as a Snow Ranger, working for the US Forest Service, where he was responsible for avalanche forecasting and mitigation.

A powerful avalanche at A-Basin that resulted in a fatality his first day skiing the area established John's early interest in avalanches. He founded Snow Research Associates after moving to Jackson and began designing and developing tools and techniques to determine the mechanical properties of snow for avalanche forecast and rescue. SRA became Life Link International, named for ski poles John invented to link together to form a probe pole. Life Link poles and John's patented light-weight, collapsible fanny pack shovel allowed rescuers to locate and extricate avalanche victims more quickly, increasing chances for survival. His inventions continue to save lives around the globe.

In collaboration with other first members of the Jackson Hole Ski Patrol, John developed avalanche control programs between 1966-1975 that became today's industry standards worldwide.

As to John's skiing prowess, he and fellow 'troller Charlie Sands were the first to ski the then-unnamed north-facing couloir off Rendezvous Mountain. Their premier leap into the precipitous chute—named S&S in their honor—occurred only after they promised each other they would never tell who went first.

To honor his innovative contributions to the ski and avalanche world, John was inducted into the Intermountain Ski Hall of Fame on August 24, 2022. Congratulations from the American Avalanche Association! ●

SAWTOOTH AVALANCHE CENTER PROFESSIONAL DEVELOPMENT SEMINAR

BY ETHAN DAVIS, SAC FORECASTER

Due to ongoing COVID concerns, the Sawtooth Avalanche Center (SAC) hosted a scaled-down Professional Development Seminar in Hailey, Idaho on April 11, 2022. Over 25 professionals, including ski guides, snow safety workers, search and rescue personnel, researchers, and forecasters from the National Weather Service (NWS) attended the in-person event. After a two-year hiatus and in its 13th year, the energy was high and the conversations were spirited. Presentations covered new weather models, satellite-based remote sensing, and SAC forecast and weather products.

Several staff from the NWS Pocatello office attended, including Carter Mackay. Carter explained the NBM or National Blend of Models, how it's used by NWS forecasters, and how local professionals can benefit from the new tool. The NWS Pocatello works closely with the SAC and other local partners to build and refine a suite of custom weather products and tools, many of which are now implemented at other NWS offices across the country.

Next up was Zach Keskinen, a doctoral student at Boise State University. Zach presented past, current, and future research in satellite-based remote sensing. Avy Professionals and NWS staff alike were on the edge of their seats as Zach described future satellite launches and their implications for avalanche detection and snow depth measurement research. We're fortunate to have researchers like Zach here locally and look forward to more interesting conversations and research collaboration in the future.

Scott rounded out the evening by facilitating an engaging discussion on SAC forecast and weather products, forecast messaging, and staffing. These collaborative discussions are part of what makes these gatherings so valuable.

The SAC Professional Development Seminar is a collaboration between the USFS Sawtooth Avalanche Center and the Friends of the Sawtooth Avalanche Center. This event received additional support via an American Avalanche Association grant, and the Sawtooth Brewing Company donated the meeting space. Thanks to all the local professional organizations in attendance—we look forward to hosting a "full sized", in-person SAC Professional Development Seminar in 2023—see you there! ●

22.23 Winter Public Pro Schedule

Bozeman, MT
Pro 1 Jan 8-13
Pro 1 Jan. 23-28
Pro 1 Feb 12-17

Jackson, WY
Pro 1 Dec 18-23
Pro 1 Jan 18-23
Pro 1 Feb 6-11
Pro 2 Jan 9-15
Pro 2 Feb 22-28

Salt Lake City, UT
Pro 1 Dec 11-16
Pro 1 Jan 9-14
Pro 1 Feb 20-25
Pro 2 Jan 30-Feb 5
ProAvSAR Jan 17-21

Estes Park, CO
(alpine guide specific)
Pro 1 March 5-10

Seven Utes Yurt, CO
(meals and lodging included)
Pro 1 Feb 21-26

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Pro 1 Dec 9-14
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ANNOUNCING THE ALL NEW KBYG PROGRAM

BY CHAD BRACKELSBURG



The Utah Avalanche Center (UAC) is excited to announce the new Know Before You Go (KBYG) Avalanche Awareness program. For the past 18 months the UAC has worked along with the Colorado Avalanche Information Center, Northwest Avalanche Center, National Avalanche Center, and Avalanche Canada to update the program with new presentation content, new online learning courses, new videos, and a new website (KBYG.org).

The program aims to “motivate people to learn more about avalanches” by

- Teaching that avalanches are dangerous
- Showing who is affected by avalanches
- Teaching that avalanche education is the key to staying safe.

The team worked hard to redefine the learning outcomes and teaching objectives and focus on just the core information necessary to deliver these messages. The new program is significantly different from the prior version. We reduced the five “Get the” points to four points: **Get the Forecast, Get the Gear, Get the Training, and Get the Picture.** We changed the order by putting Get the Forecast first because this is the single most important point. Not everyone will recreate in avalanche terrain or even go near it, but they may hike to a cabin and should be aware of the forecast as a starting point. We also simplified the program’s message in order to ensure our audience would retain the information taught.

Why did we feel the need to change the program so much? As the team reviewed the existing program we identified a LOT of learning objectives—far too many for a one-hour presentation.

We also talked with numerous long-time KBYG presenters and received feedback that Get the Picture and Get Out of Harm’s Way were often confusing and had become a “dumping ground” for anything that didn’t clearly fit in the first three points. These two points are also much more abstract. Getting the Forecast, Gear, and Training are tangible items that you can complete. We kept coming back to the question of, “What does it actually mean to Get the Picture and Get Out of Harm’s Way?” How does an attendee know that they have done this? With this in mind, the team made a difficult decision to cut Get Out of Harm’s Way and then define Get the Picture with three clear learning outcomes:

- Describe avalanche terrain: slopes >30 degrees
- Describe some safe travel habits for traveling through avalanche terrain: travel one at a time and do not stop on or under an avalanche slope
- Recognize Avalanche Red Flags as indicators of snowpack instability

Another big change is that the KBYG presentation no longer begins with a 15-minute video. Instead, we use four short videos to introduce each point and the presentation fills in the

remainder of the learning outcomes. These exciting and energizing videos spread throughout the presentation help keep the attendees engaged and allow audience interaction through simple discussion questions.

The online learning courses have been built to provide additional avalanche information after attending a KBYG presentation, preparation for an on-snow avalanche class, or a skills refresher. The program provides over seven hours of free online education. Visit learn.kbyg.org to check out the classes.

The KBYG website is designed to be an avalanche education resource. The site not only contains information about avalanche awareness but also provides answers to commonly asked questions like, “Where do I start my avalanche education?” “What course should I take next?” and “How else can I learn?” The continued learning page provides an avalanche education pathway along with links to resources for your journey down this path.

The final program component is a full-length feature film that releases in early November. The film teaches the reality of avalanches and the dangers of recreating in snow-covered mountains. Produced by Sherpas Cinema, this film tells the story of people whose lives have been impacted or changed forever by avalanches. These stories teach the importance of avalanche education and how to prepare yourself to stay safe in avalanche terrain.

If you are a current KBYG presenter or if you would like more information about the KBYG program please email info@kbyg.org. Be sure to follow KBYG on Instagram (@KBYG.avy) and Facebook (@KBYGavalanchesafety) for more information. ●

PRIORITIZING EMPLOYEE WELLNESS AT THE UAC

BY CHAD BRACKELSBURG

A focus on employee wellness continues to increase in the outdoor industry and especially within the avalanche community. Mental health has also been a topic discussed in podcasts from Avalanche Hour, American Alpine Club, the UAC and a host of others; articles in TAR; SAW presentations including presentations from Jess Shade (<https://bit.ly/USAW-Wellness>) and Greg Gagne (<https://bit.ly/USAW-Staff-Wellness>) last year at USAW.

COVID, fatality investigations, challenging snowpack conditions, increased backcountry use, and other factors led to the UAC having a couple of very challenging seasons. We recognized this was impacting our staff’s mental health. With employee well-being in mind, the UAC built an employee mental wellness program to help address the challenges we were having and ensure that we were putting our staff’s needs as our top priority.

We worked with Jess Shade, an accomplished mountaineer, skier, and therapist for the Climbing Grief Fund (<https://americanalpineclub.org/grieffund>) to build our program and provide services to our staff. As a member of our backcountry

community, Jess was in a perfect position to be able to build relationships and trust with our staff and relate to the challenges they were having.

The UAC’s program is available to all full-time and part-time staff members. We built the program with two components.

1. **Non-therapeutic Check-ins:** Each staff member has a wellness check-in 1-3 times annually. Based on the check-in, the staff is provided with access to wellness resources for outdoor professionals from organizations such as the American Alpine Club and the Responder Alliance, or additional sessions are scheduled. All check-ins are wholly confidential with anonymous billing to the UAC.
2. **Therapy Sessions:** The UAC covers the cost of up to six therapy sessions with a licensed clinician. These sessions do not require a mental health diagnosis. Reasons for sessions do not need to be work-related. They can include a complex body of issues affecting mental and emotional well-being such as alcohol and other substance abuse, stress, anxiety, insomnia, career

discernment, grief, family problems, and psychological disorders. These sessions are wholly confidential with anonymous billing to the UAC.

After one year, we feel the program has been successful and has helped identify potential challenges before they become problems. One staff member describes that program benefits as, “A much needed check-in on our well-being. Even if you’re not suffering from a mental health issue it’s a nice check-in and an opportunity to be healthier and discuss any concern or issues.” We will evaluate the program with Jess in the fall and make any necessary improvements to continue to provide this program to our staff.

If you have any questions about this program, please feel free to contact Chad Brackelsberg at chad@utahavalanchecenter.org. ●



CHAD BRACKELSBURG is ED of the Friends of the Utah Avalanche Center.

LOFTY GOALS

The Sentinel Project Aims High at the Future of Avalanche Mitigation

BY SEAN ZIMMERMAN-WALL

The history of explosives use for the reduction of avalanche hazard is long and storied, punctuated by great ambition, rife with complex designs, and chock full of indelible characters. Many would say the Godfather of using explosives for avalanche work was the great Montgomery “Monty” Atwater. Borrowing from his experience as a 10th Mountain Division infantryman in WWII, Atwater pioneered the seemingly outlandish ideas of lobbing dynamite and anti-personnel rounds at the side of a snow-covered mountain to release one of nature’s most spectacular displays of power and destruction. All for the sheer enjoyment of the work, and of course, protecting the slopes so skiing could commence.

Following the initial salvo of hand-delivered dynamite and French 75mm rounds, the experimentation with compressed air-powered cannons began. Those initial designs were nothing more than glorified potato guns capable of launching soup cans a paltry distance with all the accuracy of a drunken archer. However, through rugged determination and persistent recalibration, the design proved effective enough to employ with regularity across the avalanche-prone mountains of the world. As time marched on, more and more experimentation took place. In Europe, the advent of Remote Avalanche Control Systems (RACS) took turn of the 21st-century technologies and modified them for efficient mitigation throughout the Alps. Eventually making their way to other continents, RACS became widely utilized to safely and consistently protect ski areas and infrastructure. While many a blaster and gunner lament the eventual decline of the original tools of the job, it is evident that with increasing regulations, environmental protections, and the public’s insatiable appetite for skiing powder on a whim, new tools and technologies need to take center stage.



UAV inaugural flight participants: dawn of a new era. Snow Basin, Utah.
 ■ NATALIE STROMBERG

FOUNDATIONAL ELEMENTS

In 1977 a young and ambitious snow lover named David Sly began working in British Columbia, Canada with his uncle who was an employee of the original CIL (*Author’s Note: this was a totally different organization than the CIL of the present era*). As contractors who worked for entities engaged in silver mining and logging, they parlayed their expertise into a job for the BC Highways Department.

“We would control Kootenay Pass with primitive avalaunchers. This was my first experience with the development of projectiles, fins, and explosives,” recounts Sly.

By the mid-1990s Sly was leading a company focused on mitigation and the continued refinement of the projectiles, most notably a reliable tailfin assembly that stabilized the ordinance in flight and allowed it to detonate consistently on impact. Starting in 2002 and via fostering partnerships and leveraging his expertise in the American and Canadian markets under the moniker of Maple Leaf Powder Company, Sly developed a technical blast consulting and avalanche control development firm. Sly connected with Crucial Gear in Uintah, Utah, to produce the Avacaster avalauncher, and eventually the Turbocaster. Crucial Gear is the U.S. partner of Maple Leaf to this day.

In time, Sly sold the tailfin molds to CIL Explosives (the current era organization) and continued making avalaunchers and being a steward of innovation and safety in avalanche mitigation. He added modern technologies as they came online and his penchant for tinkering led him to the current project of the Sentinel 6000—a drone-based deployment system capable of delivering small payloads (6 kilos) of explosive.

CURRENT DEVELOPMENTS

The Sentinel project has relied on ingenuity and creativity from the onset. Sly realized the potential of drones for avalanche work as early as 2015, and in 2018 he got serious and began playing with ideas in the workshop. He started by engineering a “barrel” that could house the ordinance and drop it while in hover. A trapdoor mechanism was required to allow this happen.

“It was a surprisingly difficult design hurdle. The door pins are pulled laterally with up to 6 kilos of weight on top of them,” says Sly.

In 2021, Sly contacted Rainhouse Canada, an engineering and manufacturing firm with multi-sector expertise that specializes in taking ideas across



Sentinel 6000 system in action. ■ GENEVA MCCALLUM

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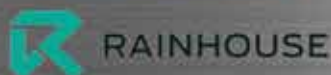
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the finish line, to assist in his efforts. They designed a reliable electronics and actuation system integrated into the barrel, which is secured to the drone's fuselage. From up to a three kilometer line-of-sight, the operator can remotely activate the deployment door while the drone is in flight. Coupled with a 35–45-minute flight time based on payload, executing missions involving several deployments is possible. A forward-facing flight camera, and a downward facing target identification camera gives the user additional oversight of the mission.

The ordinance is composed of a bio-degradable cardboard box with a small bag of ANFO and a standard cast primer charge. A single charge is double-cap and fuse with traditional pull-wire igniters secured to the fuse. The igniter cords are clipped to the inside of the barrel and when the doors open, gravity assists in the ignition of the fuse train. Users can fine tune the length of fuse and weight of the payload (<6 kilos) based on their needs.

On a sunny day in June of 2022, Sly and his son Adam, Maple Leaf General Manager, met with a group of avalanche professionals, land managers, and government officials to witness the capabilities of the platform. Gathering in the parking lot of Snowbasin Resort in Utah, the family Sly introduced the current design and the partners that made this dream possible.

Scott McCallum of Crucial Gear and Geoff Warren of Davis Catalyst Center are just a couple of the figures in attendance who have helped Sly along the way. Frank Waikart of Snowbasin helped secure the venue and watched with intrigue. Warren is responsible for unmanned aerial systems training at the Davis Catalyst Center based in Kaysville, Utah. The team informed the crowd of the parameters of the Sentinel 6000, which was specifically designed to meet the over 55-pound and under 55-pound regulation set by the FAA. With the current regulations, users wanting to apply for the under 55-pound rating will only be able to use 3kg payloads, while those needing larger payloads of up to 6kgs can apply for the over 55-pound rating.

With a young pilot trained at the Davis Catalyst Center, the Sentinel took flight and made a line at its target about 300 yards down range. The payload was inert, with no explosive content. It was dropped from a height of ~150 feet along a pre-programmed flight path set up prior to the demo. While the flight and all moving parts went as planned, a small miscalculation dropped the payload a bit short of the initial target.

"I consider the demonstration a success and it was our goal to prove this to U.S. based users. Maple Leaf is not a user, so for this project to come to fruition in the real world, someone will need to step up and go through the approval process to use live ordinance," explained Sly.

FUTURE POTENTIAL

The real nuances and subsequent challenges of the implementation of the Sentinel come down to the user profile and the regulations surrounding pilot credentials, FAA approval for transporting hazardous materials with either the under 55-pound or over 55-pound rating, and determining how the system will mesh with an operation's existing avalanche mitigation strategy. Sly is optimistic that this platform has a diverse set of potential uses in the toolbox. He also shared that a host of small technological upgrades are imminent to make the system lighter and more user friendly.

"We might be at the pitching machine and aluminum barrel stage that Atwater was at decades ago," admits Sly.

If you or your team are interested in more info on tech specs, regulations, and brainstorming, reach out directly to Dave at davidgsly@mapleleafpowder.com. ●



SEAN ZIMMERMAN-WALL is constantly tinkering with the depth of his avalanche industry involvement and working to strike a balance between job demands and a stable family life. Writing for TAR gives him an outlet for creativity and the chance to share a bit of history or exciting developments with the community. Find him this winter at Snowbird patrolling the slopes, or out in the wild environs instructing for AIARE.

DRAGON SLAYER 2022

BY MATT MCKEE FOR THE AAUNAC EXECUTIVE COMMITTEE

A AUNAC (Avalanche Artillery Users of North America Committee) is an organization whose membership consists of avalanche professionals who use surplus military artillery to help protect life and infrastructure from avalanches that impact our nation's highways, railways and ski areas. Each year the honor of **Dragon Slayer** is bestowed to a member of AAUNAC who has over their career been a major contributor to the development and sustainment of artillery avalanche control. Marty, the originator, named this award to symbolize the slaying of the White Dragon; a nod to Monty Atwater and Norm Wilson's legendary life and death battles against avalanches at Squaw Valley's Headwall in the early 60s. Those who have been awarded the Dragon Slayer is an impressive list:

- Terry Onslow 2005
- Norm Wilson 2005
- Ken White 2006
- Bob Moore 2007
- Stuart Thompson 2008
- Liam Fitzgerald 2009
- Marty Schmoker 2009
- Doug Abromeit 2010
- Larry Livingood 2011
- Dick Reuter 2012
- Daniel Howlett 2013

- Ray Mumford 2014
- Dave Hamre 2015
- Greg French 2016
- Onno Wieringa 2017
- Peter Schory 2018
- Nat Heit 2019



In May 2022 we added **JAMIE YOUNT** from the Colorado Department of Transportation and **MIKE STANFORD** from the Washington State Department of Transportation to this renowned group. Using Marty's words: "To honor you for your hard work and the contributions you've made to the avalanche industry through the use of artillery." Indeed. Thank you gentlemen.

In other business, the focus of AAUNAC continues to be the balance of supporting the M101A1 105mm Howitzer Program with the controlled replacement/retirement of that same program. This year's AAUNAC meeting included a round table discussing the benefits, challenges, and disadvantages of RACS. Most programs are somewhere in the process of replacing their artillery. Due to the diversity of each program's artillery dependency, capital funding, and land-use issues, this process will be harder for some programs than others. This year we felt it was important to share the lessons learned from 20+ years of RACS experience amongst the membership,

"This award is not the achievement of a lifetime, but a lifetime of achievement."

—Marty Schmoker

so that perhaps some of the new installations can avoid problems learned the hard way by other programs. We are proud of the efforts and improvements being made by the transition to RACS; in fact, AAUNAC has already thinned its membership at Jackson Hole, where RACS installations have replaced the M101A1 105mm Howitzers, and in the not too distant future Alta and Snowbird will be amongst the latest members to retire their weapons due to their large investments in RACS. John Stimberis made a great point during the discussion, "as we migrate from artillery to RACS, it would be great to maintain this community of users." Undeniably it will be important to maintain this continuity within the industry to continue to learn from, support, and teach each other. ●



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SLABLAB: Applying Human-Centered Design to Solve Backcountry Problems

BY RICHARD BOTHWELL & DANIEL FELDMAN

SlabLab is entering our second full season of research and prototyping.

In the 2022 season we conducted a research project, published a report of our findings, and conducted multiple prototypes to address challenges backcountry travelers told us were important to them.

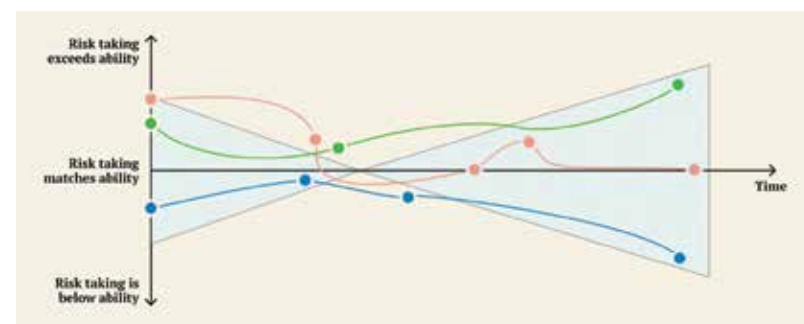
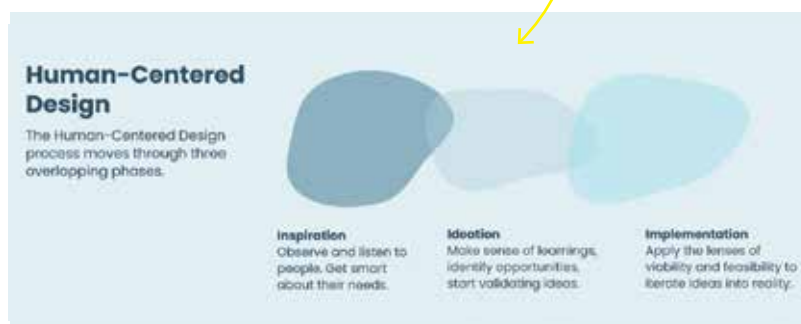
Our full report can be found at slablab.co/2021-22-season-report.

SlabLab's approach is called **Human-Centered Design**. It is a form of creative problem-solving that begins with empathy. We do our best to put ourselves in our participants' shoes and design for their needs. The goal is not to definitively prove or disprove a hypothesis but provide inspiration. We seek to offer fertile ground for new solutions. Research is typically followed by idea generation and tangible learning via rapid prototyping.

their ability to manage those risks. However, we found that early and late in backcountry careers, people made decisions about risk well above or below their abilities. People new to the backcountry are often either going big while blissfully ignorant or are afraid to get started and take on even very low risk. Then at some point in their career, often the result of an incident or after some education and training, people act more in line with their ability to manage risk for a little while. As time goes on and behaviors get normalized, most people again move away from that line significantly. They take on less risk than they have the ability to manage or take on much more risk than they can manage. The exception we saw was with professionals. The professionals (guides, patrollers) we spoke to seemed to have more self-awareness about risks they were exposed to and

For 2023, we are embarking on a second research project. We will again be sharing our findings with the community. We expect to publish our 2023 report in March. We are narrowing in on a theme for our research this year. Themes we are interested in exploring include:

- Identifying markers of good/poor teams as early as possible.
- Who, when, and why do partners choose to speak up or keep quiet.
- Relative effectiveness of various avalanche education curricula and impact on student outcomes.
- Is there a real connection between trip planning and trip quality?
- What are the expectations of students going into level 1 and level 2 avalanche classes?



We conducted a series of interviews with 29 skiers and snowboarders representing all experience levels and from a variety of locations in the US and Canada. Our interviews have a semi-structured, qualitative format. We wanted to listen to the stories of actual backcountry travelers, in their own words.

We gained six insights which we heard many times as we listened to people telling their stories:

- Finding partners is difficult for almost everyone.
- Camaraderie is often mistaken for good teamwork.
- Choosing avalanche education is most often based on cost and convenience.
- The importance of having a process to manage risk is often lost in a sea of information.
- It's difficult for the inexperienced to find places/routes to ski.
- There is a perception that avalanche education is "one and done."

Our most surprising finding was that this sport is much more "wicked" than we thought! While many people recognize the snowpack may not give us great feedback, few people recognize they are also receiving little to no feedback about their decisions from their partners, education and training, or from the process they use each time they go out in the snow.

We saw this lack of feedback lead to repeating patterns in terms of risk taking over the course of the backcountry careers of our interviewees. Most people want to take risks that are appropriate for

their ability to manage those risks. The professionals we spoke to also spoke of using repeatable processes, debriefing, and mentoring. We believe those features lead to the better outcome of increased self awareness among pros.

Out of these learnings we identified six opportunities for new solutions, which we encourage anyone interested to run with. The opportunities are all listed in our report, organized into two categories:

- Meet more partners and form better teams
- Progress and gain experience, while improving self-awareness

We have decided to focus more of SlabLab's time on this first design opportunity: fostering the formation of better teams. After our interviews we conducted two prototypes: "speed dating" for new ski partners and a personalized matchmaking service for new partners. Our speed dating events put 12-20 people from a similar area together who are all looking for new partners. Through curated discussions, breakouts, and Q&A, participants get to learn more about potential partners, and report learning more about their process of picking new partners.

We offered our matchmaking service to skiers and splitboarders in the PNW this past spring. Each participant was interviewed on several areas relating to the type of skier they'd like to be paired with, and we painstakingly searched our directory for skiers who met those criteria. This initial prototype showed great promise as we seek out ways for people to meet new partners and form better teams.

We mapped each participant's backcountry career to uncover patterns in risk taking.

We encourage you to take a look at our report at slablab.co/2021-22-season-report to see the insights and opportunities we've exposed, but also to get a better idea of how Human-Centered Design works. We feel there is fertile ground for rapid problem solving in the backcountry community by leveraging this exploratory process alongside more traditional and quantitative research. 🟩

SlabLab is currently a team of two:



DANIEL FELDMAN

Human-Centered designer with experience creating a wide variety of solutions, for a digital platform for community health workers to financial empowerment programs in rural India.



RICHARD BOTHWELL

is a long-time avalanche educator and guide, guide service owner, and former Executive Director at AIARE.

UNBURYING AND HEALING THE PAST: 40 YEARS LATER

BY MELISSA SIIG

Forty years after the deadliest avalanche in North American ski area history struck Alpine Meadows Ski Resort near Lake Tahoe, killing seven, Gary Murphy can still recall the snow stats for that unparalleled storm. The storm brought 100-plus mile-per-hour winds out of the southwest and more than 100 inches of snow over five days, followed by an additional 54 inches of snow during the five-day rescue.

“That season was the biggest of my career,” said Murphy, who worked as a professional patroller for 42 years at Alpine Meadows, 30 of those as an avalanche forecaster. “November through April of 1981–82, we had 569 inches of snow with 99.75 inches of water equivalency... it was unheard of.”

Murphy’s memory may have been jarred by the advance screenings last winter of the documentary *Buried: the 1982 Alpine Meadows Avalanche*, which interviewed survivors and rescuers to tell the story of March 31, 1982 and the emotional toll it took on all involved. The movie’s advance screenings, which played locally in Tahoe and won multiple film festivals all over the country, culminated in a 40th anniversary reunion and screening at ground zero at the Alpine Meadows Lodge. Those who lived through the fatal avalanche say that both the anniversary event and the film have had a cathartic impact on them. *Buried* will see its official commercial release this fall in theaters through Greenwich Entertainment (distributor of *Free Solo* and *The Rescue*).



Roses for Jake Smith at the bridge where he was caught by the '82 avalanche.

■ LANNY JOHNSON

“It was a seminal event in our young lives,” said Jim Plehn, who was an avalanche forecaster in 1982 and one of the main characters in the movie. “In talking to different people some of us actually learned that it took strength to go through an experience like that, that we could endure something like that.”

The 40th anniversary included a luncheon at Alpine Meadows for all 1982 employees. Around 500 people showed up, including every 1982 ski patroller who was still alive except for around three, according to Plehn, and family members of those who had died in the avalanche, some coming from as far away as Colorado. The gathering featured some powerful moments, for example when Jeff Scover, who was partially buried in the avalanche and dug himself out, spoke publicly for the first time about his experience. Scover had been standing next to mountain manager Bernie Kingery and dispatcher Beth Marrow, who were both killed.

“It’s just emotional quite honestly,” Plehn said about Scover’s first-ever blow-by-blow description of the avalanche coming through the Summit Terminal, where he and four others had been standing. “The feeling was a mixture of incredible gratitude that so many people wanted to come even though it wasn’t the best experience we all had in our lives.”

Even Bob Blair, who was the Ski Patrol Director in 1982 but had declined to be a part of the movie, showed up to the reunion. Like Plehn, Blair only worked at Alpine Meadows one more year before leaving.

“Because of the way it ended for Bob, I don’t think he ever understood how much respect people had for him,” said Plehn, noting that the person all the former ski patrollers most wanted to see was Blair. “I think he got it at the event. It was really powerful.”

After lunch, a group gathered at a nearby bridge where Patroller Jake Smith was killed in '82 and hung roses, Smith’s favorite flower since he was a huge Grateful Dead fan—a tradition that has been ongoing for 40 years. The old ski school assembly bell, which used to be mounted on a tree above where Kingery was found, was brought down to the bridge. At 3:45 p.m., the exact moment the avalanche hit, the bell was rung by Blair, Morrow’s sister, and Kingery’s grandson. Seven hand charges representing the seven people who lost their lives were set off at the Poma Rocks, the starting point for the 1982 slide.

The ringing of the bell was another tradition started after 1982 by Smith’s fiancée, but “as it got close to 40 years somehow it became more meaningful, people wanted to acknowledge it,” said Plehn.

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BURIED



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THE 1982 ALPINE MEADOWS AVALANCHE

BURIEDFILM.COM



A rapt audience at the 40th anniversary screening of *Buried*.
■ LANNY JOHNSON

That evening around 330 people, including many community members, came to Alpine for the screening of *Buried*.

"It was a different crowd than previous screenings, a higher concentration of people who were employees but it was also open to a lot of locals," Plehn said. "This demonstrated that the avalanche affected not only employees but the whole community. It was a big deal."

Plehn believes the movie has been very healing for people. While Plehn says he found healing after being absolved of wrongdoing in the 1983 court trial, many others didn't get that opportunity. He felt the movie especially helped Mike Alves, the heavy equipment manager who watched three people in the parking lot, including a 12-year old girl, get swept away.

"He has really suffered," Plehn said. "I think the movie was cathartic. Everyone has been so grateful this happened. I think it provided closure. It really did for Mike Alves."

Watching *Buried* with loved ones was also key. Larry Heywood, who was the Assistant Ski Patrol Director in 1982, brought his wife, children and grandchildren to an earlier screening of the movie, which he said gave them a better understanding of the extraordinary event he had been through.

"The film resurfaced the whole thing," said Heywood, who remained at Alpine until 2004 as Ski Patrol Director and then Director of Operations. "For my family it was an eye-opener into the past, there was a lot of discussion around that and what happened ... there has never been anything in the history of Alpine anywhere near close to that size."

Murphy also brought his family to see the movie, including his 11-year-old granddaughter, who was roughly the same age as Laura Nelson, who was buried in the parking lot along with her father and family friend.

"That was tough for me," Murphy said. "She was disappointed Laura had died. She was struggling to understand avalanches."

Both Murphy and Heywood are American Avalanche Association Bernie Kingery Award recipients, given to those who have distinguished themselves in the field of avalanches. Heywood received his in 1996 and Murphy in 2012.

Most importantly, the movie has helped cement the bonds forged among the 1982 employees by living through such an incredible event.

"Most ski resorts haven't had an event like that, that bonds people together, and those bonds were so apparent to me at the reunion, that so many people who worked for the company wanted to be there" Murphy said. "It was really unusual for ski resorts."

Greenwich Entertainment will release Buried in theaters nationwide September 23 and on VOD on November 8. To learn more about the film and how you can see it this fall, visit buriedfilm.com. ●



MELISSA SIIG is a 20-year journalist living in Alpine Meadows, CA, in an avalanche zone just minutes from the ski area. Her husband, Steven Siig, is one of the filmmakers of *Buried*. They have three children and own a movie theater in Tahoe City.

Reconsidering the elements of

“OBSERVED AVALANCHE RESCUE”

“Chance favors the prepared mind.”

—Bradley Lilly, *The Bravest: A Fireman’s Tale*

BY JAKE HUTCHINSON

I’d like to think I don’t leave much to chance in avalanche rescue, but I know I’m lying to myself. Often the difference between a live recovery and a devastating outcome will be determined by chance before I have even initiated my search, which is an incredibly heavy thing to carry every time I watch a partner or student enter avalanche terrain. I am driven by the fact that, despite my best efforts, my best training, and repeated practice, I may not be able to affect a positive outcome in the event of mishap. I am driven to be better, to more rapidly assess search threats, to be more efficient with search technologies, to have better systems for my gear and how it’s deployed. I devour articles and accident reports and look for learning opportunities, for both myself and for ways I can better challenge and teach my students to be better partners and better rescuers.

I’ve been around avalanche rescue a long time, from my first companion rescue in the early 90s to being the Accident Site Commander on numerous large-scale, multiple agency missions. I’ve taught rescue courses to professionals and recreationists alike and helped develop rescue plans for multiple agencies and ski patrols. In the course of teaching and patrolling, I’ve had the opportunity to proctor and observe several hundred rescue tests of various types and I keep seeing the same mistakes, the same time sucks, and the same bad technique. My methods are far from scientific, simply a collection of years of observing the difference between theory and practice—watching how the human element seems to always screw up a perfectly executed rescue.

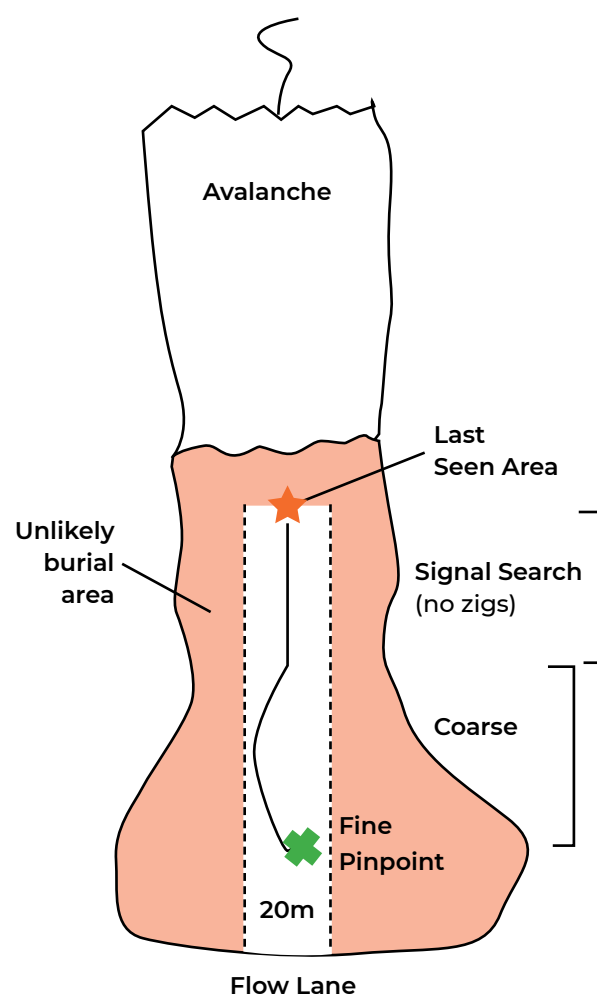
At the 2012 ISSW in Anchorage, AK, Don Bogie and Andrew Hobman presented the paper:

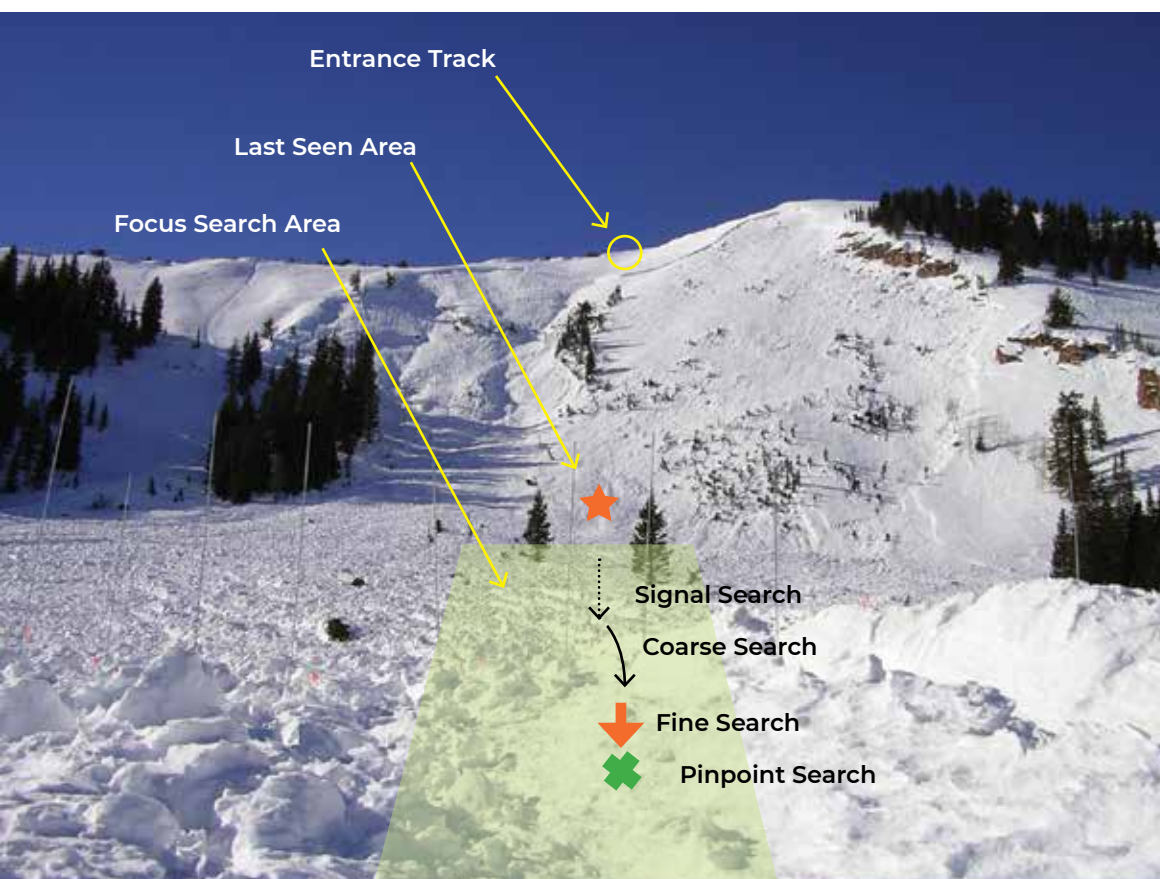
Simplified view of a Focused Search. Use the Last Seen Area (the star) and a reasonable range of 15–20 meters to define your search lane.

“APPLYING SEARCH THEORY AND COORDINATED INCIDENT MANAGEMENT TO AVALANCHE RESCUE”—looking at how the methodology the US Government used to hunt for submarines during WWII could be applied to avalanche search. This paper was the first to highlight the importance of ‘Probability of Detection’ (PoD) to me in avalanche search work. At the time, I was highly focused on Avalanche SAR dogs and have used this terminology and theory in my training and teaching protocols, but it was in the development of the American Avalanche Institute Pro Rescue course in 2013 that I began to fully appreciate the value of this theory in organized avalanche rescue. In subsequent years, I have applied this theory to how I teach companion rescue as well, both from an individual and small team perspective.

For the sake of this article, I will focus on what I call ‘observed avalanche rescue’, which for the sake of definition here, is any avalanche involved that meets at least one of the following criteria:

- Victim was observed in the flowing avalanche debris—**credible LSA** (Last Seen Area) can be established. Keep in mind, this does not have to be a person from the victim’s party, simply someone who can give you a place to start the search process.
- **Surface clue or clues** to establish a high probability flow line.
- **Tracks**—this one can be tricky or misleading. The possibility that someone traversed away from the track should be considered, especially if looking at snowmachine high mark tracks or complex entrance features that may require horizontal travel.





These criteria all help to minimize the search area, therefore increasing PoD, maximizing and focusing resources, limiting time inefficiencies, and giving searchers the best chance to successfully locate and extricate a buried subject. **In the absence of one or all of these clues, traditional avalanche rescue methods should be deployed as the situation requires.**

I don't think any of this is revolutionary, and I've watched numerous professionals who have adopted these techniques over the years, so I don't think it's new, but I do think it's time we reconsider how we teach a few phases of the avalanche search to both the professional and recreational communities.

A basic understanding of avalanche flow, and how things and people move once caught, is critical to minimizing wasted time in avalanche search. Objects don't move horizontally in a flowing avalanche debris. Even high-level snow machine riders follow the rules of gravity once caught—gravity always wins and snow flows downhill like water, moving over and around obstacles as rivers do, carrying everything with it.

So what? In my professional experience, a few moments of critical thought and planning can greatly improve search efficiency, therefore increasing the likelihood of a successful rescue. The simplest piece of critical thought one can apply here is to eliminate areas with little or no probability of detection and focus resources in the line of flow or most likely line of flow.

Let's start with the transceiver search itself. Since the transceiver era began, we have made very few collective changes to how a search should be performed, with the flux line search method being the last significant improvement. As technology has improved and transceiver manufacturers move away from anything but three antennae digital transceivers, one needs to ask, are we clinging to relics that no longer serve us?

SIGNAL SEARCH

So, if we have an LSA, clue and/or track to minimize our search area, why are we teaching people to zig-zag the entire deposit looking for a signal? After testing nearly every beacon on the market today multiple times, I have concluded that even with a little transmitter interference and an absolute WORST case scenario, a searcher can reasonably rely on a 15-20 meter range, which means that a person walking or skiing straight downhill on the flow line is effectively searching a 30-40 meter swath. This brings up an important consideration, knowing your transceivers worst case search range; there can be huge variances between models, brands, and units. Knowing how to test it and understanding the difference between a number on the screen and the actual physical range on the slope are critical to effective searching. Back to my original point, if this is an observed avalanche, we can reasonably expect the subject has followed the flow line downhill and made very minor deviations from that line, even in tight couloirs opening into broad debris fans, the deviation from the initial flow lines by buried subjects is minor in my experience. Therefore, when we are teaching companion rescue, I teach the following progression:

Visualizing the layout in real terrain helps a search become more efficient.

Establish an area of probable detection by connecting the dots from the track, last seen area, and flow direction of the avalanche. This helps focus on likely burial areas and eliminates unlikely areas —which can be searched later if required.

- Establish the LSA—it is critical in this method your LSA involves a captured subject; if they were still upright and moving independent of the debris flow, you will likely need to expand your likely burial zone.
- Visualize the flow line—take into account, bends, benches, rocks, and trees.
- Get to the flow line and start your search either straight down or straight up that line.

Nowhere has this time suck become more evident to me than in a Pro 1 rescue test. I have watched countless students in a 50x50 meter area start with very slow and very methodical zig zags, costing themselves precious time. In reality, even if the targets were at extreme opposite corners, a rapid lazy S pattern from one boundary to the other more than adequately covers the test site.

COARSE SEARCH

I don't see much need or room for improvement here, although reminding people to slow it down a notch seems to be useful advice—move at an appropriate pace to allow the transceiver processor to provide you with accurate, relevant information. Moving too fast downhill leads to overshooting the fine search target.

FINE SEARCH

This is a place where relics seem to be pervasive. I continue to see student waste time and confuse themselves marking grid boundaries in the snow. Why? This was a method to resolve the fine search before we had accurate range data, there is no need for this step anymore. I simply tell people to find the smallest number and probe. It's easy to teach and far more accurate than creating a box and choosing the middle. Once the searcher gets to the point they want to begin the fine search (generally less than 5m), they need to get the transceiver on or near the snow, having the searcher on their knees is an ideal compromise in distance and economy of movement. In angular hard slab avalanche debris, this may be 20-30 cm above the surface—you should always minimize fluctuations in height above snow, **the key to an excellent fine search is only changing one variable at a time.** I then have them always search uphill first, to avoid getting any further below the target than they already are. As soon as the number goes up, they need to come back downhill (maintaining orientation relative to the slope) and look for the smallest number, essentially moving until the number goes up again and then returning to the smallest number. From here I go 90 degrees one way or the other, with the same protocol, find the small number and then probe.

This is also a place where poorly designed or explained training costs precious time. Shallow burial drills with small targets create poor skills. Searchers always look for numbers less than 1m, when in reality, they may never see numbers less than 2,3, or 5. Students seem unwilling to start probing when 2.2 m is the lowest number, so teach people they may not see small numbers, and set up drills with realistic depths and targets that can be probed.

PINPOINT SEARCH

Probing is such an overlooked and important skill. Digging without probing leaves the chance

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of missing your target by mere inches; this is just too great of a chance to take. I have seen excellent avalanche dogs and transceiver searchers dig in the wrong spot due to the nuance of scent rise and flux lines, neither of these is subject to the rules of gravity and shouldn't be treated as such.

I don't remember where I first saw it or was taught it, but the only tricks I have here are first showing people a 10cm grid and **probing a spiral pattern on the grid**. It seems to be easier to maintain discipline than envisioning the traditional circular spiral. Second, the old cliché couldn't be more true here, "**Slow is smooth, smooth is fast;**" haste in the pinpoint creates massive gaps in the probe area due to poor spacing discipline and random probe angles.

RESOURCE MANAGEMENT

Time is king in avalanche rescue, and I think we would all agree shoveling is the time suck here. Transceiver technology has become so good that search times are minimal, it's the excavation that counts. I believe there are pros and cons to the various organized shoveling methods out there and I won't get into them here, but the common thing they all require for maximum efficiency is people.

The recent article in TAR 40.3, "Group Searching" by Bruce Edgerly and Jim Conway, suggests lane searching in a group scenario, particularly in a multi-burial setting. I have used this method in large scale avalanche searching before, primarily as a means to clear areas of the deposit and focus resources. In the Dutch Draw search in 2004, we had reports of more than 25 people buried in a 14-acre area; we divided the scene into nine grids, assigning transceiver, RECCO, and dog teams to each before calling them clear. I believe there is some merit to this technique in two situations:

First, you have no clues or LSA information, i.e. the slide wasn't observed or for whatever reasons you didn't see where your partner or partners were caught.

Second, when you are part of an organized rescue group responding to a large avalanche with limited information and want to clear zones of searchable signals as quickly as possible. If you are dealing with an observed avalanche, there is no reason to clear lanes 20 meters or further from your last seen area, regardless of the number of buried subjects, you are simply putting limited shoveling resources further from the place they will be most needed. I think this method is useful but is limited to situations where you don't have information to focus your search area.

So what do I propose instead? One thing that proctoring several hundred pro rescue tests and recreational rescue courses has taught me is that humans fumble gear when stress is applied. In the case of a rescue test, the clock is the only stressor we can safely apply; the consequences of failure are far less than the real world. If you can't test under stress, how will you perform when it's GO

time? Training people to properly store their gear in a manner that it can be quickly and effectively deployed is of primary importance; I can't tell you how many probes, shovel blades, or packs I have watch slide or tumble down the slope as stress mounts and searchers try to get their gear out, while maintaining their transceiver and communicating with others around them. For this reason, especially in a recreational setting, I would never deploy *all* of my resources to begin searching with transceivers, regardless of size or number of people.

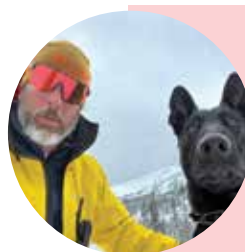
In a perfect setting, each searcher would have at least one and possibly more rescuers ready to begin probing and shoveling, allowing time for the extrication team to properly deploy their gear and be ready to move efficiently, as well as the transceiver searcher to fully focus on the task at hand. As soon as the searcher says to start the pinpoint, the shovelers should be ready to assist with the shoveling process.

Let's take the following scenario: a group of five has decided to descend a slope, following safe travel protocols so descending one at a time. The first rider descends without incident and tucks themselves away in what they believe is a safe spot. The second begins their descent and triggers a slide, getting caught, carried, and buried. The three remaining people on top should be deployed as follows:

1. **Transceiver search**—move immediately to LSA and begin search, if LSA is on the bed surface, be water! Flow downhill to the top of the deposit and begin the search.
2. **Deploy shovel and probe**, pack back on, transceiver to search and stowed, move downhill and be ready to begin pinpoint search when directed, you become a support shoveler.
3. **Deploy shovel**, pack on, transceiver to search and stowed, you are the tip of the spear when 'Strike' is called

The first skier, who is theoretically downhill, has a few responsibilities, has skins on if required, shovel out ready to assist, is also the **site commander**, who holds the big picture so they can direct and observe. They also may be the person who calls for 911 or other help and may need to acquire a location to communicate.

In a multiple burial search, I would try to support two searchers each with a prober/shoveler. It's hard to define every scenario out there, but in situations ranging from dozens of courses to real life situations, having dedicated shoveling and probing resources has proven time and again to be the fastest way to extricate a buried victim. I agree that giving people jobs is important but giving them the right job could be the difference between a bad day with some lessons learned and a horrible day with permanent consequences. ●



JAKE HUTCHINSON is the Technical Director for AAI and Membership Trustee for the A3. He's currently in the slow process of relocating from the Wasatch to the Gore Range and raising/training two Malinois, one for live find and the other for human remains.

Public Health and the Avalanche Industry: WHAT'S THE CONNECTION?

BY KELLY MCNEIL

In the last couple of years, as we battle the ongoing pandemic, people have been hearing a lot more about “public health.” At its core, public health is a simple concept: the health of our population as a whole. For those who work in public health, the overarching goal is to protect and promote the health of our communities and the people who live in them.

It is my opinion that avalanche risk management is a form of public health. Our main objective as avalanche professionals is to keep people safe by providing them with useful tools for decision-making. We are doing the same in public health. Over the course of the next few issues of *The Avalanche Review*, I'll be making a case for utilizing existing theories and evidence-based strategies from public health research within the avalanche risk management industry. **In this first article, I'll establish working definitions for some common public health terms and concepts in order to highlight parallels between the two fields.**

There are two prongs to the concept of public health: **the health of individuals** and **the health of communities**. We also see this in the avalanche context, with “health of individuals” analogous to “personal decision-making in avalanche terrain.” The health of communities, on the other hand, looks like mitigating avalanche danger on public roads and at ski areas or building a robust operational risk management plan to quantify and diminish risk.

A cornerstone of public health is **preventative medicine** and **interventions**. The goal of prevention is to catch people before they're sick or injured; think using seat belts, wearing helmets, or even exercising and maintaining a balanced diet to minimize the risk of heart disease. Prevention might look like education in the form of formal classes, awareness talks, and/or instructive videos, forecast products, and mitigating at ski areas or on roads.

Public health research helps us determine the **best practices** for educating individuals and communities on these prevention and protection measures. Public health practitioners develop programs to assess the needs of a particular population, develop interventions to address those particular needs, implement the intervention within the population, evaluate the effectiveness of the intervention and then disseminate the findings throughout the professional community. This is an effective and proven way to develop


programs to influence both community and individual behaviors. For example, the social-ecological model has been used to understand the relationship between individuals, social factors, and communities. This model demonstrates the range of factors that need to be considered when discussing behavior change among individuals and communities and helps identify potential prevention strategies utilizing the entire community structure (see Figure 1). This is one example of a potentially useful framework from public health that could be beneficial to apply to the field of avalanche risk management.

At the 2016 International Snow Science Workshop in Breckenridge, Colorado, Geisler (2016) presented the use of behavior change theories in avalanche education. They stated that the introduction of the **behavior change theory framework** could help individuals and educators trying to influence behaviors when it comes to the decision-making process. This is

one of the primary areas where we can begin to pull concepts from public health and integrate them into our educational practices.


How can we incorporate existing evidence-based theories and practices that are being used in public health to increase our effectiveness as avalanche professionals? Whether you're writing a forecast product, a patroller managing a rope line, a highway worker using explosives, an educator teaching people about decision-making, or a researcher working to understand and explain these phenomena, our collective goal is to reduce injury and death from avalanches.



The Socio-Ecological Framework.  MODIFIED FROM MCLEROY ET AL., 1988

Our main objective as avalanche professionals is to keep people safe by providing them with useful tools for decision-making.

Throughout this season, we will make a case for the use of public health concepts in the avalanche community. In the December issue, I'll examine the parallels between public health/health education and avalanche education, as well as the use of existing behavior change theories and how they could be utilized to help understand when and why individuals engage in specific behaviors. In the February issue, I will provide answers to the question, Can we learn from existing public health practices on how to disseminate specific messaging to reach different target audiences? In the final article of the series in April, I will focus on avalanche workers' safety and health, both mental and physical.

In order to be as effective as possible as an industry, we can and must learn from others. I'm excited to be collaborating with a working group of avalanche professionals and educators interested in behavioral science this season, including Dr. Sara Boilen, Liz Riggs Meder, and Emma Walker. I look forward to continuing this conversation and invite you to contact me with your thoughts this season. 

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THE SECOND BITE



A triggered avalanche with two skiers caught and one partial burial. Grand Prize, 9650', NNW, ~35 (start zone), SS-ASu-R2-D2-O, 55cm thick, 290' wide, 460' vertical, 930' length of path.

Lee skiing down the first couloir into the land of Gnarnia.

STORY & PHOTOS BY
JONATHAN PREUSS

It was my third day out in the Mushroom Ridge area. I was feeling confident that I knew what was going on in the snowpack. A couple of waves had brought new snow to the mountains after a three-month-long dry spell. This time of year people break out bikes and load up summer wax on skis, meanwhile it was dumping cold snow in the mountains! I love getting out this time of year and skiing steep lines. The new dry snow can change to mashed potatoes within minutes so it's necessary to have a flexible schedule to get the goods.

I put out a desperate message attached with some powder photos from the day before into an Instagram post. "Hit me up if you want to ski tomorrow!" An old friend who I haven't skied with in a long time reached out. I told him to bring all the sharp things he owned and meet at my place. Lee showed up and I opened my laptop with a proposed ski tour plotted on CalTopo. One couloir would give us access to the area referred to as Gnarnia and then we'd climb back out, then traverse a ridge to a north-facing couloir. He looked at me and said, "This is exactly what I wanted to do today." I pointed out three possible exits from our last run, which would bring us out of the Grand Prize drainage.

There are no daily avalanche forecasts delivered this time of year, so it becomes even more important to stay on top of the weather and see what is going on in the snowpack. I mentioned to Lee that the best snow right now was on the north faces (as per usual) and the only stability concern I had was Wind Slabs and Dry Loose problems.

Lee looks up at the corniced ridgeline that halted access into our last couloir of the day.

Lee carefully walking over rocks to get to the line.



STINGS WAY MORE

My thought was to stick to confined terrain features (couloirs), where a precise slope cut could clear away any issues. I wanted to steer clear of big, open faces where it's harder to safely manage wind slab problems.

At the trailhead we talked about rescue equipment, first aid kits, bivy tarps, and repair kits. Then we separated gear between us to travel light and fast. I mentioned where my InReach device was kept and how to use it. This is something I do with anyone I don't tour with on a regular basis, especially my guests I'm taking out for the day. We did a transceiver check and marched up the skintrack.

Lee commented on the drifting snow once we got higher on the ridge. The winds had basically moved snow from most aspects within the last week, so it was challenging to know exactly where the most recent load was coming from. It was going to require looking at each slope individually to assess where or if it was loaded with any new wind transport. There were no recent slab avalanches observed.

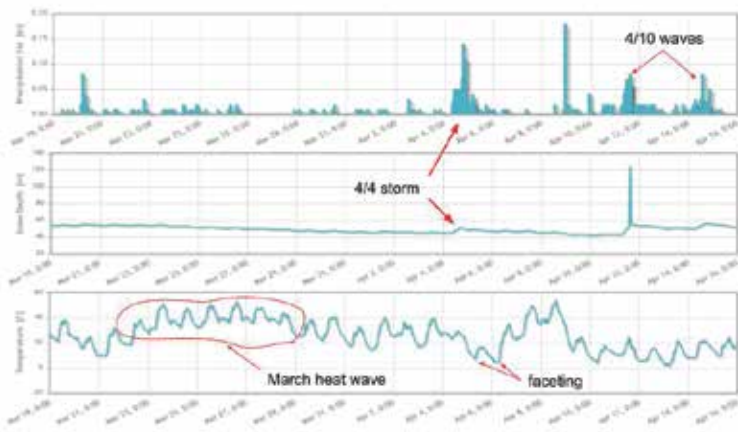
We made it to the top of Mushroom Ridge, where we had to navigate through small rock bands and snowfields. I poked my pole through the snow to feel if there were any slabs sitting over weak layers. Nothing stood out in my rudimentary stability tests. I elected to downhill skin across the small start zone (~50' long) to avoid multiple transitions. Looking back on it now, it would have been much safer to stick to the ridge and not add too much time.

We stood at the top of the first run, a 35°+ NNW couloir that had multiple sections to regroup on the way down. I set a slope cut down to a nice moat that was created over the season with the prevailing NW winds, then continued down fast snow that had pockets of wind-blown pillows for some softer turns. Nothing moved and I yelled up to Lee to come down to me. He skied down and then continued down the last pitch into the aprons. Just as he started to descend, a local couple skied down from the Upper Gnarnia basin. I shouted to him that there was another skier, but he couldn't hear me. I don't like dropping in above other parties. It's bad practice in my mind. If we were to trigger an avalanche, it would be on top of them and possibly add more people buried. But everything was fine and we skinned up to examine our next climb.

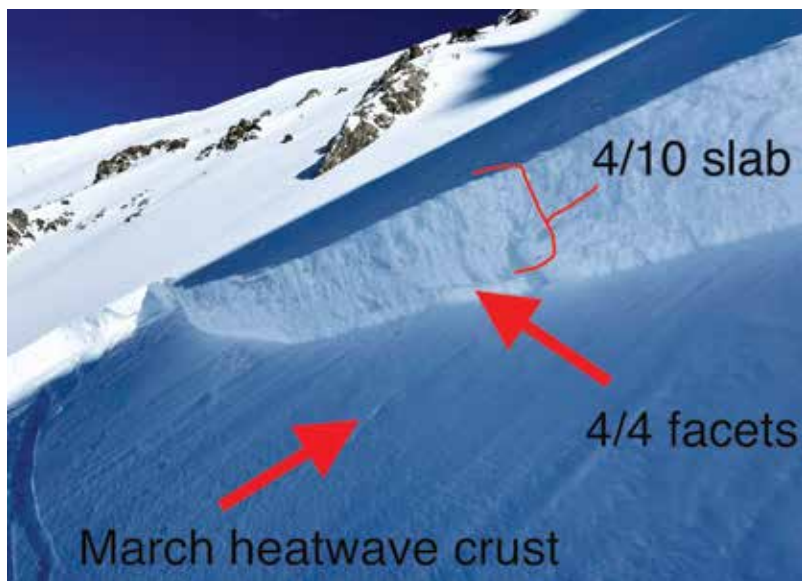
The upper basin was wind blown off the ridges and looked like terrible bootpacking conditions. We decided it would be best to continue down and then wrap around the ridge to gain point 10,126'. There was another small couloir feature to connect us downhill. It was a short, north-facing feature

Lee was a buddy, NOT a guest.

A good case for radios.



Snowpack data from the Lower Titus (9156') weather station, which has similar elevation and is the closest location to the avalanche incident.



The crown of the avalanche captured a clear picture of what had failed in the snowpack.

that I entered with caution. I skied to the rib in the middle and posted up to have eyes on Lee as he skied through the whole pitch. When I can't see the whole descent, I will try to get down to a safe location so I can see the entire line. In the event it slides, you can see the rider and get a last-point-seen location. It was another solid run with even more ski pen (aka deep snow) thus more powder shots!

The next climb was up a steep west face that connected to a ridgeline. We skinned up it and got a view of our previous two runs. Another party of two was skinning out a wide couloir feature back to the Horse Creek exit (refer to "Other Party of 2" GPS track). The slope was 35–45° (based on Slope Shading) and N/NW facing 9200–9500'. I must have subconsciously acknowledged they were moving through steep terrain with no consequences. This undoubtedly created a bias for the day about stability being good.

We finally got up to the last couloir of the day and this is the one I had been drooling over on Google Earth for a week now. I knew it was going to ski great because I skied a similar feature four days earlier and there was more snow out there now. When we got to the ridge to look into the slope, it was riddled with cornices and the entrance looked too rocky to descend from the top. I looked for another way to access the run. I ran up and down to get different views, looking for a weakness in the corniced ridgeline. There was a small entrance that had a little cornice that we could cut loose using a ski to saw off the cornice, leading to a small, delicate traverse that would require walking over lots of rocks to get the couloir. I proposed the plan to Lee; he was

game for it. So we went to work, carefully turning our way into the run and across the face.

After some debate on whether we were skiing or rock climbing, we were in! We skied it in two pitches, regrouping halfway down. It was all-time skiing and we wished it lasted for another 1000'. At the bottom, we looked back up and talked about the run. We discussed our exit plan; I again brought up all three exit strategies in no particular order.

(Refer to the CalTopo interactive map to fully understand the following options.)

Option 1 was to exit through a small, steep section that looked wind-loaded and would require gaining the same ridge we had just walked up. Lots of booting over loose rock—we quickly said no to that option.

Option 2 was to gain the saddle next to where we ended the run. It was a small face with a 200' band of red (35–45° slope shading). This was the fastest way out and was calling our names.

Option 3 was to continue down the basin and wrap around through lower angle terrain. It was the longest way back to the Western Home exit, but by far the safest. The steepest section of this route would be on an east aspect, which was less likely to have any avalanche problems on it with recent sun exposure.

We talked over all of the options and our tired bodies kept going back to Option 2. We had a great day and we were now "smelling the barn." When analyzing skin tracks in avalanche terrain, there are a few points I take into consideration if there are no safer options to move through that terrain and have to ascend steep slopes.

1. Is there a Persistent Slab problem? If the answer is NO, then proceed with caution. Dig to visually verify and periodically check to confirm throughout the climb out. Other avalanche problems should be considered too.
2. Stay on the lowest slope angle as possible. Statistically speaking, the closer you get to the magic number of 38°, the more likely the slope is able to trigger an avalanche. If there is a collapse in a layer, it will travel faster and possibly longer in steeper terrain, thus creating a larger avalanche with more snow to knock you over or get buried deeper.
3. Stick to the deepest snowpack or no snow at all. I'm sure this point will open up some discussion. Some would argue if you are thinking in this manner, then maybe you shouldn't be on that slope. Thinner snowpacks are notorious for being trigger points in avalanches. We are traveling and impacting the snow closer to suspect layers and therefore more likely to initiate failure. So if you stick to the deeper snowpack, you are less likely to trigger anything sitting below in the snowpack, but if you do trigger an avalanche, it will likely be a hard slab which is more destructive and challenging to get off. It is always safer walking up on rock, where you aren't connected to the snowpack, but it is slower and less efficient to carry your skis/boards on your back. Keep in mind that traveling over little sections of snow that are connected to bigger slopes can be ideal spots to trigger avalanches as well.
4. Avoid being above terrain traps (gullies, cliffs, creeks). Make sure your route has a clean runout and an apron, rather than channelized terrain to minimize consequences and stay on top.
5. Are there any environmental factors increasing the chances of causing injury? Is the sun influencing slab consolidation or introducing water into the snowpack to cause Wet Loose or Slab avalanches? Is there rock or cornice fall from above and could we be in the line of fire?

I started to break trail up the exit Option 2 (marked in yellow) towards the saddle that would give us a fast exit back to our vehicle. We were halfway up it and I looked back at Lee and asked if we should ski another run down the skintrack. We agreed it would be great snow, but would make the decision at the top.

I was about a switchback away from being in the clear at the top when I saw snow moving all around me. I remember thinking, "Fuck, not again." I somehow turned myself around and tried to run over (we were in tour mode) towards the flank of the slab. After I fell over on my side, I knew I was in it and reached for the trigger on my avalanche airbag. I could hear it inflate the large red balloon around my back as I tried to push to keep myself on top of the debris. I came to rest on the bed surface and looked up to see what was above me and see if I could see Lee. Then I looked down to see the slide continue down the mountain and I could see Lee on top near the bottom. Everything halted and I shouted down, "Are you alright? Do you need help getting out?" I could see he was on top and only partially buried, so I ripped off my skins and skied down to him.

We were in awe of what just happened. I remember being angry that I just got caught in another slide within three years almost to the day. I felt “like a boxer that’s been knocked down and lost his step”—*Senses Fail*. How did I let that happen again?! Then I couldn’t understand why I felt so calm. The first slide I was in I thought, “I could die in this right now.” But why didn’t I feel the same rush of adrenaline with this one? Was it because I didn’t hear the collapse or that I could feel the bed surface and knew it wasn’t too deep? I knew the runout was clean and a good place to get caught. It was a strange feeling.

Lee was only buried knee deep and right side up, so he was able to wiggle his way free. We talked about the slide and walked through the chain of events. Lee remembered us both shouting avalanche, when I only remember looking at him right before my trauma response went into fight (beast) mode. He heard the collapse when I didn’t hear anything. I remember getting a bad feeling maybe 30 seconds or so before triggering the avalanche.

I have thought back on that feeling a lot since that day. What could I have done at that moment? Calmly tell Lee we should carefully transition to downhill-mode as gently as possible? Should we have just pointed it downhill with skins on and hope we don’t wreck from downhill skinning? What if we triggered it on the way down? Then we would have all of that snow moving above us and be more likely to be buried and not have a chance to get off the slab. Unfortunately, I don’t have an answer to this question, but I can’t help but think about intuition and gut feelings. They are something you shouldn’t just push away.

We came up with a new game plan to get out of there. It didn’t look like too much hangfire above the crown and maybe we could boot up through some rocks. If the hangfire were to release, it wouldn’t be that big and we would be able to get off of it easier than what we just experienced. Option 1 looked wind loaded with snow and we would have to repeat the same ridge bootpack which was slow and tiring. A week later, there would be a visible crown near this option. Option 3 still felt long and we just wanted to get the hell out of the mountains.

So we skinned up the same slope again. Having to climb it again felt like rubbing salt in the wound. I could feel the facets sitting on top of the bed surface which felt like walking over a slick layer of sand. I would occasionally take video and photos to document what happened. When we got up to

the crown, I ran my fingers through the profile. I visually noted the hand hardness of all the layers and where the failure occurred. There was about a 55cm F->4F soft slab sitting over 5cm of faceted snow 1–2mm, which stood on top of a stout Melt/Freeze crust which formed in a week-long heat wave in March. It was an obvious weak layer that I missed. I must have skied over this layer on other slopes within the last week. But now it had a consolidated slab on top of it.

After looking at some nearby weather stations, I put together the pieces that I missed by not digging into the new snow. On April 4, a small storm dropped 4–6” (SWE 0.40–86”) followed by two cold nights which caused it to facet. On April 10, that layer was buried by numerous days of moderate increments of snowfall (23–29”, SWE 1.10–2.25”) over a seven-day period, creating a heavy-over-weak setup in a time when most of us thought we were just skiing powder in a spring-time snowpack (melt freeze cycle).

The snow scientist in me wanted to do some stability tests in a crown profile to see how reactive that layer was and link some corresponding numbers to it. I looked up at what looked like small hangfire from down below and my nerves twitched with the thought of tapping on that

If you’re interested in seeing JP’s digital re-sources, contact the editor at [avalanche.org](mailto:review@avalanche.org).

I put together an **INTERACTIVE MAP** to follow along this story and observations. It was built through CalTopo and there are a bunch of different Map Layers you can toggle through to see Slope Shading (avalanche terrain), Satellite (to see the ski runs), and Mapbuilder (topography lines) to see the terrain features, aspects, and elevations. You can use the folders located on the left to turn on/off (click the arrow in the box) tracks, exit options, etc. which will allow you to focus on one part at a time. Sometimes it can be overwhelming to have everything on the map at once, so you can enable what you would like to see on it. It is best to view through a web browser via laptop or desktop platform and not on the app with your smartphone.



CalTopo

While creating this story on my recent near miss, I wanted to be able to create a visual for my audience to walk through the terrain. Pictures can sometimes help with this story telling, but I think this is where CalTopo is a powerful tool! There are several overlays that are my “go to” while reading maps online. They are Google Layers: Satellite, MapBuilder Topo, and Slope Angle Shading. Depending on what I am specifically looking for while tour planning, is which overlay occupancy is turned on at a higher percentage. Most of the time I have the MapBuilder Topo set to <30% so I have some shape on terrain to the satellite image. And I turn the Slope Angle shading on/off when I want to see avalanche terrain. There is a whole lot more that can be done with CalTopo but that’s for another episode.



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slab. We didn't like our initial plan to bootpack through a small rock couloir, which now looked like 40 feet of tromping over a slab which had avalanched less than 30 minutes ago. A rock rib gave us some more elevation to get closer to the ridge. We executed the plan and made it to the saddle, then transitioned to skiing and moved quickly through runouts back to our vehicle. The hot spring snow turned back to solid snow (aka breakable crusts) and made for survival skiing.

So what did I learn? If I want to grow old in the mountains, I will need to increase my margins of safety. This would be easy to do by just avoiding avalanche terrain, but I know this is unrealistic because I enjoy steep skiing, and as a ski guide, guests request that type of terrain. How can I manage skiing in steep terrain, but not get caught in another slab avalanche? Both times I have now been caught in avalanches when I was skinning. Sometimes there is no other way to get up to the top or through mountains without doing this form of travel. But now I will have to add some more rules to this is an acceptable risk in addition to the previously mentioned points. Here are some thoughts I have come up with:

Burnout: It was the end of a long season filled with managing a small company through COVID and a low snow year. Between guests and guides getting sick and figuring out how to find the good snow after weeks to months of no snow, I was ready to turn the brain off and just go ski some lines. I wasn't tracking the weather as closely as I should have and wasn't taking the time to dig, to see what I was missing out there. Burnout comes most years with seasonal guiding work and will have to be taken into account when skiing in the spring. There is no "taking days off" in the mountains. You have to be fully present and actively reading the current conditions. The day you let your guard down in high risk areas could be the day the mountains show you their true power.

Winter Returned: I was skiing around like it was a locked-up spring snowpack capped with new snow, thinking it was glued to that hard crust from the March heatwave. I wasn't adjusting my mindset (refer to Atkins paper on *Ying, Yang, and You*) to the fact that it was snowing large amounts with periods of time for weather to change those layers. We had a winter with months of no major



The author with airbag deployed.

change in the snowpack. The 12/11 layer plagued us during the beginning of winter as it was trending towards a Deep Slab in certain locations, but ended up going dormant. After that, we have months of Open Season with no major changes in the snowpack. But then winter turned back on in April and May, so I should have accounted for that change with an Assessment mindset. Whenever it snows, we should be digging in the snowpack to see how new snow interacts with old snow.

Other thoughts: The last point is more of an observation than a lesson. When Lee and I debriefed our incident, he mentioned that he knew he was going to be alright because I was wearing an airbag and was likely to stay on the surface and thus could dig him out. This is a new (to me) concept that I haven't thought about before.

Within the coming weeks, the 4/10 persistent weak layer would catch other backcountry travelers off guard. A group of snowmobilers would remote trigger another large avalanche six miles north near Phyllis Lake. There was chatter about another group triggering an unreported avalanche in the Sawtooth Range. A week later, a guided group triggered Cody's Bowl while skiing down. Luckily, the guide was able to ski off the slab and the group was posted up in a safe position on the ridge. The guide trusted their gut instinct which told them to make that last turn right towards lower angle terrain. That gut feeling may have been the key to not getting swept down that path.

Sometimes the mountains feel like a drug that is impossible to give up. They allow us to run away from problems that we face in our real life. But even the safest drugs have shady aspects that require attention, trepidation, and reverence. We have to respect the mountains and in return they will let us come home at the end of the day.

Special thanks to Dan Schwartz for his editing skills and to Lee for helping me share this experience with you all. ●



JONATHAN PREUSS "JP" has been guiding in the mountains of Idaho since 2010. He studied Outdoor Education at Johnson State College. He has been an operations manager, SAR member, educator, and an AMGA certified ski and rock guide. He likes spending time hunting avalanches and continuing the journey of snow science, which he will do this winter as the newest member of the Sawtooth Avalanche Center (SAC) forecasting team.

MONEYBALL—THE REPLACEMENT OF INTUITION WITH DATA

The central premise of Moneyball is that the collective and accumulated wisdom of baseball insiders, including players, managers, coaches, and scouts, is doomed to failure. It states that despite ample opportunity to refine their skills over years of practice, their selection of players turned out to be subjective and often flawed. Moneyball advocates the replacement of intuition with data. Decisions should be based solely on evidence and reason. That is how you win. When the evidence points one way and gut feeling points another, you go with the evidence, whether in baseball or in avalanche terrain.

In North American avalanche education we've been playing Moneyball for many years now, replacing intuition in an uncertain world with the absolutes of any and all data and information we can find. But is there still room for us to cultivate

intuitive thinking? Should we be tapping into our gut feeling for assistance when it comes to complex, fast evolving high stress situations?

According to Kahneman in *Thinking Fast and Slow*, expert intuition is gained when three criteria are met:

- Repeated practice.
- Immediate feedback. You have to know at the time whether you got it right or wrong.
- Regular order in a high validity environment, such as in a game like chess.

Unless these three conditions are satisfied, expert intuition will be difficult to obtain. Here lies the rub: we seldom operate in a high-validity environment when we are dealing with the uncertainty and spatial variability of a winter mountain snowpack. Indeed, well trained backcountry users are likely to avoid the avalanche problem altogether by prudent use of the avalanche forecast. It is only when we engage with an

Don't trust your instincts: you'll wake up in jail.
—Andy Jerram,
ski instructor to the rich & famous.

Agree for some avalanche professions and agree for some avalanche problems. In other words, ski patrollers are hunters and seek out wind/storm slabs; most bc users avoid all.

Using Intuition In The Backcountry

MOVING ON FROM THE

MONEYBALL

Sabermetrics: the search for objective knowledge about baseball by analyzing statistical records, has transformed the sport. Its concepts are encapsulated in the Hollywood movie Moneyball, starring Brad Pitt and based on the book Moneyball: The Art of Winning an Unfair Game, by Michael Lewis.

MINDSET

BY MIKE AUSTIN

COMMENTARY BY DREW HARDESTY

Your goal shouldn't be to buy players. Your goal should be to buy wins.

—Moneyball.

But what about Klein? AHA – you get to him later....

I would love to see this experiment done with rookie and 20-year patrollers!

avalanche problem that we begin to truly understand it. Only a subsection of backcountry users, such as forecasters and ski patrollers running mitigation, actively go out and seek avalanches on a regular basis, and even then, it is not uncommon for them to operate in a feedback vacuum. If Kahneman is correct then expert intuition has no business in our backcountry decision-making. Indeed, research looking into the effectiveness of Sabermetrics shows that even when experts were given the baseline information of the statistics and then asked to add to it with their expertise and intuition, they actually performed worse than novices given the same data.

THE FAILURE OF INTUITION IN MOUNTAIN PROFESSIONALS

The inability for us to meet Kahneman's three criteria for developing expert intuition whilst operating in the uncertainties of the backcountry is perhaps partly the reason why guides feature so heavily in avalanche involvements¹. They falsely believe that the process of repeated practice alone is meeting the criteria for gaining expert intuition, they are trying to develop expert intuition in a low validity environment without immediate feedback.

Avalanche training for mountain guides in Europe remains much less structured, formalized, or as in depth as that of their North American counterparts. The insular nature of the European mountain guiding profession, seldom operating in teams or working for guiding outfits, has newly

qualified guides lacking the required mentorship to provide the nuanced feedback from the snowpack needed to cultivate intuition².

Kahneman also refers to fractionation of skill as another source of overconfidence. Professionals who have expertise in some tasks are sometimes called upon to make judgments in areas in which they have no real skill. Expert skiers with the skills to guide guests in a high mountain environment, and indeed have undergone a degree of avalanche training, are expected to make subtle judgments in areas in which many have no depth of expertise. Put bluntly, they're not nearly as good as they have been told they are when placed in an avalanche environment.

So that's it. Intuition has no place in the backcountry. It coerces mountain professionals into making poor decisions and we should continue to focus on honing a Moneyball mindset, checking our human behaviors, and seeking out data. Right? Well perhaps not...

Iain Stewart-Patterson, an IFMGA mountain guide and professor at Thompson River University, argues that ski guide training programs could and should incorporate intuition-based avalanche training in addition to the analytical training they currently receive. He noted that the ski guides in his study group regularly relied upon their intuition regardless of the level of their formalized avalanche training. It would therefore seem at odds not to train and develop that intuition. Our reluctance to teach intuition is likely due to the perceived difficulties involved in such a training

process, fortunately Stewart-Patterson offers solutions; such as providing an opportunity for structured feedback from peers during p.m. guides meetings, extended periods of debriefed tail guiding and utilizing low fidelity simulation training as used in other high-risk decision-making industries.

Intuition is a Warning.
—Ian McCammon

MONT CHARVIN

On New Year's Eve 2019 four of us set out to ski from the summit of Mont Charvin, a popular one-day ski tour in the Aravis Range of mountains close to the Mont Blanc massif in France. Unglaciated and non-technical, it's a good early season objective. The Aravis Range is prone to glide avalanches throughout the season due to its slopes being steep and long grassed, providing an ideal sliding surface for the snowpack. On arrival at the bitterly cold trailhead we noted that our route of ascent had a hanging fish mouth of a glide crack threatening part of our up track on the final headwall, to which we'd be exposed to for an hour or so. We briefly commented on it then dismissed it. Temperatures were frigid in our pre-dawn start. As a strong fast team of four we'd be stripping skins on the summit by mid-morning before any warmth from the weak December sunshine could have any meaningful effect on the snowpack up high.

Three hours later and 50 meters directly beneath the giant fish mouth, we approached the safety of the summit ridge, the snowpack was indeed feeling completely locked up as we transitioned to ski crampons to tackle the steep hard snow of the headwall. I felt a small 'pop' beneath my skis. Not a whoomph, not a collapse, just a weird tiny little pop. A while later as the sun finally came onto the face I felt another similar pop—more distinctive this time. Glide avalanches are notoriously difficult to predict and offer little in the way of clues to their imminent detachment. We'd be through the danger zone within five minutes if we continued skinning up. A short but succinct discussion was initiated by one of the team:

*I felt a really weird pop.
Huh! Yeah me too, I've felt it twice now.
Let's get out of here. (it wasn't a suggestion my ski partner was making, he was alarmed and already stripping his skins—fast!)
Umm...Okay!*

Suddenly gut feeling had our cortisol levels red lining. I recall thinking: 'these guys think we're nuts' as a group approached us from the skin track below, watching us inexplicably transition and traverse away. Three minutes later and barely out of its path, a glide avalanche released full depth; playing pinball with several groups ascending below us.

Back at the safety of a flat meadow beneath our peak, having checked on the walking wounded, we contemplated our decision-making that day as the first of the PGHM rescue helis came into view. Was it my partner's intuition that saved the day? Clearly a failure in our heuristic thinking had placed us in the line of fire, but did my Moneyball mindset keep me on the slope too long, waiting for additional information in order to complete my decision-making process?

AN INTUITION-BASED DECISION MODEL

As an industry that has bought in into the Moneyball mindset complemented by a heuristics and biases view of how we should make our decisions, perhaps we have overlooked elements of an intuition mindset that have the potential to serve us well? We have failed to appreciate the value of other decision-making models. The Naturalistic Decision Making (NDM) model as championed by Gary Klein, unlike Kahneman, advocates using intuition as part of the natural process of how we arrive at a decision in real world situations. Interestingly for us, he observes it is of particular value to practitioners that operate in high-risk environments.

SCIENTISTS SEEK THE TRUTH. PRACTITIONERS SEARCH FOR SURVIVAL

Klein looked at the decision-making process of certain groups in society, primarily risk practitioners. These groups had developed expertise in fast, high consequence uncertain environments. He examined how firefighters, fighter pilots, and police officers made their decisions. He concluded that these groups developed intuition that was worth trusting. His research can be seen to be particularly valuable in the avalanche realm as the study environment was based on those operating in the field, opposed to university-based control groups often used in the experiments conducted into Heuristics and Biases.

Klein observed that first responders who operated in *High Risk / High Frequency* events developed what he described as Recognition Primed Decision Making (RPD). To his surprise the firefighters he studied weren't interested in weighing up options to make their decisions as he had anticipated, but that they simply sought recognition of past similar situations that they had built up in their memory over years of experience. They would then pattern match their mental database to the task in front of them and then re-enact or adapt similar solutions that had worked for them previously.

The caveat here is that this is a tool for experts. Only experts have gained sufficient experience in all aspects of their field to possess a rich repertoire

Mount Charvin New Year's Eve avalanche. Injured parties can be seen at mid height and at the base of the peak.
MIKE AUSTIN AND DATA-AVALANCHE.ORG



of patterns in their memory, being able to make fine discriminations that may be invisible to others. They possess sophisticated mental models of how things work, even though they often cannot verbalize the rationale for their actions, and have resilience to adapt to complex and dynamic situations. These experts have developed their intuition as a tool.

An intuitive decision style provides the ability to make quick high-quality decisions when time is short. It follows that it will work well when we are tired, cold, and suffering from cognitive overload. In this respect Klein's understanding of intuition overlaps with the concept of Kahneman's System 1 thinking.

Compare this to an analytical decision style. Analytical thinkers want their decision-making process in the mountains to be like chess, when in fact operating in the uncertainty of a winter snowpack is more akin to playing poker. While both are games of skill, chess has all the information required to win laid out in front of us: a Moneyball data-rich environment. In contrast, poker is full of hidden information where we are often putting the jigsaw together in the dark. The problem with being embedded in an analytical mindset is that we operate in an environment where availability of data is often scarce, spatially distributed and constantly changing. We need tools to address uncertainty and using intuition is a tool that can help us.

RECOGNITION PRIMED DECISION MAKING (RPD)—A TOOL FOR SURVIVAL AND RESILIENCE

As an avalanche practitioner I'm always looking for an edge when setting up for a day in the mountains, usually in the form of a stack of small margins that I judiciously load up on for breakfast washed down with a big steaming mug of Moneyball data. If a Moneyball mindset gives us a baseline from which to make decisions in avalanche terrain, we can use this baseline to identify anomalies. After all, isn't intuition simply the subconscious noting the pattern being incorrect?

For expert practitioners, using intuition in *high risk / high frequency* situations is their default operating method. But it is their ability to recognize that they are in a *high risk / low frequency event* that will get them off the slope when the Moneyball data says they're still good to go, such as the weird little pops in the snowpack on Mont Charvin.

High risk / low frequency is the '404—no results found' page we get when searching for pattern recognition in our memory banks for previous similar situations. These previously unencountered anomalies in the patterns that we struggle to reconcile should be a red flag. It is in these *high risk / low frequency* encounters where bad decisions occur and outcomes are often catastrophic. Recognizing where we are located within our margins of safety gives us the opportunity to relocate ourselves in this space. Decision-making expert Laura Maguire argues that this recognition of where we stand in relation to an acceptable threshold is true **resilience**.

NATURALISTIC DECISION MAKING (NDM)—A PATHWAY TO REFLECTION

Steven Haines, a Geneva-based touch therapies specialist and author of a series of books on the interaction of body and mind, attended a Rec Level 2 we ran in the mountains surrounding

Chamonix last season. He offered the insight that we can train instinct by learning to value and pay attention to our feelings—as sensations and as emotions. 'The former leads to the latter. Instinct becomes a skill to be developed.'

This isn't as warm and fuzzy as it may sound³. Haines added that he appreciated our invitation to the students to pause at key moments of their day, but from his perspective for reasons we hadn't even considered. As avalanche educators we know that slowing down at key moments: transitions from the up track to the descent, preparing to drop into a consequential line or throwing a hand charge during a control line run, can provide a valuable pause to foster situational awareness and facilitate communication. Haines offered a refinement he valued; whilst in the pause to notice how present you are or how absent you feel. There's a value to this form of self-grounding for making decisions from a good place. **In essence, self-awareness is critical to effective situational awareness. Being centered improves our intuitive decision making.**

INTUITION TOOLS

- Expert intuition is reliant on experience. In the low validity environment of avalanche terrain, it requires coaching and mentoring from skilled practitioners over an extended period to address the lack of timely feedback.
- We must be honest with our level of expertise. Mountain professionals with a handful of seasons under their belts lack the personal database to use intuition reliably.
- Use intuition as a one-way valve: use it to say no—never to say go.
- Value tapping into your feelings, both physical and mental during your day. Especially during a pause at key moments. Self-awareness facilitates better situational awareness.
- Anomalies are missing gaps in our personal database of knowledge where intuition has little value. Recognizing anomalies is a cue to relocate yourself within your set safety margin, they're a warning to change your plan or back off.

It's useful to demystify intuition. Experts who possess intuition are often perceived to have a shaman-like aura. Both Klein & Kahneman agree that intuition is simply the recognition of patterns. Lynne Wolfe observes that intuition can be viewed not as a linear single thread of information along a timeline, but as stitches in a tapestry that we connect subconsciously to form a feeling in the background.

Whilst it may be difficult to gain expert intuition in the low validity environment of the mountains, once obtained it can be a powerful tool in addressing uncertainty and can complement a heuristics and biases mindset. Intuition and analytical models are not mutually exclusive events or processes. The blending of a human factors and Naturalistic Decision Making will always be a better strategy than relying solely on a Moneyball mindset. ●

I hate losing more than I love winning.
— Moneyball

See Mike's article Short Stack in TAR 40.1 about the analogy of playing poker in the avalanche world.



Risk/ Frequency matrix. ■ GORDON GRAHAM

One thing that I really have appreciated is how Amy Pertuz recommends lots of "mini-forecasts" to attune us to conditions. We've talked a fair bit in the last year; she's an avy pro in Colorado. She is in TAR 40.2 Early Winter. Reach out to her.

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BEYOND FACETS

Evolving the way we think about the Human Factor

BY DR. SARA BOILEN, LIZ RIGGS MEDER, & EMMA WALKER

When John Lawton invented the first avalanche beacon at Cornell in 1968, he made a monumental leap forward for backcountry safety. His Skadi beacon, developed with significant input from Ed LaChapelle and fondly called the “hot dog,” pulsed electricity through a copper coil, resulting in sounds in the searching party’s headset that got louder as the receiving unit got closer to the buried victim. It would not be an exaggeration to say this was groundbreaking.

What Lawton set in motion at his Cornell lab has seen substantial improvements in the half-century since the Skadi hit the market. An increase in analog frequency in 1986 meant a longer range, and BCA rolled out the first digital beacon in 1997. Today, three-antenna transceivers are the norm, and we continue to see improvements in the technology every couple of seasons.

It’s time to apply that same thinking to subjective hazards we face in the backcountry.

When Ian McCammon first brought the phrase “heuristic trap” to the avalanche community at the 2002 ISSW in Penticton, he quantified something that he believed most travelers in avalanche terrain already knew. “Even though people are capable of making decisions in a thorough and methodical way,” he wrote in that paper, “it appears that most of the time they don’t.” In the last twenty years, McCammon’s work has often been used to answer that question: Why do people make decisions that have such terrible consequences?

Even though people are capable of making decisions in a thorough and methodical way, it appears that most of the time they don’t.

But McCammon never meant for his research to be an answer.

“I wrote that a long time ago,” he chuckled when we brought up his 2002 Penticton paper in a recent phone interview. McCammon believed his research would be a jumping-off point for further studies, papers, and inquiries. “Just teaching people about these traps isn’t enough to keep them from falling into them,” he told us. “My real hope was that it would be a kickstart for other applied research. I want people to say, ‘That’s great, but you know what we really need to do?’”

When Lawton built a beacon, researchers and developers saw it as an opportunity for continued improvements. Indeed, the recent recalls of several avalanche transceivers are not evidence of some inherent failing in the technology, but of a continued and concerted effort to be sure that people are using the best possible devices for the best possible outcomes. When it comes to behavioral sciences, though, we stopped at the “hot dog.”

Today, an overview of the acronym FACETS is sometimes used as a stand-in for an avalanche education lesson in and of itself. But FACETS was never intended to be a tool or educational point in and of itself: “Numerous studies suggest that merely learning a taxonomy of persuasion tricks does not make people any less susceptible to them,” McCammon wrote in 2002, specifically citing Pratkanis and Aronson (2000). “Thus it seems likely that effective human factors education must do more than provide a laundry list of heuristic traps: It must give people simple, viable tools for recognizing and mitigating heuristic traps and other decision errors in avalanche terrain.”



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The backcountry is not always a wicked learning environment.

■ MARK WHITE

It's time to evolve our thinking about human factors to the equivalent of a modern three-antenna digital beacon.

In response to McCammon's work, many educators began individually and collectively trying various methods to give students a process or the knowledge to counter common heuristic traps. Agencies and individuals created frameworks and procedures. Some even borrowed from other disciplines and adjusted those risk management strategies to apply them to risk in avalanche terrain. If FACETS is a hot dog, these frameworks are potentially two-antenna beacons. The problem is that we haven't figured out if those people have actually taken it out of the box and are using it properly—never mind whether it's actually helping them.

This leaves behavioral science in the avalanche world in its current predicament. In short, our technology and knowledge are not progressing and improving year over year. But—no less than beacon technology—our lives depend on them. McCammon built on the early work of Fredston and Fesler and Tremper, and by analyzing nearly 600 avalanche accidents and identifying common patterns and decision-making influences, attached data to their ideas and gave us a common language. Now, it's time to evolve our thinking about human factors to the equivalent of a modern three antenna digital beacon.

To help advance us to the next breakthrough, we think we should be working together to answer these questions:

1. What is currently being taught about human behavior and decision-making? What tools and processes have been developed to help people counter heuristic traps? What ideas and theories are informing how we communicate with the public?
2. What do participants actually take away from these courses? In other words, is our instruction effective? How do the end users understand our forecasts and hazard messaging communications?
3. How is this changing participants' behaviors? Are those behaviors leading to a reduction of accidents and near misses?

We are committed to taking the baton from McCammon and matching our understanding and education of human behavior in avalanche terrain with our knowledge of snow mechanics, radio technology, and rescue techniques. These questions just scratch the surface of the work to be done in this realm, and we're excited to see others involved; we know that researchers, such as those at Montana State University, Simon Fraser University, and others are trying to answer some of these questions as well. In other words:

some of this work is already happening, and we believe it's time to unify our efforts in order to amplify that work.

This fall, we will embark on this collaborative process by conducting focus groups at several regional SAWs, with the hope of a better understanding of question #1. Over the course of this coming season, we'll share the answers we uncover. The qualitative research will guide our next steps so that we can begin to build a roadmap for collaboration within our industry to address questions #2 and #3.

This work requires collaboration across disciplines. In the physical sciences, we see sound partnerships between researchers and practitioners, and we want to help our industry emulate those relationships with other fields. Our goal is to build a roadmap for collaboration within and outside of the avalanche world, with fields like psychology, education, and public health, and to draw upon existing expertise so that we can make our way to that metaphorical three-antenna digital beacon.

At the end of our conversation with McCammon, he reiterated his hope that more research will be done in this realm. "Here we are, 20 years later, and people are still dying from the same effects," he pointed out. "I really hope somebody either proves my early work wrong—or improves it immensely." ●

RESOURCES

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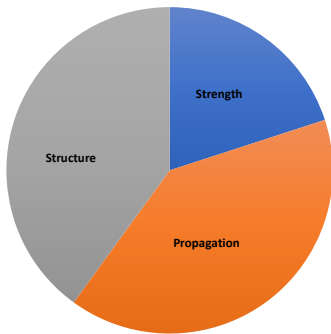
EMMA WALKER holds an MS degree in outdoor and environmental education from Alaska Pacific University. She is the author of *Dead Reckoning: Learning from Accidents in the Outdoors*, has edited two volumes of *The Snowy Torrents*, and works as AIARE's Curriculum Manager.

STRENGTH, STRUCTURE,

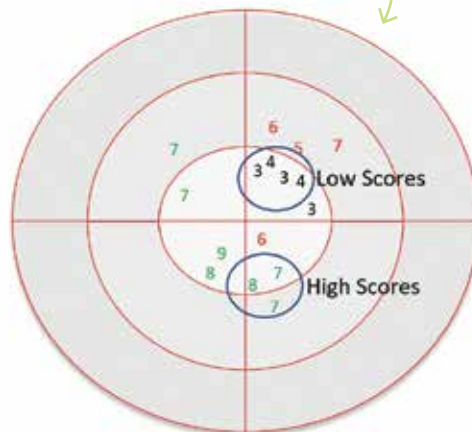
BY DAVID RICHARDS

Can we score a snowpit for more effective communication and decision-making?

Often, I find myself in a quandary. Digging a snowpit with a newer (or sometimes more experienced) snow person and when all is said and done, they look at me and say, “so what does that mean?” I have had this happen with new skiers, students, ski patrollers, and even my wife. (This last one is most alarming since she hears me spew snow talk daily.) To me this indicates a problem in our ability to understand snowpit information and more importantly, to communicate those findings. Perhaps this proposed method will help with that communication. As a caveat, what I am about to propose is not designed to communicate stability in **wet slab** conditions.



scores. Imagine a set of observations being made to an Avalanche Center with pit scores of 1 to 9. You look at the observations and see that all pits on mid elevation Northeast are expressed with a similar score which reflects lower stability. At the same time, the numbers on Southwest are showing higher scores and thus higher stability. Voila, you have an instant “heat map,” if you will, of snow pits and easy to interpret data. Many forecast centers produce heat maps of where avalanches have been occurring. Perhaps one could be produced daily based on observations and the possibility of where they will occur in the future by simply using scores of snow pits? **See example below:**



three simple factors. Is there a persistent weak layer? Is there a weak layer less than one meter deep? And is there a hand hardness change of one step or greater.

Using this concept, snowpit findings exhibiting more stable snow would be scored with a higher number and those with less stable findings would score within the lower range. By using this scoring method, the interpreted stability would be easier to communicate and for other users or observers to understand at first glance. The idea might make the information that is shared between users, or to a Forecast Center more uniform, more usable, and easier to disseminate.

	Rating	Description	Score
Strength	Difficult	Tap score 21-30	3
	Moderate	Tap score 11-20	2
	Easy	Tap score 0-10	1
Propagation	ECTX	ECT Provided No Results	3
	ECTN	ECT Provided No Propagation	2
	ECTP*	ECT Provided Full Propagation	1
	ECTPV*	ECT Fails With full propagation on Isolation	0
Structure	Good	layer	3
	Fair	meter deep and lacking a PWL	2
	Poor	Strong snow on top of weak snow, PWL is present	1
	Very Poor*	All Lemons or PHD factors are present	0

Total Score =

While this article was in development, we debated back and forth about whether any component of the stability wheel dominated the assessment. Full propagation automatically affects the Structure score: **see Rules.**

A snowpit was once viewed solely as a forecasting tool. However, with the advent of newer testing methods, a pit is now often viewed as an indicator of stability and is used as a now-casting tool. Many years ago, Liam Fitzgerald presented me with the concept (the original source of this concept was presented as the Stability Wheel by Don Sharaf, TAR 2003) of looking at snowpit information and the interpreted stability through the lens of “Strength, Structure and Energy.” Then, rating each factor with a score of Good, Fair or Poor. I have continued to use this method personally to interpret findings and it is now taught in Level 1 curriculum. However, it has since changed from the concept of “Energy” to a more easily identified and more pertinent term: “Propagation.”

This method works very well; Strength, Structure and Propagation are three things that everyone, from the most basic user to the wily veteran can easily see and interpret. These factors do not need a magnifying loupe or any special skill—only a set of eyes, a hand, a shovel and ECT cord, and the ability to count. Further, the beauty of these three factors is that they can easily be given a score. But that said, it is still difficult for many people to communicate the snowpit findings in comparison to overall stability. We need to do better than “so what?” or “looks good to me.”

I propose that these three simple and observable factors could be scored numerically. Then, using very simple addition, the overall interpretation of the findings could be rated through the sum of the

It is important to note that using this method, we are not providing a go, no go number. (That may come later if it is used widely and we see that many accidents do in fact occur when scores are lower for the overall pit, but the amount of data and research that would require is yet to come.) However, this process may be useful in choosing terrain appropriate for the snowpack, as well as proving useful for tracking a persistent weak layer over time.

What I am proposing here is the use of scoring.

In the interest of giving weight to the two factors of Structure and Propagation, which most people agree are the two most important factors measured by the Strength, Structure, Propagation Stability wheel I propose that weight is given through the application of three rules as opposed to changing the scoring numbers within the model. This reasoning is based on simplicity. If we were to change the numerical value of different factors, the model is less easy to remember and thus less likely to be used effectively.

Three rules apply:

- *If PWL exists Structure score ≤ 1**
- *If ECTPV then Structure score = 0**
- *If ECTP then Structure ≤ 1**

Further, I would encourage that if one is in doubt, scores should default to the lower number. In this model the structure is defined through

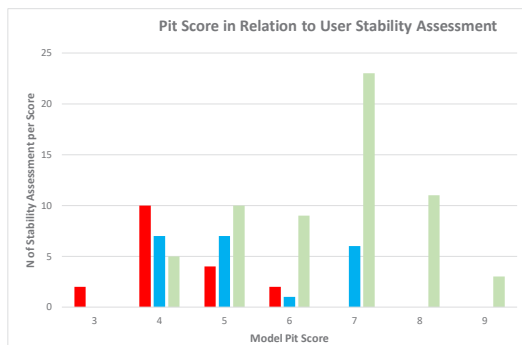
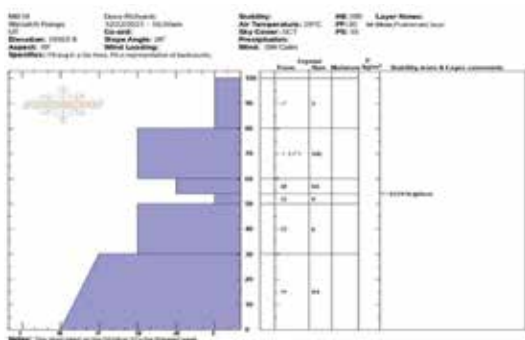
For example: if we were to dig a pit 150cm in depth with a faceted layer of snow at 90cm, then perform an Extended Column Test (ECT) which scores ECTP 17. Using this method; our pit score would equal four, not something I would be particularly happy with. Meanwhile, another aspect has the same faceted layer, but an ECTN 25. We are improving with a score of 6; still not great, but better. And finally, we dig pit number three, which lacks the facets but has a non-persistent weakness 130cm down and a score ECTN 23. Our score is seven, improving. The higher your score, the better things are looking, just like elementary school (or the Glasgow Coma scale depending on your level of cheeriness).

If we look at this from the point of view of the average user of an Avalanche Forecast Center website, they may look at the snowpit image below and try to make the most of it. But many people who do not graph pits for a profession would likely get lost in the sauce. Try it! I just did with my wife, an experienced user, with Level 1 education and a husband that will not shut up about snow and other silly stuff. She literally said, “what does this mean?”

There must be a way to communicate this data more effectively and more efficiently. Now if we look at the same pit and I tell my wife it has a score of 3, she says “oh, that sucks.” I have gotten the point across.

The pit was scored zero for structure based on the presence of a PWL, depth, and a hardness

PROPAGATION



change. It scored one for propagation with an ECTP, and two for Strength with a tap of fourteen. The slope avalanched later in the week.

After discussing this concept with a few folks, I have bumped into a couple of walls. The first question, raised by some people is this: should propagation be weighted more heavily than other factors? A very valid point for sure, for if the fracture cannot propagate then there is no avalanche. In response I raise these points: tests are suspect in deeper snowpacks, thus structure trumps all in that instance. Second, tests are known for false stable results. This is either due to spatial variability or poorly performed tests, among other things. These factors are true when tests show lack of propagation. However, when propagation is present, this scoring method does heavily weight its score. I would point out that Propagation scores by default affect strength scores. If ECTX, then Strength is equal to three and if ECTP then structure score is defaulted to one. Through these rules, we weight Propagation and Structure to default to lower scores when the culprits are present.

These rules for the scoring process do not completely put the argument to bed. Other people, including myself, would say that structure trumps all, and in a deeper snowpack that is difficult to evaluate, that is probably right. Thus, the weighted score of the presence of a PWL ruling that Structure defaults immediately to one. However, even with these rules to address Structure and Propagation, I am sure that faults exist in the model. Yet, it seems that this model works well for the presence of most avalanche problems.

Does this concept work in practice? To examine that question I have examined 100 snow pits drawn from the Snow Pilot data base. To be considered the pit data must include an ECT score as well as an observer's Stability rating. Pits were selected without prejudice to date or international location. Looking at these pit entries, I first examined the Structure and then the ECT scores of the pit. Based on this, the pit was scored using the scoring model. At this point the score was compared to the stated "Stability" reported by the recorder. This comparison showed good correlation between the use of the model and the users stability assignments in the case of Poor and Fair assessments. There was also a generally strong agreement when the model scored a high number with the assessment of good stability. However, it does appear that there is a disagreement between the model and the user resulting in some users rating a pit with a good stability when the numerical score is in fact low. This appears to be the result of weaknesses in the upper snowpack (top 30cm) which would result in lower pit scores but not occur to the user as a severe problem.

This comparison is promising in that it shows that the model, if widely used would not only work, but will reduce the variability in the perceived stability rating reported by the user. By standardizing the scoring method through a numerical value, much of the ambiguity of stability assessment may in fact be removed.

It is important to note that at this point this model is being used only with the Extended Column Test. However, a non-scientific observation of recorded snow pits on the Snow Pilot database shows that a great many users do not either utilize this test, or do not record it. This poses the question as to whether this scoring model could be utilized with other testing methods such as a Compression Test (CT) or perhaps even a Deep Tap Test? The author believes that the answer is yes. The model can be used with any test of the user's choice as long as the conditions of equal weight and accurate interpretation are met.

The process of scoring a snowpit has been discussed for many years, and for sure this simple method may be (hopefully is) just the first step and part of a conversation. That said, it seems that for the purpose of communicating instability to the greater community and perhaps for the purpose of further research in the future, maybe this step is worthwhile.

We work in an environment of increasingly complex data and even more complex language that we use to explain that data. Without a doubt there is value in the nitty gritty, but the modern era has led to a short attention span. Thus, the avalanche rose at the top of the page, and the pictures to explain avalanche problems. It is widely acknowledged that the more we reduce the information in an idea, the more likely it is that the information will stick. Perhaps through a scoring method the avalanche community could do ourselves a favor and more easily communicate instability through simple math and a more simple number.

When it really comes down to it, I would rather ski an eight than a four. That is something that can make sense to everyone. ●



DAVID RICHARDS is the Director of the Avalanche Program for Alta Ski Area. He has worked as a guide, rescuer, and educator. He is still wondering why he can't communicate with people after all these years.



GABRIELLE ANTONIOLI works for the Boise State CryoGARS group with a focus on SnowEx work. She also forecasts for the Going-to-the-Sun Road in Glacier National Park.

Grom,

Thanks for sending this my way. I feel honored to be on the shortlist-- not sure it's deserved, but I'll take it.

First of all, I really like the premise. Really, anything that takes messier data and makes it more quantifiable while maintaining quality is appealing. My comments are summarized below:

1. This would be a great tool operationally to track structure on different aspects, particularly within a ski patrol or a forecaster group-- anyone with enough experience. Hard to quantify that experience thing, but safe to say that in professional organizations it would be incredibly useful to have these heat maps. Overlay it with av activity and it becomes even more interesting. I'd like to try out using it for a season!

2. I think the harder sell might be getting average users to derive further numbers from numbers they already struggle deriving and integrating meaning from. I think WE find the tests to be easy and interpretable. The avg user's pit can be a mess, so the challenging part here might be having them derive a score/meaning from that with something they already struggle deriving meaning from unless it is very obvious.

3. I think propagation and structure should be equally weighted. There are plenty of times where structure alone turns me away, more often than not, regardless of propagation. Low ECTN scores with the right slab setup/appearance, I essentially regard as propagation. Usually, it only takes a little bit of extrapolation experience and imagination to know what will make it propagate.

Cheers,

G

NEW TECHNIQUES FOR VIEWING AND COMPARING AVALANCHE SEASONS

“
IN TERMS OF AVALANCHE FATALITIES, LAST SEASON ENDED WELL BELOW THE LONG-TERM AVERAGE.

NAC

National Avalanche Center

The 2021–22 season was another winter of extremes. November and December brought heavy snowfall, providing a good base in many parts of the country. That was fortunate because high pressure planted itself over the western U.S. for the next six weeks, leading to exceptionally dry conditions. Parts of California near Tahoe went from a record setting high SWE in December to record low snowfalls and SWE for January and February. Alaska fared much better, enjoying abundant snowfall, often down to sea level.

In terms of avalanche fatalities, last season ended well below the long-term average with 17 deaths. These were evenly spread across user groups, with seven snowmobile/snowbike deaths, six skier/snowboarder fatalities, and four snowshoer/climber/hiker deaths. While every death sends tragic ripples through our mountain communities, last season felt like a bit of a reprieve from the record 37 avalanche fatalities during the 2020–21 winter.

It’s challenging to characterize and compare avalanche seasons beyond using generalized words and a generous dose of hand-waving. Previously, we lacked an effective way to visualize how avalanche danger ebbs and flows across the country during a particular winter. Thankfully, this is changing. For the

past six years we have databased the avalanche danger data that populates the National Avalanche Danger Map at www.avalanche.org. Now we are working with Scott Havens and Clark Corey of Snowbound Solutions to visualize these data in ways that allow us to better understand changes in avalanche danger through time and space.

Here we use these visualizations to compare last season (Figure 1), when we had relatively fewer deaths, to the 2020–21 season (Figure 2), with its record high number of fatalities. In these Figures, the date runs along the x-axis, the forecast zones (by Type 1 avalanche center) are along the y-axis, and the colors represent the highest danger level for that zone and day. These graphics provide a new way to demonstrate temporal and spatial changes

2021–2022 BACKCOUNTRY AVALANCHE DANGER BY ZONE

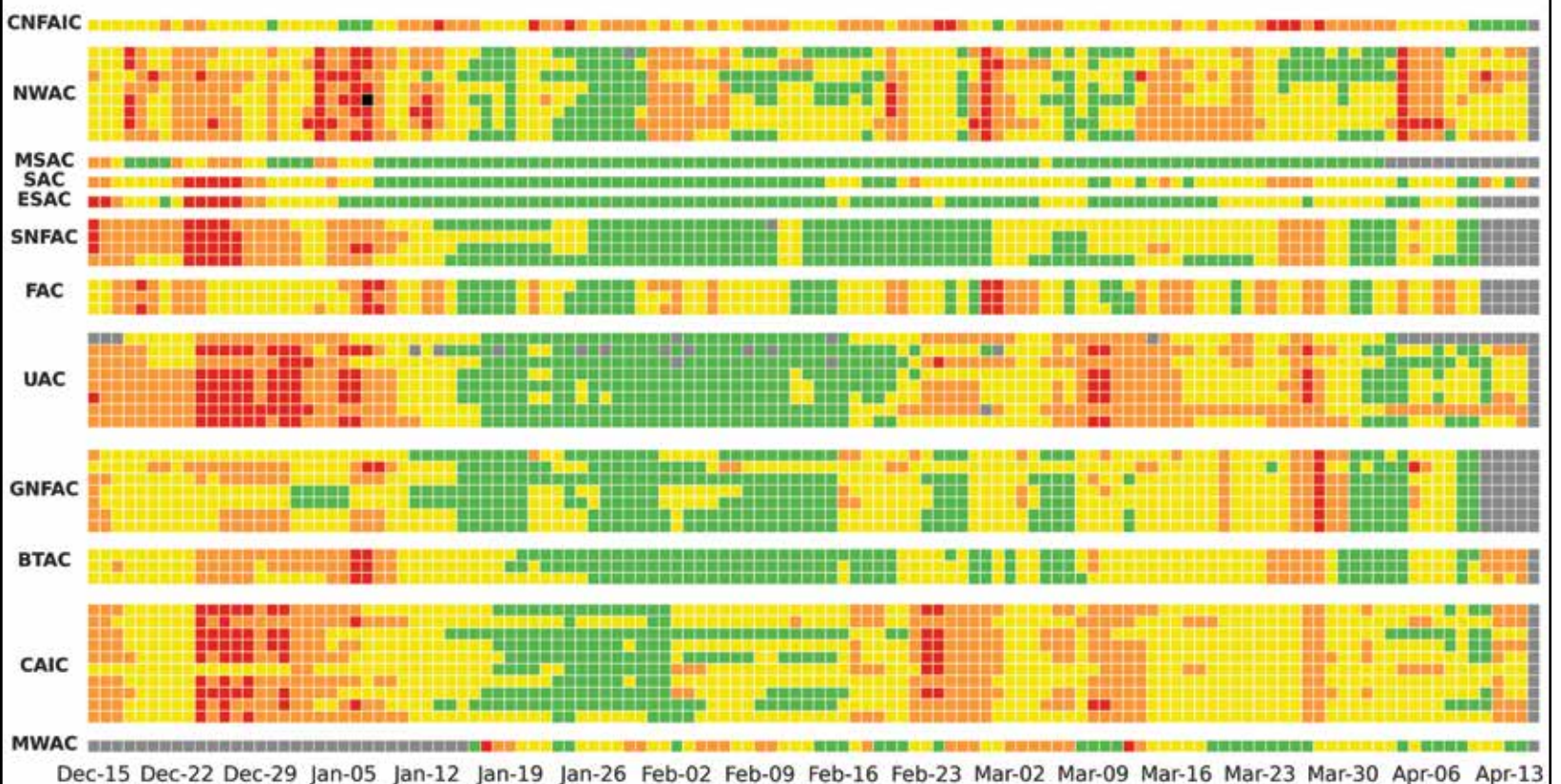


FIGURE 1: The highest avalanche danger for each avalanche forecast zone for the 2021–22 winter. The y-axis is ordered by Type 1 Avalanche Center, the x-axis is the date during the season, and the color represents the avalanche danger for that day and zone. Note the prolonged period of mostly Low to Moderate avalanche danger across much of the country from early January to the third week of February.

2021-2022 AVALANCHE CENTER SEASON SUMMARIES PART 1: ALPHABETICALLY, A TO E

in avalanche danger throughout an enormous region.

Looking at last season's avalanche danger helps us understand why fewer avalanche fatalities occurred. For example, elevated avalanche danger in much of the western U.S. from mid-December into early January (Figure 1) coincides with eight of the season's 17 fatalities. Everything changed by early- to mid-January. At this point the snowfall mostly ended and the danger quickly transitioned to Low over a remarkably widespread area, staying that way for weeks. These relatively benign avalanche conditions coincided with the core part of the winter, and we had only two additional fatalities by the middle of February. Snowfall resumed around the latter part of February, the avalanche danger rose accordingly, and five more fatalities

occurred. The last few weeks of the season consisted of a variety of conditions, but Low-to-Moderate conditions dominated many areas.

In contrast, the conditions of 2021-22 differed dramatically from the 2020-21 season (Figure 2). During that season, mixed conditions nationally gave way to widespread Considerable, High, and even Extreme avalanche danger in February. This widespread elevated danger, combined with a dramatic spike in backcountry use, led to 26 fatalities in a single month. By early March snowfall tapered off in most areas, leading to a general decrease in avalanche danger and several weeks without avalanche fatalities.

Comparing the Chugach National Forest Avalanche Information Center data (top line of Figures 1 and

2) to the rest of the western U.S. is interesting. Though not perfectly correlated, we've noticed that over the last few years when the lower-48 is getting storms, the Chugach is often dry, and vice-versa, and this is reflected in the avalanche danger. In comparison to the lower-48, the avalanche danger on the Chugach National Forest was a bit lower during February of 2021 and a bit higher during the core part of the 2021-22 winter.

Avalanche accidents do not necessarily occur simply due to dangerous avalanche conditions, nor do they always result in a fatality. Rather, accidents result from a confluence of terrain, weather, snowpack, and human factors. That said, extended periods of elevated danger over large areas—especially during the core part of the winter

—clearly increases the probability of people being caught and killed in slides. Graphical representations of the avalanche danger over large regions throughout an entire winter help explain the broad-scale patterns in avalanche danger experienced during a given winter. We plan to do more analyses of these avalanche danger data in the coming seasons.

With that broad summary, we hand this issue of *The Avalanche Review* off to the Avalanche Centers. Each center provides an invaluable service to its community. We are extremely proud of their accomplishments, and we hope you enjoy reading about them.

—Karl Birkeland
and Simon Trautman

USDA Forest Service National
Avalanche Center

2020-2021 BACKCOUNTRY AVALANCHE DANGER BY ZONE

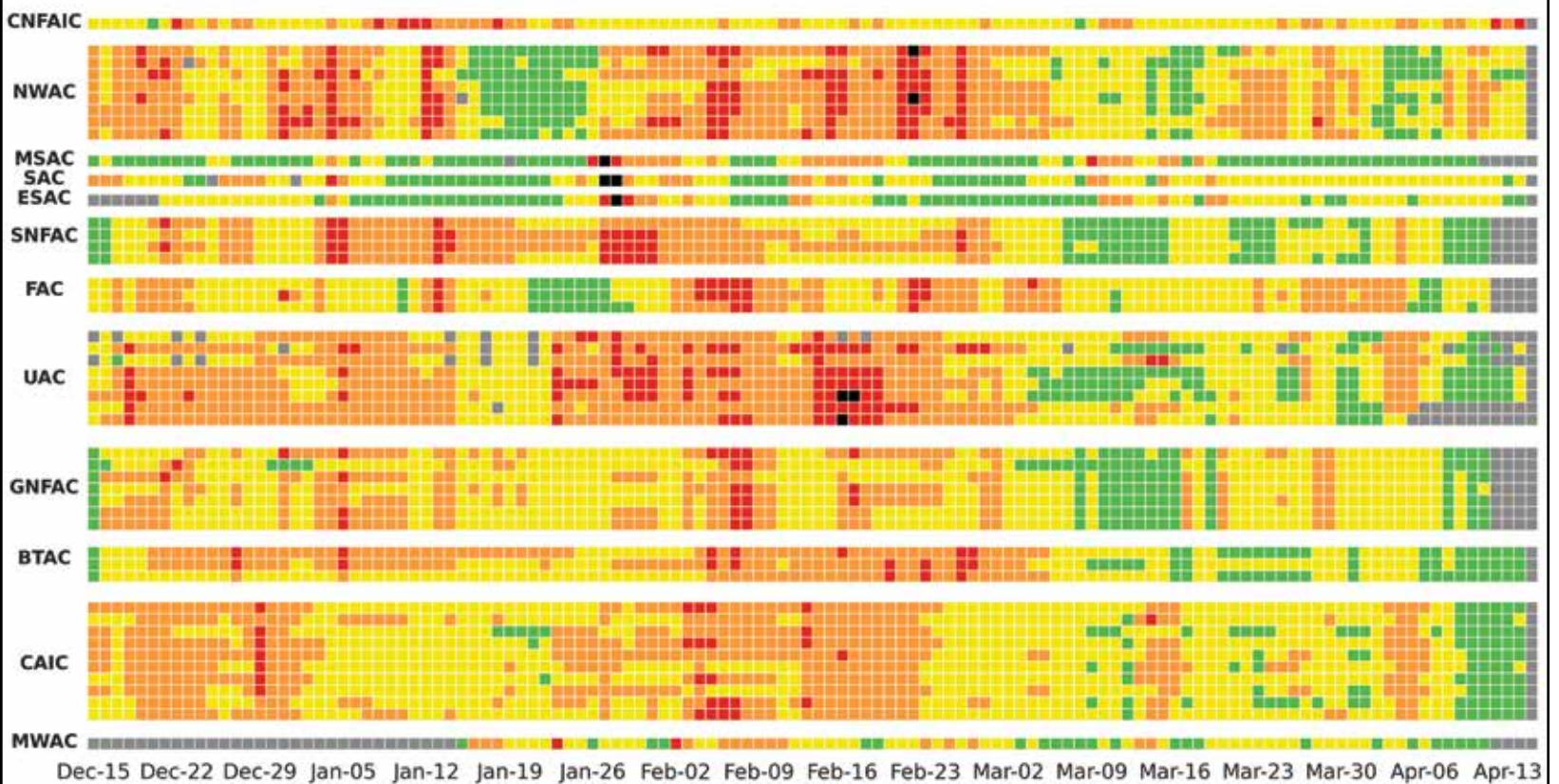


FIGURE 2: The highest avalanche danger for each avalanche forecast zone for the 2020-21 winter. The y-axis is ordered by Type 1 Avalanche Center, the x-axis is the date during the season, and the color represents the avalanche danger for that day and zone. Note the extensive period of elevated avalanche danger during February, with large portions of the country having Considerable, High, and even Extreme avalanche danger.

AAIC

Alaska Avalanche Information Center

Cordova, AK

Warm weather in October kept the mountains mostly snow free. Temperatures dropped below freezing down to sea level in November and December, allowing four feet of unconsolidated snow to accumulate. Interestingly, the snowpack at all elevations resembled that at sea level. Temperatures increased January through March, bringing snow above treeline and a mix of rain and snow at lower elevations. Typical avalanche activity occurred, mostly storm-related events. By April, no snow remained at sea level while the height of snow at mid-mountain peaked at 3.2 meters. Our spring shed began the first week of April and lasted throughout May. A handful of relatively large slab avalanches occurred mid-May, the latest in recent history. The average mid-mountain temperature from October 1st to April 1st was the lowest in eight years. Correspondingly, the maximum height of snow was the largest in eight years. No avalanches reached the highway.

—Hoots Witsoe

Haines, AK

Haines enjoyed a spectacular early season this year, with an October base at higher elevations and ample deep powder from November through January down to sea-level. The October base was strong enough that we had a noticeable lack of large avalanche activity throughout most of the winter, even after some significant storm cycles and a few warm(ish) periods. The snow seemed to bond nicely with regular maritime storms, a warm snowpack, and cold periods that were not long enough for significant faceting.

By January we had built up deep snowpack in starting zones but without some of the natural avalanche activity that we typically see. This combined with the presence of a few mid-elevation rain crusts had us worried that a deep and destructive cycle could occur if the weather brought in a major thaw / rain event. But this year that just didn't happen. In the last issue of TAR, we had submitted a photo of an isolated deep slab that occurred in early February. This was our only data point for this deep layer, and we asked the

question, "is this a one-off event or a harbinger of a future deep slab problem?" It turned out to be a one-off. By the time of our usual busy season in February-March, concerns were changing to new surface hoar layers in the upper pack, and large cornices that were occasionally failing and triggering slides.

The surface hoar issue did lead to some human avalanche involvements, including one full burial (rider was dug out uninjured) and another slide that led to severe trauma (rider also survived).

Eventually the good snow conditions became wrecked by some cold April NW winds, and the season wound down before a wet slide cycle began in early May. The transition was slow as cooler temperature preserved the spring snow until late May when a significant warm up occurred and caused wet slab releases.

It was a busy season with 193 forecasts published for 92 days along with an Avalanche Rescue and Level 1 Rec sponsored by the HAC and hosted by the Alaska Avalanche School along with seven other free training programs. We also hired a fourth part-time forecaster.

In total our education programs reached 135 students directly; this included students of all ages at the school and in the community. Social media channels surged to 80,470 user sessions when we learned how to connect Instagram and Facebook, plus a total of 18,228 website visits with 914 unique website visits from Haines.

—Erik Stevens, Jeff Moskowitz,
Tim Thomas & Brady McGuire

Valdez, AK

Looking back at the 2021–22 winter in the Valdez/ Thompson Pass area on paper it would appear mostly average; Thompson Pass received 456 inches of snow with 42.1 inches of SWE, which is 46 inches below the 502" average. Valdez hit the average mark right on the button with 300" of snow and 26.4" of SWE.

In reality, this season was far from normal. Two events in particular characterized our winter season. The first was a significant deep persistent weak layer that existed at the ground known as "the November Facets." This weak layer plagued our forecast zone from late November through February with numerous natural D2-D3 avalanches. D3s continued to occur at this layer through April, although these became isolated to steep south facing terrain during the spring shed.

The second event that made its mark on the season was our area's first avalanche fatality in 13 years.



CORDOVA: Warm temperature and sunshine triggered this natural slide on a N-NW aspect above mile 3 of the Copper River Highway, an area that typically receives heavy loading from precipitation events. ■ HOOTS WITSOE



HAINES: Cornice fall that stepped down and triggered a D2 unsupported slab on a NW aspect at 4500' observed April 21. ■ JEFF MOSKOWITZ



VALDEZ: Natural D3 avalanche on Mt. Billy Mitchell that occurred during the 2/18 avalanche cycle. ■ JED WORKMAN

This accident involved a helicopter ski guide during commercial operations. The victim was a longtime Valdez resident and was one of the most experienced and respected guides in our area. His passing has left a massive hole in our tight knit community that cannot be filled. (see obituary of Mike Hamilton on page 11 of this issue of TAR)

Winter weather began early with the first snowfall to valley floors arriving on September 21 at Thompson Pass. Fairly regular snowfall and above average temperatures continued through early November with Thompson Pass receiving 96 inches of snow by November 7 and Valdez recording 7.73" of rain. The amount of energy that was injected into the snowpack early season became the fuel for significant faceting to occur over the next two months.

November through January brought a significant pattern change that set the stage for that deep persistent weak layer to form. Above average temperatures swung to below average and storms became sparse. Each time a moderate snowfall or wind event would occur, the November facets would activate, causing D2-D3 avalanches that failed naturally near the ground. As the new year came around, an

outflow/north wind event occurred that reached speeds of 70 mph for two consecutive days, along with gusts up to 87 on Thompson Pass. Directly following this, temperatures fell to -25° F on Thompson Pass. The New Year's wind event created a strong bridging effect above the November facets, which decreased signs of instability previously present. By the end of the dry spell we were left with a thoroughly damaged snowpack with depth hoar chains up to 1.5 cm at or near the ground. On November 12, the HS at Thompson Pass was 26 inches. By January 10, the HS was 22 inches in the same location. This spot where snowfall is measured is very susceptible to wind scouring, although it still paints a clear picture.

On January 10 the weather switch was once again flipped on and temperatures climbed above seasonal norms and snowfall became frequent. From Jan 10 through March 8 there were only 11 days without recorded snowfall on Thompson Pass, though some days only trace amounts occurred. The initial pattern change brought in 40" of snowfall with 4" of SWE on Thompson Pass in a five-day period from January 6-16, triggering multiple D2-D3 avalanches. Several more storms rolled through, producing

similar snowfall amounts with deep natural avalanches. As storms continued and the snowpack built in depth, stress upon the November facets increased. Natural avalanches became more significant in depth and width with some slopes running multiple times.

On February 18, after more than a week of snowfall delivered four feet of snow, a significant Pacific system then deposited 29 inches of snow with 2.7 inches of SWE in a 36-hour period. A significant natural avalanche cycle ensued with widespread natural D3 avalanches on all aspects at mid and upper elevations. On February 21, another strong system rolled through, producing 17 inches of snow with 1.9 inches of SWE on Thompson Pass. What was interesting about this system was that only one deep natural was observed.

The February 18 avalanche cycle was a turning point in our season. We had finally received a large enough load of snow to shake out a lot of slopes that were barely hanging on. However, very poor structure still existed at the base of our snowpack. After the 2/18 avalanche cycle, the distance of the November facets from the surface made it unlikely for a person or snowmachine to affect it. Thereafter, it would require an even larger load of snow to create another widespread natural deep cycle, which we never received. The 123 inches of snow, along with mild temperatures on Thompson Pass in February, created a more typical coastal Alaskan mid and upper snowpack atop the November facets. Reactive instabilities began to exist primarily in the upper snowpack rather than the mid and lower.

Lucky for everyone, the decrease in sensitivity of our DPWL occurred at the same time as the normal influx of helicopter operations and general backcountry ski tourism that we see in the spring. March saw a couple feet of snow the first week followed by many days of overcast skies and light snowfall which continued to strengthen our mid and upper snowpack. Our first prolonged high pressure came near the end of March. A stable snowpack was in place and clear and calm conditions promoted significant surface hoar development and near-surface faceting. On April 5 a storm cycle brought 26 inches of snow and 2.2 inches of SWE, prompting a significant direct action avalanche cycle on all aspects and elevations failing on SH/NSF. No step downs were observed. For a couple days many human triggered avalanches were reported on SH. Sensitivity at this interface quickly decreased as the layer was laid over and absorbed into the soft snow beneath and green light conditions

continued. Following the April 5 storm, the typical spring high pressure moved in with no precipitation recorded for two weeks. A strong north wind event coincided with the beginning of the high pressure but this was short lived and generally benign weather followed. Once again significant surface hoar and near-surface faceting occurred. On April 22-23 our area received 8-12 inches of snow south of Thompson Pass and 4-6 inches north. Steep north facing terrain became reactive to human triggers at the 4/22 interface. On April 25, Mike Hamilton was killed in an avalanche near the Pencil Glacier, SE of Thompson Pass on a NW aspect at 5500'. The victim triggered the avalanche near the top of the slope and was carried over a significant cliff band. His group reached him quickly but significant trauma had already taken his life. This accident was deeply felt by the Valdez community and marked a tragic end to the winter of 2021-22. Our heartfelt condolences go out to his family and friends

—Gareth Brown

The Sierra Nevada mountains continued the streak of feast or famine during the 2021-22 season by recording one of the heaviest storm cycles on record mixed with agonizing dry spells. Throughout the hits and misses of a fickle winter, the Bridgeport Avalanche Center (BAC) had a very successful season made possible by structural changes and growth.

Winter began during the second half of October with an atmospheric river that pummeled the Sierra with 1.6" of Snow Water Equivalent (SWE) at the Sonora Pass Snotel sensor. Our 'insta-base' Halloween storm (October 25-27) dropped 3-7 feet of snow, depending on location, and set the stage for a persistent weak layer above treeline on isolated northerly slopes. During the dry month of November, our snowpack weakened in the shade and melted out to bare ground in the sun, providing a stark contrast to the start of the season. December came in quiet and morphed into the snow delivery month with two weeks of back-to-back



BAC: Strong wind sending our snowpack into the Great Basin during the December storm events. ■ JULIAN HANNA

INSIDE SLIDER STORMS:
(noun, slang term)
A weather system that slides north to south down the east side of the Sierra, rather than west to east as usual, while an area of high pressure sits off the coast, creating strong winds and steep pressure gradients.

“
THE SIERRA NEVADA CONTINUED THE STREAK OF FEAST OR FAMINE DURING THE 2021-2022 SEASON WITH ONE OF THE HEAVIEST STORM CYCLES ON RECORD MIXED WITH AGONIZING DRY SPELLS.

storms leaving us with just under 30” of SWE at Leavitt Lake! Along with the new snow it would be remiss not to mention the accompanying wind, its damaging effects on the snowpack, and the multiple days of continual strong to gale force southwest flow. Windward aspects were stripped to bare ground while leeward sides became pencil and knife hard. A high pressure system then parked itself off the California coast, forcing storms to the north, creating the layout for a dry spell that persisted over the range for an unsettling amount of time.

No human-triggered avalanche incidents were reported to the BAC over the season, however a large natural cycle in December threatened residential properties. Slide paths off Crater Crest in Twin Lakes and Mt. Olsen in Virginia Lakes deposited debris near and around

uninhabited buildings for not the first time. Thankfully the buildings in these areas are primarily occupied during the summer. At the time of these large avalanches in December, Persistent Slabs had been forecasted across the Sierra. Poor structure from basal facets originating from the Halloween storm became the likely cause for these larger natural avalanches.

2022 kicked off with a 47-day dry spell that lasted until February 16. The latter half of February and the beginning of March received several inside slider-type storms producing a total combined SWE amount of 1.8”. Slider storms, colder and of a more northerly orientation, didn’t pack the same punch as our tried and true southwest flow, leaving behind dust on crust instead of our beloved Sierra cement. April started dry and finished out with more precipitation than the three preceding months combined, culminating in an end of the month series of storms that dropped 2” of SWE.

Outside of big snowfall totals, the talk of the town was the successful incorporation of the Friends of the Bridgeport Avalanche Center (FOBAC). Receiving the 501(c) 3 not-for-profit designation helped the center achieve its goals by posting snowpack summaries and advisories, providing continuing education, coordinating training programs, and taking on fundraising efforts. FOBAC’s support and volunteer efforts were instrumental to the overall success of our operations. Having this official structure in place allowed the forecast team to focus their snowpack summaries toward the 7,254 acre Bridgeport Winter Recreation Area (BWRA), which became a federally designated winter motorized recreation

area in 2009 under the Omnibus Public Land Management Act, a first of its kind, providing a venue for balanced use between motorized and non-motorized users. Outside of snowpack summaries tailored to the BWRA, the BAC also provided snowpack observations from our forecast area, the Bridgeport District of the Humboldt-Toiyabe National Forest (HT). The BWRA opened

to motorized use for the 2021–22 season on December 18 and closed on April 12 under the guidance of our minimum snowpack depth requirements.

BAC staff produced 38 snowpack summaries delivered twice a week for the BWRA and 58 observations throughout the season for the HT as a whole. The BAC was staffed with four employees for the season, three people full-time and one part-time. Joe Soccio, Julian Hanna, and Joe Dellaporta made up the full-time staff while Sue Burak joined on part-time status, splitting her responsibilities as an avalanche consultant between Inyo and Mono Counties.

With grim snowpack totals and long durations of dry spells the winter might have seemed a bit of doom and gloom, however with the revitalization within the BAC program and a potent end of the season



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storm, operations remained vigilant. From the forecast team, we would like to express a big thank you to the volunteer efforts of the Bridgeport Avalanche Center board, our neighboring centers to the North and South, and all our field volunteers for helping us accomplish our goals this winter.

—Julian Hanna

BTAC

Bridger-Teton Avalanche Center

The 2021–22 season had a significant mid-season drought with consistent snowfall on either end. Snow began to fall in the upper elevations in September and began accumulating by mid-November. Warm temperatures during the first week of December helped to melt off snow on solar aspects that had accumulated in the early part of the season. The snowpack persisted on shaded aspects during this time. As December wore on, a series of relatively small storms helped to slowly build slabs on top of thin weak layers that had formed between storm systems. As to be expected, high shaded aspects held the weakest and most widespread crop of facets.

On December 16-17 a large storm brought high rates of snowfall to many areas, and the first significant load of the season. A fatal accident occurred at the end of this storm in the Big Hole Mountains in Eastern Idaho adjacent to the Teton and Southwest Trails forecast areas. Two 17-year-old males were buried while sled skiing and did not survive.

Between December 22 and January 8, two separate loading events brought significant snowfall to the region. The Raymer plot at 9,360 feet at the Jackson Hole Mountain Resort recorded 131" of snow with 13.42" of SWE during this two and a half week period. Extensive avalanche activity occurred throughout all three forecast zones, with average crown depths in the 4–6-foot range. Observations from the Southwest Trails forecast area showed impressive propagation with some crowns extending close to a mile. Mitigation efforts at JHMR produced crowns up to eight feet in depth. A weak layer that had formed on December 5 was the culprit in many of these avalanches.

Following the holiday storm cycles the faucet turned off and precipitation events were few and far between for eight weeks. Between January 9 and March 5, just 31.6" of snow with 2.57" of SWE fell at the Rendezvous Bowl plot at 9,580 feet at JHMR.

The first half of March saw a series of storms that slowly built slabs on top of weak layers that had formed during the extended dry spell. A slow uptick in avalanche activity occurred as these slabs grew. An extended avalanche cycle ensued, producing large avalanches that were mainly confined to the southern forecast zones. Activity made its way north into the Tetons, though only a handful of large avalanches occurred during this time. Unfortunately one of those avalanches resulted in a fatality in the South Fork of Game Creek on the west slope of the Tetons.

Following this period, a significant warmup marked the second half of March when large avalanches were reported in all three forecast areas.

April saw a return to winter-like conditions during the first half of the month. Between April 10 and 21, the Rendezvous Bowl Plot received 53" of snow and 5" of SWE. Minimal avalanche activity was observed or reported during this time, as deeper weak layers that had been active in early to mid March had gone completely dormant and relatively mild temperatures helped any weak interfaces to quickly gain strength.

Peak snow depth occurred between April 15 and 18, depending on location. The second half of April through May saw a more typical springtime pattern of warming, freezing, and precipitation.

Fatalities

This season saw two fatalities in Wyoming and two in Eastern Idaho. One of those fatalities fell within a BTAC forecast zone, in the Tetons. These incidents are a sobering reminder of the high consequences of recreating in avalanche terrain.

Our condolences go out to the families and friends of those involved in these incidents. Visit avalanche.org for more details.

December 17: Relay Ridge, Big Hole Mountains, Idaho: two snowmobile/skiers.

March 12: South Fork Miner Creek, Sierra Madre Mountains, Wyoming: one snowmobiler.

March 17: Game Creek, Tetons, Wyoming: one skier.

Personnel

This year saw significant turnover in the avalanche center staff. Bob Comey retired at the New Year after



BTAC: Deep slab release at Jackson Hole Mountain Resort.



BTAC: Diagram of Game Creek fatality incident.

30 years of service to BTAC. Chris McCollister also moved on after 20+ years of service. Both Bob and Chris made significant contributions to the center and are missed. Frank Carus was selected as the new director. Returning this year were Mike Rheam and Lisa Van Sciver. Drew Gibson from Copper Mt. and John Fitzgerald from WYDOT joined the team as forecasters. Noah McCorkel was an intern with Lisa in GTNP. Rounding out the team was Alex Drinkard who served in the role of observer and field partner.

Website

Data collection and the weather station network managed by BTAC are significant parts our work program. A much-welcomed upgrade occurred during the season which shifted data collection to a cloud-based system, allowing for greater flexibility in work locations for forecasters while utilizing up-to-date software. Carol Peck managed this transition and did so with great patience as the staff identified and worked through issues with the new system.

In the works for next season is a new website which will incorporate the new background software and historical data. Advanced data visualization tools such as the Snowpack Tracker and the 24-hour weather data a.k.a. "Big Sheet" will be carried over or recreated on the new website.

Partnerships

As is the case with most USFS centers, the BTAC relies on significant funding from other sources; the BTAC Foundation and Wyoming State Trails. The State Trails program provides both financial and material support to the forecast team as well as educational support in the form of free avalanche classes for motorized users. Courses were provided in Rock Springs, Togwotee Mountain Lodge, Jackson, Alpine, Cody, Saratoga, Horse Creek and in the Big Horn Mountains. Classes were provided to motorized and non-motorized users using a mix of funding. There were Level 1 courses (3), avalanche rescue classes (6), avalanche awareness presentations, and guides courses (full and refresher courses). Total participation was roughly 225 students. In addition, an Avalanche Alliance grant funded a course for 11 people from the Teton SkyLiners club in Victor, ID.

Along with this support, Grand Teton National Park continued to provide a salary for one forecasting position. This is a great example of an interagency partnership improving the quality of the forecasting and information-sharing products that the BTAC provides for the public.

—John Fitzgerald

CAIC

Colorado Avalanche Information Center

The 2021–22 avalanche season in Colorado was marked by seven avalanche deaths, one more than the 10-year average. There were 4830 avalanches reported to the Colorado Avalanche Information Center (CAIC) during the season. We documented 90 incidents (second only to 2018–2019) with 106 people caught in avalanches, exceeding the 10-year medians of 56 incidents and 84 people caught. This included thirteen multiple-involvement accidents and four fatalities where the victims were not wearing transceivers.

The season was characterized by prolonged drought periods interrupted by a few prodigious storm cycles. The seasonal snowpack began to develop in mid-October with a few modest storms. On October 29, a skier triggered and was caught in a small avalanche on Loveland Pass, marking the first incident of the season. November was a dry month so the snow that was on the ground quickly developed into a weak faceted layer. Very warm temperatures coming near the end of the month melted the snow back to bare ground on all but high-elevation northerly aspects. On these north-facing slopes the weak foundation was established.

It finally started to snow again around December 7, and we issued our first Avalanche Warning of the season as heavy snowfall arrived on December 9. Storm totals in favored areas of the Central and Southern Mountains reached two to three feet of snow and around 3.5 inches of SWE. During a five-day stretch from December 7 to December 11 we recorded 494 avalanches.

Following another two-week dry spell, December 23 marked the beginning of a memorable holiday storm and avalanche cycle. The storm began with an atmospheric river event that brought at least an inch of SWE to all the mountain areas with upper end totals reaching 5.5 inches in a 48-hour period.

Sadly, this period of intense snowfall resulted in Colorado's first avalanche fatality of the winter. On December 24, a skier triggered an avalanche and was buried in a small terrain feature near Cameron Pass. On the same day, five other



CAIC: Before—The striking image above was captured by backcountry tourers near the Eisenhower Tunnel. The avalanche broke above the fourth rider to descend the slope.



CAIC: After—This avalanche on Coon Hill, March 20, 2022, demonstrates that tracks on a slope are not a sign of stability.

people were caught including two ski patrollers and two inbound skiers. On Christmas Day there were three more incidents involving two more ski patrollers. Snow continued every day through the end of the month, and we issued Avalanche Warnings every day but one from December 24 to 31.

Following the Christmas Day avalanche involvements, five more people were caught in avalanches through the end of the year with

no injuries. The most notable incident was a full burial and successful recovery of a skier on Anvil Mountain north of Silverton. The rescue effort by the ski partner was remarkable considering the victim was buried 2.2 meters deep.

Avalanche activity from the holiday storms spilled into the first week of January, fueled by a decent storm dropping one to two feet of snow in the Northern Mountains from January 5 to 7. On January 8,

two snowshoers and their dog were caught, buried, and killed in an avalanche near Hoosier Pass, marking the second and third avalanche fatalities of the season. Neither victim had any avalanche rescue gear.

Then the spigot shut off and we entered another prolonged dry spell lasting almost six weeks. Across the state we only picked up 5 to 12 inches of snow for the rest of January. The drought produced a thick layer of near-surface facets that grew deep enough to generate facet sluffs. This was really the only avalanche concern for a remarkable month-long stretch of mostly LOW danger that allowed for safe travel in terrain usually reserved for more stable spring conditions. Eventually the facet sluffs grew large enough to warrant Moderate danger as we moved into February, but the drought persisted.

We knew the party would end once this prominent “drought layer” was buried. Small amounts of snow in the early part of the month built thin slabs on the drought layer and a quick uptick in avalanche activity ensued. Human-triggered avalanches were breaking wider than expected given the thin slabs, and this offered a glimpse into how this prominent weak layer would behave with a bit more loading. People were slow to adjust to the abrupt change

in conditions, and we saw a rash of incidents as February wore on. Fortunately, there were no fatal accidents until the drought finally broke with a major storm beginning on February 22.

Over the next several days favored areas picked up one to four inches of SWE. This built dense slabs on the widespread drought layer and spurred many large avalanches. Half of the avalanches recorded during the month (650 of total 1,214 avalanches) ran between February 22 and 24. Avalanche Warnings and Special Avalanche Advisories remained in place from February 23 to 27 to warn the public about the abrupt changes in avalanche danger.

On February 25, a group of four residents attempted to access their backcountry cabin near Marble. The group triggered an avalanche that caught three of them and killed one person along with his two dogs. None of the group members were wearing transceivers. The next day a large avalanche seriously injured a skier in the La Plata Mountains. In total, 10 people were caught in avalanches during this late-February period while Avalanche Warnings and Special Avalanche Advisories were in place.

The drought layer continued to plague us into March. The CAIC

recorded large (D2) avalanches on 30 of the 31 days, 30 people caught in avalanches, and two deaths. The steady stream of avalanche incidents resulted in close calls and minor injuries until the middle of the month. On March 17, while climbing a couloir, a solo backcountry tourer triggered and was buried in a large avalanche in the San Juan Mountains east of Lizard Head Pass. Guides from Heliitrax noticed the recent avalanche and conducted a transceiver search from the air. They detected a signal and began a rescue. The avalanche buried the tourer deep in a terrain trap and it took rescuers an hour to excavate him.

The second fatality of the month occurred two days later, on March 19, in Fish Creek east of Steamboat. Two backcountry tourers descended through steep, complex terrain. One skier triggered an avalanche and was swept over a small cliff and through trees. He sustained significant trauma and did not survive.

While the rate of avalanche incidents slowed down after the second fatality, backcountry travelers continued to be surprised by human-triggered avalanches through the end of the month.

While the drought layer plagued the snowpack throughout the month, the second half also saw a major warm spell and pronounced wet avalanche cycle. The Wet Slab avalanches activity peaked on March 27 and 28, making for some complex backcountry forecasts.

By early April, the spring warmup really took off and weather events were more notable for periodic dust layers rather than abundant snowfall. Avalanche activity and incidents decreased and consisted primarily of soft slabs from small amounts of drifting storm snow, or Loose Wet avalanches. We wrestled with when we could finally put the persistent weak layers to bed, and were getting close when two backcountry skiers triggered a D3 avalanche on one of those few high-elevation thin rocky slopes we were still worried about.

Unseasonably warm temperatures pumped ample amounts of water in the snowpack, and melt continued more or less unabated into May and melt seemed about a month ahead of schedule as the seasonal closures on the high mountain passes opened. Dust was surfacing in most places, interrupted only by a few minor storms, and we thought we would ease into the end of our season. Tragically this was not to be. On May 29, three climbers were caught in an avalanche that was triggered by rockfall on Mt Meeker in Rocky Mountain National Park. One climber suffered minor injuries. One sustained serious injuries

and required helicopter evacuation. The third climber was fully buried and killed in the avalanche. The buried climber was not carrying an avalanche transceiver.

We hope the number of multiple-involvement accidents and number of victims not wearing avalanche transceivers are just anomalies and not the sign of a worrisome trend.

— Brian Lazar

CBAC

Crested Butte Avalanche Center

A winter of feast and famine

We'll remember the winter of 2021–22 for its bipolar behavior. The season brought historic storms, unprecedented droughts, mega avalanche cycles, bizarre weak layers, heatwaves, and intolerable wind events. The snowpack peaked near median, but the winter story is far from average. Our center's slogan for the past 20 years: “We do it every day” could have also used a disclaimer: “...but we haven't seen that before.”

A month-long dry spell ending in early December reduced our snowpack to record or near-record lows with just enough coverage for faceting to run rampant. The drought culminated with a week of record high temperatures. This heatwave was a saving grace for the sunny half of our terrain, which melted down to dirt on most slopes.

December brought an abrupt and dramatic reversal to the season. A hard-hitting 3.5” of SWE from December 8-10 spurred a large widespread cycle on slopes with existing faceted snow coverage. Then, over the holiday week, Santa delivered a miracle storm system that single-handedly produced almost half of our entire winter's snowfall in just 9 days. Schofield Pass recorded 14” of SWE—nearly matching our largest prolonged loading event since its installation in 1986 (14.8” in January 2017), and accomplishing such in five fewer days. The “Santa Slammer” brought six days of HIGH danger and culminated with one day of EXTREME danger on New Year's Eve.

Our avalanche tally for the month of December included 14 D4s, 87 D3s, and 248 D2s. The New Year's Eve cycle expanded runouts and



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Will Mook

“

THIS SEASON BROUGHT HISTORIC STORMS, UNPRECEDENTED DROUGHTS, MEGA AVALANCHE CYCLES, BIZARRE WEAK LAYERS, HEATWAVES, AND INTOLERABLE WIND EVENTS.

wiped out mature timber in numerous drainages. A couple of cabins were damaged or destroyed. The longest-running slide off of East Beckwith produced an alpha angle of 17 degrees, and we visited numerous slides with sub-20 alpha angles.

Over the course of the month, our snowpack changed from one of the shallowest on record to one of the deepest on record. While this made for an exceptionally dangerous month, it also set us up for a deeper and stronger snowpack going into the rest of the year. Despite dozens of near misses or accidents around the state in December, there were zero near misses, accidents, or fatalities reported in the Crested Butte backcountry. Our team deployed several additional strategies during the holiday storm to spread warnings, including CDOT highway signage, radio PSAs, a podcast, and special video messaging.

The snow guns turned off abruptly in January: light snowfall at the start of the year fizzled into a drought that lasted until mid-February. This was the most significant mid-winter

flatline we have on SNOTEL records. From January 8 until February 16, Gothic saw only 4” of snow. We saw 19 almost-consecutive days at LOW danger, something that is almost unheard of for our region. Even more extraordinary, we completely removed Persistent and Deep Persistent Slabs as a problem, something I have not seen mid-winter in my career here. Skiers and riders regularly ticked off big lines that are often untouched until springtime.

The six-week drought produced a widespread and exceptionally large-grained layer of near-surface facets that grew up to 2 or 3 mm in size at lower elevations. In some terrain, it resembled depth hoar; a characteristic that I haven’t seen from a mid-season weak layer. We unaffectionately called it the “sandbox layer,” given its complete lack of cohesion.

Snowfall finally returned in earnest on February 21, and over the next three days, storm totals reached 3.8” SWE. This brought the walls crashing down on the sandbox layer in one of the most extensive cycles near and below treeline that I can recall. We documented over 365 slab avalanches, mostly D1 to D2 in size. After this pervasive flush, we were left with a poor but spotty persistent slab structure. Incremental snowfall through mid-March continued to build on slab size while activity became sporadic. A record-breaking and prolonged warmup during the last week of March caused a D1 to D2 wet loose and wet slab cycle, and another notable warmup in May produced another round of large wet slabs on high northerlies. The snowpack declined faster than normal under a warm, dry, windy spring that left us with dust blanketing the snow surface.

Despite several periods of exceptionally challenging and dangerous conditions, we are fortunate to report zero burials, injuries, or fatalities this season. Five people were caught in avalanches in the Crested



CBAC: Extensive crown lines in the wake of the holiday storm. Photo taken above the Ruby Range during a helicopter flight on January 2nd. Crown heights ranged from 8 to 12 ft thick during field visits. ■ CBAC



CBAC: A backcountry cabin in the Anthracite Range was relocated during the holiday storm. ■ CBAC

Butte backcountry, all D1s. Three of these occurred while people were ascending avalanche terrain. Perhaps the closest call was a dog walker who narrowly avoided getting hit by a large natural avalanche during our February cycle. This was a good reminder that the urban and suburban interface overlaps with avalanche terrain in our valley and that effective outreach includes more than just backcountry users.

What’s new?

- **Outreach:** Our outreach program, in its 2nd year, continues to ramp up efforts including trailhead days, fireside chats, educational programming, and more.
- **Community Beacon Park:** We launched the Jeff Schneider Memorial Beacon Park downtown.

- **Avalanche Visualization Tools:** We developed an avalanche database and designed several avalanche visualization tools. Check out our avalanche rose here: <https://cbavalanchecenter.org/avalanche-rose/>
- **Game Cams:** We deployed two remote game cams with snow stakes to monitor storm totals in data-sparse areas—a successful experiment!
- **Danger Sign:** Now in its second season, our large roadside sign at the entrance to town advertises the current avalanche danger and our website for more information. It’s an effective tool because there’s only one road in and out of our valley.
- **Obs text hotline:** We set up a Google Voice number that

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forwards texts to our staff email account. It was an easy and free way to gather more public obs from the texting crowd.

- **Heli flights:** West Elk Air sponsored our center with a couple of helicopter flights, which we used strategically to document avalanche activity after big cycles.

—Zach Guy

CNFAIC

Chugach National Forest
Avalanche Information Center

The season started early and strong in Southcentral Alaska. By early October there was enough snow on the ground for multiple avalanches involving people getting caught, carried, buried, and injured. Luckily none of these accidents resulted in fatalities. We got clobbered by the Halloween storm at the end of the month, which brought 19" of rain to Girdwood, 28" of rain to Portage, and 20–25' of snow at elevations above 5000'. The storm set a U.S. record at Portage Lake as the northernmost location to record two consecutive days with 8" or more of rainfall. This system got us started with well above average precip totals, but with extended dry spells in mid-November, late December, and early January, we finished the season almost exactly on the 1991–2020 median peak seasonal SWE. Alternating warm storms with colder dry spells left us tracking two buried crusts, which for reference purposes conveniently formed on or near Halloween and New Year's. These crusts would play a role in producing large dry slab avalanches as late as mid-February, and D3+ wet slab avalanches in late April through May.

We had a scary stretch of human-triggered avalanches in the beginning of December, with 11 human-triggered avalanches in two days—some of which were over 1000' wide. This included two human-triggered D3s and one full burial. Besides the amount of activity, this cycle was especially noteworthy because it was *not* preceded by a major loading event. Rather, after three days of quiet weather and very little avalanche activity following a cold late-November storm,

conditions finally became unstable as the low-density snow gained enough strength to start behaving like a slab.

The next major cycle came early in the morning on February 18, as strong winds with only 1" of SWE overnight, on an unstable snowpack, resulted in multiple avalanches stepping down to the Halloween crust—producing crowns 10' deep or deeper in some start zones. This cycle had a major impact on Girdwood infrastructure, with avalanches closing the Seward Highway, burying a bike path 20–30' deep in multiple locations, and destroying a section of a distribution power line.

Despite an unusually cloudy March (only four days of clear skies over the entire month), we had three problematic layers of surface hoar form. The layer cake of buried surface hoar and storm slabs was pushed to its limit at the end of the month as a storm brought 3–6' of snow over three days. This resulted in a widespread natural D3–D4 cycle, with some crowns over a mile wide. The day following the storm, a group of skiers remotely triggered a D3 that propagated several hundred feet above them and ran roughly 800' vertical feet just a few feet in front of their ski tips.

Things quieted down in mid-April when we enjoyed the rare combination of good weather, stable snow, and great skiing and riding conditions that we dreamt about all season. However, all good things must come to an end and after 12 consecutive days of low danger, a warm storm brought 2–4' of snow to higher elevations and rain to 1900' (which is actually pretty high for us coastal folks). This marked the start of the springtime shed cycle. As temperatures continued to warm, things really began to fall apart when the sun came back out. Very large natural wet slabs occurred, including one avalanche in the Girdwood Valley that was over a half mile wide and 4–6' deep. Glide avalanches pulled out wider sections of wet slabs, with a very scary near-miss in the most heavily used motorized zone at Turnagain Pass. A group of four riders was descending the common Seattle Ridge up-track when a glide avalanche released several hundred feet wide and up to 6' deep, pulling out an even wider wet slab roughly 4' deep. Two riders were able to hit the throttle and ride out of the path, one was able to get to the side of the path with his machine buried, and the fourth person was caught and buried with only the back of her helmet sticking out of the debris. She was able to clear an airway with a hand that was shallowly buried in front of her helmet and her partners rescued her with minor injuries.

Staff

We were excited to add John Sykes to our forecasting team this year, completing the forecast staff with Director Wendy Wagner and Lead Forecaster Andrew Schauer. John has done an outstanding job in his first season, which was hardly a surprise given his impressive professional, academic, and mountaineering background. John completed a MSc in the Snow and Avalanche Lab at Montana State University and is currently working on a PhD at the Simon Fraser University Avalanche Research Program. He has worked as a guide for the Alaska Mountaineering School, and an educator for the Alaska Avalanche School, American Avalanche Institute, and Gallatin National Forest Avalanche Center. Filling the Internship position was Allen Dahl, a native Alaskan from Bethel. Allen was a super addition, a steadfast partner, wrote up most of our observations, and began researching future opportunities for BIPOC

individuals in the avalanche education field. Last, we are lucky to have the continued contributions of Graham Predeger, who was able to step in for a forecast, several field days, and a lot of behind-the-scenes operations assistance and stability discussions.

Our operation would not be possible without the leadership from the Forest Service or the support from the Friends of the Chugach Avalanche Center, who provide just over half of our operating budget. We would like to thank everyone who is working hard to keep us running, including the local businesses, members, and donors who contribute funds. We also greatly appreciate the professional collaborations we have with Alaska DOT and Railroad Avalanche Programs, Alaska Guide Collective, Alyeska Snow Safety, Chugach Powder Guides, Alaska Avalanche School, Chugach Electric, and the Hatcher Pass Avalanche Center.

— Wendy Wagner



CNFAIC: Visiting GNFAIC forecaster Alex Marienthal checking out the debris from a large wet slab avalanche on Turnagain Pass's Sunburst ridge. ■ ANDREW SCHAUER



CNFAIC: CNFAIC staff outside our office in Girdwood. Left to right: John Sykes, Allen Dahl, Wendy Wagner, Andrew Schauer. ■ LOU SASS



COAC: Hometown terrain in the 3 Sisters Wilderness during early season. ■ AARON HARTZ

“

WE HAD SEVERAL LARGER WET SLAB CYCLES RESULTING FROM HEAVY RAIN IN THE MOUNTAINS. FORTUNATELY, THERE WERE NO REPORTS OF SERIOUS INJURY RESULTING FROM AVALANCHES.

COAC

Central Oregon Avalanche Center

platform for reporting. The InfoEx allows COAC to share reports with local ski guides working in Central Oregon and greatly increases the amount of information coming into the forecasters. Local backcountry users also contribute by posting observations to the COAC website.

December started out dry but then we received much of our seasonal snowpack from mid December through early January. Storms were minimal for the next few months and April became the new powder season. For those who had not packed away skis, boards, and machines, April provided some of the best conditions of 2021–22. Most of the reported avalanches during the season were size 1 & 2 wind slabs and storm slabs. We also had several larger wet slab cycles resulting from heavy rain in the mountains. Fortunately, there were no reports of serious injury resulting from avalanches, however through the grapevine we did hear of some close calls.

One big change in the organization this year was to bring on a new and diverse group of board members. As the new board members settled into being part of the COAC family, several of the original directors made the decision to step down from the board. So far the energy and fresh perspective brought in by the new board members has been tremendous and there is no doubt they will keep COAC moving forward.

COAC is a non-profit primarily funded by the local community and outdoor industry partners. Development director Zoe Roy and various board members work directly with a wide variety of fundraising activities. Much of what they do focuses on keeping the

community engaged with memberships, educational activities, and a lineup of great events throughout the season. Some of the key events include the Bend-SAW, silent auction, monthly avalanche awareness presentations, and the VertFest uphill/downhill race. As COVID restrictions eased off this season, we had great attendance at all events and record turnout for the VertFest race.

Goals for COAC in the near future include moving to a seven-day/week forecasting schedule, adding a weather station, and expanding our forecast zone coverage.

Thank you to everyone who supports COAC. As always, we look forward to seeing everyone at the annual Bend-SAW in November and beginning forecast operations in December.

—Aaron Hartz

ESAC

Eastern Sierra Avalanche Center

The winter of 2021–22 marked the Eastern Sierra Avalanche Center’s 16th season serving the backcountry community and the fourth season that we have operated as a Type 1 center. The 2021–22 season began relatively early in the eastern Sierra with a series of strong precipitation events bringing up to 30” of snow and 4–6” of SWE during October.

Some backcountry enthusiasts got out for their first turns of the year and the region at large celebrated the rising lakes and above average soil moisture. After a relatively warm and dry November, snow began falling in earnest on December 8. One atmospheric river event after another impacted the forecast area with prolonged periods of intense snowfall. Totalling 163” of snow and over 22” of SWE, accumulations during the month of December accounted for most of our winter precipitation. Significant avalanche activity accompanied the December storm cycles with extended periods of widespread High hazard and concerns focusing primarily on Storm Slab, Persistent Slab, and Wind Slab instabilities. One of the more notable avalanches recorded this season occurred as a result of mitigation efforts on Mammoth Mountain on December 26. This Deep Persistent Slab avalanche, running on basal facets near the ground, was triggered with artillery on the tail end of a major loading event. It had an average crown depth of 96”, a width of 1,000’, a run length of 3,500’, and a destructive size of D4. (HS-AA-R5-D4-G)

Instilling a feeling of seasonal whiplash, January proved to be the driest on record with zero measurable precipitation in the eastern Sierra. A few inside slider events brought small accumulations adding up to about 11” of snow during the months of February and March. Despite these small storms our weather pattern was largely dry, with periods of record high temperatures. Predictably, avalanche activity waned throughout the dry spell that persisted through most of the season. However, variable and challenging surface conditions remained top of mind for the forecast team and it’s fair to say the primary hazard this season was “slide for life” conditions, particularly in the high alpine where smooth wind-sculpted snow demanded the full gamut of mountaineering equipment & travel techniques. Several close calls could be attributed to the firm and slick conditions, including one skier who fell and slid for over 2500’ through a narrow couloir called the Pinner on Laurel Mountain, thankfully surviving with only minor injuries.

Despite the lack of significant precipitation during the heart of winter, it was impressive how well the early season snow held up. For most of the season, coverage was adequate for backcountry travel and the long periods of low avalanche hazard opened a plethora of opportunities for the backcountry enthusiast. Significant heat waves occurred near the Equinox and again at the

On the field operations side, there was not much new at COAC for the 2021–22 season. We had four professional observers in the field and we issued avalanche forecasts Friday through Monday from December 1 through the end of April. The pro observers and forecasters continued to utilize the International InfoEx

“

ONE OF THE MORE NOTABLE AVALANCHES RECORDED THIS SEASON OCCURRED AS A RESULT OF MITIGATION EFFORTS ON MAMMOTH MOUNTAIN ON DECEMBER 26. THIS DEEP PERSISTENT SLAB AVALANCHE, RUNNING ON BASAL FACETS NEAR THE GROUND, WAS TRIGGERED WITH ARTILLERY ON THE TAIL END OF A MAJOR LOADING EVENT.

end of March with record setting daytime highs. These prolonged periods of very warm temperatures, light winds, and clear sunny skies proved to be the final death blow to the dwindling lower elevation snowpack. With access receding quickly and thin, degraded snowfields disappearing throughout the forecast area, ESAC issued the final forecast of the season on April 11. In the weeks following the final forecast of the season, several powerful winter storms impacted the Sierra with 34" of snow and 3.96 of SWE in the month of April, more than triple the total precipitation during the first three months of 2022. Strong spring storms are not uncommon in the Sierra, and backcountry enthusiasts rejoiced with the potential for late season powder turns. The return to winter-like conditions came with a

return to winter-like avalanche concerns and several natural and human triggered avalanches were reported throughout the forecast area.

Thankfully no avalanche fatalities occurred in the eastern Sierra during the 2021–22 season; however, this season did see several notable close calls. On December 13, a solo skier was caught, carried, and partially buried in an avalanche in the Mammoth Lakes basin, but fortunately was able to extract themselves and self-evacuate. The avalanche hazard was rated HIGH on the 13th with periods of very heavy snowfall and strong winds leading to increasing hazard throughout the day.

On December 23, two backcountry skiers were hit by an avalanche while transitioning in the Mammoth area. Both members of the party were carried, and one was completely buried. Luckily, their partner was only partially buried and was able to free themselves, conduct a beacon search, and excavate the fully buried skier in time. Neither skier was injured, and they were able to self-evacuate despite losing at least one ski in the avalanche. Hazard was listed as HIGH on the 23rd with 20" of new snow and 2" SWE recorded overnight and continued heavy snowfall during the day.

On the same day, a roof-avalanche buried two small children in the Mammoth area. Both individuals survived the event, but one required an extended stay in the hospital to recover from their injuries.

After 42 consecutive days of LOW hazard and dry weather, we began to see small precipitation events leading to isolated wind slab development. On March 20th, after one of these small storms, a group of four triggered a small avalanche while ascending a bootpack in the north couloir on Bloody Mountain just south of Mammoth. All four were caught and carried, but everyone was able to self-arrest and no one was injured.

Although the 2021–22 was not a banner year in terms of snowfall, ESAC accomplished several major milestones. For the first time, we hired two professional observers, expanding our field presence throughout our broad and diverse forecast area. Additionally, ESAC transitioned to a new website and observations platform as the season kicked off. This much needed update provides a much cleaner, more intuitive, and a more pleasant experience for the user. ESAC also hosted several education events both in person and virtually in the communities of Mammoth Lakes, Bishop, and June Lake.

—Steve Mace



ESAC: Avalanche in the Paranoids on Mammoth Mountain.

■ STEVE MACE



ESAC: Feast—Forecaster Steve Mace enjoying deep December snow on Chicken Wing. ■ RYAN HUETTER



ESAC: Famine—Approaching the mountains during a dry part of the season. ■ STEVE MACE

2022 SNOW & AVALANCHE WORKSHOP DATES

October 8, 2022 — Four Corners Snow and Avalanche Workshop — Silverton, CO

October 13–14, 2022 — Colorado Snow & Avalanche Workshop — Breckenridge, CO

October 16, 2022 — Northwest Snow & Avalanche Workshop — Seattle, WA

October 21–22, 2022 — Wyoming Snow & Avalanche Workshop — Jackson, WY

October 26, 2022 — Montana State University Snow and Avalanche Workshop — Bozeman, MT

November 2, 7, and 9, 2022 — Utah Snow & Avalanche Workshop — Sandy, UT

November 4, 2022 — Southcentral Alaska Avalanche Workshop — Anchorage, AK

November 11–12, 2022 — Northern Rockies Snow & Avalanche Workshop — Whitefish, MT

November 12, 2022 — Bend Snow and Avalanche Workshop — Bend, OR

Spring 2023 — Sawtooth Avalanche Center Professional Development Seminar — Ketchum, ID

Date TBD — California Snow & Avalanche Workshop — Location TBD

DEAR EDITOR,

I greatly enjoyed “Influence & Motivation” in TAR 40.4. A lot of it struck close to home.

I should preface my comments with the admission that I am not an expert in snow science nor avalanche education. I am just a guy who likes to get out there with my friends. The extent of my “expertise” is Avy1 and 10 years of skinning in the Green Mountains of Vermont, the Swiss Alps, and the Idaho Rockies.

But maybe that lack of expertise makes me a reasonable person to weigh in on avalanche education. I took two key things away from Avy1 (other than how impressed I was with my instructor, Jon Preuss).

First, I am confident that should my partner be caught in an avalanche, I will find her body, eventually. I got the extra long probe. But I am unlikely through my own efforts to save a life in a serious avalanche situation. Even if I find her and dig her out in time, getting her to the required medical care is a whole ‘nuther ball game.

Which leads to point 2. Even though I prepare for it, I don’t ever want to be in that situation.

As noted in the SLAB survey and elsewhere, avalanche education is complicated. There is a lot to know! That’s why the need for mnemonics and checklists. Honestly, I don’t remember it all and have to refresh before every outing. Moreover,

based on my experience, I don’t think most people who went through Avy1 remember most of it a year later. I don’t see many people other than the local guides doing ECTs (we are lucky to have those guides). I am pretty sure that most people I see out for a day trip have their car keys in their pocket or pack. Maybe it’s just the people I know, but when we do the prep check run through for how to react in an avalanche, half of them forget calling 911 as a step.

How would I make AvyEd more effective for day trippers like me? I would place more emphasis on 30-degree terrain. I would give more time to the inclinometer and use thereof. Beacon shovel probe...and inclinometer They are light, they are cheap, they are low-tech. The slope angle sticker on the ski pole is like the extra battery for the beacon. Oh, and I would actually practice calling 911 (role play). Most people have never done it, and it does not seem to come naturally to them.

Avalanche safety for me has come down to the following.

- Who I skin with. I don’t expect my partners to save my life, so I don’t want to put them in that position, and I won’t skin with people who I think will put me in that position. Having watched my group search exercise in Avy1 turn into a cluster f**k,

I’m not going out with more than three other people unless we have a guide with us. Group dynamics are...dynamic.

- When I skin. It’s gotta be a bluebird day with a forecast of sun. I prepare for the storm, but I try to avoid it. I hate skiing in low vis anyways.
- Where I skin: I stick to the green parts on the avy forecast. Nothing over 30 degrees. Constant attention to what’s above and below me.

Is this sufficient to make me a “safe” skier? I think so? But then, I could fall in a tree well.

Does this limit my skinning? You bet it does. It limits it to great days with good friends. It minimizes the likelihood that I am going to be a burden to my friends or to my community, or that I am going to show up in an article in TAR.

Do I miss the gnar? Not enough to do the real work required to be prepared for the exponential consequences. I haven’t read an article in TAR about anyone who kept to 30deg with nothing steeper above or below them.

Am I boring to skin with? No. Maybe. Probably? Depends who you ask. Am I bored? Hardly ever.

Be safe and enjoy winter,
Perry Boyle
Ketchum ID

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