39.2
DECEMBER 2020

THE AVALANCHE REVIEW

ARE YOU IN AN ISLAND OF SAFETY?

This avalanche was in Broads Fork, Big Cottonwood Canyon, Utah, which is notorious for large glide avalanches. It cleaned out the entire upper rock slab so I felt alright about hiking up the debris and skiing the flank. *Mark White, Utah Avalanche Center professional avalanche observer*

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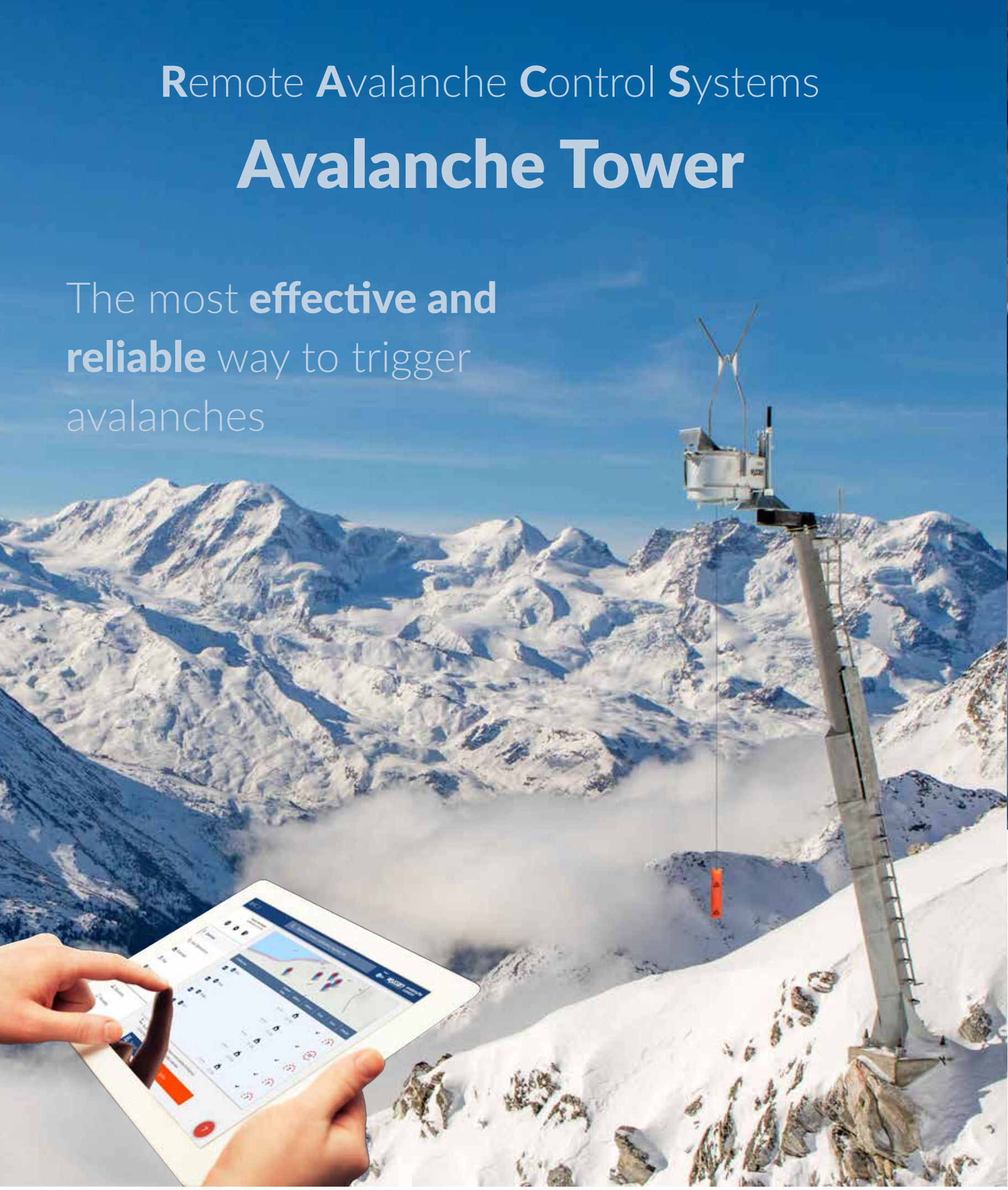

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A3 STATEMENT OF PURPOSE

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

THE AVALANCHE REVIEW

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ISLANDS OF SAFETY

FEATURE STORIES

DO **ISLANDS OF SAFETY** EXIST?

DEPARTMENTS

NO EXPLOSIVES. DECREASED CLOSURE TIMES, INCREASED WORKER SAFETY.

GAS REMOTE AVALANCHE CONTROL SYSTEMS

Fedaia Pass, Italy
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CONTRIBUTORS

Freelance writer **Leath Tonino** is the author of two essay collections about the outdoors, most recently *The West Will Swallow You* (Trinity University Press, 2019).

Doug Krause is an avalanche hunter and aspiring safari guide. He currently divides his time between Colorado and Zimbabwe and believes a full life requires perpetual challenge, bacon, and a beer.

Henry Schniewind studied avalanche forecasting as part of a Geology and French literature degree in 1989. Now he lives in the French Alps and works as an off-piste ski guide and speaker: henrysavalanchetalk.com.

Rob Coppolillo is a mountain guide and writer living in Chamonix, France. His latest book, *The Ski Guide Manual,* is available from ChauvinGuides.com, Amazon, or come to Cham and get one in person.

Bruce Tremper is the happily-retired Director of the Utah Avalanche Center. He regularly wanders around in wild places with his camera and his wife, Susi, who occasionally allows him to putter around on avalanche projects in his spare time.

With five decades of mountain rescue experience and working with avalanches, **Dale Atkins** has spent some time in and around so-called islands of safety. Currently, Dale works for RECCO AB and is a rescue instructor for Cascade Rescue.

Karl Birkeland is the Director of the Forest Service National Avalanche Center. He has worked as a ski patroller, backcountry avalanche forecaster, avalanche researcher, and program leader. He enjoys time in the mountains with his wife and two daughters.

Henry Munter is the General Manager and a lead guide at Chugach Powder Guides, in Girdwood, Alaska.

Roger Atkins has a background in physical science and a passion for powder skiing. This led to curiosity about avalanches, a negligence at office work, and over thirty years as a helicopter ski guide.

FROM THE EDITOR

BY LYNNE WOLFE

Mid-November and the snow is piling up in my driveway. I am hopeful for the remainder of 2020. Minimal facets at the base can be an optimistic if not realistic short and long-term goal, as well as an apt analogy for current affairs.

I am encouraged and inspired by the energy and expertise that I see on screen on the virtual SAW circuit. People are determined to feed their curiosities and keep up their education even as nothing is the same as it ever was. It's great to see old friends and new voices offer insight to our community. Behind the scenes I text 🍻 beers to my buddies and on we go, trying to amass tools to make better and better decisions. I skim the lineups of the SAWs I couldn't attend and find myself formulating questions, then saving yet another presentation for when I have time. Never enough time, though, and next year I hope to share an in-person toast with many of you.

This TAR feels full of that early season energy. It's a grab bag of topics, so I bet you'll find something interesting and applicable to your own practice. The Education tab is full this issue as we've tried to present a sampler of what different educators are doing during Covid to pivot towards virtual and field-based classes. As usual, the decision-making folder has some useful stories as Doug Krause weighs in on lessons learned across his career and Shawn Davis gives us a stack of reasons to incorporate the Timeout into our backcountry practice.

I had a great time putting together another round table in response to Henry Schniewind's initial query about Islands of Safety. Some great photos and food for thought here.

Under the forecasting heading, Henry Finn and his colleagues at Simon Fraser University give us more insight into bulletin readers, aimed to help the bulletin writers, while Alex Marienthal of the Gallatin NF avalanche center ties stability test results to writing more accurate forecasts.

Crown Profiles brings you a Buddhist-toned interview with Jerry Roberts by the thoughtful Leath Tonino, reflections on ski patrolling during the onset of Covid from Andrew Hennigh, and part 2 of avalanche center season summaries, with a focus on our hardworking small centers.

Conspicuous in their absence in this issue are any science-based articles, which I am saving for the usual February science issue. Ping me if you have any topics you'd like TAR to pursue.

Finally, keep up your energy and optimism for this winter, friends.

FROM THE NEW A3 PRO PROGRAM COORDINATOR

BY ERICA ENGLE

When Lynne asked me to write a short piece for the TAR, I started scratching my head. What a unique time to take on this new job, I thought. With the uncertainties surrounding the Covid-19 pandemic and our country's political and economic situations, I have found myself pretty distracted this last 6-8 months. It has been a challenging time for many, wondering how the pandemic and the national climate will affect our professional lives and our world.

During this past spring and summer's guiding season, while working in the field with the challenges of Covid-19, readjusting my bearings required a notable about of energy. As we move into winter, reflecting on the past year and reorienting to the changing conditions is a valuable exercise for all of us in the avalanche field. The new hazards, complexity, and constant uncertainty of Covid have broadened our understanding of risk management and worker safety. We find ourselves in a time heightened with new and colluding stressors impacting our daily lives in acute and chronic ways.

What will it take for us to adapt and thrive in this changing environment?

My conclusion to this question is that, with an extra dose of moral leadership and resolve, we can use the same strategies that always prove vital in working through challenging, complex problems. These include active listening, investigating, analyzing, sharing information, collaborating through conflict, and readying ourselves for the dynamic future by anchoring to shared values and a commitment to maintaining a growth mindset.

My goal as the A3 Pro Training Coordinator is to support these strategies and values.

Now entering the fourth year of operational courses, the A3 and the Pro Provider Alliance have made significant strides in building a program suited to the needs of a diverse avalanche workforce. It has been incredible to watch the progression since the program began with the original Avalanche Education Working Group brainstorming sessions at Alta, Utah in 2013, through many stages and now to our current program. A wide diversity of dedicated professionals continues to bring a wealth of input. Previous coordinator Kate Koons did remarkable work shepherding the implementation of the Pro Program through the past three years. We still have a lot of work to do, and I look forward to reaching out to stakeholders across the industry, listening to the successes and challenges, and continuing to bring people together and move the Pro Program forward.

While there is a lot to be uncertain about, one thing has remained certain for me: my passion for working within professional avalanche education. A big part of that passion comes from knowing that the people who work in this field are resourceful, resilient and able to ride out storms together. To all the professional avalanche workers, educators, and students, I look forward to working with you, toward a vibrant and resilient future for the A3 Pro Training Program. Reach me at: erica@avalanche.org.

METAMORPHISM

FLATHEAD AVY CENTER

The axiom that "The more things change, the more they stay the same," might summarize recent metamorphism at the Flathead Avalanche Center. After four seasons as Director, the indefatigable Zach Guy has returned to Colorado as the Lead Avalanche Forecaster at the Crested Butte Avalanche Center. We suspect nostalgia for northwest Montana will quickly lure him into Brush Creek and onto Timbered Hill.

Blase Reardon, FAC's Lead Forecaster for the past two winters, has stepped into the Director role, inadvertently closing a circle that started two decades ago when he worked as a seasonal forecaster for a precursor to the FAC. Veteran Mark Dundas returns to fieldwork and forecasting after a winter away for health reasons. He will undoubtedly salt his observations and forecasts with more enlightening tidbits about local history, place names, and classic rock. We are thrilled to have him back. Cam Johnson and Clancy Nelson also return to the FAC for their second and third seasons, respectively. Both are hands-on, fix-it forecasters, though one prefers to tinker with snowmobiles while the other dives into Linux and websites. Rounding out the team is Professional Observer Guy Zoellner, who can take on chauffeur, counselor, trail-breaker, and comedian roles as needed.

A TRIBUTE TO ROBERT CLAUDE "PETE" PETERS

BY DAVID SLY

On May 11, 2020, the international snow control industry lost a champion, ambassador and advocate, Pete Peters, who passed away from complications of pneumonia. Pete is survived by his partner Barbara Robertson, his brother James Peter and his nephew Russell Peter.

Born on November 12, 1928, Robert Claude Peter hailed from Greenville, California. He was raised with his brother James on the 500-acre family ranch and homestead.

In January of 1951, 21-year-old Pete joined the U.S. Army and served in Korean war. Although he did not speak much of the war to me, he did mention that he flew many reconnaissance flights over enemy lines, dropping propaganda folder information, which was meant to convince the enemy to surrender.

Following military discharge Pete worked in the washing machine, dishwasher, dryer repairs and had a laundromat business in Oakland, California. How does this experience shape his future? His life changed when he met two key people.

Along with Monty Atwater and Ralph McCracken, Pete designed, built, and continued further development of avalauncher guns. 50 years ago, the three men met. Not only was the chemistry among them obvious, but the genesis of the ideas began. Their experiences blended well and they were the guiding minds behind the ideas, molds, and systems. The three created a reliable, effective and properly fitting tail fin arming system. These corresponded with explosive booster parts, a recommended detonator geometry, base charge, and primary charge. The unique and well-thought-out designs culminated in the avalauncher system still in use today.

Pete's time in the military along with his appliance repair provided experience with equipment, which had chatter valve and balance ports associated with the pistons in the motors. His knowledge of repairing this equipment fit well in developing an avalauncher pressure vessel that could dump all the gasses immediately without firing out of sequence.

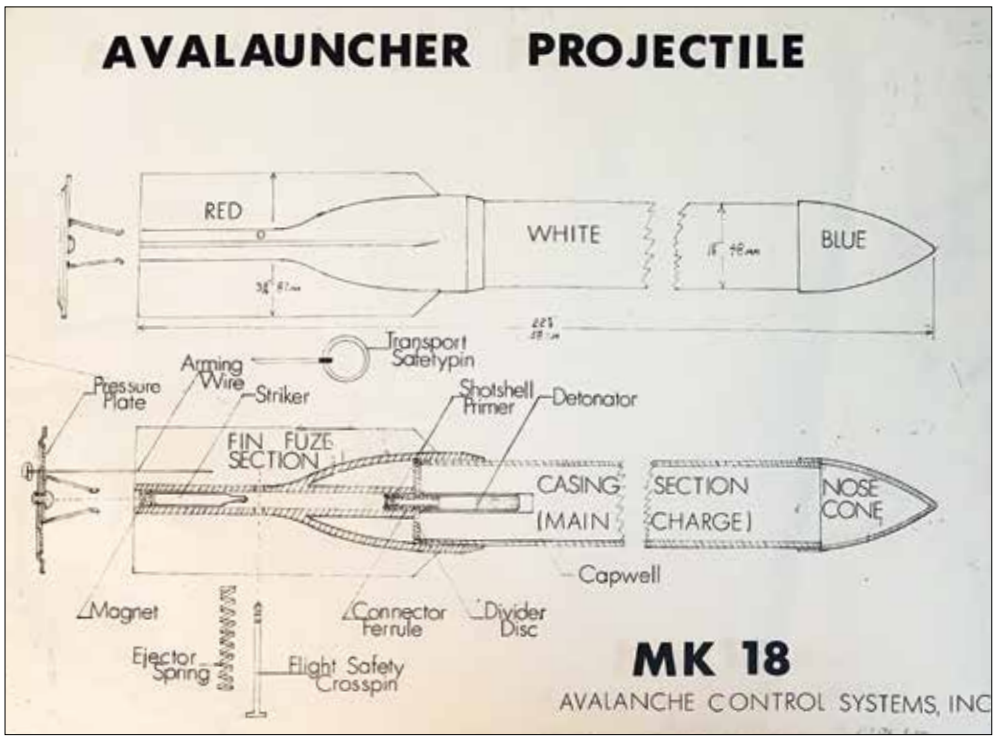
He knew the value of a professionally installed balance port inside the valve chamber to help prevent piston chatter and premature firing.

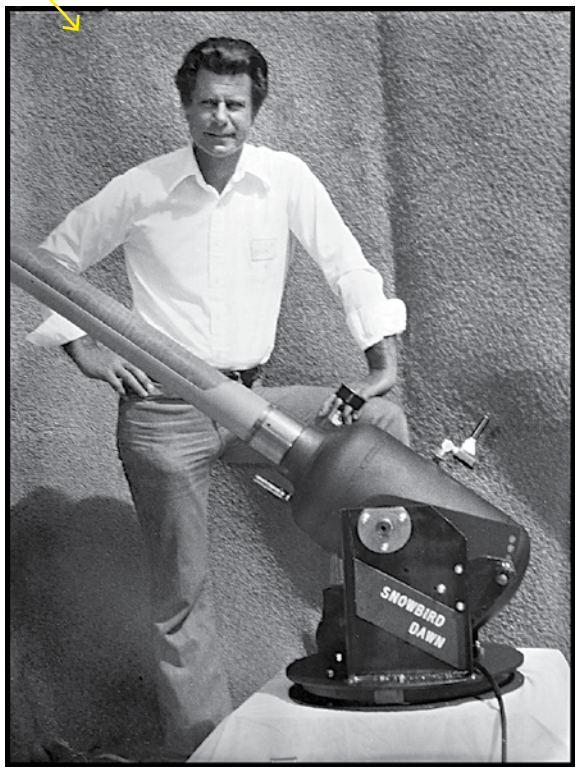
Combine the above with Monty Atwater's studies of snowpack and Ralph McCracken's industrial experience with the Caterpillar Company and the result was the onset of "Avalanche Control Systems Inc, American Rocket Crafters," which was originally a joint partnership between Pete and Monty Atwater.

The first tail fin engineered drawing blueprint is dated 1973. I have all the original engineered drawings of the guns, fins and parts. Perhaps you may find them in an avalanche control museum one day!

Pete was very personable. He took time for you and tried his utmost to help you. He would run around Oakland finding specialty parts for all his customers even those not directly related to his systems. His passion was being involved in snow control and promoting his avalauncher systems.

I met Pete around 20 years ago. CIL and MLP were partnering to serve the avalanche industry with custom explosives and initiating systems, which also involved supporting the avalauncher control niche. Of course, this meant working directly with Pete, whom I got to know very well, assisting him in making thousands of tail fins in his Oakland house. He was quite the character and we shared many laughs and stories of our experiences. I often met with Pete and his cronies for breakfast at Mamas Royal Café, on Broadway Street in downtown Oakland.





Avalauncher dud rates over the past five years have hovered around .25 of one percent. Pete would say, "Quality control in the assembly process and a well-run, disciplined procedure at the gun tower are keys to a low dud rate." Good advice from an industry veteran.

Pete made about 140 avalauncher guns of various styles and models, many of which are still in use today. He assembled around 1,000,000 tail fin units that have been used in South America and all over North American avalanche programs. Pete deserves wide recognition for his 50 years of dedicated service to the Snow Control Industry, his development of the avalauncher guns and ammunitions and his comradery to everyone he met.

It was my honor and privilege to have worked and partnered with Pete during my career.

David G. Sly has been President of Maple Leaf Powder Company since 1992. Maple Leaf Powder Company is a full service explosives and blasting consulting firm, which has been designing and marketing the Avacaster Avalauncher system and associated ammunitions for logging, mining, and avalanche control since 1977. (See ad this page.)

IN MEMORIAM

A FAREWELL TO A GREAT LEADER AND FRIEND: SAM WYSSEN

STORY AND PHOTOS BY ROZ REYNOLDS

The first thing you would notice about Sam Wyssen was his smile and the high frequency of it. He always took the time to share experiences with the people around him. No matter your position, Sam would lend you his ear and, likely, invite you to come visit the Wyssen factory in Switzerland. Sam Wyssen was a person who filled the world he lived in with his kind heart, good humor and innovation. He truly cared about the people in his life and though he had accomplished much, you would never hear it from him.

Tragically, Sam was in a small plane on the 25th of July, traveling to celebrate the retirement of a good friend, when the plane went down. All three passengers and the pilot passed away. Details of what caused the crash are not yet known. Though his presence is sincerely missed and deeply felt in the community, his innovations will continue to make avalanche control safer and his legacy will have persistent effects for decades to come.

His contributions to avalanche control live on in the world and in the spirit of the company he built. The story starts with Sam's grandfather, who started Wyssen Seilbahnen, a cable car company, almost 100 years ago. Wyssen Seilbahnen is still operating today and was the foundation from which Wyssen Avalanche Control (WAC) was created. Both companies are still family owned. Through Seilbahnen, the first innovation in the avalanche realm was developed using cables to transport charges and preventatively release avalanches. Sam Wyssen saw a need for a new design and an innovative solution for avalanche mitigation which took the form of a new Remote Avalanche Control System (RACS) and the Wyssen Avalanche Tower. Today there are over 450 of these systems worldwide. Sam personally traveled to each country where WAC systems have been installed and met with the avalanche teams who would use them and the communities who would be affected by them.

Back at home in Switzerland, as well as when Sam was on the road, he would always be sure to balance his work time with family time. He would spend weekday lunches coming home to be with them and was a ski coach for his son's ski team. Furthermore, Sam routinely left his office to frequent the rest of the Wyssen factory, a very picturesque place often surrounded by cows with Swiss bells. All Wyssen systems are still produced there today and through the hard work put in by Sam and company along the way, Wyssen will continue to produce existing systems as well as innovate new ones into the future. At his passing his employees, whom he considered family, expressed how much they looked up to him; to them, he was more than just a leader, but a remarkable person with an amazing heart.

The projects and consequently his travels took him around the world and in North America Wyssen started up in Canada in 2016 with the first project at 3 Valley Gap (British Columbia). After attending the ISSW 2016 in Breckenridge and seeing the interest expressed by the American avalanche community, the decision was made to aim for the first project in the US. The first Wyssen Avalanche Tower came to the United States in the Fall of 2017—Little Cottonwood Canyon in Utah. Many travels to the USA and Canada followed to meet with the Wyssen team members in the countries and the local avalanche communities.

Many of us who had the pleasure of spending time with Sam say that we learned so many life lessons from him. Sam led by example and truly embodied the ideal that connections in your life matter the most. It is nice to reflect on time spent with him and apply his life philosophy to our daily lives. To sit with dear friends, coworkers, and acquaintances and to enjoy the time we have together. To work hard but also realize the more connected you are with the people around you, the more effective our work will be. This is the legacy left behind by Sam Wyssen. In his words: "**Let's stay for one more beer.**"

October 27, 2020, Hatch Peak: This avalanche was remotely triggered above the rider while descending the slope. Thousand Dollar Run is seen in the runout. For more information and photos of Hatcher Pass, please see their 2019–20 season summary on page 40. *Photo Jed Workman*

THOUSAND DOLLAR RUN, HATCH PEAK, HATCHER PASS, ALASKA

BY FRED TRIMBLE, GOLD CORD MINE, ALASKA AND TOM MURPHY, GUNNISON, COLORADO

Hap Wurlitzer was many things to many people, but most of all he was the storyteller of Hatcher Pass. Karl Wurlitzer got his lifelong nickname, Hap, short for "Happy New Year", for being the very first baby born anywhere in the country on January 1, 1937. In 1957 he drove up the Alaska Hi-Way in a two-seater Nash Rambler. Hap held odd jobs in Anchorage like selling used cars and whirlpool baths. Along the way Hap had the good fortune to stake the very last Trade and Manufacturing homestead in the entire country, now the site of Hatcher Pass Lodge. Hap bootstrapped the Lodge in the process of "proving up" to earn the land patent to the 10-acre site. The Lodge has always had a focus on mountain life and the outdoors, but most of all on skiing.

Hap took to the surrounding mountains himself for the next 40 years, partly for recreation and partly for promotion of his dream to facilitate the creation of a downhill ski resort. In the process of being in the mountains over the years, many local names were coined by Hap and his friends at the Lodge. This is my recollection of the story Hap told about how one of the most popular, 1000 Dollar Run, got its name:

> *Hap had climbed up to Hatcher Pass proper and was skiing down on some telemark gear. At some point on a steeper section of the terrain, he took a yard-sale fall. During the tumble, a piece of gear, most likely a metal edged ski tip, hit Hap in the mouth and knocked several teeth out and caused some other severe dental damage. He also broke a ski pole and his glasses. Hap had to take a trip to the dentist for extensive dental work. The resultant total for the carnage was exactly $1000. That's precisely how the run got its classic name.*

Hap had a hand in hanging local names on many other geographic features in the area, places like Friendship Pass and Birthday Pass, Marmot Mountain, but those are another story…

Hap made his final run down the mountain on October 24, 2020. He will be greatly missed by all who knew him and that cherished his stories. Tall-tale or true, I would give anything to hear just one more!

Hatcher Pass, circa 1985: Hap Wurlitzer and Tom Murphy.

AVALANCHE EDUCATION GOES DIGITAL

ZOOM ZOOM: RECREATIONAL AVALANCHE EDUCATION IN THE TIME OF COVID

BY EEVA LATOSUO AND KATE KOONS

A3'S ROLE IN AVALANCHE EDUCATION

The American Avalanche Association oversees professional avalanche education in the United States and sets recreational avalanche course guidelines. Avalanche education can achieve more consistent and constructive outcomes for students when courses in the United States follow common guidelines and practices. Being recognized as an A3 approved course provider means that the curriculum has been vetted against A3 guidelines. The approved course providers are listed on avalanche.org and the American Avalanche Association websites.

For the last five years, the A3 has put considerable amounts of time and energy into the Pro Program. The A3 Pro program is now entering its fourth season and it continues with great enthusiasm from students, instructors, and industry alike. Over the last three winters, six Course Providers have delivered professional avalanche education to over 2000 students ranging from ski area, forecasting, guiding and education sectors. Throughout this time, we have seen refinement in terms of the delivery of courses and more consistency in outcomes. The goal from the very beginning has been to achieve consistency in testing outcomes, meaning no matter where you take your course and from whom, we will all speak the same language and can expect the same level of professionalism across sectors of the industry. Moving forward, the Pro 1 and Pro 2 courses will be the only ones offered in the near future with the current Pro Course Providers.

Important note, A3 is not an accreditation body for educational operations nor does it certify the instructors for a particular standard. The previous Certified Instructor program was terminated in 2019 as it was termed to be a token process that was not adequately reflecting avalanche instructors' competencies. Instructors who deliver pro level training attend a separate A3 workshop to ensure that the student evaluation standards are the same across the providers. On the rec side, avalanche education institutions have varied levels of in-house training to coach their instructors, but there is no single mile marker to state that the educator you are taking the course from is indeed an effective teacher. Same goes for business practices or ethical marketing: A3 is not responsible for the character of these businesses or non-profits.

Nevertheless, being an A3 approved recreational avalanche course provider means that the organization adheres to the current avalanche education guidelines and is committed to providing high quality education for their students. A3 streamlined the application process this fall, removed the application fee, and is looking to build a more meaningful network among listed programs. A3 will be reworking the education content on Avalanche.org this winter to make it more useful for folks looking for appropriate courses and for the avalanche educators as a functional outreach channel. Another goal for the A3 Education group this year is to review the guidelines for all the recreational avalanche course types. If you have concerns or ideas, shoot an email to a3education@avalanche.org.

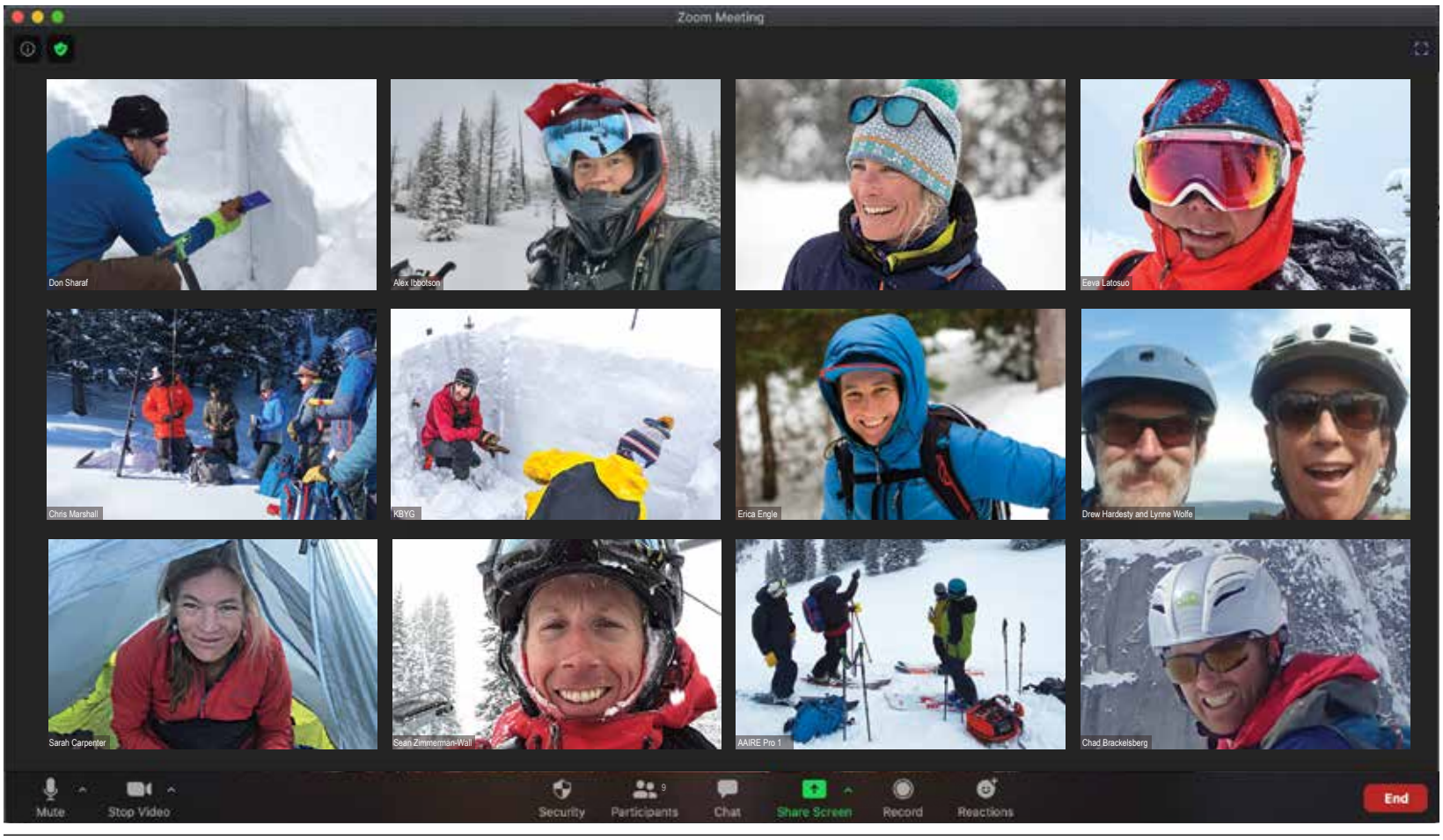
PANDEMIC SEASON

Covid-19 has changed the landscape for avalanche education needs and offerings. In the spring, people flocked to the backcountry, but at the same time many avalanche courses were canceled as the outdoor industry was doing their part in fighting the spread of the disease. During the summer 2020, the guiding industry, led by the American Mountain Guide Association, developed procedures on how to conduct outdoor activities safely in small groups. You can find those procedures here: https://amga.com/responsible-return-work/.

Avalanche education is lucky to build on summer experiences. Education providers will also still need to navigate operating restrictions from land managers and insurance companies for public safety and risk reduction.

In winter 2020–21, all of us anticipate large crowds of new backcountry users who will need training. Avalanche courses around the country are already filling up with waitlists. Students are encouraged to stay in their own region to take a course to cut the need for travel. Many of the listed course providers have made adjustments to their programs by minimizing classroom instruction and adjusting group sizes. Online components are replacing inside sessions. A3 does not have specific guidelines for online education, but listed course providers are the known experts in avalanche education who will also have a better handle on field instruction in unusual times. There is a consensus among avalanche educators

Educators and contributors discuss virtual education virtually (and hypothetically) in preparation for in-person field time.



that the field days are crucial for learning. For example, Level 1 might not have any classroom instruction this winter, but the recommendation is to still have 14 of the 24 required hours of total instruction in the field, making for two full days of backcountry learning.

IT IS A JUNGLE OUT THERE

There will be other sources of online training for awareness level programs that are accessible when avalanche courses are full. Basic knowledge like "Check the forecast" can be learned from sources that are not specifically approved by A3. Some of these programs are quite brilliant and innovative, but if the avalanche program goes beyond a two-hour presentation or has a field component, A3 recommends using approved course providers. These operators have been taking students responsibly in the backcountry before the pandemic changed the education scene.

If you are working or taking an avalanche course this winter, you should ask for specifics on how the program is delivered. A course provider's listing on the A3 website does not guarantee that a course or program will be safe. A3 urges you to pay attention to the Covid-19 prevention measures for the field sessions. None of us know how the winter will proceed, but it seems unlikely that we have a miraculous change in the trends. A better plan is to be patient and play by the rules until there is a vaccine or the pandemic has succumbed by other means.

Eeva Latosuo serves on A3 board of directors as Education Trustee. She is faculty at Alaska Pacific University and teaches avalanche courses for Alaska Avalanche School. She lives and works on Denai'na lands in Anchorage, Alaska.

Kate Koons is a lifelong learner who will be the first to laugh at herself. She will be leaving her job at A3 this fall, yet she won't be far from the avalanche world. She'll continue to teach pro courses and ski guide when she can fit them in. More than likely, you'll bump into her somewhere in the Tetons on her skis or trail running.

SOCIALLY DISTANT AVALANCHE EDUCATION

BY CHAD BRACKLESBERG

Online learning has been growing rapidly for the past two decades and has been widely adopted for everything from corporate learning to online college classes to continuing education. Now with Covid-19, everyone is embracing online learning.

When the UAC started building the Know Before You Go (KBYG) eLearning Program in late 2017, we envisioned creating a program of 15 courses starting where a traditional KBYG presentation left off. Our goals with KBYG were to start people down a lifelong path of avalanche education and provide a knowledge refresher. Online avalanche learning was not yet being widely used and we were unsuccessful in getting financial support to build the entire program.

We released the KBYG eLearning Program in November 2018 with five courses based on the five KBYG points (Get the Gear, Get the Training, Get the Forecast, Get the Picture, and Get out of Harm's Way). We felt this was the most important information to deliver and would be a good test of the community's desire for online avalanche awareness training. The program was a successful test, with over 13,000 registered users and almost 25,000 course views between the release in November 2018 and April 2020. We never would have thought less than two years after this release that almost all classroom avalanche education would be delivered online due to the Covid-19 pandemic.

The backcountry in Utah, as well as other areas of the country, saw a huge jump in users when resorts shut down in March. Backcountry gear flew off the shelves and daily we saw as many vehicles at trailheads as we would expect on President's Day weekend powder day. In April, we had nearly 50 human-triggered avalanches in one powder weekend. By the end of April, the UAC team knew we had to start making plans for delivering avalanche awareness and education during

the 2020–2021 season. We deliver KBYG to over 8,000 people each year in Utah, with group sizes ranging from 10 to 500. How would we continue to reach school kids and adults with our avalanche awareness message? What about our "Backcountry 101: Introduction to Avalanches" classes? Last year we had over 650 students, each attending a four-hour classroom session. How would we deliver classroom sessions safely?

The Backcountry 101 classes offered a simple solution. We could record instructors presenting the classroom content and assign these videos as part of the pre-course materials. Since these courses see so many first time users, we wanted to make sure we still offered a 'hands-on' classroom experience. To do that, we have held a two-hour Zoom virtual classroom session the evening before our classes to give students a chance to ask questions and allow us to clearly communicate what is needed for the field day. This has allowed us to accommodate more users by offering both weekend and midweek classes.

KBYG presented a more difficult problem to solve. We knew there would not be a single ideal solution for all groups. We focused on five ways to deliver KBYG to cast the widest net possible.

1. Our primary focus was reaching school age kids with this message. With most Utah schools incorporating at least some virtual/at-home learning, we wanted to provide teachers with an avalanche awareness curriculum for their students. Our solution was to partner with CAIC to develop an interactive KBYG eLearning course (https://learn.kbyg.org). This is "Course 0" to introduce the five courses released in 2018. The full six-module KBYG eLearning program gives teachers six hours of online content for students. Any teacher who has to develop their own online curriculum will welcome six hours of exciting, pre-approved content. We released this "Course 0" the first week of October via social media and emailed the curriculum to teachers who normally coordinate in-person presentations.
2. In a 12-month period starting January 2019, Utah saw six avalanche fatalities in which the victim or a member of their party was missing some or all of their essential avalanche rescue gear. We saw a need to reach users who don't know about their local avalanche center with a basic avalanche awareness message. The catch-22 is if a user doesn't know about their local avalanche center, how can we reach them with our message? We needed to find new channels for our messaging. We are addressing this by using the social media accounts of our partners; recruiting local shops, brands, and ski resorts to help us spread our awareness message by hosting a KBYG livestream.
3. We achieved great success with livestreaming KBYG and other educational content via UAC social media channels last spring and are continuing to stream the KBYG series and special topic presentations on our social media channels.
4. For groups that still want a private, interactive presentation with Q&A, we are hosting private video conference (Zoom, Skype, etc) KBYG presentations.
5. Lastly, we wanted to make sure that anyone could view a complete KBYG presentation on-demand. We recorded a full KBYG presentation and published it on the KBYG.org website. Along with providing a great resource for users, it provides an effective training tool for new KBYG instructors.

By casting this broad net, we hope to reach many of these new users with an avalanche awareness message. We will address the request for in-person presentations this season as we receive them and based on current CDC and state guidelines for Covid-19 safety.

When we first conceived the KBYG eLearning program, we identified 15 courses we wanted to create. As our community embraces online avalanche learning we hope to collaborate with others and continue to expand the KBYG eLearning program.

If you have any questions about the KBYG program, please contact : chad@utahavalanchecenter.org.

Chad Brackelsberg is the Executive Director of the nonprofit Utah Avalanche Center. Chad is an avid backcountry skier, ski mountaineering racer, ultrarunner, and mountain biker.

ELECTRONIC AND DISTANCED AVALANCHE EDUCATION

BY SEAN ZIMMERMAN-WALL

Adapting to an ever-changing and complex environment is part of the daily routine for many avalanche practitioners. Taking an account of all the available information and making thoughtful choices is a fundamental skillset that enables many a mountain dweller to find a path forward in the most unfavorable conditions.

In avalanche education, instructors take on the mountains with all their uncertainty and combine that with an audience of individuals with differing backgrounds, mindsets, and abilities. There are many schools of thought on how to connect with students in a meaningful and memorable way, and instructors throughout the educational paradigm in the US find creative ways to deliver dynamic content on a spectrum from awareness presentations to high-level professional training. The proliferation of online educational content follows suit with the evolution of the backcountry user and avalanche practitioner alike. Developing new mediums for interaction and knowledge transfer that resonate with groups who prefer the wind in their face to the glare of a screen is no mean feat. However, in our constantly connected universe, there is no quicker way to disseminate information and gather feedback than by using a digital sphere of influence.

AIARE's trajectory on this course continues to take into consideration educational theory and investigate delivery methods in an effort to prepare backcountry explorers of every ilk. Our initial online training program (started in 2016) provided an opportunity to increase instructional time without having to increase time with an instructor. The goal to create a baseline for instructors to build from during the 24 hours of classroom and field instruction took several years to achieve. However, each consecutive season, instructors using the tool found increasing levels of information retention during the course. This cognitive priming allowed for more robust classroom discussions and field application of principles embedded in AIARE's Risk Management Framework.

The current reality of Covid and social distancing serves as a catalyst for the development of online training that is not only a way to preload students with information, but to completely replace the traditional classroom environment. Blended learning and flipped classrooms are already in place in higher education. By taking stock of what works well and what works better, we have begun refining an online curriculum that approaches parity with in-person lectures.

Here it is also important to mention that AIARE operates differently than other recreational course providers. We are the central organization that builds and develops a curriculum package for the AIARE Provider Network, and then trains instructors to teach that curriculum and our recreational Risk Management Framework. The individual providers within the network (private entities or public institutions) are in charge of hiring qualified personnel and ultimate delivery of the actual courses, but they all adhere to a specific set of guidelines created by AIARE, which follow established recreational course guidelines and have been audited by the A3.

Our principal goal this summer was to make sure we support our Provider Network through consistent outreach regarding how they hope to operate next season. We also performed a major update to our online platform, which now moves into on-course modules that can be used remotely (asynchronously or synchronously.) However, the delivery will ultimately be up to the providers themselves based on their respective state and county ordinances when it comes to group gatherings. To further support the launch of the upgraded platform, AIARE's Director of Recreational Programs, Liz Riggs Meder, is offering pre-season training sessions for both the providers (>100) and the AIARE instructors (>450) on how to use the tools.

Working through the somewhat painful implementation of the aforementioned online training left AIARE looking for different approaches that matched our internal abilities to manage.

Our updated platform utilizes a Google Sites interface which allows for easy population of content, enables check-for-understanding quizzes, and is segmented to be utilized as modules that fit into our three-course continuum, known as Decision Making in Avalanche Terrain. Individually the courses are referred to as AIARE 1, AIARE 2, and Avalanche Rescue. Each course is already supported by a Student Manual and Fieldbook, and the online modules will give further guidance on how to best use these materials. We aim to gather feedback throughout the season from our instructors and providers on how this tool is being employed and are excited by what this means for future development. In essence, the 2020/2021 season will be a crucible for how our organization integrates new technology, and then observes and compares our current state with our desired state.

Internally, we have also adapted our Instructor Training and Professional Training courses to reduce geographic spread of instructors and reduced overall course size, but not necessarily course ratios. We are also migrating to a virtual classroom that will occur during the same week as the field courses. Utilizing mediums such as Zoom, Google Classroom, and Prezi will help achieve a certain level of interaction and promote discussion between participants and the instructor team prior to field travel. In the field we will maintain independent pods of instructors and students. We have developed a host of additional policies and guidelines for our instructor staff to follow too. Fortunately, we have had some great guidance from our medical advisor and legal teams, and our Executive Director has made sure we have been well suited to make the pivot.

Without a doubt there will be moments of difficulty and frustration in the months ahead. Our mission of "Saving Lives Through Avalanche Education" will serve as a guiding principle and we look forward to the challenges. We also encourage collaboration and the sharing of problem-solving strategies across the industry.

Sean Zimmerman-Wall resides in Utah and splits his time between patrolling at Snowbird, working as AIARE's Pro Program Director, and serving on the A3 Board of Trustees. Free days are spent chasing two groms through the mountains and introducing them to the wonders of the natural world.

AVALANCHE EDUCATION IN THE TIME OF COVID: **NECESSITY IS THE MOTHER OF INVENTION...**

BY SARAH CARPENTER

As avalanche educators for the American Avalanche Institute, we are in the business of risk management. We are constantly evaluating the likelihood of something happening and the consequence of that something happening (i.e. an avalanche on a particular slope). We are also considering our vulnerability and exposure. And even with this vocabulary, there is always an element of uncertainty with travel in avalanche terrain. This vocabulary and a basic understanding of uncertainty are really useful tools in adapting in the time of Covid.

When evaluating the risk of Covid impacting courses, it seems that the likelihood increases if you put students in a classroom for an extended period of time. Identifying this concern, we then manipulated the levers of vulnerability and exposure to adapt to life amidst a global pandemic and moved our classroom curriculum online.

This winter, our students will have access to self-paced online learning that consists of recorded classes, graphics, a digital copy of a workbook, activities, and quizzes, as well as links to articles, videos, and additional information. We will then offer field sessions to complement the online learning and offer a venue for focused practice and coaching of skills introduced online. In addition, we will spend time on Zoom or some other platform building community, answering questions, and debriefing exercises and tours from the field sessions.

To facilitate contact tracing and in an effort to limit exposure, we have shrunk some of our group sizes and anticipate having groups function independently of one another in the field. We also are exploring the option of keeping students with the same instructors for the duration of the course. While this limits the number of perspectives that a student may get, there likely will be greater continuity in the field and more detailed personal coaching.

We are really excited about this new paradigm of avalanche education. It offers an opportunity for more field time with each course type. It also offers students an opportunity for review. If a concept is not understood after watching the class once, students can re-watch parts of the online class to gain a better understanding of the concepts presented. They will also have a workbook and note-taking templates at their fingertips to address multiple learning styles. It also offers students more flexibility to learn at their own pace before arriving at the field session.

Covid has forced avalanche course providers to re-think how we provide education. While no one wants to see the pandemic last any longer than it has already, we believe that the adjustments that we made to reduce the risk of Covid exposure will likely improve our educational product for years beyond our current crisis.

Sarah Carpenter is a co-owner of the American Avalanche Institute. She teaches avalanche courses to both recreationists and professionals and loves sharing her excitement about the winter environment with others. Sarah also works as a ski guide in the Tetons. She lives in Victor, ID with her husband, Don, in a house they built together (with a lot of help).

In avalanche education, instructors take on the mountains with all their uncertainty and combine that with an audience of individuals with differing backgrounds, mindsets, and abilities.

ADAPTABILITY IN THE AVALANCHE INDUSTRY: INTEGRATING DIVERSE CULTURES

BY ALEX IBBOTSON

Snowmobiles add greater travel distances, speed, and higher impact potentials for backcountry users to an already unpredictable backcountry environment and snowmobile use is increasing in the mountainous, North American backcountry. Ski or snowboard-based avalanche practitioners who adopt snowmobiles as efficient operational transportation are without a standard for snowmobile training. An unclear scope of expertise around snowmobile use in the avalanche industry is a risk to public safety. Simultaneously, backcountry practitioners are assuming a duty of care for clients and leading them through the backcountry on snowmobiles without an industry training standard. Integration between ski or snowboard-based and snowmobile-based avalanche practitioners would enrich each group with a more diverse perspective of backcountry safety.

At the Microwave riding zone near Smithers BC, dark clouds from an approaching storm indicate it is time to travel to the trail head. *Photo Alex Ibbotson*

Although the growth rate of snowmobiling is high, snowmobile-based practitioner enrollment in professional avalanche training is low, making it difficult for avalanche training providers to offer regular snowmobile-based courses. The Canadian Avalanche Association (CAA) has certified only six snowmobile-based practitioners in their Avalanche Operations Industry Training Program Level 2 (delivered on snowmobiles) in the past 7+ years, while the American Institute for Avalanche Research and Education (AIARE) has only ever certified five candidates in the American Pro 2 Motorized course. In the summer of 2020 I connected with a diverse group of eight professional level avalanche educators from Canada and the United States to be involved with a research project to promote diversity through inclusion in the avalanche industry.

With an action-oriented process, my goal was to inspire a community dedicated to supporting snowmobile-based practitioners through the professional avalanche education pathway. The perspective of this inquiry was informed by my experience navigating the CAA Level 2 Industry Training Program as a minority snowmobile-based practitioner in a predominantly ski-based mainstream culture.

Appreciating the need for more snowmobile voices contributing to avalanche educational content, AIARE enthusiastically joined as partner organization for this research. AIARE develops research based professional recreational avalanche training for backcountry users in the United States, South America and Europe. AIARE was formed to advance standardization for avalanche training in America (Personal Communication Steve Conger June 25, 2020). Utilizing existing national and international standards from the American Avalanche Association and the CAA, AIARE follows a consensus-driven process to produce an avalanche education program and training courses that meet the needs of trainers and course participants

AIARE was formed from a chance meeting between Karl Klassen, a prominent avalanche practitioner within the Canadian Avalanche industry who designed Canadian avalanche curriculum and AIARE's cofounder Jean Pavillard, in 1992. This relationship contributed to a united approach to curriculum design for AIARE's avalanche training programs. The design of this research project will follow the same foundation of integration, collaboration, and inclusion that AIARE was established on.

Through relationship and knowledge sharing, this inquiry is already deconstructing the popular narrative around snowmobile culture, particularly within the avalanche industry. We are highlighting concentrated areas where snowmobile-based practitioners

are currently modeling a snowmobile avalanche safety culture by enrolling in professional avalanche training despite numerous systemic barriers. In this appreciative inquiry approach, together with leading avalanche curriculum creators and world class snowmobile-based practitioners, we explored ways to cultivate an avalanche safety community and catalyze an increase in snowmobile-based practitioner enrollment in avalanche training. In narrative interviews, a diverse group of ten snowmobile practitioners from Canada and the USA shared what an inclusive avalanche industry looks like from the perspective of a sledder.

The first stage informed a second phase of data collection, where eighteen diverse snowmobile-based guides, avalanche educators, industry workers, and professional athletes met in a virtual meeting space and discussed how to support up-and-coming snowmobile-based professionals in obtaining an industry standard of avalanche training. The questions were specifically, "With your experience, what advice do you have for a sledder hoping to achieve a professional level of training?" and "What can we do as leaders in the industry to support an up-and-coming sledder to achieve a professional level of avalanche training?"

The most common topic that arose was the inability for snowmobile-based practitioners to obtain mentorship from a highly experienced avalanche practitioner who is a good enough rider to move through complex terrain efficiently. As snowmobiles are increasingly recognized for the vast efficiencies they bring to backcountry travel, snowmobile mobility experts are being told that they should learn to ski in order to obtain the social collateral required to qualify for further professional avalanche training.

By appreciating diverse perspectives, this dialogical and qualitative inquiry is aimed to increase snowmobile-based enrollment in professional avalanche training by creating compassionate linkages between snowmobile-based practitioners and established avalanche professional communities.

Siegel (2017) described integration as "the honoring of differences and the cultivation of compassionate linkages" (p. 286). Relationship building and knowledge sharing between ski or snowboard-based and snowmobile-based practitioners has inspired a common purpose for a snowmobile avalanche safety community to emerge and we have introduced a communication network to support this. The differentiated elements of snowmobile-based and ski or snowboard-based avalanche practitioners will behave collectively as a healthy complex system capable of self-organization and adaptation, if they have integration and maintain independent identities (Siegel, 2017). The unique identities of these differentiated groups will create stability in the groundlessness of transformational change promoting novel innovative results, disintegrating the cultural rigidity that comes with a tight mono-culture of sameness (Varela, Thompson & Rosck, 2016).

Transformational social change is change that fundamentally shifts a person or group's beliefs. The current global Coronavirus health crisis has normalized transformational change, which has set the stage for a safety evolution within snowmobile culture. The wisdom exchanged between these differentiated groups will enrich the other with valuable safety practices towards a more professional and diverse avalanche industry adapting to increased snowmobile use and whatever else the future holds.

A movement of action has already sparked from this engaged group and the momentum is magnifying areas where a snowmobile avalanche safety culture had already sprouted. Recently there was a snowmobile-based practitioner panel at the Virtual Snow Science Workshop which opened awareness around diverse perspectives on backcountry safety. If you are interested in promoting diversity in the avalanche industry and supporting the integration of snowmobile-based practitioners with avalanche communities please contact me to get connected with our growing international network (alex@canadabackcountry.ca).

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Alex Ibbotson is a leadership coach, strategic culture consultant, integrative facilitator and educator. She began her journey in the avalanche industry when she recognized her snowmobile riding aptitude allowed access to complex terrain where recreational avalanche training was not sufficient. Alex provides and avalanche training with her own company Canada Backcountry Services.

DO STABILITY TESTS INFLUENCE FORECASTERS' SLOPE STABILITY RATINGS?

A case study supporting the application of snowpack stability tests

BY ALEX MARIENTHAL, DOUG CHABOT, AND KARL BIRKELAND

INTRODUCTION

Snow stability tests provide information about the likelihood of avalanching on slopes with a similar snow structure. They are especially important during times of conditional stability, when avalanches or obvious signs of instability may be rare (LaChapelle, 1980). Avalanche forecasters use these tests to assess stability across a region, ski area, or transportation corridor, while recreational backcountry users typically use them for assessing slopes they want to ski or ride. Regardless of these differences, stability tests are invaluable for informing decisions for traveling in, or opening or closing, avalanche terrain. This study focuses on professional avalanche forecasters, showing that stability tests influence their slope stability ratings in nearly 30% of the tests. Our results show the importance of stability tests in professional decisions regarding avalanche conditions.

METHODS

We used stability test data collected by professional avalanche forecasters in the western US over four winters (2016-17, '17-18, '18-19, '19-20). Forecasters entered snowpit profiles and stability test data into SnowPilot (snowpilot.org) so we could easily collect and analyze the data. We asked forecasters to utilize all the information they had available to assess the stability of similar slopes **prior to performing any stability tests**. After conducting a CT, ECT and/or PST, we then asked them to record an "after tests" stability rating for similar slopes.

Slope stability was rated *very good, good, fair stable, fair unstable, poor,* or *very poor* (*Figure 1*). This rating scale is adapted from table G.1 in Snow Weather and Avalanche Guidelines (American Avalanche Association, 2016). Table G.1 uses a scale of five rather than six ratings with "fair" between "good" and "poor".

Layers in the springtime snowpack in the Bridger Range, Montana. *Photo Alex Marienthal*

We asked forecasters to specify *fair stable* or *fair unstable* instead of *fair* in order to binarily classify pits as *stable* or *unstable*.

Our research question is: **Do stability tests influence slope stability ratings?**

We originally requested these data to answer questions regarding stability test accuracy and skill, so forecasters were not aware of the question presented in this article; this should reduce any potential bias of participants.

RESULTS

After four seasons of data collection we had 562 snowpit profiles that included "before test" and "after test" stability ratings and at least one stability test (CT, ECT or PST). We received profiles from Montana (235), California (127), Utah (91), Nevada (58), Colorado (49), and Idaho (2).

Out of 562 profiles:

- 437 were rated *stable* before stability tests were performed (78%).
- 125 were rated *unstable* before stability tests were performed (22%).
- After doing stability tests forecasters changed the stability rating at least one step on the six-level scale in 29.4% of profiles (165/562 profiles) (*Figure 2*).

In 11.0% of profiles (62/562), forecasters changed the slope stability from either stable to unstable or unstable to stable. Forecasters changed a total of 8.9% of profiles rated stable (39/437) to unstable, and they changed 18.4% of profiles rated unstable (23/125) to stable.

DISCUSSION

We chose professional avalanche forecasters for this study because they have all the latest information about the snowpack stability in their region, and are therefore best positioned to assess the snow stability prior to conducting a stability test. They track weak layers and snowpack structure starting with the first snowfall, document every reported avalanche, regularly check all available weather stations, and dig repeatedly to track weak layer development and stability. Forecasters assess and verify snowpack stability, and they utilize stability tests as part of this process.

There have been debates in the avalanche community whether tests are valuable since spatial variability can give conflicting results. We argue that our results are one more piece of evidence showing the value of digging and stability tests. Professional avalanche forecasters, likely the most knowledgeable of anyone traveling in their region, adjusted their assessment 29% of the time based solely on stability tests. This does not discount the dozens of other observations a forecaster makes, but rather it highlights the power of digging in the snow and performing a stability test.

TABLE G.1 Snow Stability Rating System

STABILITY		EXPECTED AVALANCHE ACTIVITY		
STABILITY RATING	COMMENT ON SNOW STABILITY	NATURAL AVALANCHES (excluding avalanches triggered by icefall, cornice fall, or rock fall)	TRIGGERED AVALANCHES (including avalanches triggered by human action, icefall, cornice fall, rock fall or wildlife)	EXPECTED RESULTS OF STABILITY TESTS
Very Good (VG)	Snowpack is stable	No natural avalanches expected	Avalanches may be triggered by very heavy loads such as large cornice falls or loads in isolated terrain features	Generally little or no result
Good (G)	Snowpack is mostly stable	No natural avalanches expected	Avalanches may be triggered by heavy loads in isolated terrain features	Generally moderate to hard results
Fair (F)	Snowpack stability varies considerably with terrain, often resulting in locally unstable areas	Isolated natural avalanches on specific terrain features	Avalanches may be triggered by light loads in areas with specific terrain features or certain snowpack characteristics	Generally easy to moderate results
Poor (P)	Snowpack is mostly unstable	Natural avalanches in areas with specific terrain features or certain snowpack characteristics	Avalanches may be triggered by light loads in many areas with sufficiently steep slopes	Generally easy results
Very Poor (VP)	Snowpack is very unstable	Widespread natural avalanches	Widespread triggering of avalanches by light loads	Generally very easy to easy results

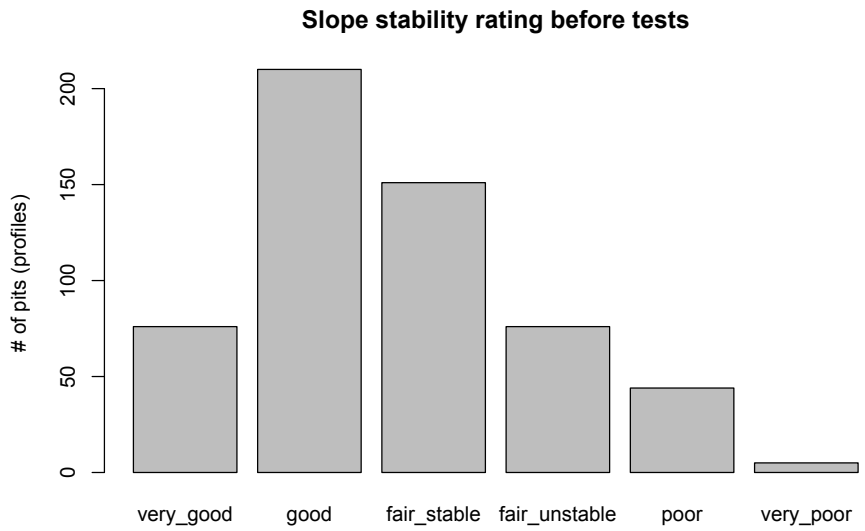

Figure 1. Distribution of stability rating for profiles before stability tests. Scale of stability ratings shown along x-axis.

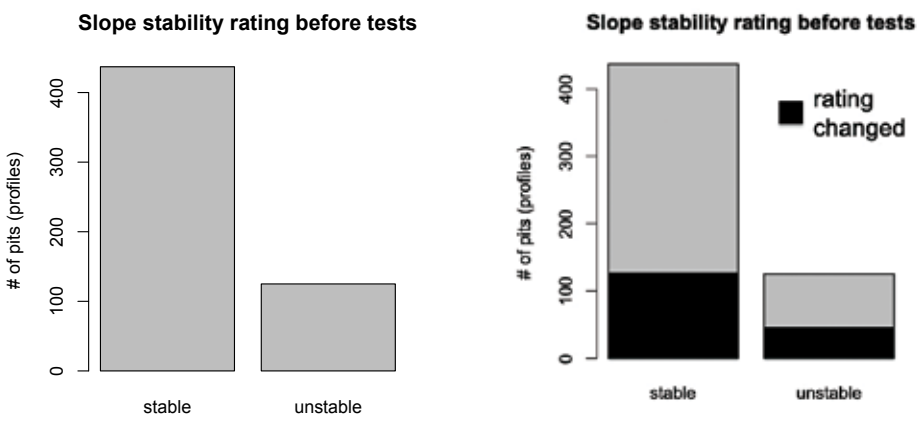

Figure 2. Distribution of profiles binarily classified as either "stable" or "unstable" (left), and the number (29.4%) of profiles that the rating changed at least one step on the scale of six after stability tests were performed (shaded on right).

Forecasters in this study rated 125 slopes unstable prior to doing a stability test, but in 23 (18.4%) of these cases doing a test changed their rating to stable. This may seem surprising since we typically teach people to never use stability tests to convince us that a potentially unstable slope is stable. Rather, tests are typically only used to search for instability. In other words, if we think a slope is unstable before doing a test for whatever reasons, we should not ski/ride it even if our tests show stable results. Despite this, forecasters in this study changed their rating to stable on almost 1 in 5 slopes they had originally rated as unstable. This reflects how forecasters are constantly tracking and assessing stability for a region versus making an assessment to ride a specific slope, and these changes might be as forecasters utilize tests to reduce their uncertainty about instabilities. Of course, false stable test results are dangerous, so forecasters often dig multiple pits/tests to confirm any significant change in stability assessment.

Alternatively, of the 437 slopes that forecasters rated as stable prior to conducting a stability test, doing a test changed their minds 39 times (8.9%). This shows that even a person with an intimate knowledge of the snowpack in their region changes their assessment from stable to unstable nearly 10% of the time. Clearly, a stability test in these situations can prevent the user from making a "go" decision in a "no go" situation.

In summary, forecasters changed their slope stability rating at least one step on 29% of slopes after performing a stability test. These findings support the usefulness of stability tests for assessing snowpack stability on similar slopes in a region. Interestingly, stability tests commonly influence slope stability assessments of avalanche forecasters, even when they already possess an extensive amount of information about the snow stability. This highlights the importance of gathering as much information as possible to justify our decision of whether or not to travel in avalanche terrain.

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Alex Marienthal is a forecaster at the GNFAC and ski patroller at Bridger Bowl. His favorite stability test is an explosive airblast, but will settle for the ECT when/where explosives are not allowed.

photo Dan Ventura

DO RECREATIONISTS HAVE THE SKILLS THEY NEED TO USE AVALANCHE BULLETINS EFFECTIVELY?

HENRY FINN, ANNE ST. CLAIR, PASCAL HAEGELI, KARL KLASSEN, MARY CLAYTON, AND ROBIN GREGORY

INTRODUCTION

To consistently make safe and informed decisions about winter backcountry travel in the mountains, recreationists need to be able to accurately understand and sensibly act upon relevant information about avalanche conditions. For many individuals, this information is obtained from the public avalanche bulletin, which is tasked with facilitating the avalanche risk management practices of an audience that varies widely when it comes to their technical competence and informational needs (St. Clair, 2019).

In recent years, concerted efforts have been made to improve the production end of avalanche bulletins and the consistency and reliability of information they provide. However, much less focus has been placed on the receiving end of avalanche risk communication. As a result, not much is known about whether winter backcountry recreationists possess the avalanche bulletin literacy skills they need to properly use, comprehend, and implement bulletin information.

Before a meaningful evaluation of bulletin literacy can be conducted, it is important to understand that depending on the recreational objective, the risk from avalanches can be managed at different levels of sophistication. For some recreationists, it is completely legitimate to consult the bulletin to make simple, large-scale decisions, such as whether or not to enter the backcountry on a given day based on the danger rating alone (St. Clair, 2019). Other, more advanced users require more nuanced insights to inform small-scale management of personal exposure to avalanche risk (St. Clair, 2019). While the literacy requirements may differ substantially among individuals, it is critical for all bulletin users to form accurate interpretations of the information they need to make appropriate avalanche risk management decisions.

Figure 1. During spring of 2019, more than 3000 backcountry recreationists took part in an online survey which evaluated their capacity to use, understand & apply avalanche bulletin information.

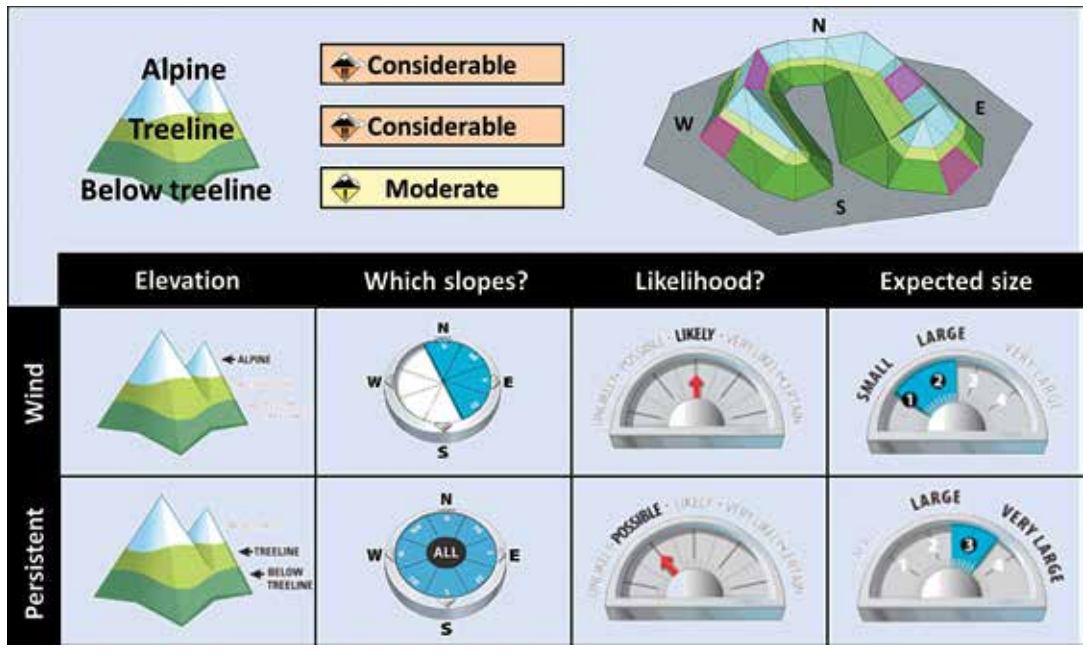

Figure 2. The slope choice question: participants were asked to state which of 4 highlighted slopes on a 3D mountain model were appropriate for traveling on given hypothetical avalanche conditions. Which would you choose and why?

METHODS

For this research, we used a custom-built online survey (*Figure 1*) containing a series of literacy evaluation questions that assessed the capacity of recreationists to recall, understand, and apply avalanche bulletin information correctly. Towards the start of the survey, participants were presented with a list of statements describing different bulletin use practices and asked to select the one that best described their use of bulletins when planning for backcountry trips. These statements, which were based on findings from St. Clair's qualitative interview study, comprise an avalanche bulletin user typology[1], with each level increasing in terms of the sophistication of decisions made and the breadth of avalanche bulletin information incorporated. Participants were then targeted with specific literacy questions and were evaluated using grading criteria that were based on these self-reported levels of bulletin competence.

One of the most pivotal questions in the survey was the slope choice question (*Figure 2*), which assessed the ability of participants to synthesize avalanche bulletin information and apply their interpretations into a decision about the suitability of terrain for backcountry travel. This exercise asked users to determine whether each of four separate slopes were appropriate for travel based on hypothetical avalanche conditions. The survey also included a series of exercises that examined understanding of individual concepts related to the danger ratings and the avalanche problems.

RESULTS

In our promotional efforts for this study we aimed to incorporate the views and perspectives of a wide range of participants with differing levels of avalanche and backcountry experience. In total, 3,198 people completed the survey. While the sample was dominated by backcountry skiers (2,429) and self-describing males (2,343), representation was relatively even between Canada and the United States, between age groups, and between different experience categories. The sample also contained 150–250 participants for each of the activities of snowshoeing, snowmobiling, and ice climbing, as well as 568 individuals who had not taken any formal avalanche training.

[1] You can find out more about Anne St. Clair's avalanche bulletin user typology in an article she wrote for the spring 2020 edition of *The Avalanche Review.*

In the first phase of our analysis we wanted to observe people's self-perceptions as bulletin users and whether this differed between demographic groups. Participants generally self-reported towards the higher end of the avalanche bulletin user typology scale; the two most advanced options on the five-point scale were chosen by just under three quarters of respondents. Between genders, males self-reported as significantly higher bulletin users than females. Between those that engaged in different activities, snowshoers self-reported significantly lower in the typology and backcountry skiers significantly higher in comparison with all other activity types. Unsurprisingly, participants' level of avalanche awareness training was the variable that had the strongest influence on self-reported bulletin user types.

Next, we wanted to obtain an overall picture of how participants performed on the avalanche bulletin literacy questions. The following are some summary statistics:

Recall:
- When asked to type out the danger rating terms from memory, 66% of bulletin users were able to recall all five danger ratings in the correct order.
- In the avalanche problem recall question, most of the sample were able to recall the wind (86%), persistent slab (72%), and storm slab (58%) problem types, but less than half could remember each of the other types.

Comprehension:
- 65% of non-bulletin users were able to place the five danger ratings in the correct order after being given the terms.
- 92% of the sample correctly identified moderate or considerable as the most challenging danger ratings to manage.
- 70% correctly stated they check the danger ratings of all three elevation bands if their route plan involves crossing "large open slopes".
- 87% correctly identified which compass directions were highlighted in a hypothetical aspect icon.
- 78% identified appropriate mitigation strategies for both of the avalanche problems they were shown.

Application:
- In the slope choice question, 58% of the sample were unable to provide a reasonable response that was free from inconsistencies or systematic errors of judgment.

The results from the literacy questions indicate that despite the relatively strong performance on the items that evaluated knowledge recall and comprehension, more than half of recreational users at all levels in the bulletin typology seemed to encounter challenges with the integration and application of multiple bulletin components in the slope choice scenario. This suggests the task of combining multiple bulletin components and putting them into action is a substantial step up in difficulty from simply recalling and comprehending individual concepts related to bulletin information. This indicates a lot could be gained from helping users bring the various pieces of bulletin information together into a reasoned pattern of logic.

DIFFERENCES BETWEEN SEGMENTS OF THE BACKCOUNTRY POPULATION

The next phase of our analysis focused on the question of how various background factors (e.g., demographics, training, experience) were associated with performance on the avalanche bulletin literacy questions. The statistical approach in our study used classification trees to simultaneously examine the effect of all the background factors together and identify the most significant influences.

One of the most consistent patterns that emerged was that avalanche awareness courses appear to be highly beneficial in facilitating the development of bulletin literacy skills for all levels of users. While this is a very encouraging result for avalanche education, it is worth remembering that avalanche awareness training also had a strong positive association with self-reported bulletin user types, and a significant portion of participants did not exhibit the skills required for their self-reported level. Hence, it is important for instructors to not only teach skills, but also communicate the type of decisions that can be made with these skills.

Numerous additional and important trends were revealed when we compared how different subgroups of the sample performed. Our results suggested older backcountry recreationists tend to have lower levels of bulletin literacy than younger individuals. This finding carries greater weight when coupled with the outcomes from a recent study by Peitzsch et al. (2020), that found the median age of those killed in avalanche accidents in the United States over the last 70 years has increased from 27 to 33.

Snowmobilers, snowshoers and out-of-bounds riders were the users that most frequently encountered literacy challenges, particularly among intermediates. Perhaps one of the most surprising results from this component of the analysis was that years of experience in the backcountry was the background variable that had the least significant influence on bulletin literacy. The absence of a significant relationship between backcountry experience and bulletin literacy skills contradicts a general theme in avalanche safety literature, whereby experience is thought to be one of the most critical components of becoming an all-round competent and routine mitigator of avalanche hazard (Jamieson, 2000; Tremper, 2018).

RECOMMENDATIONS MOVING FORWARD

The results from our study provide an exciting opportunity to think strategically about how the role of the avalanche bulletin could be modified to facilitate users in the task of extracting bulletin information and applying it successfully in avalanche terrain. The traditional communication dynamic that bulletins provide has been one of unidirectional delivery of information about current conditions; users typically visit the bulletin website to obtain information relevant to their trip plan. The consistent challenges of participants to apply bulletin information in the slope choice scenario highlight the immense potential for avalanche bulletin websites to play a more active role in avalanche education.

If designed effectively, directly integrating interactive exercises into avalanche bulletin websites could foster a constructive learning environment that provides accurate and reliable indicators for recreationists to self-evaluate their level of understanding. Self-monitoring skills such as these are considered important prerequisites for meaningful learning (Dunning, Heath, & Suls, 2004; Kruger & Dunning, 1999). The inclusion of interactive exercises in avalanche bulletins, coupled with the routine nature of avalanche bulletin use, could generate regular and repeated learning opportunities that neither avalanche awareness courses nor the backcountry environment are able to provide.

CONCLUSION

Our limited understanding of avalanche bulletin literacy skills among winter backcountry recreationists makes it challenging for warning services to ensure their bulletins are structured in a way that resonates effectively with the target audience and helps them to manage their risk effectively. In this study, we aimed to start the process of addressing this gap by conducting a comprehensive evaluation of bulletin literacy to identify the skills that users commonly struggle with, and to highlight the demographic groups that stand to benefit the most from future interventions. Those interested in exploring the results of this study in more detail can find the thesis publication at www.avalancheresearch.ca/pubs/2020_finn_bulletinliteracy/.

THANK YOU

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Henry Finn holds a master's degree from Simon Fraser University's Avalanche Research Program. His thesis project explored how avalanche bulletin information is being used and comprehended by backcountry recreationists. With a background in education and science communication, he is interested in the ways that methods of information delivery can influence perceptions, attitudes, and behavior.

it's time for a TIMEOUT

BY SHAWN DAVIS

In 2004 the Joint Commission on Accreditation of Healthcare Organizations (aka JCAHO or simply "Joint Commission") put out their Universal Protocol procedure, intended to reduce the occurrence of wrong-site, wrong-procedure, and wrong-patient errors. It was found that many surgical mistakes were due to human error. Rightfully so, this was considered unacceptable, and systems were put in place to reduce this occurrence. Some of you may be wondering what this has to do with avalanches. Well…

One key component set forth by the Joint Commission was the use of the *timeout* in many procedures. While written for surgical settings, this procedure is also commonly used in the ER also. The "timeout" is called prior to committing to a procedure, with the intent being to ensure all parties involved stop what they are doing and have open communication to ensure no mistakes are being made. Other common aspects of the *timeout* include: ensuring everyone is clear on the course of action, if the course of action is the correct one, and is all necessary equipment present? When reviewing the surgical mistakes, it was noted many were mental errors, including: haste, fatigue, lack of communication, and a reliance on the most experienced person in the room to make decisions. This should sound familiar to those of us in the avalanche field. Looking at the concepts covered in the *timeout*, many are applicable to other fields. These include:

- Having all members participating in the event be present for the timeout
- Have the timeout be standardized, so that it is always done the same
- Have all members involved actively communicate
- Have one person read through the checklist item by item to ensure nothing is missed

How does this relate to those of us in the avalanche field? The idea of mental mistakes being made in the backcountry is nothing new. It has been noted that as great as 70% of avalanche victims have some level of avalanche training (McCammon, 2000). It has also been noted that in as high as 90% of incidents the victim or someone in their party triggered the slide (McCammon, 2000). Finally, it has also been well documented that in the majority of cases, warning signs were present but were not heeded. We in the avalanche field have done a good job recognizing that mental mistakes are being made. The next step is finding ways to reduce these mental mistakes. This is why I am proposing we take a ***timeout***, similar to what is done in the medical field. Clearly the warning signs are present; we simply fail to heed them. If we can have all group members stop whatever else it is that they are doing and actively participate in an open conversation, we may make some startling realizations. I would propose we also utilize a checklist; this promotes consistency, keeps everyone on the same page, and helps ensure nothing has been missed.

In creating a checklist, I had several factors I wanted to accomplish. I wanted it to be simple, yet still effective. Could it be applicable to a wide variety of different people and situations? Would it be user-friendly? For this purpose, I have come up with the acronym BEWARE.

B: Bulletin
E: Equipment
W: Weather
A: Avalanches
R: Route
E: any additional Evidence

B: BULLETIN

What information was contained in that morning's avalanche bulletin? What aspects have a higher risk? If a slide does happen, how big do you expect it to be? The information is there, it is incumbent upon us to familiarize ourselves with it. Is the bulletin's information congruent with what we are seeing?

E: EQUIPMENT

It is vital for us to take a moment and double check that we have all of the proper equipment. But more than that we need to ensure it is all in proper working order. This means checking the batteries and functionality of our transceiver. If using an air bag pack, is the pull handle out and ready to deploy? Is the air canister full? Do we have our Avalung mouthpiece out and ready to use?

W: WEATHER

What is today's weather forecast, and how does it relate to what we are trying to accomplish? Are there winds that are transporting large amounts of snow on lee aspects? Is there solar radiation that is contributing to wet slide potential? How is the weather affecting the conditions stipulated in B, the bulletin?

A: AVALANCHES

Have we seen or heard of recent avalanche activity? Is there information on the Bulletin regarding recent slides? As natural avalanche activity is one of the best indicators of unstable conditions this is vital information.

R: ROUTE
What was our intended route when we started? Have we deviated from that plan? If so, for what reason? If we planned on avoiding a particular slope or aspect, and we are now there, why? Does anyone in the group have powder fever? Have we convinced ourselves that conditions aren't as bad as we first thought? Are we simply in a rush?

E: ADDITIONAL EVIDENCE
Have we noticed cracking, collapsing, whumpfing, or other warning signs? Changes in wind or weather? Also, have we noticed our companions seem to be cold, hungry, or fatigued? Any factors that can impact our judgment need to be taken into account as well.

When would be the best time to utilize this ***timeout***? That depends on the circumstances. For professionals, it may be before leaving the office or patrol shack. For recreationalists, it could be at the trailhead. It can also make sense to review the checklist again prior to committing to any possible avalanche terrain. I don't believe there is going to be a one-size-fits-all answer. The key aspect is that *it happens*, with the ideal goal being that it happens as consistently as possible. This maximizes the odds we will be successful in preventing mental mistakes.

An added benefit to utilizing a timeout is to decrease the expert halo problem. In the past we have waited and hoped someone in the party would have the courage to speak up if they saw something concerning. Now, we are stopping the entire party and asking questions of everyone involved in an open forum. This gives an open space for all to share their observations, and provides mentorship opportunities.

We are already seeing a small example of this in action. It is a widely accepted best practice that, when beginning a transceiver search, everyone on scene stops moving and holds a hand up when they have switched their transceiver to search mode. In taking a short pause, we are actually increasing our efficiency by reducing wasted time. Now we have an opportunity to apply that in a preventive manner, so that we may catch mental mistakes before they happen. Just like no amount of gear can ensure we always survive being caught in a slide, there is undoubtedly no way to prevent all human-triggered slides. But we should never stop trying to stack the odds in our favor.

I hope you all have copious powder this winter with abundant fresh tracks. And I hope you take time for a timeout. ⬢

Shawn Davis is a recovering former avalanche addict, having spent many years as a member of the Copper Mountain Ski Patrol and Summit County Rescue Group. He currently works full time as a Firefighter/Paramedic. When not chasing his young son around the mountains of Colorado he can be found partaking in his newest favorite pastime, naps.

WHEN REVIEWING SURGICAL MISTAKES, IT WAS NOTED MANY WERE MENTAL ERRORS, INCLUDING: HASTE, FATIGUE, LACK OF COMMUNICATION, AND A RELIANCE ON THE MOST EXPERIENCED PERSON IN THE ROOM TO MAKE DECISIONS. THIS SHOULD SOUND FAMILIAR.

FROM LYNNE WOLFE:

I think that practicing the Timeout is as crucial in avalanche decision-making as it is in toddler tantrums. It almost doesn't matter WHAT you do or say, as long as you interrupt the fast thinking. There are lots of excellent checklists out there; if BEWARE or ALPTRUTH works for you, there you go! Examine your ritual: Timeout means that you involve a stepping back or summarizing moment before a move is irreversible.

In my practice, both teaching and personal, in a Timeout I ask this set of paired questions:

- What do you/we WANT to do?
- What do you think you/we OUGHT to do?

Which makes people laugh in funny and rueful ways, ideally leading to self-awareness and then to better situational awareness.

In addition, subtle and effective communication on the part of an engaged teammate can slow down the "I WANT" thinking that sometimes takes over, especially when the powder is deep.

Werner Munter covers it nicely in his 3x3 work as well:
https://www.bergfreunde.eu/munter-reduction-method-calculator/
wherein you assess conditions, terrain, and person at three scales, at least three points in time during the day: regional, local, and zonal. Munter also gives numerical values to steps in condition severity. Have a look.

there will be
no alpenglow tonight

gray sky and wind
up in my face

squinting celebrates
the end of day

stinging eyes
a storm's edge

i bow to the mountains
the hidden mountains
the coming snow
—*Leath Tonino*

AVALANCHE ZEN

A CONVERSATION WITH JERRY ROBERTS

MOUNTAIN WEATHER MASTERS

INTERVIEW BY LEATH TONINO

This interview was originally published in the magazine Tricycle: The Buddhist Review.

Some folks sit on a cushion and count their breaths as though it were a matter of life and death. Others, like 68-year-old Jerry Roberts, a retired avalanche forecaster for the Colorado Avalanche Information Center, meditate wholeheartedly on the intricacies of snow.

I do not use that word "meditate" lightly. As a forecaster, Roberts's job was to rigorously and relentlessly observe the snowpack. That involved studying everything from weather systems swirling in the Pacific to the structure of ice crystals out the back door. His special awareness was then tapped by the Colorado Department of Transportation to help determine when to shut down the mountain roads around Telluride and Durango. Winter in the San Juan Mountains begins in October and ends in June, and the range often receives 300 inches of snow in a single season. It is a notoriously dangerous place.

Currently, Roberts does part-time consulting work with Mountain Weather Masters, an outfit he co-founded. The group's logo—a sword-wielding samurai backed by a white cloud—reflects his longtime interest in Japanese culture. Roberts's house in Ridgway, Colorado, is cluttered equally with avalanche maps and anthologies of haiku by Issa, Buson, and Basho. I met him there on a bright winter morning, and we sat by the fireplace, drank coffee, and talked. He showed me homemade chapbooks of his own free-verse haiku, many of which braid the languages of snow science, skiing, and mountain geography with the language of Zen.

Enlightenment? Roberts wouldn't claim to know much about such an exalted state of being. Self-deprecating and quick to laugh, he jokingly referred to our conversation as "bullshitting." Nevertheless, I could tell from his warmth and sincerity that talking about snow and poetry was, for him, an immensely valuable pastime. After my second cup of coffee, when I rose to leave, instead of offering a handshake, he smiled and told me, "Keep on enjoying life."

How did you first get interested in snow and avalanches?

Living inside was never an option for me. I grew up at the foot of the Sangre de Cristo Mountains, here in Colorado, and as a kid I was constantly outdoors. A big part of my life was climbing peaks and skiing off them. Digging nature. Enjoying the turn. Feeling the wind on my face. Those experiences in the wild can be so vivid. You become them. For some of us, there's no turning back.

Spending so much time in the backcountry, sometimes going out for weeks on end, I saw my share of avalanches. Pretty soon I was thinking, Hmm, I better learn a bit about this huge power I'm edging up against. The air blast created by an avalanche can reach 200 miles per hour. In some cases we're talking hundreds of thousands of cubic yards of snow on the move.

So in the early '70s I found my way to the San Juans and took an avalanche course. Within a few years I'd moved into an abandoned miner's cabin in the subalpine and was collecting data for the Institute of Arctic and Alpine Research. It was a simplified, almost ascetic existence—skiing a bunch, learning the snowpack. The locals down in town called me and another buddy who lived up there "the snow monks." We were hooked. Who would have ever thought looking at snow could be so exciting?

What exactly does "looking at snow" entail?

It all starts with the weather. Back then, forecasters weren't using the Internet. What Internet? It was more like a finger in the air: Okay, it's coming from the southwest. Might be a big one. Get ready.

Wind is the architect of avalanches, so you're tracking the storm's movements, gauging speed and direction. You're monitoring temperatures, too. Did the storm come in warm and then cool down, bonding the new snow to the old snowpack's surface? Or did it come in cold and then warm up, creating a dangerous upside-down cake, a heavy, wet slab sitting atop a low-density base? You're constantly interpreting. Is it a hard block or a soft block? What got loaded with snow, north faces or northeast faces?

Small world becomes big world—that's how I like to sum it up. A forecaster observes things at two scales, the micro and the macro. You look at a snow crystal under a hand lens and see all the beautiful angles, and then you think about how a hillside loaded with these things can all of a sudden fracture, come down and cover the highway, and sweep you into oblivion.

I'm reminded of a line from the Soto Zen teacher Taisen Deshimaru: "You must pay attention as if you had a fire burning in your hair."

Yeah, you're afraid to go shopping at the supermarket an hour away because you might miss a wind event. You can't be absent from your place. You have to be totally present.

Forecasting is not just a job; it's a lifestyle. You don't think about Christmas or your wife's birthday. You don't go on vacation. One storm in '05 lasted four days, and I got maybe eight hours of sleep. From November through May, paying attention is what you do. It's who you are. There's no difference between on and off.

Over the years, I learned so much by just being out there. A friend of mine says, "Experience is a series of nonfatal errors." Every winter I added something new to the list of what I knew. You develop a daily mantra, your daily prayers: Look for this, note this, pay attention to this. If you don't, somebody is going to get hurt. Maybe you.

WHEN A FEELING REACHES ITS HIGHEST PITCH,
WE REMAIN SILENT,
EVEN 17 SYLLABLES MAY BE TOO MANY.

— *D. T. Suzuki*

As you immerse yourself in the observation of these massive forces—storms and avalanches and the like—you must become increasingly aware of your own smallness, your own fragility.

There's a quote attributed to Miles Davis that says, "If you're not nervous, you're not paying attention." I used to joke that it was my job to worry for half the year. That sounds negative, but it's not. The worry is itself a kind of meditation. You worry from the first storm to the last storm. Why hasn't that slope avalanched? It's got to avalanche soon.

Our mortality is with us through all stages of life, whether we're aware of it or not. As a snow viewer, out in the middle of the storm, you know that the possibility of the end is always present. Mortality isn't an abstract concept—it's right in your face. The sky is falling! How am I going to get home without being killed?

At times it was dangerous driving the road in "full conditions," snow coming down so hard you could barely see past the steering wheel. Over the years, small avalanches took me for some rides while I was out skiing. For much of my life I've had a daily, maybe an hourly appreciation of my own impermanence—a heightened sense of how delicate things really are.

Because no matter how much expertise you have, no matter how keen your focus and diligence are, the big one can still slide on you unexpectedly, right?

One has to be comfortable living with uncertainties—that's just part of the deal. In the worlds of snow and weather, but also in the rest of life, there are so many unknowns. Our job is to try to reduce some of the uncertainties while simultaneously learning to live with them. Some days are better than others, and every day is another invitation to try.

Without mindfulness, my job living with the uncertain nature of snow would have been impossible. Sitting, walking, skiing, they all lead to the same place: Mindfulness. Mindfulness of what is.

How does haiku fit into all of this?

I've always been drawn to the counterculture, so naturally I spent some time in the Bay Area in the sixties. I was interacting with the Beat poets, going to readings at bookstores. That was my first eye-opener. All of a sudden I was thinking on that plane—the haiku plane.

The Zen aesthetic relies on the fewest possible words to express a situation, a feeling, a view. It shaped how I looked at everything, including snow. Alongside the more scientific approach to the snowpack, I began to understand it through these little descriptive bursts:

WIND SLAB LAYERS
THICK AS VAN GOGH
BRUSH STROKE.

I'd pull off the road during a blizzard, or stop at the end of a ski run, and scribble something about the mood in my notebook. Some of my haiku are okay, some aren't. That's fine with me. The importance lies in the attempt, the effort at catching a moment.

The contemporary American poet Jorie Graham has described poetry as a way of going through life, as opposed to accidentally slipping around it.

Even if you're serious about not going around it, you do. We all do. Searching for the right words to make a haiku, skiing a perfect line through the trees—these can get you going through life, at least for a little while.

The haiku is both a meditation and an expression. You disregard the nonessential and focus on the essential. There's a discipline to it. It's similar to writing a good avalanche forecast or weather forecast with a minimum of words—less room for confusion or misinterpretation. It's also an attempt to share some space with the masters, to walk the mountain paths with traveling monks and roshis, begging bowl in hand. There's a haiku by Basho that I love:

COME, LET'S GO
SNOW-VIEWING
TILL WE'RE BURIED.

Buried in what? In snow? I wonder if it isn't also something else. As you put it a minute ago, maybe by viewing snow we get buried in "what is."

One of the great things about snow is that its meanings are infinite. It melts and becomes ditchwater for ranchers or drinking water for city dwellers. It has significance for an avalanche forecaster today and for Basho back in the 17th century. It can be a dream or a nightmare. And yet it's all the same, just different crystals that have bonded together—needles, columns, stellars.

After six-plus decades in the Colorado Rockies, what would you say are the lessons that stand out in your mind?

It might sound trite, but what I've learned is that the mountain always leads in the dance. It's hard to say much more about it than that. You do what you are allowed, nothing more. You wander around above the trees, knowing all the while that you are a temporary trespasser.

I don't want to be a downer, but people are going to die. Avalanches will take us out. It will happen. Years ago, a friend said to me that in the San Juans we've got a "tiger of a snowpack." That always stuck with me because of its animistic sensibility. Rocks, snowfields, clouds—I see them as alive. That mountain outside the window is a living, breathing thing. And it's bigger than you are! It's in charge. If you're not careful, you're going to get bit in the ass by the tiger. You're going to suffer. It's a big tiger.

As you said earlier, though, for some folks there's no turning back. It's a risk worth taking.

Right, so you learn all you can, pay attention, and then learn some more.

Nature has this draw, whether it's the ocean, the desert, the river, or the mountain. For me, it's the sound of wind from Arizona and Utah carrying desert dust that will become the snowflake nuclei here in the San Juans. It's that smell: "Aaaaaah, the turn / I can smell it / in the air." It's the feel of powder snow blowing up into your chest as you round your turn on a beautifully angled slope. There's stillness at the heart of that motion. Gravity is pulling you down, the same force that wants to collapse the entire snowpack and send it to the valley floor. Steep skiing is just one controlled fall after another.

"One controlled fall after another." That has a lot of overtones.

Words come up short. D. T. Suzuki, the prominent early exponent of Zen in the West, once said, "When a feeling reaches its highest pitch, we remain silent, even 17 syllables may be too many." ⬢

wind
without you
winter would be warm

like a mouse
beneath drifted snow
i would make a home
inside the season

wind
i want that home
but you want nothing
other than motion

and your desire
if i'm not careful
will kill me

—*Leath Tonino*

background photos
Ben VandenBos

THE ONLY FACTOR

BY DOUG KRAUSE

Memories of the early days of my ski bumdom are hazy at best, but sometime in the mid to late 90s I shuffled into the sharp dry breeze of the car park at the Silverthorne Recreation Center in Silverthorne, Colorado. *Crap*, I thought, *this is one of those things I'm going to have to immerse myself in for a decade.*

I'd just finished a Level 1 avalanche class, my first taste of avalanche education, and felt no better prepared to actually ski in avalanche terrain than when I started. We saw slides of frozen dead people, were introduced to a dizzying array of grain forms, and learned about Bullseye Information, but for what? In the absence of obvious clues, I felt little better prepared to stand at the top of a slope and answer the relevant question. *Will it go?* Hence my frustration. It seemed as if I would need years and years of experience to have any hope of developing a whiff of useful expertise—useful for actually skiing good terrain that is, because, yeah, I hate golf.

A couple years later I perched high on a rib of Arapahoe Basin's East Wall talking to my boss on the radio. *Can we open it?* he asked. *Christ,* I thought, *I don't know.* It would be more than another decade before I felt comfortable managing the balance of evidence and uncertainty, but I had an intuitive grasp of each. Yes, we had evidence of stability. Yes, I had uncertainty regarding the remaining potential for ski triggering an avalanche. So, I guessed, like most skiers do in the face of uncertainty. *Open 'er up.* **It will probably be fine.**

I spent some years at Arapahoe Basin learning how to manage terrain and squatting in various holes staring vacantly at 20-layer sandwiches of wind slab and faceted crap. I learned to "never trust a depth hoar snowpack"—which is not even remotely helpful advice. *Welcome to Colorado folks. Everything is open, but I wouldn't trust it.* I learned to build a measure of trust from a series of well-placed ka-friggin'-booms supplemented by the ravening hordes pounding those edgy grains into a perceived submission.

I think it was 2001 when I started a decade-long seasonal pilgrimage to Las Leñas, Argentina. This required significant deprogramming regarding what could and could not be skied. In those days digging a hole in Leñas was more likely to present a wall of white concrete than a poop cake. It was here, in the absence of my little pentolite buddies, that I began religiously implementing terrain margins. They saved my ass more than once. Intuitively I began thinking in terms of avalanche problem types, sensitivity, distribution, exposure, consequence, and treatment—though I lacked the vocabulary to articulate these issues or ruminate on them in a logical fashion.

The form and content of avalanche education assumed urgency for me in 2007 when I took command of the snow safety program at Silverton Mountain Ski Area. The safety and welfare of my friends and the public lay largely on my shoulders now and the gulf between what a ski patroller learns in the first couple years and what they become after eight or ten seasons spread like a foggy chasm with no obvious bridge. We cross this bridge—yet, how? **Dumb luck? Mentorship? Trial and error?** Yes. All of the above. The survivors show us what is possible by this path, yet our physical and emotional scars bear testament to the peril. There has got to be a better way, a missing link, a map that points the way forward. My true search began.

I settled on communication as the first stone—the solid footing that supports us as we attempt to cross the invisible sky bridge between experience and expertise. Here was something not a part of traditional avalanche education, something that was critical and endemic. A skill inextricably entwined with our work that could be taught and practiced and mastered. Surely the benefits of such a skill percolate through every other critical competency. But, of course, it wasn't enough.

The frenetic whirlwind of Alaskan heli-skiing reinforced my belief in communication skills and highlighted another critical competency: situational awareness. Nothing like Alaskan heli-skiing to highlight any deficiencies in situational awareness. Turns out, it can be broken down into its constituent parts and practiced. No more telling people to be the sponge; **now we talk about observation planning, and integrating obs into mental models, and using them to project forward and consider all that may pass.** Here is another foundation stone of decision-making.

Managing teams in Colorado, and Alaska, and Japan led to a conviction that teamwork is another critical competency we can define and train for. When I want to learn about something, my first step is to usually look for a book on the subject. Well, twenty years ago that was my first step; now, I go to the internet, peruse the fluff for a bit, then drill into the academia on Google Scholar. Sadly, avalanchistas cling to their bubbles and silos like a spider trapped by its own web. We're not so different from the rest of the world and it turns out there is little new under the cloud deck. There are terabytes of freely available research on communication, and situational awareness, and teamwork, and hazard, and risk, and how poorly humans manage all of the above.

So, there's the rub, right? We identify problems; we identify solutions; and we even teach folk how to walk the path between them—yet we fail again and again and again. Cognitive bias, logical fallacies, and mental heuristics have been square in the crosshairs of avalanche educators for many years now. *Eureka! This is why we fail!* So the story goes. Some avalanche educators argue that static fatality statistics in the face of rising usage point toward success. No doubt education improved, but I'm not much of a back-patter—more of a pee-in-the-soup kind of guy.

Thanks to the development of the Conceptual Model of Avalanche Hazard and the incorporation of risk modeling into avalanche education we now have better language and analysis tools than ever before—but…I still see the struggle every day. Too often attempting to divine the sensitivity of a specifically distributed Wind Slab problem up to D2.5 still leaves me at the top of a slope wondering *is it gonna go?* I can throw a margin on my plan and aim for the center of my operational risk band, but—**did I miss an opportunity or get away with something?** I don't know. I wonder if we're in the right ball park, or even playing the right game. Have we really learned how to make better decisions?

TURNS OUT, IT'S NOT ABOUT BEING A BETTER AVALANCHE PERSON, IT'S ABOUT BEING A BETTER PERSON.

THAT'S MY EPIPHANY.

Top: Checking out the consequences in the middle of the couloir. *Photo Mike Hamilton*
Bottom: Searching for the threshold of acceptable risk. *Photo David Dellamora*
Both photos from Cerro Entre Rios in Las Leñas, first used in TAR 27.3.

This story first appeared in the New Zealand Avalanche Dispatch, *which you can find at www.avalanche.net.nz/resource/nz-avalanche-dispatch/*

My quest for more stepping stones led me to patience and humility and while researching humility I stumbled on the concept of emotional intelligence. I don't like that term because it connotes images of validating feelings and supporting each-other's fuzzy needs. Not that there is anything wrong with that, but maybe it's because I'm a dude or I was trained by the dictum—there is no crying in ski patrol. Maybe it's because I believe too much emphasis on emotional support undermines one's ability to develop assertive communication—it can be a crutch. I prefer affective intelligence. Regardless, I do like what the concept truly represents. In fact, I believe no subject is more important for safe travel in avalanche terrain. **My own deconstruction of the concept leads to a set of four competencies: self-awareness, self-governance, social-awareness, and social-governance.**

This is not the place for a detailed exposition of each competency, but we can dip our toe in the water. Self-awareness is just that. It's the ability to harness humility and mindfulness to achieve a truer understanding of what is guiding our thoughts and actions. This awareness in turn gives us the opportunity to exercise control over the devilish short cuts and knee-jerk reactions our minds are so wont to embrace—to exercise self-governance. Social awareness and governance are taking these same principles and applying them to the other humans *i.e. Maybe that guy's not an asshole, maybe he's just tired and frustrated; so, I'm gonna be polite, persistent, and empathetic instead of telling him to piss off; hopefully that will get better results.*

Does that sound familiar? Like maybe something your mom told you, or you heard in kindergarten, or in church? Yeah. Every time I expound this concept I can't help but mention the obvious, that it will not only help you and your partners more effectively navigate avalanche hazard, but it will engender benefits in every other part of our lives. Turns out, it's not about being a better avalanche person, it's about being a better person. That's my epiphany. We are not just ***a*** factor in avalanche terrain, we are ***the*** factor, and until we learn how to manage our own behavior and apply those lessons to those around us—all is for naught.

Telling Stories

STORY AND PHOTOS BY ANDREW HENNIGH

This article is dedicated to the memory of Ed Masters.

The plan was in place for the next morning; the avalanche control teams were notified, shot counts were given to the shot makers, and the forecast had been adequately analyzed and over analyzed. It was mid-March and this storm would be fairly routine, so by 4pm that afternoon, with planning done, the snow safety department was spinning a few yarns in the office when I got the email on my phone:

> *Today we announced the difficult decision to suspend the operations of all of our North American mountain resorts, retail stores, and corporate offices beginning tomorrow, March 15, 2020, for one week to assess the rest of the season.*

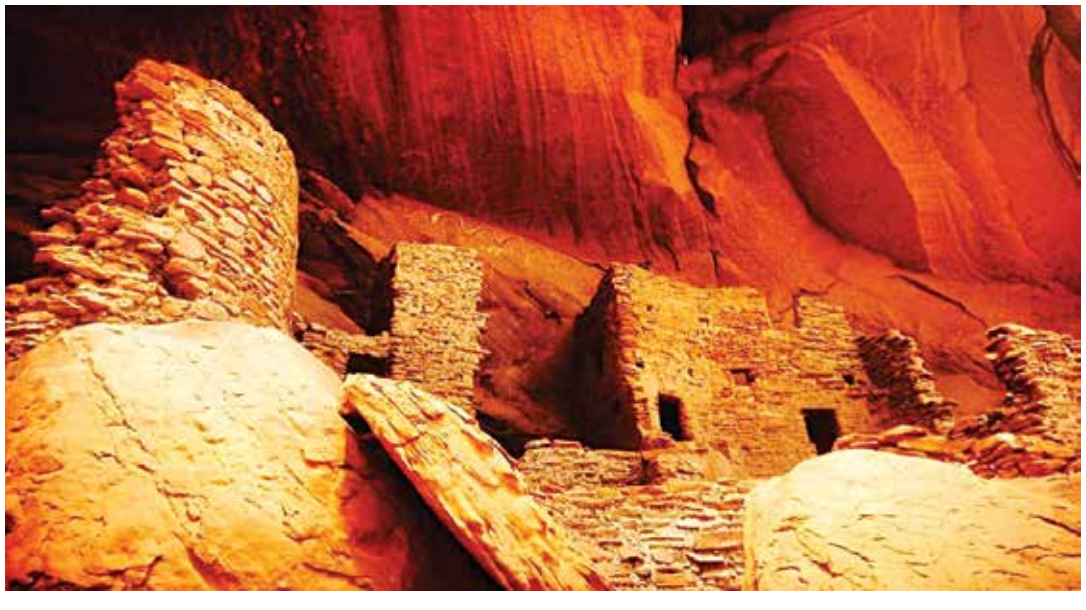
No avalanche control work the next morning and over the next few days it would become obvious that the ski area wasn't going to open again; no more early mornings, no more 10-50s, no end of season parties, and no tear down.

In the weeks to follow a few of us would go walk around the mountain to get out on skis for a couple hours and we joked about how the mountain had been abandoned, conjuring parallels with the ancient civilizations of North America who also seemed to just walk away one day for unknown reasons.

There isn't a person alive right now who doesn't have a story about Covid-19 and how it affected them, but it will be the collection of our stories that will paint the picture of these times we're living through and the more stories we collect, the clearer the picture will be for future generations. There will be a lot to learn from this period in history, not only about the global pandemic but about our culture as whole, about how we treated each other, how we treated the planet and the mistakes we're making, our accomplishments, and our outcome can and will only be judged by those who study our history. If we have one collective goal as a civilization it should be to collect as many of our stories as possible so that we can leave those who come after us with a road map to our mistakes, our accomplishments, and to better outcomes than our own.

As a community, whether it be skiers, climbers, mountain bikers, river hippies or just good old-fashioned dirt bags, we all have wonderful

Generations of patrollers gather to tell stories and celebrate a beloved avalanche dog, Kenai.



Ancient civilizations abandoned their homes along the San Juan River in Utah.

Story time with a legend.

stories to tell. Our stories of knee-deep powder days, sunrises from portaledges, and big white-water descents could be the stories that give the world hope, joy, and determination as we navigate our way out of these trying times.

Stories aren't just important during moments of historical enormity. As the late great singer/song writer, John Prine said, "If you're writing a story song you better have a darn good ending, and if you don't, you better have a good moral to the story." If a story has something to teach us, then it's a worthwhile story and if it's also a good story it'll reach a bigger audience. There is currently a generation of ski patrollers who have seen storms, droughts, avalanches, wrecks and anything else that can happen on a mountain, who are retiring and taking their stories with them. The next generation should be sitting around the floor of patrol shacks everywhere, crisscross apple sauce, begging these silverback patrollers to instill their wisdom upon them. If we can learn from their mistakes and their accomplishments then we can hopefully skip those particular trials and tribulations, and make our own mistakes to teach the next generation.

Fabricating epics around the fire.

For all the stories that have been told around campfires, all the parables in patrol shacks, the folk tales of river runners, or dirt bag potboilers there are countless numbers of stories missing from our collective narrative. It shouldn't come as a surprise that there are far fewer BIPOC participants in the greater outdoor recreation community, it shouldn't come as a surprise that women are consistently telling us that they have been made to feel marginalized by our greater outdoor community. Our collective narrative is incomplete and because of this, we are missing out on vastly different perspectives that not only could contribute to some wonderful stories but that may be able to teach us lessons that we have never even considered because we have always lacked that context.

Our biggest challenge to ourselves in the outdoor community right now shouldn't be to ski the biggest line, it shouldn't be to make first descents on rivers or first ascents on mountains. Our biggest challenge, the thing that will progress our sports and our communities, should be to include anyone who wants to go outside and play, to include anyone who wants to excel, to include anyone who wants to work in our industry. Then we can begin to collect their stories and learn and grow and maybe even improve our collective outcome as a society.

P.S. Shortly after finishing this article our Assistant Patrol Director, who had recently retired after 32 years of patrolling, passed away unexpectedly. He was a mentor to an entire generation of patrollers and one of my biggest regrets in life will be not sitting down with him, a bottle of tequila, and a tape recorder. ⬢

Andrew Hennigh has been a ski patroller for 20 years between Eldora Mountain, Park City Mountain, and Mt. Rose. He was an avalanche forecaster at Mt. Rose before returning to Park City to work as a snow safety specialist, his current job. In the summer he works as a BLM river ranger in Desolation Canyon on the Green River in Utah.

If we have one collective goal as a civilization it should be to collect as many of our stories as possible so that we can leave those who come after us with a road map.

Ed instilling some wisdom upon a young me.

Although this slope is only 15 degrees, this supposed island of safety was locally connected to a very small 30-degree slope below (with only a 5' section at 32-degrees) and this avalanche nearly killed a friend of mine.
Photo Bruce Tremper

ARE YOU IN AN ISLAND OF SAFETY?

The few 'islands of safety' not inundated by this avalanche would not have felt safe if you were there at the time.
Photo Roger Atkins

Dear Lynne and Team TAR,

I'm looking for a standard/shared definition or vocabulary amongst avalanche experts for **islands of safety** (or 'safe spots') in avalanche terrain.

Are you aware of any articles, studies or discussions dedicated to this topic in past editions of TAR?

I've done a number of searches and have only come up with references, albeit numerous, to the subject, but no detailed discussion or definitions.

I'd be very grateful if you could point me in the direction of any TAR articles or other credible sources that discuss or define the topic of islands of safety (or safe spots) in avalanche terrain.

...and apologies if there's something obvious I missed, it wouldn't be the first time!

Best regards,
Henry Schniewind

Interspersed through the text is a series of photos from Roger Atkins. He tells this story: While skiing on the gentle ridge, we remotely triggered a size D-3 avalanche which pulled back up to 30 meters onto the low angle ridge. Several skiers were caught and carried a short distance in 10-degree terrain. Even ridge tops are not 'islands of safety' in some conditions—stay well away from the edge!

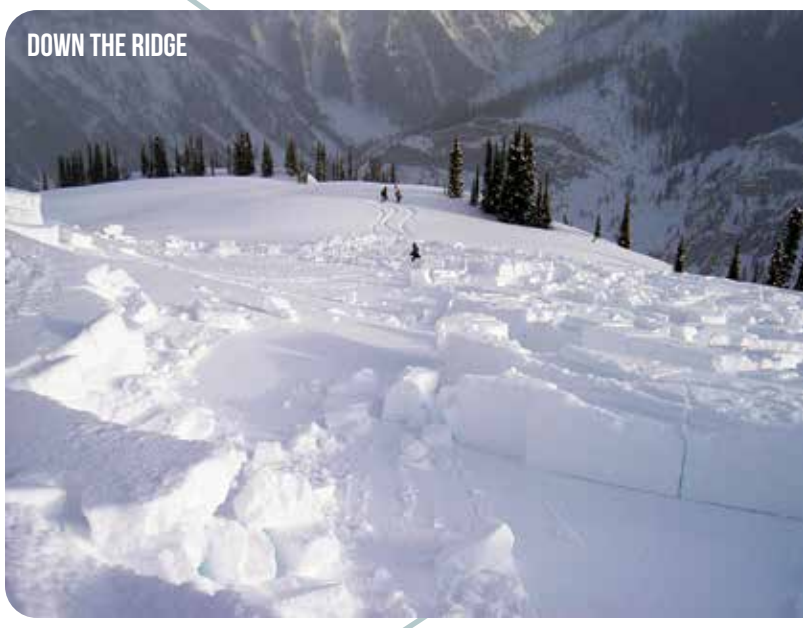

RIDGE TOP

Hey Henry-
Nice to hear from you. I looked first of all in the UAC's Avalanche Encyclopedia, but nothing there: https://avalanche.org/avalanche-encyclopedia

Here's a discussion we had in TAR last year that may be helpful. See PDF OAT.TAR38.2 (One at a Time round table).

And I bet that Rob Coppolillo has a definition in his new Ski Guides Manual. Rob?

Let me know what you come up with,
Lynne


DOWN THE RIDGE

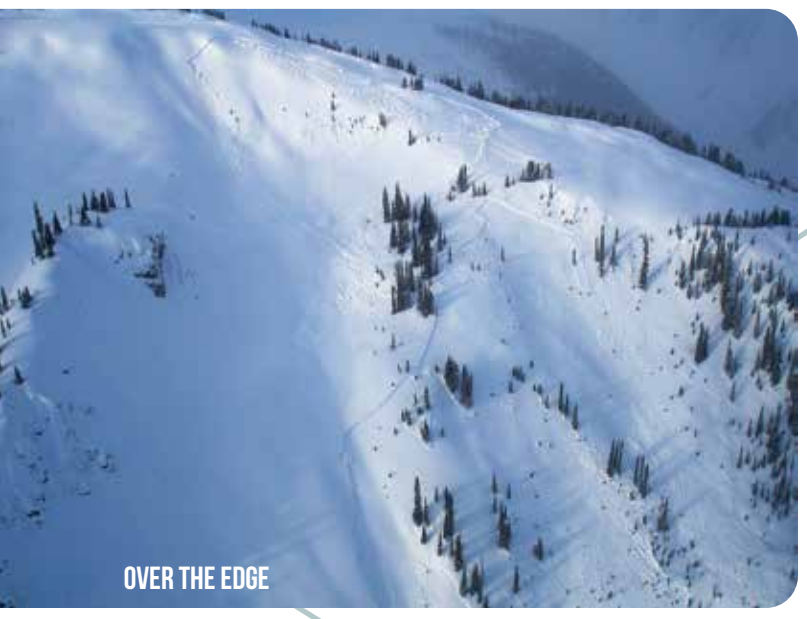
ROB COPPOLILLO:

Hi Lynne and Henry!
I'm maybe not the best resource for all this, as I only started paying attention to all this madness in the early 2000s....I can't really give any sort of grand-arc-of-history on the term—maybe Tremper or Jamieson would be good?

It seems like "islands of safety," as an avalanche term, was fading by the time I began doing courses/studying. At some point, maybe you know for sure, Lynne, people realized "islands of safety" like trees and rocks were trigger points....I recall somebody reminiscing about that concept from the 70s....

But no, it's not defined in the Ski Guide Manual. We tried to use the idea of less or more exposure, in place of "safe zones" or "islands of safety."

I think another hesitation from the education side is the idea of turning less experienced (oh hell, turning anybody!) loose with the idea of "islands of safety"—that really requires some expert terrain ID. Several decades into accident data we see ourselves mistaking "safe" terrain over and over and over ... just chewing on this idea the last few days.


OVER THE EDGE

BRUCE TREMPER:
As far as I know, there is no "definition" of the term islands of safety. It was a term used by my mentors when I first started my professional avalanche career in the 1970s. I understood it to mean a terrain feature that was relatively safe—or at least safer—from an avalanche that came from above—a terrain feature that reduced our likelihood of being caught and/or our vulnerability if involved. Examples might include gentler terrain such as a spur ridge where the slope steepness was less than 30 degrees or in terrain protected from avalanches from above by a large rock outcrop, thick trees or perhaps an avalanche-splitting spur ridge. It was a place where one or more people would wait and watch the person crossing the more hazardous terrain in case they needed to perform a rescue. Yes, many people have been washed off their "islands of safety" by unexpectedly large avalanches or ones that unexpectedly fracture above our "islands of safety" **or fracture onto unexpectedly gentle slopes**. Unfortunately, it's a term that is sometimes more a product of magical thinking than what can be justified by the laws of physics. The bottom line is that it's just another layer in the multitude of Swiss cheese safety nets that we all build into our systems, hoping that each layer nudges the probability arrow a little farther away from death or injury.

Thanks Bruce (and again to you Lynne for flagging the great OAT article and Rob for your reflections),

One of the reasons I reached out to you all about a definition for islands of safety is because here in France it is one of the top risk reduction points, îlots de sécurité (which are sort of mini-islands). For example, ANENA displays an îlots icon on their 'RIDE SAFE' T-shirt just after the 'distances' icon.

While I'm aware the term is used a lot less often in America since my initiation to the 'madness' in the mid/late 80s in the greater Bozeman area, it looks like it's still a part of the unofficial vocabulary amongst some/many pros:

'**island(s)...**' came up around 10 times in Lou's OAT article and discussions ('**safe zones**' around 30 times).

The problem I'm trying to resolve (as a person who strives to first communicate standard definitions, vocabulary etc.) is:

1. The lack of clarity and consistency around the various implied and applied definitions of the term(s). Also there seems to be no clear high profile definition, like Bruce's, emanating from authorities like ANENA and the international community around those terms: islands, zones, spots... some people/pros in France refer to these 'islands' as a place that can/should be totally safe, while others express serious reservations à la Dale Atkins. For example, the definition of the term from ANENA is pretty good (not that easy to find, but the only one I found) https://avalancheridesafe.wordpress.com/lhumain/ilots-de-securite/.

The problem with this, in terms of clarity, is that it combines two very different entities in one definition: **a) 'The safest islands...'**, out of the track of the avalanche and, **b) 'Islands in the: path, starting zone, track...'**

There's a variance and blurring of terms that comes through in the OAT article too; one example is in Lou's sum-up, "Safe zones and islands need to be 100% reliable". This contrasts Bruce's definition above—that the 'islands' term refers to a relatively safer place that can't be seen as 100% safe.

2. ...and then, to make matters simpler, there's the trigger point around the 'islands of safety' issue, that you brought up Rob. I've been conversing some with Seb Esconde from ANENA on the balance between the risk of triggering in 'safe places' vs the risk of not decreasing exposure, this may be a sub-theme.. albeit essential. For now briefly, one angle I find difficult on this trigger point/island of safety issue (and people learning about the subject find hard to understand) is the contradiction: in renouncing a ridge/ spur ridge as an island of safety because it's a potential trigger point, but then validating a line of similar spots as safe(r) or unexposed as a route for ascending—for climbers as well as ski tourers.

So what do you want Henry?!

A simple definition and vocabulary for the overall concept of Islands of Safety, Safe Zones, Safe Spots, or less/more exposure as Rob suggests, for those points, A. and B., between which OAT (and/or distances) is advised as part of the overall set of 'risk reduction measures' that is generally agreed on by the international snow/avalanche community.

In my opinion, it's important for people like me to be told (by people like you—the international snow/avalanche community) what the standards are in terms of definitions and vocab so that we all speak the same language to winter sports enthusiasts (pro and not pro)... Then we can give our subjective point of view within that context. So I'm very happy to help with this type of normalizing/discarding of these terms. I meet with the team at ANENA at least once a year in view of 'speaking the same language'. But at the same time, I'm happy to defer to you all, AAA, ANENA / Seb Esconde, SLF, CAA, SAIS... in view of the overall goal: accident reduction.

In any case, if you believe an article, initiative and/or inquiry on this subject is worth it, I suggest it is served up as a sequel to Lou's OAT article and uses his quote as the title,

Aha, "safe zones," or "islands of safety." What are they?

Let me know what you think even if you believe I'm splitting hairs and should just get on with the task of awareness and education. A massive task in most of Europe, as you probably are well aware of—the majority of people don't even know where the secured areas end and the unsecured areas begin in the resorts themselves!

All the best,
Henry

DALE ATKINS:

Great discussion! Thanks for including me in the conversation. I'll add some history to "islands of safety" before chiming in with my opinion. While I am not sure exactly when "islands of safety" entered our lexicon, the concept and practice goes back at least to the mid 1930s, and likely much earlier. In the 1936, Gerald Seligman, founder of the International Glaciological Society (and an avid skier), in his seminal avalanche book, *Snow Structure and Ski Fields: Being an Account of Snow and Ice Forms Met with in Nature and Study of Avalanches and Snowcraft*, advised, "If there are any rocks, let the track be from rock to rock, for there is a chance that they will stem the falling snow." However, he also cautioned that in thaw conditions, the snow will be wettest near rocks and more ready to avalanche in their proximity." He sagely adds that the skier or climber "must use his judgment." That same year, Scottish alpinist and writer E.A.M Wedderburn wrote *Alpine Climbing On Foot And With Ski*. Wedderburn mentioned, "By linking up small rock outcrops the [avalanche] danger may be diminished." At that time much of what was known about avalanches came from the Alps; I suspect that Austrian Mathias Zdarsky wrote about using rock outcrops for protection in his 1916 booklet *Elemente der Lawinenkunde*.

A quick skim of Atwater's 1953 *Avalanche Handbook* and his 1961 Snow Avalanches make no mention of using rock outcrops for protection. However, a little later in 1961 Ed LaChapelle's authoritative pocket guide *The ABC of Avalanche Safety* (later changed to *ABCs of Avalanche Safety* when rewritten by Sue Ferguson in 2003) hit booksellers' shelves. This was the first English language book aimed at recreationists, and LaChapelle wrote, "Rock outcrops, clumps of trees or ridges may offer islands of safety in the avalanche path." From there the phrase seems to have subtly slipped into and eventually deeply into colloquial usage. However, mention of "islands of safety" does not appear in avalanche textbooks of the 1970s and 1980s. However, by the 2000s, it started to appear.

That's unfortunate because "islands of safety" are a paradox at best and an illusion at worst. While there are some people who have been "saved" or "protected" while hiding behind a terrain feature (which I have done more than a time or two), there are a lot of graves with the bodies of unlucky avalanche victims—some of whom were savvy folks—who sought the same protection, or were swept away when they triggered an avalanche upon approaching or leaving the "island."

Safety, like stability, is an absolute term that seldom exists with avalanches. Something that is not safe is dangerous. We think, work, and play in a domain of conditional instability. We should think about our actions not in terms of safety, but in terms of how dangerous we are. Some actions, or inactions, (and conditions) are more unsafe or dangerous than others.

Safety in the mountains is a fallacy. It doesn't exist. Mountains, as Reinhold Messner says, "are just dangerous." Some days, some slopes can be more or less dangerous. I have tried on numerous occasions to make myself really small while cowering behind a large boulder, to spread myself thinly along the wall of a shallow alcove in a couloir, and pitched a tent in a stand of thick old-growth timber in the middle of a storm. My emotional brain tells me I am safe, but my cognitive brain can only laugh and remind me of my reality. Knowing I am not safe is humbling and keeps me searching for a less dangerous place. In the immortal words of André Roch, "The avalanche does not know that you are an expert."

AN ISLAND OF SAFETY IS A PLACE THAT IS SAFE FROM THE AVALANCHE I EXPECT TO BE POSSIBLE, BUT WHICH MAY NOT BE SAFE FROM AN AVALANCHE I CAN'T PREDICT OR IMAGINE.


OVER THE EDGE

KARL BIRKELAND:
This is all an interesting discussion. Like many things in avalanches, how you define a so-called "island of safety" depends on the avalanches you are dealing with. I think the idea of people getting taken out at their "island of safety" is typically due to a larger avalanche being triggered than they expect, or that they aren't sufficiently skilled to determine what an "island of safety" really is.

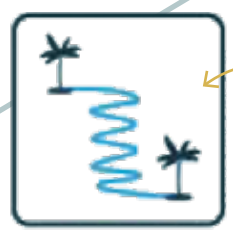
As far as triggering an avalanche from a so called "island of safety", I think we used to see this more before folks fully understood that a shallow area isn't necessarily a safe spot, but is rather a spot where triggering might be more likely. And that shallowly buried rocks, and to a lesser extent trees, also present good places for triggering.

So, do "islands of safety" exist? I would argue that they do exist, but that it takes someone with a great deal of experience in that terrain to be able to identify them. For example, we see heli-ski guides and ski patrollers able to identify and utilize such areas. However, even when they do identify them, they need to be able to adapt their definitions of these "islands" for changing avalanche conditions, especially when large and/or deep slab avalanches are happening. When avalanches are big, areas formerly known as "islands of safety" might now simply be a part of the avalanche path.

Anyways, just my 2 cents. Bottom line here is that there aren't any definitions of what constitutes an "island of safety" that I know of, and that changes in the avalanche conditions will change what does and does not constitute such an "island". Sorry I don't have a cleaner answer!

Lynne, I think an experienced heli-ski guide might have the best answer to this. Perhaps someone like Henry Munter? Or someone at one of the Canadian companies? Roger Atkins?


PULLBACK EVENT



HENRY MUNTER:
Hi all. Interesting conversation, thanks for the opportunity to hear your thoughts!

First, I love the graphic, very much.

I don't have a working definition on paper. The simplest thing I can come up with is "an Island of Safety is a location that won't be hit by a smaller, or more predictable avalanche, but which may not be safe from a larger or less predictable avalanche." Said another way, "an Island of Safety is a place that is safe from the avalanche I expect to be possible, but which may not be safe from an avalanche I can't predict or imagine."

I do refer to Islands of Safety while ski guiding, and I also remind people that nothing we are doing is safe. Sometimes you may find me doing both in the same breath. It's tough to read and write about the different and sometimes contradictory meanings of the word "safe". In practice, I use both the relative and absolute meanings: "We'll ski one at a time to that safe spot", said to a group of clients at the top of a run, doesn't have time for a deep dive into its relativity; "helicopter skiing is not safe", as paraphrased from a release and waiver or warnings given in the field, also needs to have a clear and constant meaning. Utilizing these contradictory ideas while assessing, communicating, and managing risk is pretty essential to what I do. The more we drill down on what is precisely safe, the less useful the definition on the majority of days that we are out there. So, I'm good with referring to safe zones that aren't capital-S Safe, but many won't be.

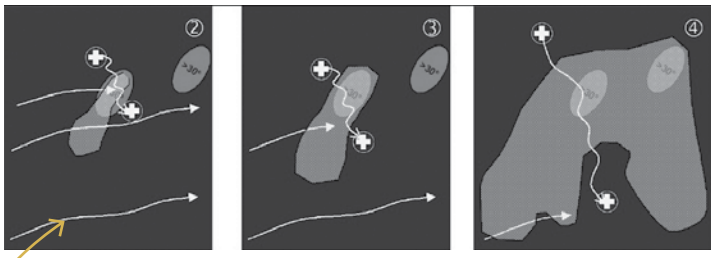
Karl was generous about heli-ski guides being able to identify and use Islands of Safety. As to the way I come up with these things in different avalanche problems, the best analogy is a computer algorithm, executed in part by guide-room analysis but mostly by intuitive judgments in the field. I'd like to think that my personal algorithm takes the probability of the different sizes of avalanches and then fits the various options in the terrain to the Goldilocks regroup or watching spot, that is not too far, not too close.

Because too close is more consequential, the algorithm appropriately weights the actions and is biased to too far, but not too biased because of the probability that something will happen to someone in the back of the pack and they will be harder to see. The algorithm also takes into account various situationally compounding risks such as whether a group member is able to follow directions or incoming clouds that are threatening the egress.

I write all this to express that terrain management and safe zones are about "fit" and "matching", and the critical premises are correctly assessing situational factors and intuitively understanding the probabilities. Unfortunately we can't measure how effective we are at this because the probabilities are uncertain, the factors complex, and the event feedback limited. But we can say that people who adapt their assessments to different situations are probably going to be more successful, and people that manage the terrain the same way every time are probably not. The best tools to facilitate this application are a Willingness to Say No (having recognized that even relatively safe spots may not exist today), a well calibrated sense of slope angle (for the many times that measuring it is impossible), a good memory for analogous avalanches, and the discipline to get your head out of the snow and remember the big picture.

I'm not sure I'm being helpful here, and if you've read this far I'm sorry! Aside from recommending skiing from palm tree to palm tree, that's all I got.

Hope it's winter where everyone is!



This is great. Thanks again for your perseverance on this subject. It has been really helpful for me!

Henry M's thoughts are impressive. His intuitive algorithm allusion got me to thinking it would be good to have some sort of rough set of visuals of the flow/progression of his thinking.

That reminded me of a diagram that Alain Duclos presented a number of years ago: a visual reference on distances and islands of safety in three hazard scenarios (the 'islands' are depicted as the large + signs):

1. The three squares provide the reference/starting point for an 'island of safety' algorithm.

2. Each square includes:

a) hazard ratings—the numbers in the upper right corner of each square refer to the rating;

b) an intuitive interpretation of the potential size of the avalanche danger that could be based on the rating and/or an intuitive interpretation of the analogous 'recent activity';

c) and there's an intuitive projection of islands of safety and distances—based on the size of the 'possible avalanche' in that square—on the decent and possible lines of ascent around >30 slopes.

The three square model provides a sliding scale-reference point context, for discussion and/or individual intuitive assessment of the "probability of the different sizes of avalanches..." which then can then help to assess the "fit the various options in the terrain" as Henry M. puts it.

You wouldn't be striving to get a precise set of instructions from this obviously, but it helps as a tool to visualize (and maybe it even helps to apply) the very real benefits of what I think that Henry is communicating. Namely that:

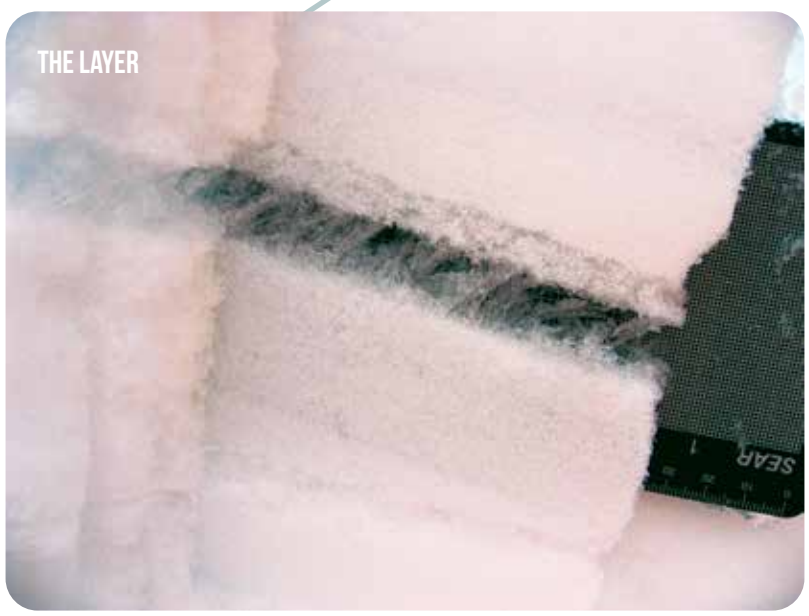
people who adapt their assessments to different situations (are more successful).. than.. people who manage the terrain the same way every time (less successful).

A somewhat similar point on how dangerous it can be to 'manage the terrain in the same way every time', in a high consequence risk context with low 'event feedback', has been evoked as one of the key operational flaws that led to the Concorde accident in France:

> "....we'd become used to the small holes and other small repairs. And getting used to something, a routine, is the worst thing you can do. We'd noticed small holes appearing from time to time. But then one day, there was a massive one, resulting in 113 people dead."

That's a recent quote from Frank Debouck, the Operations Manager for the Concorde at the time of the accident in July 2000. The quote appeared in an article/interview in the ANENA Revue Neige&Avalanches #165 that I translated in the last part of an article I wrote earlier this year; if you're interested it's on this link: https://henrysavalanchetalk.com/accident-reduction-in-the-covid-era-the-biggest-error-would-be-to-believe-that-we-dont-make-errors/.

—Henry S.



ROGER ATKINS:

A fundamental backcountry risk reduction strategy is limiting the number of people and time spent in areas of greater exposure and regrouping in safer locations. Decades ago, we referred to this as "moving from island of safety to island of safety." I cannot even count the times this practice made the difference between an exciting moment and a potentially fatal accident for myself or someone near me. The number of times that this simple choice has saved lives eclipses the number of times when any other practices and tools have made any difference.

I have also witnessed numerous events and close calls where avalanches ran over places that we considered generally 'safe,' including helicopter pickups, regrouping sites, lunch spots, dense forest, and even snow study plots. We sometimes see avalanches that travel hundreds of meters up the opposite side of the valley, that extend the trim line well into mature forest, that pull back tens of meters onto flat terrain at ridge top, that propagate and release through remarkably low angle terrain, and that turn corners and travel inconceivably far down valley. Avalanches will continue to surprise us; almost every year I hear "I never would have believed this was possible if I had not seen it with my own eyes." One morning I went to check the study plot to find it washed away by an avalanche that pushed all of the water out of a lake. No observations that day.

What does this say about islands of safety? Regarding avalanches, there are few absolutes but there are safer or riskier choices. The term "Islands of Less Danger" would be more accurate, but it doesn't exactly roll off the tongue.

Choosing islands of safety is a complex judgment. The degree of safety afforded by any "island of safety" is not only a matter of terrain; the degree of safety provided by any terrain feature is always changing according to avalanche conditions and according to what people are doing there. Study plots carefully selected as completely safe from avalanches by teams of avalanche professionals have been hit by avalanches; sometimes there are no islands of safety in, or even close to, large avalanche paths. Smaller terrain is more straightforward.

Are there problems with the interpretation of islands of safety today, and would a precise definition be helpful? We seemed more accepting of uncertainty and subjectivity in the past, and I find it more productive to learn to function in an uncertain world than to create an illusion of control. Spatial variability and information gaps lead to uncertainty, and uncertainty lends itself to subjective language while precise language about uncertain things creates an illusion of certainty. Acknowledging our uncertainty keeps us better prepared for the unexpected. Our uncertainty is also always changing and I assess the nature and degree of uncertainty as deliberately as I assess the snowpack. My decisions are frequently determined by my uncertainty rather than what I believe I know about conditions.

Travel behavior is key to risk reduction in avalanche terrain; this is the one thing that we have the most control over. The art of confidently adjusting our behavior to changing conditions and different situations is a lifelong endeavor that is part of the joy of spending time in the mountains.

Anything but Normal...

2019–2020 Avalanche Center Season Summaries: Part 2

photo Ben VandenBos

In Celebration of Small Avalanche Centers

BY LYNNE WOLFE AND SIMON TRAUTMAN

Avalanche Centers come in all shapes and sizes, carry intensive workloads, and spend significant time garnering resources. For this issue of TAR, we want to honor the smaller centers who typically do a lot on thin time and financial margins. These operations generally consist of one or two forecasters and community volunteers who have to do EVERYTHING—from fieldwork to forecasting, managing websites to building weather stations, to fundraising and education.

The following season summaries illustrate the important role these individuals play in their respective communities. So support them where you can and best wishes for the winter ahead!

Simon Trautman is National Avalanche Specialist at the National Avalanche Center.

Taos Avalanche Center

After a long warm and dry fall in Northern New Mexico, the first significant snow was in late November with a series of three storms that brought 40 to 50" and over five inches of water that predominantly fell on bare ground. Higher elevation northern facing slopes had lingering snow from late October that faceted, then produced our first avalanche cycle of the season on November 30th with 3 to 6' crowns on northerly aspects above treeline. This wet heavy snow provided us a great base for the rest of the season. The lack of early season snow was a nice reprieve from our typical basal facet/depth hoar layer that stays with us throughout the season.

It had seemed like a long wait for the season to start, but December did not disappoint, with storms interspersed throughout the month, and ending with three storms that started Christmas Eve and continued through New Year's Day. With a deepening base and the basal facet layers already having avalanched, conditions were great and most of the instabilities were confined to the storm snow. What was different from typical years is the convective nature of these snow showers that laid down several significant layers of graupel in the snowpack. Although graupel tends to heal quickly, our layers of graupel, 10 to 15 cm thick, persisted into January's long cold dry period and then became large faceted graupel clusters. A significant storm on January 16th–17th brought 16 to 20" of snow with 2 to 2.5" of water and 60 mph winds. Natural and human triggered avalanches were observed on the 17th on all aspects and elevations running on these buried graupel

TAC: March avalanche cycle. *Photo courtesy Taos Avalanche Center*

layers . January 17th we issued our first and only avalanche warning of the season. Instabilities from this storm continued over the next week, with several remotely triggered hard slab avalanches in the alpine.

This mid-January storm was the last significant storm we'd see for the rest of the season. Intermittent small storms, wind, and warming temperatures during prolonged periods of high pressure and high snow levels set the theme for the rest of the season. The beginning of February felt more like April with temperatures above freezing at all elevations. Multiple buried faceted crusts in the snowpack would be tested with each incremental loading event. These avalanche cycles would mostly be confined to easterly aspects near and above treeline.

We shut down operations with the last summary on March 21st with road closures and shelter in place orders from the Covid-19 pandemic.

TAC started in 2016 as 501c3 non-profit, but quickly ran into hard times during the 2017–18 season with a historically low snow year where we only saw 72" for the entire winter. After financial hardships, we were able to get TAC operational last season, offering snowpack summaries four days per week. We also were able to provide a free Level 1 avalanche class for 30 kids in the Northern New Mexico area. We helped two high school students with independent snow science and climatology projects. We also worked in conjunction with a recent MSU graduate where we conducted 194 PSTs at 10 different sites looking at slab communication in regards to multiple slab/weak layer combinations and slope angle. We have finally secured permits for avalanche classes in the backcountry, where we hope to see more avalanche education and class offerings in the years to come.

—Andy Bond

WEST CENTRAL MONTANA AVALANCHE CENTER

This year brought both positive evolution and challenges (pandemic related and not) to the West Central Montana Avalanche Center. Forecaster Logan King wrapped up his "on snow duties" at the end of last season and left to go east and work on a meteorology doctorate. We are grateful for Logan's longtime efforts and are especially thankful for his work this year in producing the first Avalanche Atlas for the City of Missoula. Logan's work with the center started with Know Before You Go lectures in area schools and ended with him being one of two full-time forecasters for a 900,000-acre forecast area. The WCMAC would likely not be where it is without Logan's steady hand. We look forward to trying to lure him back to Western Montana after his matriculation.

After a forecaster hiring process that stretched out to midseason, we ended up with three very talented new staff. The West Central Montana Avalanche Foundation hired Jeff Carty and Todd Glew as avalanche forecasters in November, and Andrew Schauer joined us in mid-February. Along with Travis Craft, these hires effectively doubled the number of forecasters from previous years. These new additions to the team, along with a substantial increase in public observations, allowed us to provide better geographic coverage of our forecast area.

FRIENDS GROUP EDUCATION

The West Central Montana Avalanche Foundation's efforts to increase and evolve our education program offerings continued this year. Highlights included; an increase in Motorized Awareness courses, a recreational level 2, a mechanized level 1, a Women's Only Avalanche Rescue Course, and a level 1 Refresher for two Forest Service employees and the Foundation's Volunteer Board. We had good attendance throughout the year but were forced to cancel several remaining yurt and lodge-based courses on March 16 due to Covid-19.

AVALANCHE EDUCATION PROGRAM OVERVIEW:

- Total Participants: **2257**
- Total Classes: **48**
- Free Courses: **36**
- Free Participants: **2169**
- Number of Instructors: **18**
- Female Instructors 2020: **3**
- Women's Only Courses: **2**
- Advanced Motorized Classes: **3**
- Motorized Free Courses: **8**
- Motorized Free Participants: **405**
- Canceled Free Education Due to Coronavirus: **5 events**
- Canceled Paid Educational Classes Due to Coronavirus: **3**
- Number of Education Directors Retiring after 13 Years of Service to Missoula Avalanche: **1**

SNOWPACK & ACCIDENTS

The snowpack in West-Central Montana started unstable in late December/early January and began to trend stronger after mid-January. Some early November storms led to good coverage for the time of year. However, we saw little significant snowfall for the next two months. What sat on the ground alternately faceted and thawed while light snow trickled in, creating a genuinely rotten snowpack structure that consisted almost entirely of facets and crusts. By December 31, we had around 100cm of "base" that was utterly non-cohesive. Stepping out of skis or off a sled, you would sink swiftly to the ground. We were doubtful that the snowpack we had was capable of producing a slab avalanche due to its lack of cohesion. Relatively high snow levels throughout the early season also left many hazards exposed.

Starting January 1, we received 2.5" SWE overnight accompanied by 35-50mph winds, on top of that rotten base. We issued an avalanche warning along with a high hazard rating. This is also

WCMAC: Gotta get up to get down. Cars fill the over flow parking lot at Montana Snowbowl on April 01,2020. On March 26, 2020, Montana Governor Steve Bullock issued guidelines for safe recreation during the coronavirus pandemic. State guidance and directives discouraged Montanans from outdoor recreation activities that pose enhanced risks of injury or could otherwise stress the ability of local first responders to address the Covid-19 emergency (e.g., backcountry skiing in a manner inconsistent with avalanche recommendations or in closed terrain). *Photo Nick Mott*

the day we had our only fatal avalanche accident of the year.

On January 1, 2020, three snowmobilers triggered a slide in the Southern Mission Mountains. One escaped, and two riders perished. All three party members had airbags, but one fatality was not wearing a beacon. The three victims did not have avalanche specific backcountry education. The two victims were buried under five and nine feet of snow, respectively. The slide was remotely triggered from the bottom and slid on the surface hoar/crust layer. These are the first backcountry avalanche related deaths in the forecast area since 2010.

In the aftermath of this accident, we saw a significant spike in attendance at our public avalanche awareness presentations. We heard several highly skilled riders convey their belief that an airbag was the most effective tool to survive an avalanche. Another fallacy that we heard repeatedly was that treed slopes don't slide. However, the fact that we had alerted the public through an avalanche warning and continued to expand the education program led to us gaining some trust and converts with user groups that we have been reaching out to for some time. We continued to work hard to reach all of our backcountry users about commonly held misconceptions. Staff were able to engage backcountry travelers in direct dialogue at in-person public forums to clear up misconceptions held by some within the motorized community.

The storm that arrived on January 1, continued for two more days, delivering up to 4.5" of SWE. Two more days of warnings followed until January 3, and the danger remained high on the January 5th forecast. Overall, we received up to 17.7" SWE in January. Depth hoar and basal facets continued to be an issue until the end of January. In the Southern Bitterroot, the Lost Trail ski patrol ski cut a D4 slide with a 6-8 foot crown that went to ground, and observers and partners reported multiple other full depth avalanches around the ski area. A lucky group of Level 1 students witnessed a naturally triggered avalanche from the safety of adjacent on area terrain before they began a tour on their first field day. A D3 avalanche, with an 8-foot crown, was triggered on a 30º slope in the Mission Mountains. Local social media posts and public observations reported numerous other "close call slides" releasing during this cycle. The remoteness of much of our backcountry and increased outreach efforts likely helped prevent more incidents in the first half of January.

The hazard remained at Considerable until January 16, when we downgraded it to Moderate, but we stayed in a low likelihood/high consequence setup due to the depth hoar. We continued to get poor test results within the forecast area for the next three weeks. The weakness of the depth hoar was tied directly to snow depth. The northern part of the forecast area received more snow and rounded out considerably faster than the south. South faces had a much weaker structure due to shallower depths. As late as February 8, there were reports of natural avalanches failing at the ground in the Southern Bitterroots. Around this time, we wondered aloud if we would venture out on a slope over 30º this entire season.

February came in with a blast, combining 100mph wind gusts with temperatures to 46º at 7600'. Our deep persistent slab problem quickly healed across our forecast area, except for up in the Southern Bitterroots, where it persisted well into March. We received up to 7.1" SWE in February, and coverage rose to 118% of average. High west winds continued sporadically throughout February and made wind slabs the most widespread problem.

Considerable and Moderate hazard ratings were reasonably balanced throughout the month. Moving into March, surface instabilities were the primary concern, and we entered a long stretch of low to moderate danger scale days.

THE PANDEMIC

Covid-19 affected us profoundly. We began practicing social distancing on March 16, driving separately to trailheads. We also stopped touring with volunteers and agency partners. It didn't hamper our ability to get observations, but it did affect the number of locations from which we could compile data. We ended the forecasting season on April 1 this year, approximately 15 days earlier than usual.

After ceasing forecasting operations on April 1, there was a period of high use and Moderate to High danger. This combination put our entire community on edge. Not unlike recent seasons, April arrived with a strong winter system. This system triggered a widespread avalanche cycle due to extensive surface hoar growth in late March. We saw our backcountry community make good use of our public observations forum and share conditions and warnings during this time. We know of no avalanche related accidents or injuries that transpired during this time.

Backcountry travel increased substantially after Montana's March 27 shelter in place order. This may have been partially due to Montana Governor Steve Bullock's specific allowance for outdoor recreation (for which we were quite grateful). While we did not see the same spike as some towns with larger ski areas or higher population densities, the increase in backcountry travel was substantial. It would be an understatement to say we were grateful that we did not have an accident in April or May.

In the first few weeks of the pandemic lockdown, we initiated some internal and community discussions regarding our public stance on risk. These stemmed from Halsted Morris's March 25 letter and also us witnessing social media posts of people looking for information after deciding that this was the time to give this whole "backcountry skiing and riding thing a try." On April 8, we published guidance on our website, recommending that all users in our forecast area forgo backcountry skiing. Our position hinged on the potential effects on the health care system and the inability for users to operate in a risk environment with low to medium impacts.

Since none of the WCMAC forecasters are USFS employees, and thus exist outside the liability, pension, and benefit umbrella of the Federal Government and Department of Agriculture, our decision to cease operations was partially dictated by discussions with our insurance providers, local health care representatives, plus state and local officials.

Frankly, as we write this, the non-profit funding landscape looks pretty bleak. Growing uncertainties loom in the face of an economic downturn, incredibly widespread need, and painful realities relating to the first truly modern plague. Regardless of these difficult times, we're confident that we will be able to resume our operations in late November to early December 2020, as users of our forecasting and education products have come to expect. Say it out loud along with us….. "You just can't keep a good center down."

Among the season's accomplishments, we:

- The WCMAC issued fifty-four (54) avalanche forecasts and four (4) avalanche warnings.
- The website Missoulaavalanche.org received one hundred and forty-two (142) public observations, a new record.
- New additions to the WCMAC forecast team increased our products' accuracy and frequency.
- The WCMAC utilized in-person public forums (i.e., Snowpack Discussions) to generate an astonishing amount of public buy-in and interaction with our center.
- Staff guidance helped the City of Missoula complete its first urban avalanche atlas.

—WCMAC Staff

WALLOWA AVALANCHE CENTER

The winter of 2019–2020 in Northeast Oregon was highlighted by powerful storms, followed by extended periods of high pressure. By mid-April our overall SWE was above average; our Basin Index reported 121% of median. We began avalanche forecasting later than usual, issuing our first advisory on December 19. Our final advisory was issued April 2, following a 1-2' storm to finish off March. In total we issued 29 advisories and two avalanche warnings. This winter we offered two advisories a week for January, February ,and March, issued on Thursdays and Saturdays.

Two of our biggest storms took place January 10-14 and February 5-7. The first storm brought significant snowfall, ranging from 1.8"-7.4" of SWE. An avalanche warning was issued on the eve of January 11-13. Unfortunately, on January 11, a local snowmobiler died in an avalanche in the Elkhorn mountains (one of our forecasting zones). Due to the nature of the high avalanche danger, we were not able to make it to the accident site to conduct a field investigation.

The February 5-7 storm was a pineapple express out of the west, which unleashed 8-10" of SWE in the Western Wallowas and Blues. A storm that began as heavy snowfall quickly turned into rain on snow and our second avalanche warning was issued. This was a unique storm cycle, as the Southern Wallowas only received 0.7" of SWE. Normally the Southern Wallowas receive the greatest snow totals, but this winter, due to a westerly flow, the Blue Mountains and Western Wallowas were favored. A Snotel site we monitor along the Oregon-Washington border in the Blues picked up 10" of SWE over three days, but due to the warm nature of the storm only increased in HST by 25". The bright side is the layer of buried surface hoar which was quickly destroyed by all the heavy precipitation.

Between storm cycles, we saw numerous periods of high pressure which allowed for the formation of surface hoar and near surface facets. The surface hoar events made for challenging forecasting and mapping of the whereabouts of this PWL. One particular layer of surface hoar in the Southern Wallowas, buried in mid-February, remained reactive in snowpack tests until mid-March. Fortunately, its distribution was not widespread, and although a skier and snowmobiler did trigger small avalanches on this layer no one was injured.

Beyond avalanche forecasting our free avalanche education and fundraising efforts significantly increased this winter. We offered six avalanche awareness presentations and in total provided free education to over 300 individuals. This was our second winter as an AIARE provider. We offered all of the Rec Level classes, including a Motorized Level 1. In total we had 56 students participate in Level 1, Level 2, Motorized Level 1, or a Rescue Course. Our hope is to increase the number of motorized students in the future, as this is an underserved population.

We took our fundraising campaign on the road this fall and visited Portland, Seattle, and Boise,, as these three metropolitan areas account for the largest traffic to our website. Many skiers and riders from these three areas visit the Wallowas and Elkhorns to recreate in the winter. Website traffic this winter increased by nearly 10,000 views or 20%.

A couple of exciting additions included a new avalanche forecaster and a new 2018 Polaris Pro snowmobile. Tom Guthrie joined our forecasting team and helped with field observations and written advisories. Tom has been ski guiding and personal skiing in NE OR for a decade, and we are grateful for his depth of knowledge. Through a local grant, we purchased a new 2018 snowmobile from a local dealer, which allows us to maintain weather stations, collect snowpack observations, and work with motorized users.

Covid-19 certainly added a unique challenge, but fortunately we were able to continue to offer avalanche advisories into early April. As an organization which offers advice on staying safe in the mountains, we offered recommendations to backcountry travelers to tone down their terrain and limit backcountry travel. Oregon Governor Kate Brown closed all US Forest Service developed recreation sites on March 31st, which included all snow parks. Although the National Forests were not closed, it was recommended that people stay at home to limit exposure and help prevent the spread of Covid. It's difficult to predict what long term impacts our avalanche center will encounter due to the pandemic. We are hopeful we can all resume our normal lives by next winter and our forecasting can resume as per usual.

— Victor McNeil

WAC: Motorized AIARE Level 1 class. *Photo Victor McNeil*

CENTRAL OREGON AVALANCHE CENTER

OPERATIONS: The Central Oregon Avalanche Center had another great year. This was our third season of operating as a Type 2 avalanche center and issuing bi-weekly advisories to the public. Our operations team consists of a part time staff of four observers and forecasters who issue 48-hour advisories on Tuesday and Friday evenings. Community engagement with the avalanche center has been strong and we greatly benefit from the public observation reports on the website. For the 2019–20 season, COAC began using the international InfoEx and can now share information internally with other local operations who operate in avalanche terrain.

Our snowpack was pretty thin (for the Oregon Cascades) through the end of December and we finished the month with about a meter of snow sitting on the ground in most locations. The height of snow eked along until mid January when a storm dropped over a meter of snow in just several days, after which it felt like

CENTRAL OREGON AVALANCHE CENTER

winter had finally arrived. In addition to our typical storm slab and windslab problems we had multiple persistent weak layers throughout the winter that stayed active for varying amounts of time, but were usually out of play after a few weeks. Although not uncommon, 'whumpf' is a sound that local skiers and splitboarders have been hearing a lot more of over the last couple of winters. Throughout the course of the season there were numerous reports of natural and skier triggered size 1 to size 2 avalanches with the occasional larger avalanches. We also had a few reports of close calls with avalanches in steep terrain resulting in big rides but only minor injuries.

COAC maintains a remote backcountry weather station that transmits data on the hour to the Mesowest network. This has been a great asset to our forecasters and anybody touring in our local area. One of the ongoing challenges with the station is rime ice that accumulates on the wind sensor and since we operate with part time staff, we are not always able to make it to the station for deicing. In December the weather station received a modem upgrade and is now communicating on the 4G network.

EVENTS: COAC's operating budget is entirely based on memberships, community and local business donations, industry partners, and fundraising events. Our fundraising season was kicked off in November with the second annual Bend-SAW, hosted on the Central Oregon Community College campus. We had a great lineup of speakers including John Scurlock, Lynne Wolfe, Drew Hardesty, Anne St. Clair, and Bjarne Salen of The Fifty Project. The event packed the house with over 250 people in attendance and finished off with a lively aprés party at the Deschutes brewery in downtown Bend.

In February we held our third annual 'Fresh Tracks' party at the 10 Barrel brewery. The event was full of revelry with food, beer, local bands and a silent auction.

The Vert Fest skimo race/backcountry festival, was our last major fundraising event of the season. This was held at the Mt. Bachelor ski resort in late February. The race attracts participants who are new to touring and elite athletes alike.

Since the beginning of our organization, COAC has offered monthly free to the public avalanche awareness presentations. This season they took place in good style at Immersion Brewing in Bend.

COVID-19: In mid March, the local ski resort postponed operations due to Covid-19 and we initially saw a surge in people using the backcountry. Many resort skiers and riders were still hungry for turns and could be seen bootpacking with gear strapped to backpacks at some of the easy access backcountry venues. Not long after, the Oregon governor issued a 'shelter in place' order and subsequently the Deschutes National Forest closed developed recreation sites including Snoparks (Oregon's maintained winter recreation access points) and trailheads. Following these closures it was nearly impossible for our observers to access the backcountry. At that time, COAC decided to end operations early for the season, almost a month ahead of schedule.

The central Oregon backcountry community continues to become larger each year, and our goal is to grow with it and support the needs of human powered and mechanized winter backcountry users. We are a relatively new avalanche center and we still have a lot of room for growth and improvement. This spring and summer, our team will be discussing how we can grow and adapt to provide snow and avalanche information in the best way possible to our users with the budget we have to work with. We are already looking forward to the 2020–21 season and hope to see you in the backcountry next winter.

—Aaron Hartz

KACHINA PEAKS AVALANCHE CENTER

By season's end, San Francisco Peaks had received 257 inches of snowfall at 10,800 feet, 99% of our annual mean winter precipitation. Sixteen natural slab avalanches were reported, as well as several explosive initiated releases at Arizona Snowbowl. One small skier-triggered wind slab avalanche was reported. No avalanche related injuries were reported, and no avalanche fatalities occurred.

OVERALL: Our season can be described in three phases.

PHASE 1: Between late November and early January we were on a roll. Winter started with some big storms. From November 20-30, 47-52 inches of snow fell between 9,730 and 10,800 feet, ranking the month as the fifth wettest November on record. Heavy snowfall on the Friday after Thanksgiving, dubbed "White Friday," led to our first cycle of natural storm slab avalanches. Regular productive snow storms and several high elevation rain events continued through December setting up conditions for crust/facet sandwiches and icy, slide for life surface conditions up to 12,000 feet. A strong Christmas storm brought 36 inches of snow, initiating another cycle of natural avalanche activity. By New Year's Day, we had received approximately 130 inches of snowfall at 10,800 feet, half of our seasonal average.

PHASE 2: Drought conditions dominated starting the first week of January. For six weeks ending on February 21, less than eight inches of snow fell, and what did come was in flurries. As usual our nemesis was the wind. Some hard slabs developed, but high winds stripped many above treeline slopes down to the ice layer. Sliding falls were the main hazard.

PHASE 3: Precipitation resumed on February 22 with 15 inches of snow, followed by a third avalanche cycle. Storms continued to impact northern Arizona intermittently for the rest of the season. Although the snowpack generally stabilized over time, more high elevation rain on March 11 created another worrisome persistent facet/crust weak layer. Arizona Snowbowl ski patrol triggered a dramatic hard slab avalanche on this layer on March 14, but thankfully no other delayed action events were observed. The most potent snow storm of the late season was on March 18-19, when 32 inches fell prompting a special storm update. Signs of instability were prevalent, but no natural or human triggered av-

KPAC: Avalanche triggered by explosives at AZ Snowbowl on March 14, 2020. *Photo Ken Galinski*

alanches were reported. The season finale came on April 14 with 20 inches of dreamy powder, however, by this time northern Arizona, like most other areas, was locked down by Covid-19.

On March 20, Arizona Snowbowl ski area suspended operations. Access was limited by an extended closure of Snowbowl Road, a primary backcountry access artery. This action was intended to inhibit backcountry use, thereby preventing stress on the already taxed medical and emergency service resources. It was an odd ending to an otherwise excellent season. During the winter, Kachina Peaks Avalanche Center issued 22 weekly snowpack summaries on Fridays, and four mid-week storm updates starting on November 22, 2019 and ending on April 17, 2020.

WINTER BACKCOUNTRY PERMITS: Of particular note, Coconino National Forest discontinued the winter backcountry permit program for the 2019–20 winter. The free winter backcountry permit has been a requirement, issued to individuals each winter since 1997. This system was developed in response to a tragic avalanche fatality in 1995, and as a means of educating winter backcountry users of the potential dangers of winter travel in mountainous avalanche terrain. Eliminating the program is a testament to KPAC's success in raising the bar of avalanche awareness amongst local Arizonans.

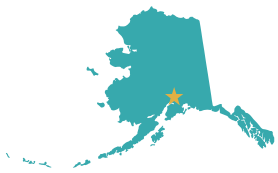
WEBSITE ACTIVITY: Our website continues to be our primary communication avenue. During the winter we had:

- 6,238 unique visitors to our website www.kahinapeaks.org
- 3,880 unique visitors to our snowpack summaries; 2,822 of these were from the state of Arizona, and 1,199 from Flagstaff, AZ
- 480 users received email notifications of snowpack summaries, updates, and another 293 received text alerts
- Total website activity was down 15-20% from the previous season, understandable, as activity correlates with seasonal snowfall, and the Covid-19 closures cut the season short

AVALANCHE EDUCATION: We had a banner year of avalanche courses, overseen by our new Avalanche Education Coordinator Robby Rechord, with one level 2 course and six level 1 courses, enrolling a record breaking 74 students. We also offered 43 ($200 each) scholarships to these courses, 28 of which were utilized, at a value of $5,600. Regretfully, our annual Mikee Linville Avalanche Scholarship Fundraiser scheduled for March 28 was canceled in compliance with the Mayor of Flagstaff's orders to close nonessential businesses and avoid congregation of more than 10 people. As a result, our restricted scholarship account is significantly depleted for next season, putting next winter's scholarship program in jeopardy. During the winter KPAC also offered three free introduction to avalanches workshops at local community centers and outdoor sport shops. These have always been well attended and appreciated by the Flagstaff community.

GRANTS: This season concluded the second year of funding through a Resource Advisory Committee (RAC) grant from Coconino National Forest. This grant provided funding for regular snowpack depth measurements along an elevation gradient, on a variety of slope aspects, as well as, supporting backcountry stability observations, and snowpack summary reports. We are hopeful that renewing this source of financial support can continue into the future, allowing us to operate effectively on limited resources.

—David W Lovejoy



HATCHER PASS AVALANCHE CENTER

The Hatcher Pass Avalanche Center (HPAC) was founded in 2009 by Jed Workman and Allie Barker to fill a desperate need for avalanche information in our community. From the beginning, we followed NAC guidelines and consulted with our regional avalanche center, CNFAIC, as well as other industry mentors, in building and growing the avalanche center. Because HPAC operates on state land, no federal funding or support exists. Interestingly, the State of Alaska provides no funding for avalanche centers although a mandate is written in the state statutes.

A few years after starting HPAC, we partnered with the Alaska Avalanche Information Center with intentions of becoming a stronger center through networking, more affordable group insurance, and non-profit status. AAIC centralized the management of several avalanche centers across the state which initially appealed to our fiscal challenges. However, we soon realized our priorities and focus should be purely on the HPAC mission while supporting our local community. Unfortunately, around this same time, the AAIC mismanaged HPAC funds, crippling our operation.

In a timely and decisive action, Jed, Allie, and an unofficial board of directors, applied for federal, non-profit status. Since 2019, HPAC INC., a 501(c)3 organization, began to rebuild. Our new board consisted of 7 members, each a leader in our community and committed to avalanche safety. After transitioning to our own 501(c)3, community support became increasingly stronger. Within one year, we surpassed our previous financial position with the ability to afford insurance, pay two forecasters, and a third, new position this year, assistant forecaster. Another initial challenge and ultimate reward as a stand-alone avalanche center has been partnering with an agency center, CNFAIC. We share an observation platform, website design and presentation, which all contributes to our success.

In order for our small board and two forecasters to achieve all the duties to manage the non-profit and provide professional avalanche products, we all wear many hats and this can be taxing. Funding HPAC requires ardent commitment to in-person fundraisers, grant writing, and securing community and corporate donations. However, we value the autonomy of creating and running a small, grassroots, non-agency center.

ORGANIZATION UPDATE

Grassroots, non-agency avalanche centers have their work cut out for them. It's no easy hurdle to bring into existence and sustain a community run non-profit avalanche center while simultaneously providing quality, professional level avalanche safety information to the general public.

We've learned through trial and error that organizational avalanches occur. Ideally, an organization plans for many D1s and the occasional D2, but not all are set up for the catastrophe of a D3 or larger. See our note above for more detail on this topic.

SEASONAL REVIEW

Our local NRCS hydrologist and snow aficionado said...In October "it started with a bang, and hasn't let up!" As of mid-April, this season has not hit the record books yet, but it's close and it's not over.

An early start in October brought a thick warm blanket of snow which covered unfrozen ground, and led to a widespread and impressive glide crack and glide avalanche cycle. About three feet of snow kicked off the season, providing excellent coverage in the upper elevations. Warmth brought rain to the lower elevations until colder temps brought snow later than normal.

Long time Hatcher Pass guru Nancy Pfeiffer remembers 1997, when September started out with a 3-foot dump, then led to a significant glide problem that season. Nancy was the only person we spoke with who could remember a glide avalanche problem at HP.

The warm early winter made for a moist and rounded snowpack lacking any persistent weak layers (PWL). "Hatchurnagain" is the term used to describe the continental Hatcher Pass expressing itself as the maritime Turnagain. This is the first time we saw a meter of rounds from the ground up in the last 18 years, standing clearly in contrast to the typical persistent weak layers and basal facets that plague our "normal" snowpack. More than one confused local pulled us aside to ask questions about grain ID. As it turns out, some of the locals only know the sharp crystal types.

HPAC: March 22, 2020: Delia Creek. Remote skier trigger SS-ASr-D2.5-O. The approximate trigger location along the uptrack is circled. *Photo courtesy HPAC*

Alaskans expect cold winters and awful mosquitoes in summer. Much of Alaska's pride is hung on that hook. So, when the weather is just too darn agreeable, people get antsy. Fortunately, January's cold snap brought balance to our lives, and PWLs back to Hatcher Pass.

Heater socks, Webasto Vans, and the Dylandog camper all returned as our saviors from the cold as sub-zero temperatures returned and the snowpack gave up its moisture. Our old friend, Square Powder returned. Stability remained good, without a problem overlying weaker snow, and surprisingly, The Matanuska Wind forgot about Hatcher for a few weeks! Skiing and riding conditions were at an all-time high.

The longer the winds remained calm, the more we became skeptics. We knew The Mighty Matanuska had to blow, it was just a question of when. It came at the end of January, decimating riding conditions and building dangerous slabs. Luckily, we had been feasting and our bellies were full from a few weeks of excellent conditions.

Hatchurnagain was a thing of the past, glides virtually disappeared, and we returned to our historical continental snowpack. Wind drifted snow, sitting on the January persistent grains, produced avalanches five feet deep, and remote triggering became common. February brought approximately 6.4" of SWE and by March 9 the eight-foot-tall Marmot snow stake was buried. (The stake remained under snow until April 7.) The tides had turned and the January weak layer continued to be the culprit.

A tragic avalanche fatality occurred in the lower elevations, near the 16-mile road run, at HP on March 9th. This unfortunate accident occurred in a small terrain trap, in otherwise relatively benign terrain, involving a 17-year-old.

On March 12, after another loading event, an avalanche was remotely triggered from below, barely crossing, but closing the road. Daisy bell mitigation was performed with minimal results.

After each subsequent loading event, backcountry users continued to remotely trigger large avalanches on the buried January facets, up to five feet deep.

The next big change came in mid-April, when spring sprung literally overnight. Temperatures rose to above freezing for several nights in a row triggering a large wet slab cycle.

As of April 23, the Independence Mine Snotel (3500') shows 28" of SWE for the season, approximately 28 feet of snow. 82" is the current depth of snow, 6.8 feet of snow.

This season was a fast transition in every case, from glides, to deep persistent slabs, to wet slabs, to a prudent Covid response and shut down of our operation.

Thanks to grant funding and collaboration with the CNFAIC, HPAC built a new, impressive website this season. This season's success can be defined by our fundraisers, community support, grants, a supportive hard-working board, and a massive amount of labor (thanks to bellies full of caribou, pork, carrots, and sauerkraut from Chugach Farm!).

HPAC received nearly 200 community observations this season, 6,961 followers on Facebook, and over 50,000 views during big weather events. We finished the season two weeks early due to Covid "stay at home" mandates. Overall, the season followed a pattern of low probability and high consequence for avalanche and Covid problems.

We hope that HPAC's resurgence this season with ups and downs will continue to make our non-agency center stronger and more resilient in the coming years.

—Allie Barker and Jed Workman

ALASKA AVALANCHE INFORMATION CENTER

With an emphasis on professional development and information sharing, AAIC continues to support outreach and forecasting in rural parts of Alaska that are beyond the established Forest Service advisory areas. Four centers operated this season: Cordova, Eastern Alaska Range, Haines, and Valdez. Tracking website visits, nearly 15,500 users accessed our website with more than 60,000 page views. Peak usage was at the end of January, and again four times during March.

CORDOVA AVALANCHE CENTER

Warm temperatures at the beginning of winter left us with a skinny snowpack in the upper mountains at best and nothing below treeline. A storm on New Year's Eve brought heavy rain to the peaks. Temperatures then abruptly dropped after midnight allowing snow to accumulate at sea level. This created a sleepy persistent weak layer. Cold snowy weather continued through February, with the height of snow reaching 150cm at sea level. A couple of avalanche cycles occurred, including a few large slab events. A cool drought through March kept activity at bay. Temperatures increased in April, and a "rain to the peaks" event led to the beginning of our spring shed meltdown. Some cornices and glide cracks failed, as well as some small loose snow events. Mostly, however, the snowpack melted in place. No avalanche activity reached the highway, though air blasts were felt on two occasions. No backcountry incidents were reported.

Overall, the snowpack was above average at sea level, average at mid-mountain, and below average in the upper mountains. At 500m, the average temperature was lower than the last two winters; the maximum height of snow was higher, while precipitation remained near average. A five-year average of our limited data suggests that after six years of significantly increasing temperatures, the trend may now be decreasing. Of note, a linear fit of the data shows a 0.25`C increase in average winter temperature per year. This insinuates that in 400 years, our average winter temperature will be the boiling point of water. Future avalanche problems to consider: Scalding Slabs and Steam Blasts.

—Hoots Witsoe

EASTERN ALASKA RANGE AVALANCHE CENTER

The Eastern Alaska Range Avalanche Center focused on avalanche awareness courses this season for the interior. We did workshops ranging from 90-minutes to six hours. We impacted over 200 individuals at local snowmachine retails, ski shops, and the University. This year we also had the opportunity before Covid-19 to run a successful snow machine Level 1 based out of a remote lodge in the Alaska Range mountains. This relationship promises to be long lasting and directly impact the riding community in Alaska.

Our other success this season was installing a weather station in the Alaska Range that was reported by Alaska USGS to be the most talked about weather station in Alaska. The early snow reports brought many new riders and skiers to the area, which previously had no mid-elevation snow data. This was a shared effort between EARAC, USGS, and the local ski area who provided 4x4 transportation for the install.

—Mark Oldmixon

HAINES AVALANCHE CENTER

After years of low snowfall, Haines finally had a "normal" winter this year. Snowpack was deep down to sea level, and the mountains were plastered.

- Haines Customs Border Station (valley bottom): 279" of snow (120% of average)
- Haines Town: 218" of snow (123% of average), with 45" of precipitation from Oct-April (99% of average)
- Total SWE at treeline on April 25th: 70" (at 2,600ft, Maritime zone, about average)

The deep snowpack and consistent storms led to fewer PWLs than in previous years. Recreational

AAIC: HS-AFu-D2-R4-O Avalanche that buried 3 and killed 2 young snowboarders on December 30th, 2019 at Chilkat Pass. This slide occurred on an often-used hill next to a trailhead parking lot. Approximate burial locations are circled. *Photo Erik Stevens*

AAIC: Hippie Ridge DOT mitigation March 5, 2020 shows the nature of natural and human triggered activity that pulled out on facets buried in February. HS-N-D2.5-O/G, South aspect, MP 34. *Photo courtesy AAIC*

Skiers/Riders/Snowmachiners were quite active before the pandemic hit.

We were not without avalanche problems, of course. The Chilkat Pass zone, located in a more Continental climate, had problems with depth hoar and crust-facets all season. Early season rain events drove freezing levels up in elevation and formed melt-freeze crusts, followed by cold air outbreaks. We actively monitored and discussed these crusts throughout the season, and spent extra time trying to map out their elevational distribution.

Tragically, these snow conditions in the Pass created the recipe for a deep, hard slab avalanche that buried three young snowboarders from Haines as they bootpacked up a small hill on foot. Two of them were fully buried and did not survive. The third was buried up to his neck, and was only able to self-extricate after nearly an hour before communicating via InReach.

This event was important, tragic as it was, because it occurred on an unassuming hill just steps from a trailhead parking lot. The hill is approximately 30m tall and has been used by local families for decades as a place to slide on snow. It should serve as a strong reminder to think big when it comes to small, heavily-used terrain. It also underscores the importance of local avalanche forecasting, observations, and education in our town. Avalanche safety is NOT (as one local town Assembly-person put it) just for extreme riders participating in a high-risk sport.

With limited funding for forecasting operations this year, recent accidents motivated an even greater dedication to our growth in education and public outreach. HAC staff taught 16 classes this season (176 students total), ranging from free awareness sessions to A3 Rescue Classes, Snowmachine Avy Awareness, and a Level 1 Rec.

Snow conditions going into the Coronavirus shutdowns were quite good as the consistent winter storm track changed over to steady high pressure. Many recreationists made the decision to limit their exposure in the mountains, while others continued to take advantage of the spring snowpack without incident. Some local riders were called out by their peers on social media for skiing risky terrain during this time. Even in Alaska we were hearing about problems with trailhead crowding and SAR resources being stretched in the lower-48.

For our part, it was an easy decision to stop all staff operations by the end of March. For one, we were out of funding due to large cuts this year, and for two, public observations were becoming less frequent. Our end of season messaging stated that limited observations, limited SAR resources, and limited transportation options all warranted extra caution in the backcountry.

—Jeffrey Moskowitz, Tim Thomas, and Erik Stevens

VALDEZ AVALANCHE CENTER

The 2019–20 season was characterized by near average snowfall, cold temperatures, and a significant amount of northeast wind that followed nearly every storm. The Thompson Pass DOT recorded 521 inches of snow for the year with 54 inches of SWE. The average snowfall for Thompson Pass is 504 inches. Thompson Pass experienced 14 wind events with one in early March exceeding gusts of 100 mph. January saw a prolonged period of subzero temperatures with minimal precipitation and strong winds. This type of weather is typical for our region at some point midwinter, but what made this season unique was that there was very little inversion present, as is typically the case with this weather pattern. Strong winds prevented surface hoar development, although significant near surface faceting and faceting deeper in the snowpack occurred due to strong temperature gradients.

This season was unique in the number of avalanches that closed the Richardson Highway. Mid February and early March saw five large natural avalanches affecting the highway that originated from the south buttress of Three Pigs Mountain at mileposts 37-39 on the Richardson Highway. There are two avalanche paths in that zone that commonly affect the highway, but this year's avalanches occurred in different paths that have not been recorded running full track in many years. One of these slides occurred outside of the designated highway avalanche area, and while it did not deposit debris on the road, the powder blast snapped trees up to 12 inches in diameter and deposited them on the highway. These avalanches affected this section of highway from 2/12 through 3/3, and failed on PWLs created in January. These were in the D2-D3 range and buried 2,350 feet of highway collectively. Avalanches along other sections of the road affected the highway as well, but were less substantial.

The Valdez Avalanche Center posted 123 public forecasts over 23 weeks with 13,900 website visits from November through May. We continued operations during the coronavirus pandemic, although various fundraisers and awareness clinics needed to be canceled. VAC adjusted the shape and scope of our forecast zone, overall reducing our forecast area. This was done to create a more accurate forecast product with the resources that are available to VAC. Elevation bands were adjusted as well to better suit our coastal latitude and character of our mountain range.

—Gareth Brown

HAINES AVALANCHE CENTER: A DECADE OF LEARNING AND GROWTH

JEFF MOSKOWITZ AND ERIK STEVENS

Rural Alaskan communities with close proximity to snow-covered mountains are considered lucky if they have a local avalanche center. With a wide array of terrain, user groups, and conditions, Haines, Alaska, is one of those lucky places. Over the past ten years, the Haines Avalanche Center (HAC) has worked to foster community support and engagement in safe backcountry recreation.

We founded the HAC in the winter of 2010–2011, initially as a basic Website platform for local snow, weather, and avalanche observations. In those early years, the need to collect snowpack data and share it with the public was a novel concept in Haines and community buy-in was slow. Information on winter conditions was not publicly available, limited to word of mouth, and tightly held by local heli-ski operations. We started to dig snow pits, help better forecast meteorological events, and share quality observations through an online Website platform.

In the 2011–2012, the HAC joined under the umbrella of the Alaska Avalanche Information Center (AAIC) and became one of many satellite non-profit avalanche centers across the state. Every season since we deliver our mission:

To promote avalanche forecasts, education, research, professional development and the networking of practitioners in pursuit of healthy lifestyles, and the reduction of unintentional injury and death.

The AAIC helps the HAC with not only insurance and grant writing, but also peer support, state resources, and statewide knowledge.

Snowmachiners and backcountry skiers of all ages make up the majority of the local backcountry demographic, though snow-shoers, hikers, cross-country skiers, kite-skiers and snow-bikers also enter the terrain, which is as diverse as its users. Terrain here varies from simple, such as trees and low-angle bowls, to more challenging chutes, spines, and summits, to complex glaciated valleys with extensive terrain traps. At Chilkat Pass, tempting slopes and easy access exacerbates the need for observations, forecasts and education, with many close-calls and surprises not far from the road.

When it comes to avalanche forecasting, the region surrounding Haines is data sparse, which is why observations are so critical. Three HAC forecast zones are in separate snow climates: coastal, transitional, and continental. All are accessed by a 50-mile stretch of highway that leads from the coast through the Canadian border into a sliver of British Columbia. Avalanche problems across each zone have huge spatial variability and the associated difficulties, but altogether less so than in regions like the Rockies. Our well-defined and well-scoped forecast area is also relatively small, which is crucial (check out the size of our forecast zones compared to many others on Avalanche.org).

Unfortunately, Haines has been wrought with avalanche accidents the last ten years. There have been three commercial avalanche related accidents (2012, 2014, and 2016) and one cornice fall (2013) that have resulted in five deaths. Two recreational accidents in March 2019 and December 2019 culminated in three fatalities. We can promote the culture of reporting on avalanche activity and close calls by learning from these events. Accidents and near-misses highlight the importance of data collection, layer tracking, free and formal training opportunities, and issuing timely forecasts. (https://alaskasnow.org/haines-accidents/).

As part of our education efforts, HAC started providing free annual school and community AAIC avalanche awareness programs in 2012. In addition we've hosted an Avalanche Rescue and Level 1 Rec training every season since February 2018, and first offered a two-day motorized-specific awareness program in the winter of 2019. After two accidents in 2019, the importance of basic avalanche safety became clear to the Haines community, so last year, when we offered rescue and level 1 courses, the public showed up with record participation.

Between 2016 and 2018, HAC helped install and coordinate several local weather stations. During the fall of 2016 the Mount Ripinsky 2600' station was installed in the maritime Lutak zone. The next year, HAC coordinating the placement of a SNOTEL at 2510' on Flower Mountain in the Transitional Zone. And in 2018 our staff and volunteers worked together with the Yukon Avalanche Association on another station at 3123' in the continental Chilkat Pass Zone. HAC maintains these weather stations by periodically de-riming them and/or digging them out. They provide invaluable information for recreationalists and forecasters. (https://alaskasnow.org/haines-weather-center/)

HAC's weather history archive suggests the increased challenges that accompany a changing climate. Old timers around here look at the terrain and say that it used to get more snow. Two recreational accident reports from 2019 point toward low probability/high consequence anomalies, as extreme weather drives extreme avalanche conditions. Early season rain crusts played a role in each of the 2019 fatal avalanches (by comparison, accidents prior to 2019 were mostly caused by tricky surface hoar layers). At mid-elevations melt-freeze crusts are the new normal and prolonged drought and high pressure systems have produced lengthy periods of near-surface faceting.

The HAC addresses winter backcountry usage and snow safety with observations, forecasts, education, and data from weather stations. Each dimension helps inform the others and increase the accuracy of forecasts and issued warnings. This public information is available for people to utilize and make more informed decisions while recreating in avalanche terrain. We need increased training and community outreach to ensure that this information is used correctly.

The HAC seeks to not respond to avalanches, but work at preventative measures. The message, "If someone triggered an avalanche the day before in the same place you are going, would you want to know about it?" propels the center's staff and volunteers to put in the time and effort to promote safety in the backcountry. We're here to provide information, increase public safety, and reduce or prevent avalanche accidents in our community. The HAC faces challenges such as small-town politics and obtaining sustained funding, but in spite of the challenges we provide a quality product for an increasing number of backcountry users.

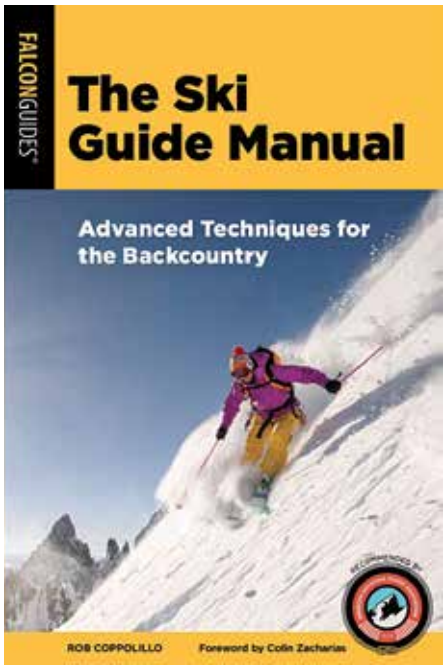
You can support the Haines Avalanche Center 501(c)(3) non-profit by making a tax-deductible donation. Visit https://alaskasnow.org/haines-hac/ and look for the Donate button.

AAIC: Often in Southeast Alaska, the most notable avalanche activity happens during a storm, like this evidence from a climax cycle that took out widespread deep instabilities on Mount Ripinsky in the Lutak Zone Spring 2018. Then in the same storm, re-filled crown lines with significant accumulation and finished with rain, hence the rain-runnel. *Photo Jeff Moskowitz*

Jeff Moskowitz lives in Haines, Alaska, works remotely as a cartographer, and contributes heavily to local snowpack and avalanche observations as a HAC forecaster. He has been a recreational avalanche instructor since 2009 and an AAIC public educator since 2013. He enjoys breaking trail in deep-snow and hold a Pro 2 certificate.

Erik Stevens grew up skiing in Flagstaff, AZ, studied in Boulder, CO, and moved to Alaska in 2010 to find deeper snow and bigger mountains. He fell in love with Haines, and never left. He is currently Director and Forecaster at the HAC, a freelance software engineer, photographer, gardener, hunter, fisherman, homebrewer, and mediocre saxophonist.

BOOK REVIEW



I sat down to spin through Rob Coppollillo's new *Ski Guide Manual* a couple of days after the A3 Membership meeting and subsequent online seminar from Dr. George Loewenstein of Carnegie Mellon University.

Dr. Loewenstein presented a jaundiced yet data-driven view of human nature: even with scenario training and perusal of avalanche accidents, backcountry travelers STILL think "I would never make THAT decision," and go on to do exactly what they WANT to do. Blase Reardon and I texted throughout the presentation (sort of like sitting next to one another at ISSW), finally coming to the conclusions that the reasons that guides and forecasters do make good decisions and bring 'em back alive is in part because we use systems, like checklists and run lists that keep us disciplined in the face of good powder and signs of no propagation.

With all of the above as deep background, I fundamentally agree with Rob's systems-based approach to ski guiding. His introduction emphasizes systems thinking and practice. Practicing systems thinking begins with Trip Planning, which is Rob's first chapter, and the lens through which the reader is introduced to the rest of the book.

In terms of tools for trip planning, as an old-schooler, I like the emphasis on using both hard copy and electronic maps. Rob covers pros and cons of each, introducing new school tools without expressing overt preferences for any.

Rob's tone is open and conversational, which requires the reader to take the time to actually read the book, rather than skimming for pearls. His open-ended questions are designed to facilitate thinking and discussing systems, then discussing them again in a mandatory debrief after the day or adventure concludes. This jibes cleanly with something that Ian McCammon told me one day at a long-ago USAW: "Cognitive work analysis leads to system optimization."

An ongoing theme of Deliberate Practice boxes gives the reader topics to put into effect, then analyze. One suggestion for the reader: excerpt these boxes and take them into the field; do one a day and debrief them, whether you choose rope skills, steep skiing, or a communication challenge, they'll be worth your while.

The sidebars from experts and friends add insight and clarity. My favorite is from well-spoken guide Sheldon Kerr on communication (page 154). Her points resonate with me, from *See contribution and opinion-forming as a duty rather than an option*, to *Make room for others' voices*, and the incisive *Don't go skiing with assholes*. Many of our TAR friends are included on the sidebar author list; thanks friends for lending your expertise and voice to this project.

Rob has worked hard to include up-to-date deep background in his tome. A close read will give you a reading list as long as your arm, and encompass many TAR favorites and historical progressions, especially in the Decision-Making chapter.

Avalanche folks: skip to the Snowpack chapter on page 258. Well-written and nuanced, this would be a great reference if you are about to teach your first avalanche classes, or your first for the season. Karl Birkeland as usual gives us clear insight into not just how, but when/ where/why to perform an ECT, and how to weigh its data. It's clear that Rob has labored to make this chapter as up-to-date as possible, especially in terms of turning theory into practice.

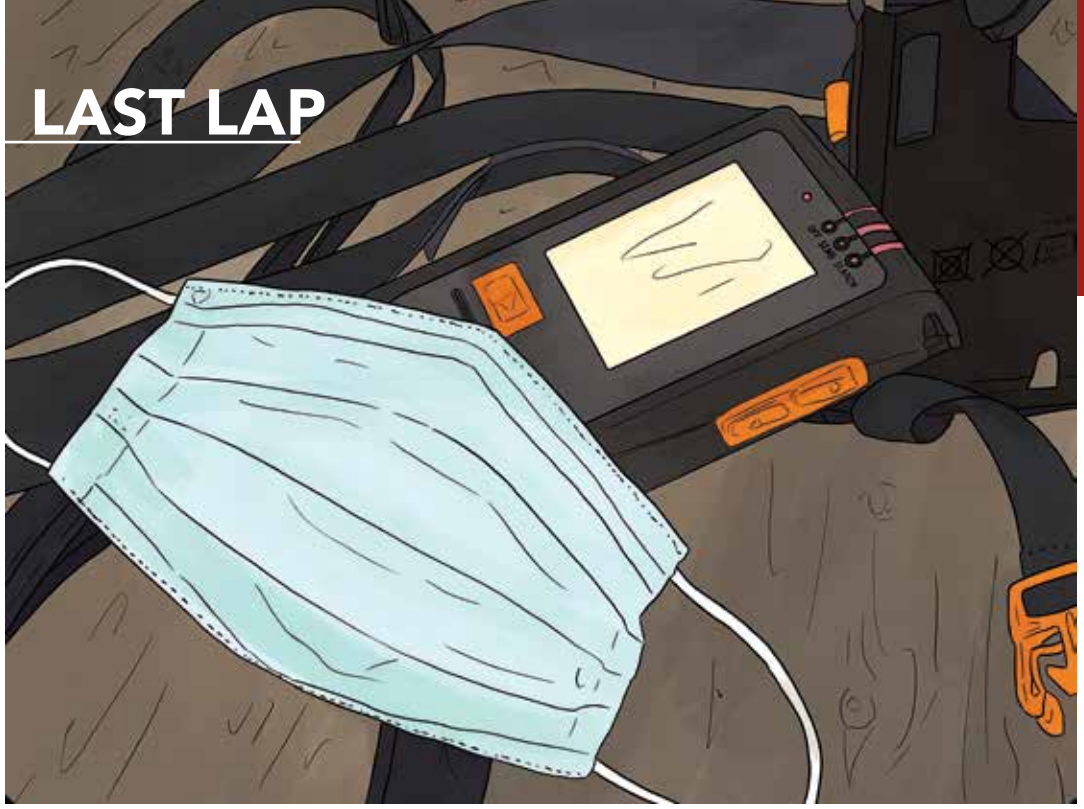
A few critiques:

- As a non-AIARE ski guide, I get AIARE fatigue. Rob addresses this early, but it still builds up for me. It would be more non-denominational to see "your fieldbook," rather than "the AIARE fieldbook."
- Is this the place to be teaching/ demonstrating ski guide first aid? I'd leave that topic for in-person training. Too many physical subtleties to teach in a book, in my opinion.

Go read the Conclusion, page 291, first. See where you want to drill into the material and budget some time to have a conversation with Rob about skiing and making it home in one piece, with a nice beverage at hand, gently dissecting the day.

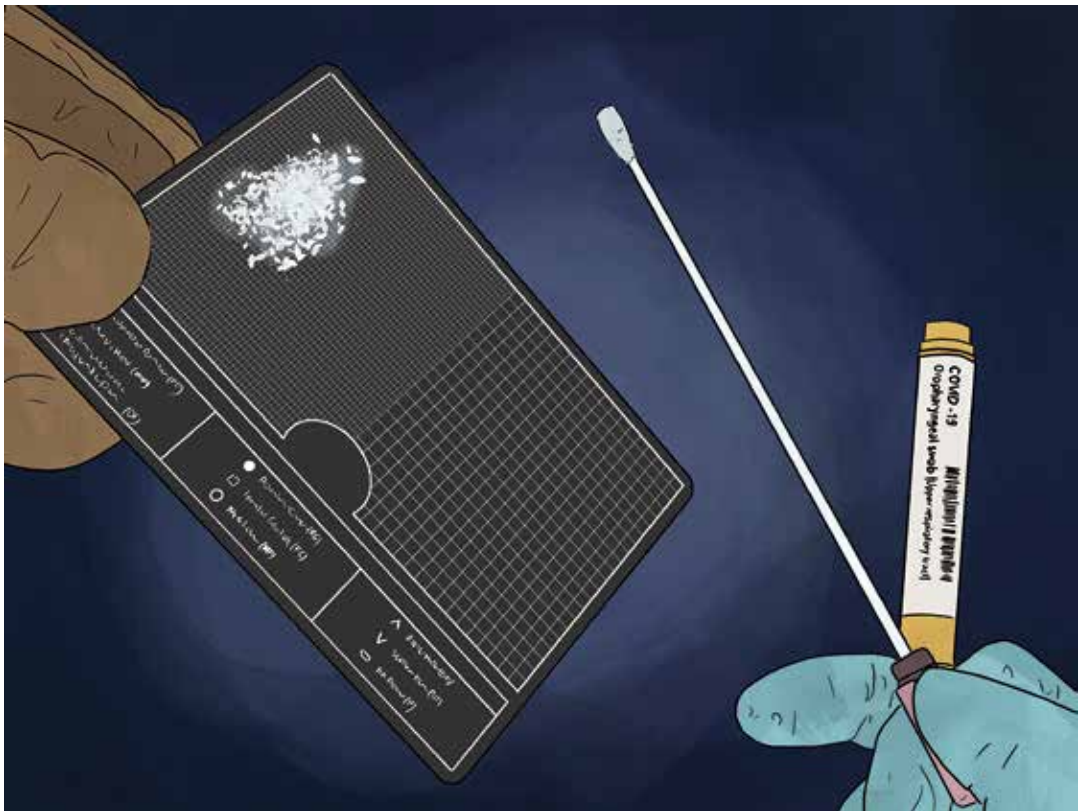
Finally, I like and recommend this book, even if you're as crusty as I am… Good reminders throughout, and great topics for thought, discussion, and practice. ⬢

—Lynne Wolfe



THE COVID-19 ADVENTURES OF SHRED AND JERRY!

ILLUSTRATIONS BY CY WHITLING
TEXT BY DREW HARDESTY



EPISODE 1

AT THE TRAILHEAD....

JERRY: PSYCHED TO PUNCH THAT LINE TODAY, SHRED!
SHRED: UH, WHERE'S YOUR BEACON, JERRY?
JERRY: I DON'T WANT TO WEAR IT. IT'S UNCOMFORTABLE. PLUS I'M NOT GONNA GET AVALANCHED.
SHRED: BUT JERRY...THE THING IS...YOU WEAR IT FOR BOTH OUR SAFETY.
JERRY: YEAH WELL MOST PEOPLE WHO GET SLID SURVIVE, SHRED, I READ THAT ON FACEBOOK.

EPISODE 2

AT THE MORNING GUIDES' MEETING...

JERRY: PSYCHED TO OPEN UP THE SIK LINE TODAY, PEOPLE!
SHRED: WELL...NOT SO FAST, JERRY. WE HAVE SOME CRITERIA THAT NEED TO BE MET BEFORE WE OPEN UP THAT TERRAIN--AVALANCHE ACTIVITY NEEDS TO SETTLE DOWN. WE NEED POSITIVE TRENDS WITH SNOW TESTS AND OBSERVATIONS. AND LET'S GIVE IT A FEW MORE WEEKS SO THAT NASTY LAYER IS GONE.
JERRY: WELL...OK.

JERRY TAKES HIS CLIENTS TO SKI THE SIK LINE THAT AFTERNOON ANYWAY.

SHRED: JERRY, WHAT HAPPENED? I THOUGHT WE AGREED ON CERTAIN CRITERIA FOR SAFETY?
JERRY: DUDE, IT WAS FINE. THE CLIENTS DEMANDED IT. WE COULDN'T WAIT ANY LONGER. AT LEAST I HAD MY BEACON TODAY.

EPISODE 3

AT THE FORECAST OFFICE....

JERRY: I THINK THE DANGER IS GREEN OR LOW TODAY. I THINK PEOPLE SHOULD BE ABLE TO SKI WHAT THEY WANT.
SHRED: I'M NOT SO SURE, JERRY; IT'S STILL DANGEROUS OUT THERE IN SOME AREAS.
JERRY: YEAH BUT ONLY FOR HIGH RISK INDIVIDUALS.
SHRED: HMMM...
JERRY: OK LET'S COMPROMISE AND CALL IT 'SMART GREEN' OR HOW ABOUT 'MODIFIED YELLOW'?

(YOU CAN'T MAKE THIS STUFF UP)

STAY TUNED FOR THE NEXT EXCITING C-19 ADVENTURES OF SHRED AND JERRY!

Cy Whitling started ski blading before he ever went skiing and that's all you really need to know. More of his work can be found @cywhitling on Instagram.

Drew Hardesty is a forecaster at the Utah Avalanche Center. He watched with great interest how government and public health officials approached (struggled?) with public safety and risk messaging this past spring.

TAKE THE FORECAST PLEDGE

from the Friends of the CAIC

BY BRIAN RODINE AND AARON CARLSON

Increases in participation in outdoor activities, including backcountry winter recreation, due to the pandemic are no longer debated. As the winter approaches, we are now being asked "what is your organization doing about it?"

Getting the forecast is the most important thing someone can do before they head into the backcountry. We set out to increase this behavior by launching ForecastPledge.org. This approach has a low barrier of entry, the opportunity to follow up with educational communications, inclusive targeting, and pledges and public recognition have been shown to drive changes in behavior.

We built the Forecast Pledge on top of our existing web content management system and email communication platform. We purposely kept the number of fields small, to collect information that would help our outreach efforts and keep the pledge process short and simple. As an incentive, we offered a free class for one person at random who signs before December 1. This was designed to help with promotions and conversions among the target audience. The type of incentive is crucial. We wanted to stay focused on our target audience, so we restricted the incentives to only education and purposely did not offer skis or outerwear. The result was a landing page which converted visits to pledges at a rate of over 25%.

Realizing that we needed to expand our ability to communicate with backcountry users in addition to our social, email, and web channels, we chose to use our CRM platform MailChimp to execute the form because of the ability to execute an automated "drip" campaign of educational material to pledge takers. After an immediate thank you message, pledge takers receive spaced out email messaging including short videos from the National Avalanche Center and links to find education opportunities. This series of emails can be edited and optimized as we see how users interact with the content. We then move the users into our normal audience to receive ad hoc messaging about safety and support, from which they can unsubscribe from at any time.

While many are worried about an influx of new users to the backcountry, the CAIC records indicate that most of the avalanche incidents in Colorado after March 12, 2020 (the date of a state mandated ski resort closure) did not involve avalanche beginners. Our goal is to communicate safety messaging with everyone—and we took care to design ForecastPledge.org to resonate with all experience levels. We didn't want to discourage sharing and participation by having people or partner brands reluctant to look like they were indicating they were a "newbie." We also took care to include many user groups in the imagery to encourage an inclusive backcountry community.

Getting the forecast is the most important thing someone can do before they head into the backcountry. We set out to increase this behavior.

Committing to an action has been shown in studies to make taking that action more likely.[1] This is why pledges are common amongst voting campaigns. Plus, there is evidence that people are even more likely to change their behavior when a component of public recognition is tied into a pledge. We designed the pledge messaging to be an opportunity for takers to display social proof of whatever activity they associate themselves with, by encouraging them to share that they took it along with a photo of themselves. Our hope was that by giving them "permission" to post a flattering picture of themselves, they would be more likely to share the pledge, and that was what we saw.

In all, we've driven over 2,000 Coloradoans to pledge to check the forecast before the snow even started falling, and we aim to increase that amount several times over by the end of the season. Open rates are in the 60% range for the followup emails, and the short videos have thousands of views. Brands and media outlets across the industry jumped on board to help share the pledge, and both Friends of CAIC and the CAIC continue to be tagged in stories and posts on social media. We're pleased with the results so far and options abound for how to expand and improve upon this program.

Aaron Carlson is Executive Director of Friends of CAIC and **Brian Rodine** is Marketing and Events Manager of Friends of CAIC.

[1] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1279550/pdf/jaba00019-0093.pdf

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