# the avalanche journal



124 // S 2020

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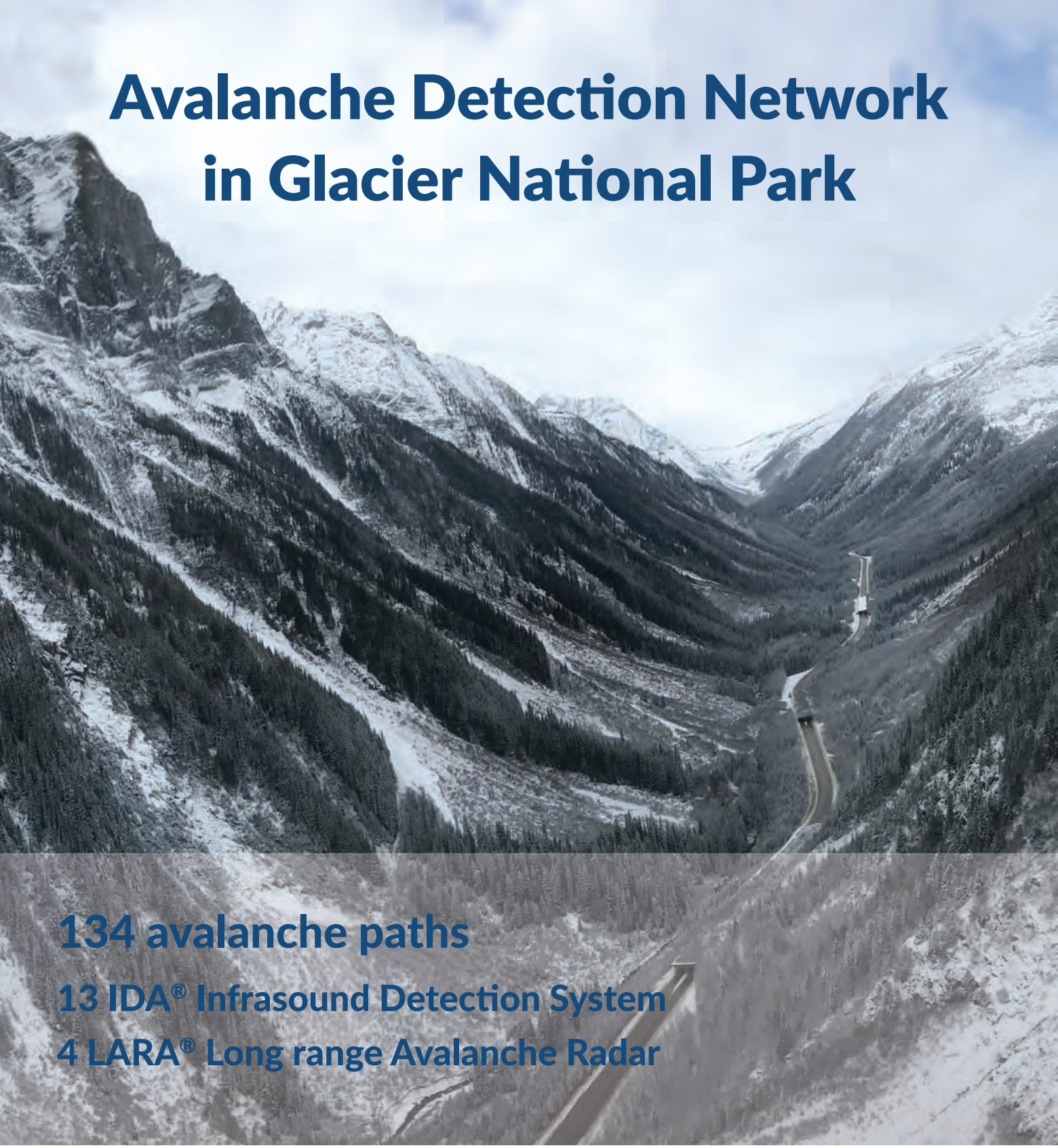

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Return undeliverable Canadian addresses, change of address and subscription orders to: Canadian Avalanche Association PO Box 2759, Revelstoke BC V0E 2S0 Email: info@avalancheassociation.ca
Publications Mail Agreement No. 40830518 Indexed in the Canadian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

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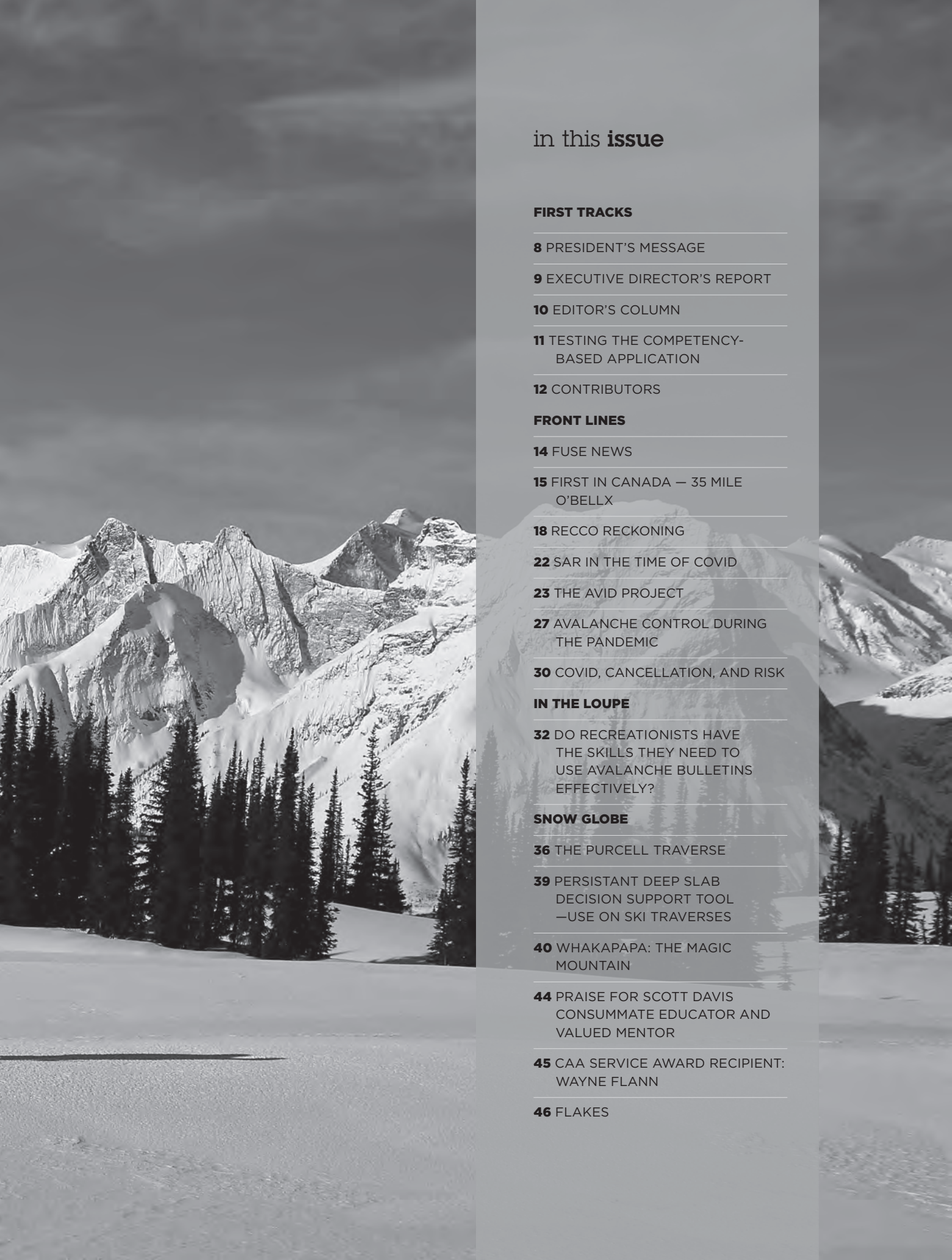

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**Walter Bruns**
CAA President

# President's Message

## BRINGING IN CHANGE

**CANADA SURE HAS** been through the wringer these last few months, as has our association and the entire membership. When the previous (spring) edition of *The Avalanche Journal* was sent out, we were mostly unaware of what was coming at us. We scrambled through March and April to adapt. Most notably, the Spring Conference and annual general meeting went entirely online in May. A huge thank you to all CAA staff who made that both possible and productive, and to all members who participated and voted.

The necessary amendments to the bylaws were passed, enabling us to proceed with a number of changes.

The requirements for new Active and Professional Members are now set by the board of directors. This is a serious new responsibility, which allows the board to respond to needs that may arise as applicants use the process. The current (and any future) board must apply this process judiciously, since changing membership requirements is a substantial undertaking.

We moved towards gender neutral language in the bylaws. Any straightforward steps we can take to be inclusive will be taken. We also returned the right to vote to Non-practising Professional Members to correct an earlier error in bylaw editing in 2016.

Lastly, we altered the bylaws to allow for entirely electronic meetings. This seemed like a logical and progressive step coming into this spring; it subsequently proved essential to allow us to conduct member meetings amidst so much uncertainty.

Of all these changes, the bylaw regarding membership requirements warrants a few more words. On June 16, following the AGM, your board passed a motion enabling the new competency-based membership requirements for individuals applying for Active and Professional Membership. These requirements are in line with the communications provided to members over the last year. As this went to press, staff were beavering away at revising the webpages so that the new process could take effect on July 8.

This makes good on the commitment by successive boards to build the elements of self-regulation as outlined in Goal 1 of our strategic plan:
*1.7.1 Define Entry to Practice Requirements for Active and Professional Members based on the Competency Profiles. These are identified to ensure only qualified individuals gain entry into the profession.*

I offer sincere thanks on behalf of the board and membership to everyone who contributed to this key milestone—the many members contributing via committees, the staff, and external resources.

As to what comes next for the social and economic order of our 'new' world, speculation abounds. Were it not for the dire and fatal outcomes, it would be fascinating to watch as human beings around the world are subjected to (among many other things) a crash course in the principles of science, likelihood and uncertainty, and the optimization of risk and reward. Some get it, too many don't.

But the avalanche community is well versed in these matters—it is our métier. I have great confidence that we will manage whatever lies ahead effectively, both individually and as an association.

With best wishes,

**Walter Bruns, CAA President**

**Joe Obad**
CAA Executive Director

# Executive Director's Report

## FROM COPING TO ADAPTING

**WHERE TO BEGIN?** The last time I wrote to the membership, I highlighted a few areas where shifting to online services was a small considered step in the right direction for our programs.

Since then, between the pandemic and demands for social change such as the Black Lives Matter movement, the world has experienced perhaps the greatest upheaval outside of wartime in many generations.

For so many of you this has meant a curtailed season and uncertainty about the coming winter. I join Walter in wishing you all health and the best prospects ahead in these uncertain times.

The times ahead call for all of us to have confidence in our abilities to adjust our services to the uncertain circumstances ahead. Confidence and uncertainty, it would seem, are the parents of adaptive management. As the CAA looks forward to the fall, we need to draw on adaptive measures to meet the needs of members and stakeholders.

We can take some confidence in our adaptations so far. The ITP team held its spring instructor meetings online. Instructors and ITP staff alike converted in-person sessions into course-specific meetings designed to improve student experiences this fall.

All of us—members, board, and staff—took a leap of faith when we held the AGM and Spring Conference online in May. Presenters committed to the online format, and members navigated the quirks of registration and GoToWebinar. The result? We nearly tripled our attendance for the case study presentations and members freely interreacted with presenters online. The challenge of physical distancing somehow churned out a victory and a new experience for members who typically do not make it to Penticton.

Likewise, the online format allowed many members full participation in the AGM for the first time, taking part in nuanced discussion and voting as though we were all under the same roof.

Looking ahead, all of our programs are facing changes because of and in spite of the pandemic. The InfoEx team is set to make good on the Mobile Avalanche Information Exchange (MAInEx) project, our SAR-NIF funded initiative to make InfoEx truly mobile, and much more. The team is more than used to virtual meetings, so they seem set to flourish.

ITP faces perhaps the greatest challenge. It is one thing to hold virtual spring meetings, it is another to deliver courses in the context of physical distancing. ITP Manager Andrea Lustenberger and Curriculum Specialist Emily Grady investigated several strategies for course delivery and have arrived at a plan for modified traditional delivery. Most of our courses demand a rotation between class and field. The options for converting the class component to online are not very supportive of student learning in this dynamic, but we have uncovered several options to pursue this strategy with physical distancing. Andrea's mantra is being ready to adapt as curve balls come our way. With a bit of luck, ITP will be able to deliver its courses and offer students a rich learning environment.

In membership, as Walter said, we are moving in earnest to competency-based applications. We know this change will ask more of applicants, referees, and the membership committee, but we believe we've offered resources on the website to help all parties with the new process.

We know how much these changes challenge us. We also know how challenged many segments of the industry will be with physical distancing, drops in demand, and a wide new range of protocols. We wish all members the best in adapting to our ever-changing circumstances. We encourage you to reach out if you feel we may be of assistance. Until then, please enjoy a safe and happy summer.

### ROBERT CLAUDE "PETE" PETERS, 1928 – 2020

As we head to press with this issue, we learned of the passing of Avalauncher pioneer Pete Peters. We offer this as a brief notice here. Dave Sly will contribute an article on Peters for the next edition of *The Avalanche Journal*.

**Joe Obad, CAA Executive Director**

**Alex Cooper**
Managing Editor

**WHEN I LOOK AT** the spring 2020 issue of The Avalanche Journal, it feels like a snapshot of life before COVID-19. A search turns up no mentions of coronavirus, COVID, or pandemic. It was sent to the printers on Monday, March 9, at a time when we were just starting to realize this virus was having serious impacts, but life was still fairly normal. Ski resorts were still open, backcountry lodges were full, heli- and cat-ski ops were welcoming guests, and avalanche forecasts were being published.

## BEFORE & AFTER COVID-19

Within a week, my colleagues here at the CAA had made the decision to cancel all remaining ITP courses. The ski industry shut down and BC declared a public health emergency. At Avalanche Canada, where I also work, we took the lead on ending public avalanche forecasts as our way of discouraging people from heading into the backcountry.

None of that was reflected in the spring volume of *The Avalanche Journal*. You may have found that strange, or maybe it was nice to sit back and read something to get your mind off the pandemic while you isolated at home. If we had gone to press a week later, the first dozen or so pages would have looked very different.

It would be impossible to present another COVID-free issue this time around. As nice as it might to have a brief escape, the virus has impacted the avalanche industry. For many of you, it meant an early end to the season as ski resorts and guiding shut down in mid-March. Others had to keep going, working amidst great uncertainty and heightened tension to transportation corridors open and industry running.

This issue does contain articles about our new reality, but it also looks at the industry beyond coronavirus. There's articles about Canada's first O'Bellx installation and new forecasting software at Avalanche Canada. The Haute Route section is back with an article about the Purcells Traverse last spring. Henry Finn from Simon Fraser University's Avalanche Research Program contributed an article based on his Master's research into avalanche bulletin users.

Brent Calkin has written about using a helicopter-mounted RECCO device to recover the body of a missing snowshoer just north of Vancouver in mid-March. That story got lost in the news because the operation started a day after B.C. declared a public health emergency. The coronavirus added a twist to what was already a very challenging search.

Perhaps most importantly for avalanche control professionals, Ruper Wedgwood has written a great about conducting avalanche control in Jasper National Park at the height of the pandemic. They had to adapt on the fly, and his article looks at the practices his team adopted to finish the season.

COVID-19 will be present in our lives going into next winter. Moving forward the only certainty is that things remain uncertain. We've never had to deal with such a world-changing event. We don't know if we've truly flattened the curve, or if another wave is coming. I hope to explore themes relating to this in upcoming issues. As usual, if you'd like to contribute an article, please email me at acooper@avalancheassociation.ca.

**Alex Cooper**

## Welcome to the Board

**PENNY GODDARD IS THE NEWEST MEMBER** of the CAA's board of directors. Originally from New Zealand, her career in the avalanche industry began as a volunteer ski patroller in high school. This turned into an obsession with the mountains. By her mid-20s, she was running a ski area avalanche program, producing public avalanche bulletins, teaching avalanche courses, and writing an avalanche awareness book. She moved to Revelstoke in 2008 to work as a forecaster for Avalanche Canada. She now works as an IFMGA mountain guide, industrial mountain safety technician, RACS installation project manager, and avalanche safety consultant.

She joined the board so she can contribute to the CAA and help work on new goals that serve the membership. Welcome!

# Competency-Based **Membership Process**

Nathan Friesen


**LAST WINTER,** I took the step of becoming a Professional Member of the Canadian Avalanche Association. To do so, I applied using the new competency-based membership process as a volunteer tester this spring.

I live in Chilliwack, B.C, and recently started working as a district avalanche assistant for the Ministry of Transportation in the North Cascades Avalanche Program out of Hope, B.C. Before that, I patrolled at Sasquatch Mountain Resort. I am also a member of Chilliwack Search and Rescue. I have worked in the industry for five years, have been a member of the CAA since 2017, and I completed my CAA Level 2 this past winter.

When I decided to apply for professional membership, I saw the new competency-based application as an opportunity for self assessment and growth. This process provided me that. Building my portfolio helped identify areas to gain more experience and how I could further train.

The application process was very detailed. I found I had to spend several sessions focusing so that my experiences, resume, and evidence files formed a comprehensive summary of the competency requirements. I liked the systematic approach of going through my work history and experience to determine how it met each competency. I found this provided an opportunity to self-reflect and helped me identify directions that can be invaluable when advancing in my avalanche career.

It took some time at the beginning to review all of the competencies in detail, learn the process, find a piece of evidence or logbook entry, and match that with personal or work experience. It required me to be honest with myself and my training; I didn't want to oversell myself and my experience.

Working on the application process was a great way to reflect on my avalanche career. Pulling up documents and putting my past work experiences down on paper helped me further process what I learned at work, in my training, and through practice. This highlighted to me the importance of having a diverse work background and training—even in non-avalanche related work—and how it can translate to CAA competencies. It helped solidify that working with others in team settings and being able to think calmly and rationally and thrive in harsh or stressful environments are important assets in avalanche-related work, and that these skills can be gained from other areas of life as well. The application process also proved an opportunity to do a critical review of past documentation, which served as a good reminder to have proper documentation saved and readily available if it is ever requested.

I see the benefit in doing an introspective personal career review and reflection, and measuring that against CAA competencies. I believe using the competencies as a detailed checklist as a professional makes one more self-aware of one's strengths, as well as areas to be improved upon with courses, continuing professional development, or mentorship. I think having the competency list also helps us as avalanche professionals to focus not only on doing 'hard skills', also teaching, mentoring, and leading in the industry.

My feedback to the CAA was very positive about the whole process. The application process will only get smoother and more efficient with time as more people complete the process and get used to this new style of application. I found the experience personally valuable in helping me self-reflect and identify my strengths and areas of improvement, which will help me become a better avalanche professional.

# Contributors

**SCOTT GARVIN**
Scott has worked for the BC Ministry of Transportation's Avalanche Program since 2003 in both Bear Pass and the northwest, where he currently resides in Terrace. He served on the CAA Board of Directors and as chair of the Information Technology Committee for the past six years and continues to engage as a member of the CAA's Technical Committee.
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**MARK KLASSEN**
Over the past 35 years Mark Klassen has worked as a ski patroller, avalanche forecaster, and mountain guide throughout western and northern Canada, and in 10 other countries. He currently is owner/operator of a guiding company based in Banff.
**30** COVID, CANCELLATION, AND RISK

**HENRY FINN**
Henry recently graduated from his master's degree as a student in Simon Fraser University's Avalanche Research Program. His thesis project involved an exploration of how avalanche bulletin information is being used and comprehended by winter backcountry recreationists in North America. With a background in education and science communication, he is interested in the ways that different methods of information delivery can influence perceptions, attitudes, and behavior.
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**ZOE RYAN**
Zoe started her avalanche career as a ski patroller at Sunshine Village. She has spent the past four years immersed in winter, travelling between the Canadian Rockies and the North Island of New Zealand working for ski areas, backcountry skiing, and studying snow. She is currently working at Sunshine Village as an avalanche technician.
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**STEVE BRUSHEY**
Steve grew his ski touring roots in the Chic-Chocs in the 1970s and morphed to western Canada in 1981. He transplanted to Terrace in 1989 and since has grown into the district avalanche supervisor with Ministry of Transportation, with a side branch as the chair of the Explosive Advisory Committee of the CAA.
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**RUPERT WEDGWOOD**
Rupert Wedgwood is a mountain guide and visitor safety program manager in Jasper National Park. He is a long time member of the Canadian Avalanche Association and currently sits on the Explosive Advisory Committee.
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# front lines

## 27

**AVALANCHE CONTROL DURING THE PANDEMIC**

in this **section**



// DANYELLE MAGNAN

# **Fuse** News

Steve Brushey, Explosives Advisory Committee chair

**TYPICALLY, FUSE NEWS** was meant to keep the membership abreast of any changes proposed or made from our various regulators. Fuse News is growing and so are changes to our business due to social media and an appetite for quick communication. Factual information is increasingly more important. In this edition, we've researched to the best of our ability some of the important changes.

To begin, the Explosive Advisory Committee (EAC) presented a brief summary of its activities in the handout that was sent to members prior to the CAA's online AGM.

Pull wire ignitors and RACS were common themes that continued to pop up this past winter, with operations reporting on challenges they faced. By working directly with suppliers, these operational challenges were resolved. Once again, our community is doing very good work handling explosives, with no serious incidents reported. We like to think this is the result of the ongoing review of your WorkSafeBC (or provincial equivalent) avalanche control blasting procedures and the appropriate supervision provided to less experienced personnel. Although evidence is anecdotal, we suggest there is likely a strong correlation.

For this article, EAC member Chris Argue researched and provided background into an older regulation that up until this fall was overlooked by WSBC regulators. He followed up with a quick summation of WSBC blasting certificate extensions brought on by COVID-19.

### TRANSPORTATION OF DANGEROUS GOODS BY AIR

In November 2019, it was brought to the attention of the EAC that Transportation of Dangerous Goods (TDG) by Air certification held by aircraft operators did not extend to operations chartering an aircraft for avalanche control blasting. Non-aircraft staff handling dangerous goods also required the TDG by Air certification, per Section 12.12 (3) (b) of the TDG regulations, which states: "If the dangerous goods are handled or transported by a person *other than an employee of the air carrier,* that person is trained in accordance with Part 6, Training, of these Regulations and Chapter 4, Training, of Part 1, General, of the ICAO Technical Instructions."

The applicability of this requirement to helicopter avalanche control has been confirmed by Transport Canada. WorkSafeBC, while not the jurisdiction having authority to enforce TDG regulations, also confirmed blasting procedures for helicopter avalanche control should reference this training and certification requirement.

Aircraft operators must also hold a valid TDG by Air certification and members should ensure it is in good standing prior to chartering an aircraft for avalanche control.

Shippers of dangerous goods by air are required to meet Transport Canada and the International Air Transport Association (IATA) Dangerous Goods Regulations [TDG Regulation 6.2 (l)]. Members who are seeking TDG by Air certification should ensure a course meets standards set by both regulators. Half-day courses that do so are available online from a variety of vendors.

Members who are familiar with the transportation of dangerous goods by ground may notice some differences in the requirements, such as:

- TDG by Air may have labelling and documentation differences from ground transportation; and
- TDG by Air certification expires after a period of two years.

Members who conduct helicopter avalanche control are encouraged to review the relevant TDG regulations, namely:

- Part 6 – Training (tinyurl.com/part6-training); and
- Part 12.12 – Aerial Work (tinyurl.com/part1212-aerial).

### BLASTING CERTIFICATION EXTENSION – COVID-19

WSBC is offering a 90-day extension on blasting certifications. These will be granted to those whose certificate expired between March 1 and June 30. If a member's certification expires outside of this period, extensions will be considered on a case-by-case basis. All blasting exams were on hold until June 1 at the earliest.

The extension policy may change and updates can be found on WorksafeBC's COVID-19 information and resources webpage.

### SUMMER THOUGHTS

As we go to print, the EAC has been advised by WSBC that any blasting control procedure renewals will have to be updated with respect to COVID-19 and social distancing. With so much uncertainty surrounding COVID-19, the EAC suggests your new procedures simply follow and incorporate Health Canada guidelines for mitigating COVID-19 risk. There are no templates to follow but if you have any questions, feel free to contact me for suggestions.

We can also report the CAA will be adjusting the delivery of Avalanche Control Blasting course in response to COVID-19.

As chair of the EAC I am fortunate to work with a very strong and engaged group of avalanche professionals that represent your sector. We are still looking for someone to directly represent the heli-ski sector. Finally, keep up the safe explosive control you do and thanks for sharing your experiences. with the EAC.

Have an enjoyable summer.

# First in Canada — 35 Mile O'bellx

Steve Brushey and Scott Garvin

**FIFTY-SIX KILOMETRES WEST OF TERRACE** along Highway 16, a 400-metre-high granite monolith rises from the banks of the Skeena River amongst a vast expanse of large coastal mountains. The area is home to goats, bats, and various species of birds and frogs. It has shared interests with three First Nations groups and is also one of several locations along the corridor where the highway is located within the CN Rail right of way.

Despite the abundance of precipitation and potential for significant snowfalls in winter, the terrain at 35 Mile doesn't have the capacity to produce large avalanches (greater than size 2.5) capable of taking out hectares of timber or burying the highway metres deep in dense snow. Instead, 35 Mile is a good example where highway location, type of overhead terrain, avalanche frequency, avalanche terminus, and terrain trap all merge to create a very tight operational risk band that can quickly transition from low to high risk as defined by the Ministry of Transportation and Infrastructure (MoTI) Snow Avalanche Threshold Guidelines.

In 2014, a trial section of avalanche fencing was installed at one of the three avalanche paths at 35 Mile to determine its viability for avalanche mitigation at this location and to ensure the fencing would not create additional hazards, mainly icefall, that could affect the highway. Over the following winters, the MoTI's Northwest Avalanche Program determined the fencing project was not suitable for the location given the abundance of steep terrain below where the fences could be installed, and the steepness of the terrain in the remaining areas to be mitigated. The search for funds for the completion of the remaining 85% of the fencing project ceased, and research and discussions for more viable options, such as remote avalanche control (RAC) devices, quickly ensued.

## PROJECT AND TIMELINE

With the advances in RAC technology and the determination that avalanche fencing was not a suitable mitigation strategy for the terrain at 35 Mile, MoTI hired the engineering firm Stantec to lead the project in the spring of 2018. Their job was to determine a RAC device that would be best suited for the complexity of 35 Mile and the operational challenges of a regional highway forecasting program.

Stantec worked closely with the Northwest Avalanche Program to develop a table of requirements for a RAC system, which was advertised by the provincial government through a request for proposal. The RFP highlighted a need and desire to move away from explosives avalanche control. We did not want a RAC that used explosives as we were too close to the highway, and as a regional program with such a large coverage area, we wouldn't have the manpower to pre-assemble all the individual charges. We also did not want to have to deal with any sort of explosives-related delays from a misfire. In the end, the TAS's O'Bellx was chosen as the optimal system.

By August of 2018, all the pieces of the project began to come together. MoTI purchased five O'Bellx units from TAS (through Avatek Mountain Systems Inc), appointed a local MoTI project manager, and retained 6 Point Engineering to assist with specific engineering aspects of the installation. In September of 2018, Axis Mountain Technical Ltd. was awarded the contract to install the O'Bellx units.

The units and towers arrived in Terrace in February of 2019 after a long journey from France and were stored for the remainder of the winter, awaiting their planned installation date in May. The initial set up for the installation process began in late April and site work began in early May. The work progressed relatively quickly, with the tower installation phase of the project wrapped up by mid-June. The final phase, flying the O'Bellx units into place and commissioning each device, was deferred until the fall as commissioning in June would have meant the units would have to be taken down for the rest of the summer and re-deployed in the fall prior to winter start-up. The goal was to deploy the O'Bellx units, test them, and have them remain in place and ready to go for the winter.

After several unavoidable delays in September, commissioning finally took place in early October. Fortunately, the weather cooperated and the O'Bellx deployment went as well as planned. All the units were commissioned and ready for the coming avalanche season by mid October.

## FIRST SEASON'S DATA

With our changing climate, winters are seemingly becoming harder to predict and this is even more evident for avalanche areas that exist at lower elevations. As mentioned earlier, 35 Mile rises from near sea level to approximately 400m elevation. The area is subject to heavy precipitation and snowfall rates can exceed four centimetres per hour quite regularly. The weather can often transition from snow to rain during typical southwesterly storm events.

With a new RAC system at our fingertips, we entered the season wondering what winter would bring us. Would we have a mild winter with mostly rain at low elevations, or would snowfall begin in November and seemingly never end until March? The following is a synopsis of the first winter with the O'Bellx units in place:

THREE OF THE FIVE O'BELLX UNITS PROVIDING A RELIABLE RAC SYSTEM FOR THE 35 MILE AREA. // STEVE OR SCOTT?

- Snowfall for the 35 Mile area as a percentage of average:
  - December – 100%
  - January – 205%
  - February – 172%
- Avalanche control:
  - Six control missions (four nighttime, two daytime)
  - 22 O'Bellx shots fired
  - 14 avalanches affecting the highway produced
- Highway closures
  - Six closures for control (the long-term average is three per season)
  - A 73% reduction in closure times, with short control missions and no prolonged closures due to high avalanche risk.

## HIGHLIGHTS AND IMPROVEMENTS

A direct enhancement from the O'Bellx units was evident from the initial control mission. Previously, avalanche program and maintenance personnel would spend long periods of up to 36 hours monitoring, assessing, and implementing specific safety measures on site until helicopter control work could be completed at daylight, when weather conditions permitted. Or, the highway was closed due to high risk when conditions exceeded the operational risk band.

With the O'Bellx units in place, the crews could set up quickly and return the highway to a safe standard much more efficiently, day or night. Completed control missions by 2 a.m. also meant additional sleep.

Anyone who has deployed explosives charges from a helicopter in confined low elevation terrain and in less than desirable weather conditions will understand our enthusiasm for the O'Bellx system. Eliminating this aspect of the previous avalanche control method at 35 Mile through was overwhelmingly welcomed.

## CHALLENGES

The addition of the O'Bellx RAC system has not come without a few challenges. The biggest has been learning how to adapt to the new system's capabilities and how to change the approach to mitigation when you have been doing it differently for roughly 20 years.

The "grabber" device supplied by TAS for deploying and retrieving the O'Bellx units from the towers by helicopter had some intermittent mechanical issues that were originally identified by other TAS clients in the United States. The units can be deployed by standard long line process and this was the method we used while TAS sorted out the grabber issue. It was resolved by the end of the winter and the necessary upgrade were made to our device. It was used for retrieving the O'Bellx units off their towers in the spring for summer maintenance and storage with no significant issues.

There were several times during the multi-sync firing sequence (multiple O'Bbellx units firing simultaneously) that one of the units dropped communication and did not fire. TAS updated the UHF radio antennas with the hardware for our vehicles, along with a software update, which appears to have remedied the communication problem.

There were two occasions where there was some discrepancy in the software data outputs for the O'Bellx units during the firing sequence as compared with the acoustic confirmations. Again, this appears to have been remedied by the recent software update from TAS, but we will have to confirm next season.

## LEARNING OUTCOMES

2019-20 was the first winter of use for the O'Bellx. Given this was the first installation of its kind in Canada and a first for using a RAC system for our program, which was 100% dependant on the limitations of helicopter bombing, we were excited to push the button on our new units and mitigate avalanche risk in any kind of weather and at any time of day. We quickly realize the operational risk band (ORB) is indeed dynamic. Typically, we would ride the curve upwards as the risk trended higher, until we reached a point near the top when numerous natural avalanches would begin to affect the highway and it would be closed. We would continue forecasting until daylight, before flying to do avalanche control. In other words, we applied explosives (heli-bombed) well after the risk peaked, on the downward side of the curve of our ORB.

We quickly figured out the efficient use of any RAC is to flatten the curve* well before reaching the top of the ORB. Firing of a RAC is very much a forecasting tool, but it also creates a bias that you have full control of at that moment. We recall telling our managers that preventative closures would now be unlikely at 35 Mile with 24/7 avalanche control capability.

What we didn't realize is there are other factors at play that restrict the ability to actually fire the O'Bellx units when you want to. Our Northwest Avalanche Program has site-specific safety measures we put into action that increase safety to highway users while maintaining an open highway. These measures will remain in our toolbox, allowing us additional time to forecast to specific conditions when firing is delayed.

## OVERALL IMPRESSION

The O'Bellx is very well suited to this site. Mobilisation and demobilisation has been accomplished in a few hours, which included transport back to Terrace, and is the clear win. As the units function on gas, there are no explosive charges to prime and load. No special licensing is required and there are no explosive misfires to deal with. Finally, avalanche control from the safety and comfort of a warm dry truck can not be overstated.

* *"Flatten the curve": We had no idea just how powerful the term would be in the months to come.*

# RECCO **Reckoning**

Brent Calkin, Lions Bay Search and Rescue team leader

*On March 20, Lion's Bay Search & Rescue used a helicopter-mounted RECCO detector to find an avalanche victim who was last heard from six days earlier. This was the first time this tool was successfully used in a SAR operation in Canada.*

**SUPERSTITIOUS BAD LUCK,** storm force winds, a mysteriously missing man, a pandemic, an avalanche, and some powerful new avalanche search technology—this definitely wasn't your typical search and rescue operation.

On Friday, March 13, gale force winds tore through Howe Sound, north of Vancouver. Environment Canada issued wind warnings, powerlines and trees fell, highways were blocked, and thousands lost power across B.C.

In the mountains, a subtle horror worthy of Friday the 13th emerged. Extreme winds pressed and compressed spindrift into a hard, hard slab. Baited, a trap laid in wait. The following day, it sprung.

## DAY ONE, MARCH 18

The taste of 140 proof alcohol lingered as I belted into the front seat of the helicopter. The COVID-19 pandemic was getting more serious and someone had swabbed the radio headset mouthpiece with isopropanol. The strong vapor and acrid taste cut through any thought this was going to be a normal day.

It started with a confounding message from the RCMP that a snowshoer had gone missing in the Lion's Bay area four days ago. His last communication was on Facebook: "Going to Hat Mountain, Lions Bay for a hike."

Hat Mountain is a domed granite peak crouching over Howe Sound. To the east looms Mount Brunswick, a higher and more impressive jagged knife edge of a peak. Their summits are joined by a number of trail spurs and a col with a picturesque but steeply side-hilled section of the Howe Sound Crest Trail.

We approached Hat from the west, noting a sketchy looking snowshoe track. It climbed up the summer route, made treacherous by the 3.5 metres of snow that rounded over the top edge, and dropped into a collection of steep chutes and gullies that bottomed out in significant cliff bands 100 metres below the peak.

it looked like the hiker gained the peak without incident. Hat seemed clear, so we flew on towards Mt. Brunswick via Hat pass, skimming above the mountain firs clustered in the col.

The trees opened up to reveal a jumble of broken snow piled up at the bottom of the pass. The helicopter came to rest in a hover as we looked down with dismay. We could see snowshoe tracks vanishing into the path of a size two avalanche. I radioed it in, asking Lions Bay Command for a Level 2 avalanche forecaster to assess the hazard, CARDA dogs and handlers, and a helicopter-mounted RECCO detector in case we couldn't mount a ground search.

Only 15 minutes had passed since take-off, but I felt like we'd already found our target.

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I hadn't started a day like this for a few months. Winter is generally a quiet time for our team. Lions Bay Search & Rescue (LBSAR) covers an area of tough, technical terrain just north of Vancouver centred on the 30-kilometre Howe Sound Crest Trail. In summer it's busy with hikers and mountaineers, while winters are quieter. We've found those who go there in winter tend to be pretty experienced skiers and mountaineers, and also tend to successfully self-extricate when they get into trouble.

As spring approaches, a wider mix of users head out, mistaking the warmer valley weather for an easing of winter conditions in the alpine. They are often hikers on snowshoes following summer trails and navigating with cellphone GPS apps. Depending on the snow depth, there may even be trail markers to guide them. What's missing are any indications they are walking straight into a slide path. They often don't wear transceivers, don't carry probes and shovels, and don't even know they are in avalanche terrain. If there is an incident, companion rescue is unlikely, and the reality is a SAR response to a full burial is likely to be a recovery operation.

Our first challenge was finding a CAA Level 2 avalanche forecaster to act as avalanche safety officer, per Emergency Management BC requirements. Both of LBSAR's Level 2's were quarantined with the flu, but a number of the Level 2's in the region had just lost their usual jobs due to COVID-19 and were available. North Shore Rescue (NSR) provided their active avalanche duty officer, Tristan Rasmussen, and a second member to run the helicopter RECCO detector.

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Our initial flight did not turn up any signs of the missing hiker in the avalanche debris. There were lots of tracks on Mt. Brunswick and we saw a skier-triggered size one slide in a nearby couloir. One of the search crew recalled a Facebook post about this. It was from the day the hiker went missing.

We contacted the poster, who revealed they came upon the size two slide soon after their descent, but they hadn't seen it while ascending that morning. They had taken pictures of our missing hiker on top of Mt. Brunswick, just a few hours

before they came across the avalanche. We now had a last seen point for our hiker, and a travel path that led straight through the avalanche path.

The NSR members flew in from their base with the heli RECCO. Tristan did a slope safety assessment from the air and decided that despite some hang fire and increased risk of warming, it would be safe to put a limited number of searchers on the slope. We discussed whether the area should be assessed first with the heli RECCO, but we didn't have enough information about its capabilities as a micro-search tool for a subject without RECCO reflectors. We decided the standard AVSAR procedure would be followed, with a ground assessment of the site, marking ingress and egress routes, establishing a gear cache, and searching with transceivers, handheld RECCO detectors, CARDA dogs, and by spot probing.

The first day's ground operation was brief as the west face of Mt. Brunswick shed snow as it got cooked by the sun. We worked the slope with transceivers, handheld RECCO devices, dogs, and probes for 1.5 hours without success. Plans were made to get a larger team on the slope early the next morning when it was safe to perform a probe line search, and bring the CARDA dogs back.

**DAY TWO, MARCH 19**

The day dawned clear and cold. Twelve searchers and two dog teams were flown in to continue the search. We brought 12 one-piece steel rods, our personal probes, and a number of G3 probes that screwed together. We started a probe line in the most likely spot of the deposition zone.

Some things quickly became evident. The deposit was much deeper than our 3.2-metre probes. It had undergone several melt-freeze cycles and was incredibly dense. The steel probes would freeze into the debris almost instantly and required two or three searchers to yank them out. Within moments, three were bent. As we looked at the debacle of the probe line with dismay and imagined having to do the entire slope in this slow and painful fashion, one of the dogs gave a strong scent indication further down in the deposition zone. The probe line shifted to that location, and the solid probes were abandoned for the G3 ones.

There were no strikes in the new location. We realized the debris was still deeper than the probes. We decided to dig down two metres so we could probe to ground. It was so incredibly difficult, someone half-jokingly suggested we use a chainsaw. It just so happened LBSAR had recently purchased an electric chainsaw that could do the job without contaminating the slope nearly as much as our stinky old two-stroke saw.

With the chainsaw, we sliced out grids in the sidewalls and floor of the pit and scooped out the blocks. We realized the debris was about six metres deep in that spot. Still, we got no strikes, but we did get a RECCO hit in the sidewall of the pit. I called command to find out how far the RECCO beam would penetrate through the snow, trying to figure out how far from

TALON HELICOPTER FLIES IN WITH THE HELICOPTER-MOUNTED RECCO DETECTOR. // BRENT CALKIN

A SEARCHER USES A CHAINSAW TO DIG THROUGH THE DEBRIS FIELD. // BRENT CALKIN

the sidewall the hit might be. At this point, time was moving fast and with solar heating raising the avalanche danger, we curtailed our activities for the day. We hoped after all the probing we had done, the slope would have a bit more aeration and the dogs might have better luck early the next morning.

Back at command, Martin Colwell, our search manager, pulled me aside. He had contacted RECCO and received an answer on the RECCO penetration question—30 metres through snow for a reflector, or possibly one to two metres for incidental electronics. The RECCO Rep suggested we use the helicopter detector to do a tight grid search of the debris. I wondered whether this would be redundant due to the time we had spent with the handheld RECCO, which I had assumed offered more precision. The rep's advice was that the heli RECCO was actually much more powerful than the handheld and would pick up much weaker signals, such as one reflected by incidental electronics like a cellphone. I stopped my questioning, eyed Martin for a moment, and backtracked on my original hesitation.

"OK, let's do it," I said. "But let's make sure it doesn't slow down the ground operation. Put the RECCO in at first light."

## DAY THREE, MARCH 20

Considerably past first light and standing in Lions Bay's field LZ, I glanced balefully at my watch and shot eye daggers in the direction of Hat Mountain, where I could hear the helicopter working with the RECCO. It was clearly past the intended flight time for the ground crews. I contemplated calling the machine back, but instead asked with a bit of tartness their ETA for picking up the ground crews. "About 10 more minutes," was the reply.

They kept to that time window and while coiling the RECCO line, they picked up two hits. The first was a weak one in the corner of our pit from the previous day, and the second was a considerably stronger hit in a more northerly section of the deposition zone. The first was picked up at maximum gain on the detector, while the second hit was detectable at level five, with the RECCO unit just centimetres off the snow surface.

Our goal was to investigate the hit in the pit first. We suspected it may have been caused by having our gear cache at the edge of the deposition zone, as there was at least one RECCO tag in a jacket that was stashed there, and it was within 30 metres of the detector. We were very methodical with the handheld RECCO in that area. The operator took off all his electronic gear and put it well away from the pit. Everyone with a RECCO tag stayed well clear. The handheld unit would not confirm the heli RECCO hit, and the hit from the previous day was not repeated.

The helicopter pilot walked me to where they got the second hit. I planted a ski pole at the spot, pulled out the handheld RECCO, and conducted a micro grid pattern search. About a metre from the pole, I got the familiar "beep-beep-beep" RECCO indication. At full gain power, it indicated an area about 30 cm by 30 cm. Reducing the power by one notch, I barely got an indication in the same area. I also tried tilting the detector 90 degrees to change the signal polarity, but the signal strength did not change.

I asked the dog handler to bring the dog to that spot. After a minute or two circling the area, the dog started digging about a metre upslope of the marker. We confirmed the spot with the other handheld RECCO unit. It picked up the same signal, same spot, and same strength. We called over the probe team and indicated the exact start point.

The very first probe strike went down 30 centimetres and made a hollow thud, sounding like we'd hit a search practice strike plate. It wasn't what I expected for a real operation. It was also surprisingly shallow after all the deep probing we had done.

We started digging and quickly uncovered a pair of snowshoes; the hollow thud had been the drumhead-like membrane of the snowshoe deck. They were still attached to the pack. We demobilized most of the search team immediately and kept the five most senior members on site to extricate our subject.

## AFTERMATH

The helicopter RECCO was the hero of the operation. A buried subject with no witnesses and no RECCO reflectors made for a difficult find. It took three days, with two dogs per day scouring the slope without a positive hit, terrible probe line conditions, and very weak and inconclusive handheld RECCO indications. When extracting our subject, he was in Gore-Tex head to toe, which would have restricted scent flow, and was encased in a whole-body ice lens. The dogs were at a definite disadvantage.

If the heli RECCO had been used on day one, it's likely we would have spent only a few hours looking for our subject, and the bulk would have been done from the safety of the helicopter.

What did the RECCO pick up? Our subject was well equipped with aluminum rimmed snowshoes, aluminum ski poles, an aluminum and steel ice axe, and steel crampons. For electronics, he was carrying a point and shoot camera, a cell phone, a car key fob, and a lithium power bank. According to RECCO representatives, the metal of his travel gear was unlikely to reflect the RECCO, but all the electronics were a possible source.

What if our subject had a RECCO reflector in his clothing? Either the handheld or heli RECCO could have pinpointed him very quickly. RECCO claims the heli rig could have picked him up with the helicopter flying at a height of 100 m at 100 km/h. That's quite impressive.

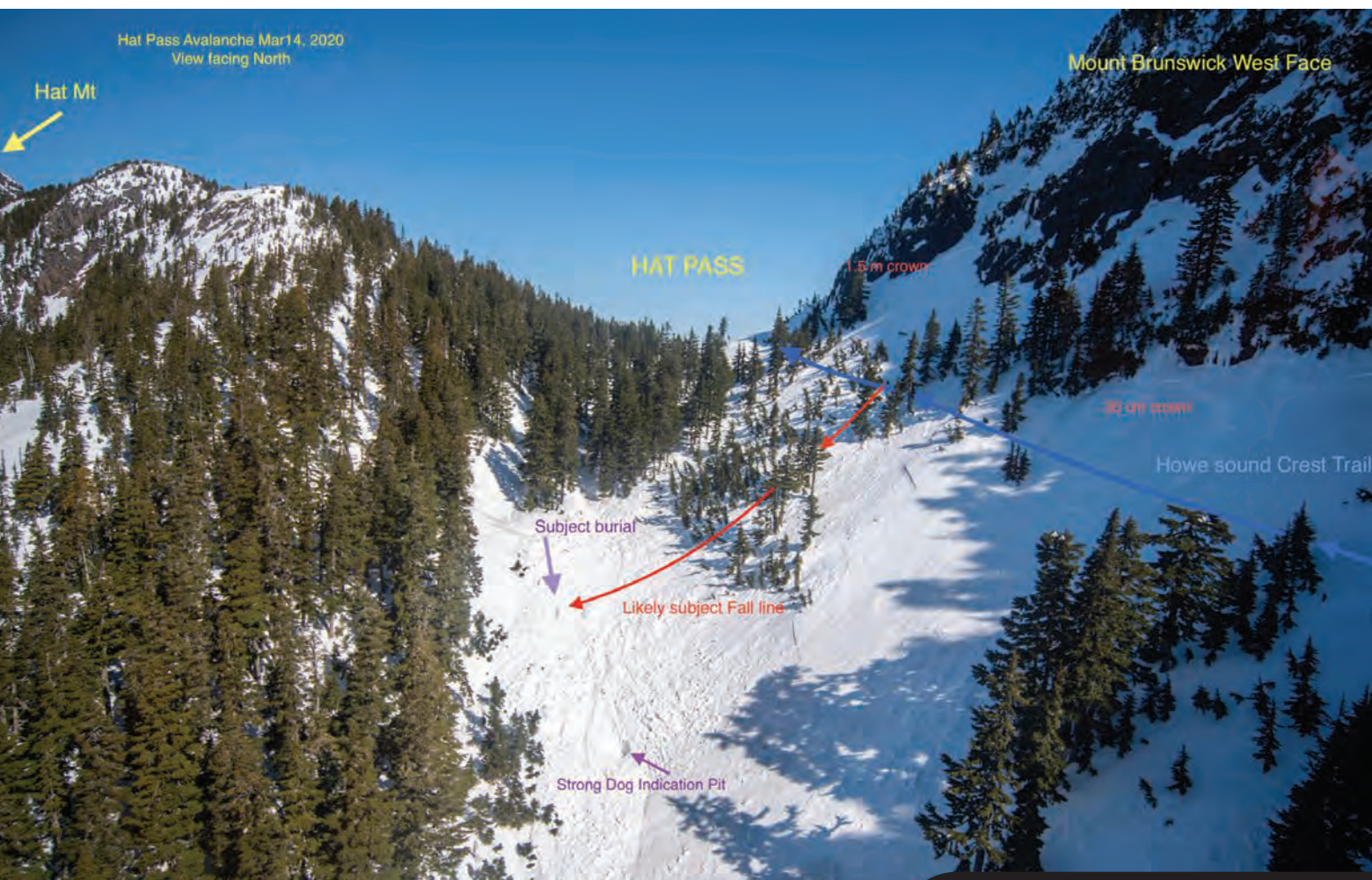
**POSTSCRIPT:**

The demobilization was somber as we packed our gear and watched the taillights of the coroner's van fade into the distance. We carefully dried off the chainsaw and re-oiled the chain. We made a note to recycle the solid steel probes, and to buy a bigger stash of the G3 probes. We plugged the handheld RECCO in to recharge.

I considered what we'd learned about it and its big brother. The handheld detectors have been around for a few years and require significant practice to use effectively. They're great when a burial includes a RECCO reflector but proved less effective when the only objects to detect consisted of the subject's buried electronics.

I feel the most important information we learned, is that the heli RECCO has the potential to be an effective search tool for subjects with no reflectors and no transceiver. It would be a rare individual who would be travelling with absolutely no electronics, and the power of the large helicopter mounted RECCO unit appears to provide a good option for safe and effective searching, especially in dangerous or difficult search conditions.

If anything can give a positive spin on a tragic event such as this avalanche, it's the successful use of this recent technology, and spreading this knowledge for future AVSAR operations.




AN AERIAL VIEW OF THE HAT PASS AVALANCHE SITE.
// CHRISTOPHER MORRIS

# **SAR** in the time of COVID

Brent Calkin, Lions Bay Search and Rescue team leader

*The Hat Pass avalanche search and rescue operation launched the day after a public health emergency was declared in British Columbia. Naturally, this had an impact on the SAR operation. We asked Brent Calkin how COVID-19 impacted the operation to find the missing snowshoer.*

**THE AVALANCHE JOURNAL:** This SAR operation started right when a public health emergency was declared in BC. In your article, you mention sanitizing the helicopter headset when you started the search, but what other precautions did you take on the first day of this operation?

**BRENT CALKIN:** The first day of the search was early in the pandemic spread and we attempted to have some level of social distancing, but we were really more concerned about the possibility of our subject having the virus. Our main protocol if we found a sick person was to put a mask on the ground for them, back away, have them put it on, and then expose as few people as possible to them.

We also realized our helicopter landing zone forward operating base was not set up well for hand washing, as it has no running water. Hand sanitizer became an important early procurement during the operation.

We were diligent about not having our own members show up sick to the rescue, even though it meant that we lost two of our avalanche forecasters to what was likely a mild flu.

**TAJ:** This was a tumultuous time around the world, with many people figuring out how to adapt to COVID on the fly. How did your procedures change to prevent the spread of COVID as the recovery effort progressed?

**BC:** We packed four crew members plus the pilot into the helicopter on the first load of day one, and everyone had their own headset mic. By the end of the day, all the seat cushions except for the front one had been removed from the helicopter, along with all the communication headsets, except for the ones up front. Social distancing, as much as possible, had come to the cramped confines of the helicopter.

By the end of day one, there were hand sanitizer stations set up and face masks had been sourced from our local ambulance station. It was actually early enough in the pandemic that the paramedics weren't yet frantically protecting their personal protective equipment (PPE). One concerning question was the use of N95 masks. We hadn't received much guidance on when to use the high filtration masks, and we worried about whether the light surgical masks were good enough.

**TAJ:** How did these changes impact the efficiency of the search?

**BC:** The search efficiency dropped significantly for a few reasons. We had to cut back numbers in each helicopter load, making team dispatch slower, and gear such as radios, ice axes, and crampons had to be sterilized before being handed to another person.

**TAJ:** What did you learn about managing a search during a pandemic, and what procedures are you following now?

**BC:** It has actually gotten easier as time has passed. Emergency Management BC has sent out a lot of information and we have decision trees that are pretty clear about how to manage the threat. The main practical issue is that wearing PPE is hot and uncomfortable, to the point of not being able to see through the fogged up eyewear, so it's usually a question of keep a two metre spacing most of the time and then putting the gear on when we need to work close to each other.

The real issue will be when we actually have a COVID patient and have to carry them out on a stretcher, and we ALL have to wear the heavy PPE, N95 masks, gloves, Gore-Tex and eye protection.

# **The Canadian Avalanche Information Distribution (AvID)** System Development Project

Karl Klassen

**THIS YEAR,** Avalanche Canada completed the first phase of a multi-year project to develop new forecasting tools that aim to:

- Improve the efficiency of AvCan forecasters.
- Improve the accuracy of AvCan's public avalanche forecasts.
- Improve the effectiveness of AvCan's forecasts as a risk communication and decision-making support tool.

The Avalanche Information Distribution (AvID) system development project started on April 1, 2017, when Avalanche Canada (AvCan), with support from our public safety partner Parks Canada, received a three-year National Search and Rescue Secretariat SAR-NIF grant.

The project was run by the AvCan warning service and IT staff, who worked closely with internal core personnel. We also employed a set of talented and dedicated contractors in the following roles: business manager, technical manager/lead developer, and front-end developer.

The SAR-NIF grant finished on March 31 of this year, marking the end of the first phase of a larger project. Phase 1 came in on time and, other than AvCan putting in somewhat more internal resources than anticipated, on budget. The following objectives were achieved:

- We created a new forecasting application (AvIDfx) to replace aging legacy software.
- We built a new data application (AvIDdx) that aggregates weather data, provides forecasters with a visualization of the data, and allows additional data streams to be added in the future.
- We funded and supported research at Simon Fraser University's Avalanche Research Program that explored users of AvCan forecasts, the ability of users to effectively utilize AvCan forecasts; and how AvCan forecasters access, visualize, and analyze the data used to produce avalanche forecasts.

AvID applications are completely cloud based. With a compatible browser, an internet connection, and login credentials, anyone can access and use AvIDfx and AvIDdx from any computer at any time. The software is designed and constructed using a highly modular approach, which makes it easy and relatively inexpensive to customize, add new or enhance existing elements, or create new components.

AvIDfx v1 launched successfully in November 2019. It was used by AvCan and Kananaskis Country forecasters for the 2019-20 season with no major problems. Forecasters reported the app was quite intuitive, allowed a highly

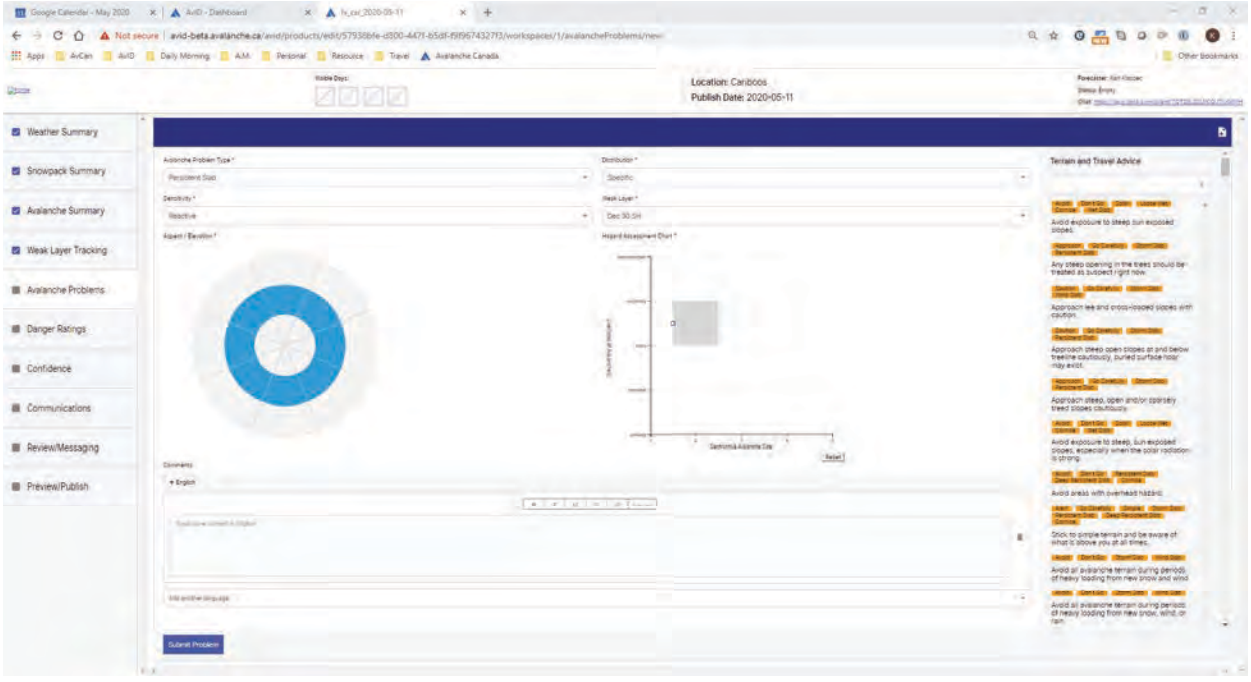



FIG. 1: AVIDFX FORECAST PRODUCTION WORKFLOW

flexible approach, and significantly increased efficiency.

AvIDfx does not publish a complete forecast. Rather, it produces discrete data that is then stored in a database where it can be consumed by a client. In this case, the client is AvCan's website, where the data is compiled into the forecast that is seen by the public. This approach, coupled with the modular design, will make it easy to modify our existing forecasts and create new risk communication products in response to research that's examining how we can better meet the needs of our diverse users.

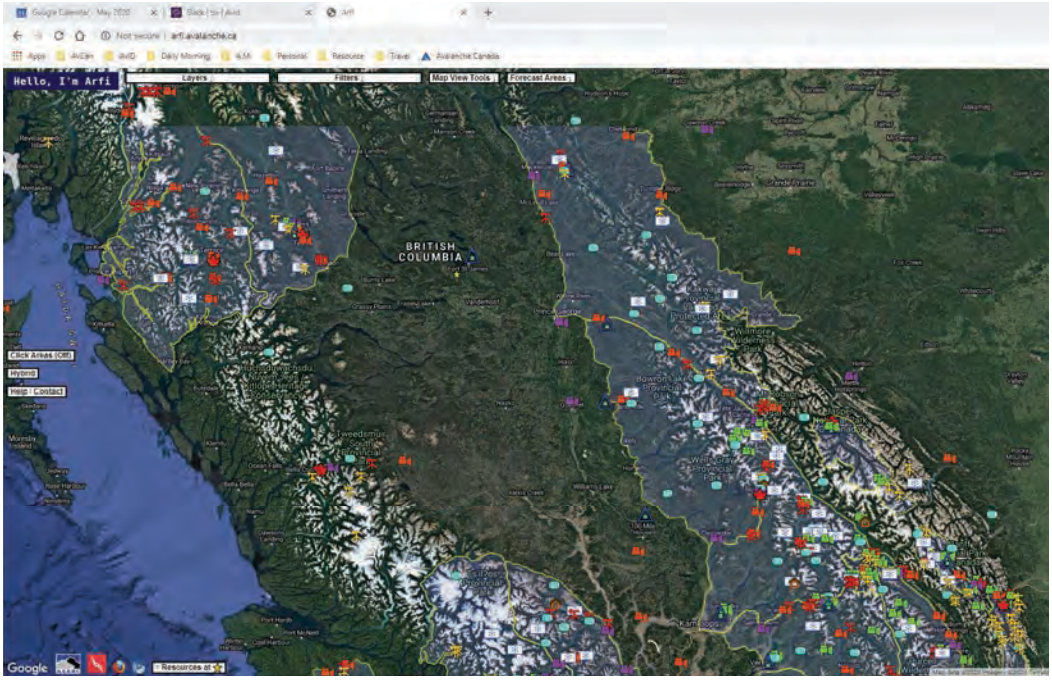


FIG. 2: AVALANCHE RESEARCH AND FORECASTING INTERFACE (ARFI)

AvIDfx is based on the conceptual model of avalanche hazard. While the design is novel, the workflow and process was familiar to us, making it reasonably straightforward to create the user stories and design specifications the development team needed to build the software. This familiarity also helped us easily assess the design, to ensure we got what we wanted and needed (Fig. 1).

AvIDdx was a different story. Our experience with data aggregation and visualization was limited. Our original expectation was that we'd simply create modernized geo-spatial visualizations such as the Avalanche Research and Forecasting Interface (ARFI) (Fig. 2) or the map view of InfoEx (Fig. 3). We knew we wanted more options and increased flexibility in charting functions than is offered by InfoEx (Fig. 4). And we knew we wanted the ability to include data sources not contained in the ARFI and InfoEx systems.

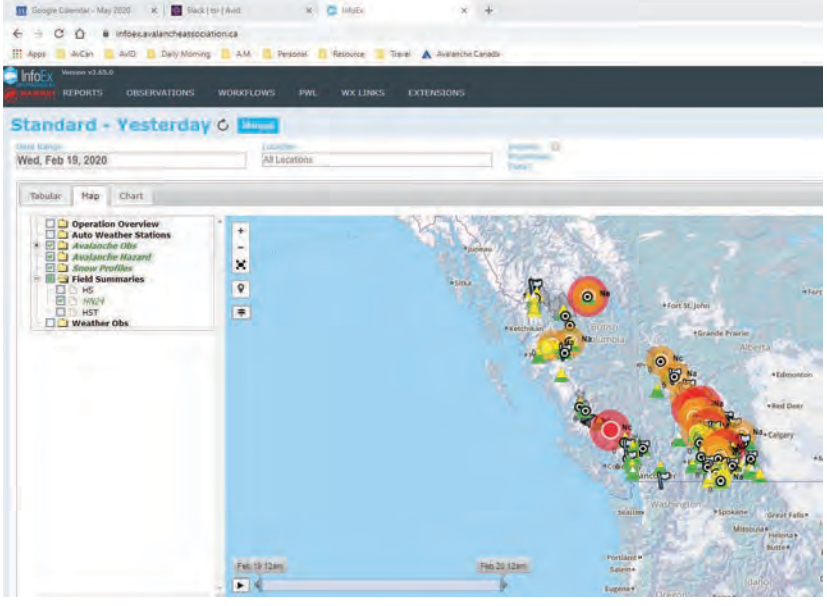


FIG. 3: INFOEX MAP VIEW

Our vision for AvIDdx was a unified "dashboard" where a forecaster could access, filter, sort, and visualize all the data used to analyze avalanche hazard and produce public avalanche forecasts. But we did not have a clear idea of exactly how this would look. Fortunately, we found help.

As we were building the AvIDfx application, a researcher named Stan Nowak from the Big Data Initiative at Simon Fraser University (SFU) came to our attention through SFU's Avalanche Research Program, where he was helping with snowpack model data visualization. Stan visited AvCan a couple of times during the forecasting season to watch and interview forecasters at work. This serendipitous collaboration resulted in the project taking on unforeseen but very exciting new forms. Stan brought an incredible

depth and breadth of visualization expertise, challenging our preconceived notions of what was possible and what we needed. *(Editor's note: Stan wrote about some of his work in Vol. 122 of the Avalanche Journal.)*

With Stan's research and input, we worked through many iterations of user specifications and tested numerous data visualization prototypes. While this slowed down development, this work ensured a foundation that will allow inclusion of all known and potentially new data streams in future. We also developed an exciting new weather visualization that's very different from traditional approaches (Fig. 5) and preliminary designs for an avalanche observations dashboard were completed (Fig. 6). Due to the pandemic causing the early shutdown of AvCan's forecasting program, we were not able to implement AvIDdx in the 2019-20 forecasting season. However, the beta version is running and v1 will be ready for launch in the fall of 2020 for the coming season.

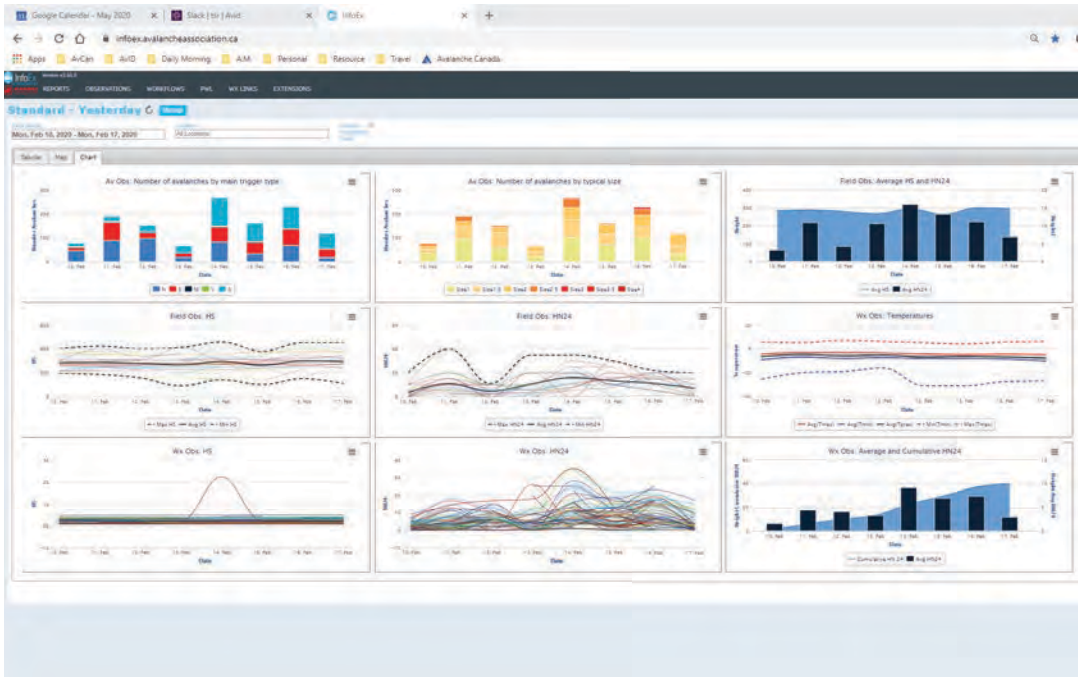


FIG. 4: INFOEX CHARTS

The research into the efficacy of our forecasts has been equally exciting and is playing an important role for the future of avalanche risk communication and decision-making support. Two master's theses have been completed to date:

- *Exploring the effectiveness of avalanche risk communication: A qualitative study of avalanche bulletin use among backcountry recreationists*, by Anne St. Clair (who won the prestigious Graduate Dean's Entrance Scholarship in recognition of her work).
- *Examining risk literacy in a complex decision-making environment: A study of public avalanche bulletins.*, by Henry Finn (see his article on page 32).

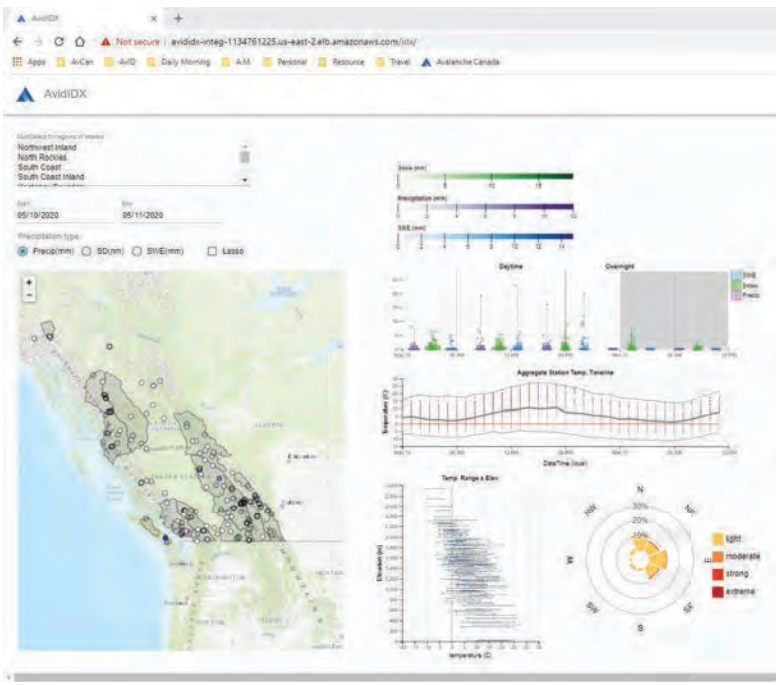



FIG. 5: AVIDDX WEATHER DATA VISUALIZATION BETA VERSION

The results from these two projects are already forming the basis for assessing what changes might be applied to improve avalanche forecast content, structure, and display. The data from Anne and Henry's work will support ongoing research for years to come. Current projects are examining:

- The effectiveness of the avalanche danger scale.

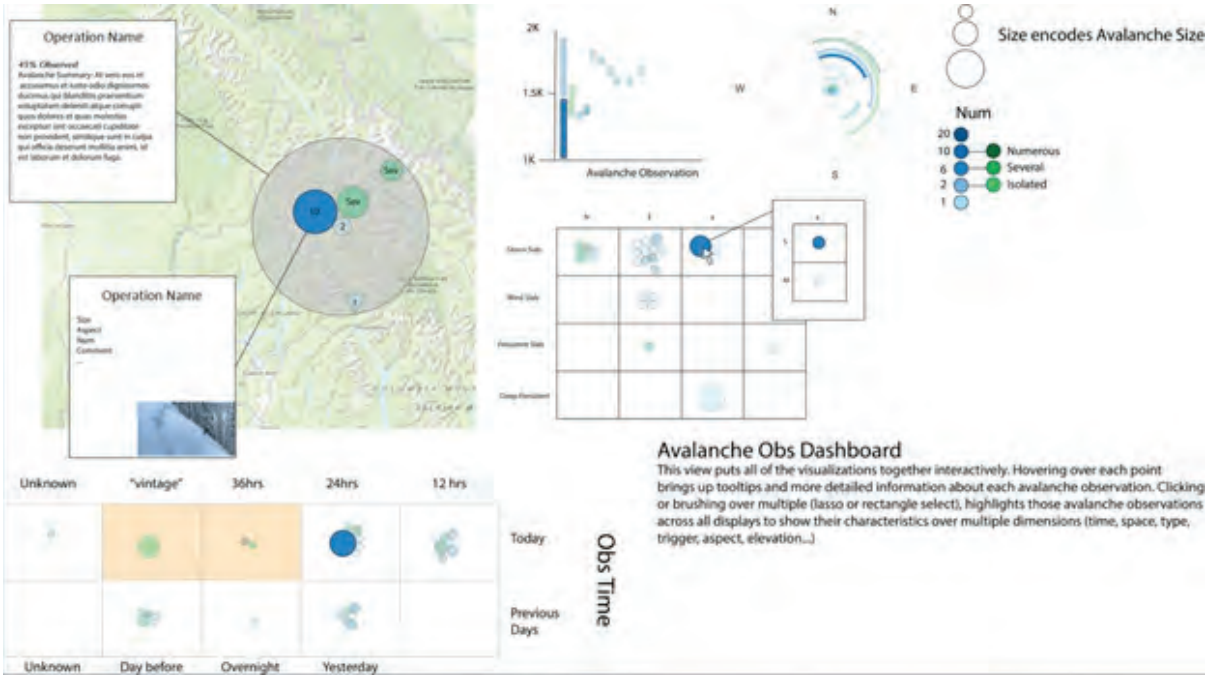



FIG. 6: AVIDDX AVALANCHE DATA VISUALIZATION DESIGN

- Ways to improve safety messaging in avalanche forecasts.

In addition, Stan's preliminary research into avalanche forecasters' use of data has now become his PhD project at SFU's School of Interactive Arts and Technology. Stan will be examining the development of visual analytics systems that address uncertainty and ambiguity in avalanche forecasting and other complex analysis domains.

The innovative approach and success of AvID's first phase has attracted national and international attention. Partners and colleagues in Canada and USA are interested in both the software we've developed and the research at SFU. Phase 1 of this project has created a strong foundation. AvCan is now working on building a funding and development consortium of national and international partners that will support future phases of AvID development.

Moving forward, AvCan will continue to support research at SFU, both in the data realm and the avalanche risk communication domain. This will drive revisions to our products and decision-making support tools in the coming years. In the next phases of development, we anticipate creating a range of new features and functions in both AvIDfx and AvIDdx. Some ideas include:

- Developing new AvIDfx workflows so we can produce new products to better meet the needs of existing and emerging user categories.
- Adding new data streams to AvIDdx, resulting in more dashboard visualizations.
- Making AvIDdx a data nexus that not only imports and aggregates data for visualization but also allows data to be exported, making it available to client applications. This will offer avalanche forecasters and practitioners options for using and sharing data with co-workers, with other professionals, and eventually perhaps with the public.

At the time of this writing, AvCan is already self-funding Phase 2 of the AvID project. We'll fix a few minor bugs that turned up last season, carry out a number of feature enhancements, and work on some back-end upgrades that will stabilize and speed up AvIDfx. AvIDfx is designed to support bilingual forecasters, as well as publication in French and English, and these functionalities will be made operational in Phase 2. This will lead to AvIDfx v1.1 launching in the late summer of 2020 and being used by AvCan, Kananaskis Country, and Avalanche Quebec. On the data aggregation side, the plan for Phase 2 is to add an avalanche observations dashboard in time for the fall launch of AvIDdx v1.

We have a plan for Phase 3 ready to implement with any partners who come on board. And we look forward to continuing work with our partners to build out the AvID system to full functionality in the coming years.

# Avalanche Control During **the Pandemic**

Rupert Wedgwood

## A DISTANT STORM APPROACHES

Concern for COVID-19 grew like our awareness of a distant storm. First, only flashes of light were seen over the horizon hinting at what may follow. Unsure of the storm's trajectory or intensity, these first warnings were quickly dismissed, only to have our attention reawakened by the growing rumble of distant thunder. Before long and seemingly out of nowhere, the storm arrived.

In early February, I found myself on a flight to Central America with my wife as one of the largest storms of the winter slammed into the peaks of the Great Divide around Jasper, my home where I forecast for Parks Canada's highway program.

It was business as usual along Highway 93 North, the Icefields Parkway, as my colleagues closed the highway and commenced avalanche control operations. Little thought given to the news from China of an illness emanating from the city of Wuhan.

This would be the last time we would do helicopter avalanche control without masks.

## THE JASPER PROGRAM

There are two avalanche regions that the visitor safety team in Jasper are responsible for: the southern section, which extends north from Saskatchewan River Crossing to Tangle Hill near the Icefields Centre; and the northern section near the town site the Ma-ligne Lake road.

The Icefields Parkway has been classified by Parks Canada as a scenic highway without the national economic priority of the Trans-Canada. With fewer political concerns arising from longer closures, Jasper's tactical tool kit lacks the high-cost remote avalanche control devices that are found along Highway 1. Jasper's arsenal is similar to many ski hills and includes ski cutting, hand and case charging, helicopter bombing, and an Avalauncher.

## THE AWAKENING

By mid-March the national news was dominated by COVID-19 and the Jasper visitor safety program had been designated an essential service. Most other park staff were being asked to work from home. Minimal safe-work guidance was given to the visitor safety team by senior management as they waited to hear from national office. No personal protective equipment specific to COVID-19 had been issued. Staff who developed cold-like symptoms were required to go home and self-isolate for two weeks.

I had returned to Canada three weeks prior to the new self-isolation rules for international travelers; others were less fortunate. Although business continuity planning had been in place since the era of Y2K, little national or local direction was provided. As Mike Tyson once famously said, "Everyone has a plan until they get punched in the face."

It was clear we would need to tackle the opening act of the pandemic by drawing from the strengths of our team and our professional community. The mountain parks' avalanche control and visitor safety teams took a collaborative approach to develop procedures. As emergency first responders, our training and response packs were set up to identify and deal with body fluid isolation. We set about distributing these limited supplies within the team and reworking our standard operational procedures. I recognized there would be a run on cleaning products so I visited the local hardware store and purchased a two-month supply of gloves, bleach, and paper towels. The hand sanitizer was long gone from the shelves, as were disinfectant wipes.

The team put their heads together and developed a series of guidelines around physical distancing, sharing of workspaces, and operational practices. We reached out to our air couriers and asked them how we could best manage helicopter avalanche control work while minimizing exposure to each other. Our medical director, Dr. Unsworh, provided feedback and advice as medical understanding grew.

It was a busy time, with some team members pursuing PPE from dubious suppliers with the tenacity of black-market racketeers, while others explored the use of Zoom and Google as communication and collaboration tools. The strength and value of the InfoEx as an online collaboration tool was brought into sharp focus as our understanding and appreciation of its functionality grew. Having access to our weather station data through the Forestry Technology System 360 online portal was extremely useful with its graphic displays and threshold alarms.

## DEVELOPING AND ADAPTING

There were many challenges to the new workplace as staff struggled with internet connectivity and the frustrations of developing a collaboration tool kit that could bridge the government IT system and our home computers. Resources were scarce and support from parks management was almost non-existent for the first five weeks. There was often


MATT CALLAGHAN, ARROW HELICOPTER PILOT, HOLDS UP A BAG OF HAND SANITIZER WHILE RUPERT WEDGWOOD AND DERYL KELLY TRY DIFFERENT MASK TYPES TO TROUBLE-SHOOT THE FOGGING EFFECT THEY CAUSED ON EYE PROTECTION. SOCIAL DISTANCING WOULD BECOME IMPOSSIBLE ONCE INSIDE THE HELICOPTER. // GARTH LEMKE

a lack of knowledge or conflicting information. It is often when circumstances are at their very worst that you will see the very best coming out in people and our team did itself proud.

## ADAPTIVE PRACTICES

Here are the interim protocols and practices developed and adopted in Jasper National Park during the spring:

| TYPE OF CONTROL | DESCRIPTION |
|---|---|
| PHYSICAL DISTANCING | ONE PERSON PER VEHICLE, TWO METRE PERSONAL DISTANCE, TELEWORK |
| ADMINISTRATIVE CONTROLS | OPERATING PROCEDURES, SHIFT WORK, ENHANCED CLEANING |
| PPE | EQUIPMENT WORN OR USED BY INDIVIDUAL TO REDUCE EXPOSURE OR CONSEQUENCE |

All JNP explosive procedures remained in effect. Below are additional precautions we adopted to address COVID-19 considerations:

- Do not become complacent. Keep to the minimum two metre distancing from others.
- Manage yourself. For example, Sneeze and cough into your elbow, carry tissues for a runny nose so as to not contaminate your gloves and shared surfaces.
- Use hand sanitizer frequently.
- Do not touch your face (eyes, mouth, and nose).
- Use surgical masks when distancing is not possible.
- Wipe down shared surfaces often throughout the day.

### Vehicles

1. Follow the JNP COVID-19 Shared Space and Resource Protocols (a copy was kept in each truck and on the Google drive.)
2. Occupy only your assigned vehicle, with only one person per vehicle.
3. Use hand sanitizer frequently.

### Helicopter

1. Wipe down working area within the helicopter including headset before and after the mission. Confirm with pilot what type of cleaner and method of application is appropriate.
2. The aviation team will not change during the mission unless one of the crew becomes air sick. Should this occur, the headset and working area (door handle seatbelt, safety lanyard assembly, etc.) will be wiped down.
3. Overalls, eye protection, surgical masks, and gloves to be worn by the crew.
4. No eating or drinking in the helicopter.
5. Use hand sanitizer between mission payloads.
6. Distancing of two metres will not be possible in the helicopter. The flight team must use surgical masks during the helicopter mission unless it impedes the ability to perform their tasks.

**Explosive handling (assembly and at the magazine)**

1. Only the assigned team members to be at the work site.
2. Maintain physical distancing. Set up two truck tail gates for a larger working area.
3. Overalls, eye protection and gloves to be worn. Be aware that thin surgical style gloves are prone to tearing when picking up objects such as cast primers. Work on the ground or close to the ground to avoid dropping from a height when using surgical gloves.
4. Use hand sanitizer frequently.

**Avalauncher operations**

1. Only the assigned team members to be at the work site.
2. Follow the JNP COVID-19 Shared Space and Resource Protocols.
3. Overalls, eye protection, and gloves to be worn by the crew.
4. Maintain physical distancing.
5. Only one person handling the Avalauncher.
6. Only one person operating the remote trigger.
7. Only one person recording results on the tablet.
8. Use hand sanitizer frequently.
9. Consider use of N-95 masks for gunner and assistant gunner due to proximity when loading payloads into the Avalauncher.

**Case charging**

1. Only the assigned team members to be at the work site.
2. Maintain physical distancing.
3. Overalls, eye protection and gloves to be worn.
4. Use hand sanitizer frequently.
5. For access to and from the blast site, the blaster may need to sit on the tailgate of the vehicle to maintain two metre distancing from the driver.

## STRATEGIES FOR GOING FORWARD AND LESSONS LEARNED

Mark Twain once said, "History does not repeat itself but it often rhymes." Looking back, what can we learn from the last few months to help set our teams up for success in the uncertain times ahead?

- Stay connected to your community and the best practices that are emerging.
- Be collaborative, open minded and try not to let the confirmation bias take hold. This can be done by drawing from the wisdom of your team and industry partners.
- Recognize everybody's risk perception and tolerances are slightly different, and be respectful of these differences.
- Trust in science but be respectful of individual beliefs.
- Only when team members feel that their safety is taken seriously will they be in a position to focus body and mind on the tasks presented to them.

LEFT: DAVE MCCASHIN ASSESSING THE SUITABILITY OF PPE FOR AVALANCHE AND SAR WORK. // DAVE MCCASHIN

RIGHT: DERYL KELLY TRYING OUT AN N95 MASK AND GOGGLES DURING A HELI CONTROL MISSION IN MARCH. // RUPERT WEDGWOOD

- Empower team members to be creative and take responsibility for program innovations.
- Be willing to adopt new strategies within the workplace to maintain safety and get the job done.
- Develop new areas of expertise within the team to help introduce new equipment, PPE, and methods.
- Be incremental in your approach as rapid change can be unsettling. We are all subject to the status quo bias.
- Establish new partnerships to help navigate new challenges.
- Leverage the use of existing tools and adopt new ones that will help you in the workplace.
- Recognize the job will take longer than it did before and communicate this to management.
- Above all, keep your sense of perspective and good humor.

## WHAT'S NEXT?

The future is far from certain and it is unlikely we will reach a homeostatic status quo any time soon. As we move forward, I am certain that the workplace will continue to evolve in order to maintain the safety of our teams and standards of professionalism. There is little value in looking back and lamenting a bygone age. With change comes opportunity to those that choose to frame the future with an open and optimistic mindset.

I would like to thanks my team for their good humor, insights, and professionalism in developing these practices: Deryl Kelly, Ben Firth, Jonny Simms, Garth Lemke, Jeff Andrews, Jesse Milner, Darren Vonk, Dave McCashin, Al Horton, and Dr D. Unsworth.

# **COVID,** Cancellations, and Risk

Mark Klassen

**DECISION MAKING** surrounding COVID-related cancellations this winter became a lot easier for me when I quit thinking about it as business-related (how do I manage clients cancelling trips?) and started considering it as safety-related (how do I manage the risk that COVID poses?). COVID, first and foremost, is a hazard to which I was exposed. It presented a physical danger to me, my family, my staff, and my guests. How I managed it either reduced or increased my risk. By changing this perspective, I understood that clients had good reason to cancel their trips, and it enabled me to know when I should cancel myself.

Although this was an exceptional and unprecedented circumstance, the risk-based decision-making principles I use while guiding still applied. Risk-based decision making considers the following:

- The likelihood of an event happening (with a critical element being exposure to the hazard).
- The consequences of that event occurring (with a crucial component being our vulnerability to the hazard).
- The potential costs and benefits of our decisions.
- The tolerance for risk for individuals, groups, and society.
- The amount of uncertainty involved in the situation.

## UNCERTAINTY

Uncertainty drives the entire risk equation. The ISO 31000 definition of risk is the "effect of uncertainty on objectives."

In the case of COVID, the level of uncertainty was, and still is, staggering. Not only was I uncertain, but epidemiology experts were as well. There was a lack of understanding as to the capability of the virus. For example, months after the disease was first detected, case fatality rates of those contracting the infection were unclear.

While guiding, I can reduce uncertainty in two ways: get more information or change my exposure to the terrain. With COVID, it was going to take months to get more information on the specifics of the hazard it poses, so in the short term I needed to change my exposure to the "terrain." For COVID, the way to do that was distancing and isolation.

Due to the enormous amount of uncertainty about the situation, it was unclear what the COVID likelihood/consequences were, or what the costs/benefits may be if I ran a trip. I felt that both my clients and I did not have a real understanding of the COVID risk on a trip. I needed to be aware that we were unaware. In the latter part of the winter, I had to be honest with myself and understand that I could not make good decisions about how COVID would affect the safety of my trips.

## RISK TOLERANCE

What was my tolerance to the risk posed by COVID? What was the tolerance of my group of clients, my group of guiding colleagues, my family? What was the tolerance of society in general—government, media, the courts, the community in which I live?

Without a clear understanding of what the risk was, I could not make a reasonable judgment based on my risk tolerances. That in itself pointed me towards cancelling the final six weeks of my winter season. But in the end, what I thought didn't matter, because society made the risk tolerance judgment for me. Society told me what to do. If I listened to my community, it was hard to justify running any trip after mid-March.

## LISTEN TO THE EXPERTS

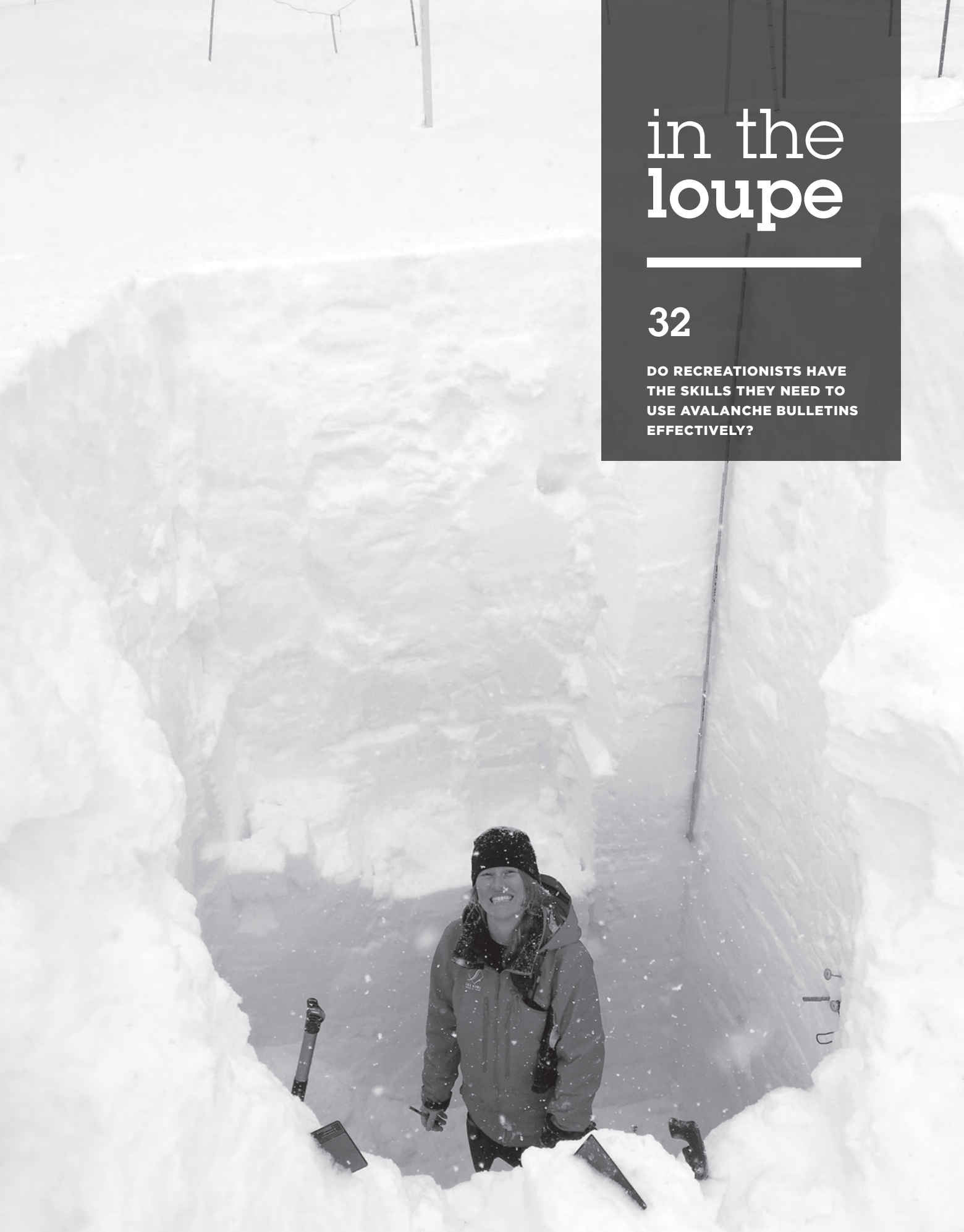
When I am guiding, I am an expert in mountain safety. I hope that people will do what I ask of them: space out in avalanche terrain, wear an avalanche transceiver, get short-roped, put on a rain jacket. I am not an expert with COVID; I am now the client. I need to listen to the epidemiological scientists and health care providers in the same way I expect my clients to listen to me in the mountains.

In March, the COVID experts said to limit contact with other people and limit risk activities to avoid putting stress on the search and rescue and health care systems in case an accident occurs. As we go forward, we need to continue listening to the experts, trusting them as we open up but also if we need to slow things down again. With more information, our uncertainty will lessen and we will be able to make better informed decisions. We will have a better understanding of what the actual risk is, and that enables us to make decisions based on our risk tolerances.

# in the loupe

## 32

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



// CLAYTON MARR

# **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.

## METHODS

For this research, we used a custom-built online survey (Fig. 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 (Fig. 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.

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

[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 Journal*

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 judgement.

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.


FIG. 1: DURING SPRING OF 2019, MORE THAN 3,000 BACKCOUNTRY RECREATIONISTS TOOK PART IN AN ONLINE SURVEY WHICH EVALUATED THEIR CAPACITY TO USE, UNDERSTAND AND APPLY AVALANCHE BULLETIN INFORMATION.

## DIFFERENCES BETWEEN SEGMENTS OF THE BACKCOUNTRY POPULATION

The next phase of our analysis focussed 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

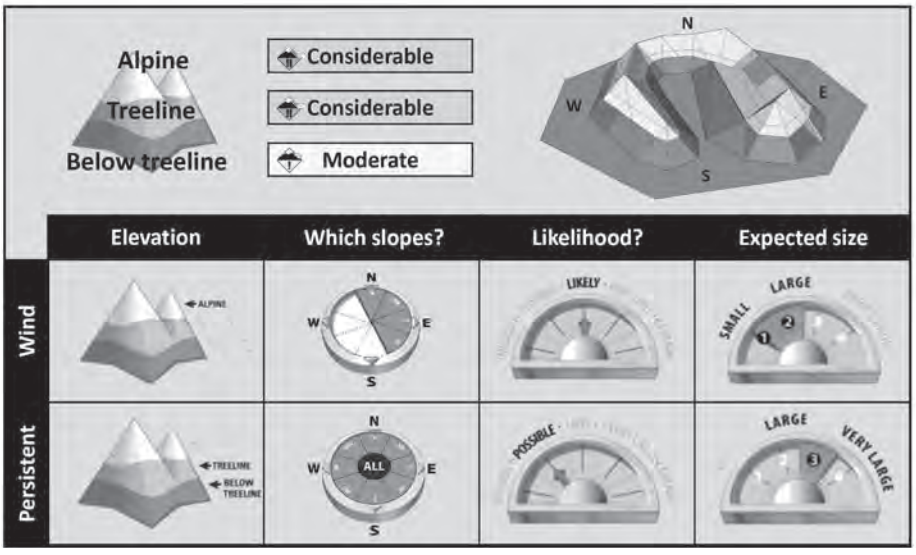



FIG. 2: THE SLOPE CHOICE QUESTION: PARTICIPANTS WERE ASKED TO STATE WHICH OF FOUR HIGHLIGHTED SLOPES ON A 3D MOUNTAIN MODEL WERE APPROPRIATE FOR TRAVELING ON GIVEN HYPOTHETICAL AVALANCHE CONDITIONS. WHICH WOULD YOU CHOOSE AND WHY?

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

We thank Avalanche Canada, Parks Canada, the Colorado Avalanche Information Center, the Northwest Avalanche Center, and all other US Forest Service Avalanche Centers for promoting our survey among their communities, and everybody who took the time to complete our survey.

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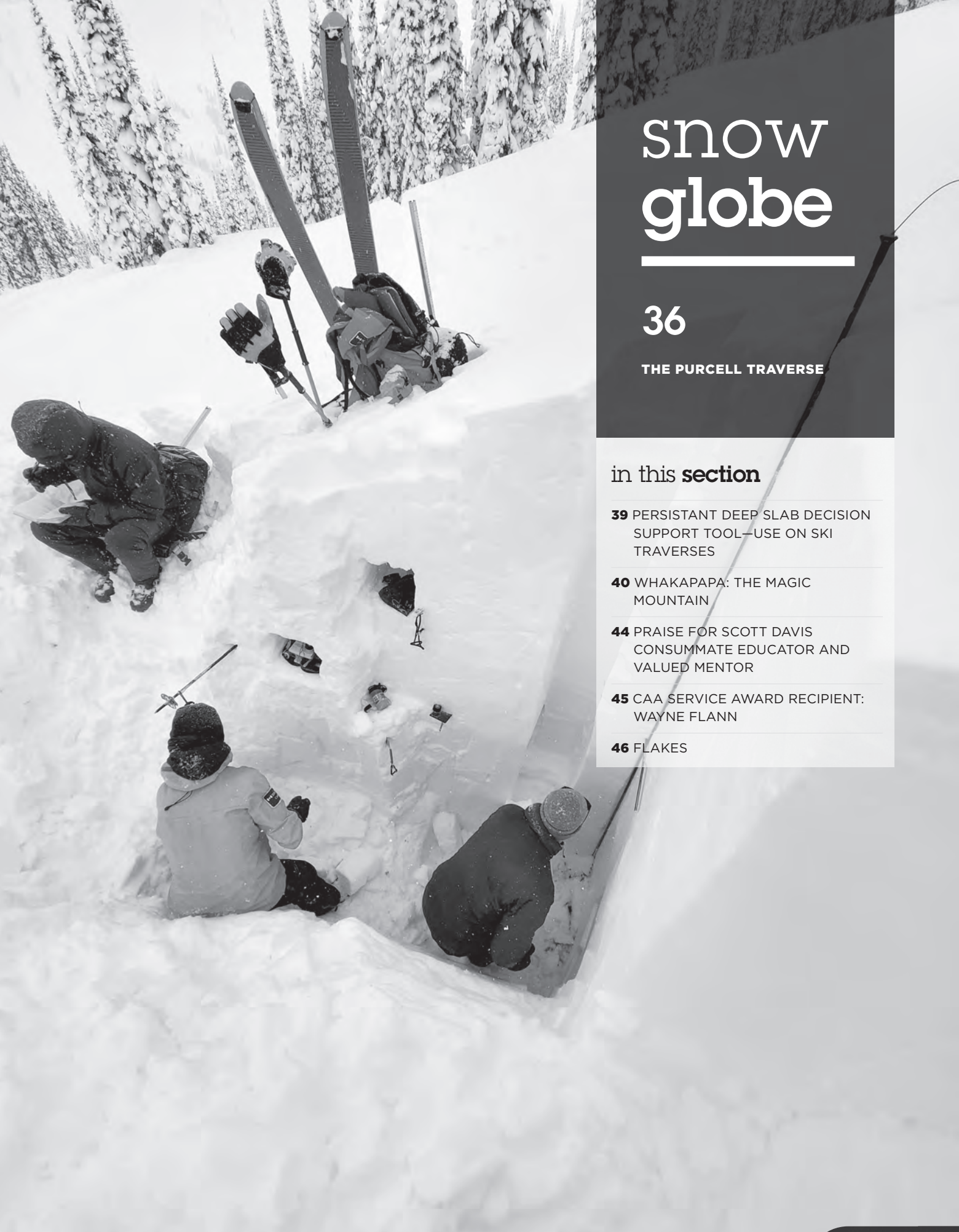


# snow globe

## 36

**THE PURCELL TRAVERSE**

in this **section**

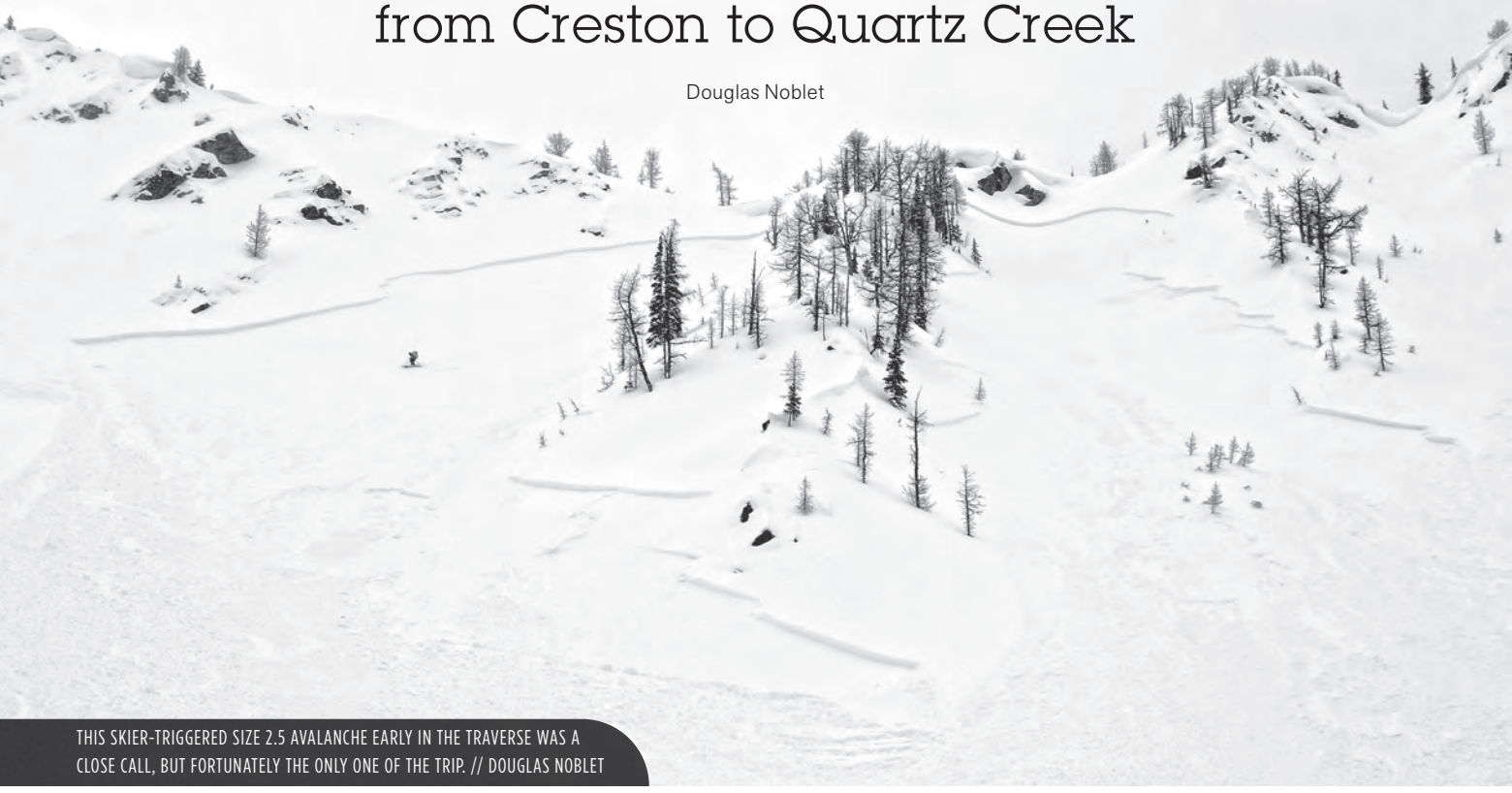


// BRAD CHRISTIE

# The Purcell Traverse

## 26 days through the mountains from Creston to Quartz Creek

Douglas Noblet



THIS SKIER-TRIGGERED SIZE 2.5 AVALANCHE EARLY IN THE TRAVERSE WAS A CLOSE CALL, BUT FORTUNATELY THE ONLY ONE OF THE TRIP. // DOUGLAS NOBLET

**LAST SPRING, FOUR FRIENDS AND I** *set out to traverse the length of the Purcell Range, from Creston in the south to Quartz Creek in the north. We'd placed five food caches and allotted 32 days to complete the 350-kilometer journey, based on traveling roughly 10 kilometers and 1,000 meteres of vertical per day.*

**OUR TRIP STARTS ON APRIL 4, 2019,** at the south end of the range, just east of Creston. Joining me are Steve Senecal from Nelson, and Mark Grist, Lena Rowat, and Nick Matwyuk from Vancouver. The faces are familiar—we all participated, in part or in full, in the complete ski traverse of the Selkirk Mountains in 2016. In fact, the idea for the Purcell traverse came during the Selkirk traverse. It all started when Steve and Madeleine Martin-Preney dreamed up traversing the full length of the Selkirks while attempting Mt Logan a few years prior. Once the Selkirks were accomplished, the Purcells seemed like a natural follow-up.

The first leg starts on a logging road just above the highway, followed by four days of less than exciting travel. Drizzly weather and low clouds keep us to the valley bottom, navigating a maze of cut blocks and old roads. Arriving at our Grey Creek Pass food cache, we are excited to spend a dry night in a small hut. With the wet weather and long days on old roads, both my feet have developed massive and painful blisters. I spent the last day pondering my future on this trip, tempted by the easy exit to Grey Creek and home to Nelson. After a cozy and dry night, and a lot of duct tape on my feet, I continue. The blisters eventually heal.

Leaving the hut, the weather has improved and ski conditions are great. We push north, following a high line. On the sixth morning, we wake up to a surprise 15-20 centimetres of blower snow. Our first run of the day, a large north-facing alpine feature, is uneventful. After a few hours of walking through hilly terrain, we are approaching our second north-facing descent. The sun had been out for a few hours, though it has now clouded over. The winds are light. As we peer over the col, we feel a whumpf and the snow texture changes slightly. We spend some time scouting and discussing options. We feel another whumpf. The descent has two chutes, split by a rib of larch trees. We settle on the conservative option, entering directly above the larch rib. I volunteer to ski first.

Two turns in, everything around me cracks. I make a beeline for a small tree just ahead. Luckily, the debris peels off to both sides of the rib and leaves me a clear shot for the trees. I look up to see the rest of the team wide-eyed, asking if I'm okay. I'm fine, though I might need new underwear. Oh wait, those don't come until cache three!

The avalanche is roughly 150 metres wide, with crowns up to 60 centimetres propagating on both sides of the rib and running for several hundred meters. It's a healthy size 2.5,

with debris up to four metres deep. The wide propagation is what surprises us most. It's a close call no doubt, too close for comfort. After skiing the icy bed surface, we put our tails between our legs, retreat to the nearest safe camp spot, and debrief. We mostly stay out of the alpine the next day, working valley bottoms to our next cache at Powder Creek Lodge.

After restocking with food, we ski off on a bright and sunny morning. Assessing conditions as we move, everything indicates good stability. We are still a bit gun shy after our close call, tiptoeing through the mountains. The day involves big terrain with limited options, yet we make it all the way to Dewar Hot Springs. Our forecast is calling for 24 hours of stormy weather starting in the morning, so we decide to spend a day here. After all, a hot spring is a pretty good place for a rest day! I somehow manage to spend an entire nine hours in the water!

The next few days are fairly uneventful. We have a highlight run off the Lees-Clutterbuck Col, floating through 50 centimetres of blower pow. Even the heavy packs seem to float away. We wake up very early one morning to navigate two kilometres of mouse-trap terrain south of Mt. Toby, only to find out everything slid in the big mid-March warm-up. Instead, we walk on massive piles of debris for two kilometres. On day 14 we reach our midpoint, and our third food cache at Jumbo Pass.

After a night at the hut, we debate our next move. Three ladies are joining us for the next leg and a storm is coming. We spend the day resting and skiing near the hut, while Kathy McKay and Kelsey Knoll join us in the evening. The next morning, Mark leads us through a safety talk. We discuss group dynamics, current conditions, and deep slabs (see page 39), before setting off to meet Kristen Ann Francis Murrell down the road. We hunker under a bridge, waiting for Kristen as the rain pours and avalanches rumble down all around us.

After high fives with the sled-tow team, we get ready to move on. But why move today? The conditions are deteriorating so we opt for another dry night at the hut, avoiding all travel during an obvious avalanche cycle.

The next morning, skies are clear and temperatures have cooled. We set off for a wonderful day of alpine views in the Jumbo Valley and Eyebrow Peak area. We get to see the extent of the avalanche cycle—pretty much anything that could slide had gone. We are sure glad to have waited the extra day, however, now we have to keep moving. There is another storm coming, and our food is going to run low.

We travel from Jumbo Pass to the Bugaboos in only three days instead of the planned five. The ladies get a taste of ski traversing: big days, beautiful alpine views, and the only bushwhack of the trip to top it off. As we approach the

THE TEAM CROSSES THE MAGNIFICENT TERRAIN OF THE PURCELL MOUNTAINS. // DOUGLAS NOBLET

Bugaboos, the weather chases us. We barely stop for lunch and on the final descent clouds close in right behind us and the winds are howling on the glacier. The plan is for CMH to drop off our food and pick up the ladies.

Within 15 minutes of arriving at the Conrad Kain Hut, a Bell 212 is landing in the incoming blizzard. Just like that, we are left to the sound of wind blowing on the hut while we dig into our newest stash of snacks. Meanwhile, the ladies are treated like royalty at the CMH lodge before being flown to their vehicles parked at the highway.

The name of the game is run, hide, run! We spend two nights at the hut waiting out a storm. We push some big days, making it to our fifth food cache at the McMurdo Cabin in only two-and-a-half days. We'd love to spend more time on this leg, but another storm is keeping us on the go.

Fortunately, the storm doesn't really materialize. After picking up food, we move on to our last leg. We are excited to have gone through what we thought was the most challenging terrain and look forward to the rolling hills above the Duncan Valley. Instead, we find a rotten snowpack, with cracks shooting out for what feels like hundreds of metres in all directions. We remote-trigger an avalanche on very mellow terrain, then another larger one from ridgetop. We quickly realize that safely navigating this terrain will be challenging and opt to finish the trip by mostly following valley bottoms and mellow terrain.

Our trip ends midday on April 29 with a greeting by Kathy and Kristen in the Quartz Creek parking lot, fresh pizza in hand. While hiking out, Steve and I found ourselves making a half-joking plan to traverse the Monashees.

Our trip was a success. We had a close call, but no major injuries or broken gear. Travel conditions were generally quite good,and there was some excellent skiing to be had. The weather provided some challenges, but that is to be expected. I've been asked a few times if I,: would do it again? The answer is easy: No! I'll go somewhere else next time.

THE TEAM WALKS OVER VALLEY-BOTTOM AVALANCHE DEBRIS ON THEIR WAY TO JUMBO PASS. // DOUGLAS NOBLET

# Persistent Deep Slab Decision Support Tool – Use on Ski Traverses

Mark Grist

## BACKGROUND

Ever since a former colleague jokingly characterized the Purcell snowpack as "all of the facets of the Rockies, with none of the snow of the Selkirks," I've been wary of skiing in the range. The grim news of a double fatality from an impressive size three persistent deep slab (PDS) avalanche on January 12, 2019, on Mt Brewer[1], southwest of Invermere, only heightened concerns. When my winter included two talks about the PDS decision support tool (by Simon Horton in Seattle and Bruce Jamieson in Pemberton), I felt the universe was trying to give me a hint and it was time to take notice.

What I particularly like about this tool is its ease of use in the Excel spreadsheet format. All you do is answer yes or no to 11 questions and it provides you with the checklist sum. It gets better—the program runs on the Excel app for smartphones. A copy can be found at the bottom of the web page[2] listed in the references.

How useful was the tool on our 26-day traverse? To start, I reviewed the spreadsheet and read Mike Conlan and Jamieson's paper[3] before leaving. The primary utility was having a list of 11 key parameters to keep front of mind when making terrain decisions. I can think of four occasions when I pulled out the list and went though the items with our group. On travel days, we didn't have a score higher than four based on our best assessment at the time, meaning natural and human triggered PDS avalanches were unlikely, according to the tool.

## CAVEATS

We didn't feel the need to review the questions daily, but only when conditions and terrain prompted us. The truth is, 60–80% of the time ski traverses take place in non-avalanche terrain or very low risk, simple terrain; and often when a more predictable spring diurnal pattern prevails. I suspect the tool is most useful for mid-winter daily operation programs, not only to give some structure to decision making in a highly uncertain domain, but also to document an operation's due diligence in conducting a thorough hazard assessment.

We also didn't regularly examine basal layers for the presence of facets or depth hoar (there usually isn't time on an extended traverse), so our tool sum tallies likely had a low bias.

Conlan and Jamieson note the tool was developed from data obtained during winter and that, "The tool may not work during spring months when temperatures drastically increase and the upper snowpack becomes wet." Conditions were primarily winter-like throughout our traverse (including a chilly -9 C on our penultimate morning), but previously there was a significant mid-March heatwave that forced the Columbia traverse party out of the mountains for several days[4].

## THE BIG PICTURE

We were very fortunate to have detailed snowpack and route information from local guide Kirk Mauthner. In particular, two key pieces of information really helped guide our terrain choices:

1) Avoid areas where ground cover is shale as it frequently gives a shallow (and faceted) snowpack, similar to the Mt Brewer incident. Google Earth was our friend for route planning.
2) The snowpack was deeper (and usually less faceted) on the west side of the Purcells than the east, so whenever possible and prudent we would bias our route towards the west side.

I mention this is to encourage incorporating as much local/anecdotal information as possible to complement the tool rather than use it in isolation.

In a sense, we were lucky with our overall conditions, for we didn't see evidence of a single PDS avalanche on our entire traverse (partly due to sub-par weather and visibility), and there were only two deep slab avalanches (both scrubbing down to glacial ice) reported in the Purcells on InfoEx from March 15 to April 30.

It would be easy to think this tool has no use, but not so. I'll finish with a line I sent to our group when I first mentioned using the tool:

*"I see it as a good way to quickly keep our situational awareness high with regard to this type of avalanche problem, and hopefully not lose track of any key predictive factors (yay checklists!!!)"*

## REFERENCES

[1] https://www.avalanche.ca/map?panel=fatal-accidents%2Ffatality-mtbrewer-2019-01-12

[2] https://schulich.ucalgary.ca/asarc/node/338

[3] Conlan, M., Jamieson, B., 2017. A decision support tool for dry persistent deep slab avalanches for the transitional snow climate of western Canada. Cold Regions Science and Technology, Vol 144, pp. 16-27).

[4] Baker, L., Heathcott, A., 2020. Walking Away: An attempt at the full Columbia Mountain traverse. The Avalanche Journal, Vol 123, p37.

# Whakapapa: The Magic Mountain
## Ski Patrolling on the Central North Island of New Zealand

Zoe Ryan

**Ko Tongariro te maunga**
Tongariro is the mountain

**Ko Taupo te moana**
Taupo is the lake

**Ko Ngãti Tuwharetoa te iwi**
Ngãti Tuwharetoa is the tribe

**Ko te Heuheu te tangata**
te Heuheu is the Chief

OMINOUS LENTICULAR CLOUDS SIT OVER MT. RUAPEHU, WHICH ALONG WITH MT. TONGARIRO AND MT. NGAURUHOE, FORM THE VOLCANIC PLATEAU OF NEW ZEALAND'S TONGARIRO NATIONAL PARK. // CONRAD SMITH (LIFE CAPTURED PHOTOGRAPHY)

*The above is a Maori introduction to the region of Tongariro National Park. The local iwi, Ngãti Tuwharetoa, maintain the inherent responsibility to protect the mountainous area for which they belong. Located in the central North Island of New Zealand, the immense stratovolcanoes of Tongariro National Park command respect due to the unforgiving nature of both the weather and rugged alpine environment. I've spent the past four winter seasons (Canadian summers) working as a ski patroller on the northern slopes of Mount Ruapehu. Working on an active volcano amounted to be starkly different than the Canadian Rockies, where most of my mountain experience has been drawn from. Here is an overview of my time working on the Magic Mountain.*

**PERCHED ON THE CENTRAL PLATEAU** of New Zealand's North Island, Mount Ruapehu is one of three prominent stratovolcanoes that make up the striking landscape of Tongariro National Park. Three ski areas operate on the volcano's vast slopes, which stretch for about 15 kilometres along the flanks of the 2,797 metre peak. Tukino, a small club field, is located on the western slopes, Whakapapa Ski Field on the northern slopes, and Turoa Ski Field on the southern slopes. The latter two are both operated by Ruapehu Alpine Lifts.

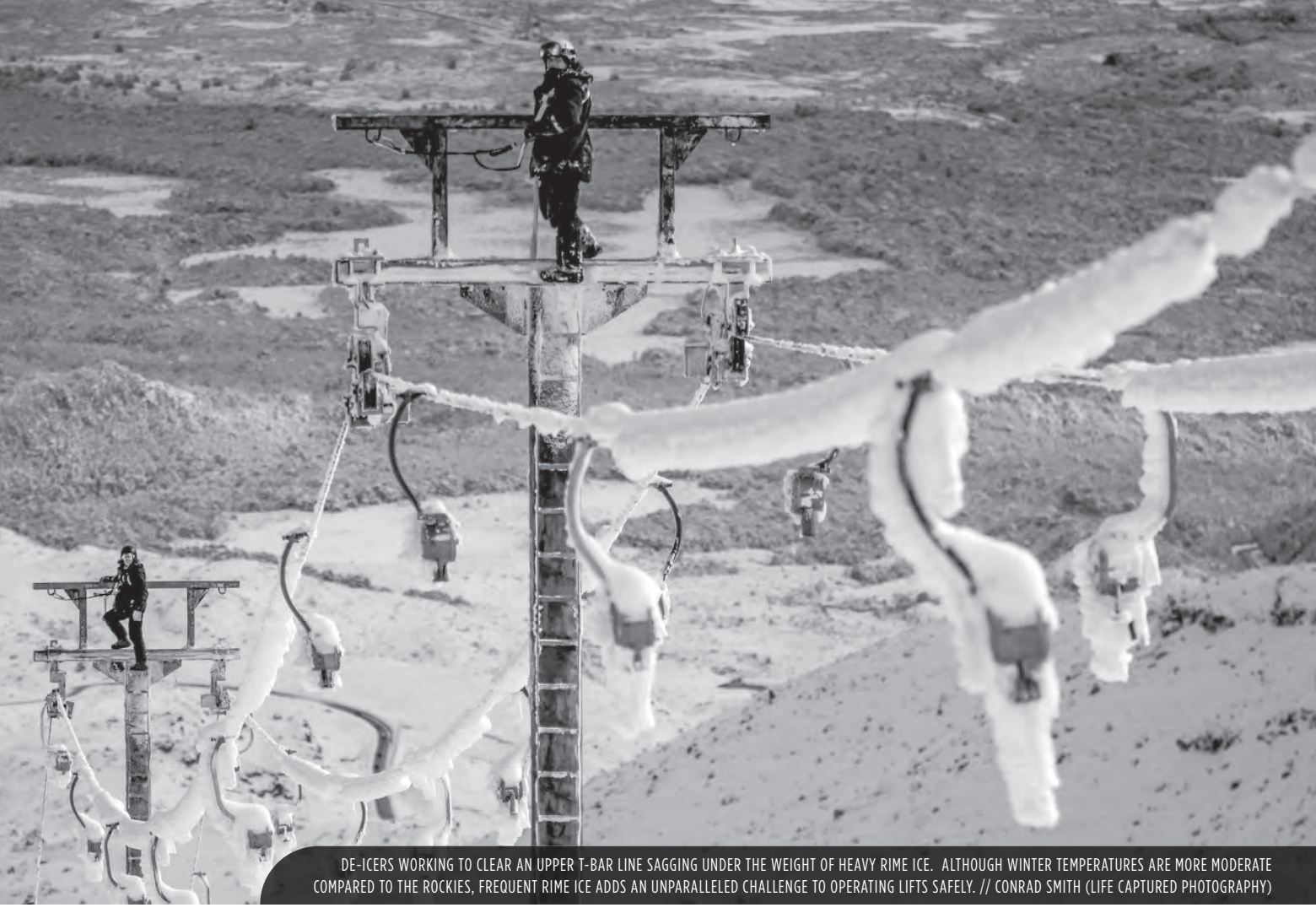
Sitting 2,000 metres above the surrounding plateau, Ruapehu was formed by volcanic eruptions—lava flows, volcanic projectiles, and lahars (mud flows). The rugged terrain consists of undulating scree slopes, boulders, and sheer cliff bands that require significant amounts of snow and wind transport to fill in the numerous gullies and depressions before the ski areas can operate. That said, one coastal storm front can change it all!

### Stratovolcano

A spherical volcano made up of hardened lava, mudflow and ash. Characterised by a steep profile, summit crater lake, and periodic explosive eruptions. They are known to be the most dangerous of volcanos as they can erupt with little warning, releasing large amounts of lava flow, volcanic projectiles, and lahar mud flow.

### Whakapapa - Māori pronunciation: ['fakapapa]

Which means genealogy: a line of descent from ancestors down to the present day. Whakapapa's geneaology links people to all other living things, and to the earth and the sky, and implies a deep connection to land and the roots of one's ancestry.



DE-ICERS WORKING TO CLEAR AN UPPER T-BAR LINE SAGGING UNDER THE WEIGHT OF HEAVY RIME ICE. ALTHOUGH WINTER TEMPERATURES ARE MORE MODERATE COMPARED TO THE ROCKIES, FREQUENT RIME ICE ADDS AN UNPARALLELED CHALLENGE TO OPERATING LIFTS SAFELY. // CONRAD SMITH (LIFE CAPTURED PHOTOGRAPHY)

There is very little change in topography between the ocean and the three stratovolcanoes. The prevailing westerly air flow often brings intense low-pressure systems that originate in Antarctica and come into New Zealand off the Tasman Sea. These moist air masses sweep over the rolling farm lands of the North Island before ascending the gradually rising slopes of the central plateau. The slopes of the volcanos get pummelled with rapidly rising moist air, usually at near freezing temperature. This delivers a challenging combination of dry snow, rime ice, rain, and wind in series and results in deep, wind affected deposits of new snow that vary significantly in composition across elevation bands and aspects.

To paint a picture, an average storm cycle can produce anywhere from 30-100 mm of new precipitation, with an average snow density of around 300 kg/m3 (compared to roughly 50-100 kg/m3 for the Rockies). In combination with the infamously high winds of the region, any given week of changing weather can drastically alter the lay of the land. Significant accumulations of rime ice frequently build on the structures and lifts. This requires a dedicated team of de-icers, who scale the icy lift towers to physically beat the rime ice off the structures using a yeti stick (akin to a wooden baseball bat). The de-icing team works tirelessly throughout the storm cycles in high winds and low visibility to manage ice build-up that, left untouched, would cause serious damage to infrastructure.

It can be hard to maintain an accurate assessment of the avalanche hazard during the intense and dynamic storm cycles. In addition to wreaking havoc on lift operation, rime ice and extreme winds tend to interfere with weather telemetry and weather plot data. This makes our hazard assessment heavily reliant on snowpack and avalanche observations. However those are challenging under extreme weather conditions (visibility, wind, and ice) that limit the ski patrol team's ability to access the upper slopes during storm days. When the wind whips exfoliating rime ice that becomes too painful for our skin and too slick for our snowmobiles, the team is forced to wait out the weather to re-evaluate the avalanche hazard once the storm has cleared.

There are more differences in avalanche hazard than similarities compared to the Canadian Rockies. One of the biggest is the snowpack's ability to self-heal during huge storm cycles. It is possible to have upwards of 300 mm of new precipitation without significant avalanche hazard present when the storm clears due to the dense ice layers that form in the snowpack that effectively bridge any potential weak layers below. On the other hand, in the Rockies, we are often focussed on incremental loading on top of persistent weak layers that cause instabilities that last for months, if not the entire winter season.

The most common avalanche problems on Mount Ruapehu are wind slab and loose wet avalanches. Although these problems tend to heal quickly, the team works to remain

cognizant that very large avalanches (both wet slab and persistent slab) can form and are of high consequence due to their unpredictable nature and destructive potential. Combined with limited terrain access to conduct ongoing maintenance and avalanche mitigation during large storm events, this can put infrastructure at serious risk.

We use the same terminology to communicate avalanche hazard, but the differences between Ruapehu and the Rockies are tangible. Relatively small avalanches at Ruapehu can be deceptively destructive given the roughly four-fold higher snow density. The large prevalence of cliff bands in Ruapehu's volcanic terrain presents a risk to skiers as well—even small avalanches can pull skiers over cliffs in steep terrain, or cascade down into narrow gully hazards.

Impenetrable ice layers in the Rockies typically only occur in the spring, but they are frequently present in the snowpack on Ruapehu. Although impenetrable ice intuitively suggests avalanche hazard is low, this is not always the case. Occasionally, weak faceted layers can fail below impenetrable rime ice, and sometimes below numerous layers of rime ice. This kind of failure is usually triggered in very steep terrain, often above cliff bands, where small failures step down into deeper layers. These problems can be particularly hard to manage, requiring large explosives on specific terrain features, and will often produce very dense and destructive avalanches.

Since Ruapehu sits at a latitude of 42°S, the sun's radiation is strong, has a high daily trajectory in the sky, and shines mainly on the northern mountain slopes. Whakapapa's northern aspect means that loose wet solar avalanches commonly feature in snow safety operations for the entire season. The relatively dark colour of Ruapehu's volcanic rock, which has a lower albedo compared to the typical grey colour of the Rockies' limestone, compounds the solar warming. Another factor in loose wet avalanche hazard are the frequent rain on snow events throughout the season, which can trigger widespread natural avalanche cycles.

This combination of avalanche hazards can keep the ski patrol team busy throughout a long day, starting with ski cutting and bombing to control wind slab avalanches from overnight winds, followed by more ski cutting or passively closing terrain to deal with the loose wet hazard that results from the afternoon heat. This is in addition to responding to accidents, trail maintenance, and many other aspects of public safety, which can make for very dynamic and physically demanding work. Fortunately, this is what many patrollers love about the job!

One unique hazard on Ruapehu is the fact the ski areas sit on the slopes of an active volcano, which erupts roughly

SKI PATROL ASSESSING THE AVALANCHE HAZARD IN THE UPPER SLOPES DIRECTLY ABOVE THE SKI AREA BOUNDARY AFTER A STORM. RIME ICE CAN MAKE SLOPE ACCESSIBILITY CHALLENGING FOR SNOWPACK OBSERVATIONS. // CONRAD SMITH (LIFE CAPTURED PHOTOGRAPHY)

LEFT: A SKI PATROLLER IS TOUCHING THE OUTER EDGE OF THE CROWN OF A SIZE 3 PERSISTENT SLAB AVALANCHE LOCATED IN RUAPEHU'S TE HUEHUE VALLEY HEADWALL, A LARGE AVALANCHE PATH THAT THREATENS THE UPPER LIFT INFRASTRUCTURE. A THIN LAYER OF FACETS FORMED BETWEEN TWO HORIZONTAL RIME ICE LAYERS. ONCE BURIED, IT PRODUCED NATURAL, EXPLOSIVE, EXPLOSIVE REMOTE, AND VEHICLE REMOTE AVALANCHES UP TO SIZE 3. RIGHT: THE RESULTING DEBRIS PILE SITTING ABOVE THE VALLEY T-BAR. // ZOE RYAN

every 10 years and affects the ski areas with both aerial bombs and lahar mud flows. New Zealand's GNS Science conducts continuous geophysical monitoring of volcanic activity. Daily testing of an eruption alarm system, instructional safety posters, and frequent eruption drills prepare skiers for the possibility of a large-scale volcanic eruption (Figure 9).

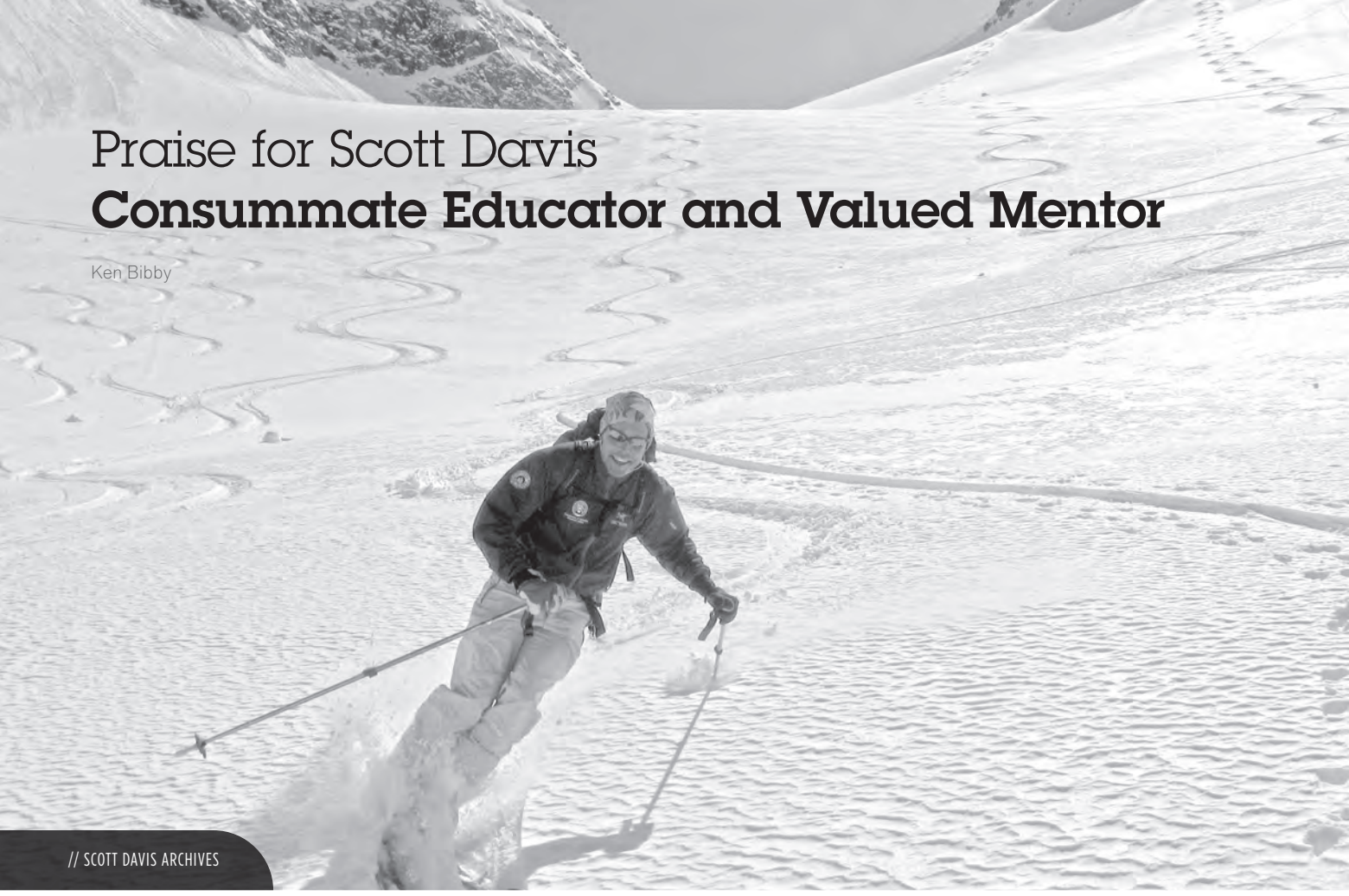
New Zealand's ski season is short and busy, so the Ruapehu team needs to maximize short weather windows, working terrain as efficiently as possible to open for the public. This is very different from the Rockies, where the complex nature of the continental snowpack requires a methodical and vigilant approach, often with steeper terrain only opening in the latter half of the season. Switching between these two opposing environments as I switch seasons necessitates a shift in mindset. Utilizing strategic mindsets is helpful in this instance, as well as communicating operational goals on a daily basis. In both instances, maintaining a structured approach towards managing avalanche hazard is imperative.

Working on Mt. Ruapehu has been an unforgettable experience that changed my perspective on avalanche hazard, strong winds, and the value of dry gloves. Although sometimes arduous, working amongst the incredible forces of nature experienced in this region is unparalleled. That being said, it's the people that make the place. A good sense of humour and humility and a necessity in this environment, and the hard-working Kiwis on this mountain have plenty of both. I feel very privileged to have had these experiences and to have learned to navigate a winter environment much different from that of my home.

ICONIC MOUNT RUAPEHU ERUPTION IN 1995 AS SEEN FROM WHAKAPAPA VILLAGE (LOCATED 15 KM DOWNSLOPE FROM THE RESORT) IS A REMINDER OF THE DANGEROUS NATURE OF THE VIOLENTLY EXPLOSIVE STRATO VOLCANO. // TIM WHITTAKER

# Praise for Scott Davis
# Consummate Educator and Valued Mentor

Ken Bibby



// SCOTT DAVIS ARCHIVES

**I FIRST MET SCOTT DAVIS** in the spring of 1999 as I was preparing to launch myself into a grand adventure in the Gold Range of the Monashees. Flight logistics meant there was an extra seat in the helicopter and Scott hitched a ride for a solo birthday run at the southern end of the traverse. I recall being significantly impressed by this, as it was one of my first real glimpses at what is possible with mileage and experience. Little did I know then that he would play an important role in my career as a valued mentor and friend. Two years later, I found myself at Selkirk Lodge as a young apprentice, working with this legendary mountain guide.

Truth: our early working relationship was tricky. I was young and eager, with no shortage of bravado and a distinct lack of awareness of the concept that I didn't know what I didn't know. I wanted to be out front, but spent much of my time at the back, stewing and observing. At one point I declared with great indignation, "I've been guiding for two entire seasons already!" which is something Scott teases me about to this day. Despite my frustrations with my role as his apprentice, something became very clear to me: I was watching a master at his craft and his loyal guests loved him for it.

In 2005, I found myself working with Scott again, this time in the CAA's Industry Training Program. Scott has been an ITP instructor since 1999 and has now taught almost 40 courses over more than two decades. The passion, skill, and consistency that Scott brings to his work as a mountain guide also comes with him to the classroom. I have watched as our students benefitted from his depth of experience across numerous industry sectors, his personal interest in both the technical and scientific aspects of avalanche work, and his simple commitment to excellence.

I learned from Scott—as I had as a young apprentice—and became better at my craft, both in and out of the classroom. Scott's role in the evolution of the ITP cannot be overstated. He has had a profound influence on both curriculum development milestones and on individual course outcomes.

Scott announced his retirement from the ITP last fall. Although I'm not completely clear on what that means coming from someone who has claimed to be "semi-retired" for years, I do know we will all miss teaching with him. And when I raise an eyebrow at a young, hot-under-the-collar apprentice or student, I will do my very best to again follow in Scott's footsteps as a patient mentor.

Although this might sound a bit like a eulogy, Scott is alive and well in Revelstoke. You'll no doubt run into him early season sprinting up Connaught Creek, or trying not to fall off his road bike.

Hats off SFD—your legacy is something to be proud of.

# CAA Service Award Recipient: **Wayne Flann**

Alex Cooper

**WAYNE FLANN IS THE RECIPIENT** of the 2020 Canadian Avalanche Association Service Award. He was nominated for his long career in the avalanche industry, and for his blog, where he provides regular news on avalanches from around the world.

"If the Avalanche Canada bulletin can be equated to a box of fresh cookies, Flann's blog is the raw ingredients that make that delicious box of cookies," wrote Ryan Bougie, who nominated Wayne for the award. "For the empowered, discerning avalanche information consumer, Wayneflannavalancheblog.com is a daily must-read. Whether you're a seasoned reader or going to take your first few clicks after reading this submission, I think we owe some gratitude towards Wayne Flann for his tireless efforts towards avalanche safety."

Wayne has been a member of the CAA for more than 30 years, starting as an avalanche forecaster on Blackcomb Mountain. He is a Professional Member of the CAA, a Level 2 member of the Canadian Ski Guide Association, a volunteer with Whistler Search & Rescue, a licensed paramedic, long-line technician, and a consultant for the film and television industry.

But he is best known for the Wayne Flann Avalanche Blog, which has become essential reading for people in the Sea-to-Sky region, and in the avalanche industry. On it, he posts daily reports on snow, weather, and avalanche conditions. The blog features numerous photos, webcam images, satellite weather imagery, weather maps, and links to avalanche news from around the world.

"In this chaotic time of COVID-19 and all the new societal rules of physical distancing, I think it is appropriate to nominate a member who contributes online," wrote Bougie. "Even when most businesses have closed and the InfoEx is a ghost town, Flann's blog marches on, churning out content for all those readers who are bored and stuck at home."

Congratulations Wayne!

**Q&A WITH WAYNE FLANN**

**THE AVALANCHE JOURNAL:** What inspired you to start your blog in 2011?
**WAYNE FLANN:** I was working on a film job with helicopter access to the alpine in early November and there was a crust facet combo in the snowpack. Some people were beginning to get up into the alpine to ski tour so thought it would be a good idea to get some relevant information out on social media.

**TAJ:** How did the blog start and how has it evolved over the years?
**WF:** It started as just local avalanche information, but I later began to get more data from around the world. Tourers and sledders started sending in avalanche observations and photos, which added to the information I was gathering. Some readers asked about weather information, so I eventually started writing my own version of the forecast.

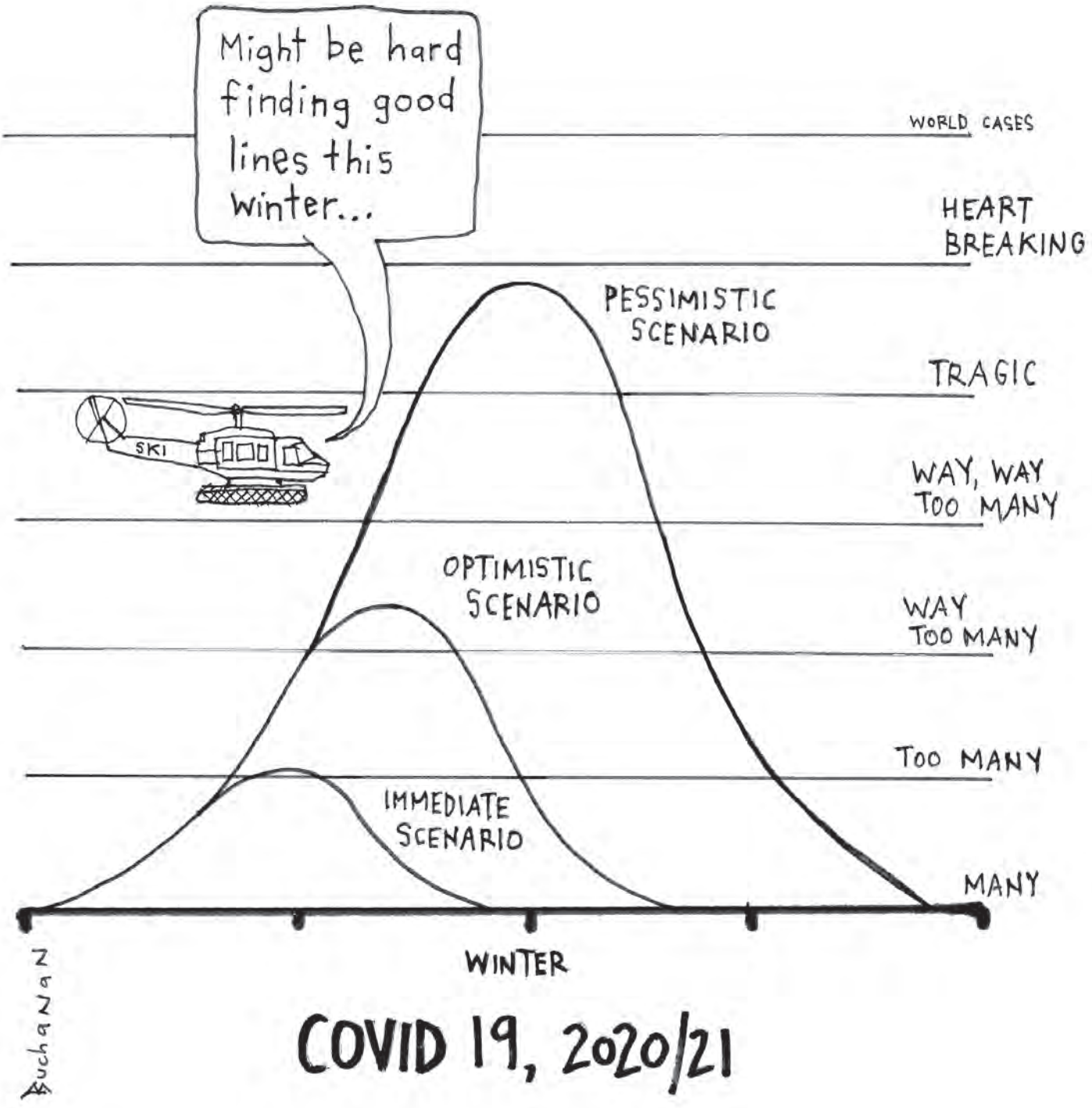
**TAJ:** On average, how much time do you spend on it every day?
**WF:** Depending on how much is happening locally and globally, two to four hours per day.

**TAJ:** What do you enjoy most about producing your blog?
**WF:** Trying to get information to people to help them make good decisions when recreating in the backcountry, and seeing how close I can be when estimating snow fall amounts.

**TAJ:** How does it feel to be recognized with the CAA Service Award?
**WF:** I'm very honoured, and have been inspired by all the members on the list.

# Flakes

**ROB BUCHANAN**



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