

# Avalanche

## REVIEW

VOLUME 30, NO. 2 • DECEMBER 2011

www.AmericanAvalancheAssociation.org

## Poco a Poco en Pimenton

Crown of a SS-N-R4-D4, Planta 6 and 7, after overloading of a conditionally unstable snowpack made up of crusts and facets. 115cm of 6% fell with very light winds. Moderate winds blew from the west (left-to-right over the ridge) at the end of the storm.

Photo by Tim Lane, August 2011

### Story by Matthew Primomo

Talking with Glenn Vitucci, I figured it would be an adventure: an experience and a great opportunity to live in a beautiful place and speak another language for a while. What I got from Matt McKee was messages like, “Don’t screw up, or they’ll throw your ass in jail,” and, “There are no safe zones anywhere around the camp.” Not that he said these exact words, but I got the idea. He also advised me, “It’s a great way to hone your skills and become a very talented avalanche forecaster.” Well alright, what the hell. (For Glenn and Matt’s Pimenton mine story, see TAR 28-2.)

Some of the job perks include 80km of high mountain road, of which some 60km are affected by avalanches. We had no weather

station, spotty internet, no radar, moldy projectiles, and chains of basal facets – and my Spanish was weak. I heard stories of storms that lasted for weeks on end. However, upon meeting don Tim Lane, the only guy I know who has 68 years and 90 winters under his belt, I realized it was a great decision. We had a remarkable lunch at his favorite restaurant and got to know each other. He was just like me, except over twice my age. After I had a chance to see the road and the camp for the first time, he put it out there, “You know we’re fu@\*ed, right?” I knew. That’s probably why we end up lurching til dark, swilling away our fears with double pisco sours and endless bottles of vino tinto every time we’re in Santiago together.

See story continued on page 14 ➡

### in this issue

From the President.....	2
From the Editor.....	2
Metamorphism.....	3
AAA News.....	4
What’s New.....	7
<b>Snow Science</b>	
Post-Control Releases.....	11
SkinTrack Wireless Backcountry Access Gate.....	12
<b>Crown Profiles</b>	
Poco a Poco en Pimenton.....	cover, 14
Chinook Pass Photo Centerfold.....	16
Avalanche Sequence.....	19
Season Summary: Payette Avalanche Center.....	30
Season Summary: New Zealand.....	31
<b>History</b>	
SLF Celebrates 75th Anniversary.....	18
The Avalanche Review Over 30 Years.....	20
<b>Education</b>	
Effective Team Development.....	24
Before & After the Avalanche.....	25
<b>Decision-Making</b>	
Heuristic Processing in Avalanche Terrain.....	26
Unfreeze - Change - Refreeze.....	28
Decision Fatigue.....	29

*Faerthen wanted TAR to be a resource for snow workers, something they’d turn to in top shacks and academic offices, a journal in which publication was an accomplishment.*

—Blase Reardon, *TAR in the 21st Century*, pg 23



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**The mission of the AAA is:**

- A. To provide information about snow and avalanches;
- B. To represent the professional interests of the United States avalanche community;
- C. To contribute toward high standards of professional competence and ethics for persons engaged in avalanche activities;
- D. To exchange technical information and maintain communications among persons engaged in avalanche activities;
- E. To provide direction for, promote, and support avalanche education in the US;
- F. To promote research and development in avalanche safety.

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**Articles,** including editorials, appearing in *The Avalanche Review* reflect the individual views of the authors and not the official points of view adopted by AAA or the organizations with which the authors are affiliated unless otherwise stated.

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# from the president Community, Knowledge, Professionalism

Friday, October 28, 2011

My favorite three words to describe the American Avalanche Association are: community, knowledge, and professionalism. Although I am typing this column in the early morning darkness, saddled by a brain fogged from jet lag, it's easy to identify some recent examples and share some thoughts about these important words and what they mean in giving back value to you, our member.

The AAA is quietly celebrating our 25th year of service to the American avalanche community. At this same time our venerable publication, *The Avalanche Review*, celebrates 30 years. There was once a time when turning 30 was thought to mark a slide toward middle age (and worse), but excitingly *The Avalanche Review* has grown only more vibrant and compelling. This advancement serves as a model for our association.

I would like to be able to personally thank by name all of our founding members and also those others who have added significantly to our association. But if I try, I will no doubt forget several or many. For fear of offending those whose names I might not remember, I'll take a safer course of action and offer a sincere, "Thank you!" to all who started our association and to those of you who continue to participate in the AAA. I will, however, single out one for a special "Thank you," and it goes to Mark Mueller, our executive director. Mark celebrates his 10th anniversary of managing the AAA. I hope when you see or talk with Mark you will kindly thank him. He deserves it.

Like *The Avalanche Review*, it's time for the American Avalanche Association to grow and flourish. And we are headed that direction. At our recent board meeting in Leadville, it was confirmed, as expected, that we are financially steady and stable. Our board continues to foster themes of community, knowledge, and professionalism. Two examples of community and knowledge are AAA's involvement in regional avalanche workshops and research grants.

By the time you read this, AAA will have helped support, along with local avalanche centers, workshops in Alaska, Colorado, Montana (x2), New Hampshire, Utah, and

Washington. Our industry partner C-I-L Explosives provides the financial support for AAA to help you. Most of the speakers are professional members. These workshops are great examples of AAA giving back to you.

The board also provided research grants to three women: Jody Bones, Sara Simonson, and Robin Wooldridge who are contributing to our knowledge. Normally, we only fund two grants, but this time the three proposals were solid and worthy. So, AAA is helping them help us.

Another way of giving back to our members is through membership services. As our association grows, Mark needs tools to better manage us. The board asked Mark to seek out a membership management program, and he was already a step or two ahead of us. Currently, he is looking at several Web-based programs that will enable him to manage our people, money, and resources. The board will make a decision and implement a program in spring 2012.

My third favorite word about AAA is professionalism, a forceful word for an attainable ambition where one strives for excellence in their occupational efforts. An interesting point about professionalism is that not all professionals achieve it, while some non-paid authorities do – and this can happen in the AAA. The success is not the paycheck; it is about the practitioner.

When seeing or hearing AAA members leading, instructing, or lecturing at regional, national, and international workshops, conferences and schools, the participants hear from the best-of-the-best. These AAA members are more than avalanche experts; they are leaders and mentors who meld knowledge, skills, experience, and attitudes with passion to produce an effect that not only informs but inspires. To me that is professionalism. It is what our best members do, and I can think of no better way to give back to all members of the American Avalanche Association. I hope your aspirations and passion will inspire you to achieve professionalism. —Dale Atkins, AAA president ❄️



# from the editor



Lynne and Chili-dog get some post-CSAW canyon time before the onset of another eight months of winter. Photo by Sue Miller

# MLK Rain Crust Merits Review

First real blizzard of the winter is sideways outside my windows. I am organizing gear, editing TAR 30-2, and planning for TAR 30-3. Seems like an early snow and a subsequent cold, dry month have created weak underpinnings for much of the West. It is always a struggle to balance desire and reality; a November fatality in Little Cottonwood unfortunately may serve as pre-season wake-up call to the hungry throngs. Social media changes the way we learn about and assimilate accidents; I wonder if subsequent behavior changes as rapidly?

This issue is a nice mix with no real central theme, but some remarkable photos and a taste of a variety of topics from decision-making to education to history, with a nice sprinkling of snow science. Historically speaking, we have a couple of articles from the SLF to commemorate their 75th birthday, then a hefty retrospective on the occasion of the 30th anniversary of *The Avalanche Review*. It was a great pleasure to compile essays from the preceding TAR editors; I only wish Sue Ferguson were able to see how her baby is growing up. A quest to print TAR cover shots sent many on the AAA board to their archives; thanks to our loyal supporters for their help, and especially to Sue's successors, my predecessors: Bruce Tremper, Steve Conger, Faerthen Felix, and Blase Reardon.

Potential contributors: don't wait for a theme issue; your articles are welcome any time. I always find that a theme brings up further thought and discussion such as Chris Zajchowski's linked heuristics articles or Alex Marienthal's discussion of decision fatigue after our spring human factor theme.

The February issue of TAR, 30-3, will cover a theme around last season's rain crust laid down in widespread distribution on the Martin Luther King weekend. Its subsequent burial and re-emergence as crucial layer in avalanche cycles merit some investigation. If you wrestled with this problem then we would love to hear from you. We'll have a mix of practical and theoretical, some astonishing photos, and hopefully some forecasting conclusions and tips for the next time we tackle the crust/facet problem.

And as of late November, I have no set theme for the April issue. Got any ideas? Case studies? Timely topics? Lines are open – let me know what you think.

—Lynne Wolfe ❄️

# corrections



NGI during annual safety training.

Christian Jaedicke from NGI in Norway wrote the article about the NGI group in TAR 30-1, not Krister Kristensen. *The Avalanche Review* regrets the error.

In TAR 30-1's EU season summaries, Alain Duclos was the photographer for the three avalanche photos on page 34,

in David George's article on last year's snow and avalanche season in France. The photos are from Alain's impressive Web site [www.data-avalanche.org](http://www.data-avalanche.org). *The Avalanche Review* regrets both errors and promises to pay closer attention to our colleagues across the Atlantic. ❄️

## metamorphosis

Congratulations and thank you to our newest Life Member, Russ Johnson, and to our other new AAA members:

### NEW PRO MEMBERS

Todd Hannan, Columbia Falls, MT  
 Gary Vaillancourt, Idaho Springs, CO  
 Brian Taylor, Frisco, CO  
 Tucker Patton, Olympic Valley, CA  
 Chris Bilbrey, Durango, CO  
 Mark Falender, Snowmass Village, CO  
 Toby Cruse, Dillon, CO  
 Michael Kotjetin, Zionsville, UT  
 Michael Buotte, Gallatin Gateway, MT  
 Andrew Gibson, Frisco, CO  
 Joe Stock, Anchorage, AK  
 Wendy Wagner, Salt Lake City, UT  
 Bob Tomsy, Salt Lake City, UT  
 Bill Romberg, Anchorage, AK  
 Victoria Kerr, Conifer, CO  
 Justin Peacock, Denver, CO  
 Olivia Cussen Race, Leavenworth, WA  
 David Riggs, Truckee, CA  
 Stefan Lofgren, Ashford, WA

John Gellings, Girdwood, AK  
 Timothy J. Miller, Anchorage, AK

### NEW AFFILIATE MEMBERS

Jennifer Boisvert, Anchorage, AK  
 Debra McGahn, Wasilla, AK  
 Bruce Wilkins, Seattle, WA  
 Ibrahim Loeks, Santa Fe, NM  
 Geoff Lodge, Portland, OR  
 Myron Allen, Laramie, WY  
 Michelle Jung, Boulder, CO  
 BJ Marraccini, Superior, CO  
 Brian Pollock, Westminster, CO  
 Carl Dowdy, Golden, CO  
 Janie Merickel Hodge, Breckenridge, CO  
 Jeremy Dobish, Golden, CO  
 John Raich, Ft. Collins, CO  
 Brad Acker, Boise, ID  
 Carlos Cummings, Bend, OR ❄️

## Brad Sawtell Leaves CAIC

The 2010/11 winter was my last season working as an avalanche forecaster and educator for the CAIC. My wife Heide and I moved from Colorado to the Methow Valley in Washington (Winthrop, to be specific). We chose to live closer to family, and the Methow is a community that we have wanted to be a part of for many years.

I hope to continue to work in the snow, weather, and avalanche field during the winter months and as a carpenter during the summer. I will miss working for the CAIC as well as the amazing staff whom I worked with for the previous nine winters. I will miss the early mornings, writing snowpack discussions and evaluating the avalanche danger for the public, Skype chats with colleagues before the sun rises, and playing the music to *Pop Goes the Weasel* in my head while breaking trail in Colorado's world-famous depth hoar and issuing "small dog" warnings on "breezy" days. I will also miss the many faces of other snow professionals I met and worked with at the various ski areas in Summit, Eagle, Lake, and Chaffee counties – including various search and rescue teams and CDOT highway crews – as well as showing old friends new zones to ski tour.

I look forward to being part of the winter community in Washington, exploring new terrain in the North Cascade Range, breaking trail over supportable snow with less wind, and needing a field lens to identify faceted grains. ❄️



## WSDOT Changes

Story by John Stimberis

There have been a few personnel changes at WSDOT South Central Region Avalanche Forecasting and Control Program. John Stimberis is now leading the avalanche forecasting and control program. There are also a few new faces in the program. Luca Adelfio from Moonlight Basin, Bryan Johnson from Schweitzer Mountain, and Mark O'Geen from Kirkwood have joined the program. WSDOT welcomes their knowledge and experience.

The Snoqualmie Pass/I-90 program will soon see the first phase of a large avalanche-mitigation project next summer. The I-90 Snoqualmie Pass East project expands a four-lane highway to six lanes along a five-mile section of mountain highway. The project will be completed by 2017, and it includes the largest snow net installation in North America, as well as a complete overhaul to the existing two-lanes snow shed. The South Central Region Avalanche Program encompasses both Interstate 90 over Snoqualmie Pass and State Route 410 over Chinook Pass. ❄️

## More CAIC News

Matt Steen has been hired as the San Juan forecaster for the CAIC. Matt grew up on the front range and learned to ski at El Conquistador in southern Colorado. His passion for skiing and snow science led him to ski patrol in Utah and Colorado, and he landed in the San Juans in 2001. Matt patrolled in Telluride for 10 years where he worked as a snow-safety supervisor, helping the ski area expand into new and uncharted terrain. He finished his ski patrolling career with an avalanche study that mapped Bear Creek, a backcountry playground adjacent to the ski area. In the summer he continues to explore the surrounding mountains in the southwest, and always loves to run through the sprinklers.

Tim Brown has been hired as the Breckenridge forecaster. Tim began his avalanche career in Crested Butte and started taking his curiosity about the natural world into the winter backcountry. He soon

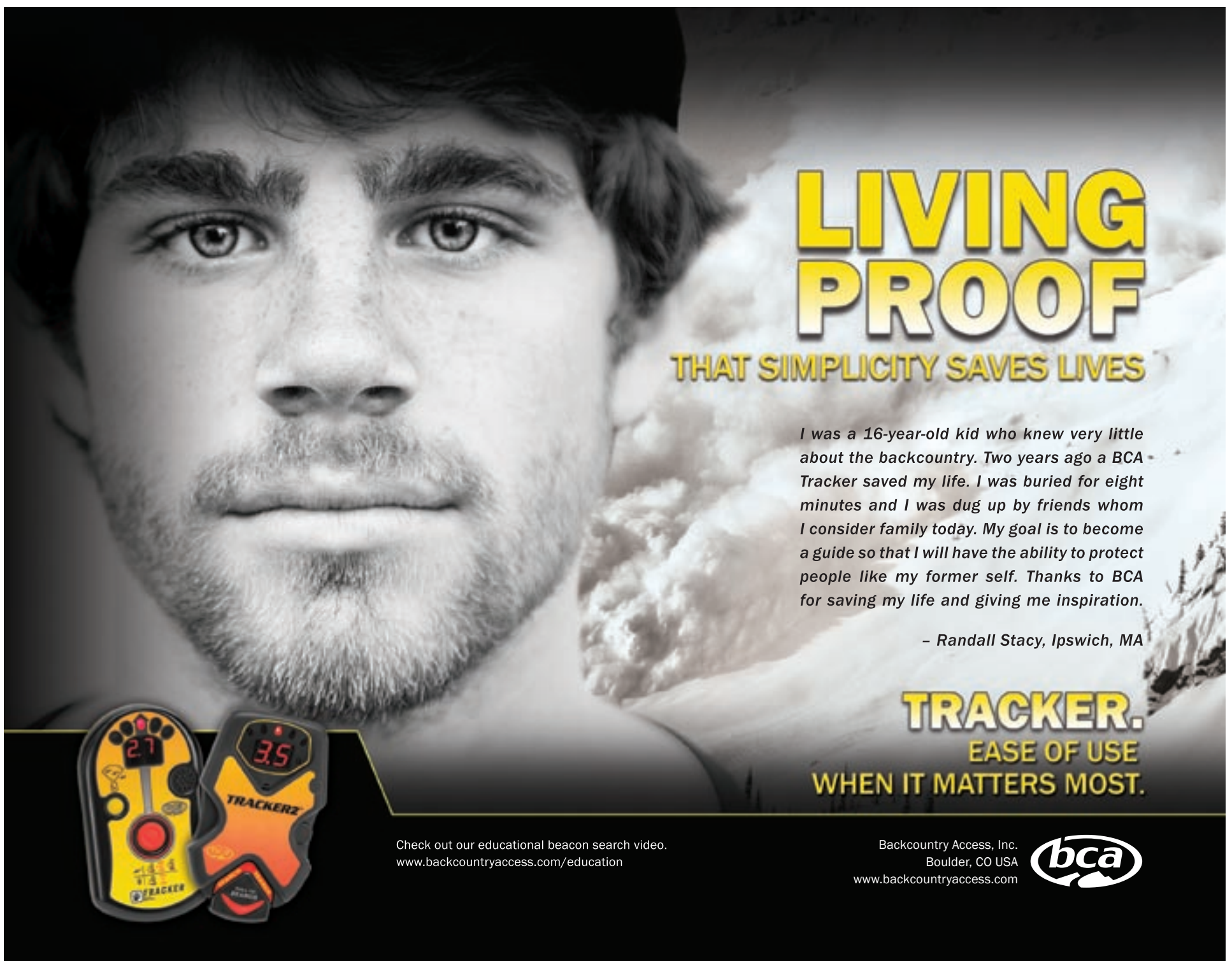
realized that what you don't know about snow actually *can* hurt you, so he found mentors to learn from. Now a fully certified IFMGA mountain guide, Tim spent the majority of the last decade guiding rock, alpine, and ski

mountaineering routes worldwide and teaching avalanche safety courses throughout the West. Tim continues to be intrigued by nuances of snow and is glad to know that the learning will never cease.

Ann Mellick has moved to a permanent position with the CAIC. She previously ran the Northern San Juan field office as both a backcountry and highway forecaster. She will now be running the new Ouray office, forecasting for Highways 550 and 145 over Red Mountain and Lizard Head passes. ❄️



Tim Brown joins CAIC.



# LIVING PROOF


THAT SIMPLICITY SAVES LIVES

I was a 16-year-old kid who knew very little about the backcountry. Two years ago a BCA Tracker saved my life. I was buried for eight minutes and I was dug up by friends whom I consider family today. My goal is to become a guide so that I will have the ability to protect people like my former self. Thanks to BCA for saving my life and giving me inspiration.

– Randall Stacy, Ipswich, MA


## TRACKER.

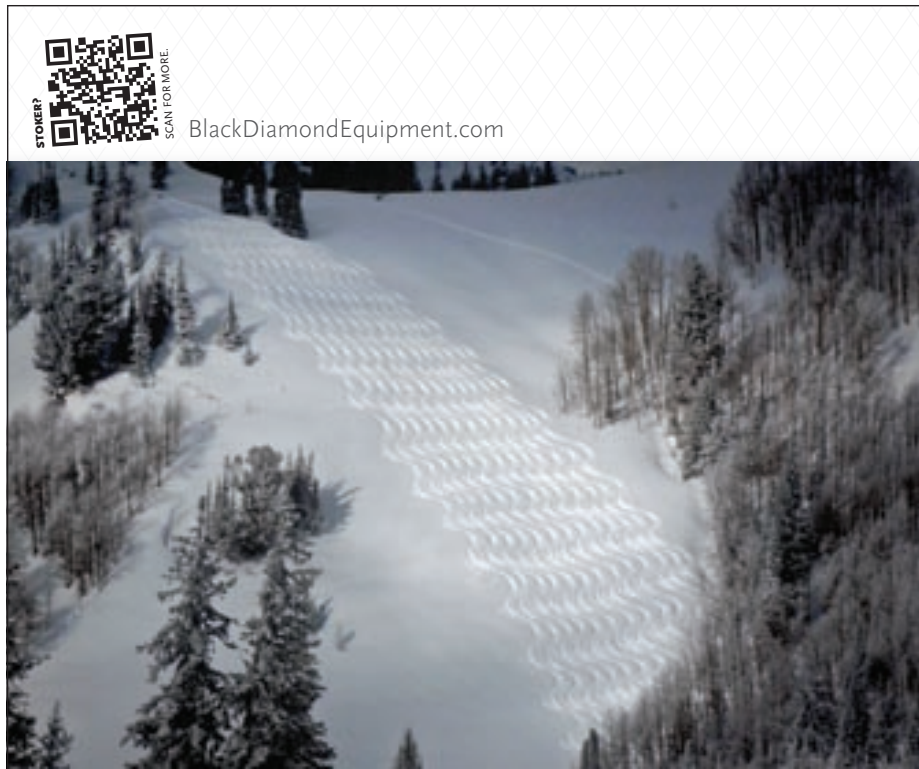
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## aaa news

### AAA Moves to Electronic Membership Communications: UPDATE your EMAIL!

Last spring, AAA began communicating with its members and subscribers using Constant Contact, an online email-marketing provider. This summer and fall we've sent renewal reminders and meeting notices. You only receive these electronic messages if we have a current usable email address for you.

What? You didn't receive any emails from AAA this summer and fall? Perhaps the email address we have for you is incorrect or not used anymore. Our email to you could have been spammed, but that is not common. You can set your spam filter to allow emails from aaa@avalanche.org. In some cases the mistake is mine: I entered your email address incorrectly. My bad. I'm working on correcting those errors. Email and address updates anytime during the year should be sent to aaa@avalanche.org.

In the future as we continue transitioning to more complete online membership management, you will manage all your contact information online.

The transition to electronic communications may take a little getting used to. We are applying a one-issue grace period to everyone for his or her membership and subscriptions to *The Avalanche Review* so everyone can adapt to our new program. Finally, thanks in advance for helping make this new program a success.

—Mark Mueller, AAA executive director ❄️

### AAA Fall Board Meeting Notes

The American Avalanche Association fall board meeting was held in the Kennecott Room, National Mining Museum Conference Center, Leadville, CO, on Thursday, October 13, 2011.

**Present:** Dale Atkins (*proxy for Mike Ferrari*), John Stimberis (*proxy for Patty Morrison*), Brad Sawtell, John Brennan, Jamie Yount, Scott Savage, Kirk Bachman, Jordy Hendrikx, Lynne Wolfe (*proxy for Blase Reardon, Kyle Tyler*), Sarah Carpenter (*proxy for Lel Tone*), Stuart Thompson, Halsted Morris (*proxy for Rick Grubin, Bill Williamson*), Mark Mueller.

1000 SWAG and all SAW workshops. Big expenses: future TAR and ED expenses. Looking very strong financially, but dues may decrease due to Paypal fees of 3.5%. Endowment account is down, rainy day fund. Dale: concerns- we work close to the line, how to increase revenue stream?

#### Membership Report

**Strong round of applications in spring;** the future looks to stay similar. Expired membership numbers are not valid due to grace period as we transition to electronic memberships and renewal reminders. Some new subscriptions from each of the SAW workshops. TAR is mailed 3rd class, doesn't get forwarded.

**Pro development grant proposals:** Spent more than budgeted, dependent on donation from CIL/ Orion (\$6400 this year, spent \$6750), then gave money to Sierra. So we are over, but this is a big member service. Got a lot of requests, some from new folks/ workshops, and was able to honor all requests:

CSAW, CO.....	\$2000	
USAW, UT.....	\$1500	
Whitefish, MT* .....	\$1000	
NSAS, WA.....	\$750	
ESAW, NH*.....	\$500	
AK.....	\$500	
MT.....	\$500	
TOTAL.....	\$6750	*new

There may be another Sierra event; Larry Heywood might ask for money; what to do? Budget for it now, give it to them. C-I-L Explosives money comes in at the end of last fiscal quarter. Should Sierra donation/other future monies for workshops go out dependent on dollar amount from them? Should we seek out corporate/gear donor for funds? Challenge other explosives folks to donate? Section reps: give verbal promo to C-I-L Explosives at workshops.

**ISSW promo:** Brainstorm how to get publicity for AAA RE: sponsorship at ISSW. Do we want to donate, get name on Web site, on book? Promote visibility at ISSW? T-shirts, hangtags.

**New decals:** GB, take them and hand around. But Mark spent too much money here – economy of scale: \$750 instead of \$500. Artwork by Nicole Greene for the 25th Anniversary decal.

**Taxes** due November 15, will get extension, complicated this year.

#### Call to Order, Introductions

**Welcome to Jordy Hendrikx**, new research chair. Jordy is from the MSU snow department that has a long history of snow research. Prior to that he worked at NIWA in NZ as a snow and avalanche scientist. He has a PhD on Milford Road with Conway, et al, and is interested in spatial variability in real-world issues.

#### Financial Status

**AAA is doing fine financially.** For details, please contact Mark Mueller. Avalanche center fees program has ended for several centers; most have their own 501(c)3 status through Friends groups now. We did just get contacted by Sawtooth NFAC to continue our non-profit umbrella as their 501(c)3 status is still pending. This program is sometimes a big headache, and a lot of work for Mark and the accountant.

**Expenses:** mostly reprinting SWAG, which generates a good amount of income. Gear Web site has not worked for six months. No expenses for printing membership directory since it's electronic, which saves money and trees.

**We run four bank accounts:** one for avalanche.org, one is Operations Acct. Most expenses are handled through the Operations Acct around AAA.org. Avalanche.org account site has \$56,000, generated by AC listings (map), gifted from avalanche.org when we took over control. We also maintain NAC account for AC pass-through funds, kept active in case someone needs tax-exempt umbrella. The fourth account is the Paypal pass-through for membership services which then goes to operations account. We maintain a flexible amount in the Paypal account of between \$1000-2000. The operations account has about \$25,000 right now, including printing

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**AAA Logo**

We are renewing our *Service Mark* for American Avalanche Association name.

**SWAG Copyright**

Need to protect our *intellectual property*. Ethan and AAA need to appear as authors, all except photos which are all donated. Application is filled out and ready to go.

**Electronic Renewal Service**

Right now we are using *Constant Contact* that doesn't store our database on their site. Started with spring renewal cycle which worked well with smaller numbers. Mark just has to input email, include links, then reminders. Can get numbers on how many get kicked back, and Mark just figured out how to get specifics on "undeliverables." Seems about the same effectiveness as hard copy mailing. Will send out one more reminder email. Ultimately, members will enter their own updated info into database instead of Mark making edits. Can set it up to auto-notify a month before a membership expires. Mark still spends lots of time with database – to make this more efficient is a crucial work flow improvement. Sometimes people revert to sending a check, and that is fine. We DO NOT give out email list, but can send out emails from us RE: benefits, section reps updates (LW offers to edit any section updates that reps want to send out). Maybe Mark should build a calendar to outline our schedule RE: government and membership, so that he could hand it over if necessary.

Once we decide we want to go fully electronic with database, it will go quickly, just migrate an Excel spreadsheet. Should do this in spring/summer. Choices to be made: go on fall/ spring membership renewal cycle? Board members: go to [www.wildapricot.com](http://www.wildapricot.com) to see what they offer, what our options are. Let's try to move to this by spring 2012. Everyone look at Web site by January 1 and form an opinion as to what we should do.

Mark will provide recommendations in one short doc RE: how to integrate this into our pre-existing systems. Can Mark come up with numbers for the cost for support/ migration? \$1000 annually, depends on how many entries in database. How much money might we save? Stamps (\$440), envelope-stuffing time, printing, Mark's time, then would omit Constant Comment. Do we get buy-in from the board?

**COMMITTEE BUSINESS/REPORTS****Publications/TAR: Lynne**

TAR is doing well with lots of great material and more interaction via Facebook. Doesn't cost much extra to print more pages. Let's put more content on the AAA Facebook page, everyone! We can make more people admins, or just post as regular folks.

*Avalanche history project:* Got interviews with Art Judson, Don Bachman, and Ron Perla. All mp3 files have been transcribed into Word docs to become pdfs and posted online.

**Research: Jordy**

Jordy Hendriks is the new Research Chair. *Fall academic grant proposals:* trying to keep them objective, not sent to directly involved supervisors. All got five to six reviews; all reviewers noted

that all proposals are high quality, all from women. Propose to fund all three, but can take out some costs with good advising. How much do we fund? Does GB want to see proposals? No, would prefer that only the qualified committee sees them; can request apps if board member wishes.

\$750 to Bones, \$750 to Simonson, \$500 to Wooldridge proposals: passes.

Jody Bones, MSU: *Exploring effectiveness of explosives for avalanche control.*

Sara Simonson, CSU: *Rapid loading, measuring paths with large loads, using data collection.*

Robin Wooldridge, MSU: *Explosives on snow – interested in impact on snow; do we see actual changes in snow?*

Jordy plans to structure review differently, make the process more transparent (see separate article from him in TAR 30-3). Jordy will put together a marking sheet with central questions and a scale sheet, numerical outputs, reviewers not related to proposals, then circulate this for comments and write a short article for the Feb issue (deadline December 1-15).

**Membership: Stuart**

*New Pro and Member Affiliates:* discussion on refining questions on pro applications so that it is easier to discern. All applications ultimately accepted.

*Establishing the application deadline:* do we need to change the deadline in order to make all applications fit our timing? No, this cluster always happens. Section reps, get after it early, please. Spring deadline is March 1 which gives us six weeks. August 1 Fall deadline gives us six weeks as well. Also having problems with the membership application pdf: GB members try to go online and fill out app, send it in. What version of Adobe Reader are you using?

**Education: Sarah and Kirk**

*AVPRO for 2011/12:* Last year AVPRO was at Aspen Highlands, which went well, some new things at AH. This year it will be held February 25 to March 4 at Telluride, where it is easy to run. Running more than one a year is a lot of work. Still have a good amount of scholarship money to give out. Looking for instructors to work them. It is a great program, better ratios at 15 rather than 18 students. Can we run one in Cascades/AK? Now harder to run them in Montana: different reqs. Utah ones haven't filled. Colorado has a market, plus very interesting snowpack. Clientele is mostly patrollers and DOT folks.

*NAS:* Where do we stand with this? Talk about flow chart. NAS is intro to AVPRO. Dale will go figure out the long answer, though.

*Course Provider Listing:* Program review.

*Guidelines for Snowmobile Education:* New ones from last winter, lots of input from people working in the snowmobile education field. Adopted by GB.

*Certified Instructor (CI) issues:* Stick with CI name, although there are some issues, perhaps legal, with the "certified" term.

*What to do with continuing education?* Make it an honor system; no one needs to admin/monitor it. Post on the Web site some examples of reqs and hours. Some folks think this should be mandatory; most of the CIs who



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Continued on page 8 ➡

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Photo: Simon Patterson



Halsted Morris, AAA awards chair, and Becks Hodgetts of the Arapahoe Basin ski patrol present the AAA Kingery award to Ian Borgeson at CSAW. Photo courtesy A Basin ski patrol

## Kingery Award Goes to Leif Borgeson

Story by Halsted Morris, AAA Awards and Memorial List Chair



The American Avalanche Association awarded one Bernie Kingery Award in 2011. This year the award was given posthumously to Leif Borgeson, who was the snow safety director at Arapahoe Basin Ski Area. The Kingery Award recognizes a sustained career by an AAA professional member, primarily engaged in field avalanche forecasting, mitigation, research, education, or safety. Leif’s career spanned all these areas.

The nominators of record for Leif’s award are Ethan Greene, Kelly Elder, Hal Hartman, John Snook, and Tim Finnegan; however, there was a virtual dogpile of Colorado avalanche professionals who wanted to be on the nominators list. Due to this, it seemed appropriate to present the award to Leif’s family at the Colorado Snow Avalanche Workshop (CSAW) in October. Leif had also made several presentations in the past at CSAW. Rebecca “Becks” Hodgetts of the Arapahoe Basin ski patrol wrote the following citation.

“Leif Borgeson was the quintessential snow practitioner commensurate to the qualifications for the Bernie Kingery Award. He began his career nearly 30 years ago at age 21 as a ski patroller at Arizona Snowbowl. His contribution to the avalanche community in Summit County, Colorado, began in 1984 at Keystone Resort. Leif transferred to Arapahoe Basin Ski Area in 1990. For the next 13 years he worked as a key member of a 12-person staff charged with managing 490 acres of Class 1 avalanche terrain.

“During his career he was an educator at Colorado Mountain College with the ‘avalanche simulator,’ co-founded the Rocky Mountain Avalanche School, taught at the Summit County Professional Avalanche School, and presented at Summit County Rescue Group avalanche seminars. An avid backcountry skier and Denali climber, Leif took part in numerous backcountry rescues with his certified avalanche dog. He traveled to Iceland as a ski area development and avalanche-mitigation advisor. Leif also spent a season on the La Rosiere ski patrol in France. Accolades include 1995 Colorado Ski Country USA Ski Patroller of the Year.

“Leif left the ski patrol briefly to become the training director for the National Ski Patrol in 2003. Unable to stay away from snow, he returned to ski patrolling at Copper Mountain for the 2003/04 season. Leif returned home to Arapahoe Basin as the ski patrol training coordinator a season later. A promotion to Arapahoe Basin Snow Safety Director in 2005 allowed Leif to focus his career on snow-safety leadership and snow-science research. Leif redesigned the ski area avalanche atlas, updating it to current industry standards. He also developed the avalanche mitigation plan for the Montezuma Bowl expansion, which nearly doubled the size of the ski area and included an additional 200 acres of Class 1 avalanche terrain.

“Leif partnered with other snow-safety experts from around the world to conduct wet-slab avalanche studies at the ski area. Leif freely shared his knowledge with his co-workers and as a co-author of several research papers which he presented at conferences such as the Colorado Snow and Avalanche Workshops, International Society of Explosives Engineers, and International Snow Science Workshops.

Leif unexpectedly passed away in February 2011 while doing his favorite thing – hiking and skiing with his son, Ian.”

Leif’s son Ian accepted the award on behalf of his family and the Arapahoe Basin ski patrol. ❄️

## Tahoe Hires Two Avalanche Forecasters

The Tahoe National Forest, Truckee Ranger District, is pleased to announce that Brandon Schwartz and Andy Anderson have been hired to fill our two FS meteorological technician (avalanche forecaster) positions. These are full-time seasonal (GS-8) 13/13 positions. Based in Truckee, CA, they will be responsible for the Forest Service and Sierra Avalanche Center’s (SAC) common mission to provide daily avalanche advisories for the Tahoe Region.

The Forest Service provides the infrastructure and supervision for the program while the SAC board and friends group provides the financial backing, community contacts, and support. We are so stoked to have these two skilled individuals on our team! Please welcome them and bring on the winter! ❄️

## what's new

# Why Measuring Snow Density Matters

Story by Craig Dostie

### Why does knowing the density of snow matter?

There are three common reasons. 1) To increase understanding of the snowpack for predicting avalanche hazard on a particular slope, 2) to estimate the amount of water in the snowpack (which contributes to forecasting knowledge), and 3) to know the density of snow as a percent, something skiers and snowboarders enjoy bragging about.

### Bragging Rights

Strictly speaking, percent snow is a measure of porosity – a ratio of the volume occupied by snow crystals versus the total volume of the sample. Snow density on the other hand is simply the mass per unit volume. However, since snow is frozen water, the easiest way to deduce the percentage of snow is to make a snow density measurement, then convert that value to percent.

A simple way to do that is to simply take the snow density value and move the decimal point to the left one digit. Thus a snow sample with a density of 50kg/m<sup>3</sup> is approximately 5% snow.

However, to be perfectly accurate one must account for the fact that snow, which is ice, does not have a density of 1.0g/cm<sup>3</sup> like water, but instead is 0.92g/cm<sup>3</sup>. Therefore to properly account for the fact that water expands as it becomes a solid means that a snow sample with a density of 50kg/m<sup>3</sup> is actually (5 x 1.09) percent, or 5.49% snow (see table at right). In reality, few skiers bother to prove their claims, spouting percentages merely to appear superior.

### Snow Density Versus Snow Percentage

Snow Density kg/m <sup>3</sup>	Percent Snow %
500	54.35%
200	21.74%
100	10.87%
50	5.43%
20	2.17%
10	1.09%
5	0.54%

### Estimating Water Content

For years hydrologists have been measuring snow density and converting it to the snow water equivalent (SWE) value to understand the amount of water held in a snow pack. This has practical value for estimating spring runoff in rivers, and water volume available for farming. It also has value in estimating avalanche activity.

According to *The Avalanche Handbook*, "The total precipitation (in mm of water equivalent) is more fundamental than new snow depth for avalanche prediction." Whether the snow falls as light and deep, or heavy and dense, either condition could be produced by an equal amount of water and thus create the same avalanche potential, though triggered by different types of events. Thus, knowing the SWE of a particular storm snowfall helps with the overall understanding of the snowpack.

To convert snow density to its equivalent water volume, or the snow water equivalent (SWE) you simply need to weigh a known volume of snow and then convert that to the equivalent volume of water for the same weight since the weight of water present, in either liquid or solid state, is the same. All that changes is the volume (and temperature).

$$\text{WeightSnow} = \text{WeightWater (same \# molecules)}$$

$$\frac{\text{DensityWater} = 1.0g / 1.0cm^3 = 1.0g / 1.0ml}{\text{Therefore:}}$$

$$\frac{\text{WeightSnow}}{\text{DensityWater}} = \text{VolumeWater}$$

## C-I-L Thrifty Snowlauncher Offers Benefits, Reduced Cost

C-I-L Explosives is introducing a new and revolutionary snowlauncher for this snow season. The Thrifty Snowlauncher is the culmination of a research project to deliver a "state of the art" product at a "thrifty price." Everett Clausen of C-I-L Explosives tells TAR that he wondered, "Why can't we develop something with a lower cost?" So they put some time into designing the Thrifty.

This innovative new snowlauncher utilizes stabilizer legs to keep the nose and body centered, allowing for a stabilized exit from the barrel – improving accuracy and allowing longer distance shots with the same pressure application. By replacing the traditional molecular explosives with a cap-sensitive colloidal, several benefits are achieved. The blackening of snow upon explosion is much reduced, the explosion is more voluminous in nature, and in the potential event of a "dud," the explosives degradation is faster and more complete in nature. The use of a cushion nose point will cut down on deflections and rock hit misfires, and the RECCO chip is still there doing its job. The crowning achievement of this research is that the price of the Thrifty is much lower than any of the conventional snowlaunchers. These units will be on the market and available as soon as DOTs have completed their paperwork and issue the formats.

### Avalanche Forecasting

While there are many other properties of a snowpack that will give a faster and more accurate indication of avalanche potential than snow density – such as relative the hardness of layers – measuring and keeping track of the snow density can provide important information for avalanche prediction.

There are many factors that contribute to the stability of a snowpack and the likelihood of an avalanche occurring. Super dense snow may be an indication of a stable snowpack if this condition exists throughout the snowpack. Changes in density can indicate weaknesses too, or help to quantify differences between layers in the snowpack such as a buried surface hoar layer, a strong melt freeze crust, or changes in grain types. These are structural factors that are difficult to interpret because they don't indicate instability by themselves.

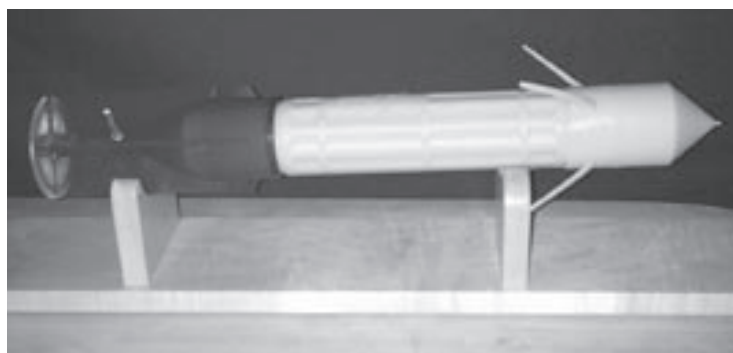
Though there is no threshold value for snow density to indicate the formation of a slab, the denser a snowfall is, the more likely it will form a slab. Avalanche instructor and one of the guiding forces in AIARE curriculum, Colin Zacharius, says, "One condition of particular concern is when warmer, denser snow falls over cooler, less dense snow." This has the signature of a heavy slab over a weak layer that could shear. The question is, what sort of trigger could make that happen? That's where SWE comes in, as it helps to quantify the load intuitively. With experience, you can anticipate the level of trigger needed: a breath of wind, a snowboarder, a snowmobile, or hopefully, nothing.

Measuring snow density can be done in a crude form by documenting hardness changes in penetration, such as fist, finger, pencil hardness. A snow-density gauge adds more precision to such measurements which will certainly help with an overall awareness of conditions over time, provided density is measured in a consistent way throughout the season, but may not necessarily help with prediction at a specific time and location. Snow density is one more factor that professionals use along with other snow-structure factors in their evaluation of instability. Knowledge is power when used in the right hands.

There are two things to keep in mind when performing this measurement. The first is that it is difficult to obtain an accurate sample of snow in a container without causing a shift in the density of the sample being measured. The volume of the container may not be completely filled, or the snow will be packed tighter in the container as a result of attempting to fill it.

In the case of very light density snow, the simple act of transferring it to a container will cause settling and packing of the snow which increases its density. So sampling errors can be a problem with measuring snow density, especially with low density snow. As the density of the snow increases, the probability of sampling error is reduced though it is still dependent on good technique.

*Craig Dostie is the former publisher of Couloir magazine and a freelance writer. While editing product copy for Brooks-Range catalogs and Web site the desire to revise their snow-density gauges arose. This article was written in conjunction with developing a new set of snow density/SWE gauges for Brooks-Range. For more detailed snow-density research figures, please contact Craig Dostie at [cdostie@earnyourturns.com](mailto:cdostie@earnyourturns.com), or the editor.*

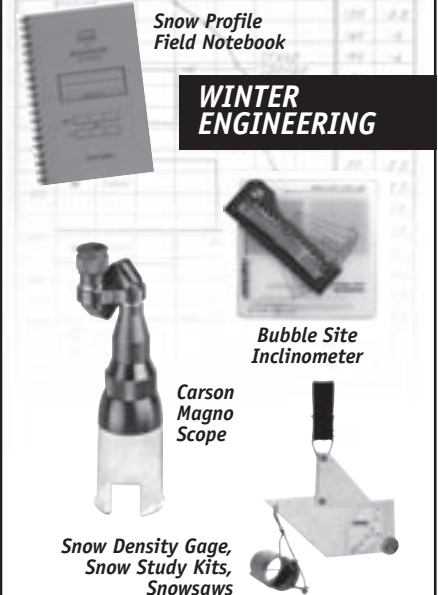


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The Northern Rockies Avalanche Safety Workshop attracted 220 attendees for its inaugural event. Here, Ted Steiner kicks off the workshop with a big welcome.

## Northern Rockies Avalanche Safety Workshop Kicked Off in October

Story by Erich Peitzsch and Ted Steiner, NRASW steering committee • photos courtesy GlacierWorld.com

The inaugural Northern Rockies Avalanche Safety Workshop (NRASW) took place in Whitefish, Montana, on October 1. The one-day regional avalanche safety gathering featured guest speakers, vendor displays/demonstrations, lots of awesome raffle prizes, and over 220 attendees. Five guest speakers each spoke for 40 minutes with 20 minutes available for questions from attendees. Following the lecture portion, an after-event social hour took place at the Great Northern Brewery.

NRASW planning began in mid-June, and getting organized by October was certainly a challenge. We were fortunate to meet this task with a dedicated, positive, and tireless volunteer steering committee.

NRASW could not have taken place without the support of our sponsors. First and foremost was the American Avalanche Association, which was the first organization to step in and provide seed money. THANK YOU! We would also like to recognize additional nonprofit-based financial assistance provided by the Flathead Nordic Ski Patrol (FNSP), the Northern Division of the National Ski Patrol, Whitefish Mountain Resort Ski Patrol, Glacier Country Avalanche Center Inc. (GCAC, Inc.), Whitefish Community Foundation, Great Falls Ski Patrol, and the national office of the National Ski Patrol.

Vendors included local retailers as well as nationally based avalanche safety equipment manufacturers. Overall, 42 financial and in-kind sponsors supported the workshop and were critical for its success. The workshop audience was comprised of avalanche industry professionals as well as winter backcountry enthusiasts from various areas in Montana, Idaho, and Washington. Post-event evaluations indicate that, overall, attendees enjoyed the information presented by guest speakers and overwhelmingly requested that NRASW become an annual event.

The speaker lineup included avalanche professionals with over a century of cumulative avalanche-safety

experience under their belts. Lynne Wolfe, editor-in-chief of *The Avalanche Review* and seasoned Exum guide, started the morning by discussing the human factor of traveling in avalanche terrain. She discussed the intuitive, impulsive, and analytical components present in winter backcountry decision-making.

Jordy Hendriks, director of the Snow and Avalanche Laboratory at Montana State University in Bozeman, was the next speaker in the lineup. Jordy discussed the importance of spatial variability when conducting and interpreting stability tests in the field.

Mark Staples, was able to join us despite nursing a case of “throttle thumb” from the past winter. Mark, an avalanche forecaster with the Gallatin National Forest Avalanche Center, discussed traveling in avalanche terrain with an emphasis on using snowmachines. He discussed the similarities, but also the important differences, in ways to assess slope stability on a snowmobile versus other modes of travel.

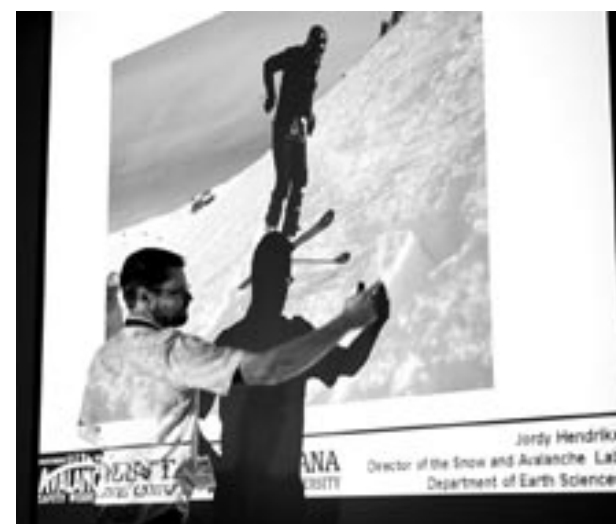
After lunch, Doug Richmond, director of the Bridger Bowl ski patrol, roused the crowd and focused his presentation on identifying “bull’s eye” field information and combining that information with snow and weather information for recreational “now-casting.” He emphasized the importance of this field schooling component which underlies his motto: “To know there, go there.”

Batting cleanup, Don Sharaf, co-owner of the American Avalanche Institute and forecaster/lead guide for Valdez Heli-Ski Guides, ended the speaker session by discussing the importance of various electronic and field-based resources to track and assess snowpack, weather events, and slope stability over the course of a season.

While each presenter focused on a different topic, the theme throughout the workshop remained constant: the importance of revisiting the basics when traveling and assessing slope stability in avalanche terrain.



Between sessions participants mingle and fondle skis and avalanche tools at sponsor’s tables.



Jordy Hendriks, AAA research chair and director of the Snow and Avalanche Lab at Montana State University, discusses how to minimize the false stable rate by using one of the propagation propensity tests (PST and ECT) rather than or as an addition to the pictured Rutschblock.

NRASW was a “net zero” event with all money raised above and beyond the workshop’s overhead costs donated to the nonprofit avalanche center Friends group, GCAC, Inc., and our local backcountry winter rescue group, FNSP. For more information about the NRASW event and its sponsors, please go to [www.avalanchesafetyworkshop.com](http://www.avalanchesafetyworkshop.com). ❄️

### AAA BOARD NEWS

*continued from page 5*

responded to survey did not want more requirements to fulfill.

**New CI reqs?** Have a rotating committee with Jerry as the lead, two other folks who are also CIs. Make a scoring sheet that keeps objectivity; maybe Jerry already has one? Post e-app on Google docs for committee to review. Increases credibility of program. Only real req is to keep pro membership up. Check box on your re-up form. Lots of discussion on this, many folks firmly believe that this should be mandatory.

**Motion:** Stuart moves that CI comm (Brad, John, Jerry), bring appropriate reqs for CI professional development to GB fully formed. Bring it to GB in order to be in Feb TAR (deadline December

1-15). Passes. Finances/ how to pay for it comes in the plan.

#### Old Business

**Avalanche.org:** Brett resigned; not enough time. Perhaps we should stick with Shirley who knows the Web site better than anyone? Yes. Mark has been managing avalanche.org site; now asking for \$200 a month extra, to come out of the avalanche.org account. Passed.

#### New Business

**Yearbook as per Krister Kristensen?** Maybe instead of every year, do it only once as celebration of AAA 25th anniversary. Sell a few pages of advertising? Cherry-pick some articles? X amount per year, make a little money. Make it a NICE book, not just digital. We need someone to put together a

plan, pull together a list: Halsted will get it started. Stuart will help. Will try to come up with a plan by the first of the year.

**Fall 2011 AAA 25th Anniversary:** nothing planned right now, see yearbook above. Stickers commemorate anniversary.

**Email voting between board meetings:** mostly yes/no topics that require little discussion. How many responses do we require? Half? Do we need a quorum or everyone/ unanimous need to respond? Depends if it is a matter that needs a vote or not/ policy or administrative matter. Needs clarification.

**AAA intellectual property:** how to share. Last year a group wanted to use part of SWAG in smartphone app: can they? Also, Brooks-Range wants to use SWAG material in card for profit. We might want to come up with a policy for the future. Suggestions: Can they

make material available to membership at discount? Make sure we are fully recognized, propose for them to say in the future: “used by permission of the American Avalanche Association.” We are not using that language at this time, but would like to standardize what is used. Not an easy solution to this problem, but it will be copyrighted soon. Overall, we want to get this material out there without hassle as it was gifted to us. Ethan and Mark will discuss this, come up with a solution for the user groups. Maybe make a donation to the education fund?

#### Spring Meeting Location & Date

The next AAA board meeting will be held somewhere in the Pacific Northwest, May 19 weekend, after artillery users meeting. John Stimeris is in charge. ❄️



## Squaw Valley Buys Alpine Meadows Implications for Ski Area Backcountry Access Still up in the Air

Story by Craig Dostie

The unthinkable has occurred. Squaw Valley has bought Alpine Meadows. Andy Wirth, CEO of Squaw Valley confirmed the news with an announcement on TahoeTV. The simple ramifications of this announcement are that passholders at either resort can now ski at the other. This does not, however, mean that skiers from Squaw can legally ski over to Alpine Meadows from the top of the KT-22 chairlift. The terrain between the two is owned by Troy Caldwell who has been slowly working to develop the White Wolf ski resort, located inbetween the two resorts. In fact, in a bureaucratic blunder several years ago, he managed to obtain ownership to the very parcel of land where the KT lift offloads.

No doubt he is in a very lucrative bargaining position at this point. Until that deal is closed, it appears that some sort of shuttle will probably be arranged for skiers wishing to ski at both resorts on the same day.

From a backcountry perspective this is excellent news for Squaw skiers, but dubious for Alpine skiers.

Squaw Valley has had a closed boundary policy since forever. The reason is simple. Squaw owns the land their lifts are on, so they are liable for any accidents that may occur from someone leaving their boundaries and skiing onto the surrounding forest service land.

Alpine Meadows leases their land from the forest service, and when the conditions are acceptable, allows skiers to travel out of bounds. If someone were to be injured while skiing out of bounds and sued for damages, they would be suing the USFS, an entity that will not easily be made to pay for such actions.

With the combining of Squaw and Alpine, Squaw skiers will not have "legal" access to backcountry terrain from the Alpine Meadows side. Conversely, Alpine Meadows skiers who yearn for the sustained steeps of Squaw will now have access to those slopes too.

It will be interesting to see how Squaw Valley and Alpine Meadows work out the logistics of this merger, particularly with regards to the missing link known as White Wolf.

More to come as more is learned.

Craig Dostie is the former publisher of Couloir magazine and a freelance writer. ❄️

## SnowPilot Upgrade Now Available

Story by Doug Chabot

A new version of SnowPilot has just been released. If you have never used SnowPilot, check out the Web site at [www.snowpilot.org](http://www.snowpilot.org) where you'll find great information on this free program. A YouTube tutorial is even available to help you learn how to use the program.

If you already have SnowPilot, an upgrade is required. SnowPilot has been moved to a new, more stable server, which requires the newest version to access. All users *must* upgrade to the newest version in order to synch your pits with the database as well as search for snowpits. There are new added features as well: international snow symbols; saving pits as CAAML; ability to write long, detailed notes; addition of the Propagation Saw Test; linear or exponential graphing; highlighting the layer of most concern.

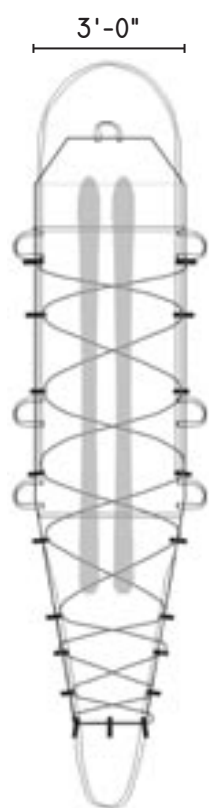
### Upgrade SnowPilot in Two Easy Steps:

1. Download the new version (Version 8 build 1194) at <http://snowpilot.org/downloads/PC-Pilot.jar>
2. Save PC-Pilot.jar to the exact folder that holds your older version. You will overwrite your old version with this new one.
  - a. This new version is 100% compatible with older ones. All your user preferences and snowpits will populate this newest version. Please send all your pits to the database. Researchers are counting on them!
  - b. After you installed V.8 build 1194, make sure you are online and open SnowPilot. The box "SnowPilot News" will pop up indicating you are connected to the web and ready to send pits.
  - c. Click <Select> in the upper left corner.
  - d. Click <Send Data to Web>. If you have a lot of pits, the upload might take a while.

After you upload pits, I recommend deleting them from SnowPilot to keep the dropdown list manageable. Remember, you can save any pit as a jpg or save the raw data. Plus you can always retrieve your pit information from the database. The choice is yours; it will not affect the usability at all.

Doug Chabot is the director of the Gallatin National Forest Avalanche Center and has worked as a professional mountain guide in Alaska and the western US from 1989 to the present. Doug has been on 16 Alaskan climbing expeditions as well as climbs in Nepal, India, Afghanistan and Pakistan, and has worked in Pakistan and Afghanistan building schools for a non-governmental organization. Please drop him a line if you have any questions or problems with SnowPilot; he can be reached at [dchabot@fs.fed.us](mailto:dchabot@fs.fed.us). ❄️

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## Ullr Labs Releases First Electronic Avalanche Field Notebook

Ullr Labs announced that their Mobile Avalanche Safety Tool™ (MAST) for iPhone can be purchased from the iTunes Store by visiting [www.ullrlabs.com/tar](http://www.ullrlabs.com/tar). MAST™ combines the camera, GPS, compass, and clinometer built into an iPhone with the features of an avalanche field notebook to help winter snow enthusiasts make better backcountry travel decisions. Users can:

- Download the most recent avalanche forecast and Danger Rose for the area they plan to tour.
- Easily record weather, terrain, and snowpack conditions along their route – without the need for a cell phone signal.
- Record location, slope angle, aspect, and a photo of the site in one easy step.
- Use scroll wheels, sliders, and touch buttons to record weather conditions, terrain, snowpit layers, and stability test results – all based on the Snow, Weather, and Avalanche Guideline (SWAG) standards. Several pen-based tools are available to use the iPhone touchscreen without removing gloves.
- Receive warnings when the data suggests high-risk conditions, based on established snow science.
- Record avalanche incidents – location, slope angle, aspect, and a photo of the site, type, size, cause, and number of people involved.
- Transmit the observations to the appropriate avalanche center, where they can be shared with forecasters and other backcountry travelers.
- Link to a wide variety of videos and other resources to learn and sharpen skills.

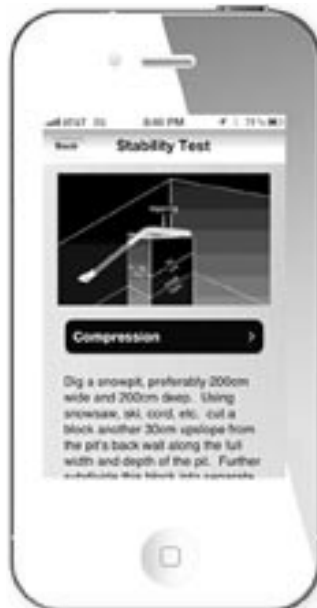
This project resulted from the efforts of Bob Hoffman and Scott Chamberlin, two backcountry enthusiasts who first met through the internet forum sponsored by Teton Gravity Research. They collaborated for four months before meeting face-to-face – 30 minutes before presenting their idea and early code to Mark Moore at the Northwest Weather and Avalanche Center (NWAC). Mark and the NWAC's Friends of the Avalanche Center liked the idea and made several introductions that helped the Ullr team get things rolling.

"We want to thank Mark, Andy Anderson, Bruce Tremper, Ethan Greene, Karl Birkeland, and Nate Greenberg for their advice and encouragement during our development phase," said Bob and Scott. "Their ideas have made this a much better product. We also want to thank the American Avalanche Association and Ron Simenhois for letting us use the stability test diagrams from Section 2 of SWAG."

Recognizing the importance of regional avalanche forecasts and information exchange to backcountry safety, Ullr Labs is donating 10% of its gross license fees to the avalanche centers (or Friends organization) where MAST's users are located.

Bob and Scott are working with SAC, ESAC, UAC, and CAIC to integrate data transmission between MAST and their Web observation forms. Regional centers without an observation input form on their Web site can create their own with just a few lines of code provided by Ullr Labs.

The company is also looking for a way to provide the application free to AAA and AIARE-certified instructors. "We hope instructors can use MAST™ to help students analyze the effect of snow, weather, and terrain conditions, and to provide access to other educational resources," said Scott and Bob. "Unfortunately, we are still trying to figure out a way to distribute both a paid and a free version of the same code without offending iTunes. It will happen, but it may take a little time." ❄️



Above: a few different views of the functionality of this new iPhone app.

## Man Receives 3 Months Suspended Sentence for Forgetting Beacon

Story by David George at [www.pistehors.com](http://www.pistehors.com)

An Austrian ski tourer has received a three month [suspended] prison sentence for the manslaughter of his wife. The case centered around the use of avalanche beacons. According to the Salzburg court he was touring with his supposedly inexperienced wife with their beacons switched off and in their rucksacks.

Fresh snow had fallen on March 17, 2010, when the couple undertook a tour to Radstadt near Obertauern. The man told Austrian radio, "We thought we'd go down a safe route. We were sure that we would not need our beacons. My wife has always trusted me." After testing the snowpack with other tourers, the woman went on ahead with the man following behind to help in case of problems. He apparently triggered a slab measuring 80 by 250 meters which buried his wife. The slide occurred on a 35-degree slope; the risk was given as considerable (3/5). The lack of beacon seriously delayed finding the victim even when rescue services arrived on the scene. The 58-year-old woman had suffered from serious head injuries after being buried over a meter deep in dense snow. The defendant's lawyer was stunned by the verdict and said he and his client needed time to decide whether to appeal.

If the sentence is not appealed it will add to case law, putting additional responsibilities on more experienced members of backcountry groups (already established in France) and could effectively mandate trailhead transceiver checks, at least in Austria. One might think that losing his wife was punishment enough, but the ruling may leave the man open to additional civil claims by the victim's family.

### Verdict Surprised Experts

Michael Larcher, director of education of the Austrian Alpine Association has questioned the verdict. He points out that although the woman was less experienced than her husband, they had been touring together for years. "She was no beginner, but had enough personal knowledge to know to turn on her beacon," Larcher points out. "Given that the lack of beacon was the main reason for the verdict, in my opinion, you cannot put all the responsibility on the husband – it is an issue of personal responsibility."

Estolf Müller, representing the Austrian Mountain Rescue Service, said that "judging who is experienced is legally very difficult. I'm really sceptical when the courts intervene in a private sport so long as innocent bystanders are not endangered. When you go into the backcountry everyone has to be responsible for themselves."

David George manages an English-language Web site on mountain, ski, and avalanche-related topics in the Alps: [www.pistehors.com](http://www.pistehors.com). ❄️

## Snow Sense: Fifth Edition 2011 by Doug Fesler & Jill Fredston

Review by Lynne Wolfe

Do you teach level 1 avalanche courses and require Snow Sense as your text? In recent years, have you found yourself printing and distributing an additional set of handouts on topics like the ECT, shear quality, and strategic shoveling?

Well, handouts no more. There's a new updated Snow Sense available, and it's just as down-to-earth as the previous incarnations, but revised and updated to reflect recent research and practice. Even though Doug and Jill have been on their sailboat for months, they've remained current in the field. The editing expertise of Doug Chabot and Karl Birkeland adds depth and expertise, but we can still hear Doug and Jill's distinctive voices continuing to tell us, in a "prepare for emergencies" paragraph, to "be sure to bring a functioning brain."

In addition to the initial notes, changes include using "facets" rather than "TG" or "kinetic metamorphism;" this updated language is further reflected in the checklist, where the snowpack and human factor sectors have been rewritten. The best update, however, replaces the dated stress/strength explanations and diagrams of snow failure with an entirely new chapter on Deformation: how snow behaves as a material. The reader is treated to a discussion of spatial and temporal variability, trigger zones, and propagation propensity as up-to-date as anything in TAR or presented at one of the fall workshops. This chapter would be a great pre or post reading for your level 1 (or level 2) lecture on fracture mechanics, to help you explain or your students understand the phenomenon.

Other improvements noted include a new section on precautions for sledgers and moving the weather chapter BEFORE the snowpack chapter to better reflect weather as the architect of the snowpack. Rescue becomes its own chapter rather than an afterthought. It seems to be a conscious choice not to try to teach beacon search in a textbook, to leave it for the field and follow manufacturer's directions. There is in-depth discussion of managing a rescue – as victim and as rescuer – including an emphatic section on common mistakes, all obviously based on years of experience. Strategic shoveling is mentioned, one photo included, but I would have liked to see more information and better graphics on this topic.

Finally, the photos remain fabulous, clear and illustrative of important points, taken from Doug and Jill's vast library of experience. The new Snow Sense is almost a picture book, reminiscent of LaChapelle's *Secrets of the Snow*. Pick up a copy; you'll see that old dogs can learn new tricks, on top of the long-time highly successful old tricks.

The new Snow Sense will be available soon at Amazon, REI, and various mountain shops. Several Friends groups are also selling them. Wholesale bulk orders can be placed through Alaska Mountain Safety Center at [snowsensebook@gmail.com](mailto:snowsensebook@gmail.com). ❄️





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## snow science



A post-control release leaves a lot of room for uncertainty. When Liberty Bowl at Big Sky went in December 2007, probe lines and time proved that, luckily, no one was caught.

### Post-Control Release Seminar

Story & photos by Scott Savage

The Gallatin National Forest Avalanche Center hosted a professional development seminar in Bozeman on March 9, 2011. The AAA, working with a generous C-I-L Explosives donation, sponsored the post-control release (PCR) and surprise avalanche workshop. Ski-area forecasters and patrollers, highway forecasters, backcountry forecasters, educators, researchers, graduate students, and Forest Service snow rangers attended the day-long event. The participants' diverse backgrounds and a small class size (roughly 25 people, plus speakers) helped generate several interesting discussions.

Karl Birkeland (*USFS National Avalanche Center, Montana State University*) began the day with a review of some basic fracture-mechanics principles, leading to their possible implications on PCRs. Karl explored the avalanche community's current understanding of crack initiation, crack growth, crack propagation, and ultimately avalanche release. Using Norm Wilson's famous *Right Charge, Right Place, Right Time* mantra as a backdrop, Karl finished by presenting some theories on how failures to initiate or propagate cracks might help explain PCRs.

Dan Miller (*Montana State University*) presented results from his recent work on the snowpack's response to explosives. Dan and his students and colleagues are measuring the dynamic response to detonations using sensors placed at various depths in the snowpack and multiple horizontal distances from the charge. They compared the responses for different shot locations (relative to the snow surface) as well. Hopefully Dan's field work and computer modeling will continue to help us understand how explosives release avalanches – keep up the great work!

Alec van Herwijnen (*SLF Davos, Montana State University*) presented a simple fracture mechanical field test that mere mortals can perform. Alec demonstrated how to perform the test and explained the wealth of fracture-related information that he and other researchers can obtain from the results. Alec's depth of understanding of fracture in snow was extremely valuable to the crowd – please contact Alec at [alec.van.herwijnen@gmail.com](mailto:alec.van.herwijnen@gmail.com) if you're interested in collecting data for him this winter so he can

continue shedding light on fracturing in snow.

After hearing from three talented researchers, it was time to delve into some real world examples. Eric Knoff (*Gallatin NF Avalanche Center*) spoke about "unusual avalanches" at Snowbird, Utah, where he worked for years as a patroller. Jimmy Collinson (*Snowbird Snow Safety*), who was scheduled to speak but unfortunately could not attend, provided some material for Eric's presentation. Eric began with a skier-triggered PCR that caught multiple people and fully buried one skier in 1982. Next, he presented a surprisingly large explosives-triggered slide that pulled out a heavily ski-compacted slope that had been open most of December 2007. This slide propagated over 200m wide and the crown was up to 3m deep. Eric's final example was a natural release that occurred in the middle of the night in January 2006, pulling out another ski-compacted slope – yikes!

Jordy Hendrikx (*Montana State University*) shared insights that he gained during his time working on the Milford Road in New Zealand. Jordy explained how the program successfully deals with some of the most extreme snow and avalanche conditions in the world. While a surprise avalanche destroyed the tunnel portal during an avalanche closure (no public were on the road), Jordy did not document any PCRs during his time there. Given the intense precipitation events, jaw-dropping terrain, and rain-on-snow and glide-avalanche problems encountered on the Milford Road, I was surprised by the lack of surprise avalanches and PCRs that Jordy and his colleagues observed. Jordy attributes the ongoing forecasting and mitigation success to excellent weather instrumentation and a tightly managed program.

Doug Abromeit (*recently retired from the USFS National Avalanche Center*) pulled double duty, presenting two separate talks. He first spoke about the rash of ski area avalanche incidents during the 2008/09 winter and the Forest Service perspective on these events. Doug covered a few incidents in-depth, explaining the conditions that created the events and any subsequent changes in operations or policy. Doug

Continued on page 13 ➡

### So what *are* PCRs & surprise avalanches?

Karl Birkeland and others hashed out the following definitions last winter:

**PCRs** (post-control releases) are avalanches that occur on a slope after mitigation measures (explosives and/or ski cutting) have been applied to that slope, and they are not associated with any significant snowpack loading between the original control measures and the avalanche. Of particular interest are PCR avalanches whose slab boundaries take out one or more prior shot holes or the locations of air blasts.

A **surprise avalanche** meets at least one of the following criteria:

- catches an avalanche professional
- occurs on a slope after mitigation work has been completed
- occurs on a slope after an avalanche professional has deemed the slope stable
- the size or scope of the avalanche far exceeds expectations



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# SkinTrack: Wireless Embedded System Monitors Lift-Served Backcountry Access Gates

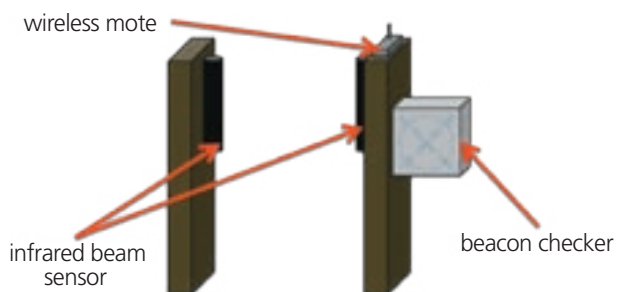
Story by Marc J. Rubin & Tracy K. Camp



Many ski resorts (such as Vail, pictured above) have backcountry access gates that are not monitored in any way.

**Many ski resorts** have backcountry gates that offer patrons quick and easy access to dangerous and uncontrolled avalanche terrain. Beyond resort boundaries, ski patrollers are not responsible for maintaining snowpack stability or for rescuing injured patrons. When backcountry users pass through access gates, they assume all liability for their own safety and well being. Though many ski resorts offer lift-served backcountry access, the gate usage is not tracked in any way. Ski resorts have no idea how many people use such gates and whether or not they carry the proper safety equipment (i.e., avalanche transceiver, shovel, probe). With funds from an American Avalanche Association Graduate Student Research Grant, we have designed and implemented SkinTrack: a wireless embedded system capable of monitoring lift-served backcountry access gates.

SkinTrack is designed to count the number of people passing through backcountry access gates with and without transmitting avalanche transceivers (Figure 2). Such backcountry usage information could be useful in many ways. First, in the event of a backcountry avalanche, local search and rescue teams would have near real-time data (i.e., number of people, number of beacons, last known time and location) that could aid recovery efforts. Second, avalanche forecasting and research institutions could analyze usage statistics to gain an understanding of the backcountry population. Lastly, ski resorts could use the information to inform risk management decisions (e.g., should we close the gate during peak tourist season?).

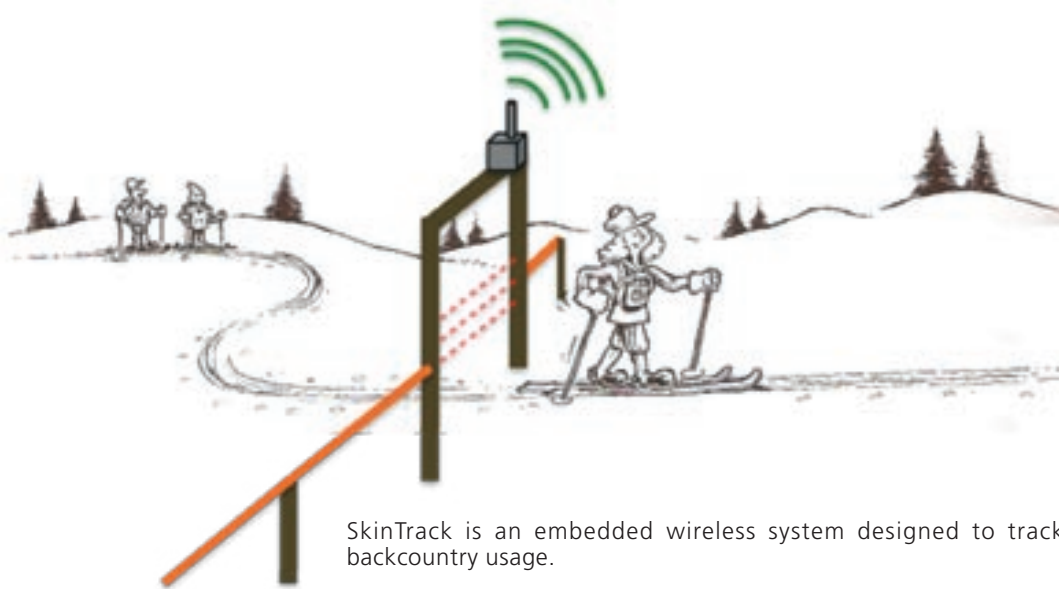


The basic design of SkinTrack's gate includes a wireless mote and two sensors.

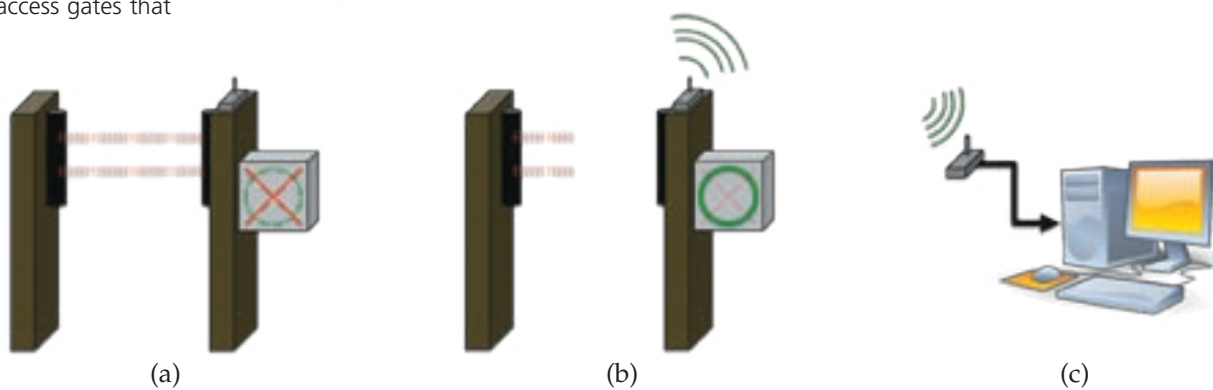
## Design

SkinTrack is designed to collect backcountry access gate usage information using a wireless mote, two sensors, and a base station computer (Figure 3). A wireless mote is a small, low-power, inexpensive, embedded computing device that can process, store, and communicate sensor data. The two sensors used by SkinTrack are an infrared beam sensor and an avalanche transceiver checker.

SkinTrack works as follows (see diagrams at top of page). The wireless mote continuously polls the infrared beam sensor and avalanche transceiver checker (top, a). When the infrared beam is broken by a person walking through the gate, the wireless mote uses the beacon checker to determine the presence or absence of a transmitting avalanche transceiver (top, b). The wireless mote then transmits this information wirelessly to a base station computer, where the data is processed further to provide near real-time updates (top, c).



SkinTrack is an embedded wireless system designed to track backcountry usage.



The wireless mote polls the infrared beam sensor and avalanche transceiver checker. (b) When a person breaks the infrared beam the mote determines whether a beacon exists and transmits the information wirelessly. (c) A base station computer then receives the wirelessly transmitted data and processes the received information further.

## Implementation

We successfully implemented a prototype of SkinTrack using many commercially available products. SkinTrack is currently installed at Ski Loveland, Colorado on the Forest Service Access gate near the top of lift one (see photos below). The following is a brief description of the components we used to build SkinTrack.

for outdoor security applications (below, b). This brand of infrared sensor was selected for two main reasons. First, the sensor is designed for outdoor use, with a water-tight construction and large operating temperature range (-49°F to 131°F). Second, to prevent false positives the sensor uses a modulated dual beam approach, which only triggers an alarm when both infrared beams are broken.



A SkinTrack prototype is currently installed and collecting data at Ski Loveland, Colorado.

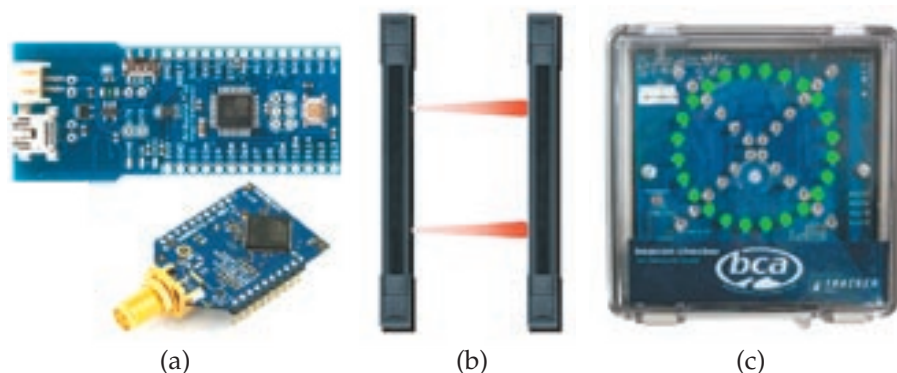
**Wireless Mote:** The wireless mote is an Arduino Fio with an XBee XSC Pro 900 MHz radio module (below, a). An Arduino based system was selected because they are inexpensive, open-source, easy to use, and have a large support community. In addition, the XBee radio modules are designed as “plug and play” components, making it very easy to upgrade to a higher power radio based on the needed transmission range (e.g., 100m to 10km). The wireless mote is housed in a waterproof aluminum enclosure and the XBee radio uses a 12 dbi directional Yagi antenna.

**Infrared Beam Sensor:** The infrared beam sensor is a SECO-LARM curtain sensor built specifically

**Avalanche Transceiver Checker:** To sense the presence or absence of an avalanche transceiver, we used a Beacon Checker made by Backcountry Access (below, c). When turned on, the Beacon Checker listens for a transmitting (457 kHz) avalanche transceiver within proximity and indicates the presence or absence of a beacon through visual, audio, and digital outputs. The Beacon Checker is highly adjustable, with knobs and switches to adjust the receiver range, light emitting diode (LED) brightness, power save modes, and digital output.

**Electrical Power:** Depending on the selected brightness of the Beacon Checker's LEDs, SkinTrack consumes up to three Watts of power, which is less than an average lightbulb. SkinTrack is powered by a 12 Volt, 35 Amp-Hour lead-acid battery charged by a 30 Watt solar panel. The battery is housed in a sealed plastic container and will be buried by seasonal snow. We chose to use a relatively large battery and solar panel to guard against the harsh winter environment found at Ski Loveland. In other words, the battery should last through multi-day storms and extremely cold temperatures, and then recharge quickly when the sun is out.

**Base Station:** SkinTrack's base station consists of an XBee radio module and 12 dbi Yagi antenna connected via USB cable to a Dell computer running Ubuntu Linux. The computer is located at the top of Ski Loveland's lift one, which has grid power and network connectivity



We chose to use many commercially available products to build SkinTrack. (a) The wireless mote is an Arduino Fio with XBee Pro XSC 900 MHz radio module. (b) The infrared beam sensor is SECO-LARM passive infrared curtain sensor. (c) The avalanche transceiver checker is a Beacon Checker made by Backcountry Access.

(Ethernet). When the base station receives the wirelessly transmitted data, a daemon process stores and transfers the information to a server located at the Colorado School of Mines (CSM). The server at CSM then processes the data by storing it in a MySQL database and displaying the data to a Web page ([http://toilers.mines.edu/SkinTrack/display\\_data.php](http://toilers.mines.edu/SkinTrack/display_data.php)). After installing SkinTrack at Ski Loveland, tests revealed that the data is displayed on the webpage within seconds of walking through the gate.

### Conclusion

We have successfully designed and implemented SkinTrack: a wireless embedded system that can monitor lift-served backcountry access gates. SkinTrack is currently installed and collecting data on the backcountry access gate near lift one at Ski Loveland, Colorado. We plan to collect backcountry usage statistics during the upcoming 2011-2012 ski season and display the results on SkinTrack's website: [http://toilers.mines.edu/SkinTrack/display\\_data.php](http://toilers.mines.edu/SkinTrack/display_data.php).

The information SkinTrack records (i.e., number of humans with beacons, number of humans without beacons, time of departure) could be invaluable to many people, including search and rescue teams, avalanche researchers, and ski resort risk managers. SkinTrack can collect data to answer many questions such as: "how many people use backcountry access gates," "how many people use avalanche transceivers," and "do avalanche forecasts affect people's behavior?"

### Acknowledgments

I would like to thank the American Avalanche Association for providing funds to implement SkinTrack. I would also like to thank Dr. Alan Marchiori for helping me design and debug the electrical circuits. Many thanks go to the ski patrollers at Ski Loveland (Ron Kidder, Pip Baylor, and Jared Fresquez) for allowing me to deploy the SkinTrack prototype and for helping with installation. Lastly, I'd like to thank Jayson Teno, volunteer with the Friends of the CAIC, for helping with installation.

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Marc Rubin is a computer science PhD candidate (working with Dr. Tracy Camp) at the Colorado School of Mines. Marc is interested in applying wireless computing technologies toward avalanche forecasting, snow science, and snow safety research. Marc lives near Denver, Colorado, with his wife and six pets, and enjoys backcountry skiing, mountaineering, hiking, biking, and golf. [mrubin@mines.edu](mailto:mrubin@mines.edu)



Tracy Camp is a full professor of computer science and interim department head of mathematical and computer sciences at the Colorado School of Mines. Her current research interests include the credibility of ad hoc network simulation studies and the use of wireless sensor networks in geosystems. Dr. Camp shares her life with Max (born in 2000), Emma (born in 2003), her husband (Glen), and three pets (two cats and a dog). The four humans are vegetarians who tremendously enjoy living in the foothills of the Rockies. [tcamp@mines.edu](mailto:tcamp@mines.edu)



Another Liberty Bowl PCR shot, December 2007

## PCR SEMINAR REPORT

*continued from page 11*

stressed the solid safety record of ski area avalanche programs even during that deadly season. His take home point: you can reduce the danger but you can't eliminate it.

Doug's second presentation depicted a snowpack that resulted in three fatalities in the central Idaho mountains in 1996, including an experienced heliski guide. The snowpack was loaded heavily in January and early February but did not produce activity on the persistent weak layer that eventually caused the ski guide fatality. No signs of instability were observed the day of the event, and several guided groups had skied in the immediate area without incident that morning. Doug's official report indicated that solar radiation and a significant temperature increase seemed to play a significant role in the fatal event and several slides that occurred nearly simultaneously on the same layer. The roughly 48-hour avalanche cycle remains perplexing to Doug and others today, especially when he considers recent research that suggests surface warming should play a fairly minor role in dry, deep-slab avalanching. Congratulations on your retirement Doug – but please continue enlightening us with your perspectives and sage advice.

Scotty Savage's talk highlighted a disturbing trend: patrollers are being caught, and sometimes killed, in avalanches that they themselves trigger



The patroller in the hole: caught and buried in an explosives-triggered surprise avalanche that ran much larger than expected, Dec 2003.

with explosives. Scotty covered six incidents, examining why these accidents happened and how we might prevent future accidents. He examined safety margins and how other industries deal with "narrowing margin" environments, including aeronautics and process engineering (inherently safe designs). Scotty stressed that there will always be outlier events that are difficult for individuals and programs to anticipate in the heat of the battle, and that adapting strategies from other industries might reduce the risk that avalanche-mitigation professionals face.

Next, Randy Elliot (*Bridger Bowl*), Don Bachman (*retired lion of the avalanche industry*), Doug Abromeit, and Karl Birkeland sat for a panel discussion. The group's cumulative experience created great discourse on several open-ended topics.

Karl Birkeland concluded the seminar by reviewing what we know and don't know about surprise avalanches and PCRs. While we have a better understanding of fracture mechanics, we do not understand exactly what is happening. Recent advances in propagation tests are shining light on fracturing, but there is no "silver bullet" field test to evaluate stability. We are learning more about spatial variability and explosives, but we still cannot determine the "right charge" or the "right place" to trigger an avalanche with absolute certainty. Perhaps the most promising development is that we have a clearer view of what we don't know than we did just a few years ago. Karl finished the day by stressing the need for a database to study these events. Karl is now compiling PCR data and wants to hear your stories! Please contact him at [kbirkeland@fs.fed.us](mailto:kbirkeland@fs.fed.us) if you have any PCRs to share.

Note: Videos of several of the workshop presentations are available on the GNFAC Web site at [www.mtavalanche.com/resources/lectures/surprise](http://www.mtavalanche.com/resources/lectures/surprise).



Scott Savage is the Intermountain North section representative to the AAA board of directors. After 12 surgeries, his knee seems to be showing some improvement. He hopes to be able to ski more than just flat tracking this winter, but his injury has caused him to accomplish a lot of non-ski-related work, such as writing for TAR. Photo above: Scott "icing" his knee and enjoying some fine tekillya on the Salmon.

## crown profiles



# Poco a Poco en Pimenton

Looking north over Pimenton at the path named "Great White Hope" above Campamento and the Esperanza Portals in the sun/shade line on right (August, 2011).  
Photo by Matt Primomo

*continued from cover*

### Campamento

The camp sits under paths from both sides of the drainage, each of which could nail us where we sleep. Avalanche deflection berms are in place less than 100m away from the camp buildings. The suggestion from the original consultation in the late '90s was to build some deflection berms to protect the camp. They hadn't exactly been engineered or built correctly. We now have seven winters on record at Campamento, and the building was hit in one of them. The refinery plant has been hit in two of them, once destroyed. The maintenance building has been hit or narrowly missed just about every year.

### Doing it Old School

Mid-winter that year, while hanging out in shorts and a t-shirt on the porch of Tim's place in Rio Blanco, I got to reading Monty Atwater's *The Avalanche Hunters*. An absolute classic for everyone in this business, it includes Alta history as well as Monty's perspective on forecasting in South America. The old-school snow rangers could do it without all the high-tech equipment, and so does Tim, so why couldn't I? I learned to be an expert storm watcher: checking hourly snowfall, water content, temperatures, and pressure like my life depended on it. I think these first-hand observations are something modern-day, technologically advanced forecasters often lack. A ski area snow safety worker won't stay up night after night watching the snowfall. Neither will a backcountry forecaster. Tabular SWE values and snow height only tell part of the story.

I was lucky to have a very dry season to break me in to the place. It was also the first year with two more mine portals: Esperanza 2 and 3. Esperanza 4 to come next year. These are all located on a steep southeast-facing hillside cutting through a number of small paths, too narrow a zone to hit with our trusty B2000M avalancher. In my first season we created an alert system and evacuation plan for the Esperanza Mine portals. I was able to compile an avalanche atlas over the season and retain our historic records. Thankfully, the big one never came.

### An Avalanche Hunter's Dream

It just so happened that they struck a fairly high grade gold vein in the spring of my first season. Simultaneously, the price of gold shot up. Over the northern

hemisphere winter I relayed emails with Tim. "Just purchased the weather station," he related in one. "Getting a new Falcon GT to mount on a Hagglund," he said in another. "Got the go-ahead to hire an observer for the Cumbre," in yet another. This season was shaping up to be 250% better than last; how could I not go back? It was somewhat of an avalanche hunter's dream. I agreed to return for a second round, but if and only if the deflectors were built up. This request was said to be next on the list for the excavator to complete. When I got back, I found out the machine had broken down and still needed to finish building a new section of road before we could have it.

A month into my contract I saw Frank Coffey at a restaurant in Santiago and struck up a conversation, even though we had never really met. We chatted a bit about last season and the depth hoar problem that we had dealt with. "This year's going to be different," he said. "This year it's going to be like, 'Welcome to the Andes.'" Gulp, and with that, reality set in. (The deflectors still hadn't been touched.)

We are located at 11,000', with peaks up to 15,500' in the immediate vicinity. The river valley below is at 1500' and about 30 miles away. That's a 14,000' vertical rise in a fairly short distance. We're located in the interior of the range, just three miles from the crest. The altitude keeps it cold, and the orientation and sheer size of the cordillera wrings every last bit of moisture from the air masses that are forced up and over. Our trusty NOAA meteogram tends to under-forecast precipitation by about 3.5 times. It is not unusual for it to snow for four or five days straight, reaching rates of 12cm/hour at the most intense part of the storm, then clear up and follow with seven cloudless days. Another interesting factor is that we're located at 32 degrees south, meaning strong solar radiation. Diurnal temperature swings are incredible. Matt McKee told me that if this place were Colorado or Utah, you'd be screwed. Well, the past couple years it has been one of the thinnest, weakest snowpacks I've had to deal with.

### The Least of our Worries

After storm six in 2011 I had a day cleaning the road with our best Pisten Bully operator, Jarra. We rocked out to CCR and cleaned through eye-opening debris piles. Some measured 4m high on the road. The scary part came the next day,

after some 15cm of settlement within the storm snow, which had amounted to 84cm with 58mm of water. On south aspects, all of this was sitting on a pencil-hard wind crust over some basal facets. Now we had a slab.

A lunchtime control session was in order; round two for this storm. Blue skies, light winds, and about 0°C. Perfect. Jaime and I charged up to the cannon and assembled some shots. The mission was carried out quickly so as to not affect important work time. The results were somewhat disappointing, as there were no major slides that we could see. I had commented on how the blind shot above the maintenance building might've produced some results. Sure enough, as we walked back down I spotted the crown as it came into view. It had run all right, on the basal facets below a thin dusty wind slab. 3m of debris was deposited on the patio of the maintenance shed (a popular work zone) and 4m on the road below in two spots. Unbeknownst to me, the mine boss, lead mine engineer, and head mechanic took a quick trip down the road to repair a machine during the control session. They got blocked by the debris when coming back up an hour later. This incident demonstrates the underlying attitude here. Something I find interesting about this one is that we had hit that path with two shots during control toward the end of the storm – and now an R2D3. I don't think I'd call it a maritime snowpack. I'm a fan of Carvelli's Random Shot Placement technique to reduce uncertainty (see story in TAR 23-9).

Another demonstration of the mindset is as follows: Mid-August 2011, I was up to bat, looking at a few possible crushing storms in the long term. We were short on projectiles, as the order for 300 we put in a month and a half earlier had been all but lost. I sent an email to Tim, to the owner/manager, and to the engineer who is in charge of explosive orders, stating the urgency of the situation. As I write this it is early October, and those projectiles are nowhere to be seen. Luckily, the big one never came.

We finally managed to get Hal Hartman to come for a visit and save us. Hal made his arrival after storm six, when I counted road strikes from 28 paths. The cycle produced slides up to size 3 and gave us a great example of the model avalanche cycle that we would want to use the mobile launcher on. Any bigger the expected slides, and it probably isn't safe doing control on this road. Our situation is somewhat unique because you can't possibly hit all of the paths, therefore control on the road is complex, necessitating guidelines for control work. It would be completely possible to find yourself deep in the canyon having a ball shooting down size 4s and getting yourself buried from an unnamed 2000m path that you never looked at closely before. Instead, the main use will be for nudging those persistent weak layers, as storm snow instabilities are usually settled out by the time we can get a plow to them. Hal almost barfed upon Tim's explanation of the "micro-climate" that occupies the Raspa (a zone where the road drops about 600m from a high traverse with numerous switchbacks above a huge cliff, down to the river). Well, that's just the way it is here. We can't possibly shoot our way down the road after each storm; we'd use some 250 projectiles per round of control. It's more a process of selection. The development of an avalanche atlas for the road to aid in the selection is a daunting task. However, as Glenn said, that's the least of our worries.

The camp is our big worry. It didn't take long for Hal to agree. So there we were, sitting around the long table in the downtown Santiago high-rise office for a meeting. The owner/operations manager was given Hal's summary report from his first trip up. "Will you hold a revolver to your head, loaded with one bullet, and pull the trigger at the start of every season?" This was Hal's analogy to illustrate the danger our Campamento faces. And with that, Hal has been contracted to re-engineer the deflection structures to protect Campamento, where some 150 people may be at any given time, from a 1:300 year avalanche. Thank you, Hal! You are our hero. The preliminary triumph called for a celebration of Pisco sours and lomo.

### Cowboy Country in the Andes

Pimenton and its 80km road remains a frontier in the Andes, and it will likely remain a frontier for years to come. Cowboy country, some might say. However, improvements are being made. "Poco a poco," is what Tim says, and in all actuality the program is just getting off the ground. It's not easily compared to an operation in the states. The small scale narrow vein gold mine may be here for five to 40 years, or less, or more. This makes investing in program infrastructure a gamble. We still await the actual rebuilding of the defense structures which, as in other scenarios, has proven to be like pulling teeth. As much as we would love to see this place littered with weather stations and a team of six forecasters, the reality is that this is South America and things move slowly. However, we do what we can. We may actually get a weather station or two. And who knows, maybe sooner or later we will have this place dialed in, highly organized, and under control... until Mother Nature teaches us otherwise. But that's just what working for an operation in the central Andes is all about.

*Matt Primomo has been chasing winter for the past couple of years, working as a guide and educator for Utah Mountain Adventures and White Pine Touring in Utah during the northern hemisphere winter. When not working he can be found living out of his truck, climbing in the desert or getting hammered by waves as he tries to surf.* ❄️



Alex and Ponce operating the Falcon GT during target practice at the Junta del Rios launch site.



Maria Elena 1 Path after another near miss of the maintenance shed, HS-AA-R2D3.



Stocking the big truck among orange trees in Los Andes in preparation for a large storm.



Andres, our observer, reaping the rewards of a job well done after a storm and cleaning process at the Cumbre, a section of road the goes over a pass. *All photos by Matt Primomo*

# Spring on Chinook Pass

Opening & maintaining this scenic route through Washington's Cascade Range

Photos by John Stimberis



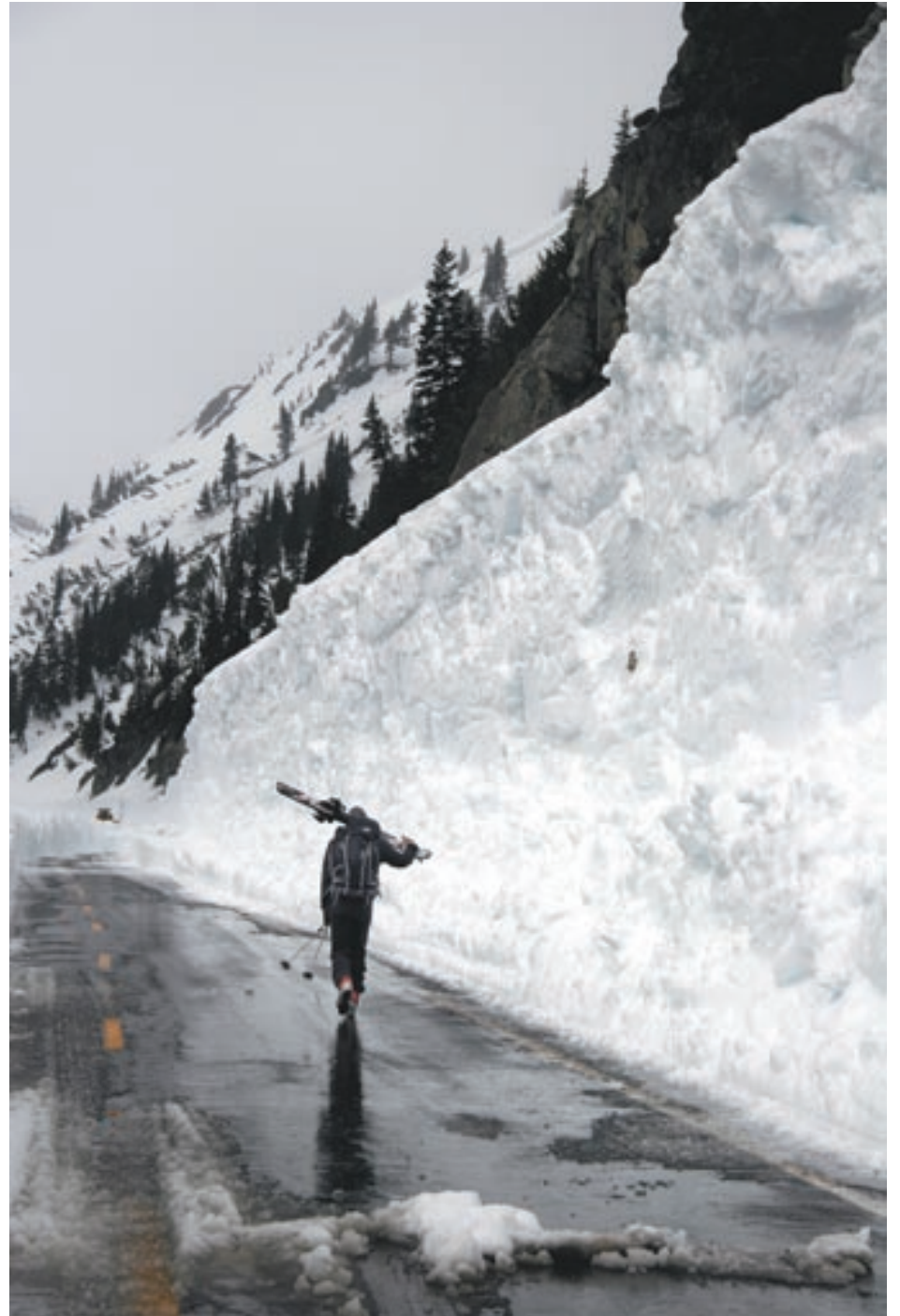
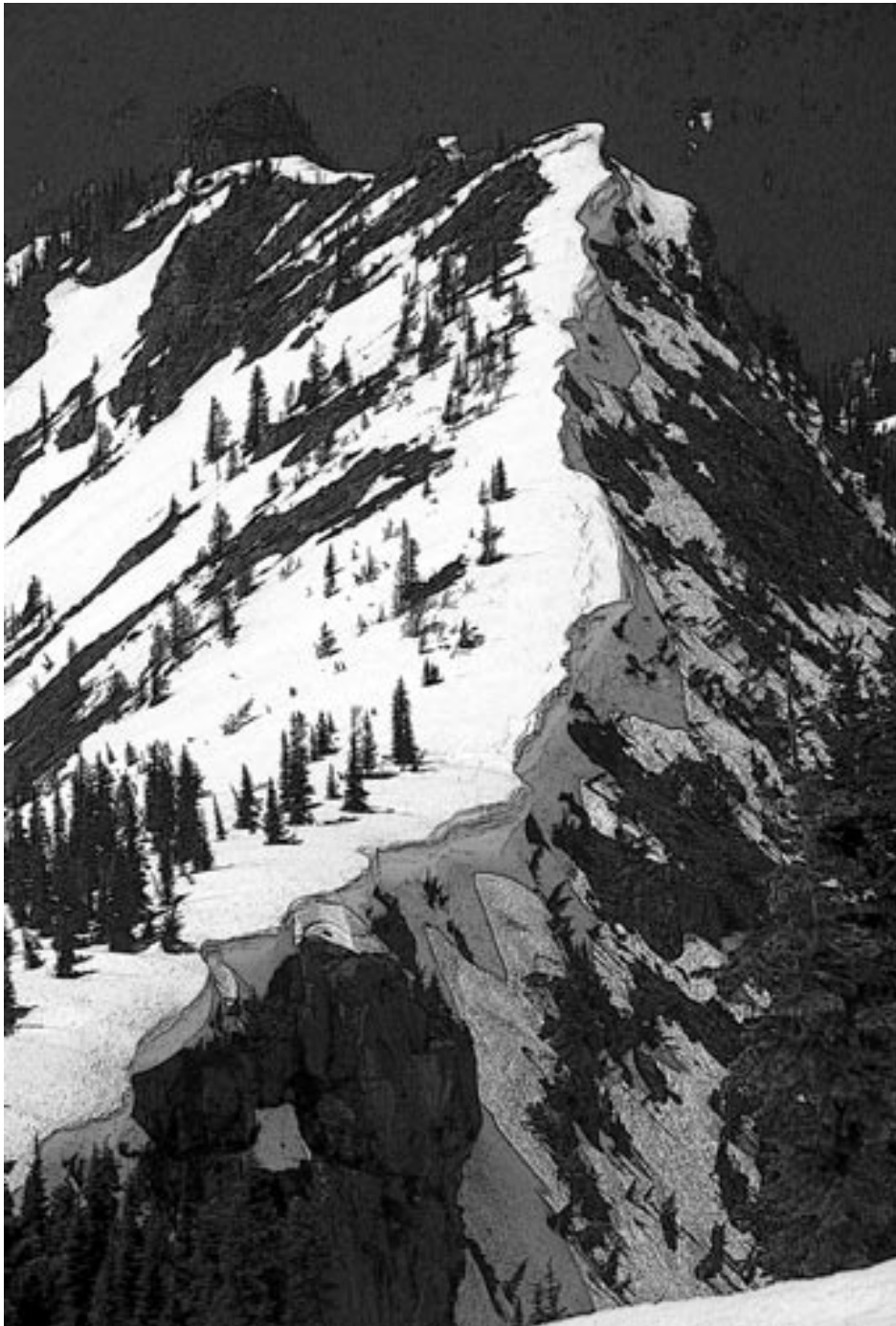
Guest star Rob Gibson begins the daily ascent above the highway. Large packs full of explosives will provide great rewards on a warm day. This photo won WSDOT a national award!

*right:* Explosives are usually buried deep in the spring snowpack. We hope to affect deeper layers and yes, to also cause big avalanches.



John Stimberis comments on the artistically rendered ridgeline below, left: "I'm continually drawn to this cornice line. The shapes and forms speak to a deeper aesthetic, and not just an avalanche hazard."

*John Stimberis leads the avalanche forecasting and control program for the South Central Region of WSDOT. He is also vice-president of the American Avalanche Association and an avid photographer.*



Avalanche Specialist Jeff Taipale walks along State Route 410 shortly after maintenance crews cut through the snow to the pavement.



history

# Beginnings of Snow and Avalanche Research and the SLF

Story by Christine Huovinen and Jürg Schweizer • Photos courtesy SLF

Ever since man first occupied the Alps, avalanches have posed a threat. For centuries, it was primarily the inhabitants of the mountains who were affected, together with their cattle and dwellings, but the gradual development of the tourist industry has since extended the risk of damage and, therefore, the interest in avalanche research.

Until the start of the 20th century, the avalanche problem was being addressed largely by individuals, often foresters. These observers described avalanches and categorized them according to their character. Some early works concerning avalanches and defensive structures were published. Promoters of ski tourism, railways companies and hydropower plant operators were making louder pleas for scientific methods to be adopted for avalanche research from the 1920s, and they supported the establishment of the Commission for Snow and Avalanche Research in 1931. It became the first central agency in Switzerland dedicated to researching avalanches systematically.



### First Research Facility Built in '30s

The members of the Commission soon realized, however, that their interest in avalanches had to extend beyond the summer; they needed to observe the snow in the winter and learn about its structure and the evolution of microscopic snow crystals. For this purpose, they built a first laboratory out of snow in Davos in 1935. To avoid the risk of warm spells threatening not only the experiments, but also their accommodation, in the winter that followed they moved their laboratory, now a wooden shed, up to the Weissfluhjoch, in the middle of avalanche country, and established a study plot. The Commission continued to work there until 1942, when the Federal Government adopted a resolution to establish the Swiss Federal Institute for Snow and Avalanche Research. The timing, during the Second World War, mirrors the great significance attached to avalanche research by contemporary business leaders and politicians. Just one year later, in April 1943, the SLF celebrated the official opening of its new home on the Weissfluhjoch.



The first research laboratory was constructed from snow in 1935.

### Development of New Measuring Instruments

Besides new premises, however, the scientific discipline of snow and avalanche research needed a methodology of its own and special measuring instruments. Scholars had been developing a variety of measuring instruments since research started in 1936, including a ram penetrometer, a shear test apparatus, and a device to determine the air permeability of snow. Some of these instruments are still being used today, but technical refinements have been introduced in the intervening period of course.

### SLF Becomes the International Center of Snow and Avalanche Research

In the early years, especially during the war, the avalanche researchers sought very little international contact, but a lively exchange began once hostilities ceased. Researchers from the Alpine countries and overseas turned to the Swiss as experts and undertook further studies at the SLF, and SLF employees travelled abroad to assist with local avalanche protection programs. The SLF was soon recognized as the center of snow and avalanche research and is still acknowledged as such today.



Cone penetrometer for measuring ram resistance.

### References

*Die Schnee und Lawinenforschung in der Schweiz*, master's degree thesis by historian Dania Achermann ❄️

Congratulations to the WSL Institute for Snow and Avalanche Research (SLF) on the occasion of their 75th Anniversary.



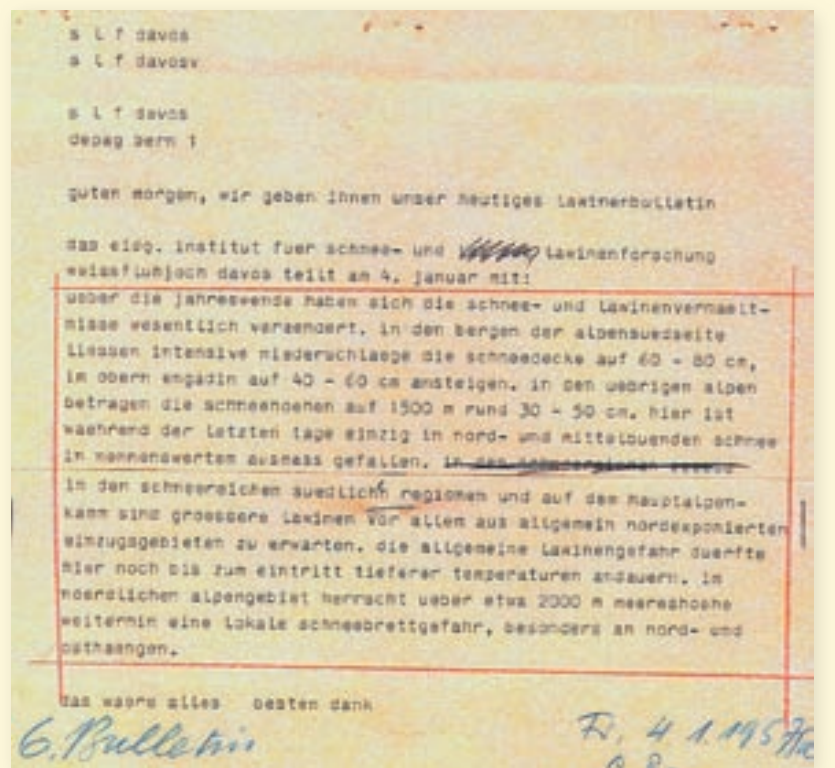
On December 13, 1916, Gran Poz in Austria was overwhelmed by tremendous snow masses, killing 270 of the 321 soldiers who were stationed there. Source: *History of the Military Mountain Guide* (German only), <http://www.heeresbergfuehrer.at>.

## Origins of the Avalanche Bulletin

Story by Thomas Stucki and Christine Huovinen

When the Commission for Snow and Avalanche Research was founded in 1931, it was primarily dedicated to conducting systematic research on avalanches. The Swiss Ski Association first used the Commission's observations to publish information on the weekend snow conditions in the Swiss Alps in the winter of 1936/37 by way of press and radio reports.

The strategic military importance of the Swiss Alps in the Second World War raised the political significance of avalanche research. The experience of the First World War, during which around 60,000 soldiers are thought to have perished in avalanches, had not been forgotten. In addition, an avalanche above Lenk in 1939 buried an entire company of mountain troops. This accident reinforced the interest of military leaders in the Commission's work. At last, the Commission's call for personnel and financial support from the armed forces was given a sympathetic hearing. As the army's collaboration was stepped up, military units received avalanche training from employees of the Weissfluhjoch research station. In 1940, the military, working closely alongside the Commission, established an avalanche warning service with observation stations in various locations in Switzerland. Avalanche warnings for the armed forces were thus institutionalized.



Avalanche bulletin of January 4, 1957, sent to the Swiss news agency in Bern.

### Military Avalanche Service Extends to Civilian Population

After the end of the war, the SLF Institute spawned by the Commission took over responsibility for avalanche warnings from the military on October 1, 1945 and established the civil avalanche warning service. In 1950, 20 observers were feeding information about the weather, snow and avalanche situation to the avalanche warning service. Each week, the SLF published an avalanche bulletin by radio and in the press. These releases were welcomed by both the emerging winter sports resorts and

Continued on page 29 ►

# Avalanche Sequence

Submitted by Elliot Halverson • Photos by Bryan Calcaterra



This slide was triggered by a cornice cut on May 13, 2011. The aspect is NE on the south ridge of Wheeler Peak near Alma, Colorado. About 6 inches of new snow fell the day before. The crown was a foot deep and 40 feet wide, and the slide ran about 750 vertical feet. Elliot Halverson and Tanner Rainville cut the cornice to test the slope while Bryan Calcaterra snapped this photo sequence of the results.

**Bryan Calcaterra** works mountain operations and snowmaking at Beaver Creek. As he lives on the East Vail bus route Bryan has been a regular on that popular sidcountry lap. He also enjoys skiing across the street in the Gore. **Tanner Rainville** is a long-time athlete for Level 1 Productions who lays down tracks all over the globe. **Elliot Halverson** is an accountant and alpine enthusiast who enjoys couloir skiing and the Colorado corn harvest. The Ten Mile and Mosquito Range are his home zones.

# 30 Years of *The Avalanche Review*

## Reflections from editors past & present

Hard to believe, but this winter brings the 30th anniversary of *The Avalanche Review*. In commemoration we wanted to take a look back, get perspectives from our previous editors. Thanks so much for all your barely paid hard work. You are the people on whose shoulders this paper stands.

Inside: The 1981-82 season... Was it the "Winter of the Snow Dragon?"



### The Alpine Meadows Avalanche

by Norman Wilson

3:15 pm — Wednesday, 31 March 1982 — The avalanche, more than 4.5m deep and over 900m wide slipped from its anchorages 200m above the valley floor and the base area at Alpine Meadows Ski Resort. Seconds later, seven people were dead. One more would remain missing until the following Monday. One of those killed was an avalanche hunter of twenty years experience — Bernie Kingery, Alpine Meadows Mountain Manager and chief of avalanche control.

Just about everyone knows the story—the storm hit the Sierra on Sunday; the brunt of it in the Alpine Meadows-Lake Tahoe area. Intense snowfall, accompanied by high winds, caused high avalanche hazard in the ski area and along the access road by Monday morning. On Monday, Tuesday, and Wednesday the snowfall intensity occasionally reached five and eight centimeters per hour while the wind ranged near 100 mph and gusted to 120 at times.

On Monday the upper part of the ski area was closed to the public. On Tuesday only the lowest lifts were operated. Avalanche control was intensive: the ski patrol applied hand-thrown explosives at those few parts of the area accessible in those conditions by lift and skis; but the wind at first limited, then finally prevented, movement on the high exposed ridges. Thus, the slidepaths that threaten the base area were engaged with artillery: a 75mm recoilless rifle fired from a fixed position on Gunner's Knob, some 60m above the lodge, and a road-fired 75mm rock howitzer.

The snowpack contained a sun crust below the new snow and a soft, water saturated layer beneath that. Since the storm started and remained cool throughout the period, slides were expected to go as deep as the sun crust. On both Monday and Tuesday the artillery was fired "blind" on critical targets—each morning and evening—with extra shots, high and low in the target zones, during each firing mission. On those days, at the few slidepaths the avalanche crew was able to reach on skis to apply hand-thrown charges, the results of their tests seemed normal: all of those paths appeared to be performing as expected—by yielding expected releases. But the water-saturated layer deeper within the snowpack remained worrisome, and on Tuesday one of the road avalanche sites gave a warning of something unusual. Here—two parallel chutes fall 400m to the road. The east gully was given its usual explosive treatment, but without resulting snow movement. Minutes later, when the west gully was tested, the east gully released a class 3 slab avalanche.

On Wednesday the snowfall and wind continued. By mid-afternoon the total snowfall observed since Sunday at the study plot near the lodge had reached 250cm.

The ski area was closed to the public. Only the avalanche control crew, necessary maintenance crews, and a few management personnel remained in the area. By this time the state highway between Alpine Meadows and Lake Tahoe was already closed by avalanches across the road at several points.

The artillery was fired again on all the critical targets Wednesday morning. The recoilless rifle fired on Wolverine and Beaver Bowls and Poma-Rocks; the howitzer fired on Pond Slide, the Buttress, and the adjacent road slides. Firing was completed at 10:30 a.m. After firing the howitzer, the crew observed the runouts of Pond and Buttress slides as well as they could through the intense snowfall. They saw what they thought was avalanche debris just above the road and parking lot. They assumed from this observation that the slidepaths had responded to the effects of the artillery.

At about 2 p.m., Jim Plehn, Larry Heywood, Tom Kimbrough, Casey Jones, and Jim Orsi departed for Squaw Valley, intending to ride up KT-22 chairlift, then to ski to, and place explosive charges in the starting zones of the slides that fall from the back side of KT onto the access road. At about the same time Patrol Leader Bob Blair and other members of the avalanche control crew departed for their homes for a much-needed break.



Alpine Meadows

Bernie Kingery, with Beth Morrow acting as his radio scribe recorder, remained in Summit Building, some 30m south of the main lodge. Summit Building contained the communications and nerve center of the ski patrol and avalanche control teams, pika lift crew and ski school headquarters, a locker room, and public restrooms. The building, in addition, housed the drive terminal of Summit Lift, whose cables and chairs entered the open south end of the structure.

Bernie and Beth were there to coordinate the avalanche control work on KT and the road guards needed for that operation.

At this time the avalanche tracks and runout zones at Alpine were loaded and smooth. The heavy storms of January, which spawned gigantic, and in some instances unprecedented, avalanches throughout the Sierra had been followed by regular and frequent storms. Natural avalanches were falling at Squaw Valley, where two houses and four chairlifts were damaged during this period. Casey Jones had consulted his Avalanometer early that day—it indicated a period of moderate hazard that afternoon.

When the Alpine avalanche released, it developed tremendous speed as it fell from its 38°-39° starting zones. It bowled over trees 1 meter in diameter and snapped smaller ones off like a lawnmower; it mangled numerous Thiboks, DMC's, and other slope grooming equipment; it did major damage to Kangaroo and Summit Chairlifts; it smashed in the west wall of Summit building and simultaneously entered the open south end of the structure at great speed, causing what resembled the effect of an explosion inside the building.

The avalanche then rocketed across the 2nd story side deck of the main lodge, smashed through the windows and doors that compose most of the south wall of that structure, and piled up inside. A piece of this avalanche finally came to rest beneath Victoria Station Lift, some 90m beyond Summit Building.

The northernmost part of the slide entered a subdivision some one-half mile north of Summit Building, where it nudged, but did not damage, several houses.

The center part of the slide fell from Pond Slide into the west edge of the parking lot and filled an area some 60m by 180m with 4.5m of snow, killing three people who had walked to the area from nearby condominiums.

All portions of the avalanche traveled well beyond the maximum runouts observed since the ski area was developed in 1960-61.

When the avalanche struck its hammer blow at Summit Building, Bernie and Beth, both in the far northeast corner of the patrol office, were hurled through what had been a wall, along with desks, pieces of the structure, and miscellaneous equipment, to be buried near a tree some 25m to the east. Two lift crewmen, standing at the northwest corner of the same room, fell to the floor and were able to stay in place—they were buried briefly but managed to clear themselves. A third lift crewman, who was standing in the south-center part of the room, was blown out with Bernie and Beth, but found himself, after the dust settled, injured but on the surface.

At the moment the slide hit, lift operator Anna Conrad, who with a friend had cross-country skied to Summit Building from her home to retrieve some clothing (and had been roundly chastised by Kingery for traveling on the access road on skis in those conditions) was at her locker in the lift ups room on the second floor. Her friend was a few feet away. The avalanche buckled the floor beneath Anna and her locker—the dropped to the first floor, alongside a heavy wooden bench. The lockers, along with structural members, fell across and were supported by the bench. She remained there, at times unconscious, until she was uncovered—alive—more than five days later. Her friend was killed.

The slender threads on which hang the fates of men were dramatized by several occurrences during the moment preceding the slide: Tom Mosher was at the west edge of the parking lot, in the process of attempting to attach a chain to a snowbound auto, so he could tow it to a recently plowed part of the lot. Tired, he was persuaded to go into the lodge



Sue Ferguson, TAR's first editor, raps about and on the block perched on her shovel. Taken by Mark Moore in the Northwest during one of many field investigation outings while she was a forecaster there, most likely near Chinook Pass, WA, circa mid-1980s.

Letter to Lynne Wolfe, current TAR editor, from Bob Ferguson (Sue Ferguson's brother) for Ed LaChapelle's memorial in TAR 25-4:

Hi Lynne,

Well life comes full circle. Thank you so much for keeping this part of Sue (*The Avalanche Review*) alive and thriving. Thank you for your work. I remember the beginning of this *Avalanche Review* adventure. Sue had to sign her house over to my Dad in order to secure a loan from him to start *The Avalanche Review*. I remember many evenings helping her prepare for the dreaded mailing. This was a big deal back then. As a college student she worked for a t-shirt maker; she had this brilliant idea (all her ideas tended to be brilliant) to make t-shirts to raise money and to promote the *Review*. I wore mine until it was a faded rag. While we were cleaning out her house I found a brand new one. It has become my favorite thing of hers along with her two black cats named Toby and Frieda.

Our family wants to send along our gratitude for Ed's life as a teacher and a mentor to our sister and daughter. He was a very special person in Sue's life and in the lives of so many other people. I first met Ed at Sue's PhD dissertation defense. I was the lone family member. I remember Ed asking Sue a tough question in a tone I did not appreciate. I remember vividly wanting to pounce on him, but instead I cleared my throat as loudly as I could... Sue nearly killed me. I met him again at Sue's graduation party and finally when he spoke with so much eloquence and joy about his beloved student and colleague at Sue's memorial.

They will both be missed.

With Love, Brother Bob

## Adventures with the TAR Baby: 1986 - 1993

Story by Bruce Tremper

I'm frightened to see how quickly history can slip away from us. With Ed LaChapelle and Sue Ferguson no longer with us, now perhaps only Rich Marriott and Mark Moore remember the very early history of *The Avalanche Review*. I can only pick up the history from about 1986 when Sue Ferguson – the brilliant and visionary founder of *The Avalanche Review* as well as the American Avalanche Association – “chose” me to take over as its second editor. For the word “chose” you should substitute: “finally found some damn fool stupid enough to take on the time-abys, creativity-sucking albatross of a young, struggling newspaper – all without pay, of course.”

Sue brought *The Avalanche Review* (TAR) with her to Utah from Seattle in 1983 when she took a job at the Utah Avalanche Forecast Center. But after three seasons she seemed more than happy to flee the stogy, paranoid, weird state that Utah was in those days – long before it exploded into the hip outdoor Mecca it has become during, and after, the Olympics. With Sue's exit, I came from the Alaska Avalanche Center to take over as the director in 1986.

Sue knew a sucker when she met one, and I remember meeting with her at the sole hip restaurant in Salt Lake before she drove her Volkswagen out of town for the last time. She explained that since the infrastructure of TAR was already established in Utah, she asked me to take over as the editor. She also plied my ego with various lies, a strategy which normally works well on me, but to my credit I told her no, that I had more than enough just to learn my new job.

But the next season, I could no longer resist her repeated pleas. And suddenly, I had not just one full time job, but two. One paid money, involved skiing and was widely appreciated by the public; the other was none of those things. By the time I realized what a huge mistake I had made, Sue was celebrating in Seattle, comfortable in her new job with the Northwest Avalanche Center – and finally rid of the TAR baby she had created. She had found her fool.

Sue was the perfect – perhaps the only – person in the avalanche community at the time, capable of starting *The Avalanche Review*. She was a brilliant, accomplished,

worldly, woman with a PhD in geophysics, an ex legal secretary, a cartoonist, a protégée of Ed LaChapelle, and she already knew much of the avalanche community in both the US and in Europe.

I was more or less the opposite. I had spent my entire life in Montana and Alaska before moving to Salt Lake. I was still wobbly when stepping onto an escalator, had never been in a parking garage. I was a poor speller and as a fourth generation Montanan, I learned proper grammar only as a second language. Luckily, my mother was an eccentric genius, a lawyer, a university professor, a fine writer, and she had even published a TAR-like monthly newsletter for the Montana skiing community.



Bruce Tremper sifts through important paperwork.



In December 1988, TAR 7-3 published Mark Kalitowski's now-classic, *The Avalanche History of Alta*, which editor Bruce Tremper typed into digital format from the author's handwritten yellow legal pad.

She not only forced me to learn proper grammar (OK, partially learn) but to take a typing class in high school where I was one of two sheepish boys in a large class full of girls. Using the strong work ethic, responsibility, and stubbornness I learned from my parents, I dove in and gave myself a crash course in the unfamiliar world of mastheads, fonts, layouts, Adobe PageMaker, copyright law, advertising, printing, bulk mailing, and the *Chicago Manual of Style*. I called my mother a lot.

After a day of forecasting avalanche hazard for the Utah Avalanche Forecast Center, I went to work on my second job as the TAR editor. Life became a blur of 16-hour days with few days off.

Always a visionary, the year before I took over, Sue converted TAR to an all-digital publication with one of the first versions of Adobe PageMaker. It was buggy, frustrating software, which ran on the second-generation, IBM personal computers, which had a myriad of problems all their own. The scanned photos looked grainy and horrid on the ancient software as well as in print. I cursed a lot. I quickly learned to turn over more and more work to the layout person Sue

Continued on page 23 ▶

# TAR Volumes 12 - 18

Story by Steve Conger

An advertisement appeared in the April 1993 issue of *the Avalanche Review* soliciting an editor or assistant editor for the upcoming season. It was written with a healthy dose of Bruce Tremper humor that enticed me to answer it in a moment of weakness. This led to my becoming co-editor with Bruce for Volume 12. The first issue I pushed out the door included a great cover story by Jim Woodmencey about the summer avalanche on the Grand Teton. That issue (8 pages) included a remembrance of Dale Gallagher and introduction of the memorial fund established in his honor. I resorted to my mom's Colorado A&M yearbook for a photo of Dale to accompany the ones provided by Roland Emetaz.

Being co-editor lasted all of one issue as Bruce was truly looking to pass on the torch. At the fall 1993 AAAP board meeting held in conjunction with the National Avalanche School, full responsibility was passed on to me including chair of the publications committee. I distinctly remember John Montagne's admonishment that I keep the *Review* a serious publication and not include the humor that Sue was known for under her editorship.

The *Review* had one "paid" writer at the time, Dan Judd. He received advertisement space in exchange for his regular "Nuts and Volts" column. Dan's column helped many snow workers understand both electronics and the advent of the digital information age. Issue 6 that season included the seminal article by Kelly Elder and Karl Birkleland, *Snow Science, Necessary Instruments, and the Scientific Method*, that provided solid reference to any practitioner preparing to merge with theory at an ISSW. The jakusho test for weak layers developed by Japan Worker's Alpine Federation was introduced to the Western world in issue 3. Rob Faisant was finally able to get the grammar corrected from who to whom do you call on the list of avalanche information phone numbers.

During my tenure as editor, the most important person was Suzi Elmore of Elmore Design who was the graphic artist and production manager. Since volume 11, she assembled the text, graphics, and artwork. More significantly she was the one who ensured deadlines were set and met the best we could (sometimes a very difficult thing when contributors were all volunteer authors). Sue had started the *Review* in the paste-up days (photo-quality columns of text and separate photos, ads, graphics all glued to a layout board). This was the transition to the digital age. All submissions came in person or through the mail, on floppy disks; others as hard copies that had to be typed in by me late at night. Photos and slides had to be sent out and turned into a format that the publishing software could work with.

Volume 13 carried important topics from the ISSW at Snowbird to a larger audience. Other important topics of the season included potential loss of availability of explosive control components, avalanche transceivers operating on separate frequencies, a focus on standards issues by the AAAP, a tragedy at Alpine Meadows, the recoilless rifle, and introduction of the tangent method of transceiver search. There were many staunch contributors; among them was Mike Stanford who provided a topical article nearly every season.

The winter of 1995/96 was a big one and the *Review* as well. A seventh issue was produced in June summarizing the winter aka the Westwide Avalanche Network. The first Halsted Morris photo appeared; his ongoing submission of photos chronicling the meetings of the AAAP earned him the official title of unofficial staff photographer.

The next season saw the introduction of a new logo designed by Suzi Elmore for the AAAP, still used today minus the P. Finally, in issue 6 of that season, I ventured out into the realm of PNW humor and included Alan Dennis and Mark Moore's, *An Avalanche Story*, given at ISSW '96. It provided a glimpse of possible early avalithic US and Canadian Danger Scales of "hardly any/almost none, some, more, a lot more, sheeet" and "much less than considerable, less than (almost) considerable, truly considerable, more than considerable, a lot more than considerable."

Throughout many of the issues there were seasonal summaries by representatives of the various regions and forecast centers along with stories of notable events similar to regular contributor Art Judson's *Storms and Floods in the West*. When contributions waned for a particular issue deadline, readers were re-introduced to key historical articles from the USFS Alta Avalanche Studies archive.

Regular contributors like Jon Andrews, Dale Atkins, Don Bachman, Karl Birkeland, Sam Colbeck, Sam Davis, Bruce Jamison, Mark Mueller, Bruce Tremper and those mentioned elsewhere, truly made up the core of the *Review's* content during my time as editor. Without them, there would have been no publication.



Volume 16 had a theme that continued into volumes 17 and 18. Each of the regional avalanche forecast centers and highway operations were highlighted over the course of the three seasons. The revised AAAP avalanche education course guidelines, Steve Conger getting deep into the Sorcerer Lodge's backcountry. Photo by Lynne Wolfe



This treasured, age-yellowed copy of TAR celebrating its 10th anniversary was published in 1992, just prior to Steve Conger taking over the editor's helm from Bruce Tremper.



This dog-eared copy of TAR 14-6, published in April 1996 during Steve Conger's editorship, features Sam Colbeck's seminal article on corn snow, as well as reports on several avalanche incidents throughout the US on eight grayscale pages.

descriptions of education programs, teaching tips, transceiver advancements, and use of GIS rounded out volume 18.

*The Avalanche Review* did not go without controversy during my editorship. Some was due to my choice of article titles. Articles covering the introduction of new technologies, i.e., the digital transceiver and avalung provided similar fodder for various perspectives to elaborate. ISSW 94 was described by Ed LaChapelle as a "collision of theory and practice" which lead to a number of articles over the following two seasons about the future and direction of ISSW.

In the fall of 2000 I passed *The Avalanche Review* editor torch on to Faerthen Felix and Blase Reardon. It had matured from a volunteer undertaking to a small stipend for the editor thanks to the AAAP board.



# Perspectives on TAR

Story by Faerthen Felix

When I became an avalanche forecaster, I felt pretty isolated. I was working for the Manti-LaSal Avalanche Center, which was essentially autonomous from the SLC office.

The Manti-LaSal Forest is large and widespread though, not just the LaSals. During my tenure as program director I expanded our outreach south to the Abajos and opened forecast coverage north to the Wasatch Plateau (Manti Top), where people were getting killed more frequently.

Working in a remote, geographically dispersed forest, usually alone and with few resources, I just focused on making it work. It soon became obvious that things worked better, I could accomplish more, and life was easier when I could find partners who wanted the same things. To achieve common goals, I worked with UDOT, NWS, NRCS, various US Forest Service offices, colleges, Telluride ski resort, Silverton Avalanche School, UAC, and some of the ski resorts in Salt Lake City.

But I never really felt connected to the larger avalanche community. It seemed like there were some really heroic, really experienced, really inspiring avalanche people out there...then there was me.

One of those inspiring people was Sue Ferguson, the founder and long-time editor of TAR. Sue had moved on, but TAR hadn't yet. When the opportunity arose to become the editor of TAR, I figured it was an opportunity to connect others in the avalanche community who must feel isolated in their remote mountains, too.

Digital technology was beginning to open possibilities of reducing complexity and allowing more distributed production. I was able to convert us from paste-up and negatives to desktop publishing, saving cost and effort I could apply more productively.

TAR had been a one-man show until I brought in new talent: Blase Reardon as associate editor, Halsted Morris as advertising executive, contract artists. And many gifted writers new to TAR.

This team allowed us to expand the scale, content, and format of TAR to create a tool with broader reach and more connective potential within the ever-expanding community. After I moved on, Blase and Lynne Wolfe successfully continued and expanded this effort.

I hope that everyone in the avalanche world today feels that TAR represents them, not just their heroes. And if you don't, I hope you choose to make suggestions and get involved. Because if you are reading this, then TAR is your voice.

Faerthen Felix is a filmmaker and the assistant manager of the UC Berkeley Sagehen Creek Field Station near Truckee, California. ❄️



TAR 19-4, published February 2001, was edited by Faerthen Felix with assistance from co-editor Blase Reardon. The 12-page issue features stories on safety and technology advances.

## TAR in the 21st Century

Story by Blase Reardon

My first exposure to the production side of *The Avalanche Review* was peripheral. Steve Conger and I were briefly housemates in Salt Lake City early in his stint as editor. His copies of TAR itself were like postcards from a distant but fascinating country I was just realizing existed. Six years later, it was a surprise when someone – Karl Birkeland, I think – asked if I was interested in helping Faerthen Felix edit TAR.

I was barely involved in the AAA; I'd only recently become a professional member of the organization. I'd written just one article for TAR, an avalanche center profile that was part of the series Steve had initiated. But I'd worked as a technical writer and editor, and I knew Faerthen. It seemed like a great opportunity to deepen my travels in a landscape of snow and avalanches that had grown a little less foreign. Besides, Faerthen was editor; I'd just be helping out. So I said yes. I couldn't have guessed I'd wind up involved with *The Avalanche Review* for over 10 years – a third of its lifespan – trying to implement a shared vision for the publication while seeing my involvement as temporary.

The first issue for both Faerthen and me was October, 2000: volume 19, no 1. The AAAP had just dropped the "P" to become the AAA. The cover article highlighted the new Forest Service National Avalanche Center, and inside were a tribute to Sam Colbeck on his retirement; obituaries for Billy Westbay, Paul Ramer, and Seth Shaw; and three pages devoted to the newly developed AvaLung. In hindsight, it's clear Faerthen and I were starting in a time of deep transition for snow professionals.

Faerthen and I had our own ideas of change. She wanted TAR to be more professional and more relevant, less of a newsletter and more of a resource for snow workers, something they'd turn to in top shacks and academic offices, a journal in which publication was an accomplishment. It was a vision I shared, and we initiated new features like event calendars, "Metamorphism," "What's New," "Avalanche of the Month," and "Q and A" with avalanche professionals. We solicited articles from a wider range of patrollers and guides. And to keep the reading from getting too dry, we printed articles from Jerry Roberts. We also started editing articles – not just proofing them for typos and errors, but making suggestions to improve tone, coherence, and clarity. And Faerthen instituted a new look – contents on the front page, fold reversed, more photos, and a dynamic layout.

Helping Faerthen make these changes was great; she was energetic and confident. But abrupt changes in leadership at the AAA meant that for the sixth and final issue of that season, I was suddenly left as editor on my own. I

Continued on page 27 ➡

## THE TAR BABY

continued from page 21

had used after she transitioned from the old, cut-and-paste layout on boards to the new digital technology. Soon, I could just bring her a disk of text files along with the photos and artwork. Although it made life simpler for me, I chewed through a different graphic layout person every year or two because they quickly became weary of the shoddy quality of the material and my frustratingly fluid schedule, which revolved around the timing of avalanche cycles.

In those days, at least half the material submitted to me came as handwritten pages. I remember my old ski-racing buddy, Mark Kalitowski, handed me the now-classic article, *The Avalanche History of Alta*, handwritten on a yellow legal pad. I heavily edited his writing – actually I started over from scratch – and I probably should have listed myself as a co-author. Luckily Mark was a careful researcher and a fine photographer who did all the copy work on the old photos from the Alta and University of Utah archives. The article is still used as a respected reference and pops up near the top of a Google search.

Following Sue's footsteps from several years earlier, that first summer I did a month-long pilgrimage to the Swiss Institute of Snow and Avalanche Research in Davos and also in Grenoble – all self-funded, of course. I wrote several articles on their work including the work of Hans Gubler on the increased effectiveness of aerial detonations, which helped to launch the bomb tram and boo shot techniques in the US.

I don't remember how many years I remained as the editor, perhaps six or seven, but I do remember that it became an unbearable burden I longed to shed. Too many late nights, few days off, people always angry because I did not return their calls or answer their letters during an avalanche cycle, always hustling for advertising. And all this for no money. Hmmm.

I tried hard but couldn't find another fool – er...talented editor – who wanted to take it over, but miracles often arrive from the most unexpected places. Steve Conger was the forecaster with the Utah Department of Transportation and we lived about 50 yards from each other at Alta (the upper and lower Guard Stations). One day he said he wanted to take over TAR. I resolutely kept the grin off my face as I dished out the same platitudes Sue used on me several years before. "It's a service to the avalanche community; you can meet lots of people; it will be great for your career; you'll love it." Yessss!

Even though I was probably the worst editor TAR ever had, when I see how far it has come since those early days, I feel honored to play a small part in it. We should all thank the other hard-working editors and authors who have contributed so much of their time and love through the years. It has taken quantum jumps in quality with each subsequent editor – Steve Conger, Faerthen Felix, Blase Reardon, and finally to the astounding work of Lynne Wolfe. I can't help to marvel at it every month when it arrives. Little things add up to big things. ❄️

## education

# Backcountry Safety Through Effective Team Development

Story by Jake Urban

Backcountry access does not require you to have the necessary skills to travel and explore it safely, although that would be prudent. The resort skier routinely exits the boundary gates and finds him or herself entirely unprepared. Once out-of-bounds, the skill set required to survive and excel changes drastically. Ski technique is but one arrow in the quiver of the backcountry skier. In *Outliers: The Story of Success*, Malcolm Gladwell suggested that 10,000 hours of practice is necessary to master a skill. If you went on a hundred 8-hour ski tours a season, it would take you 12 and a half seasons to break the 10,000-hour threshold. Only a minority will attain this level of personal practice in their backcountry skiing careers.

Effective team membership and performance takes time too. Those backcountry groups that perform at a highly efficient level master the necessary skills over time. If this is the case how can we ever develop the team skills to safely travel in the backcountry before our knees give out?

Bruce Tuckman's 1965 research, *Developmental Sequence in Small Groups*, provides us with a tool to understand which skills need development and how it happens. In his research, Tuckman identifies five stages of group development, which provide a way to evaluate the group and its readiness or unpreparedness to take on any given objective. A highly effective team needs to develop through several stages before it effectively produces a high-quality product; the amount of time to get to that quality product will be different for every group. The stages are characterized by recognizable and observable traits that help us better define where a group is and what types of tasks they may be ready for.

Tuckman defined the five stages: Forming, Storming, Norming, Performing, and Adjourning (see diagram, right). He maintained that these phases are all necessary and inevitable in order for the team to grow, to face up to challenges, to tackle problems, to find solutions, to plan work, and to deliver results. His theories, the basis for subsequent models, are often considered a framework for all types of group development.

### Forming

During the Forming stage, often referred to as *the honeymoon*, the work output is generally low as members are focused on defining the goals and task, how to approach it, and what skills are needed. The length of this stage will depend on how clearly the task is defined. Groups with simple tasks will move through orientation quickly, but groups with complex goals and tasks may spend much longer in this stage. This stage serves to clarify the team's mission and to strengthen relationships between team members. Teams that pay attention to building the relationships as well as focusing on the task tend to do better than those that skip over relationship building. Teams, after all, are made up of people who must work cooperatively for a successful outcome. The deeper the emotional ties between teammates, the greater commitment individuals tend to have for the team. All new groups, whether novice or expert experience the forming stage, but must be given the time necessary to form. Objective-based goal orientation should not be the focus; rather, set easily attainable goals that allow the group to foster and focus on greater bonds.

### Storming

The Storming stage is characterized by arguments, a conflict, or a dip in morale. The honeymoon is over. Differences between initial expectations and the reality of the situation become clear. Members may have varying opinions of what the group is to do and how to accomplish it. Members are also beginning to confront the differences in their personalities and values. Members may feel anger or frustration with the task or with other members or may even resent the presence of formal leadership.

Generally, this stage is relatively short. Some groups, however, may become stuck in this stage and continue

to be both demoralized and relatively unproductive. In the worst cases, some groups never emerge from this stage and, possibly disband in frustration, thus proceeding directly to the Adjourning stage.

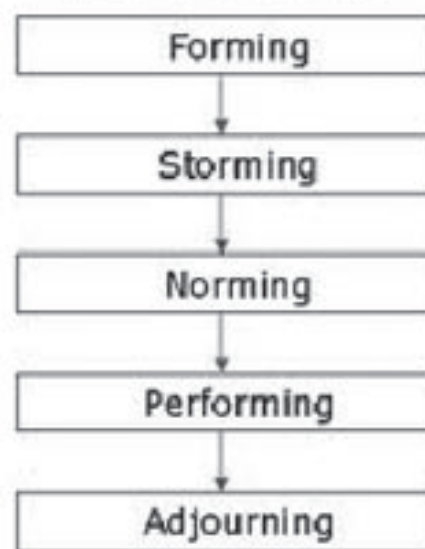
Groups in the Storming stage should limit their exposure to risk. Big unknown factors are at play while ego and individualism run high. Goal orientation may not be group-centric, and the opportunity for accidents often rises. Not speaking up or not "having a voice" can exacerbate this stage. The internalization of dissatisfaction does not equate to harmony. Take the time to resolve personal and group internal struggles and goal conflicts before trying to take on any task. Structured problem-solving tools are often helpful, leading into the subsequent stage.

### Norming

The Norming stage in the group's development involves the resolving of issues; setting up group processes; and setting of group policies, procedures, and values while increasing production. Members are now resolving differences and clarifying the mission and roles. Members are less dissatisfied because they are now learning more about each other and how to work together, and making progress toward their goals. They are developing skills that will help them work together, such as a problem-solving process, a code of conduct, a set of team values, and measurement indicators.

Member attitudes are characterized by decreasing animosities toward other members, feelings of cohesion, mutual respect, harmony, and trust, and a feeling of pleasure in accomplishing tasks. The work

### Stages of Team Development (Bruce Tuckman)



is characterized by slowly increasing production as skills develop. The group is developing into a team.

This is the time to up the ante and focus on outcomes and performance. Setting appropriate and progressively more difficult goals will help the further development of the team. Keep in mind that members are still developing skills around the code of conduct. Patience and tolerance are essential qualities in promoting group development to the next stage, Performing.

### Performing

During the Performing stage, the team is accomplishing goals/work effectively. Production is high, and the climate is positive. Member attitudes are characterized by positive feelings and eagerness to be part of the team. Members are confident about the outcome, enjoy open communication, exhibit high energy, and disagreement is welcome and handled without emotional conflict. Although work is being accomplished through all the stages, this stage reflects the work being accomplished most effectively.

This is not to suggest that only teams in the Performing stage should take on risk or set goals. Rather, if the group has just met and is still forming, their task expectation should be lower or less risky than groups who have developed into the Performing stage. Additionally, groups with less experience should



**A highly effective team must develop through several stages before it can effectively produce a high-quality product.**

develop goals that are in line with their experience.

One example of a team in the Performing stage would be a very experienced touring party that has achieved the goal of safely skiing a particularly steep line in deep powder conditions. At this stage of development, the group may implement varied and practiced communication techniques like hand signals or whistling. Position in the terrain and exposure to the risk is respectively purposeful and appropriate.

A novice touring party that has achieved the goal of safely skiing boot-top powder on a lower angle ridgeline could also represent this stage. With this group, communication is also practiced, but has simple delivery and is clearly understood by all group members. Additionally, this group may choose to stay in visual contact at all times, whereas another group's experience may provide them with the ability to communicate out of the line of sight. Both groups have developed techniques that could not be performed on their first outing. Rather, they have practiced and internalized an action and thus adopted a higher-level communication technique. With appropriate goal setting, a group of any skill level can have a peak experience and develop into the Performing stage.

It has been observed that functional teams occasionally revisit the Storming and Norming stage to strengthen their bond. Higher functioning teams often revisit the Norming stage before Storming occurs. A highly functional team, with many hours of practice in the area of conflict resolution, can recognize the need for a change in group norms before a conflict arises.

### Adjourning

The fifth and final stage, Adjourning, reflects the ending of the process. Depending on the team's success in accomplishing its task and how strongly the members bonded, this stage may reflect either a sense of loss or relief. When a team disbands, time should be spent addressing how to properly recognize the team's accomplishments. Assuming we have all been to the brew pub after an epic powder day, my guess is that backcountry skiers have this stage dialed! In all seriousness, this stage is incredibly important, especially to educators, as it represents how we close our courses. A meaningful debriefing or structured course close is not only imperative to the development of the team by honoring their efforts, but also helps facilitate students beginning to tour with peers. Colin Zacharias' article, *Where Do We Go From Here? A Lesson Plan for Post-Course Student Risk Reduction* is an excellent resource that can help instructors develop an effective adjourning stage.

Finally, adjournment can include the members leaving or in the worst of scenarios, can also be experienced by the loss of a team member due to



death. With any loss of life grief is a necessary and integral part of the Adjourning stage.

### Teamwork Implementation

My suggestions for instructors implementing this model of group development begin with having a humble respect for the concepts that we teach and the amount of time students must commit to their own personal application even before a basic competency can be achieved. When introducing the concepts of teamwork, we often suggest that everyone has a voice and that team members have as much information about the goals, objectives, roles, values, and processes. For example: the right route for the right group at the right time. While introducing these concepts, include the idea of continuously setting goals to develop these skills through experience and time with considerable practice, preferably under the tutelage of a more experienced partner.

Students would be best served if instructors had an increased understanding of how to apply the five stages of group development model to a working group in order to facilitate better group experiences and outcomes. I have been a part of this at the beginning of every AIARE in-house training course, where enough time for some type of introductory activity allowed for

a forming stage, the crucial building block to creating a functional team. Individuals are all more accountable to a group when they have some form of emotional connection. By developing good facilitation techniques and fostering a team atmosphere in our courses, not only do we model the process of team building but potentially create an environment that is emotionally and physically safer for students to learn in.

Finally, the idea of mentorship may be the most important part of the solution. Through mentorship one may develop skills faster and avoid some of the pitfalls of inexperienced leadership and decision-making. Most professional organizations committed to safety suggest this practice. Both AIARE and the AMGA are great examples of this practice; they support mentoring by requiring it as part of the process of becoming an instructor.

My suggestion is to take this a step farther and be a mentor to someone in your personal life as well. I am not suggesting you to take a gaper out to tomahawk down your double-top-secret powder stash. Rather, support someone who has more potential than experience and whose company you enjoy.

While these suggestions won't eliminate accidents, they can be part of the solution. In 1994, Fredston, Fesler and Tremper wrote an article entitled, *The*

*Human Factor –Lessons for Avalanche Education*. In their conclusion, they stated, "In teaching mountain travelers how to evaluate avalanche hazard it is not enough to focus only on the physical factors causing avalanches." They make it clear that more time should be given to the exploration and understanding of group dynamics. Just one more skill set worthy of 10,000 hours of practice. What are you waiting for? The clock is ticking!

*Jake Urban is a Jackson Hole-based outdoor educator who teaches for Central Wyoming College (CWC). Additionally, with his wife, Marilyn Davis, they co-own Jackson Hole Outdoor Leadership Institute through*



*which they provide AIARE avalanche and SOLO wilderness medicine curriculum for CWC. When not teaching you can find Jake in the Teton backcountry working on his 10,000 hours in a variety of skill sets.* ❄️

## Before & After the Avalanche

Story by Marilyn Davis

Traveling safely and efficiently in the mountains, whether in summer or winter, requires more than accumulating sport-specific skills or certifications. And doing things thoughtfully and safely often loses out to doing things quickly and easily.

A combined Avalanche Level 1 (Avy 1) and Wilderness First Aid (WFA) course was born at Jackson Hole Outdoor Leadership Institute from our desire as owners and instructors to provide students with the decision-making skills to avoid avalanches, and also to prepare them as first responders to care for injured patients in the backcountry if the need should arise. We also wanted to increase the backcountry user's perspective of the possible consequences of an avalanche incident such as traumatic injuries, asphyxiation, hypothermia, extended care, and rescue times. In this combined course, just like in standard stand-alone wilderness medicine and avalanche courses, emphasis was placed on the anatomy of an accident and the behaviors that prevent them. In the aftermath of an avalanche accident, personal skills as well as skills in leadership and patient care matter, and can mean the difference between life and death.

Leadership and communication were taught via the planning, preparatory, and decision-making aspects of the combined course. Students worked through a process that required them to self-assess, ask questions, weigh possible options, and encourage conversations and open dialogue. We wanted students to begin to consider themselves teachers, to begin to develop a leader's persona, and to model the behavior they desired. We

asked students to consider not only the weather, terrain, and snowpack, but their own and each other's skills, experiences, concerns, and informed opinions.

Over the course of several days students became more open and comfortable with each other. They hashed out ideas, shared war stories, and started to redefine "prepared." They became more at ease with revealing pain and limitations and realized how drastically a single member's strengths and weaknesses impacted the whole.

The Avy 1 provided an immediate application and relevancy to the WFA and the reverse was true. Students all tuned into the avalanche science more keenly, knowing the destructive power of even a small avalanche, and the consequences for not understanding the critical factors. WFA became more real because an immediate application was clearly right there.

Sure enough, the small stuff was all manifested in our field days despite discussing these preventable issues during classroom scenarios. We made our best attempts to develop awareness and encourage self-management, but students still made (minor) bad decisions and at times learned the hard way. Two students who had not spent long days in their ski boots encountered blisters. One arrived on the second day with his blisters properly bandaged and showed them off. Another student stopped the group en route to voice concern and address a hotspot before it actually blistered. Though this could arguably appear to be a small or even insignificant "injury," on a longer or overnight trip it can mean the difference between a quick, fun ski out and a

lengthy, torturous one. It also helped students extrapolate to the setbacks a broken leg or unconscious patient would present.

In the WFA classroom we discussed preparing for all weather conditions. This included a lecture on heat loss, conservation, and gain. More talk about prevention: layering, emergency clothing, sunscreen, sufficient food, water, and hot sweet tea. In the field, we stopped for breaks to adjust layers, snack, and check in with each student. In the field we found that one student didn't bring multiple layers, and another student owned only cotton and brought several changes to compensate. Lunch was at each student's leisure. But on day two, one student revealed that he was so caught up in the day's activities that he never ate even though he had time and watched others eating.

On field days, students had the option to bring first aid materials that were available to them in the classroom. We cautioned them to maintain realism, and to only bring things they thought they would add to their first aid kits. Students added triangular bandages, splinting materials, rope, tarp, extra food, and water. In this regard we felt that we had increased awareness.

Afterward, we found that the students in the class believed that combining the curriculum was essential to maximize and ensure safety in the backcountry. All of the students had some side and backcountry experience, and immediately saw the benefit of both avoiding an avalanche, but also ultimately surviving one. The immediate application served to make all the peripheral, more conceptual material more relevant and easier to comprehend and appreciate. This included the responsibility and liability issues as well as understanding (and interfacing with)

the significant industry built around guiding, first aid, and rescue.

As instructors, we believe that the courses reinforce each other; much of this context would have been less vivid or meaningful without the practical, integrated application.

Since both Avy 1 and WFA are introductory in nature, we cautioned students that mastery would be an unrealistic, immediate goal. However, we hoped to instill the need for continuing education so students could continue to master all of the skills necessary to travel more safely in the backcountry.

*Marilynn Davis (photo above) is an owner/instructor of Jackson Hole Outdoor Leadership Institute, a part-time EMT/FF for Jackson Hole, WY, and an adjunct faculty member at Central Wyoming College's Jackson Campus. Ed Sanden, a student from the combined Avy 1/WFA course, graciously provided course feedback and content for this article.* ❄️



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## decision·making



Familiar terrain with a minimum of tracks: enticing us through the fog. Tough set of decisions today, but remember that it is called Avalanche Bowl for a reason. Teton Pass, from the Glory bootpack.

# The Sensibly Guided Search: Heuristic Processing in Avalanche Terrain

Story and photo by Chris Zajchowski

Heuristics – rules of thumb or cognitive shortcuts that influence judgment and decision-making – have received a good deal of attention in recent years as potential causes of human-triggered avalanche accidents (*Bader, Bostock, Lau, Quade & Wilkes, 2010; Tremper, 2001; Furman, Shooter & Schumann, 2010; McCammon, 2000; Simenhois and Savage, 2009*). McCammon's initial work correlating FACETS heuristics – familiarity, consistency, acceptance, expert halo, social facilitation, and scarcity (tracks) heuristics – avalanche accidents (2004) has provided a foundation to explore other potential cognitive shortcuts, such as Margaret Wheeler's discussion of a developing gender heuristic (2008).

The number of heuristics complicit in avalanche accidents seems to be on the rise. With this proliferation in rules of thumb the general take-home message with the unveiling of each new heuristic has been a warning to be wary of how previous experiences affect decision-making capability in avalanche terrain. As Wheeler states, it is important for backcountry users to examine:

"...[How] do your own perceptions stem from your own experiences? How might they be shaped by them, and how might they be leading you astray? What might your experience level, your training, and your background do to shape your personal mindset, therefore your decision-making dynamic?" (*Wheeler, 2008*)

Assessing what previous perceptions, mental maps, and stereotypes we all bring into the backcountry is crucial to confronting the potential for heuristics to negatively effect the judgment and decision-making process. That said, in the effort to name and quantify the use of shortcuts, what often gets pushed to the side is why the shortcuts are created in the first place. In other words, if heuristics are potentially harmful, why are they so commonly used?

Through a deeper look at the dual-nature of heuristic specific to avalanche terrain, it's clear that individual rules of thumb can be both situationally useful and harmful; by discussing how lived experience creates heuristics, the current research in avalanche education, which focuses on heuristics as "traps," becomes just half of the story. Perhaps most importantly, examining how our daily lives inform our heuristic framework provides one possible reason as to why it's so tough to teach decision-making through heuristic and see positive results.

### Heuristic paradoxes

When students in avalanche courses are instructed to watch out for the six heuristic traps outlined by McCammon, or the gender heuristic identified by Wheeler, they are essentially being asked to be wary of how their previous experience influences their judgment and decision-making. While this call for self-reflection is important, it can also be problematic.

For example, the familiarity heuristic focuses on the use of past experience to deal with present situations in familiar terrain. A party who assumes a slope "never slides" because the group has skied it a billion times with no issues is relying on the familiarity heuristic. On the other hand, if the same party sees or hears bull's-eye data and decides to pack it in for the day, based on their collective, previous experience in familiar settings, they are also relying on the familiarity heuristic. In either case, the party has chosen the same shortcut – familiarity – based on different data – "never slides" or "bull's-eye data" – to make a decision.

The results from Nate Furman, Wynn Shooter and Scott Schumann's recent study build on this paradox (2010). In their examination of factors influencing decisions to ski, Furman, et. al., found the avalanche forecast to be the most influential variable in their

sample's decision-making process, with five of the six FACETS heuristics, as well as individual skier's propensity for risk, contributing to decision-making. The increase in avalanche hazard was, predictably, found to lead to a decrease in decision to ski. While few would argue that using an avalanche forecast is a dangerous, irrational component to determining whether or not to drop in, it may come as a surprise that a decision based on an avalanche forecast is itself a heuristic.

The availability heuristic is defined as the process of using the most recent or influential information to guide one's decision-making (*Priest & Gass, 1997/2005; Tversky and Kahneman, 1982*). Availability accounts for the subjects in study by Furman, et. al., who relied, more than anything, on avalanche reports to make decisions in the backcountry (*Furman, Shooter & Schumann, 2010*). Availability also accounts for two of my friends who refused to ski in the Wasatch backcountry for the better part of the 2008/09 season. After standing in the probe line at Snowbird, helping search for avalanche victim, Heather Gross, they simply didn't want to touch the backcountry. Even when the hazard level dropped, the experience most readily available, the one that had a lasting impression – probing in-bounds – was what guided their decision-making.

In both cases listed above, the availability heuristic influences judgment and decision-making. That said, it's difficult to say that either group's decision to trust the most readily available information – avalanche report or probing in-bounds – was unjustified or a "trap."

### The Sensibly Guided Search

It seems heuristics can be useful or harmful, and a single heuristic – familiarity or availability – can be

Continued on page 28 ➡

# On to the Future

Story by Lynne Wolfe

I'd been a TAR subscriber and then a AAA pro member, zealously devouring every new issue of *The Avalanche Review* front to back, then stashing them to digest later. First issues in my records actually belonged to my husband Dan, who studied snow under Sam Colbeck at CRREL: volume 1, number 7; and volume 3, numbers 1, 3, and 4. My own issues begin with volume 15. I was late to the snow and avalanche world; unlike many of you, I didn't learn to ski 'til my 20s and about avalanches too much later, after a few close calls in the early '80s on Teton Pass.

My involvement with the magazine began, however, at ISSW 2002 in Penticton, where I had the fortune (or misfortune) to sit next to Blase Reardon, then-editor of TAR, at the AAA membership meeting. When, after a couple of beers, I remarked that one speaker obviously needed editing, he challenged me, "So you think you can edit? I'll let you give it a try." I tackled a couple of articles for Blase, earned a little cash for my efforts, and was hooked. After a couple of years and a promotion for me to co-editor, Blase and I started writing editorials, planning out our

issues, cornering presenters and poster authors at ISSW, persuading them to write up their work for us. The first issue where we implemented this idea was 23-3, where we brainstormed a human factor and decision-making issue at the Jackson ISSW in 2004. Articles included pieces from Laura Adams, Iain Stewart-Patterson, Steve Conger, David George, and the first look at the stability wheel from Don Sharaf and Ian McCammon. We were thrilled when our editorial, calling for input and observations, motivated Ed LaChapelle to put down a few words for TAR in his seminal essay, *The Ascending Spiral*, that first appeared in TAR the following fall, 24-1.

TAR 24-1 was also my first issue as editor-in-chief. Blase had decided to go back to grad school, leaving TAR in my lap, but also leaving us financially solvent, in the hands of a remarkable graphic designer, Karen Russell of Fall Line Design, and he worked tirelessly to transition us to color. I felt set up for success.

In the last few years as editor, I have taken advantage of the immediacy of communication in this electronic age. Articles no longer go back and forth at the pace of the US Postal Service. I can send off edits or a request for a sidebar, solicit a bio, a photo, a writeup, and generally expect a quick reply. With an eye on the internet, close calls and amazing photos come to my attention almost instantly. TAR has become a forum for timely case studies with honest analysis; a place for subtleties of perspective, sidebars that clarify, expand, or contrast a central point.

In addition, we have an active AAA board and buy-in from forecasters, guides, patrollers, and educators; when something newsworthy happens they persuade compatriots, "You need to write that up for TAR." I have been able to change my spiel from, "Can I convince you to write for us?" to "I'd like to invite you to submit an article." This shift allows us to present what seems crucial for practitioners and snow geeks alike picked from the sea of information that comes from ISSW and a plethora of continuing education forums.

Please continue to send TAR your snow and avalanche-related musings, problems, remarkable events, and photos. We will still take articles sketched on the back of a cocktail napkin, but high-resolution photos and Word docs are gratefully accepted. Check the AAA Web site publications page for our Guidelines for Submissions and deadlines.

THE  
*Avalanche*  
REVIEW

A Publication of the American Avalanche Association

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Playing  
**BATTLESHIP**

Doing battle with buried surface hoar calls for some innovations in strategy; here are some ideas to get us started.

Story by Scott Davis

This S5-N-R2-D2-O avalanche (photographed via helicopter on April 2) failed on buried surface hoar approximately 1m deep, which formed between March 20 and 22 in the Chikot Range near Haines, Alaska.  
Photo by Matt Borish

See more on tracking this layer from Matt Borish on page 16

I am not sure who remembers that childhood game called "Battleship." It's a game where you call out letter/number combinations, hoping they correspond with a square on your opponent's grid that contains one of their battleships – basically a hit-or-miss kind of thing. I am reminded of this game every time I trounce around in terrain with a buried surface hoar layer that I never observed while it stood proud in the light of day. You know it always seemed it would be easier to win at Battleship if you could somehow get a peek at your opponent's layout before you started, but of course that would be cheating! I suggest the same is true for us "avalanche poodles." Remember, this is a game we all want to win, even if we cheat a little bit.

Canadian avalanche professionals are pretty good at recording to standards and disseminating endless streams of information and data, and we should congratulate ourselves for that. But we also need to acknowledge how lame we are at tracking and mapping surface hoar in a meaningful and useful way.

Currently, to the best of my knowledge, this is the state of affairs. Observations of surface hoar formation are noted in personal field books, perhaps commented on in the InfoEx

See story continued on page 17

The Avalanche Review  
P.O. Box 2831  
Pagosa Springs, CO 81147

In *Playing Battleship*, Scott Davis issued an open-ended challenge to the avalanche community on tracking weak layers. That article first appeared on [www.avalanche.ca](http://www.avalanche.ca) and – at the suggestion of a TAR subscriber and with CAC permission – we're reprinting it here. Alongside it we're publishing responses to a variant of Scott's challenge that I sent to a wide variety of snow aficionados.

How do YOU map/track the distribution of a weak layer? Show me a page from your pit book, an overlay that is electronic or hand-drawn, a coherent narrative that is easy to interpret. Industry standard or personal innovation? What do you use/what are your considerations?

From the variety of responses, it's clear not everyone plays Battleship the same way. You may not agree with all the viewpoints or need the sophistication of some of the tools, but I hear a similar message in each: "Pay attention!"

—Lynne Wolfe ❄️

**in this issue**

From the Executive Director ..... 2  
From the Editor ..... 3  
AAA News ..... 3  
Metamorphosis ..... 5  
What's New ..... 6  
Education ..... 11  
ABCs of Digging ..... 11  
Media ..... 12  
Social Media Helps Track Avalanche Incidence ..... 12  
Snow Science ..... 14  
La Niña Implications ..... 14  
Playing Battleship with Weak Layers ..... 17  
Crown Profiles ..... 22  
New Zealand Earthquake Avalanches ..... 22  
2009/10 Season Summaries - Europe ..... 25  
2009/10 Season Summaries - United States ..... 27  
Hans Saari Grant Reports ..... 28

*I talk snow with everyone I run into and then digest what they say about the weak layers. This motivates me to dig even more, because a lot of what you hear doesn't make any sense, but it helps me to look for layers I might have missed.*

—Kent McBride, *Playing Battleship*, page 19

TAR added color in 2005, as this issue from 2010 displays. What does the future hold for TAR?

What's next? Well, we plan to keep the hard-copy format for a long time; I treasure the image of dog-eared copies in the patrol shack, on the back of the can, in a cardboard box trucked from rental to rental. But you can now have your subscription in electronic form if you prefer: contact me or Mark Mueller for details. No plans yet for an online magazine: is that something we should pursue? What is your vision of TAR for the rest of the 21st century?

Thanks for the support, Lynne.

*Lynne's interaction with The Avalanche Review: Assistant editor 2002-03, issues 21-2 to 22-3; co-editor 2004-05, issues 22-4 to 23-4; editor 2005-11, issues 24-1 through 30-2. ❄️*



Current editor Lynne Wolfe (above) and former editor Blase Reardon (right) worked together to take TAR into the 21st century.

## 21ST CENTURY TAR

continued from page 23

initially refused; a few issues as assistant editor weren't enough experience. But Russ Johnson, then-president of the AAA, claimed he couldn't find anyone else, so I was tagged and it.

The next year – TAR's twentieth – was rough for everyone involved. I worked to carry on Faerthen's vision, but the expansions we'd initiated were hard to manage on my own, especially on a publication schedule that called for an issue a month. It was difficult finding enough material to fill each issue when snow workers were busy in the snow. Some authors resisted having their articles edited, leading to a few tense conflicts. Our graphic designer sometimes disappeared into the red rock desert where he DJed raves. I was dealing with a death in my family and trying to establish a new avalanche program. I tried to quit.

Russ Johnson would have none of it. He requested and implemented my ideas for changes that would expand and professionalize TAR – four issues of 16 pages a year, no micro-management from the AAA board, and a published editorial policy noting that submitted articles would be edited just as they would in any other publication. And I started hearing from snow workers that they liked the changes. "Thanks for making a powder monkey like me look good," one wrote after my edits. I stayed.

I kept working to grow TAR, though I still saw myself as an interim editor. For most of Volume 21, TAR was at least 20 pages an issue, with material left over. That was partly because I'd Huck Finn'ed the gregarious and well-connected Lynne Wolfe into my old job as assistant editor. Over the next two years, she and I planned theme issues and hired a new advertising coordinator. We worked to publish articles on the forefront of snow and avalanche science. She was promoted to co-editor, and found a new graphic designer with a great eye, Karen Russell, who communicated readily and brought energy and ideas to each issue.

TAR's growth increased production costs, and for a couple of years it seemed I was asking the AAA Governing Board for more money at every meeting. To their credit, the board approved each request. Eventually, Lynne and I went for broke and proposed printing TAR in color. Again, the board approved, and with TAR the kind of professional publication Faerthen and I envisioned and Lynne ready and capable, my interim editorship was finally done. As publications chair for the AAA, I remain involved in the TAR's production, though on a day-to-day level that involvement is nominal, because Lynne, Karen, and Jazz are remarkably energetic, competent, and productive. Personally, my involvement remains highly meaningful, accidental travels through a land where I've wound up living. ❄️

## HEURISTIC PROCESSING

continued from page 26

situationally interpreted as good judgment and as a trap. If this is the case, the question arises as to how students, new to decision-making in avalanche terrain, might easily learn to effectively use their knowledge of rules of thumb in the backcountry? When is the “avalanche report heuristic” – a combination of both availability and the expert halo – helpful, and when can it disproportionately negatively affect one’s judgment?

A look at the origin of heuristics provides a potential way out from this binary. The term heuristics comes from the Greek word “eureka,” describing a search or discovery (Audi, 1999). Prior to the term’s appropriation by cognitive psychologists to describe biases that limit optimal decision-making, the term carried with it a significantly more neutral definition (Gigerenzer, 1991). In certain philosophical camps the term heuristics is considered a part of a larger process or heuristic procedure:

“Discovery is a matter neither of following exact directions to a goal nor of dumb luck, but of looking around sensibly, being guided as much as possible by what you know in advance and what you find along the way. So a heuristic procedure is one for sensible discovery, a procedure for sensibly guided search.” (Audi, 1999)

When viewed as a “sensibly guided search,” heuristic procedure has a great deal in common with the goals of avalanche education. Teaching students to take ECT scores, assess terrain, and follow weather patterns all informs a sensibly guided search, resulting in a game-time decision of whether or not to ski. Cognitive shortcuts – locate islands of safety, analyze bull’s-eye data, avoid terrain traps, etc. – are effort-reduction strategies that help inform this search.

It is important to note that heuristic procedure is an ongoing process, unlike the dominant view of heuristics as automated, fixed rules of thumb. Taking this into account, it seems what is potentially worrisome is not how our experience shapes our perceptions, but when that learning from experience transfers into fixed, inert, and static ideas and automated, unconscious decision-making. Just as a hasty pit from three months ago shouldn’t be the sole component informing a decision to ski a slope, neither should a cognitive shortcut.

So, rather than confronting heuristics, it seems the unfreezing of heuristics from their fixed, often unconscious, state is what is needed. Once brought to consciousness, their usefulness in the present search – “Should I ski this slope or not?” – can be evaluated. What is needed is a tool to encourage meta-cognition, thinking about thinking, to help bring often-unconscious heuristics into a conscious decision-making process. It is only then that a heuristic’s situational usefulness or harmfulness can be assessed as relevant to the specific slope, skin track or sensibly guided search.

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Chris Zajchowski is currently program coordinator in the Office for Outdoor Experiential Education at Loyola University, Chicago. Prior to this he lived in Jackson, Wyoming, and skied Teton Pass on a regular basis. He’s happy to have a good job, but not-so-secretly misses the access and good skiing. ❄️



## Unfreeze – Change – Refreeze: A Model for Heuristic Analysis

Story by Chris Zajchowski

While the models, metrics, and tests for snowpack stability have continued to evolve and improve to be quicker and more efficient “easily-applied decision tools” (McCammon, 2004), it appears stability tests for our “fast and frugal” heuristics (Gigerenzer, 2009) haven’t kept up.

Acronyms FACETS and ALPTRUTH have been helpful models to submit potential heuristic and environmental factors to memory (McCammon, 2004; McCammon & Haegeli, 2007). Kent McBride’s (2010) *Look, Listen, and Feel* provides an additional model to put acronyms into action. In addition to these tools, *The Change Model*, developed by Kurt Lewin provides a framework to transfer heuristics from their fixed, static nature into components to assess decision-making in avalanche terrain (Audi, 1999; Lewin, 1951; Luckner & Nadler, 1997).



As a physicist and social psychologist, Lewin used the phase changes in h<sub>2</sub>O – specifically the imagery of a block of ice that has been the re-frozen into a different shape after having been melted – to provide a metaphor that is now widely used to describe a potential model for organizational change, as well as the deconstruction of mental models (Lewin, 1951). The *Unfreeze – Change – Refreeze* metaphor, analogous to the corn cycle in an isothermal snowpack, also seems an appropriate tool to connect backcountry users who are familiar with assessing spring snowpack conditions to a conversation around assessing their own heuristic processing.

### Unfreeze

The corn cycle exemplifies changing snowpack composition, with optimal skiing occurring following the unfreezing of a bullet-proof surface. Similarly, Lewin’s change model argues the best decision-making window following the unfreezing of static, cognitive shortcuts. Lewin refers to this unfreezing as “the unlearning process,” which will provide more room for new learning (Luckner & Nadler, 1997). For example, using McCammon’s “familiarity” heuristic (2004), unfreezing the notion that a slope “never slides” will allow for a skier to make additional observations to influence her decision-making: Have there been any recent precipitation, wind-events, etc.? Any pertinent information from hand-shears, pole plants, or hasty pits? Any present bull’s-eye data? In this situation, after the unfreezing of the familiarity heuristic as the driving factor in decision-making, a skier can use tools like ALPTRUTH; FACETS; Look, Listen and Feel; and stability tests to assist in her decision-making.

### Change

When the snowpack changes from bullet-proof to corn, the perfect window to

ski within the corn cycle is created. When the decision-making of the skier changes from relying on automated, unconscious heuristics to a heuristic procedure (Audi, 1999), from a fixed rule to open search, the perfect window for decision-making is created. The unfreezing of heuristics allows for situational change in the way each heuristic is used in decision-making. In other words, if our skier can remember to unfreeze her heuristic framework when approaching a slope, she can consciously recognize that she is relying heavily on the familiarity heuristic and quickly stop to analyze if there is other pertinent data that corroborates or contradicts her heuristic. In doing so, she does not entirely dispose of the knowledge from her previous experience that the slope “never slides,” but she tests out the heuristic against other pertinent information. She takes the heuristic and adopts it as part of a broader heuristic procedure or sensibly guided search.

### Refreeze

As the temperature drops, the snowpack refreezes, and the corn cycle starts all over again. The same seems true for heuristics within a heuristic procedure. Following any learning experience, situational lessons will be extrapolated to reinforce old heuristics or potentially form new ones (Luckner & Nadler, 1997). Those lessons will then be re-frozen into an individual’s mental map, and their situational relevance will be tested another day. For example, after resisting the urge to drop into the slope that “never slides,” solely on the basis of that heuristic, our skier unfroze her past learning to create space for other environmental data. After changing her automated process to make room for new learning, she was in the perfect headspace to analyze other data and make a decision in her sensibly guided search. In this case, she assessed pertinent environmental factors, gave herself and her party the green light, and hit some hero pow.

At the bottom of the slope she refroze her experience into a familiarity heuristic stating that the slope “never slides.” When she returns to the same slope the process starts all over again – taking into account her previous experience, but keeping it from biasing her to environmental and human factors present on that specific day.

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Sometimes we make questionable decisions. By not taking the time to assess alternate routes, they saved mental energy, but faced the possible consequence of soggy feet for the next two weeks. Zach Guy and Mike Bestwick cross a river in search of snow. Ruby Mountains, Nevada.

*Photo by Alex Marienthal*

## Recognizing Decision Fatigue as a Factor in Decision-Making

Story by Alex Marienthal

This summer *The New York Times* presented an article online titled, "Do You Suffer From Decision Fatigue?" This seemed like an interesting topic, especially when you consider our occupations and recreational activities. The image accompanying the title contained the decision oriented phrases: "chicken or fish?" and "first class or coach?" The consequences of a wrong decision with one of these questions are not as severe as the consequences of a wrong decision with an issue we may face as avalanche specialists. "To open or close?" and "explosive or ski cut?" have consequences more severe than an uncomfortable seat or a dry piece of meat. In the snow world a poor decision could be damaging to persons and property, or even potentially fatal.

The article in the *Times* presented previously researched case studies to highlight some of the psychologically taxing aspects of making a decision. A single choice is not tiring, but when a series of decisions is being made the brain starts to take shortcuts to conserve energy and avoid becoming mentally exhausted. Focusing on single aspects can save energy and make the decision process easier. One example presented describes a shopper who eases the decision process by choosing based on just price or quality. When a decision involves avalanches and high consequences we cannot focus on just one part of the puzzle. If one were to only consider recent activity or snowpit results, other important information would be omitted.

Another shortcut occurs when one becomes low on mental energy; avoiding a decision may seem more favorable because it avoids the stress of making the wrong choice. While this provides immediate relaxation for the brain, it likely creates bigger problems in the long run. For example, one could be faced with turning their touring group around as snowfall rates increase, but it may seem less mentally taxing to not make a decision, allowing them to continue until further observed changes in conditions. It would be safer to stop, discuss, and weigh the possible scenarios, but this takes mental energy that may need to be conserved.

One study done in a lab discusses the effect decision fatigue has on willpower.

One group of people were presented with a series of decisions and then put through an activity of self-discipline. Another group, without making a series of decisions, went through the same self-discipline activity. The activity was a test of how long each subject could hold their hand in a bath of ice water before pulling it out. Those who made decisions prior to the test held their hand in the water for an average time less than half that of those who did not make decisions. This displays a direct decrease in willpower and the ability to control impulses when mentally exhausted.

The difficulty of making decisions due to the brain's attempt at limiting taxation of mental energy, and the consequent lowering of willpower, may be something avalanche professionals and backcountry enthusiasts want to consider. We are often placed in situations where we have become mentally exhausted and are faced with high-consequence decisions. I challenge myself – and all those who are involved in mentally exhausting, high-consequence situations – to consider the factors of mental exhaustion and decision fatigue while we are making decisions. Is it possible that a decision is being made based on an addiction to powder and low willpower? Could our decisions be driven by the instinct to use less energy by not making a decision and just continuing forward, rather than weighing the options to make a proper holistic assessment of the situation? When the route home at the end of the day presents powder, high consequences, and is possibly shorter than the route that is likely safer, consider the likelihood that a decision to take the short powder-filled route is based on a decrease in willpower or low mental energy, as opposed to an assessment of all the variables.

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### AVALANCHE BULLETIN

*continued from page 18*

the agencies responsible for public safety. After extreme avalanche activity in the winter of 1950/51, structural avalanche protection and the avalanche warning service were expanded. An additional 30 observers were recruited to telex daily reports to Davos, and the number of avalanche



Members of today's avalanche warning service attending their daily briefing.

bulletins in the winter season doubled to around 40. The SLF published the avalanche bulletin by radio and print media. Since the early fifties the bulletin was additionally accessible by phone. In 1989 the service phone number 187 was introduced, that it still in use today.

### European Avalanche Danger Scale

Although a Working Group of the European Avalanche Warning Services (EAWS) was founded in 1983 to improve cooperation across national borders, the individual countries continued for a long time to use a variety of danger scales for avalanche warning purposes with six to eight danger levels. In 1994 the EAWS introduced the five-point European avalanche danger scale. This adoption of a uniform scale represented a breakthrough in international avalanche warning and simplified matters for all interested parties.

### From Status Report to Forecast

Until the winter of 1996/97, the SLF had been steadily improving the avalanche bulletin in Switzerland, and was publishing it in the mornings, between 9 and 10 am, two to three times a week on average. The bulletin reported the prevailing conditions. From the winter of 1997/98, the service was substantially expanded again. Since then, the national avalanche bulletin has been published daily, at 5 pm, in the form of a forecast for the next 24 hours. In the period until winter 2002/03, the forecasters gradually introduced seven regional avalanche bulletins, published at 8 am and containing an update of the day's forecast. A tighter network of observers and the new series of automatic weather stations that were established (Intercantonal Measurement and Information System) continue to supply the data that underpin these reports. The emergence of the internet and the graphic options it affords, as well as, more recently, smart phones, has facilitated distribution of the bulletins and made them an indispensable aid for winter sport participants and the safety authorities. ❄️

# 2010/11 Season Summaries (continued from TAR 30-01)

## The Good, the Bad, and the Rainy



A sled can be a great tool for getting deep into the Payette backcountry, or deep into a tree well. *Photo by Dave Bingaman*



A dust layer above the MLK crust/ facet combo makes it easy to identify the culprit. A dense slab over the dust caused widespread failure on the MLK layer during the first week of March. *Photo by Dave Bingaman*

### ■ Payette Avalanche Center

The winter of 2010/11 was as varied as winter can be in the West Central Mountains of Idaho. Our weather was dominated by above-average precipitation that came in as an abundance of 7-10% snow, big dumps of blower snow, and frequent doses of high-elevation rain. The storms also brought unusually high winds that created giant cornices, pillows, and a variety of wind-related crusts and slabs. These factors resulted in more days of considerable avalanche ratings than any of our previous seasons and the issuance of three high-hazard bulletins through our local NWS office. Given the conditions, we were extremely lucky that we avoided any fatalities this year in our forecast area, yet we did experience several close calls involving both snowmobilers and skiers.

Late November and early December brought some extremely cold temps and good early season conditions, followed by our first helping of high-elevation rain just before Christmas. These conditions triggered our first widespread avalanche cycle of the year. The holidays brought in 20-30" of snow which set us up for our second big cycle of widespread avalanche activity and our first NWS high-hazard bulletin.

January came in with cold temps and a brief high pressure inversion that created a widely distributed layer of surface hoar and near surface facets. This high pressure and the daily recycling of the snow surface allowed skiers and sledders to get into the region's steepest terrain under relatively safe conditions. On January 12 we experienced another rain event followed by several days of heavy snow and high winds. These conditions brought on the second of our high avalanche bulletins in conjunction with the Boise NWS office. The resulting avalanche cycle included some of the biggest and most widespread slides of the winter with crowns visible on almost all of our backcountry slopes. The MLK weekend brought the tourists to the area and also another disheartening rain event followed by low temperatures and some ice rink-like conditions throughout the West Central area. January concluded with a few light accumulations and easy touring conditions on all aspects. Sledgers and skiers took advantage of these conditions by venturing into some truly remote and seldom visited areas.

February was a continuation of the January lull in the storm cycle until the middle of the month when the snow gods woke up again. We ended the lull with 16 inches of blower snow and high winds that resulted in the first of several close calls. A sidecountry skier without avalanche gear near Tamarack Resort set off a slide that cleaned out most of the easily accessible Wildwood Bowl down to the old snow/new snow interface. Most of February brought more blower snow and high winds that provided challenging conditions on the upper-elevation slopes and nearly epic snow conditions in the mid- and lower elevations.

The first week of March proved to be the most exciting week of the winter with four partial burials on the newly awakened MLK rain crust. The incidents involved three snowmobilers in separate locations and one sidecountry skier – again in the Wildwood Bowl with no avy gear. All were on a fairly dense slab overlaying a thin layer of facets resting on top of the MLK layer. This layer was easily recognizable by the layer of wind-transported dust just above it which made for some great photos throughout the remainder of the month. All of these incidents happened under considerable hazard on aspects that were specifically mentioned in the daily bulletins. March 16 was the third day of high hazard across the West Central with a storm cycle that lasted for three days and left behind 16-22" of wind-blown snow. During this cycle we had up to three inches of water equivalent in some areas over a 48-hour period. Late March and early April closed out our forecast season under considerable hazard with above-average precipitation and relatively cool temperatures that made for great spring skiing and even a few good powder days in May. Local enthusiasts enjoyed spring skiing well into June with a few die-hard folks finding late-season turns in July.

The Payette Avalanche Center issued 60 forecasts during the 2010/11 winter season with two forecasters and one paid travel companion. In addition to three USFS employees, PAC utilized several volunteer travel companions throughout the season and received snowpack information from the Tamarack Resort ski patrol, from the Brundage Mountain Resort cat ski operation, and from several local skiers and snowmobilers.

PAC hosted outreach and education programs that involved more than 500 participants throughout the winter. These programs included local awareness programs for skiers and snowmobilers, SAR, and agency personnel in addition to outreach to local schools. PAC also co-hosted a Level 1 class with the 705 Backcountry Patrol based out of Boise and a multi-agency avalanche drill with local SAR teams, law enforcement, and the Tamarack Resort ski patrol.

PAC and our Friends group also completed the installation of two Campbell Scientific weather stations which are now hosted through Mesowest. PAC employees and one board member of the Friends of the Payette Avalanche Center attended ISSW 2010 in Squaw Valley. PAC received a grant for an enclosed snowmobile trailer that will function as a backdrop for teaching classes to snowmobilers and as a mobile avalanche incident response unit housing backcountry rescue equipment for 10 rescuers.

PAC will continue to grow our outreach and education efforts in the 2011/12 winter season. Our biggest non-forecast priorities going into the season will be continued outreach to our growing snowmobile community and sidecountry skiers near the two local ski areas.

On a final note PAC lead forecaster/director John Groom resigned from the Forest Service this summer to pursue a new life in South Korea with his wife and son. We wish him well in his newest adventure.

—Dave Bingaman, forecaster

# A Tale of Two Storms

## ■ New Zealand Winter 2011 Story by Brad Carpenter

The 2011 winter season in New Zealand kicked off with the Mountain Safety Council's (MSC) Southern Hemisphere Avalanche Conference (SHAC) held in Christchurch June 10 -12. SHAC was revamped this season through the excellent efforts of Andrew Hobbman, director of the MSC, who brought together several excellent speakers and many folks from all different backgrounds. Bruce Tremper, of the Utah Avalanche Center, was the keynote speaker for the conference. New Zealand adopted the North American Avalanche Danger Scale this season, and Tremper, who was involved in the restructuring, and rewriting of the danger scale, helped introduce and discuss the scale, and the work that went into producing it. The new danger scale was incorporated into the newly revamped public backcountry avalanche advisory (avalanche.net.nz) this season.

The New Zealand Mountain Safety Council also introduced PowderCloud, the snow information database from Canada, hailed as the best replacement choice for the previous, and somewhat defunct, InfoEx of New Zealand. As with any new product introduced to a very large and diverse/stubborn group of people, PowderCloud was received with mixed emotions. Cost was probably the biggest gripe for most operators as many of New Zealand's ski areas are generally smaller club-owned facilities that operate on very small budgets. The original InfoEx was essentially provided free of cost. By the end of the 2011 season PowderCloud garnered mostly favorable reviews, with some details still needing to be worked out for the 2012 season.

On Sunday, June 12, the conference drew to a close, and after all the talk of snow there was only one thing missing: actual snow. A record warm May and June left nary a snowflake in the hills and mountains as opening day deadlines drew closer for the ski areas of the country. Warm temperatures also inhibited most snow making operations at the bigger fields, and folks hungrily eyed weather reports looking for cold temperatures or a big storm on the horizon. For many ski area workers it was a frustrating time, but allowed for some travel and a pseudo-summertime experience.

Three long weeks later the big storm folks had been waiting for finally arrived in the form of a vicious northwesterly flow that left some of the most seasoned



Bluff Face is a scenic place to run an avalanche hazard reduction route.

Photo by Brad Carpenter

Kiwi winter veterans stating they had never seen a northwest system like it before. Wind speeds at Porters Ski Area's ridgeline (1950 m), in the Craigieburn Range, reached a steady 195 kph (120 mph) before the entire weather mass was blown over. Around New Zealand, ski areas received from 1.5-2 m of snow on average in a storm that lasted nearly five days. The storm affected the whole of the South Island and much of the North Island. Consequently every ski field in New Zealand was able to open by mid-July.

Remote weather stations provided the only clues for what was happening in start zones during this first big storm, as the severe weather kept most operations during the event to a minimum. Stability wise, things settled out fairly quickly with avalanches occurring mid-storm. Limited backcountry observations also noted some small to medium natural avalanche occurrences. Avalanche control work post-storm thankfully had small results, and any instabilities in the snowpack were storm related as there was very little old snow on the ground prior to this first big event.

After enduring the warmest May and June in history it was only fitting that record cold in July should follow. A frigid southerly trend dominated New Zealand for several days in late July with temperatures recorded to -15°C at 1950 m at Porters Ski Area. That is damn cold when considering the average temperature is about -3°C in July, and the average Kiwi skier wears at least one cotton product in their layering system. Relief from the Antarctic freeze appeared in the form of a warm moist system from the north that was poised to move over the country. Hopes were high for a perfect storm scenario, and in the end it dumped – but just in the wrong places. Coastal areas received up to 20 cm of snow, while the mountains received about 2 cm. It was disappointing standing at the top of the Craigieburn Range skiing dust on crust while looking

out onto the flat farmland of the Canterbury Plains covered in a thick blanket of maritime powder.

This snow dumping in the flatlands of the Canterbury region only added to the misery of the people of Christchurch still recovering from the big February 2011 earthquake that claimed 181 lives and decimated the downtown business district of the city. Damage from the earthquake is well into the billions of dollars, and most of the downtown has to be torn down and re-built. Entire neighborhoods will also disappear as they were previously built in areas prone to liquefaction.

Cold and dry conditions continued for weeks, and the firm and somewhat unpleasant skiing persisted. Most areas had a great base, so all that was needed was some new snow. If I only had a dollar for every time I heard that statement this season. But the drought persisted, and in the Craigieburn Range we ended up with facet factories on south aspects and corn skiing bliss on north aspects. This trend persisted for most of the rest of the season. By early August things were looking dire if we were to make it to our closing date now two months distant. Skis were burned, oracles consulted, Ullr's name was cursed. Then praised. Then cursed again.

Finally, in the second week of August, another massive trough of Antarctic air took hold of the country. This time it coincided with a warm, moist, equatorial low, and a "perfect storm" scenario dominated New Zealand for nearly a week. Snow fell across the entire country. Graupel snowfalls in downtown Auckland made the top story on the evening news. Fierce southerly winds raked the mountains, and most ski areas shut their doors and hunkered down to ride it out. By storm's end, an additional 1.5 m of snowfall

Continued on next page ➡



Brad heads out to do control after the second big storm.

Photo by Luke Armstrong

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Athlete/Team Rider Robbie Hilliard; Photo: Joe Royer; Ruby Mountains, Nevada

## NEW ZEALAND

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were recorded to low elevations. With the average height of an adult sheep being a meter or less, and lambing season in its early stages, the sheep farmers of New Zealand were not impressed. Besides affecting the agricultural industry of the country, much of the infrastructure of New Zealand was also severely affected. Many highways were shut for days including the Arthurs Pass highway, a major east-west conduit on the South Island, which forced an inter-lodge situation for some of the ski fields and homes along its way. But the skiing was finally on!

Avalanche activity from this second large storm event was confined to a period closer toward the second half of the storm with some notable storm slab avalanches as large as size three reported. At Porters Ski Area one slide path went larger than in any previous season of recorded data. At Mt Cheeseman, a club field also located in the Craigieburn Range, a good-sized slide was reported and filmed on control: (*YouTube: Cheeseman Avalanche.mov*). There were real concerns, or were they hopes, that we were poised to see even more large avalanches, but the storm abated. Stability rapidly improved over the course of the next two days, and by the time the weather cleared no significant controlled inbounds or natural out-of-bounds avalanches were seen.

In the Craigieburn Range, one notable result from the two dominant storms of the season was the pattern of wind loading. Gale strength wind velocities for most of the duration of each event effectively stripped the high ridgelines and upper start zones back to rock, and transported large amounts of snow downslope to areas below 1000 meters. It meant that for the first time in a long time, one could ski well out into the lowland beech forests and tussock grasslands that ring the range, which made for some very long backcountry ski runs in some places.

The final blow to the 2011 New Zealand ski season was dealt in early September: Rugby World Cup fever.



The Cass River Valley, with the Black Range on the left.

*Photo by Brad Carpenter*

The Rugby World Cup (RWC), is held every four years, and was hosted in New Zealand this season drawing rugby teams and fans from 20 separate countries including the US. Yes, we have a rugby team. Rugby is the national sport in New Zealand, so much so that school schedules were changed for RWC events this season, and the usual early October school holiday was changed to later in the month. Thus, most ski areas had no reason to stay open after the beginning of October. Some hope was held out that the RWC might bring more people skiing, but at least in Canterbury, that never seemed to materialize.

So, it was the best of times, it was the worst of times in this tale of two storms, but in fact it was just another New Zealand winter. And for all its ups and downs it is what keeps most of the northern hemisphere-imported patrollers, groomers, ski instructors, and snowmakers coming back for more. In the last weeks of the season many areas enjoyed a few small, snowy freshen-ups, and stability stayed very good. We skied wind-buffed powder and sun-baked corn right to the last day inbounds and out. I'd been telling folks that I

just needed to leave the country and it would snow the next day. Within 24 hours of being back in Montana, the Craigieburn Range had a foot of new snow.



*Brad Carpenter is the snow safety director at Moonlight Basin ski area in Montana, and he also works at Porters Ski Area in New Zealand during the other winter. He recently deactivated his Facebook account and the world did not come to an end.*

