

Avalanche

REVIEW

VOLUME 29, NO. 1 • OCTOBER 2010

www.AmericanAvalancheAssociation.org

Season Roundup 2009/10

Forest Service National Avalanche Center

The Forest Service National Avalanche Center thanks all the dedicated avalanche professionals in our industry who worked diligently toward improving public and employee safety this past winter. This was another challenging year, with early season depth hoar and facets creating persistent problems both inside and outside ski areas across the West. Layers created in November and December were still producing avalanches at the end of the season in some areas. By the time of this writing there have been 34 US avalanche fatalities – only a couple shy of the record 36 fatalities during the 2007/08 winter. These included an avalanche worker, one inbounds victim, and a handful of sidecountry victims in addition to the usual mix of backcountry snowmobilers, skiers, and climbers.

Sidecountry skiers and snowboarders continue to create challenges for both ski area and backcountry forecasters. Like it or not, when folks run into difficulty in these areas, ski-area personnel are often called upon by the local search and rescue groups to assist in often difficult and dangerous rescue and recovery work. For backcountry forecasters these sidecountry areas are tough because, given the right conditions, the intensive skier traffic seen in some areas can reduce the avalanche risk. Over several seasons this leads unwary sidecountry enthusiasts into mistakenly believing that these areas are somehow “controlled” and won’t slide. However, this season showed that certain other situations – like well preserved hard slabs over facets – are not affected by even thousands of skiers and can later produce massive avalanches with the right load. This was dramatically shown by an avalanche south of Bridger Bowl which was discussed at length in TAR 28-4. Luckily no one was caught in that case.

Of course, sidecountry usage is only a small piece of the puzzle for our backcountry avalanche centers in terms of improving public safety. Snowmobile fatalities are still unacceptably high, making up half of the fatalities this past season. Luckily, many of our avalanche centers have extensive snowmobiler education efforts in place. In some areas avalanche

centers have been targeting and educating snowmobilers for almost two decades, and we are seeing dividends in terms of nearly universal use of avalanche safety equipment by experienced riders, increased awareness of the problem, and a number of live rescues. We’ve still got work to do, but we’ve also come a long ways with this user group over the past 20 years.

Much of this issue of *The Avalanche Review* features the annual summaries of the various avalanche centers. We’d like to thank Mark Staples of the Gallatin National Forest Avalanche Center for cajoling his fellow forecasters into writing and submitting these summaries. Most of all, we’d like to thank the avalanche centers. We are extremely proud of the work they do. Avalanche center advisories are accessed millions of times a season and education classes taught by avalanche centers are attended by tens of thousands of backcountry enthusiasts annually. While avalanche fatalities have been slowly creeping upwards and nearly leveling off, backcountry use has skyrocketed. This clearly shows that the efforts of the avalanche centers are making the winter backcountry a safer and more enjoyable place for all of us!

—Doug Abromeit, director,
Karl Birkeland, avalanche scientist ❄️

See NAC summaries beginning on page 21 ➡

March 11, 2010
John F. Stevens Canyon, Montana
Photo by Mark Dundas

BNSF Railway Avalanche Safety Consultant Ted Steiner tests a cornice in the Shed 7 West starting zone on the southern border of Glacier National Park at about 6,800' (2060 m) a.s.l. He describes the conditions as, “Not too dramatic, but it was a tender day with lots of audibles, collapsing, shooting cracks, and even a few triggered and one natural slab observed. Nothing larger than a class/size 1.5.

“I think we had received 6” of new snow at starting-zone elevations in the forecast area on a near-surface facets/crust combo. Temperatures had warmed since new snowfall and the wind had clearly been blowing strong from the west/southwest.”

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You guys have obviously identified the problem, and the daily discussion on your Web site is right on. The hard thing for us skiers is standing on top of an 800' run of what looks to be perfect powder and turning back.

—Utah Avalanche Center Season Summary, p31



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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 promote and act as a resource base for public awareness programs about avalanche hazards and safety measures;
- 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

It is summer, and I find myself sitting down to write the October TAR *From the President*. After serving two terms since 2007 as president, it is time for me to step back and a great opportunity to welcome Dale Atkins as the new president, John Stimberis as the new vice president, and Mike Ferrari as the new treasurer of our governing board. I can't think of three finer avalanche professionals for the positions.

I'd like to thank everyone I've been able to work with since coming onto the board in 2000. AAA has achieved much, with updated operations and a number of new programs. We've welcomed many new members and shared the loss of friends, co-workers, and some of the great avalanche pioneers: Norm Wilson, Ed LaChapelle, and John Montagne. AAA exists because of its membership and for its membership; AAA is you, me, it is all of us as we go about our avalanche work and daily lives in the snow.

A special thank you goes to the section reps and committee chairs for all their guidance and participation on various projects. And I fondly want to send enormous



Janet has the ability to both see the big picture and measure the slope angles. The AAA and SNFAC appreciate her energy and dedication. See more about Janet's retirement on page 4.

Photo by Bruce Tremper

thanks and recognition to Mark Mueller, our executive director, for keeping the ship floating and on course with commitment, grace, and a wonderful sense of humor when dealing with all of us.

See you at ISSW 2010, and see you in the snow!

—Janet Kellam, Ketchum, Idaho ❄️

from the editor



Fall colors in the undergrowth of a north-facing backcountry avalanche path contrast with the black of a recent burn in the White Clouds.

Photo by Harley Parson

Looking Ahead and Looking Behind

The first issue of TAR traditionally recaps the previous year, presenting season summaries from avalanche centers around the country, often around the world. Last winter gave us food for thought as much of the West struggled with an El Niño recipe for a deep-slab problem, topped with surface hoar frosting.

I anticipate that themes for volume 29 of TAR will include: What recipes will this year's La Niña bring us? How helpful are our new tools -- detailed GIS mapping, insight into fracture propagation, and revisions of the North American Danger Scale?

I'm asking for your input and ideas related to two of these themes. For 29-2, the December issue, I'd like your thoughts on how you track the distribution and changes of a weak layer over time. I am getting great insights from state-of-the-art GIS folks, but I also want to hear how this

is handled in the field and on the move. Old-timers? New-schoolers? Please send text and images by the end of ISSW.

Another theme revolves around avalanche education for snowmobilers. As machines grow ever more svelte and powerful, the need for consistent and effective snowmobiler education grows more pressing. Please help the AAA gather ammunition such as effective curricula and hints for reaching this population, so we can devise a broad-reaching strategy and class standards using everyone's expertise. The AAA Education Committee began this project over the summer; by the December issue we plan to have a host of information available via a "Dropbox." We'll host an informal meeting at ISSW, then a snowmobile education-themed issue for TAR 29-3: deadline December 1.

On another note, Rod Newcomb has convinced me that it's time to compile a history of avalanche forecasting in the US. He's also persuaded me to write it. Phew. I'll need your help, all of you. Right now I am developing a proposal for the Mountaineers and have formulated a structure around four geographic areas: Colorado, the Intermountain (especially Alta), California, and Washington, plus important outliers such as Alaska and Mt Washington. The book will follow the development of research, mitigation, and education in each area. I'm aiming for a collection of stories like, "There we were..." as slabs cracked and released. So tell me your stories, or let me know where to track some down. Send me ideas of people and events that I could follow up with interviews. These interviews, both audio and video, will be stored and available as part of a greater AAA history project. Let's chat about it over a beer at Squaw.

And finally, the AAA mentorship program is still chugging along. I get a few requests every year for assistance connecting an aspiring avalanchista with a mentor. Look for increased involvement on the part of the AAA Certified Instructors with this program.

—Lynne Wolfe ❄️

metamorphosis

From the Sawtooth National Forest Avalanche Center:

Chris Lundy is officially the new SNFAC director, Blase Reardon will be returning for another season as full-time forecaster, and SNFAC will have one position open to be determined this fall.



Chris Lundy

AAA members recognized by Cryosphere Specialty Group:

Jeff Dozier and **HP Marshall**, both professional members of the American Avalanche Association, have received some great recognition from the Cryosphere Specialty Group of the American Geophysical Union. Jeff has been chosen to present the Nye Lecture at the upcoming meeting, and HP has been selected to receive the Cryosphere Young Investigator Award. ❄️

Congratulations and thanks to our new AAA members:

New Lifetime Member
Charlotte Fox, Telluride, CO

New Certified Instructors

Paul Baugher, Enumclaw, WA
Santiago Rodriguez, Boise, ID
Michael Ruth, Park City, UT
Craig Patterson, Park City, UT

New Pro Members

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Brad Cosgrove, Indian, AK
Tucker Chenoweth, Anchorage, AK
Alan McClain Jr., Big Sky, MT
Chris Shelly, Denver, CO
Timothy Laroche, Missoula, MT
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Davide Sartoni, Sparks, NV
Steve Reynaud, Truckee, CA
Matt Calcutt, Truckee, CA
SP Parker, Bishop, CA
Christopher Marshall, Prescott, AZ
Mathieu Brown, Prescott, AZ
Richard Browne, Kings Canyon NP, CA
John Littleton, South Lake Tahoe, CA
Chris Carr, Mt Shasta, CA

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Zebulon Blais, Truckee, CA
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Mike Palmer, Everett, WA
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Darren Wells, Lander, WY
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John Minier, Durango, CO
Adam Clark, Missoula, MT
John Strand, Denver, CO
Josh Parker, Driggs, ID
Tim Dobbins, Truckee, CA
Dennis Sanders, Jackson, WY
Logan Talbott, Truckee, CA
Michael Foote, Missoula, MT

decision·making

Avalanche Airbags and Industry Standards

Story by Don Sharaf

I recently read Bruce Edgerly's article in AMGA's *Mountain Bulletin* that stated that avalanche airbags may be headed towards an "avalanche industry standard." He cites a French court decision as well as the recommendation by the BC Coroners Service that guiding operations consider using avalanche airbags. While I believe that avalanche airbags can be life-saving tools in the right circumstances, I also think there is more to their use than is often considered. I choose not to use one for a few reasons that I will address in this opinion piece, but I think it is important not to adopt a tool or technique as an industry standard without a thorough examination of its merits – and its deficiencies.

How They Work

Avalanche airbags are deployed with a rip-cord-like trigger that activates a compressed air (or nitrogen) cartridge that fills a stowed-away reservoir in a matter of seconds. The deployed bag(s), or balloons, increase the user's surface area, so that they are far more likely to remain near or on the surface of the moving snow. There was much recent dialog regarding "Escape from Capture" and "Inverse Segregation," but the bottom line is that avalanche airbags work well for keeping avalanche victims on top of moving debris.

What's the Problem?

Most people, myself included, who have been caught in avalanches have

found it very difficult to escape if they are knocked off their feet while they are still attached to their skis or snowboards. Once the skis come off, it is far easier to arrest on the bed surface, roll out to the flank, swim to the surface, or basically get out of the moving snow. A large part of avalanche entrainment is because the surface area that the moving snow is engaging decreases when your skis release (a large part of the reason why most ski areas require their control routes to be run on releasable equipment). An avalanche airbag increases a user's surface area significantly which aids buoyancy but also ensures that the user will likely go as far as the debris flows, with little chance of an early escape.

That's the rub; if you are in terrain where being caught has consequences beyond that of burial in the debris, (think tree strainers, cliffs, and rock gardens) then you want to get out of that moving debris as soon as possible.

Some may argue that you shouldn't be in high-consequence terrain anyway, certainly not when stability is anything less than Very Good. The reality is that many of us frequently travel in high-consequence terrain both professionally and recreationally. It is your choice, whether you "arm" the backpack/airbag at the beginning of your travel in avalanche terrain, so you do make a conscious decision

Airbags have been successful in helping avalanche victims stay on top in many documented cases. Are they the magic tool for every scenario? Don Sharaf takes a thoughtful look at the consequences of airbags in differing avalanche situations.

whether to use the equipment. If caught it requires split-second decision-making and exceptional clarity to decide whether you should deploy an airbag while caught in moving snow, but you are the ultimate on-off switch.

One last point that can be used with any new piece of "safety gear" is the concept of risk homeostasis. Simply stated: risk homeostasis is the propensity for humans to maintain their own level of acceptable risk. As new tools make activities potentially safer (e.g., making deep avalanche burial less likely) then people may up the ante and travel in more dangerous terrain. I believe that could be the case with avalanche airbags, but not any more so than carrying avalanche beacons, Avalungs™, or pieces of bark from your local medicine tree.

Summary

Avalanche airbags are a proven avalanche survival tool, but there are

times when they are inappropriate. Be thoughtful about when and where you use an airbag. Let's take a deep breath and think hard before we consider avalanche airbags as an "avalanche industry standard." Remember when there is an industry standard, you may be found negligent if you don't observe that standard.

Sources

Bruce Edgerly, *Avalanche Airbags: The New Safety Standard for Guiding?*, AMGA *Mountain Bulletin*, Spring 2010, page 11

Meiners, T., Birkeland K.W., Bartelt, P., *Avalanche Survival Strategies for Different Parts of a Flowing Avalanche*, ISSW Proceedings 2008, Whistler, BC, pp. 73-79

Don Sharaf had the pleasure of having five people edit and review this piece. Any controversial ideas, or poor grammar, are not at all his responsibility. In his spare time he seeks therapy as a habitual liar. ❄️

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Rick Johnson

Central Cascades, WA February 2009

"The slide totally took us by surprise. We'd skied this line hundreds of times before, but that's no guarantee it won't slide. This incident totally reinforced all the practice we'd done. I never panicked; I went through the beacon search like a robot. That's what you want at a time like this."

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aaa news



The above was presented to Janet Kellam at a party honoring her 14 seasons at the SNFAC. Photoshop artistry by Chris Lundy

JANET KELLAM: Thank You for your Service

Story by Doug Abromeit

Well, Janet Kellam has gone and done it – she has retired. Now while I admittedly hate it when people younger than me retire, more importantly Janet's retirement will be a huge loss to the Sawtooth National Forest Avalanche Center in Ketchum and to the avalanche community at large.

Janet started out as forecaster at the Sawtooth Avalanche Center back when it was known as the Sun Valley Avalanche Center. I was the director of the center at the time, and I distinctly remember when this striking woman walked into my office, introduced herself, and told me she was interested in becoming an avalanche forecaster. It soon became apparent she was very talented and experienced and had all the right stuff; she had been a Nordic and alpine ski racer at Middlebury College, she had worked as a helicopter and backcountry ski guide, she had owned and operated a ski touring center, and she had spent much of her adult life ski mountaineering in many of the major ranges in the West and Antarctica.

Janet started as a forecaster the winter of 1996/97 and was named the director of the Sawtooth Center in 2001. She directed the center until her retirement in April of 2010, and during that time she had a very positive influence on the avalanche world. Janet not only worked diligently with fellow Forest Service employees and community activists to hasten the transformation of the Sawtooth Avalanche Center from a fledgling center to one of the leading centers in the country, she also became an instructor at the National Avalanche School, was named to the NAS steering committee, and was elected president of the American Avalanche Association.

Janet's success was predicated not only on a keen sense of snow but also on a keen sense of how to get things done. Using persistence and persuasion with more than a little perspiration thrown in, she was able to get the Sawtooth Center on solid financial footing, revamp the AAA Web site, help establish the AAA avalanche education guidelines, develop a set of urban avalanche safety guidelines, and a lot of other good things.

Karl Birkeland adds, "Janet contributed a tremendous amount not only to the Sawtooth Avalanche Center but to the broader avalanche community, including significant contributions to overall snowmobile rider avalanche awareness and her leadership of the AAA."

A few years back, vertically challenged Sawtooth forecasters Greg Johnson and Jay Gress and I were talking to Janet at the annual National Avalanche Center meeting. The not-all-that-tall Doug Chabot spotted us standing next to the tall and very blonde Janet and said we looked like Snow White and the Three Dwarfs. Well, this is one dwarf who will miss sharing an office with Janet and seeing her practically every day, and I know her current normalized forecasters Chris Lundy and Blase Reardon feel the same.

In fact, Chris recently told me that "I came to Ketchum wanting to become an avalanche forecaster, and Janet took me from *wanting* to *becoming* the real thing. Working with Janet the past few years have been among the best years of my career."

Her immediate Forest Service supervisor Joe Miczulski added, "All I had to do was come up with some funding and get out of the way; Janet did the rest."

So while virtually everyone is bummed Janet is going to retire, there is one person who sees some real benefit to her retirement: her husband Andy. Now when he wakes up in the morning she will be home instead of off in a cold office by 5am melting snow for SWE, checking remote weather station reports, reading stability observations from the public and her co-workers, and then turning all that information into a cogent avalanche advisory by 7am.

I speak for many when I say, "Thanks Janet for your hard work and dedication and for the good times. We'll miss you, but we know you're not really retiring; you're just redirecting your energy."

Doug Abromeit is director of the FS National Avalanche Center and a long-time fan of Janet Kellam.

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- Each use must clearly represent an individual or individuals, not an entire business or school.
- Avalanche schools may list individual classes as being taught by AAA-

certified instructors or professional members. They may advertise that their programs adhere to AAA education guidelines.

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- The logo without a qualifier is exclusively for use by AAA for AAA applications and products.

All Members: Please contact the executive director at aaa@avalanche.org to receive high-resolution jpeg files with your specific qualifier(s). ❄️

American Avalanche Association Spring Board Meeting Highlights

The American Avalanche Association (AAA) Governing Board spring meeting was held in Snowbird, Utah, on April 23, 2010. In attendance were Halsted Morris, Bill Williamson, Lynne Wolfe, Patty Morrison, Carl Skustad, John Stimmeris, Chris Lundy, HP Marshall, Mark Mueller, John Brennan, Janet Kellam, Kirk Bachman, Gary Murphy.

President Janet Kellam's Remarks

Welcome, thanks for coming and for making the financial/time commitment to come as well. Please stay succinct-stick to the two-minute rule unless presenting info with financial background.

Treasurer's Report, Mark Mueller for Bill Glude

AAA made \$10,000 during fiscal year 2008/09. This past winter is the ongoing fiscal year 2009/10 which ends June 30, 2010, and we will account for at the fall meeting. AvPro was in the black.

One change: we paid \$711 in taxes this year, due to more accurate reporting of income with accounting and a thoughtful, thorough accountant. The endowment account came back up with the stock market recovery. Good words for Mark in getting AAA finances organized.

Membership Report

Numbers are up with 1200 total in all categories. Several organizations are asking members to become AAA members as well as a requirement for employment. Look for information in summer mailing.

PayPal is working well; let's continue to steer applications, renewals, and subscriptions to online payment.

Mark will break down list of expiring members by section and send it out. (*This has been sent.*) Lots of member and pro applications for this meeting. Market is expanding; discussion of reason why. Second generation, less suspicion of organization, good product, and many people are involved in several different organizations.

SWAG

Sold out first printing of 1000 SWAG but have some returns from college programs. This version of second edition had some

typos. SWAG 2010 on Web site in electronic form and printed form should be at AAA office and available the week of Sept 7 with updated NA danger scale, propagation tests, and snow classification.

COMMITTEE REPORTS Publications, Lynne Wolfe

Great compliments for *The Avalanche Review*; lots of interest in submitting articles. Working toward having full pdfs from issues 20-28 broken down (thanks to Mike Richardson) and on the Web site. There is interest in having indexes from early years on Web site (Does Blase have these electronically? Chris Lundy will check with Blase.) HP will advertise for grantee to get money to scan old issues or possibly get someone at the Boise State University library to do it. HP received volumes 10-28. Working on finding 1-9. Anyone have those volumes to loan to HP for scanning?

Discussion on TAR comps: Split between Trade (TAR advertisers) and complimentary subscriptions: TAR comps, TAR submitters who are not members/subscribers, business relationships, like organizations (Anena, SLF), ski press folks (*Off Piste*, *Backcountry Magazine*, editors) very useful service and lists get reviewed every year.

Discussion on avalanche history project: Proposal by Rod Newcomb to use extra funds from ISSW 2004 to fund Lynne writing a history of avalanche forecasting in the US. Lots of interest in this project. Several comments to the effect that this is a project worthy of endowment funds. Lynne will research the business aspect and begin some of the historical research, get back to the board with plans and details at the ISSW fall board meeting.

Awards, Halsted Morris

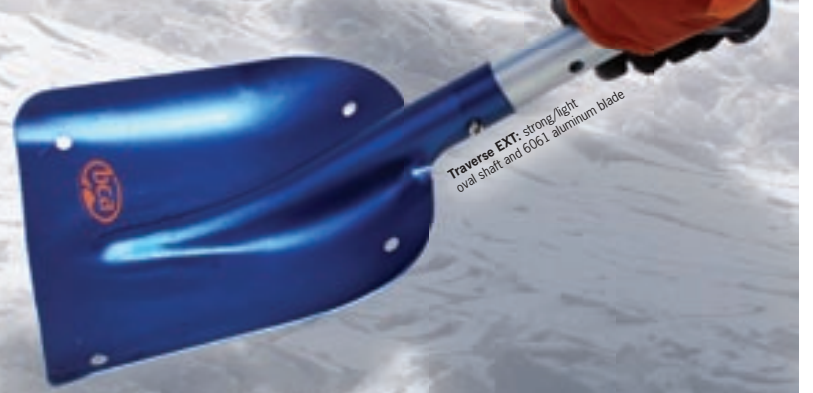
Committee is also memorial in addition to awards. Vote on inclusions to list (Mark Wolling/Big Wally). Text to be attached. Award for Howie and Dan Judd to be dated 2009 as that was when it was voted upon, which leaves 2010 open for other awards.

Now we have the Kingery Award,

Continued on next page ➡

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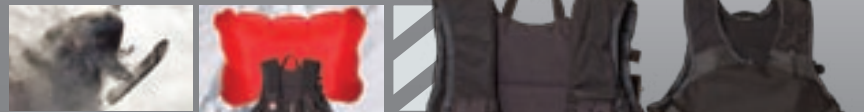


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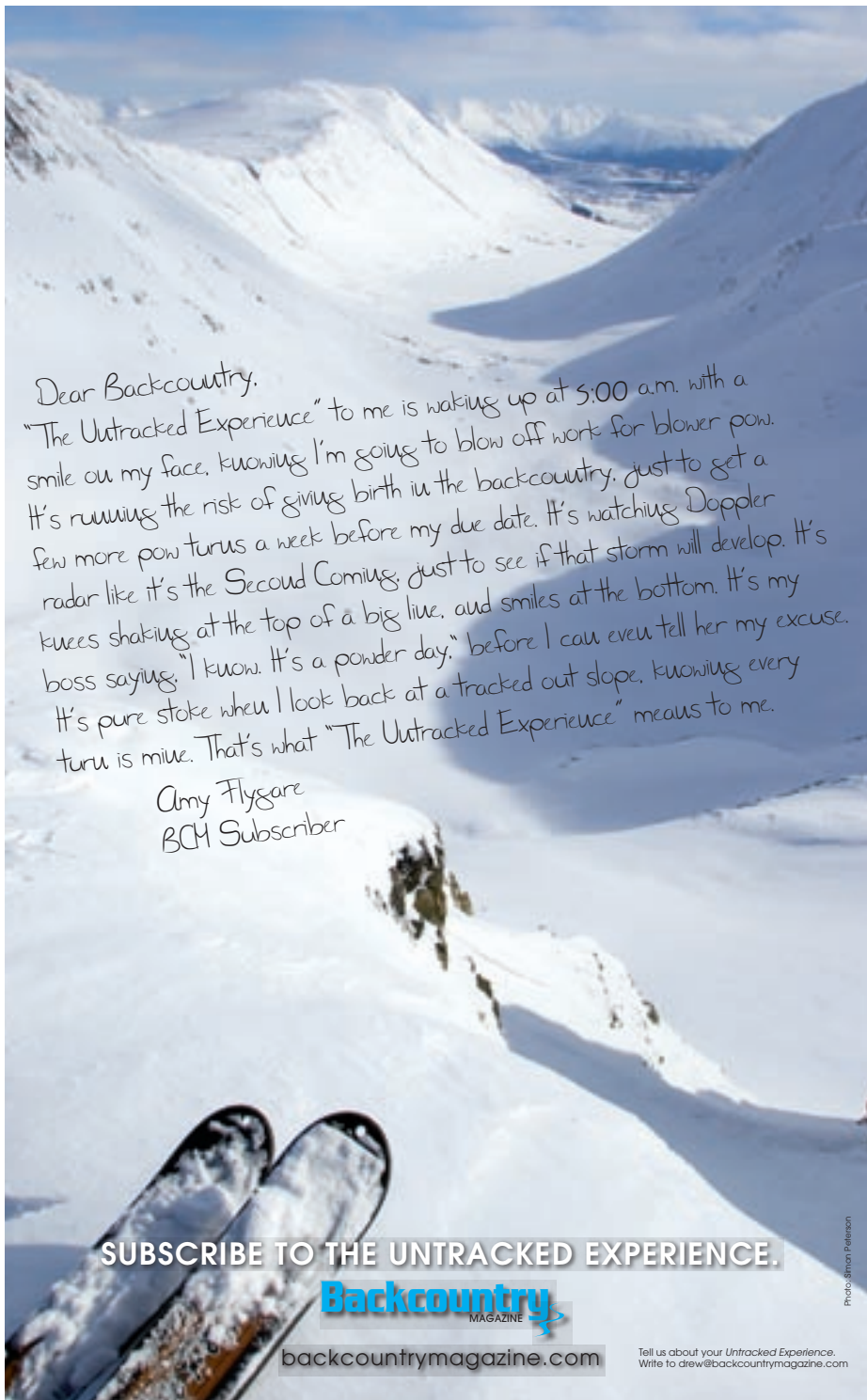


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AAA SPRING BOARD MEETING

continued from previous page

Special Service Award, Honorary Fellowship Award, and Honorary Membership Award. Do we need award for educators? Discussion: this seems to belong under Special Service Award. Add specific language that is not exclusive, however. Halsted will do this for us to vote on at the fall meeting.

Petition of Nominations is now a pdf that can be signed by each person on the electronic file. Halsted does this.

Research, HP Marshall

Practitioner's proposal: two applications (seven reviewers: scientists and practitioners). 1) One grant application: John Brennan. Project: to do research on Avalauncher (well-written and detailed). The board votes to accept JB's proposal for the full \$1000. 2) Brett Kobernik: research NSF using iButtons. Motion is to rewrite proposal to include budget, literature review, review grant at fall meeting.

Membership

More applications (46) than ever before. All were ratified after recommendation by the membership committee and secretary. Some pro applicants aren't approved and sent down for affiliate approval.

Mark requests that AAA go electronic with application process (*DONE on Web site and implemented summer 2010*).

No bringing brand-new applications to the board meeting: deadline is six weeks prior to meeting. Applications must be complete or they won't be reviewed. We will put deadlines for submissions of membership applications in a more obvious place on the Web site and at the top of the member application form.

Education, Kirk Bachman

Kirk Bachman reports that there is lots going on. Updates for all programs: AvPro, L2 instructors, etc. Articles in December TAR RE: implementing education requirements and guidelines. Now trying to come up with useful systems, not having to be policing, making guidelines widely known by providers and public.

Attached docs: course provider compliance with self-evaluation, AAA level 2 course leader requirements.

Course Provider listing program draft has been out since December, but have gotten only a few comments, such as some concerns with potential liability, which have been addressed. Now we need to adopt these documents and begin implementing them, find an appropriate fee that is not too onerous for the course providers but that remunerates the reviewers. Discussion: under \$100, as a service for the membership. More discussion as to oversight and compliance.

Motion: to give education committee the go-ahead to implement course provider oversight listing program. (*Update: summer 2010 obtained legal counsel, updated documents for clear, succinct language and plan to implement fall 2010.*)

AAA Level 2 Course Leader Requirements

These were passed and placed on the Web guidelines last fall minus the "requirement of professional development" – instead professional development is "recommended for all AAA members" as a separate issue.

Final conclusion: call them recommendations for professional

development and continuing education rather than requirements, put on Web site (*DONE summer 2010*).

Snowmobile Course Guidelines

AIARE would like AAA to work on this. Needs to be researched, using resources like Carl Skustad, Doug Chabot, Craig Gordon, Bob Comey, Chris Lundy. Important to research, interface with, and recognize what the national-level snowmobiler organizations and state groups are doing, as well as the avalanche centers.

We feel that our level 1 guidelines cover snowmobile instruction as well. But the time requirement is too long for snowmobilers, say some at the meeting. Maybe an awareness certification instead? Maybe have the level 1 class primarily for snowmo avy instructors? Lynne Wolfe and Jake Urban are working on this curriculum development under the auspices of the AAA Education Committee.

AvPro

AvPro Telluride course went great. Ski patrollers are generally our target audience. Cap attendance at 12. Snowmass for 2010/11; second spot? Need to figure out workers compensation scene and how to better pay instructors for next year. So far they are working as independent contractors with 1099s, no workers comp. Also consulting with attorney RE: insurance coverage for us taking students into avalanche terrain. Lots of potential liability there.

Lots of scholarship applications this year. Brad, Sterbie, Sarah, and Halsted are scholarship committee. Only one scholarship recipient has written article (Kevin Marston).

The AAA and the National Avalanche School are engaging in a discussion about US avalanche education.

Search and Rescue

No report. With Dale Atkins becoming AAA president, SAR committee chair position will be open with Dale covering until filled.

Sponsorship/ Supporter Program, Mark Mueller

According to Mark, it is not working. All are TAR advertisers who choose to pay \$50 extra. Let's get rid of that section of the Web site.

Motion: discontinue Business Supporter program; allow Supporters (TAR advertisers) to use AAA logo. Passed. (*DONE summer 2010: check the homepage updated look*)

Election 2010— Even years: executive group and section representatives, member affiliate representative. Ballot, etc., goes out beginning of August. Janet gave notice in fall 2009. Dale Atkins is interested in becoming president. John Stimberis interested in becoming vice president. Bill Glude would like to step down too. Who would become treasurer?

SECTION REPRESENTATIVES

Colorado Rockies, John Brennan— One continuing education event (CSAW) membership drive in fall. John drums up business by sending out packets with TAR and applications and by going to some refreshers. John contacts list of expired members: many have forgotten (about 20%).

Sierra, Gary Murphy
 Busy with ISSW, Web site.

Alaska, Carl Skustad
 Big winter, three fatalities in same day. Dave Hamre and Carl are co-chairs of ISSW 2012. Looking for big sponsors. Chugach State Park putting together an avalanche center: in the works.

Northwest, Patty Morrison
 Average but uninspiring year with big storms that ended warm. Challenging year. Patty put out email to all NW members and got variety of responses. Jon Andrews wants ISSW to be cost effective and shorter.

Three venues asking for money: NW forecaster's meeting; dealing with ATF regarding explosives/auditing. ISEE/Jon Andrews involved, putting on a blasting seminar for patrollers and industry. The Summit at Snoqualmie ski area is providing lodging, asking for money.

Grant proposal: Charlie Rubin, another weather seminar is next step. Gave timely TAR write up.

Grant proposal: Michael Jackson for the NSAS, Northwest Snow and Avalanche Seminar.

Intermountain North, Scott Savage
 Very unstable snowpack this year, including Saddle Peak. Wet snow workshop in March (Scott, TAR article). One-day GIS conference in Bozeman, April 22. Article as part of requirement for grant money. Fay Johnson is retiring also. Scott can bring requests for funding to board but cannot vote on them if he is involved.

FUNDING AND GRANTS Web / IT / Avalanche.org
 Been working on site, making it easier to use. Looking at making changes to server. Backup server is at Salt Lake weather service. Tried to reactivate Westwide, but no interest. Old data is archived. No interest in Electronic Patrol Shack.

Spent \$3097, took in \$6000, and will have some summer expenses with server move and updating information. Some costs for "Dots on the Map." \$200 per dot. We have some advertisers: Recco to be replaced with BCA. All ads go through Jazz.

All forms/files to be writeable pdfs. Jamie set up a Facebook page for AAA: admins can post updates. HP needs to get to be an admin; he needs to become a fan first.

Working on changing format of Membership Directory. Using Access now, better as an Excel file. Some folks want electronic, some want hard copy. Some both? Operational decision: where to go with this? Ultimately replace hard copy with electronic? Maybe dump subscribers, reduce bulk. Pursue changing format.

Chris Lundy is stepping down from IT role as unpaid board member and doing some paid IT work on specific projects. We are looking for replacement; have written up position description with Janet. Some of the IT work is paid, and some is unpaid.

Also, we need a new server this year. Has taken a lot of time and energy to keep up. Going to a virtual server, and looking for funds to pay a new IT person. Also need to sort out approach to managing avalanche.org big picture. Encourage

everyone to utilize and spread the word about the employment postings on avalanche.org. It is a database that works very well for employers to advertise and close job openings.

Dots on the Map
 Many kinds of representation; many kinds of avalanche centers. Most are backcountry based, two are city based. All Forest Service backcountry centers are under NAC, and CAIC (state) works closely with all FS centers in Colorado. The new ones that would like to be on avalanche.org are nonprofits. Several new ones: Bend, Crested Butte, Wallowas, Valdez. Janet, et al, have come up with a course provider checklist with thoughtful questions to be reviewed by board member, local overseer, or AAA section rep? Many constructive comments: be a 501(c)3? Dale wants us to be inclusive and help new centers be consistent. Carl moves that we go forward with checklist for new avalanche centers: Carl will work with Valdez, Patty will work with Mark Moore who is working with Bend and Wallowas, Ethan is working with Crested Butte. Passed. See full document for specifics.

Continuing Education Grant
 Several proposals: USAW: \$1000; CSAW: \$2000; Charlie Rubin, NW wx Seminar: \$300; Michael Jackson, NSAS: \$2000; NW Blasting Seminar: \$600; \$5900 TOTAL
 Motion: to fund all proposals completely, passed.

ISSW AAA Fall Board Meeting
 Sunday, October 17. ❄️

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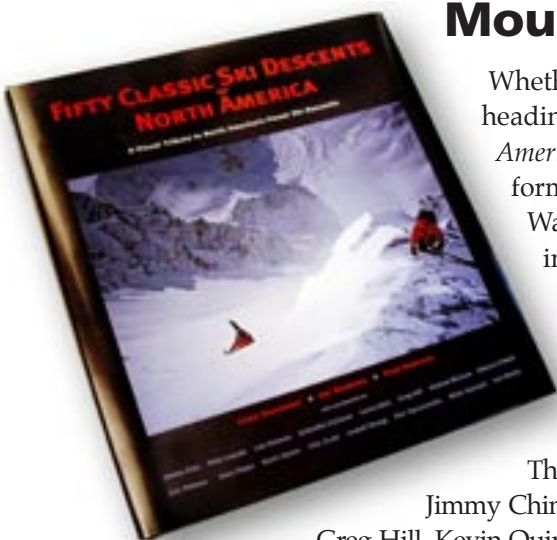
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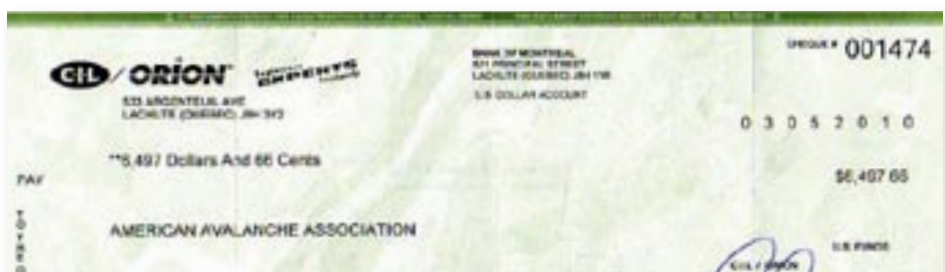


Whether you're planning an expedition to Baffin Island's Polar Star Couloir or heading out for dawn patrol on Mount Superior, *Fifty Classic Ski Descents of North America* is a visual feast of ski mountaineering that's sure to inspire. A large-format compilation of iconic and aesthetic ski descents from Alaska to Mount Washington, the book features 208 pages of gorgeous action and mountain images from many of North America's top photographers.

Created by ski mountaineers Chris Davenport, Art Burrows, and Penn Newhard, *Fifty Classic Ski Descents of North America* taps into the local knowledge of contributors such as Andrew McLean, Glen Plake, Lowell Skoog, Chic Scott, and Ptor Spriceniaks for first-person descriptions of their favorite ski descents and insightful perspectives on ski mountaineering past, present, and future.

The book showcases accomplished skiers such as Hilaree O'Neill, Lou Dawson, Jimmy Chin, Chic Scott, Pete Patterson, Kristoffer Erickson, Lowell Skoog, Mark Synnott, Greg Hill, Kevin Quinn, and Eric Pehota. Photographers include Christian Pondella, Will Wissman, Brad Washburn, Chris Figenshau, Keoki Flagg, Ruedi Homberger, Whit Richardson, and Jonathan Selkowitz.

Books will be distributed by Wolverine Publishing beginning November 10. Until November 1, a 10% pre-order discount is available at <http://bit.ly/buXM2W>, www.wolverinepublishing.com. A special limited edition of 200 books are available directly from the publisher. Each limited edition book is hand numbered and signed by the authors, and comes in a hard-bound case for collectors. To order a limited edition, contact Chris Davenport at chris@steepskiing.com. A Canadian distributor will be announced, as well as a schedule of book signings during December. Contact nick@backbonemedia.net to request a signed early edition, available to media and friends after October 7. ❄️



CIL/Orion Donates \$6500 to AAA


Craig Sterbenz accepted this check (above) from CIL/Orion on behalf of the American Avalanche Association at the Canadian Avalanche Association annual meeting held this March in Penticton, BC. Sterbenz commented, "This year's donation from CIL/Orion was almost 65-hundred bucks! Those Canadians make nice neighbors." ❄️

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ISSW 2010

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Free Snowpro Viewer

We are pleased to announce that we will be releasing to the snow community at ISSW 2010 a free **Snowpro Viewer**. This viewer will display high quality snow profile graphs from the current and all previous versions of Snowpro.

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ISSW 2010 HAPPENINGS

AIARE Education Seminar and Refresher Course: Sunday, October 17

On Sunday, October 17 – the day prior to the official start of the ISSW – AIARE will host an Instructor Refresher Course from 8:30am until 12:30pm and an Education Seminar from 2-5pm.

Instructor Refresher Courses (IRCs) are designed for existing AIARE instructors. AIARE instructors are required to attend an IRC once every three years in order to stay current. This course reviews curriculum changes and updates instructors on new technical information.

The Education Seminar is open to the public and will feature three speakers who will discuss educational issues, ideas and techniques of interest for those who instruct avalanche courses. There is no charge for this event.

Please join us in the main meeting hall. For further information contact Tom Murphy at info@avtraining.org or 970-209-0486. ❄️

Divas Night Out: Monday, October 18

In recent years, our avalanche community has seen a significant increase in the number of female professionals making notable contributions in the field of snow and avalanche research and education. This change has been reflected with an increase in female participation in the ISSW increasing exponentially.

To support this growth, the 2006 ISSW coordinators teamed up with Babes In The Backcountry to offer female ISSW attendees an opportunity to network with other professional women in the snow and avalanche field by hosting the first biennial ISSW Ladies Night. Over 100 female ISSW participants gathered to share stories, acknowledge significant female role models in the field, and form an association of professional exchange.

In 2008, the ISSW offered another Ladies Night, called the Avalanche Divas, where our professional exchange continued to grow. The momentum rolled into 2009 at the first European ISSW in Davos, Switzerland where the Avalanche Divas continued to gather and honor significant women in our industry. The Divas' first scholarship fund was set up in Davos offering European women financial support to attend ISSW here in North America.

This year, new leadership take over the reigns from founders Nicole Greene and Leslie Ross, and a Web site and blog spot have been created to provide women with a means to communicate between ISSWs. Network with your fellow divas at www.avalanchedivas.com or www.avalanchedivas.blogspot.com.

The 2010 Avalanche Divas seeks to establish a scholarship fund for females working in the snow and avalanche field. All female 2010 ISSW participants are invited to share in an evening to recognize, honor, and support women in our field and encourage mentorship among female professionals. The event will feature dinner, drinks, and a gift bag with items from participating sponsors.

To nominate a woman for recognition of notable contributions in the snow and avalanche field, contact Aleph Johnston-Bloom at alephjb@hotmail.com. ❄️

AAA Membership Meeting: October 19

AAA General Meeting is set for Tuesday, October 19, in the evening. This information is posted on the AAA Web home page in the "Calendar." ❄️



Left: During the Telluride AvPro course in spring 2010, Sterbie gave a tour of avalanche-mitigation routes. This shot was taken near "Sterbie's gun," one of the area's new Howitzers.

Photo by Sarah Carpenter

AvPro Scholarship Deadline Nears

Calling all AvPro scholarship applicants for the 2010/11 AvPro courses:

January 5-13: location TBD (LCC or Bozeman)

February 26 - March 6: Aspen Highlands, Colorado

AvPro scholarship applications are due October 31. See the AAA Web site for details at www.americanavalancheassociation.org/edu_courses.php ❄️

12th Annual NW Forecasters Meeting

Story by Patty Morrison

On March 22-23, 2010, the 12th Annual NW Forecasters Meeting was held at White Pass, Washington. The first day of these meetings usually consists of presentations and discussions on various topics of the season. The second day is a tour of the hosting ski area or DOT's region – important because it allows others to see solutions to each locale's unique avalanche-control problems.

This year's meeting kicked off with Mike Stanford from the Stevens Pass DOT revisiting the importance of range testing your beacons and understanding antenna drift. We had a good time going outside to play with various brands of beacons. The take-home message was that we should do range checks more often, plus check the antenna drift on the old beacons that we bury for beacon search practice.

We then discussed offering an avalanche-control/blasting seminar this fall, which will be held on October 30-31st in Snoqualmie Pass, WA (*see story previous page*).

Next, Jon Andrews, lead forecaster for Stevens Pass ski area, gave a plug for the International Society of Explosives Engineers. As the NW Chapter's new president, Andrews encourages avalanche-control groups to become more involved in the bigger picture of what we do...use explosives. By becoming part of a larger entity, we can have more say in the ever-changing laws that affect use of explosives for avalanche control. One of the latest concerns has been how the ATF performs their audit/inspections. Another recent concern was that the state of Washington was going to require annual fingerprinting of all licensed blasters. Andrews successfully campaigned for this requirement to be reduced to once every three years.

Andrews invited the ATF and the state to describe what they do and what they are looking for when performing an inspection. Robert Pompelli, a former ATF inspector, presented a PowerPoint titled *How to Survive an ATF Inspection*. Pompelli recommends, first and foremost, organization of all records. He said though many places have the records, they have trouble finding specific ones needed due to lack of organization. Pompelli detailed which records specifically interest ATF and how to best manage/organize these. Chuck Spalding, the current head of NW ATF inspections, elaborated that the main things they are looking for are compliance, records, and proper placement of magazines.

It's interesting to note that the ATF does not fine people for mistakes found, they help work with companies to comply first. If that doesn't resolve the problem, they will revoke the license. Mason Reiter from the Washington State Department of L&I, explosives licensing, shared similar thoughts, but mentioned that the state can and will fine companies for non-compliance.

Along the same lines, Chet Mowbrey, lead forecaster for Crystal Mountain ski area, discussed his experience with the ATF and subsequent update of how he does his inventory. He brought examples of inventory sheets from Crystal Mountain and other areas. It all comes down to checks and balances...and good record keeping of course.

John Meriwether, former patrol director for Stevens Pass, presented a PowerPoint on Backcountry Avalanche Rescue K-9s, BARK for short. BARK is a group of dog handlers from Stevens Pass, Crystal Mountain, and Alpentel ski areas who train and certify dogs for rescue as well as their handlers for rescue leadership. BARK started nine years ago to help Search and Rescue (SAR) crews with avalanche burials. It has been proven that dogs are the most effective tool for finding buried victims. Also, many SAR groups are not skilled with the specifics of an avalanche-rescue problem. BARK seeks to provide standards and certifications to assist with rescues in Washington State.

The last presentation was provided by Jay Bright and Harlan Sheppard from Cascade Powder Cats. Bright, part owner and lead guide, decided to run his operation without using explosives for avalanche-hazard mitigation. His guide program empowers staff to have learning outcomes using standardized observations. Some of these learning outcomes include improved communication, heightened situational awareness, creation of options, implementation of proper travel techniques, and appropriate terrain selection. Bright inspires his staff to use tests and observations to better understand trigger points and terrain configuration, and to identify slab propagation potential, slab strength, and bonding. Bright and Sheppard both emphasize including human factors, as the skill level, motivation, fitness, and experience of groups play a major role in terrain selection. Overall, their program uses and fully applies everything we have learned in avy courses.

On the second day, meeting participants toured White Pass's expansion, which started back in the 1980s. Patrol Director Chris Talbot was an excellent tour guide. He arranged cat assistance to get us as high as possible before we put on our skins to tour the area. As with any terrain additions, new terrain-management problems are inevitable. The tour stimulated some good discussion and suggestions on how to solve some of their new issues. The great skiing and breathtaking views of Mt Rainier and the North Central Cascades topped off an excellent seminar.

Patty Morrison is the Northwest section rep to the AAA board and a long-time snow safety officer at Stevens Pass, WA. ❄️

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AvaLung Updates

Story by Dale Atkins

Two recent uses – or more accurately described non-uses – of AvaLungs have come to my attention, that I feel are important for avalanche educators to know about. For years I have heard suppositions that a user when caught in an avalanche might not be able to insert the mouthpiece. (Crowley, et al., addressed this concern and others in our 2002 ISSW paper – an AvaLung-associated avalanche survival.) For years it seemed people got the mouthpiece in, until recently.

The AvaLung was invented and patented by Denver doctor Tom Crowley in 1996, which (I believe) he then licensed to Black Diamond Equipment. BDE sponsored and conducted rigorous testing of the device as well as several product refinements. Since becoming commercially available just over 10 years ago, I know of more than a dozen successful uses of the AvaLung (though few have been documented), including a recent January burial in Switzerland. I suspect additional uses have gone unreported.

This winter, however, for the first time I heard of incidents where AvaLung-equipped users caught in avalanches did not or could not get the mouthpiece in their mouth. The incidents occurred in Colorado: on February 26 near East Portal (South Boulder Creek) and on March 3 on Berthoud Pass (Floral Park). In the East Portal incident the user was completely buried and found by his companions using transceivers. The user at Berthoud Pass was covered by snow but able to shake loose and stand up.

Prior to these incidents the only other AvaLung issues known to me occurred in 2006. In one case (Alaska, April 18) the mouthpiece became disengaged from the user's mouth after the user collided with something during the slide. The skier was buried, found with a beacon, and survived. The other case occurred in New Zealand (August 14) where a ski patroller complained about almost biting his tongue getting the mouthpiece into his mouth. He was not buried.

In the two recent Colorado incidents both avalanches were relatively small (~200 vertical feet) and both users had bandoleer-type AvaLung IIs. In one incident I spoke to the user, and in the second incident an experienced mountain rescuer queried the user. One user has owned an AvaLung for about five years, but did not think to try and get the mouthpiece into his mouth even though he carries his device "all the time" and attends yearly trainings where use of the AvaLung is discussed. In the second incident the user thought about it but could not get his hands to his AvaLung. In both cases the subjects said that when the avalanche released, "it/things happened too fast" to react. Also, in both cases it is unknown exactly where the mouthpiece was positioned and if either user had seriously practiced getting the mouthpiece into their mouth.

For me a couple of important take-home messages arise from the two incidents. The messages are not new but serve as reminders. When caught in an avalanche some victims do not have the time or the ability to make

deliberate actions like reaching for their mouthpiece. As educators we need to make students aware of the differences between the classroom and the real world. Actions that are easy to describe indoors may not be doable in actual avalanches, and this notion leads to my last point, that deals with practice. Most AvaLung users have not practiced inserting the mouthpiece in a difficult and pressured setting. To reach up and insert the mouthpiece a few times in the comfort of the indoors or standing on the trail does not constitute practice. If anything, such action may be worse than not practicing at all, as it can induce false confidence.

For years I have encouraged AvaLung users to practice by rolling or tumbling down a snow slope. Those few who have actually done it have a more realistic awareness of how to use their device and of their own abilities.

In no way does my message imply anything negative or adverse about the AvaLung. I was fortunate to have been involved – unpaid – in the early development and commercialization of the AvaLung, including being a buried subject (both with and without the AvaLung) in tests done by BDE. I am a firm believer in the AvaLung and applaud BDE's efforts and support they provide to our avalanche community.

If you have any questions about these incidents or past ones, please ask.

Dale Atkins is currently the rescue rep, but he will become AAA president at the end of 2010. Please contact Dale if the rescue committee position interests you. ❄️



The 2008 Blasting Seminar included a segment on chopper blaster training. photo by Craig Wilbour

Blasting Seminar Set for October

The Washington Avalanche Control Council and the Association of Professional Patrollers will hold on their Avalanche Control Blasting Seminar on October 30-31 in Snoqualmie Pass, Washington.

Course agenda topics will include: Explosives used in Avalanche Control, Avalanche Control Techniques, Blast Site Procedures, Route Safety, Licensing-Documentation, Forecasting-Explosives Effects on Snow, Forecasting Highway versus Ski Areas, Misfires-Duds, Industry Standards-Resources.

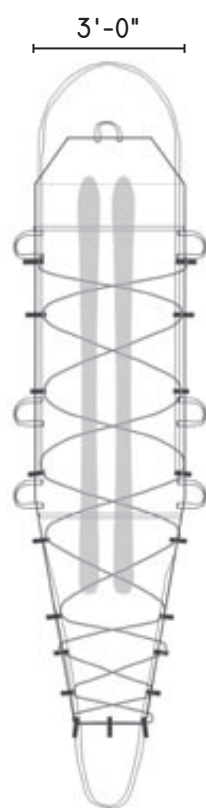
Participants must be affiliated with a blasting service (ski patrol, highways, heli ski, blasting general).

The seminar cost is \$25. Send check and application to Rob Gibson, PO Box 88, Snoqualmie Pass, WA 98608. For more info, please contact Chris Catlin at knightcdc@aol.com. ❄️

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- OCCUPANT AND SKIS FULLY SECURED INSIDE SLED FOR STABILITY AND SUPPORT
- NYLON SNOW GUARD PROTECTS OCCUPANT FROM MOISTURE AND ROPE ABRASION
- TOW STRAPS AT FEET AND HEAD
- MULTIPLE HANDLES TO AID IN PATIENT TRANSFER
- NYLON STUFF SACK
- DESIGNED AND BUILT IN BC ❄️

CAIC and SWAG Updates

Story by Ethan Greene

In the fall of 2009, the American Avalanche Association (AAA) and the US Forest Service National Avalanche Center (FSNAC) published a second edition of *Snow, Weather, and Avalanches: Observation Guidelines for Avalanche Forecasting Operations in the United States*, affectionately known as SWAG. An electronic version of the publication is now available on the Web sites of both groups. The e-book contains some new edits and additional material not included in the 2009 printing. The most notable change is the new North American Avalanche Danger Scale in Appendix G. Hard copies of the document (with updated material) are available through the AAA's Web site at www.americanavalancheassociation.org.

The Colorado Avalanche Information Center (CAIC) launched a new online database last season. The first collects and summarizes avalanche involvements. The CAIC has housed the avalanche accident records for the US since the early 1970s and has a data record stretching back to 1900. Most of the records involved fatal avalanche accidents, but we are trying to collect more information on non-fatal accidents and involvements. Public and professional users can fill out short or long reports depending on the amount of information available. There is also an investigation form for professional accident investigations. We hope people from all 50 states will contribute to the record to help us learn more about fatal and non-fatal human avalanche involvements.

The Colorado Avalanche Information Center (CAIC) began using social media as a conduit for avalanche-safety information last winter. Twitter accounts were created for each of their 10 backcountry forecast zones. Morning Tweets included the danger rating and some basic information about current conditions. They also used Tweets to disseminate information reported to the office during the day. Users could get the Tweets through Twitter or on their mobile devices. The Tweets were also posted on each of the CAIC's zone forecast pages. This year they plan to post the Tweets to the Friends of the CAIC's Facebook page and create an additional account for Avalanche Watches, Avalanche Warnings, and Special Advisory Statements from any zone.

Susan Hale and Mark Gober, forecasters in the Colorado Avalanche Information Center's Silverton office, hope to install a new weather station on the north side of Red Mountain Pass this fall. The precipitation site will be located near the top of the



A new Uncompahgre Gorge weather station records data not far from the start zone of the East Riverside slide path, which claimed the Hudsons, father and daughters, in 1963, on their way to church. Photo by Susan Hale

Uncompahgre Gorge, near a monument to the people killed by the East Riverside Slide path. US 550 passes through the Uncompahgre Gorge as it climbs south from the town of Ouray towards Red Mountain Pass. As low-pressure systems track through the area they can produce heavy post-frontal precipitation in the gorge as northwest flow is confined by the terrain. These events produce periods with high-precipitation rates in the gorge, but the most intense cloud processes occur below the beam of National Weather Service WSR-88D radar. Snow accumulation in the gorge can be two or three times that on the top of Red Mountain Pass, where current automated weather stations are located. The Monument Station will include a NOAA II precipitation gauge, an ultrasonic depth sensor, and a temperature and relative humidity sensor.

Ethan Greene is the CAIC director, and he still manages to find time to complete valuable volunteer projects such as updating SWAG for the AAA. ❄️



Payette NF Forest Supervisor Suzanne Rainville and Payette Avalanche Center Director John Groom receive the Intermountain Regional Forester Award for Exemplary Service in the form of a handmade wooden bowl.

FS Region 4 Avalanche Centers Recognized with Forester Award

This past winter the Forest Service Bridger-Teton, Manti-La Sal, Payette, Sawtooth, and Utah Avalanche Centers received the prestigious Intermountain Regional Forester Award for Exemplary Service. The award cited the R4 avalanche centers for not only enhancing public safety by issuing backcountry avalanche advisories and teaching awareness classes, but also for providing common ground for occasionally conflicting user groups that often work together in Friends of Avalanche Center -type organizations.

The award specifically noted many of the centers' accomplishments including the very successful *Know Before You Go* video and PowerPoint programs and the Spanish-language avalanche-awareness brochures, *Viviendo y Trabajando en Zonas des Avalanchas*.

Although the award is an Intermountain (R4) Regional Forester Award to the R4 avalanche centers, it represents the hard work and dedication of all the avalanche centers in the US. Congratulations to the R4 centers and to all the avalanche centers; keep up the good work.

—Doug Abromeit, FS National Avalanche Center director ❄️

Black Diamond Introduces New Products

Black Diamond Quadrant (left)



Our premier four-buckle freetouring boot, the Black Diamond Quadrant defies convention by bringing skiing performance and stiffness previously reserved for freeride boots to the touring weight range. Designed with technical mountains like La Grave in mind, where long climbs lead to no-fall-zone skiing, this boot matches touring comfort and minimal weight with the power and performance to drive big, 95mm-plus waisted skis in high-consequence terrain. Thanks to its Pivoting Cuff Technology, the Quadrant has introduced a level of performance that's never before been possible in a lightweight boot.

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Black Diamond Aspect (left)

A wide-bodied, superlight touring ski, the Black Diamond Aspect might be the ultimate one-ski backcountry quiver. A wide, floaty tip and mid-fat 90 mm waist give this high-performance tourer-and-turner-the-girth to tackle soft or variable snow, plus an aggressive sidecut for quick, slicing turns on hardpack. Designed for everything from the occasional in-bounds foray to long-distance backcountry projects, the Aspect opens the door to new levels of speed, efficiency and skiing performance.

Features: wide, floaty tip shape, deep sidecut, a 90 mm waist and a full wood core designed for high-performance skiing, from in-bounds forays to long-distance backcountry projects; lightweight paulownia wood core surrounded by Torsion Box construction; Dual Torsion Bow Technology with carbon fiber reinforcements for maximum torsional stiffness; flat tail with SkinLock for solid anchors and secure, durable skin attachment while maximizing running length. \$629.99

Black Diamond Starlet (right)

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Features: women's-specific flex; semi-rockered tip and a 100mm waist for easy trail breaking on the up and effortless surfing on the down; lightweight paulownia wood core surrounded by Torsion Box construction; Formula One Technology for maximum torsional stiffness; flat tail with SkinLock for solid anchors and secure, durable skin attachment while maximizing running length. \$659.99 ❄️





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Friends of the Utah Avalanche Center Host 3rd Annual USAW on November 6

The Utah Avalanche Center (UAC) and their nonprofit Friends organization will host the third annual Utah Snow and Avalanche Workshop (USAW) on Saturday, November 6, from 8am - 4:30pm at The Depot, located in downtown Salt Lake City. USAW is a regional event where snow and avalanche communities from Utah and neighboring states can share local events and history. The workshop provides an ongoing forum for both professional and advanced recreational level development.

The morning session is open to snow professionals and will feature an exchange of experience, ideas, and theories. The \$40 admission price includes swag bags, beverage breaks, and a catered lunch. The afternoon public session costs \$25 and offers a host of intriguing guest speakers. This year's USAW theme will focus on a recap of the challenging avalanche conditions many encountered during the 2009/10 winter. The format is like a mini-ISSW, with presentations lasting 15 minutes followed by five minutes of Q & A.

This year's lineup of presenters includes Bruce Tremper, Karl Birkeland, and Ian McCammon, just to name a few. In addition, The Rolling Stones may play an acoustic set...but we're trying to iron out some scheduling conflicts with Mick and the boys. The event winds up with a social hour, which gives everyone a chance to review the day's events and catch up with old friends and colleagues.

Event mastermind and coordinator Craig Gordon of the UAC is stoked, saying, "This is an awesome opportunity to preserve the amazing amount of expertise we have in our local and neighboring avalanche communities. Experts sharing their experience is a great way for snow professionals to learn and the master-apprentice relationship has worked this way for decades."

For more USAW info or to fill Craig in on the concerts you attended this summer, you can contact him at 801-231-2170 or craig@utahavalanchecenter.org. ❄️



As rumors swirl regarding an acoustic appearance by The Rolling Stones at USAW 2010, event coordinator Craig Gordon will neither confirm nor deny an agreement with the classic rockers, whose hits include *Satisfaction*, *Brown Sugar*, and *Sympathy for the Devil*.

BCA Floats Airbags & Beacons to Pros

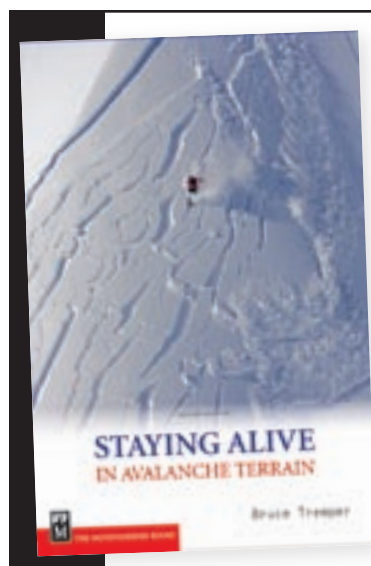


Want to try out an airbag this season? Backcountry Access, Inc., (BCA) is offering a pro loan program so you can check out their Float 30 system. The Float 30 is an avalanche airbag powered by a 2700-psi compressed air cylinder. When the trigger is pulled, a 150-liter airbag deploys from the top of the pack, behind the user's head and shoulders. This keeps the user on the surface of the debris in an avalanche. It also provides protection to the user's upper body without compromising his or her peripheral vision or ability to escape the moving debris. After deployment, the airbag can easily be stuffed back into the top

compartment of the pack. In addition to the stuffed airbag (and cylinder), the pack holds 30 liters of cargo. The air cylinder can be refilled at a wide network of BCA-qualified refill centers, including SCUBA and paintball shops.

BCA launched the Float 30 last season, shipping mainly to snowmobile dealers in the US and Canada. The company has made refinements to the pack for 2010/11, including lighter materials, stormproof zippers, a diagonal ski-carrying system, and hydration compatibility. The suggested retail price is \$699. Discount fleet and pro pricing is available to professionals and organizations using snow safety equipment in their daily work. For more info on the Float 30, see www.backcountryaccess.com/airbag.

BCA also launched its Tracker2 avalanche beacon last season to rave reviews. Tracker2 loaners will be available to qualified pros on a limited basis, depending on availability. For pro deals, fleet orders, and loaner units, contact BCA at 303-417-1345 or info@backcountryaccess.com. ❄️

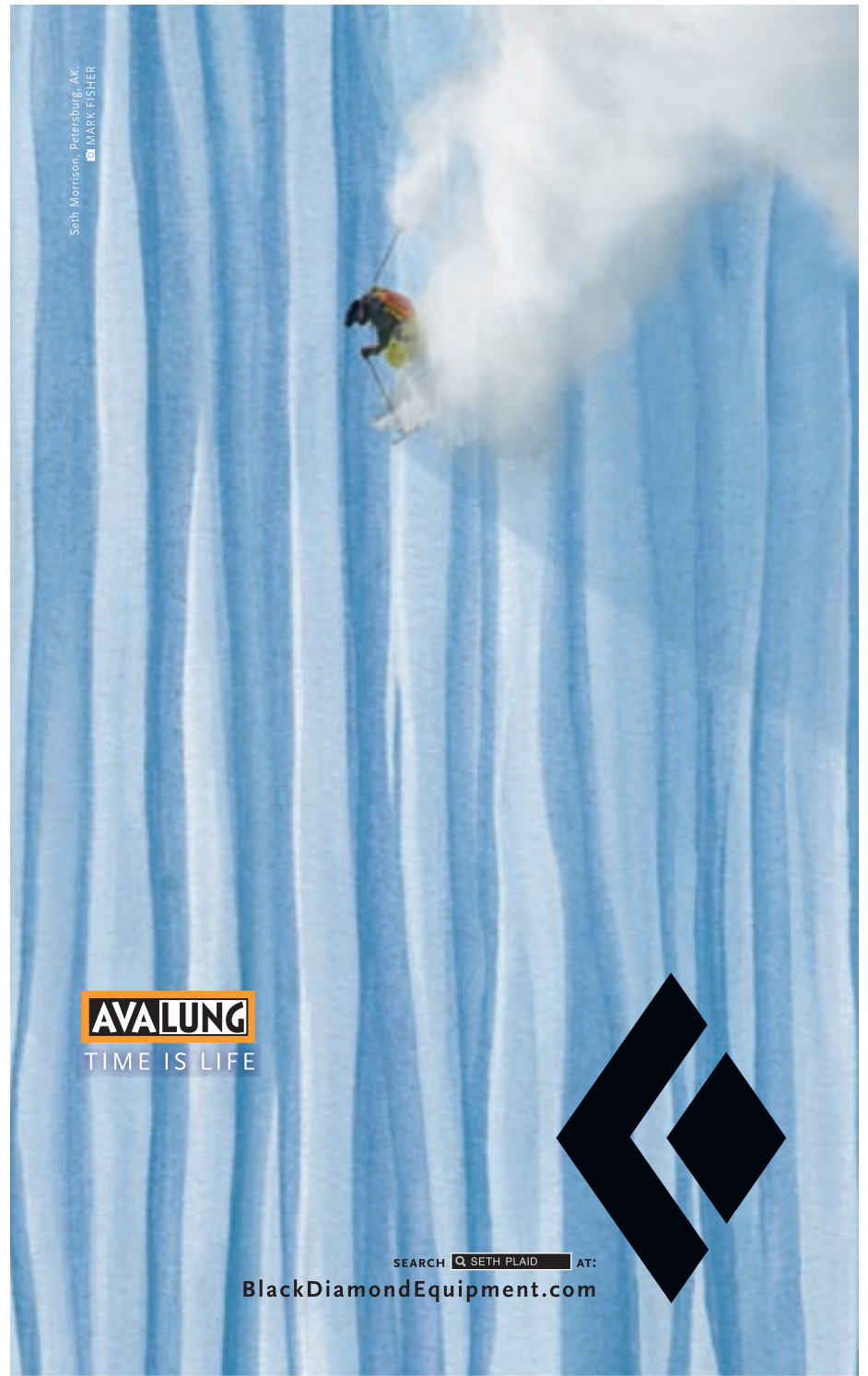


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snow science

GIS Applications for Snow and Avalanche Science

Story by Tara Chesley-Preston

On April 22, *Uses of GIS (Geographical Information Science/Systems) in the Snow and Avalanches Sciences Mini-Conference* was held as part of the Intermountain GIS Conference in Bozeman, MT. This mini-conference was sponsored by the American Avalanche Association, Bridger Bowl ski area, Bridger Bowl Ski Patrol, and the Montana State University Department of Earth Sciences. The day consisted of several talks, a round-table discussion, and a tour of the new MSU Subzero Science and Engineering Research Facility. Hopefully this will be the first of many conferences focusing on the use and applications for GIS and Spatial Analysis in the snow and avalanche sciences.

MSU graduates Alex Marienthal and Jordan Mancy led off the day by presenting a summary of their recent TAR article, *Geospatial science and snow avalanche research*. Their review of the history of GIS applications in the snow and avalanche sciences was a fantastic way to start the day.

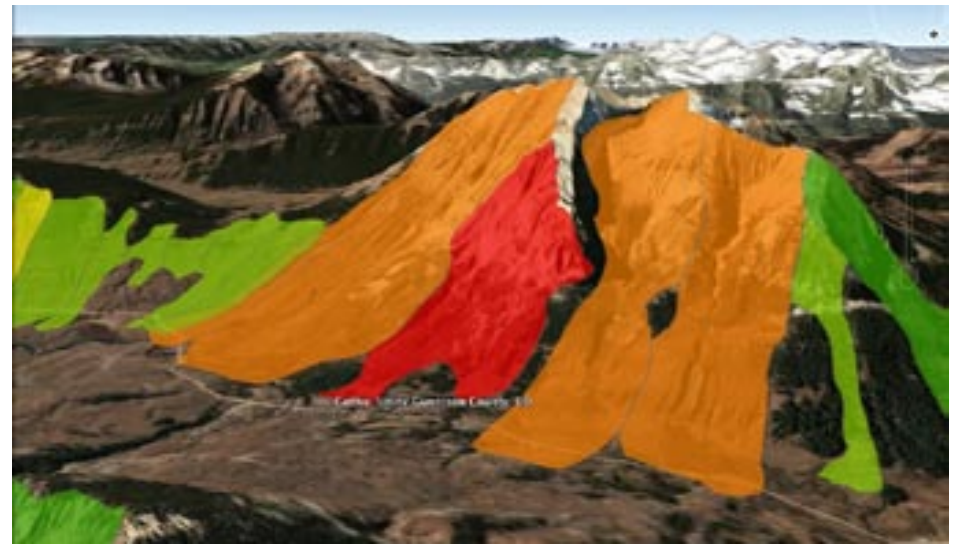
Doctoral student Cora Shea (University of Calgary) discussed using the free GIS software package GRASS to model solar warming – *Sensationally spatial: Using GRASS to take near-surface snowpack warming from eight points to many*. Shea emphasized how open source software compares favorably with more expensive GIS packages commonly used for spatial analysis work. She has put together an excellent Web site and wiki illustrating the basics of using GRASS for snow research at www.thesnowpit.com.

Recent MSU masters graduate Tara Chesley-Preston spoke about *Spatially correlating patterns of natural avalanche activity to observed and derived weather variables in the avalanche paths surrounding Gothic, Colorado*. Chesley-Preston’s talk reviewed some basic terrain analysis methods available in most GIS packages and how they can be used to help model and describe avalanche terrain. In particular it covered the use of elevation data (freely available through the USGS) to delineate avalanche starting zones and their corresponding aspects. This basic analysis was then used to help visualize the relationship between historic natural avalanche events and upper atmospheric wind direction in the Gothic Valley from 1975-2008.

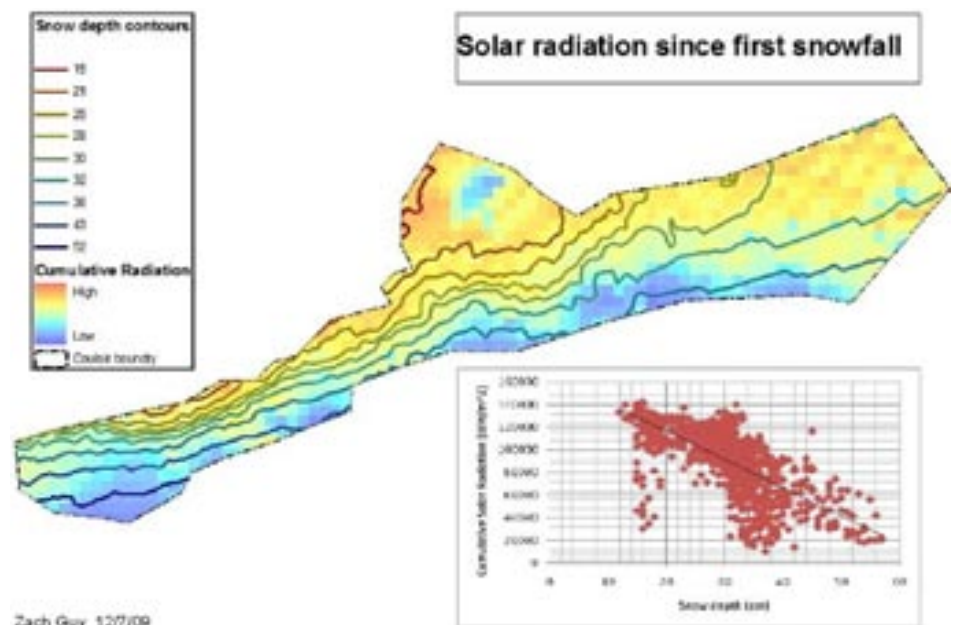
The fourth talk, presented by Matthew Borish from MSU and SEABA Helicopter Guides, was titled, *Assessing and mapping snow surface spatial variability in the Chilkat and Takhinsha Mountains of southeast Alaska*. Using portable GPS units and a GIS, Borish was able to spatially archive all the snowpit data, pictures, and avalanche data collected by SEABA guides. He then created maps of different surface hoar events delineated by the size of the crystals. He intends to use these data to map surface hoar events and run a “hot spot” analysis to better identify potentially hazardous areas after new snow covers the surface hoar. Matthew found the GIS very useful and feels it has strong potential to aid forecasting at the mountain-range scale.

Recent MSU graduate Karl Wetlaufer’s talk focused on the use of GIS for snow hydrology. Many of the methodologies he described are applicable for avalanche sciences, particularly wet-snow avalanches. This talk reviewed remote sensing methods for snowmelt-runoff modeling, modeling SWE across a region, and snowpack-energy exchange. After reviewing several of these methods, he demonstrated how they are used for snow management in both urban and rural regions.

MSU graduate student Zach Guy’s work involves looking for correlations between snowpack properties and terrain parameters. Guy described how he is mapping the spatial distribution of potential weak layers in southwest Montana and Jackson, WY area chutes and couloirs using 1m-scale LIDAR data. Guy is exploring how couloirs’ aspect and terrain features might affect slab and weak layer distribution – stay tuned for some interesting observations and results!



Avalanche path shapefiles, color coded by avalanche frequency, overlain on a Google Earth image of the mountains surrounding Gothic, Colorado.



Snowdepth in a couloir mapped with cumulative solar radiation, and a scatterplot showing their relationship. One of many possible analyses that GIS enables using elevation data and georeferenced snow data.

MSU engineering professor Dr Ed Adams presented *A GIS approach to modeling snow metamorphism in complex terrain*. His talk covered decades of work in this field, leading to current work Adams and his research group are doing to model near-surface faceting at the Yellowstone Club. They have created a model that replicates near-surface faceting events using terrain parameters, standard meteorological data, and shortwave and longwave radiation. They found that near-surface faceting is affected by both shadowing as well as small-scale terrain interactions. These results may someday be used to better account for spatial variability and to potentially identify more appropriate locations to dig snowpits.

Marienthal and Mancy finished up the day with *Statistical modeling of maximum snow avalanche runout distance in Glacier National Park, U.S.A., an inter-regional application of derived statistical runout models*. Using alpha and beta angles, they used a statistical model to determine the maximum avalanche path runout zones for many paths within Glacier NP. They fit the model to the avalanche paths on the Going-To-The-Sun Road in Glacier NP and tested it on the avalanche paths along US Highway 2 on the southern border of the park. They found the model to be useful but only to the interior of the park; the terrain varies drastically from the interior to the southern end of the park.

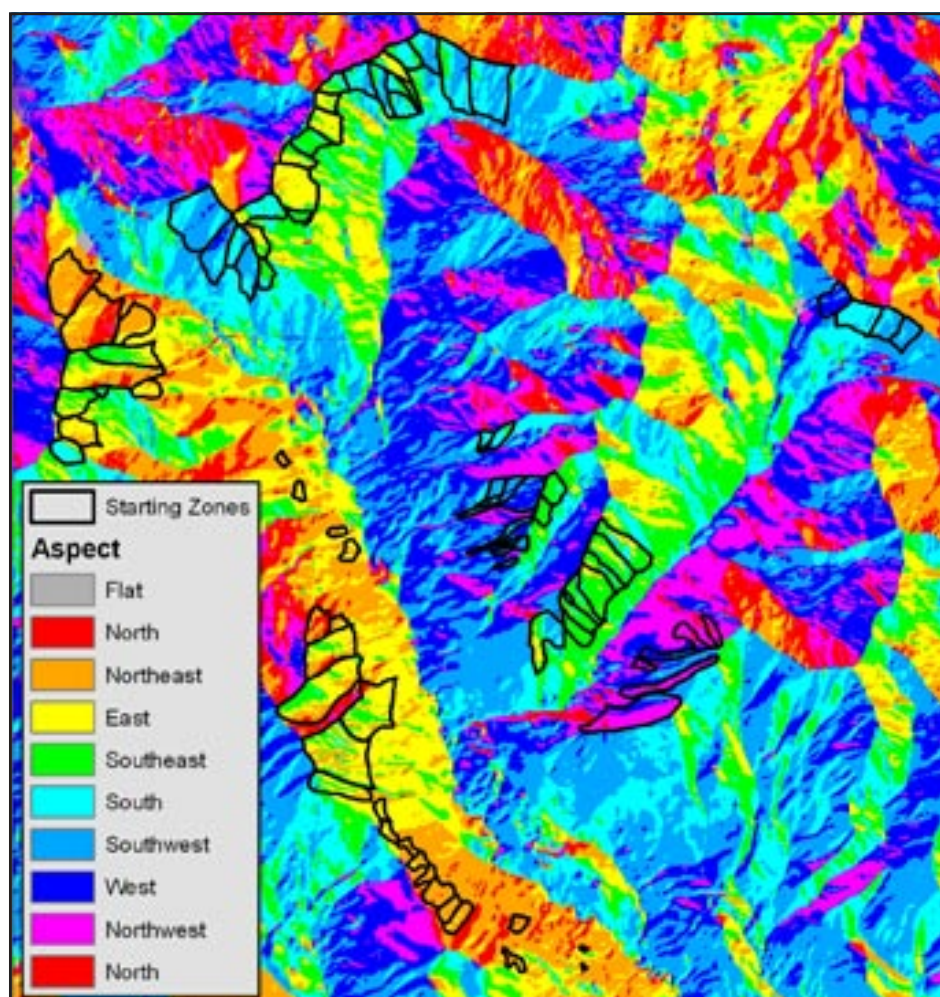
After the eight talks, the presenters and audience gathered for a round-table discussion. Much of this session was spent discussing the limitations and advantages of using GIS for snow and avalanche research and how different groups – forecasting centers, ski areas, and researchers – could use GIS to assist their work while still being cost effective.

One limitation brought up is data resolution. Most parts of North America have 30m elevation data and many have 10m elevation data. Although elevation data at these scales can be useful for many other studies, it is often not fine-enough resolution for snow and avalanche research. As we have all seen, avalanche hazard can vary greatly over 10m. High-resolution (1m) LIDAR data is becoming more readily available but is expensive to collect and only available in select regions.

Software cost was another issue brought up. Shea encouraged everyone look into open source GIS packages such as GRASS. The primary limitation to open source GIS packages is the time investment to learn the software, but Shea demonstrated that once the user has become acquainted with the software, it is a very robust and powerful tool to have at one’s disposal.

This mini-conference was a great opportunity for GIS professionals, forecasting operations, ski-area forecasters, and researchers to gather and explore how GIS technology is advancing the snow and avalanche community’s knowledge base.

Tara Chesley-Preston is a recent MSU masters graduate. If you have any questions about the conference or would like to learn more about how GIS can be of assistance to your operation, contact her at tara.chesley@gmail.com.



Avalanche path starting zones surrounding Gothic, Colorado, overlain upon terrain aspect. This can provide a relatively straightforward means of identifying the starting zone aspect.



history

Montgomery Atwater

AVALANCHE HUNTER & AUTHOR

Story by John Brennan

For well over half a century Monty Atwater has been recognized as a pioneer in the field of avalanche safety, mitigation, and education in North America. What the casual observer may overlook, though, is that Atwater was a prolific writer of both fiction and nonfiction books. As this year marks the fiftieth anniversary of Atwater's key involvement with avalanche control for Squaw Valley's 1960 Olympics – not to mention this year's ISSW at the same location – I felt compelled to elaborate on his literary achievements.

Atwater graduated from Harvard in 1926 with a degree in English Literature. His book bibliography is chronologically ordered below. Besides his books, Atwater also published numerous articles.

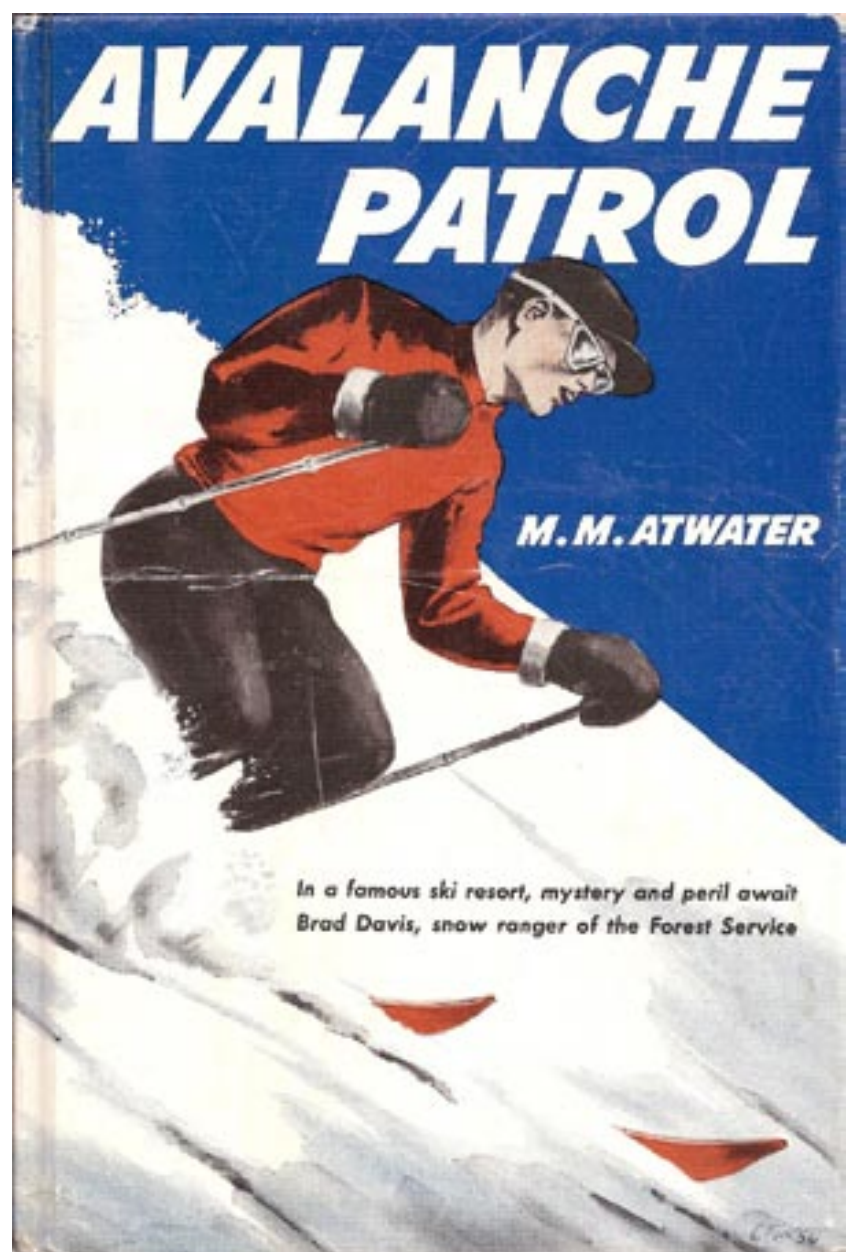
What I find particularly interesting is the number of fiction books that he wrote during his career as an avalanche specialist. His fiction writings delve into outdoor specialties such as forest fire fighters, snow rangers, and ranging cattlemen – trades that Atwater not only knew well but also lived at various times.

While all of these books hold interest for Atwater devotés, some are particularly tricky if not pricey to track down. Most Atwater books can be found through rare book Web sites such as Biblio for under \$30; I paid almost 10 times that for *Flaming Forest*. Fortunately I picked up almost exactly that amount for writing a piece on Atwater for an industry periodical – what good fortune!

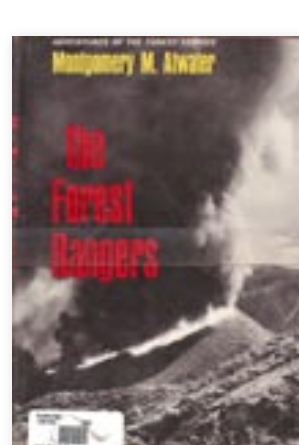
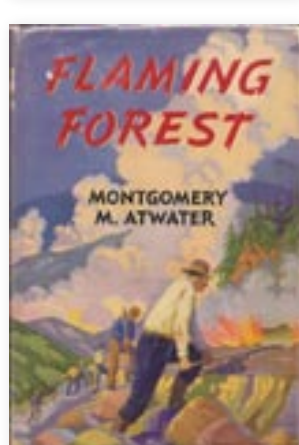
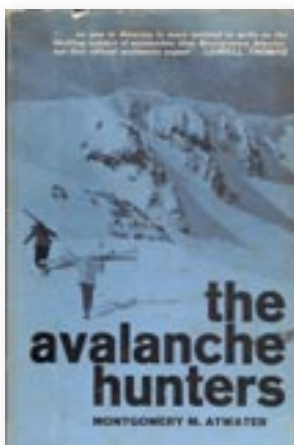
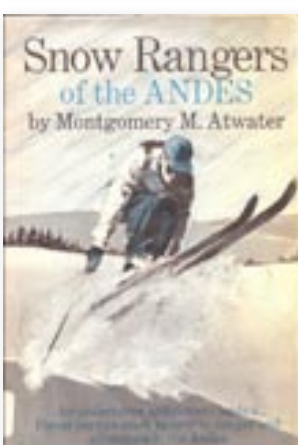
My final and most lengthy search was for the 1949 *Alta Avalanche Studies* – the precursor to the 1953 *Avalanche Handbook* (a piece of work that has been updated periodically to the present). When I tracked down the piece in the National Agricultural Library they found the manuscript significant enough to warrant digitizing it and making it available for all.

John Brennan is a full-time patroller at Snowmass ski area and his research on Atwater led him to found Avalanche Mitigation Services in 2005. Feel free to contact him at jb@avalanche.mitigation.services.com in your quest to find Atwater works. ❄️

- Atwater, Montgomery M. (1940). *Government Hunter*. fiction
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 Atwater, Montgomery M. (1969). *The Forest Rangers*. nonfiction



Below & right: A selection of classic Atwater book covers from John Brennan's library.



The North American Public Avalanche Danger Scale

Story by Grant Statham, Pascal Haegeli, Karl W. Birkeland, Ethan Greene, Clair Israelson, Bruce Tremper, Chris Stethem, Bruce McMahon, Brad White, John Kelly

INTRODUCTION

First and foremost, the purpose of the avalanche danger scale is public risk communication. As part of the public avalanche warning system, its primary objective is to accompany an avalanche bulletin and provide a relative measure of avalanche danger that corresponds with a set of definitions for each of the five danger levels. A danger rating is simply a basic ranking of avalanche danger for a period of time over a specific region.

Used in isolation, danger ratings are far too basic to achieve the precision necessary for conventional avalanche forecasting. Although the danger scale contributes to the evaluation of risk, by itself it is not an evaluation of risk. Avalanche bulletins warn of danger, but only the public themselves can determine their own individual vulnerabilities and exposure, thus being in control of their own risk (Statham, 2008).

The danger scale has also historically served an important secondary purpose. The definitions of avalanche danger contained within the scale serve as the primary guidance used by professional forecasters when determining a danger rating. While countless worksheets and checklists to aid the forecasting process have been developed over time, it is the danger scale's definitions themselves which ultimately bind the forecaster and determine the rating level.

These two purposes are often at odds. Public warnings require basic terminology and simple messages to ensure comprehension at the low-end of the target audience (Laughery and Hammond, 1999), while professional forecasters are science based, and preoccupied with the technical details of weather, snowpack and terrain (Weick and Sutcliffe, 2007).

Accordingly, the revision of the avalanche danger scale sought to bridge the gap between technical analysis and public communication. A second primary goal was to retool an already established warning system to make it communicate with a greater emphasis on consequence. This is important, as one of the strongest and most robust findings in the warnings literature is that warning effectiveness increases with the perceived hazardousness of the product (DeJoy, 1999).

METHODS

A group of 10 subject matter experts (the authors) was assembled in 2005 to collaborate on this project. The intent was to bring together a varied group representing the interests of public forecasting, research, mountain guiding, avalanche education, industry, and highway avalanche forecasting. This group remained mostly intact over the five years of project work, which included workshops in Canmore, Revelstoke, Penticton, and Bozeman, along with an extensive schedule of conference calls and email discussion.

The initial work of this committee focused on developing relevant definitions of avalanche hazard, danger and risk (Statham, 2008), and the design of a conceptual model of avalanche hazard (Statham et al., 2010) with the intent of developing a consistent forecasting model. Suspending work on the danger scale itself to first solve these two preconditions was absolutely necessary to ensure a solid foundation upon which to build the danger scale. Subsequent work and the development of early prototypes began in 2008.

Consultation was extensive and included numerous presentations and workshops in Canada and the United States to keep stakeholders informed. Avalanche forecasters from all public forecast centers were consulted for their feedback at varying stages. The European Avalanche Warning Services were consulted several times, and presentations were made at workshops in Slovakia and Austria.

Product testing of an early prototype was undertaken over a two-week period in March 2009, using an online survey linked from avalanche bulletins in Canada and the US (Ipsos Reid, 2009). This was a comprehensive public test of the danger scale.

The Avalanche Danger Scale is an ordinal, five-level warning system that is a cornerstone of public avalanche information. The system was developed in Europe in 1993 and introduced to North America in 1994. Although both Canada and the United States adopted the system, different descriptors of the danger levels were developed in each country. Fifteen years of practical use revealed numerous deficiencies in this danger scale, most notably a lack of clarity during low-probability/high-consequence avalanche conditions.

In 2005 a group of Canadian and American avalanche forecasters and researchers began to revise the system, with the goal of improving clarity and developing a single standard for North America. Initial explorations to define the problem resulted in more questions and uncovered an almost complete absence of formal underpinnings for the danger scale. The magnitude of the project subsequently changed, and in 2007 the project objectives were clarified as: 1) definitions of avalanche hazard, danger and risk; 2) methodology for assessing avalanche danger; and 3) revisions to the danger scale as a public communication tool.

This article concentrates on the third and final objective, and describes the methods and results of producing the North American Public Avalanche Danger Scale. Emphasis is placed on best practice in warning system design and the principles of risk communication, which helped reshape the avalanche danger scale into a more effective communication tool. The revised danger scale will be implemented across Canada and the United States for the 2010/11 season.

Participants were invited to evaluate scenarios in relation to a stated danger rating, and were tested for comprehension of the situation, and their ability to choose appropriate actions. A total of 4423 respondents from the backcountry community provided feedback, largely rejecting the proposed prototype and favouring the original danger scale.

On consideration of the test results, it was concluded that further improvements to the danger scale were likely to be found in the domain of risk communication, rather than avalanche forecasting. The dichotomy of a sound technical foundation versus simple communication had become a problem that the committee was no longer qualified to resolve. Expertise in risk communication, technical editing, and graphic design was sought out at this penultimate stage and was the key to completing the final version of the danger scale.

Lastly, the danger scale was translated into French by Canada's Federal Translation Bureau and then reviewed by an avalanche translation committee comprised of avalanche forecasters and professional translators.

Target Audience	Level of Knowledge	Examples of Products
Tier 1	None	Icons, colors, signal words
Tier 2	Basic	Bulletins, terrain ratings
Tier 3	Advanced	Snow profiles, raw data

DISCUSSION

Target Audience

Since 2004, avalanche warning systems in North America and Europe have evolved towards a tiered approach to public communication (Statham and Jones, 2006). This structure delivers different kinds of information to different kinds of audiences, as shown in Table 1 (above).

A thorough understanding of the target audience characteristics is necessary for effective risk communication. Laugherty and Breslforst (1991) implored warning designers to "know thy user" with regard to 1) demographics and age, 2) familiarity with the product, 3) competence (technical knowledge, language, reading ability), and 4) hazard perception.

The new danger scale was designed to accommodate a variety of target audiences and provides options to tailor public warnings for particular audiences using different combinations of products within the scale. While the avalanche forecaster will focus on the

interplay between the likelihood and size columns, a snowshoer with minimal avalanche knowledge may be better served with an icon or a color.

Number of Levels of Avalanche Danger

Some of the greatest debate surrounding the danger scale relates to how many levels of avalanche danger are necessary. While the danger scale presents five discrete categories of danger, there is a significant argument for the use of four levels (McClung, 2000), or in other cases more than five levels. Ultimately it was decided that because the five-level danger scale is by now thoroughly established worldwide, changing the levels of danger in North America only would be detrimental to the key objective of consistency and comprehension between nations.

Avalanche forecasters will undoubtedly continue to debate this matter for years to come. Any future student of avalanche danger theory will quickly discover that often, politics, expediency, self-interest, and litigation influence results. Probably we shall never eliminate the influence of such factors, but the challenge is to incorporate the best scientific information into the process to ensure the most effective results (Sanders, 1999).

Signal Words

Signal words are used in warnings to draw attention to the sign or label and to quickly communicate the level of hazard (Leonard et al., 1988). For the danger scale, these signal words are Low, Moderate, Considerable, High, and Extreme. Avalanche forecasters are typically reluctant to warn using signal words alone, but in recent years this trend has been increasing. The introduction of various decision frameworks that depend on a danger rating has boosted this trend.

Generally speaking, the words Low, Moderate, High, and Extreme are unambiguous and interpreted correctly by most of the target audience. These are terms used commonly in other warning systems, and most people are familiar with what they mean. The same cannot be said for Considerable, which when used alone, continues to demonstrate its ineffectiveness at communicating the danger. This term is subject to wide variation in comprehension, as demonstrated clearly in nearly all consultations and product testing (Ipsos Reid, 2009).

However, with a five-level warning system such as the danger scale, and only four signal words offering unambiguous interpretation, what is the best signal word for the third level of danger? The Norwegians proposed a re-ordering the terms into





North American Public Avalanche Danger Scale				
Avalanche danger is determined by the likelihood, size and distribution of avalanches.				
Danger Level		Travel Advice	Likelihood of Avalanches	Avalanche Size and Distribution
5 Extreme		Avoid all avalanche terrain.	Natural and human-triggered avalanches certain.	Large to very large avalanches in many areas.
4 High		Very dangerous avalanche conditions. Travel in avalanche terrain <u>not</u> recommended.	Natural avalanches likely; human-triggered avalanches very likely.	Large avalanches in many areas; or very large avalanches in specific areas.
3 Considerable		Dangerous avalanche conditions. Careful snowpack evaluation, cautious route-finding and conservative decision-making essential.	Natural avalanches possible; human-triggered avalanches likely.	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas.
2 Moderate		Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully; identify features of concern.	Natural avalanches unlikely; human-triggered avalanches possible.	Small avalanches in specific areas; or large avalanches in isolated areas.
1 Low		Generally safe avalanche conditions. Watch for unstable snow on isolated terrain features.	Natural and human-triggered avalanches unlikely.	Small avalanches in isolated areas or extreme terrain.
Safe backcountry travel requires training and experience. You control your own risk by choosing where, when and how you travel.				

figure 1: The North American Public Avalanche Danger Scale

Low, Moderate, High, Very High, and Extreme (Brattlien, 2009). This meant that High would replace Considerable, and Very High would replace High. While initially attractive, the potential confusion resulting from such a dramatic redefinition of established terminology ended this idea.

Thus, after much research and deliberation, it was determined to keep the signal word Considerable for the third level of danger. A pronounced effort was undertaken, with an emphasis on showing the seriousness of this danger level. It is hoped that through education, comprehension of this term will continue to improve, as it is this third level of danger when the greatest percentage of fatal avalanche accident occur (Greene et al., 2006).

Numbers

An unambiguous way to communicate the order and levels of avalanche danger is by using numbers instead of signal words. In areas with multi-lingual audiences, numbers cross the language barrier and solve translation problems. The European countries commonly refer to their danger levels numerically, using phrases such as Danger Level 4 instead of High. The new danger scale now includes the numbers 1-5 matched with each signal word.

Issues regarding the use of numbers center around three issues. First, avalanche danger does not grow in a linear fashion, as the numbers 1-5 would suggest. Danger Level 3 is a significant jump from Danger Level 2, yet this is not represented by these numbers. This gives the false impression that Danger Level 3 is simply the middle point of the scale, and conditions are not that bad. Second, a good signal word communicates more meaning about the conditions than a simple number. Used alone, the term High provides better information about the conditions than Danger Level 4, especially for an audience unfamiliar with the danger scale. Third, an ordinal numbering scheme removes any ambiguity of the placement of danger ratings in their hierarchy. Thus the problem word, Considerable, is clearly identified as between Moderate and High. Despite these issues, the use of ordinal numbers was adopted.

Colors

Colors associated with danger levels are another important method of communicating avalanche danger. Signs, maps, and Web sites are a few examples of where the use of colors can have an immediate impact. The colors on the revised danger scale remain unchanged from the previous scale, with the exception of clarifying black as the color to be used

for Extreme, and a slightly modified tone for the green that represents Low danger.

Based initially on the Swiss RGB color specifications for each danger level (SLF, 2007) this project updated these specifications by also including standards for CMYK and Web-safe colors (Greene et al., 2010).

Icons

In 2005, Parks Canada and the Canadian Avalanche Center implemented a new warning system called the Backcountry Avalanche Advisory (Statham and Jones, 2006). This introduced the concept of a tiered warning system, and provided graphical icons for Tier 1 audiences. Following this, the Swiss modified these icons slightly, added one more, and linked them to the danger scale. In 2009, the European Avalanche Warning Services voted to accept these Swiss icons as a common standard across Europe, and following this, they were included with the North American danger scale to make for an international standard.

Each danger level has a different icon, except for High and Extreme which share the same icon. There are numbers beside each icon, which are intended to help distinguish between them in black & white copy. Icons are yet another component of the danger scale that can be used to communicate a simple message with Tier 1 audiences. The media loves icons, and as the Swiss experience will confirm, there is opportunity here to vastly expand the distribution of basic avalanche warnings.

Travel Advice

This is the column previously known as Recommended Action, now significantly improved to provide strong and clear statements on what the avalanche conditions are, combined with advice on how to travel. The opening statements such as "Dangerous avalanche conditions" (Considerable), and "Avoid all avalanche terrain" (Extreme) are designed to be short and concise, with an immediate impact. The secondary statements such as "Evaluate snow and terrain carefully; identify features of concern" (Moderate), and "Careful snowpack evaluation, cautious route-finding and conservative decision-making essential" (Considerable) are intended to convey the single most important piece of advice for those conditions. The travel advice can also help forecasters discern between danger levels by referring to this column and then asking themselves what kind of travel advice they would recommend for a given day.

Likelihood of Avalanches

This column communicates the chance of triggering avalanches, both natural and human-triggered. The

likelihood terms have been re-ordered in accordance with their numerical probability equivalents (Regan et al., 1989). The term probable has been eliminated, and the following five likelihood terms are now used: unlikely, possible, likely, very likely, and certain (Statham et al., 2010).

For avalanche forecasters, the probability column has always been the most important information for determining the danger rating. In fact, it provided the only definition for determining the proper rating. Long debates over the meaning of probable versus possible seemed a diversion from what was most important. There is less room for debate with this revised terminology, and combined with Avalanche Size/Distribution and the Travel Advice, this information now provides a more complete method of determining and understanding the danger level.

Danger Scale Term	Avalanche Size Range
Small	< Size D2
Large	Size D2 to D3
Very Large	> Size D3

Avalanche Size and Distribution

Providing definitions for avalanche size and distribution and linking them to danger levels introduces a new and significant piece of information, both for forecasters and the public. Avalanche danger is defined as a combination of likelihood and size (Statham, 2008), thus the addition of size and distribution makes the system risk-based by introducing consequence into the danger scale. Avalanche size is a key indicator of avalanche danger, but until now had not been formally considered in the evaluation. Table 2 shows the destructive size ranges for each term relative to an unprotected person being caught.

The Conceptual Model of Avalanche Hazard (Statham et al., 2010) defines three levels of spatial distribution: isolated, specific and widespread. Matched with avalanche size, this information is a general overview of where and how big the avalanches might be. This benefits avalanche forecasters in their analysis, as it provides a second (with likelihood) definitive measure for reference when determining avalanche danger. For the public, messages such as "Large avalanches in many areas" or "small avalanches in isolated areas or extreme terrain" further illustrate the impact of the conditions by describing some of the consequences of triggering an avalanche.

Continued on page 20 ►

The Art of Snow

A Nontraditional, Intuitive View of Snow

Course offered by Jerry Roberts and Mike Friedman • Photos by John Stimberis

one-day, two-evening program

**Ah Haa School for the Arts
Telluride, Colorado**

COURSE DESCRIPTION

In case you are wondering: Jerry and Mike have over 70 years of combined experience in the study of snow and management of avalanches. Contact either Jerry or Mike to register or for more info: snowviewer@montrose.net ❄️

Snow and avalanches, like all wonders of nature, reveal themselves on micro and macro scales. Japanese artists, especially many of the ancient haiku poets, lived much of their lives in the mountains. By reading their poems, one can begin to understand that the snowflake is much more than just frozen water falling from the sky. We will explore these complex and elegant forms in our atmosphere and imagination which constantly drive this dynamic system. We will look for patterns. Along the way, we'll contemplate the poetry and metaphorical power of snow and how mountain communities co-exist with and pay tribute to its destructive nature. We will enter into a frozen world of snowflakes and have dialogue on interesting interpretations and world views that evolve from snow. This is not an avalanche course. No previous experience with snow, skiing, or avalanche awareness is required. There



above: Frost masks the fading colors of summer.



right: In the Chinook Valley, avalanche weather has arrived as the clouds lift and the snow begins to fall.



Slow Viewing

below: Frost is often a visitor of the night; too faint and subtle to stand out in the dark and too fragile to survive into the day. Early morning light provides the best opportunity to appreciate the shapes and reflections.

macro levels.
lives in snow.
more than
ns, the forces
We'll search
er of snow,
manifestation.
situations,
school, so no
will be no math.



above: A thin freezing rain crust meets detonating-cord for a late-night rendezvous.

above: The blanket of snow becomes thick and heavy late in the season. Repetitive patterns reflect the length of the season and the monotony of the highway.

right: Shadows, ski tracks, and subtle shapes beneath the snow contrast with another tough day at work for the patroller.



Will a Guest Ever be Able to Save Your Life?

Story by Manuel Genswein

The efficiency of companion rescue with minimal training has been proven in real accidents as well as in large-scale field tests where participants with almost no prior rescue experience have been trained in three standardized training modules.

There is a large group of clients from commercial guiding, off-piste, and helicopter skiing organizations who generally have much less proficiency with companion rescue than professionals or recreational users who venture on their own into the backcountry. Concerning the level of training, available training times, mental and physical preparedness, as well as average age, this group is very different from non-commercially guided backcountry users.

The likelihood of the first person entering the slope to trigger an avalanche is proven to be considerably greater than for the rest of the group. Despite this, there is little effort made to train guests in rescue techniques and little confidence that they will ever be able to save a guide's life. In a field test including guests of commercial ski guides and mountain guides, the potential level of efficiency was determined over three days in standardized rescue scenarios. The guests were trained in one 15-minute practical workshop. Guests were then separated from their guides with the task of searching and excavating two buried subjects as a group effort in a 50m x 80m field.

Based on the outcome of the rescue scenario, the content of the 15-minute training session has been optimized in order to achieve the greatest possible rescue efficiency. Data collected in the field included times for coordination, times for each individual phase of the search process as well as the different stages of excavation, plus photos and video documentation. Results show rescue by commercial guests is efficient and residual survival chances are surprisingly high, even in a scenario with two buried subjects.

The full paper in English is available at www.genswein.com

INTRODUCTION

A variation of companion rescue is performed by clients of commercial guiding, off-piste, and helicopter skiing organizations. The experience level of non-commercial backcountry users is typically similar, and their training level has primarily been achieved by their own motivation and sense of responsibility. Hence, during an accident the level of competence among buried and non-buried subjects is similar. In contrast, the levels of responsibility, preparedness, and training between clients and guides in commercial operations are hugely different.

By emphasizing "safety," some commercial operators create expectations that are difficult to fulfill in the context of ski touring, heliskiing, or off-piste skiing. This does not help the clients' mental preparedness for an accident. Sensitizing guests about a potential avalanche event can subsequently lead to a diverging survival rate between clients and guides when caught in the same avalanche. In this context, the clear advantage for guides is not only a result of their better physical preparedness. For commercial operators, the motivation to train their clients is partly due to their own interest and partly due to laws concerning product liability. In countries with harsher product liability laws, the training of clients is implemented more thoroughly than in countries where those laws barely exist. Also of interest is the diverging opinion among guides as to the usefulness of training their clients.

Some guides highly value a good base education also for their own good in order to be rescued. Others just hang an avalanche transceiver around the neck of their clients and resign themselves to never having a hope of being rescued by them. Because of the hopeless attitude of the latter group, typically their clients don't get equipped with probe and shovel, which makes a rescue basically impossible. The combination of probe, shovel, and transceiver – called "personal rescue

equipment" – forms the base of an efficient rescue. This holds true even for commercial backcountry operators. In this context, the potentially rapid availability of rescue equipment – e.g., helicopter-aided companion rescue by heliski companies – is not enough of a reason to fail outfitting each client with individual personal rescue equipment.

The topic of training and equipping clients appears especially important when one considers that statistically, the first person to enter a slope clearly has a higher probability of releasing an avalanche than do subsequent persons.

HOW MUCH TRAINING IS REALISTIC AND ADEQUATE

Central to this discussion is the amount of time needed to adequately train the clients. The threshold for clients and guides is rather low compared to non-commercial groups, where education is a substantial part a guide's work.

After extensive inquiries with many commercial guiding, off-piste, and helicopter skiing organizations (daily and weekly operators) in regards to an "acceptable" amount of time allocated for client training, the choice for an adequate and practicably possible time frame was 15 minutes. For those operators who have always valued fundamental training, this may appear quite short. For those guides who "just hang a transceiver around the client's neck," each minute appears to be too much.

Ultimately the 15-minute time frame meets the requirements for "acceptable" and "useful." Especially those who see the situation in a rather pessimistic light, they might put a little more importance into adequate training and personal rescue equipment for clients once they see the rather convincing test results.

With great likelihood, increasing client training time from 15 to 30 minutes would not significantly increase rescue efficiency. No great

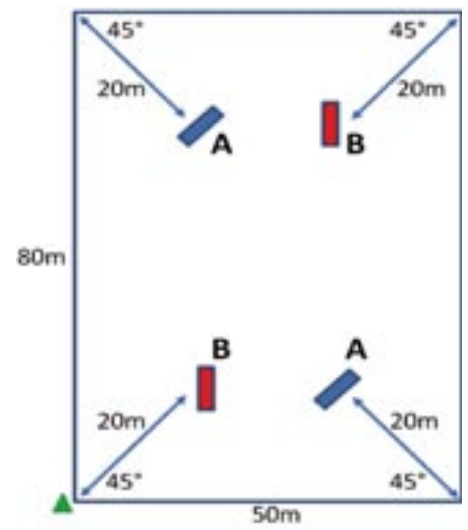


Illustration 1
Test scenario with four burials for which either combination A-A or B-B was activated.

advantages in search and rescue techniques are achieved with the additional time. A valuable addition would be a short practice of a rescue scenario. Within the chosen time frame it is technically possible to learn search/location strategy for multiple burials by applying the "marking" feature. An added feature to the search technique could be teaching how to interpret the analog tone, as well as a search strategy like micro-search strips. This would, however, lead to an unacceptable increase in training time within the average guest training. Additional information for practical training modules of 45 minutes for companion rescue can be found in the paper, *The efficiency of companion rescue with minimal training*.

GOAL OF THE FIELD TEST

The goal of this project and the field test is to design a training module for client training. Immediately after the 15-minute training, the clients were asked to search for and excavate two buried subjects in a 50m x 80m field. Based on the quantitative results of this test, conclusions as to the efficiency of the training module were made, and the subsequent module was changed to optimize the content for the next group.

During the field test, companion-rescue equipment was used to ensure optimal results for the "client" user group. Clients were trained with the most advantageous method for this user group. The decision to use optimal equipment and teaching methods was consciously taken. The goal was not to illustrate the present situation, but to demonstrate what is possible and to improve it.

Only existing and widely available equipment and teaching methods were used. None of it is particularly expensive, complex, or time consuming to handling organizations as long as adequate equipment and teaching methods are used.

TEST PARTICIPANTS

All participants were clients of commercial ski guides, mountain guides, or ski instructors. For the field test, the clients were separated from their guides. 83 clients participated in 14 groups.

The preexisting knowledge of the clients was varied; most were beginners. The average age of 53 is significantly higher than during my previous tests for the *Efficiency of Companion Rescue* or *The V-shaped snow conveyor belt*. 17 clients were older than 65 years.



The "client" group listens intently as Manuel Genswein spends a total of 15 minutes explaining the use of "personal rescue equipment" – probes, shovels and avalanche transceivers – as well as the basics of a search and burial recovery. Photo courtesy Manuel Genswein

Guides were instructed to not hold any special educational lessons prior to the test. At the time of the test, clients knew each other for a couple of hours up to a couple of days.

TEST ENVIRONMENT

A site near Oberlech (Austria) was chosen as the test site. The site proved to be perfect due to the frequency of commercial user groups as well as the training and test logistics.

Test Fields

For efficient data recording, we used two test fields of 50m x 80m (see illustration 1, at left). This size represents the median size of "survived recreational avalanches" in Switzerland. Slope inclination was approx 5 degrees in the lower third and up to 20 degrees in the upper end of the field.

Starting point for all rescuers was always a corner at the bottom end of the field (see green triangle in illustration 1, above left). In comparison with a typical off-piste avalanche accident this constitutes a significantly more difficult scenario. During an off-piste accident significantly more than 50% of all rescues are conducted from the top.

Foot penetration was between "knee-and-hip-deep." This cost the rescuers, who were only allowed to move without skis, a significant amount of time and effort.

All fields were completely tracked up so that the position of the buried subjects could not be guessed.

Buried Subjects

The "victims" were two bags normally used to carry firewood, sewn together and filled with straw. The approximate size per victim was 180cm x 70cm. The texture of those bags closely resembles the stickiness of ski clothing to snow, therefore making it necessary for the rescuers to completely remove all snow before being able to transport the victims.

When burying the victims, the snow around the victims was stomped down layer by layer. Burial depth was 50cm -100 cm, representing the average burial depth in off-piste avalanche accidents. The buried subjects were equipped with remote-control avalanche transceivers with probe detection device. Two buried subjects were activated per search, combination A-A or B-B.

TEST PROCEDURE AND DATA RECORDING

All groups were led to the site by their respective guides. Skis and other non-rescue-specific gear was left behind. Guests received adequate probes and shovels. Only three antenna avalanche transceivers with specific "marking" function to eliminate a previously located signal were used in this test.

After the group arrived at the site they received 15 minutes of instruction. All participants were simultaneously trained by one instructor. After the short instruction, participants were presented with the rescue scenario.

Details Recorded:

• Signal search time

Signal search: The search process with a search device until the first signal was received.

• Coarse search time

Coarse search: The search process from the first point of reception until the

signal decreases for the first time as the rescuer has walked over the buried subject.

• Fine search time

Fine search: The search process within the last few meters until a clear minimum of distance (or maximum of volume) can be isolated.

• Pinpoint search time (Probe)

Pinpoint search: The search with the probe pole until the rescuer hits the buried subject.

• First visual contact with the buried subject

• Full body free

Further documentation included high-definition pictures as well as real-time video.

PRACTICAL TRAINING MODULE

The 15-minute training module included the following content:

• General goal and overview

Search procedure including "airport approach."

• Basic handling of transceiver

"OFF - SEND - SEARCH". Switch SEND ← → SEARCH two or three times on command, all together, repeat until a routine has been established.

• Practical search with explanation of each search phase

Practical search of one buried subject at 35m distance. Transceiver angled at 45 degrees to group → non-linear search path, which forces attention on direction indication on transceiver. Flux lines / flux line characteristics not actively discussed. Clients follow with their transceiver on receive. Group is halted before next search phase to explain the next steps.

• Signal search

If distance to buried subject is greater than range of transceiver → signal search, as per diagram on back of transceiver, is necessary. 3D rotation until signal is detected. **Move** - no life has yet been saved by just standing still!

• Coarse search

Hold device horizontally and "move in direction of arrow." Does distance indication decrease or increase? At 10m distance: airport in sight → slow down!

• Fine search

Approach → slowly and precisely: hold transceiver close to snow surface. No marking with x! Leave shovel mark at the point of smallest distance indication.

• Pinpoint search with spiral probing up until the "hit" at approx 1.5m burial depth. Leave probe in snow. "Mark" with marking function on transceiver. Wait until all clients have marked. Activate second transceiver in 15m distance. Interpret display and strategy with multiple burials.

• Excavation Short explanation of V-shaped snow conveyor. Put clients in V formation while teaching. Basic concept: "cut blocks" and central snow conveyor belt, paddling motion and correct handling of avalanche shovel. Actively running of conveyor belt. Explanations and corrections while the clients work. Let conveyor belt run for 3-4 minutes. Practice rotation on command, no specific instructions as to behavior when first contact with buried subject.

RESULTS

Fourteen groups of 83 clients reached the following median times for locating and completely excavating the buried subjects:

	Fastest Excavation	Slowest Excavation
1st Buried Subject	4:30 min	22:30 min
2nd Buried Subject	6:48 min	27:00 min

The biggest time lag resulted between the completed excavation of the first buried subject and the start of the fine search for the second buried subject. Those rescuers who did not locate and mark the first buried subject themselves confessed that they often had great difficulty in physically removing themselves from the first buried subject and moving towards the second buried subject, as the distance indication on their transceiver increased.

DISCUSSION AND CONCLUSIONS

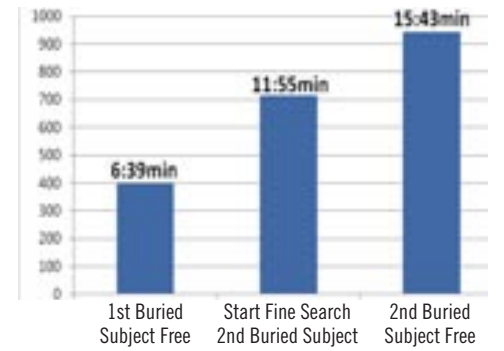
The field test results prove that very realistic survival chances exist within a commercially guided group if the main group member, the guide, is one of the buried victims. The surprisingly short search times make it clear that short and efficient guest training makes sense. The common opinion that a guest is not a deciding factor in ensuring the survival of the guide is hereby not accurate and has clearly been proven wrong. A specifically positive result is the fact that, despite the short training time, the second buried subject was located and excavated in all scenarios. Clearly this result can be attributed to the technically advanced transceivers with marking function. Problems arose for the rescuers that did not mark the first buried subject while transitioning to locate the second buried subject. Those problems indicate that transceivers could be further improved.

A basic requirement to achieve above results is to always outfit clients with modern rescue equipment which is adequate for the respective user group (probe, shovel, transceiver with "marking" function).

The author recommends that instructors use the guidelines and search and rescue techniques outlined in this paper when training their clients.

ACKNOWLEDGEMENTS

The author wishes to thank everybody who contributed to the success of this project. My first thank you goes to my long time project partner Ragnhild Eide, who was unable to participate this year,



but supported the project with valuable advice. To compensate, Ragnhild's friend, Tor Taraldsrud, helped with photo- and videography as well as in field tests. Another valuable expert, "Colani" Jon R. Bezzola (CMH, Mountain Safety Manager), supported this paper with much advice and input. Special thanks go to Mark Harald, whose tremendous initiative and support before and during the field tests ensured their efficiency. Personal and financial support for this project was received from the ski schools of Lech and Oberlech, the Alpincenter Lech, as well as the Betriebsgesellschaft der Schneesportanlagen. Another big thank you goes to all guides and ski instructors, who participated in the field tests with their groups. Last but not least THANKS to the main actors, all the clients, who interrupted their holiday in this prestigious resort for a full hour to perform unexpected hard labor in partially hip-deep snow! The reward per group: several bars of fine Swiss chocolate!

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AVALANCHE DIVAS

FEMALE PROFESSIONALS ❄️ ❄️ ❄️

An invitation to all ISSW Divas

EVENT: Avalanche Divas Night Out at the ISSW 2010

WHAT: A Gathering of Female Snow & Avalanche Professionals

WHEN: Monday, October 18, 2010 - 7 to 9 pm

ENJOY: Complimentary Drinks and Light Dinner plus Cash Bar

WHERE: Cascade Restaurant, Resort At Squaw Creek

WHY: To Celebrate and Honor the ISSW's Avalanche Divas

Please visit: <http://www.avalanchedivas.blogspot.com/> for updates and details

INTERNATIONAL SNOW SCIENCE WORKSHOP 2010
SQUAW VALLEY, CALIFORNIA

DANGER SCALE

continued from page 15

SUMMARY

The North American Public Avalanche Danger Scale will be implemented throughout Canada and the United States for the 2010/11 avalanche season. The scale is a five-level warning system that communicates the likelihood of avalanches being triggered, their expected size, how widespread the situation is, and recommends actions for backcountry travel. In addition to its acceptance in North America, the scale will be adopted in New Zealand for the 2011 southern hemisphere winter (Hobman, pers. com., 2010).

We believe this new scale, and its underlying framework, is already having a significant impact on public avalanche risk management. By clearly defining avalanche hazard, danger and risk (Statham, 2008), developing a transparent forecasting model for determining avalanche danger (Statham et al., 2010), and then revising the principal system for communicating avalanche danger, we have developed a comprehensive avalanche warning system based on the best available science and practice in avalanche forecasting and risk communication. We expect this to pay dividends in the form of better education for both professionals and the public.

Many have asked what took so long, and why all the complications? Why not just change a few words on the scale and get on with it? Well, in the end it's just a scale; nothing more than a table of carefully crafted words, symbols, and colors designed with the best of intent to help the public better understand and manage their risk. The scale is simply one more step in the larger process of understanding avalanche risk. Although fleshing out this process was time consuming, it has resulted in a more solid foundation upon which to base our knowledge of avalanche risk and public warnings.

ACKNOWLEDGEMENTS

The Avalanche Danger Scale project was a Parks Canada led initiative, funded by the Government of Canada through the National Search and Rescue Secretariat's New Initiatives Fund, administered by the Canadian Avalanche Center, and supported by both the United States Forest Service and the Colorado Avalanche Information Center. Each of these organizations contributed in-kind resources.

Many people provided invaluable contributions to this work, including most of the public avalanche forecasters in the United States and Canada. This project was truly a community effort. Our special thanks to those who worked closely on this project, including: Mark Moore, Janet Kellam, Doug Abromeit, Knox Williams, Bruce Jamieson, Alan Jones, Greg Johnson, Steve Blake, Ian Tomm, Doug Chabot, Karl Klassen, Rob Storeshaw, Rik Björnson, Helen Rolfe, Dave Pierzchala, Melissa Brown, Susan Hairsine, Jeanne Chiasson, Lise Gautron, Marc Deschenes, Dominique Boucher, Greg Kingdon, and Michael Wogalter.

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Grant Statham is Parks Canada's mountain risk specialist and an IFMGA mountain guide. He is based from Banff, Alberta, where he works on Parks Canada's mountain-safety programs, guides climbing and skiing, and teaches avalanche courses. He has sworn a blood oath with Karl Birkeland that they will never again revise the avalanche danger scale. ❄️




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Season Roundup 2009/10



Photograph of Housetop Mountain in the Southern Teton Range taken on January 7, 2010. Natural avalanche activity was widespread along the highest ridgelines of the Teton Range after strong winds loaded new snow on a shallow weak snowpack. Photo by Bob Comey

■ Bridger-Teton National Forest Avalanche Center

The weather in western Wyoming was typical for a winter with a strong El Niño. The Pacific Jet Stream tracked further south causing drier than normal conditions. The season began with cold temperatures and snow in early October. Conditions were then quite dry until a mid-January - early February storm cycle. March was also dry. Over 12' of snow fell in April and May as the jet stream migrated to the north. Even though conditions were dry, favored areas, like the west slope of the Teton Range, received over 500" of snow. Areas to the north and east only received 200-300". With the jet stream to the south, this season's wind speeds were well below average.

The early snowfall followed by mostly dry conditions created a continental snowpack. In snow-lean areas depth hoar at the base of the snowpack was a problem until the end of the season. In snow-rich areas these weaknesses persisted into late January.

A powerful storm in early January caused widespread natural avalanche activity. Storm slab and deep slab releases occurred during the mid January - early February storm cycle. In April deep wet slabs released spontaneously during a rain on snow event.

In the backcountry, 22 people were caught and carried by avalanches. Of these, four died and five were injured. Seven of the nine people killed or injured were snowmobilers. One of the deaths involved a skier in extreme terrain. Two of the people who were caught deployed airbags and were partially buried without injuries. At the end of this season our center purchased five airbags.

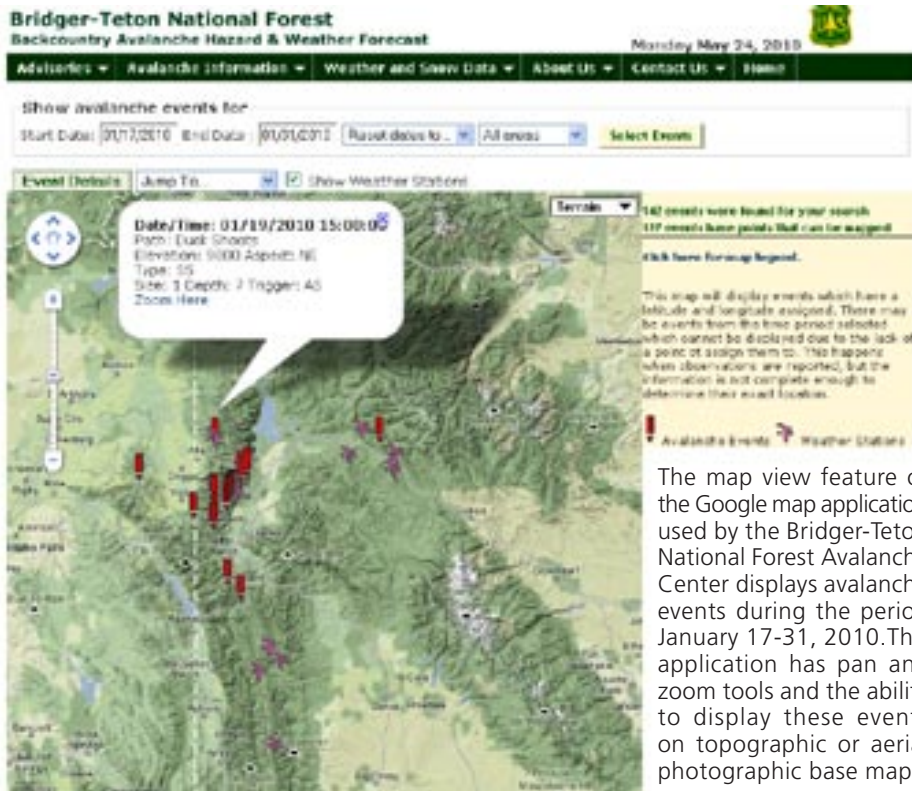
This season's improvements to our program included a redesign of our Web site layout, the addition of several new features to our Web site, and the addition of a new station to our network of remote automated weather stations. The new Web site layout included a new menu scheme and landing pages. New Web site features included links to avalanche education videos, avalanche hazard maps for the Wyoming State Trails Program, and a Google map display of avalanche activity in the backcountry and at local ski resorts. The new Chief Joseph weather station was installed on the west slope of the Tetons in partnership with Grand Targhee Resort.

These improvements were well received. Although it was a dry season, visits to the avalanche advisories on our Web site were up 13%. The new Web site features resulted in over a million page visits. The display of avalanche events using Google map application programming was very popular with our high-end users. This feature uses a Google map application to display avalanche events. Options allow for the selection of date ranges and lists details about each avalanche and terrain attributes including starting zone aspect, elevation, and slope angle. This application also sorts and displays multiple avalanche events by any of these parameters. This product greatly increased the quality and quantity of avalanche



Ski Patrollers install the new Chief Joseph automated weather station at Grand Targhee Resort on March 2, 2010. Photo by Bob Comey

Continued on next page ➡



The map view feature of the Google map application used by the Bridger-Teton National Forest Avalanche Center displays avalanche events during the period January 17-31, 2010. This application has pan and zoom tools and the ability to display these events on topographic or aerial photographic base maps.

NAC ROUNDUP 2009/10

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observations to our center and was well received as a way for our users to view this important information.

Additional improvements to our program are in process. The weather station section of our Web site will be upgraded to display weather station data in a user-friendly graphic format. The Google map avalanche mapping application will be upgraded to display avalanche events as polygons and to allow users to upload avalanche events along with the attributes and photographs of these avalanches. Our snowpack observation network will be integrated into the Google map feature.

—Bob Comey, director

■ West Central Montana Avalanche Center

Although lacking decent snow, the 2009/10 season proved to be one of the more interesting in recent memory. A close call in October and a fatality at the end of March bracketed a season punctuated by facets and close calls.

An early season avalanche on October 24 in the Bitterroot Mountains jump-started the season when four very experienced skiers were rolled after triggering a Class-2 slide in a steep couloir above Gem Lake near Trapper Peak. One person sustained a broken arm and a bruised ego. All were able to walk away from the incident. One of the involved submitted a detailed summary with pictures that detailed their decision-making from leaving the trailhead to the avalanche and rescue. This incident involved cold, late-October snow that failed to bond to the older snow in a perennial snow field. Certainly other avalanches have happened this early but this is the earliest reported avalanche incident in this area.

Early season snow stability was compromised by 50cm of depth hoar that formed during severe cold in early December. An El Niño weather pattern with a split upper-air flow persisted through the winter and limited the amount of snow that accumulated at the higher elevations. Moderate temperatures and slowly accumulating snowfall in late December and January helped stabilize the basal weakness. Our attention then turned to near-surface faceting and a troublesome surface hoar layer that formed at the end of January and persisted for the remainder of the season.

This particular layer snuck up on us as we had no major snowfall events, just short periods of accumulation over time that eventually overpowered the ability

of the faceted layer to hold up to the weight. We began seeing and hearing about human-triggered avalanche activity on Presidents' Day weekend and after every storm that passed through the area well into April.

The fatality on March 27 at Missoula Lake involved this layer that failed on a snowmobiler as he descended a northwest slope fully two months after it formed. As of this writing, large avalanches have been observed on north-northeast aspects as late as April 15. Most, if not all, of these avalanches failed on the same persistent weak layer.

Our Friends group, the West Central Montana Avalanche Foundation, continued to be successful raising funds which, through a reimbursable agreement with the Forest Service, help pay for an additional advisory day and education events. The Foundation also purchased three Beacon Basins that are located at Lolo Pass, Lost Trail Powder Mountain ski area, and Montana Snowbowl ski area.

We increased our outreach into local schools by providing basic awareness training to more than 1500 middle school to high school age students throughout western Montana. Another 500 backcountry skiers and riders attended one of the many other free sessions sponsored by the center and the University of Montana. The center also sponsored three Level-1 classes which were limited to 15 students each.

We continue to operate through a variety of funding mechanisms. We rely heavily on contributed time from our many partners on the Bitterroot, Clearwater, and Lolo National Forests; the University of Montana; the Missoula office of the National Weather Service; and others. We received education grant money from Montana Fish, Wildlife & Parks as well as grant money from our Friends group. The Lolo National Forest provided a small operating budget for the first time, so our future looks strong.

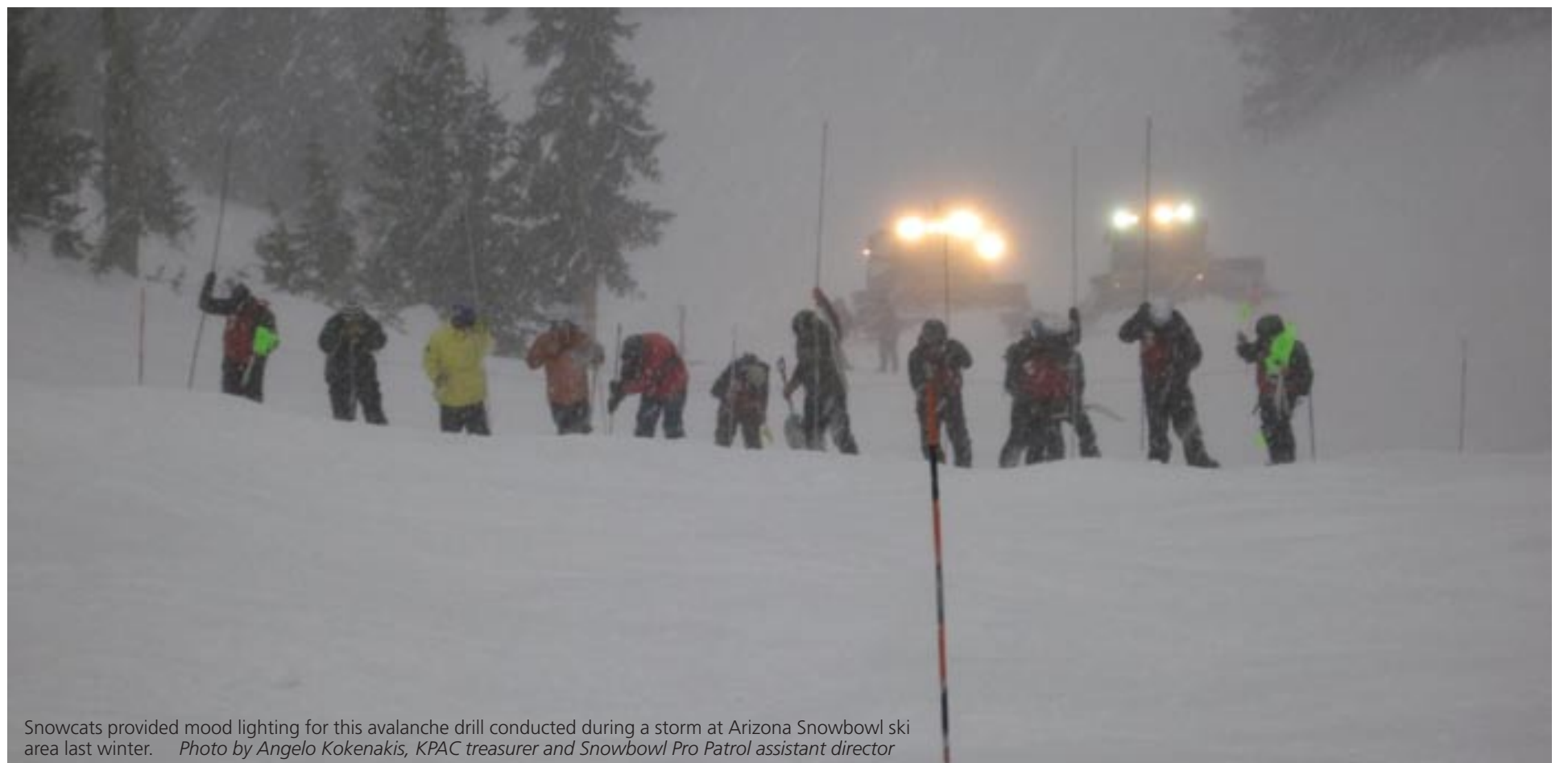
We also hope to hire a part-time educator/forecaster for the 2010/11 season which will further strengthen our education efforts. —Steve Karkanen, director

■ Kachina Peaks Avalanche Center

The mild El Niño pattern was kind to Region 3 snow country, particularly to San Francisco Peak, where Arizona Snowbowl ski resort recorded a snowfall total of 321" at 10,800' elevation, 121% of the 30-year average. In comparison, it was the biggest year since our all-time record season of 2004/05 when 465" were recorded.

Winter unfolded in an average way with Arizona Snowbowl opening on December 17 on 34" of undisturbed base at 10,800'. Early season storms were modest, producing under a foot of new with each event. Temperatures and wind were also near average during November. December stepped it up a significant notch with a wet storm that ended on the 9th and produced the sixth greatest 24-hour snowfall total on record: 32" accompanied by 80mph winds. This storm and reports of direct-action avalanching prompted the Coconino National Forest and Coconino County Sheriff's Office to issue an avalanche hazard warning on the evening of December 8. The effect was stripping windward above-treeline slopes and forming bulletproof slab on lee aspects. Surprisingly, a lot of mass vanished at high elevation, presumably due to evapo-sublimation or transport to the Painted Desert. Below tree line, thick dense wind-hammered snow created slab and generally added to the overall strength of the snowpack in most areas. This storm pushed emergency services to the limit, primarily in assisting stranded elk hunters all over the rim country.

Two weeks later, a Christmas Eve storm produced 28" at 10,800', proving that there is a Santa Claus. December's snowfall total of 110" was impressive, but the true fireworks were still to come in January with the season's most memorable event, a sandwich of three energetic storms dubbed "Stormageddon." These hit from January 18-22 in a cold-warm-cold cycle with the final event packing the biggest punch. Not only did this series of storms create havoc in the city of Flagstaff where numerous roofs collapsed, it also spurred a controversial and unprecedented event: the closure of Kachina Peaks Wilderness. Regional forecasts predicted 5-7' of snow in the high country and anticipated breaking a 30-year record. Storm totals recorded at Snowbowl were 97" at 10,800'. Initially, a "winter storm and avalanche awareness" press release was issued on January 19, then a wilderness closure was announced on the evening of January 22.



Snowcats provided mood lighting for this avalanche drill conducted during a storm at Arizona Snowbowl ski area last winter. Photo by Angelo Kokenakis, KPAC treasurer and Snowbowl Pro Patrol assistant director



A near miss involving a local Flagstaff skier occurred in Telemark Couloir, which is on Fremont Peak of the Kachina Peaks, on the afternoon of February 5, 2010. Photo courtesy KPAC

The decision to close the wilderness was initiated in collaboration between the Coconino National Forest and the Northern Arizona Emergency Operations Center. Personnel from Kachina Peaks Avalanche Center (KPAC) were consulted prior to issuing the press release. The justification was the likelihood that emergency services could become completely overwhelmed by such an unprecedented storm event. At the time of the closure there had been two backcountry search and rescue missions on San Francisco Peaks since the beginning of the storm cycle, and EMS managers anticipated the possibility that all of northern Arizona could become completely shut down.

The closure was lifted midday on January 25, but not without considerable chatter on the KPAC Web site, where views ranged from understanding support to conspiratorial outrage. After the dust cloud settled there was much speculation on whether or not the closure was justified and on the number of natural avalanches that occurred. As the evidence trickled in, it appeared that a number of significant direct-action avalanches had occurred. It also became evident that conditions had settled and were relatively stable. Emotions were calmed by agency reassurances that wilderness closures would occur only after historic events and not become a default method of assuring public safety.

The most publicized avalanche event of the season occurred early afternoon on February 5 when a well-known local skier triggered a slide in a path know as Telemark Couloir. Although uninjured, the skier took a 2000' ride. The Coconino County Search and Rescue Unit and Arizona Snowbowl Patrol got drawn into the mix, so this incident received significant media attention in the local paper and was covered in a story developed by Gillian Ferris Kohl of KNAU (local NPR affiliate) titled, *Avalanches in Arizona*.

Snow continued to fly throughout the spring months with power skiing continuing into late April and corn into mid-June. Arizona Snowbowl ski resort closed for the season on April 18.

Notable seasonable events and statistics

- Coconino County Search and Rescue reported six winter backcountry missions in Kachina Peaks Wilderness, compared to only one the previous winter.
- Over 900 winter backcountry permits were issued, almost doubling the highest number in any previous season.
- Three skier-triggered slides were reported and documented.
- Over 150 people attended one of three free avalanche awareness clinic conducted by KPAC, and 30 people (a record number) attended a follow-up field session at Arizon Snowbowl ski resort.
- 28 individuals attended one of three Level 1 avalanche courses, which took place in Kachina Peaks Wilderness through an MOU between Prescott College Lifelong Learning Center and KPAC.
- Web site activity increased by 31% based on unique visitors, totaling over 26,000 during the season. There was an 86% increase in first-time visitors to the Web site compared with the previous winter – jumping from 8270 (2008/09) to 15,290 (2009/10).
- A Web site-based survey designed to assess visitor opinions on the benefit of an avalanche advisory in the future revealed almost unanimous support. Out of 78 respondents, 99% answered they would benefit from an advisory, and 91% said they would consider financial support for such an effort in the future

Overall, it was a great season, demonstrating the utility of and appreciation for Kachina Peaks Avalanche Center, Inc. —David Lovejoy

■ Eastern Sierra Avalanche Center - Inyo National Forest

A late start, a weak early season snowpack and a long extended winter-like spring lasting into early June summarizes the season here in the eastern Sierra. The ski season started late : base depth at Mammoth Mountain was 14" the second week of December.

Despite a well-developed depth hoar layer in the southern part of the forecast area, there were only a couple of skier-triggered depth hoar slides by the end of January and only a handful of skier-triggered wind slabs. The slides were small but even small skier-triggered slides are big events for the people involved. The relative lack of skier-triggered slides may be a result of a combination factors including small skier

numbers in key locations and a generally non-reactive snowpack.

Backcountry skier and rider numbers generally increase exponentially around the first week in April. There is a commensurate increase in the number of reports of human-triggered wet snow avalanches.

The much hyped El Niño failed to deliver in the Mammoth area, but areas south of Mammoth picked up over 100% of average snow water content. The spring skiing season lasted into June.

The first avalanches of the winter season came from the remnants of super typhoon Mellor on October 14, 2009. Mellor would have been uncommonly strong even for a mid-winter storm, and close to 2' of snow fell in an 8-hour period. By the middle of November, most of the October storm snow melted, even at high elevations.

The winter's primary snowfall came in four storms: mid-December, the end of January, the end of February, and the end of March. Of these four storms, only one produced a widespread slab backcountry avalanche cycle. Ski patrol at Mammoth noted a similar pattern of numerous small slides and point releases across all four storms, but not many large, class 4 or 5 avalanches. This is surprising because the winter had its fair share of wind.



Early season depth hoar in the southern Sierras. Photo by Dan Mingori



McGee Mountain avalanche, January 24, 2010. Photo by Sue Burak

December/January— A healthy vigorous storm during the second week of December dumped 60" of snow and 8" of water in a 4-day period in the Mammoth area. Despite the mid-December dump, the only frontcountry location that had enough snow to ski and possibly avalanche was the Mammoth Lakes Basin. Sue started work on December 21, 2009, fresh out of a grueling graduate school semester, and issued the first advisory on December 23.

The season began with the usual early season Sierra depth hoar. It looked scary, collapsed in compression and extended column tests, but did not result in avalanches until the third week in January when avalanches occurred in the shallower and weaker snowpacks south of Mammoth and in the June Mountain area.

Close to 90" of snow and 8" of water came in the week after the Martin Luther King holiday weekend. The forested slopes below the June Mountain ski lodge were the site of several large avalanches with meter-deep crowns. A layer of facets above a thin crust persisted for several weeks after the storm. For the second year in a row, the lower slopes of June Mountain and the adjacent side country had a reactive snowpack compared to the relatively stable maritime snowpack in the Mammoth area.

I named the third week of January, "the Martin Luther King week of storms." This series of storms had a dramatic effect on the shallow and faceted snowpacks south and north of Mammoth. The parade of Pacific storms loaded the depth hoar with about 5-6" of water over four days and the snowpack reacted accordingly.

One east- to northeast-facing slope along a lateral moraine in the southern forecast area had a widespread depth hoar avalanche cycle several days after skies cleared. While this is a common event in intermountain and continental snow climates, this event was extremely unusual. Four days after the avalanche cycle, many avalanche rounds were fired into avalanche starting zones in adjacent areas in Bishop Creek with no results.

Approximately 20 to 25 small- to medium-size slides (R2s and a few R3s) covered a half-mile length of the slope above the road. The avalanches went to the ground in the shallow 60-80cm snowpack, and the slides appeared to have occurred at the same time. The slides occurred on convex rolls, rock outcrops, trees, and the middle of slopes.

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Once skies cleared, a widespread avalanche cycle occurred throughout the advisory area. There was a flurry of skier-triggered slides in the shallower snowpack areas south of Mammoth, including an uncommon remotely triggered avalanche via depth hoar collapse. On the same afternoon, a Mono County snowplow driver triggered a slide below a road cut that ran on the depth hoar and partially buried his cab.

The high winds that always come with storms in January triggered another large avalanche that ran on depth hoar towards the end of the "Martin Luther King Storm Cycle." A large area of depth hoar collapsed under the small knob near the ridgeline on McGee Mountain. (*see photo, previous page*) Sagebrush and rocks were visible after the avalanche cleaned out the bowl. This area was the location of several more avalanches throughout the winter. The late January storm cycle produced what is arguably the first and last widespread slab avalanche cycle for the winter.

February /March— After the late January storms, February storms came in with more wind than snowfall. At the end of the month, another week-long El Niño influenced storm produced over 5' of snow and 8-13" of water over the forecast area. The flow aloft and at the surface was from the south which gave the southern Sierra almost as much snow as the orographically favored Mammoth area. Strong northerly post-frontal winds produced a 5-day period of Moderate danger ratings. The last time Sue issued a week's worth of Moderate danger ratings was in the big winter of 2006.

A welcome period of mild weather in mid-March created springtime conditions, wet snow avalanches, and warranted Low danger ratings in the morning and Moderate danger ratings in the afternoon.

April /May— The Madden Julian Oscillation, an intra-seasonal subtropical oscillation that accounts for many powerful wet storms in the Sierra Nevada, developed into a moderate event. An area of unusually strong convection traveled east from the Indian Ocean into the subtropics and caused a series of storms at the end of March and into the middle of April. Several feet of snow along with 6-8" of water brought the southern Sierra up to average water content for the water year.

The coldest spring in many years brings to mind the first lines of T.S. Eliot's, *The Wasteland*, adapted for the season: "April and May are the cruelest months, breeding lilacs out of the dead land. Then the northern jet steers cold winter storms through for a memory of winter and a desire for spring." —*Sue Burak, forecaster*

■ Payette Avalanche Center

The 2009/10 season was a season of big changes for the Payette National Forest Avalanche Center: the center added another full-time forecaster to the staff as well as two part-time travel companions, built a new Web site complete with the new North American Avalanche Danger Scale, and entered into a partnership with the Boise National Forest to double our forecast area and increase the number of forecasts to four per week. PAC issued a total of 61 forecasts this season between mid-December and the first week in April.

The West Central Mountains received approximately 226" of snow through the first week of April which was between 52 and 81% of average snowpack at Snowtel sites throughout the area. The El Niño influenced West Central snowpack so that in addition to below-normal snow amounts, the snowpack was similar to a continental snowpack rather than the far western edge of the Intermountain zone. Our snowpack was plagued by a series of persistent weak layers that provided the scene for several of our accidents and fatalities throughout the mid and later part of the winter. Unfortunately, the presence of these layers did not influence or affect a change in the way many of our backcountry users view the normally stable West Central snowpack. Many users continued to ride and ski in avalanche-prone areas throughout the winter without taking time to check in with the snowpack – instead making travel decisions based on past experience or a perception that the snowpack was actually more stable than the forecast suggested.

The early winter snowpack was subjected to several weeks of high pressure and below-average temperatures for nearly a month at the beginning of the season; this weather pattern formed a basal layer of faceted snow that became a persistent

weak layer which was active most of January. This faceted layer caused the second US avalanche fatality of the winter when a group of snowmobilers triggered a slide that buried two riders and killed one near Rock Lake, Cascade, ID, in our South Valley area. The mid-winter snowpack was typified by small storms that kept skiing and riding conditions good and provided a safer snowpack once the basal facets were buried deeply and compressed. The small storm cycles of mid-winter were also characterized by perfect conditions for surface and near-surface faceting that also helped keep the northerly snow soft. These two very reactive layers of facets persisted in some of our colder areas through the first part of April and were responsible for several skier-triggered avalanches which included a full burial and several near misses in a very widespread cycle during the third week of February. These layers were also responsible for two more snowmobiler fatalities at the end of March near Lloyd's Lake in our northern forecast area in which three riders were caught. Two of the riders were buried very deeply and the third was partially buried and rescued by additional members of his party. The late-season snowpack showed a partial return to more normal storm patterns; these storms were characterized by strong winds, widespread windslab formation, and significant loading on leeward slopes.

PAC and the Friends of the PAC offered two Basic Awareness classes this winter consisting of a two-hour classroom session and field sessions for both skiers and snowmobilers. In addition PAC coordinated with the newly formed Wallowa Avalanche Center on the first public awareness class that they offered in eastern Oregon. PAC reached a large audience with Basic class participation totaling over 145 students spread out over three classes (snowmobilers represented the largest user group in these classes). Also in the local area, we taught two USFS avalanche classes, two class sections in local schools, one class with Valley County Sheriff deputies, and coordinated with area ski resorts on a National Ski Patrol Level 2 avalanche class offered in December at Brundage Mountain Resort.

During the season, PAC was featured on both local and regional radio segments about Northwestern US Avalanche Centers and responded to numerous print, radio, and television media requests for information about avalanche hazard and in response to the three avalanche deaths in our area.

Looking forward to the 2010/11 winter season, PAC will be offering additional classes and expanding outreach efforts to all user groups with an emphasis on local and regional snowmobile clubs. PAC will also be partnering with local Chamber of Commerce groups and other visitor and user-specific entities to increase exposure of our educational efforts and our forecast products. —*John Groom, director*

■ Gallatin National Forest Avalanche Center

We just finished our twentieth year of operation at the Gallatin National Forest Avalanche Center (GNFAC) with a great, safe season. We owe a huge thanks to all our supporters in the community, coworkers on Gallatin National Forest, and Friends of the Avalanche Center. We could not have succeeded without your help.

The starter pistol rang on October 6 with a skier-triggered slide in the Bridger Range. We were fortunate to receive lots of snow in October and November, but extreme cold in December turned much of the snowpack into weak, faceted depth hoar. This layer persisted and produced avalanches all season. Heavy snowfall in early January prompted a warning throughout our entire advisory area and the most widespread avalanche cycle in 20 years.

Another significant storm occurred in mid-February depositing 3" of SWE in the Bridger Range. Following this storm, facets near the ground on Saddle Peak, a popular sidecountry area near Bridger Bowl, reached their breaking point and produced a massive avalanche. Miraculously no one was caught or injured in this deadly slide. (*see article in TAR 28/4*)

We began daily avalanche advisories on December 5 and continued until April 11 for a total of 127 days. Unstable snow created avalanche activity and/or widespread collapsing or cracking on 83 (65%) of those days. It was the most active avalanche season in our history, and we never issued a Low danger rating. Unfortunately three avalanche fatalities occurred. An ice climber died in Hyalite Canyon in December, a snowmobiler died near Cooke City in early January, and a snowmobiler died on April 14 just after we ended daily advisories. Unstable conditions with increased numbers in the backcountry led to a record 85 incidents, nearly twice the average,



Avalanche on Saddle Peak, a popular sidecountry area near Bridger Bowl.

Photo by Sean Sperry, Bozeman Daily Chronicle



Natural avalanches at Castle Lake, in the Castle Crags area of the Mount Shasta forecast area, on April 12, 2010. Photo by Chris Carr

with 19 people caught, eight partially buried, and two fully buried. In one instance, forecaster Eric Knoff was digging a snowpit when he and his partner witnessed a skier trigger and get caught in a slide. Eric and his partners whipped out their beacons, shovels, and probes and performed an immediate rescue.

Education efforts with the Friends saw another banner year with 64 classes reaching 4900 students. People attending our classes included college students, high school students, middle school students, SAR groups, Forest Service personnel, snowmobile clubs, NWS forecasters, teen groups, miners, an Elks club, and many more in towns throughout Montana like Billings, Butte, Big Timber, Columbus, Great Falls, Helena, Dillon, Anaconda, Cooke City, and Livingston. When Saddle Peak ripped and sent shockwaves through the community, we immediately responded with a Q&A session. Attendance was overwhelming, and it was standing room only.

We also sponsored a Wet-Snow Avalanche Workshop for avalanche professionals with guest lecturers from Wyoming and Glacier National Park. This event was organized and spearheaded by Scott Savage. We are extremely proud of offering these classes, most of which are free, and couldn't do it without the Friends and our instructors: Jay Pape, Angela Patnode, Dale Gullett, Tim Campbell, Scott Savage, Beau Fredlund, Matt Borish, Ben Nobel, Mike Cooperstein, Jon Marshall, and Tara Chesley-Preston. (Look for an article on this workshop from Scott in TAR 29-2.)

We started the season with a new Web site helping us to use different media types more effectively. Photos and videos were embedded with our daily advisories, and we built a new "Sidecountry" page with information about local sidecountry areas. We hope this page will continue to grow and become a useful resource. Our accidents page was rebuilt, and we expanded our donate button to account for different events and allow people to purchase the DVD, *A Dozen More Turns*. We entered social networking by starting a Twitter page with 275 followers and a Friends' Facebook page with 1166 fans. We made 37 YouTube videos that received 77,515 views, three times last year's views. Our sidecountry awareness movie, *Stay Alive*, was re-edited and distributed to a national audience. Our advisory was accessed 20% more than last season with an average of 3906 people reading or hearing it every day.

Once again we partnered with Team Bozeman and Yamaha who loaned us two 2010 Nytro MTX snowmobiles on which we put nearly 1300 miles each. Because southwest Montana is a major destination for snowmobilers, these ripping mountain sleds are a key part of our efforts to reach this user group. They give us access to many remote areas, allow us to cover huge areas and dig many pits, and help us teach more effective snowmobile avalanche classes. We usually look forward to days when we can leave the skis at home and just go riding! Additionally, Gallatin snow rangers continue to help us more and more. Two attended the National Avalanche School, and one attended our Wet Snow Avalanche Workshop. The snow rangers continue to send us key observations while connecting with many riders in the fields and promoting avalanche safety. Local riders without avalanche rescue gear are now the exception not the rule.

Fundraising was another big success, and we are extremely lucky to be supported by many local businesses and organizations. Despite the poor economy, our Powder Blast party in the fall raised a record amount of money. Also, friends and family of Tyler Stetson, a young man killed in an avalanche in 2008, traveled to Bozeman from across the country and raised over \$15,000 for the Friends through pledges at the King and Queen of the Ridge event held at Bridger Bowl.

Lastly we continue to receive many invaluable observations from backcountry users. Ski patrollers at Big Sky, Bridger, Moonlight, and the Yellowstone Club take time at the end of every day to send us daily reports. We greatly appreciate these observations which help make daily advisories possible. Thanks to everyone who contributed to a successful season at the GNFAAC. —Mark Staples, forecaster

■ Mt Shasta Avalanche Center

The Mt Shasta Avalanche Center operates under the US Forest Service and is currently a Type III Regional Avalanche Center. We forecast three days a week and specifically for 1000 km in the Mt Shasta, Castle Lake, and Mt Eddy backcountry. However, our information is used by many north and south where avalanche advisories are not provided. Our Friends group is able to provide around 25% of our funding and continues to pay for our weather stations and Web page.

Precipitation in our area was 121% of normal this season and we finished the year with the snowpack depth at 127% of normal. Overall, it was a warm winter with one very significant storm event in April. We experienced different wind patterns this winter, more typical of El Niño, and this included stronger SE winds than normal and fewer than normal NW wind events. Although we had many human-triggered avalanches this season, we escaped again (so far) without any avalanche fatalities or serious injuries.

Beginning on Martin Luther King Jr. Day, January 18, a powerful storm series brought 32.5cm (12.8") of water and 244-305cm (8-10') of snow to the surrounding mountains. This storm paralyzed the city of Mt Shasta with heavy snowfall snapping and uprooting trees, taking out power lines for several days to over a week. Widespread avalanche activity occurred with one large avalanche on Mt Shasta travelling 5600' vertically and three miles horizontally, piling up 30' deep over a few acres.

Our outreach efforts increased this year by adding avalanche-awareness presentations in the San Francisco Bay Area. Additionally, in a partnership with the National Weather Service, we included a "Climate Outlook" section in our local presentations by meteorologist Brett Lutz. This helped attract bigger crowds to the presentations. As always, we continue to offer free transceiver clinics and these continue to be very popular. —Eric White, director

■ Mount Washington Avalanche Center

"Waiting" would be an appropriate theme for the winter of 2009/10 on Mt Washington. First we waited for winter to arrive, then while waiting for Justin's ankle to heal we waited to bring onboard a seasonal employee. Too many times we waited for our Web server to get repaired, and of course we always seemed to be waiting for the next storm to come. The one thing we didn't need to wait for was spring – it came about a month early and made for an early end to an often lackluster winter season.

By late November, winter still hadn't really arrived, and the mountain remained an unappealing shade of brown. It wasn't until December 9 that we began issuing 5-scale advisories, but then just a day later we posted High avalanche danger, and a couple days after that another 28" of snow fell across the mountain. This snapped us quickly out of our off-season hibernation and into action. Unfortunately, this hurry-up-and-wait mentality persisted during the season. While metropolitan areas to our south were getting pummeled by record snows, we patiently waited for the storms to track our way. Sometimes they did, and sometimes they didn't. One example is the storm at the end of December that left Baltimore with 20" of snow but barely a trace on Mt Washington.

A typical winter in New England has a lot of ups and downs, but this year was different. Most of the snow fell during only a handful of storms. In fact, from December through April Mt. Washington's summit received 189" of snow, which is 53" below average. Of this total, 130" came during just eight storm events. Another way to say it is that 69% of our total snow fell over 22 days, which begs the question, "What happened on the other 129 days?" Well, thanks to the famous Mt Washington winds, we are blessed (or cursed?) with an impressive ability to move snow. Sixty-three days

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saw hurricane-force winds that kept us on our toes and debating the nuances between fractions of an inch of snow and how deep the resulting slabs might be.

Desperation was setting in by mid-February when Chris wrote in the advisory, "As of 7am this morning the summit got hammered with 0.5" (1.25cm) while our new electron microscope measured 1.86mm of new snow at the Harvard plot." The drought of Jan/Feb 2010 lasted 51 days, during which time we received a mere 22" of snow. Despite this, on 16 days during this period, Tuckerman Ravine had avalanche danger rated Considerable or High.

If there were a single storm to remember, it would be the end of February storm that dropped 55" of snow at our mid-mountain snow plots. While the valleys were getting soaked with rain, it stayed cold enough up high for the precipitation to remain frozen. The unfortunate and unusual aspect of this storm was the strong and sustained east winds, which actually eroded snow from the Headwall of Tuckerman Ravine and pushed it over to the western side of the mountain. This created some impressive avalanche activity in the northern Presidential Range, though the largest were outside of our forecast area. By the time this storm was over, New Englanders were standing proud and ready to defend themselves against any naysayers who may have moved out West in search of better snow. Alas, this would be the last truly significant storm of the season. Spring came in on the heels of this storm and provided numerous warm sun-filled days throughout March and April.

In addition to avalanche forecasting, the Mount Washington Avalanche Center also has lead agency responsibility for search and rescue within its forecast area. In this regard the winter started out slowly. Most of the winter had come and gone before we saw our first person requiring evacuation. There were a couple close calls, including one where two ice climbers were involved with an avalanche presumably near Pinnacle Gully. These climbers had a lengthy talk with a snow ranger that morning about the avalanche conditions for the day, then decided to attempt their climb nonetheless. We only learned of the avalanche through a note left at the Harvard Cabin reading, "Hey guys, Got to the base and got caught in a small avalanche so we decided against the climb. Thanks for letting us shack up for a bit." Nothing else is known about the incident. This is one example of the power of the human factors involved with decision-making in avalanche terrain; even with a micro-scale forecast rating of Considerable and the personalized recommendations of the lead snow ranger, the desire to climb this route must have been strong – and resulted in the note we were left holding the following morning.

The season could not have been successful without the help and cooperation of numerous people and groups. Local climber, Mountain Rescue Service vice president, engineer, and photographer Joe Klementovich put aside his numerous hats to join us for the season. His experience and acumen was invaluable while we were waiting for Justin to return from ankle surgery in November. The Mount Washington Volunteer Ski Patrol logged over 200 person/days from March through May, working tirelessly to deliver avalanche and safety information to thousands of skiers, climbers, and hikers. Friends of Tuckerman Ravine solicited donations of labor and funds to help produce three new avalanche information slatboards. We would like to also thank all the local businesses who help us get our message into the hands of backcountry travelers. In addition to the new slatboards, in 2010/11 we will debut a new Web site at www.mountwashingtonavalanchecenter.org. This new site will replace tuckerman.org and is intended to better reflect the wide range of visitors we see and the mission of the avalanche center. We hope you all take a minute to check it out and tell us what you think. —Justin Preisendorfer, snow ranger



R4-5D3 Release, Arrowhead Slide, Haystack Mtn. La Sals. 2/26/10 Photo by Brian Murdock

Utah Avalanche Center - Manti La Sal

The 2009/10 season officially began on November 30 with 14" of snow on the ground at our Gold Basin Study Plot at 10,000' in the La Sal Mountains. This year we had a typical season opener for any southwest avy center, as storms in October and November deposited about 16" of measurable snowfall that then rotted into well-developed faceted grains by the opening date for the center. The La Sal Center was staffed this season by lead forecaster Dave Medara with assistance from forecaster/ rec tech Max Forgensi when available. Our boss, Brian Murdock, chipped in as well.



Horsehead Peak Slide, Abajo Mountains, 3/13/10. 2-5' deep, 550-yards wide, skier triggered. Photo by Pat Lambrose

December arrived with record cold and snow from valley bottoms to the peaks that would linger until March at lower elevations. The cold brought with it strong inversions and valley fog that would characterize the 2009/10 winter season. Our first major winter storm arrived on December 7 and dropped 18" of new snow and 28" in the Abajo Mountains. We issued our first avalanche warning of the season on December 8 through the National Weather Service, and a predictably widespread avalanche cycle occurred in the days to follow. The last two weeks of December were pretty quiet, with mostly high pressure and unseasonably cold temperatures. Snow on the ground in valley elevations enhanced formation of inversion conditions. Snow returned on December 29 with a 20" storm of 5% powder to rival the conditions expected in the northern part of the state. We finished the month at 113% of normal snowpack.

January started with a minor avalanche cycle after the end of the December storm. Low densities and low winds contributed to a fairly stable snowfall event. High pressure and cold temps were dominant until January 18, when another major winter storm would hit SE Utah dropping 3-5' of new snow leading to our second avalanche warning of the season. Observations were limited through this storm due to lack of access and/or visibility to SE Utah mountain ranges. When roads and skies cleared, a major avalanche cycle was recorded, including a three-quarter mile wide D4 slide in the Upper Horse Creek drainage of the La Sals. Small storms would continue until the end of the month keeping us above normal at 113% in the La Sal Mountains, 160% in the Abajos.

February started out with high pressure creating a surface hoar layer that would plague us into mid-March. When snows fell again starting on February 4, 16" of new snow produced limited activity, but highlighted our surface hoar problem. Five days after the end of the storm the surface hoar layer was still very reactive in snowpit tests. When the next major storm hit, the surface hoar layer was indeed activated. From February 19-22, the La Sals would measure 30" of new snow and a major avalanche cycle was observed on the 21st (see photo, above) in both the La Sal and Abajo ranges. Two more small storms would affect SE Utah, and we finished the month at 132% in the La Sals and 144% in the Abajos.

March started out with sunny skies, good skiing, and a reprieve from the long, cold winter that valley elevations were experiencing in SE Utah. Consistent snowfall would continue through March. With smaller storms, warming temperatures, and increasing snow depth, snow stability slowly increased through the month. This was not before a close call in the Abajo Mountains on an ENE-facing slope on Horsehead Peak on March 13. An experienced ski-touring party released a large slide up to 5' deep and 550-yards wide on a persistent weak layer, likely the February 1 surface hoar (see photo below). This scary release was a result of wind loading following 4-6" of new snow falling on March 11. The slide was initiated in a thinner snowpack area near the ridgeline and stepped down to a near-ground depth hoar layer, taking out most of the snowpack in a graphic reminder of the long-lasting nature of the persistent weak layers that plague the continental snowpack. We finished out the month at 140% of normal in the La Sals and 180% in the Abajos. The center shut down for the season on April 1.

The 2009/10 season at the La Sal Avalanche Center was characterized by colder than normal temperatures, above-average snowfall, and below-average winds. It will be remembered as a winter with great skiing and riding conditions. Snow stability, which one would expect to improve with the increased snow depth, was kept at fair or worse for February and most of March due to the buried surface hoar layer from February 1. Surface hoar layers in the SE Utah climate are usually destroyed by the abundant sunshine and high winds we experience on a normal year. With increased storm activity this mid-winter and lower than normal winds, the surface hoar was able to remain intact and be subsequently buried by February snows. While we deal with persistent weak layers in the form of depth hoar and buried near-surface facets frequently here in SE Utah, the presence of the buried surface hoar presented an interesting problem. It resulted in a major avalanche cycle in the third week of February, remained active long after that, and encouraged locals to keep the slope angles down.

Another highlight of the 2009/10 season included the automation of our Gold Basin Study Plot, an excellent plot located at the bottom of the North Woods, a popular tree-skiing run. Snow Depth, RH, and Temp are now accessible electronically. It should be online and available to the public by the 2010/11 season.

This year we produced 64 avalanche forecasts: nine were Low avalanche danger, 15 were Moderate, 29 were Considerable, nine were High, and two bulletins with an Extreme danger were issued. We issued two avalanche warnings through the

SCHUSS
Max Forgenski

Cold-Smoke
Light, Champagne
Trap-Door, Ganglands
Recycled, Boot-Top
Cherry, Velvet, Hero, Fluff, Cream Cheese
Slabby, Hollow, Chalk, Cement
POWDER
Blower, Waist-Deep, Double Overhead
Butter, Bottomless
Tracked Out
Scoured, Coral Reef, Crud, Scratcher-Tone
Mashed Potatoes, Mank, Dust on Crust
Breakable, Corn, Supportable
Welded, Chatter-Box
Sun-Cupped
GONE

National Weather Service. We taught an AIARE Level 1 class and two avalanche-awareness classes over the winter. We had only two skier-released avalanches in our forecast area (reported) with no injuries or fatalities – an indication of how conservative the skiing public is in this area. —*Dave Medara & Max Forgenski, forecasters*

■ Sierra Avalanche Center

The winter of 2009/10 once again exhibited the fundraising and management strengths of the not-for-profit Sierra Avalanche Center (SAC) in partnership with the Tahoe National Forest. The proven business plan between these two organizations goes beyond typical Friends Group support with the SAC providing over 50% of the avalanche center's total operating costs for the season. This ever-evolving relationship, executed through an annual operating plan and collection agreement, allows the SAC to collaborate with the Forest Service to provide continued avalanche center operations while also collectively focusing on future development.

Governed by an all-volunteer board of directors, SAC was able to raise \$92,781 through local donations, allotting \$45,000 to forecaster salaries, contracted field observers, snowmobile insurance, some field equipment, continuing education for the forecasters, and savings for future operation of the center. In addition, this season the SAC received a welcome increase in forecaster salary funding with \$15,000 from USDA Forest Service Region 5 and a new \$10,000 contribution from USDA Forest Service Region 4. This brought the total USFS salary contribution up to an all-time high of \$25,000. In past seasons, SAC contributions have accounted for up to 95% of the avalanche center's annual operating costs when less USFS money was contributed.

SAC worked closely with the backcountry traveling public and many major sponsors to raise funds to support the avalanche-forecasting program. The most significant sponsors for the 2009/10 season were: Alpine Meadows, Bear Valley Mountain Resort, Heavenly, Kirkwood, Mt Rose Ski Tahoe, Northstar-at-Tahoe Resort, Polaris Industries, Porters Sports, Resort Sports Network, SnowBomb.com, Sugar Bowl, Thin Air Motor Sports, and KTKE 101.5 Truckee & Tahoe Independent Radio. Each of these sponsors provided cash, goods, or services in excess of \$3,000 with some contributions as high as \$24,000.

From an avalanche perspective, the winter of 2009/10 began after much discussion of El Niño effects and enough early season snowfall to create worrisome faceted basal layers above 8,000'. Deep-slab instability on weak basal layers similar to shallow snowpacks on other parts of the continent characterized the early part of the season. By early February the snowpack deepened and matured, shifting concerns to weak layers found in the middle and upper portions of the snowpack. The spring late-season snow surveys for the Sierra Nevada came in at close to "average" after three drier-than-average winters.

From late November through late April, Tahoe National Forest avalanche forecasters Brandon Schwartz and Andy Anderson issued four early season conditions updates and 155 daily avalanche advisories. These products covered the Sierra Nevada Range of California and Nevada from Yuba Pass south through the Lake Tahoe Basin and Carson Pass down to Ebbetts Pass. This spanned areas of the Tahoe National Forest, Humboldt-Toiyabe National Forest, Lake Tahoe Basin Management Unit, El Dorado National Forest, and Stanislaus National Forest. Field observers Steve Reynaud and Travis Feist aided the forecasters greatly in providing coverage for the region.



Broken board at Becker Peak, CA., February 27, 2010.
Photo courtesy SAC



Brandon Schwartz goes deep on Mt Judah, March 22, 2010.
Photo by Andy Anderson

Eight separate backcountry avalanche incidents involving caught or buried persons were reported to the avalanche center. The numbers broke down as 13 people caught, three partial burials, one full burial, two minor injuries, and no fatalities. All of these incidents involved skiers or snowboarders and occurred during periods of Moderate or Considerable avalanche danger with the exception of one incident which occurred in extreme terrain during a period of Low avalanche danger.

The Sierra Avalanche Center launched a new Web site created by Andy Anderson during the 2009/10 season. The site provided a very easy interface for the public to view snowpack and avalanche observations collected by the forecasters and field observers, and submitted by the general public. Our users loved the embedded photos and videos of snowpack assessment and avalanche investigations. We received 99.9% positive feedback. Overall Web site traffic for the season increased by 50% to a total of 372,551 page loads for the season. A new single-day, page-load record of 7493 page loads was set on January 21, 2010.

Excellent continued growth on both operational and financial fronts contributed to another very successful year of this program. The relationship between Sierra Avalanche Center and the USDA Forest Service remains strong. These organizations' shared vision and complimentary goals will continue to fuel the success of this program.

—*Brandon Schwartz, forecaster*



Remote-triggered slide near Kebler Pass, Colorado.

Photo by Alan Bernholtz

■ Crested Butte Avalanche Center

The Crested Butte Avalanche Center's purpose is to provide weather and avalanche information to the Gunnison Valley and to the communities and towns in and around the valley. Professional forecasters observe, record, and report daily weather, snowpack, and avalanche activity while providing regularly updated avalanche conditions accessible to everyone.

During the 2009/10 operating season we did not have any avalanche fatalities but had reports of several close calls. Our fundraising efforts were successful but local observations were scarce. Overall the CBAC had a great season with good snow and fantastic backcountry riding.

The CBAC is funded by cash donations and by grants. During the 2009/10 season, our total budget was \$24,990. CBAC has a net income of \$4550 for the season. Our goal is to put 10% of our profit back into our general fund. We sent out 15,000 emails. Our Web site had 69,311 sessions and 197,102 page visits. Four locations valley-wide posted our report daily. Our daily report was read live by the forecasters on our local radio station (KBUT 90.3), which serves the Gunnison Valley and the Pitkin Valley.

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The town of Crested Butte received 150". Crested Butte Mountain Resort reported 283". Irwin town site (five air miles from Crested Butte) received 539".

Our area encompasses approximately 120 square miles centered on the town of Crested Butte in the Elk Mountains. The boundary is the Ruby Range to the west, Gunnison to the south, the West Elk Wilderness and the Quartz Creek/Pitkin Valley to the east. The Gunnison Valley is blessed with a wide range of backcountry users across the entire service area. We reach backcountry skiers and snowboarders, snowshoers and snowmobilers. The CBAC receives observations from all groups, but the ski community is best represented. Many more people use our services exclusively for the locally generated weather forecast.

The full-time forecaster schedule was two to three days a week; each forecaster is required to get field observations before their first forecasting shift. This season there were four full-time forecasters, one part-time forecaster, and one bookkeeper.

This season we redefined our avalanche watch and warning criteria to coincide with the Colorado Avalanche Information Center. We did not forecast any Extreme danger. An avalanche warning was issued for seven days: three in December, two in January, and two in February. Our first significant snowfall came in early December followed by a long stretch of dry weather in January. February was our snowiest month with two storms dropping 24-48". March was unusually dry, but we did see above average snowfall in April. We experienced a large dust event on April 5 that put a damper on the spring backcountry skiing. Due to several significant storms in April, the dust was covered for the month but came back in May.

This season we received a stability and control report from the Crested Butte Professional Ski Patrol on a semi-regular basis. This information was valuable but unfortunately was not reported consistently enough to be useful. This season we received limited public observations. Although we heard from a wide range of users, from backcountry skiers to snowmobilers, we actually received fewer observations than the previous season. Billy Barr from Gothic emailed us with any significant avalanche observations. He also reported on any snowfall or significant weather events. CS Irwin provided daily observations as well as access to their two remote weather stations. This information was valuable due to the lack of data for this part of our forecast area.

The Web site was widened on the screen which allowed us to put more information on the page without having to scroll down. The CBAC added a Zone Map depicting the six different zones in our forecast area, as well as the CBAC Interactive Map depicting recent avalanche activity, snow pit data, and avalanche accidents. We created a Facebook page this season as another way to engage supporters of the center. It has been a successful endeavor with 818 fans to this date.

The parents of Dan Krajewski donated a Campbell weather station to the center which will be located in Washington Gulch. This will be another valuable tool for our forecasters. —Alan Bernholtz, director



Christmastime slide in the Wallowa Mountains on buried surface hoar, then a step down to depth hoar. Photo by Keith Stebbings

■ Wallowa Avalanche Center

During the summer of 2009 a large community organizational effort began with the ultimate goal of launching an avalanche center to cover the Wallowa Mountain range of northeast Oregon. This culminated with incorporation papers filing with the State of Oregon and a Web site that went live in September of 2009: www.wallowaavalanchecenter.org. Initial plans were to provide educational/awareness courses and a weekly written summary of snowpack conditions observed and recorded the week previous. We were successful on both counts with four introductory/awareness seminars, including one beacon practice session. Our weekly summaries began during October and finished on April 9 for a total of 25. We received our IRS 501(c)(3) status in March 2010.

WAC staff wrote summaries based on observations submitted by an observers network made up of professional guides, backcountry visitors, and WAC staff. These summaries attempted to give persons wishing to recreate in avalanche terrain a synopsis of snowpack stability and conditions witnessed up until summary press release. A listing of concerns to be watchful for while venturing into backcountry avalanche terrain was also provided. Awareness seminars were conducted primarily by WAC staff, and our largest awareness event drew 91 participants when John Groom, a guest speaker from the Payette Avalanche Center, showcased his talent with a great production.

The season started with a teaser storm of 20" on October 4-5. This melted some but was capped by a rain crust on October 23. The season continued with several



Early February buried surface hoar plagued the Wallowas until the end of season. Photo by Keith Stebbings

small storms and crust layers until early December when a mighty cold, clear stretch produced some nasty near-surface weakness (surface hoar and the like) that would plague us well into January. See the photo (*bottom left*) taken on December 22 of a sizable slide that released after a 9" snowfall tipped the balance on the buried surface hoar layer and stepped down to the depth hoar at ground. January brought above-freezing, average-high temperatures (unusual) with numerous, mostly wet snowfalls of 4" average depth per impulse and more natural avalanche activity. January recorded our second windiest month next to March, but March wins the prize for gustiest. During a cold, calm, clear spell February 6-8 a substantial surface hoar layer developed. Later in the month this surface hoar layer was easy to find below the snow surface at 1cm thick, and stuck around the rest of the season in isolated areas. See the photo (*above*) of this layer adjacent to an active slide zone. February was a very dry month, recording less than an inch water equivalent the entire month.

Mid-May brought our seasonal maximum snow depth (not the first year this has happened) before the warmth kicked in and sent the melt water to the river runners. There were only a few close calls of folks getting too near moving snow by way of remote triggers and two folks (separate incidents) taking short rides.

WAC looks forward to our next season with additional educational offerings, new mountaintop weather instrumentation sponsored by WAC, continued improvement of our weekly summaries, and furthering our relationship with the local USFS office. —Keith Stebbings, director

■ Chugach National Forest Avalanche Information Center

The winter of 2009/10 began with a bang the week of Thanksgiving when Turnagain Pass received 117" of snow after seven days of single-digit and sub-zero temperatures. I spent most of November running around sunny Arizona happily oblivious to the frigid weather that had descended upon south-central Alaska. After arriving back in Anchorage the day after Thanksgiving and digging out my truck from the airport parking lot, a DOT sign by Potter Marsh flashed that the Seward Highway was closed at Milepost 21. "Huh...I wonder why the highway's closed?" I thought, only to find out later that an avalanche blocked the highway south of Moose Pass. And thus began the winter of 2009/10, our tenth season of operation.

General weekly advisories started November 6 with the first measurable snowfall in Turnagain Pass. Due to the outstanding support from our Friends group, we were able to issue daily advisories starting November 24 and extending an extra two weeks through April 15. Our staff consisted of three full-time forecasters and one intern. I returned for my fifth season, Matt Murphy finished his sixth, and director Carl Skustad finished his tenth season. We were very lucky to have an exceptional intern from Alaska Pacific University, Jon Gellings, who was instrumental to our field work and wrote the Friday morning Summit Lake advisory. We were also lucky to have the assistance of Alex McClain, a forestry technician from Moose Pass, who reported snow observations from the Seward Ranger District. Starting January 22, Jon and Alex posted Friday and Saturday advisories for the Summit Lake mountains on our Web site, a big step forward for us as we expand our advisory area to include the southern Kenai mountains.

We had considerably more rain events than cold snaps this winter thanks to El Niño. Our snowfall total at the higher elevations was wonderfully above average, however, with 525" falling in Turnagain Pass from November 6 to April 15. Many warm storms brought rain to the lower elevations of the Turnagain Arm area in December, January, and February. Between storms, strong inversions set up with dense fog blocking the clear skies above. We had 10 significant surface hoar events throughout the winter interspersed with countless rain crusts. Many of our human-triggered avalanches ran on one or both of these layers. Within our advisory area this winter we had two fatalities, one full burial with no injuries, and two partial burials with no injuries.

Although the month of January had the lowest snowfall total (34"), we got just enough snow to keep the surface powdery while the winds thankfully stayed away. Many folks checked a number of big lines off their list as 17 out of the 31 days in January had a Low danger rating. The stoke-o-meter was pegged, as our intern Jon would say.

Our biggest storm of the season happened from February 9-19 when Turnagain Pass got 7.5' of snow and over 9" of water. Horizontal rain below 1000' pounded our windows in Girdwood while gale- to storm-force east winds raged up high. We issued our first ever Extreme danger rating on February 18 when the storm and the snowpack hit critical mass. Large avalanches from control work covered the Seward Highway while huge naturals ripped out in Turnagain Pass. The skies cleared up for one day in the middle of the storm, which unfortunately was Saturday of Presidents' Day weekend. By the end of the day three people were dead in two separate avalanches. The Grandview avalanche on our district killed two snowmachiners, including the CEO of Conoco Phillips. He was recovered that day buried 6-7' deep, but the second victim was not wearing a beacon and not found. Crews had to wait for the storm to subside eight days later before flying via helicopter to the accident site. Over 150 people from the Alaska Mountain Rescue Group, Alaska State Troopers, Alaska Search and Rescue Dogs, Anchorage Nordic Ski Patrol, and dozens of friends of the victim worked the deep, dense



Carl and Lisa of the Chugach NF Avalanche Center ditch the heavy backcountry gear for a day of flying on the Portage Lake crust. *Photo by Deb Essex*

debris for three days with search dogs, RECCO, magnetometers, and organized probe lines. They found him on February 22, 10 days after the avalanche, buried 10-11' deep and angled over 150' uphill from his snowmachine.

March was once again our biggest snow month with over 13' falling in Turnagain Pass. On March 8, over 40" of snow fell in a 24-hour period in the Girdwood Valley. The following morning the Seward Highway was closed on either side of Girdwood due to avalanches crossing the road. It was a rare Girdwood interlude, so of course a few folks from Anchorage chartered a helicopter to score some powder at Alyeska. As I write this on April 15, we are up to 41" of new snow for the month, glide cracks are popping out everywhere, the Earth is tilting in our favor, and it is still snowing.

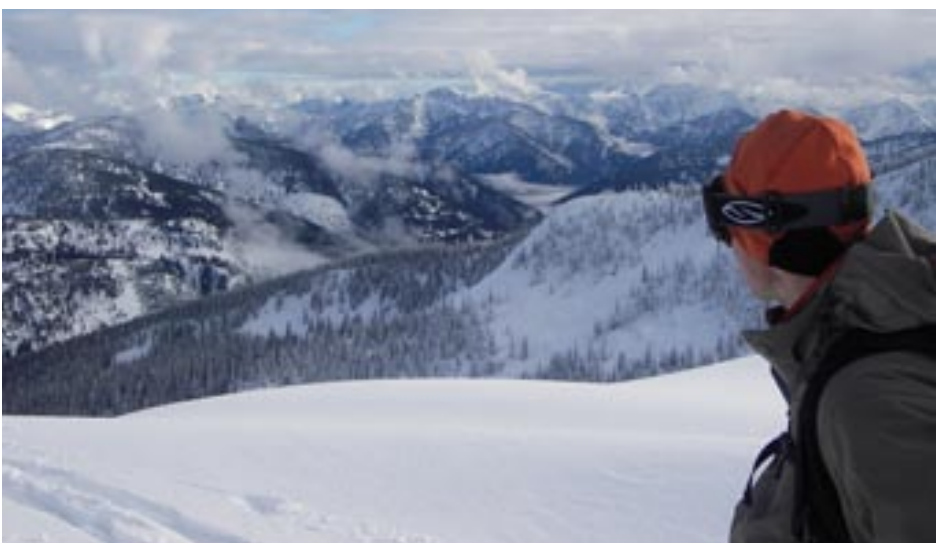
We continued to improve our Web site this year, most notably adding webcams to our Sunburst and Seattle Ridge weather stations. We also joined the YouTube ranks and recorded over 3000 views of our videos. Granted most of those views were just us watching and re-watching the videos, but hey, it's the number that counts. Our Friends group installed a new weather station on Fresno Ridge down at Summit Lake on the Seward Ranger District in anticipation of adding a weekend advisory for that area. On the education front, we partnered with the Alaska Avalanche School to host a Level 1 snowmachine workshop in Turnagain Pass. We also worked with the Alaska Avalanche Information Center in Valdez to host a Women's Backcountry Clinic in Turnagain Pass. The free Fireside Chats were once again held at the Glacier Ranger District office in November and December, where we presented five different awareness level classes on Wednesday nights. We also taught classes for the Chugach National Forest, Girdwood Community Schools, Anchorage Parks and Rec, King Career Center, and the Mountaineering Club of Alaska. All in all, we reached over 700 folks in south-central Alaska.

—Lisa Portune, forecaster

■ Idaho Panhandle Avalanche Center

Early last winter we plunged into a deep and persistent cold spell with 3-4' of snow in the mountains. By the end of December we were already dealing with two PWLs (persistent weak layer) of surface hoar over a weak base. The prevailing S/SW weather eventually came in January with strong winds, heavy snow, and warmer temperatures. Natural avalanches were occurring on steep northerly terrain as the snowpack adjusted to heavy loading from wet snow and rain. The slides ran to near the ground in places. The weather in January and February was atypically mild and we waited for the resurgence of winter in the month of March.

March, however, seemed to be the beginning of spring, and Oly was back on his motor scooter. The mountain snowpack was falling desperately below average SWE and numbers for the Panhandle region were dipping into the high 60th percentile. The snowpack in the very highest elevation zones was deep enough; however, and subtle weather changes brought stability issues. One snowmobiler was caught and killed in an avalanche that occurred on March 13 in the Selkirk Mountains 11 miles north of Schweitzer Mountain Resort. Considerable avalanche danger persisted on wind-loaded aspects and another avalanche fatality occurred on March 27 on the Idaho/Montana border.



Eric Morgan scans north aspects for avalanche activity in the Cabinet Mountains on the Idaho/Montana border. *Photo by Kevin Davis*

April fooled us all when we plunged back into winter with endless spring squalls and heavy mountain snow. In spite of climate change, early April powder is still the most reliable aspect of north Idaho weather, next to mud season.

We continued to extend our partnership with local avalanche practitioners. Dave Alley, Silver Mountain ski patrol director, sent pit observations and photos on a weekly basis to add to our advisory. Jesse Salisbury, Schweitzer ski patrol snow safety director, also provided timely and valuable snow pit observations from Schweitzer Mountain Resort. Ken Barrett of Selkirk Powder Company regularly had his guides communicating with us to keep abreast of conditions. We donated a beacon to the new SPC beacon park.

This year we expanded on our IPNF-AC Pit Day and invited all north Idaho and eastern Washington snow practitioners to a day-long event on Schweitzer Mountain hosted by Selkirk Powder Company in their top-of-the-mountain operations lodge. The group discussed weather models presented by Colby Neumann and Rocco Pilate, National Weather Service forecasters from Spokane, Washington. I'll be meeting with Colby and Rocco at their Spokane office to implement an avalanche advisory on the Spokane NOAA Web site for winter 2011. Jesse Salisbury presented snow-profiling programs, and Oly led discussion on new gear from beacons to AvaLungs. We then headed to the hills to dig pits and review SWAG standards. In all, it was an excellent day, and we hope to repeat it next year.

We seized some great education opportunities this winter with local high schools. At Sandpoint High and the Charter School we got their juices flowing with the *Know Before You Go* video and excerpts from *The Fine Line*, showed them accessible information on avalanche Web sites, and familiarized them with the functions of IPAC. I was more nervous speaking to 150 teenagers than I would have been speaking to the City Council, but we kept them engaged and had a good time.

We have also extended our reach to educate the greater Spokane community with continuing classes to St George's School, a college-prep high school, and the first avy awareness course with the Spokane Mountaineers Club. Our partnership with Idaho Parks and Recreation has been productive and this year we had a very busy schedule with Snowmobile Avy Awareness classes. In all, IPAC assisted in educating about 100 snowmobilers at classes throughout North Idaho. We also had a unique opportunity to educate and assist wildlife biologists in surveying for wolverine presence in the Selkirk Mountains. Local SAR seek our assistance for specialized training as well as the Border Patrol to the north. All this accompanied our regularly scheduled awareness courses and transceiver trainings to make for a very busy season.

—Kevin Davis, director

■ Sawtooth National Forest Avalanche Center

For most of the 2009/10 season, it seemed like Old Man Winter was on a bender – somewhere else. Yet the season proved busy with forecasting challenges for the SNFAC. We saw unusual weak layers, persistent instability, a remarkably widespread avalanche cycle, and two avalanche fatalities.

Though the winter started promisingly, 17 straight days of cold, dry weather metamorphosed 2' of early season snow into facets and depth hoar on nearly every shaded slope. The slab above this weak layer built very slowly until New Year's Eve, when stability took a dramatic and extended turn for the worse. Just 6" of snow and 0.3" of SWE resulted in widespread shooting cracks, collapses, and triggered avalanches in the northern regions of our advisory area. The instability continued with each trivial nudge to the snowpack, and we rated the hazard as Considerable or higher for 34 straight days, an unusually extended period of instability for our area.

The instability was initially confined to the northern half of our advisory area because of minimal snowpacks elsewhere. In late January, a five-day series of storms dumped over 30" of snow and 2.6" of SWE in the southern regions of our advisory area. The storms produced a natural avalanche cycle that was among the most impressive of the past 25 years. Because of the shallow snowpack, the slides were not particularly destructive; because of the weak layer's uniform distribution, they were remarkably widespread.

Sadly, the instability also led to two fatal avalanche accidents. The first, on January 22, involved a small avalanche on an off-trail but inbounds run at Bald Mountain ski area. In the second, on January 28, a snowmobiler triggered an avalanche in the Soldier Mountains that carried him over 1000 vertical feet and buried him 5' deep.

The snowpack stabilized enough to drop the hazard to Moderate in early February, but it stayed there for weeks while new weak layers developed – near-surface facets and buried surface hoar. An early March storm activated these layers, and we were off on another round of natural and triggered avalanches. In one close call, an experienced skier triggered a slab in exposed alpine terrain that carried him over a small cliff but left him uninjured. Several weak storms then brought a few inches of snow that interrupted a dependable corn cycle. We ended daily advisories March 28 with the snowpack a dismal 57% of the 30-year average.

That's when Old Man Winter finally got wise and returned. In the last days of March, a strong westerly flow hammered the northern half of our area with over 2' of snow, 1.5-3" of SWE, and average wind speeds of 30 mph or more. The avalanche danger jumped back to High with the season's third cycle of natural and remotely-triggered avalanches. Several smaller storms followed, providing a welcome boost to area snowpacks and some of the best powder skiing of the year. The SNFAC posted regular conditions updates until April 9. The weak layers in the snowpack left the threat of large, deep avalanches hanging for later in the spring.

SNFAC education efforts reached over 750 people with a wide range of interests. In October, Janet instructed at the five-day National Avalanche School at Snowbird. Locally, we taught three Avalanche Basics programs – one oriented to snowmachiners – and several other classes, including two beacon clinics. The winter's late start and unusually thin snowpack impacted class numbers, with many recreationists losing interest in the backcountry.

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The SNFAC directed four classes towards people whose work can take them onto local roads and into residential areas when the avalanche danger is high. The 93 participants included US Forest Service and Idaho Fish and Game employees, city and county fire departments and emergency responders, line crews from Idaho Power Company, and wardens from the Shoshone-Bannock tribe. A grant from the Wattis-Dumke Foundation allowed us to host a talk by avalanche researcher and educator Ian McCammon titled, *Beyond the void: Combating fatal decisions in avalanche terrain*. 180 people enthusiastically attended. Sara Lundy presented the *Know Before You Go* program to students at the Wood River Middle school and racers from the SVSEF ski and snowboard programs. Our avalanche awareness week ran from February 1-7, and the avalanche training park was operational and well used for over two months, from mid-January through late March.

The most significant operational change at SNFAC this winter was the formal inclusion of the Sawtooth Mountains and Soldier/Fairfield area into the Avalanche Advisory. To accommodate these additions, we changed the advisory format to include "Bottom Lines" and danger roses for four different regions. We also replaced old photos on our home page and added "What's New" and "Stay Connected" sections. An effort to complement our advisories with more videos received rave responses from our users. A Facebook page proved an excellent means of publicizing classes, showing videos and photos, and providing informal updates on backcountry conditions. We added an accident page for our advisory area where past reports can be downloaded in pdf format. All told, our advisory was accessed over 98,000 times this winter, a slight decline from the previous year that we attribute to the record dry conditions.

The SNFAC professional observation system remained invaluable for both center staff and local avalanche professionals. Around 200 observations were submitted through the Web-based system by the SNFAC, Sun Valley Heli Ski, Sun Valley Trekking, Sawtooth Mountain Guides, Sun Valley Resort, and USFS winter rangers. SNFAC staff continued to be involved with national-scale projects including the redesign and launch of the American Avalanche Association Web site and the development of an online avalanche accident reporting system.

Steady partnerships with local, state, and federal agencies have provided the SNFAC with more dependable funding than even five years ago. The Friends of the Sawtooth NF Avalanche Center continue to be our guardian angel; their efforts raise close to \$40,000 annually, which accounts for over 40% of our operating budget. Though she'd be the first to pooh-pooh the notion, SNFAC Director Janet Kellam is primarily responsible for those partnerships and the reputation on which that fundraising depends. At the end of the season – her fourteenth – Janet announced her retirement, and we closed the winter with "An end to many seasons" party in her honor. She has been the driving force behind tremendous improvements in avalanche education and forecasting in Central Idaho – and throughout the United States. Chris and I will dearly miss her experience, dedication and knowledge next winter. —Blase Reardon, forecaster



Titus Ridge, a 10,110' peak west of Ketchum, Idaho, after a late-season storm, March 31, 2010. Arrows mark numerous avalanches remotely triggered from X on ridge. Photo by Chris Lundy

There were 17 reported avalanches and nine reported incidents in October. Avalanches caught 10 people, partially burying three and fully burying two.

November was a dry month. There was only one storm of note, November 13-15, which brought 19" of new snow and strong southwest winds to the Highway 550 corridor in the San Juan Mountains. SNOTEL sites were 54% of average on Red Mountain Pass and 68% on Molas Pass. Fremont Pass near Leadville was doing much better, with 16" on the ground by month's end – 95% of average. One highlight of the dry month was the second annual CAIC Benefit Bash held in Breckenridge on the 14th. Over 1100 people attended the Bash, which raised \$39,257 for the Friends of the CAIC. Only one person was caught in the 120 avalanches reported in November.

The statewide snowpack shrank to 86% of the historical average in December. Across the north, Hoosier Pass was at 87% of normal and Loveland Pass at only 68% of average. The San Juan was doing better, a combined 97% of average, typical of El Niño years when the storm track drops further south. Wolf Creek Pass recorded 104" of snowfall, 217% of the 16-year average. We issued our first two avalanche warnings of the season for the San Juan on December 8 and 13.

In December, 932 avalanches were reported statewide. There were 399 in northern zones, 175 from the central zones, and 441 in the southern mountain zones. There were eight avalanche incidents, catching eight skiers and one snowboarder. Within a few days, one individual was caught in at least two separate large avalanches near Telluride.

The dry trend continued in January. The 33" of snowfall on Berthoud Pass was only 62% of normal, and 22" on Vail Pass a meager 56% of normal. The Snake River drainage on the west side of Loveland Pass was 31% of average. Across the central portion of the state both Grand Mesa, with 60" of new snow, and McClure Pass, with 44" of new snow, were 85% of snowfall averages. The first half of the month was dry across the southern zones, but the last half of the month picked up the pace with over 78" of new snow reported on Coal Bank Pass, bringing monthly totals there to 91% of normal and a respectable 106% across the San Juan.

A late-January storm cycle closed all passes in and out of the San Juan Mountains for several days. On January 22, a Durango house was struck and destroyed during our third avalanche warning. Instruments near Red Mountain Pass recorded a wind gust of 141mph.

Across the state 1209 avalanches were reported in January, including 733 from the southern zones. There were 22 reported avalanche incidents, with 21 people caught, five buried, and one killed. The first avalanche fatality was on or about January 6. A lone snowboarder was reported missing January 9, and was found a few days later out of bounds near Vail Ski area. On January 28 a localized heavy precipitation event in Glenwood Canyon triggered a couple of soft slabs that shut down rail traffic.

Colorado continued to suffer through a below-normal winter in February. The Snake River drainage near Loveland Pass was only 33% of normal. The exception was the San Juan, with 106% of normal. With the dry winter, depth hoar continued



CAIC staff, spring 2010.

Photo courtesy CAIC

■ Colorado Avalanche Information Center

All the CAIC staff returned for the 2009/10 season. Combined, we taught over 110 classes to over 6600 people, from short awareness talks to multi-day Professional Development courses. John Snook led a three-day Mountain Meteorology course October 12-14, and attending professionals came from as far away as Alaska. Simon Trautman organized a professional development seminar on "Post Control and Surprise Avalanches" on March 26. The CAIC hosted the Colorado Snow Avalanche Workshop in Leadville on the 16th, with a capacity crowd of 470. Adding to the excitement, the NAC, AAA, and AIARE also held meetings in Leadville that week.

We added several Web site features for the public. Our "Weather Station by Zone" page collected automated weather data from over 200 stations and displays summary and hourly data in a standardized format. Two forms for reporting avalanche incidents debuted mid-winter. The forms increased public reporting, and we received many good submissions. We tested and used detailed forms for professionals and are revising those for next winter.

It was a busy October. The Breckenridge ski area recorded 30.5" of snowfall October 15-31, with new snow reported on 11 of 17 days. A significant upslope storm developed October 28, with storm totals in the foothills of the Front Range around 30".



CAIC forecasters Scott Toepfer and John Snook investigate a fatal avalanche accident near Battle Mountain. Photo by Ethan Greene



Large surface hoar formed in Colorado during a prolonged dry spell in early January 2010. Photo by Ethan Greene

to be the main avalanche culprit. A second problem developed mid-month with a thin mid-pack facet layer sitting on a harder wind-deposited layer.

We had over 1100 avalanches reported in February, and once again the San Juan led the pack with 432. We issued an avalanche warning on February 20. It was a busy month for incidents. There were 21 incidents, 25 people caught (five on February 14 alone!), three injuries, four full burials, and two fatalities. The

first fatality was February 11 near the Ridgway Hut in the North San Juan zone. The second was February 23 near the Lindley Hut in the Aspen zone.

March came in like a lion and exited on a similar note. One convective storm event hammered the Berthoud Pass area on the night of February 28 into the morning of March 1. Winter Park weather instruments recorded over 12" of new snow in a 3-hour period – 5" in one hour alone. CDOT forecasters estimated 18" of new snow over an 8-hour period on Berthoud Pass. CDOT attempted to keep the pass open but gave up after nearly 100 avalanches crossed the highway. We issued our fifth warning of the season for this event. We issued the sixth warning when significant snowfall and strong winds ground almost all mountain travel to a halt March 23-25. Thanks to a series of southern-tracking and upslope events, the southern Sawatch zone increased season snow totals to 109% of average. The rest of the state remained dry, with the Snake River drainage at 24% of normal.

There were 539 avalanches reported in March. Once again, the San Juan zones lead with 244 avalanches. Twenty people were caught in 18 separate avalanches, with eight partial and two full burials and five fatalities. A snowboarder died March 10 just west of Arapahoe Basin, a snowmobiler on March 12 in the southern Sawatch, two residents in a roof avalanche in the eastern San Juan Mountains on March 19, and an ice climber approaching a route on skis near Ridgway on March 30.

The busy winter continued into April. 14" of new snow greeted supporters of the CAIC at Loveland Basin on the morning of April 24 for the ninth annual Corn Harvest Festival. Supporters raised over \$7200. This triggered our (hopefully) last avalanche warning of the season. The northern zones started to catch up on snow amounts, with 130-150% of average April precipitation. Season-to-date precipitation in the north edged up to 80-90% of normal. It was much drier in the southern zones, with only 63% of average April precipitation in the San Juan range.

Avalanche reporting tapered off as observers headed to spring activities. Wet slabs began to run early April in the southern and central zones. Multiple storms in the northern zones kept most avalanche activity confined to recent slabs. Only one incident was reported, a skier caught and partly buried on Castle Peak south of Aspen.

—Scott Toepfer, forecaster

■ Utah Avalanche Center - Wasatch

As I write this on the morning of May 4, Little Cottonwood Canyon is closed as the UDOT avalanche teams fire the Howitzer into their mid-canyon targets. Alta Ski Area has been closed for nearly two weeks. The place is deserted.

A year to remember; a year to forget. *A Tale of Two Hoars*. By Valentine's Day, I wrote that you could visit the typical snowpacks of Colorado and Montana without ever leaving the state. We not only issued a Considerable rating more than any other year, but we broke the previous records of unintentional, human-triggered avalanches (190), people caught (78) and carried (61), and numbers of those partially buried (30). These are not actual numbers. They are the numbers reported. I feel sure that there were a significant number of close calls and incidents that went unreported. What we are sure of is the number of fatalities – four – which is our running average.

Most are glad to have the season in the rearview mirror. It was interesting that most of the victims and many of those who were caught and carried were men in their 40s to mid-50s. Many were working professionals, some of whom had over 30 years of backcountry experience. One needed to recognize that this season was different from the rest and conditions varied dramatically from week to week, slope to slope. Without question, failure to recognize and adjust to changing conditions often leads to death, or worse. Ask any businessman.

It would be overdramatic to spread stories of gloom and doom. There was plenty of comedy – particularly in the snowpits.

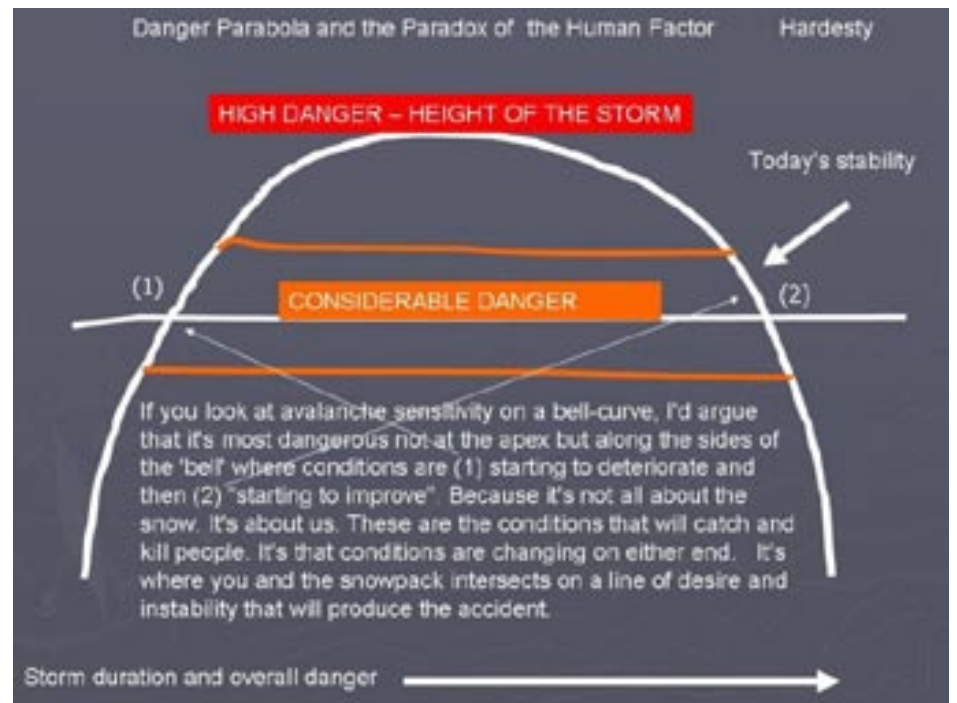
SNOWPITS: When was the last time that...

...upon smacking the shovel on top of the column for a compression test, the loose depth hoar at the bottom doesn't just fall out of the pit wall (it did this during excavation) – it blows out, as if blown out of a cannon. Like buckshot.

...an excavated pit wall has three separate columns poking out for analysis. This looks like a plumb snow wall with three "teeth" poking out to the snow tester. The avalanche technician taps the left-most column 10 times, only to have the middle "tooth" or column fail and slide off at the suspect interface.

...The savviest of a touring party ducks down off the ridge in order to gain some insight into the stability of the slope. The technician taps and taps on the top of the column, only to see the whole slope break out above him. The freight train washed him into a tree, carrying his skis and gear partially down the slope. We were still wondering how one might score this stability test.

...Multiple failure planes fail simultaneously after prodding and poking to determine stability.



September/October/November 63" — A measly 21" of snow for November – recorded in the upper reaches of Little Cottonwood Canyon. I shudder to think of the numbers in what we call "less-favored terrain." We begin to fear for the season.

December 81"/5.86 — We're mostly teased along until the December 11. A strong Pacific storm lays down 40-50" over the next couple of days, resulting in a High avalanche danger and a well-warranted Avalanche Warning. Many ski-area control workers, armed with explosives, would approach the starting zone only to collapse and release the slope. Alternating thunderous, then moaning collapses of the depth hoar shake the landscape; trees shiver from the release – the first avalanche cycle of the season. One skier was buried 2.5' deep off the Cardiac Ridge and soon recovered by his trained party.

We took little solace that the storms were over. We knew that the new snow had gained strength, but it's like rebuilding a nice house over a rotten foundation – it's bound to come crashing down again. The next day, the 15th, dawned cold and clear. Now is when it starts to get interesting. I put a graph on the web (*see above*) that outlined part of my theory on why an accident is likely to occur.

With the overall structure, remotely triggered slides were the rule and not the exception. Of course we knew this was coming. The instability persisted through January and into the first week of February. Few people now bothered to ask why we called these "persistent instabilities."

January 111"/8.22" — 80" between January 18-24 in the tri-canyons produced a High to Extreme danger and led to our first fatality of the year. A 42-year-old man in the Snowbasin backcountry triggered and was killed by a 2-4' deep hard-slab avalanche. Things were only beginning for the Snowbasin ski patrol. Late afternoon, a frenetic call came in to their dispatch office from a skier in a party of five that had exited the ski-area boundary for a run in the sidecountry – they had just triggered a 3-4' deep avalanche to the ground. They triggered numerous more slides up to 7' deep while trying to regain the safety of the controlled ski area. With such extreme danger and an accident likely if the group continued moving throughout the steep and complex terrain, the ski patrol determined that a heli-assisted hoist would be the safest course of action. Two hours later, through the skill and courage of the LifeFlight team and the Snowbasin ski patrol, the party of five had been airlifted to safety.

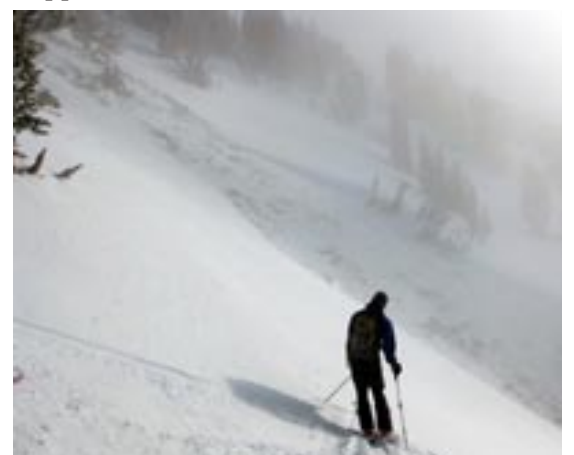
We suffered our second fatality on the 27th in the increasingly popular area known as the Meadow Chutes in the Silver Fork drainage of Big Cottonwood Canyon. An experienced 51-year-old man triggered and was buried in the hard-slab avalanche reminiscent of the other activity that had occurred over the past week.

It was only two days later that a 48-year-old snowmobiler died in an avalanche near Grandview Peak. Miraculously, the Wasatch Powderbird Guides were flying overhead, noticed the chaos and confusion, landed, and had the victim out of the 5.5' deep hole within 20 minutes. The victim was pulseless and unfortunately never revived with advanced life support.

February 64"/5.02" — Deep-slab avalanches continued to be triggered through the February 7. On this day, two significant accidents occurred within a couple hours of each other, perhaps a mile or two apart but separated by one ridge line. Both incidents involved very experienced parties. The Wilson Peak incident involved a party of three, with the victim triggering the 1-3' deep slide, suffering



Near the Park City ridgeline, the early season deep-slab monster bites again. Photo by Winslow Passey



At Gobblers Knob in late February, the deep-slab problem was still alive. Photo by Dave Budge

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Another late-February surface hoar event, this one in the Soldier Fork. Profligate and predictable, two episodes of surface hoar layer produced avalanches for weeks. *Photo by Adam Holmes*

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bilateral tib/fib fractures along with a fractured femur. With the blood loss and shock rapidly overtaking the man, it seems clear that Wasatch Backcountry Rescue and AirMed saved his life. The victim is just now nearing the ability to walk without a wheelchair.

Just to the west, a party of two stood at the top of Gobbler’s Knob. The two had perhaps 45 years of experience between them. The first skier descended the northwest-facing slope, and the slope shattered. He rode and fought the avalanche an estimated 1000’ and sustained a torn rotator cuff.

These were to be the last deep-slab avalanches triggered on the early season depth hoar. It was quite a run for this particular layer, producing slides from December 12 (the first significant load on the layering), through the late January storms (easily re-activating this persistent layer), and continuing through February 11. A run of nearly two months.

With one plot near its denouement, another was just into the prologue. The first of two surface hoar layers was just about to be buried nearly intact and soon after caught the new and old guard off guard with little discretion. Our rough estimate had over 122 human-triggered slides rip out on this layering, compared to at least 114 for the initial buried depth hoar. The surface (frost) layers activity persisted until March 7; in other word, a similar amount of activity in only half the time. It has



Liam Fitzgerald of UDOT investigates a close call in the Snowbird backcountry in March. *Photo by Adam Nesbitt*

been noted that surface hoar layers account for most of the accidents involving pros (Canada/ Europe). It’s not that these slides were unpredictable, necessarily...it’s just that, as they say, “The enemy is us.” This from one of our backcountry observers: “You guys have obviously identified the problem, and the daily discussion on your Web site is right on. The hard thing for us skiers is standing on top of an 800’ run of what looks to be perfect powder and turning back.”

March 89”/6.60” — Snow in March came in spits and sputters and had little of the frequency of activity of the preceding months. Still, we had a very close call in the backcountry adjacent to Snowbird The last of the surface-hoar avalanches was triggered on March 7, and the remaining slides for the month involved new snow instabilities or wet sluffs.

April 152”/11.29” — It began snowing on the last day of March and seemingly never stopped through April. From the March 31 through April 6, a strong Pacific storm pounded the Wasatch bringing nearly 100” of snow. During a break in the storm cycle, however, we suffered our fourth fatality of the season as a local 42-year-old man died when he and his snowmobile collapsed a cornice along the Francis Peak ridgeline.

May 44”/4.59” — And so here we are at the end of another season. El Niño kept us dry at the beginning but wintery through May. Much of the 460” that fell after the new year ended up in debris piles at the bottom of the slope. The budget ran dry by mid-month, and most of us flocked to the four winds or north to other seasonal work in the Tetons or Canada. —*Drew Hardesty, forecaster* ❄️