THE Avalanche REVIEW

A Publication of the American Avalanche Association

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www.AmericanAvalancheAssociation.org

Snow Science Hall of Fame

Charlie Rubin tells TAR: " I stayed behind the group in order to walk with Ed at the first stop on the Red Mountain Pass field trip at the ISSW. I had so much to ask him... Last year we contacted him since we were looking for a snow-free spot for a GPS site in the Olympics to monitor earthquakes; he had done research there as part of his work on glaciers. He immediately pinpointed in his memory the perfect wind-scoured spot on a glacier and then drew me a remarkably accurate map on a placemat. My team was later able to go there, and it was just as he recalled. On that walk I was able to tell Ed in person how useful his information was to me"

photo by John Stimberis

Story by Peter Shelton

originally published in *The Telluride Watch*, revised for TAR

In the late 1960s, the Bureau of Reclamation, charged with impounding more water for a growing West, had run out of large-scale options. The Sierra Club had successfully stopped Echo Park Dam on the Green River inside Dinosaur National Monument. The Grand Canyon remained sacrosanct. Glen Canyon would be flooded, but Lake Powell by itself could not satisfy the needs of the seven states in the Colorado River Compact.

Somebody got the brilliant idea to store water, in the form of snow, in the San Juan Mountains of southwest Colorado. They called it Project Skywater. It made a kind of sense. The San Juans cover as much ground as the Swiss Alps. They nurture the headwaters of the Rio Grande, San Juan and Dolores rivers, as well as much of the Gunnison. And they feed the aquifers of the vast San Luis Valley to the east.

The San Juans were already an important "water bank." If the snowpack could be increased by an estimated 10- to 30-percent per year through cloud seeding, that would be even better—right? Irrigators and city builders—there were no local ski areas yet—loved the idea. Others, principally the already avalanche-ravaged mining towns, weren't so sure about inviting more snow.

So, in 1971, the Bureau funded a study by the University of Colorado's Institute of Arctic and Alpine Research (INSTAAR) to learn about the behavior of snow and avalanches. The so-called San Juan Avalanche Project brought to sleepy Silverton an all-star team in the then relatively new world of American snow science.

This past October, at the biannual International Snow Science Workshop, hosted in Telluride, many of those heavy hitters—some of them since ascended to legendary status—gathered around a dinner table for an informal reunion.

State highway avalanche forecaster Jerry Roberts organized the dinner. Jerry and his buddy Tim Lane were the last INSTAAR observers, hanging on into the mid-1980s. For a few years they were the only residents of snow-bound Chattanooga, battling packrats, drinking in Silverton when they could, collecting data at "the office" on Red Mountain Pass, and pioneering many of the area's powder lines.

Continued on page 15 ➡

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

in this issue

ISSW is by far the coolest meeting on the planet. Scientists and practitioners in one place coming together over a love for snow…and beer…and mountains.

—HP Marshall, p19

THE Avalanche REVIEW

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american avalanche association

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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Contributions: Please submit material eight weeks prior to publication date. Include address and telephone number. Please submit typed manuscripts by e-mail or disk (3.5", Zip or CD), using any popular word processing program. Submit any figures in B & W, or as a TIFF or JPG file (300 dpi resolution at 100%). We will return materials if you include a stamped, self-addressed envelope.

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 aaa

The leaves are falling, ISSW has come and gone, and snow sits on the peaks. There is a lot of news to report. Let's start with election results. Here is your newly elected AAA Governing Board:

Janet Kellam, President
Doug Richmond, Vice President
Andy Gleason, Secretary
Bill Glude, Treasurer
Section Representatives:
Carl Skustad, Alaska
Kyle Tyler, Eastern
Peter Höller, Europe
Fay Johnson, Intermountain North
Dean Cardinale, Intermountain South
Evan Woods, Northwest
John Brennan, Rockies
Gary Murphy, Sierra
Halsted Morris, Member Affiliate Representative

Russ Johnson is stepping down as President after six years of stellar service. Thanks Russ, you've been a great leader. Dave Ream is leaving as Treasurer with Bill Glude stepping up to the Executive Board. Carl Skustad will take his place as Alaska Section Rep. Kyle Tyler will take Bob Bailey's spot as Eastern Section Rep and Dean Cardinale will take over in the Intermountain South Section. Thanks Dave and Bob, you have served on the Board for quite awhile and your service has been commendable. With Janet Kellam's move into the Presidency, Lel Tone was appointed by the Board to fill Janet's previous role as Ethics Committee Chair. H. P. Marshall has been serving as Chairman of the Research Committee for the past year or so. Committee chairs are not elected positions. Your new elected Governing Board members will begin their two-year terms on January 1, 2007. Communications to the Governing Board or individual Board members can be made by emailing aaa@avalanche.org

Mark Mueller works diligently at his post at the AAA table during ISSW 2006 this fall. *photo by Dale Atkins*

As new and incumbent Board members guide AAA through its 20th year, it is appropriate to acknowledge those who comprised the steering committee that created AAA (then the American Association of Avalanche Professionals). Representatives were elected from different geographic regions. "Their task was to insure that the proposed association met the needs of the professional avalanche community." *(1986 ISSW Proceedings, p 62)* The Steering Committee was made up of the following people:

Knox Williams, Colorado
Don Bachman, then of Colorado
Brad Meikeljohn, New Hampshire
Barry Voight, Pennsylvania
Larry Heywood, California
T. W. Tesche, California
Doug Fesler, Alaska
Reid Bahnson, Alaska
Dale Gallagher, Oregon
Bruce Meek, Oregon
Ron Johnson, Montana
Randy Elliot, Montana
Renny Jackson, Wyoming
Liam FitzGerald, Utah

Also on the committee were Sue Ferguson, Dick Penniman, Betsy Armstrong, officers of *The Avalanche Review*, and initial organizers of the proposed association. The progress of the fledgling association was reported in the pages of *The Avalanche Review* as that ski season progressed. Nearly all these folks remain active members of AAA and have contributed tremendously to make AAA an effective, worthwhile organization that we can all be proud of.

A gathering like the recent ISSW showcases how far we've come not only as an organization, but also as a profession. AAA sponsored several activities: a very successful Ladies Night on Monday, a nice 20th birthday party on Wednesday evening, and a very well-attended annual meeting later on Wednesday night—maybe beer stimulates attendance better than we might have thought? This was all a lot of fun and would not have been possible without the efforts of the following ISSW organizers: Chairman Craig Sterbenz (master of organization), Co-Chair Nicole Greene, Mike Friedman (who placed the AAA booth center stage), Bob Rule (who got all that beer together), and Kevin Cahalane (who organized our birthday party). Many thanks to them and all the ISSW crew who put on a fantastic show in a fantastic place. As great as the presentations and posters were, we all know that we value seeing our old friends and meeting new ones. How many of us only see each other every other fall at ISSW? Thanks to everyone who stopped by the AAA booth to take care of a little business, buy stuff, or just say hi. What an interesting group we are.

Over the summer and fall, two members became AAA Life Members. Life membership represents a significant monetary contribution to the efforts of AAA. Thanks very much to Bill Williamson from Ponderay, Idaho, and Gary Kuehn from Wanaka, New Zealand.

Another winter approaches; storm boards are freshly painted, instrumentation readied, magazines stocked. By the time you read this, winter will be upon us and we'll be deep in the stuff of our passion. I wish you all a safe and successful winter season.

—Mark Mueller, your executive director

mailbag

ISSW Ladies Night: It's About Damn Time!

I just wanted to take a moment to thank the American Avalanche Association for their generous support of the first ever Ladies Night at the ISSW in Telluride, Colorado, in October. It was a great gathering of women in this field from all over the world. The food was tasty, the wine flowed easily, and the gift bags were an added bonus. The night was a way to meet new friends and honor instrumental women in the snow and avalanche field. As a first timer to the ISSW, I felt lucky to share in the tribute to Sue Ferguson given by the man who received true honorary woman status: Ed LaChapelle. As my friend Martha Crocker said, "It's about damn time we had one of these," and she has been coming to the ISSW for years. I was wondering about some of the raffle prizes; it seems that one of the women really could have used a full body waxing to remove the mustache and back hair – oh wait. Now I remember that the *she* was a *he*—the one uninvited lady imposter in white dress and dainty shoes.

Thank you,
Ellie Martin along with Sarah Carpenter and Martha Crocker

submissions

- Seen any good avalanches lately?
- Got some gossip for the other snow nerds?
- Developing new tools or ideas?
- Send photos of a crown or interesting terrain.
- Send photos of avy workers throwing bombs, teaching classes, or digging holes in the snow.
- Pass on some industry news.
- Tell us about a particularly tricky spot of terrain.

Write it up; sent it to us. *The Avalanche Review* is only as good as the material you send.

SUBMISSION DEADLINES

Vol. 25, Issue 3 ..... 12/15/06
Vol. 25, Issue 4 ..... 02/15/07

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from the editor

Welcome to the mid-winter issue of TAR.

As I write this editorial, it's the genesis of winter. Snowline is creeping down the hillsides, the local ski swap is this weekend, and my new boards are mounted. Articles and authors are already lined up for the February issue of TAR. Hopefully, by the time you read this, we are deep into the season.

This issue brings you some useful tools from the ISSW: the extended column test from Ron Simenhois, a systematic method for shoveling by Bruce Edgerly and Dale Atkins, and some thoughts on calibrating taps in the compression test from Spencer Logan. Ian McCammon, as usual, has some very practical tips on a rule-based decision-making system, complete with acronyms. Doug Richmond and HP Marshall share their unique perspectives on the ISSW—from practitioner and researcher, respectively. And Peter Shelton and Jerry Roberts follow the events and personalities that made up the San Juan Project, leading us nicely into Bill Williamson's musings on mentorship.

Also in this issue we publish the last of the winning photos in last year's photo contest. Congratulations to Emily Johnston and Matt McKee for their grand prize cover shots. We hope to host the photo contest in future issues. Meanwhile, your photos are always welcome; send us images of dramatic crown fractures, snow curiosities, and personalities and share your world with TAR's readers.

The AAA education committee is hard at work under the leadership of Michael Jackson. A thoughtful e-mail forum has been re-evaluating, debating, and refining the outcomes and progression of the Level 1 to 2 to 3 courses, as well as looking at the big picture overview of U.S. avalanche education. Janet Kellam is spearheading that project; please contact her for more information.

I have agreed to coordinate the Mentorship project; the alert reader may have noted my focus on this in previous issues. Please see the articles on pages 16-17. The project's goals are to foster the transfer of information and inspiration from one generation to the next, and to help aspirants gain the appropriate skills, experience, and perspective that they need to find a productive niche in the avalanche field.

I find it gratifying and challenging to volunteer on projects like this; the reward is getting to work with some of the most talented, motivated, and professional snow geeks around. In this world of diminished government funding and involvement, much is achieved in our field and others by volunteers who donate their time and energy. Thank you to volunteers within the AAA and in so many other fields.

—Lynne Wolfe, editor

metamorphism

The AAA Membership Directory will go to press in early 2007. Could members please update their information? E-mail aaa@avalanche.org or call 970-946-0822.

New Certified Instructors
Tom Murphy, Gunnison, CO
Ron Matous, Kelly, WY
Jake Hutchinson, Salt Lake City, UT
Mark Newcomb, Jackson, WY
Liam Fitzgerald, Snowbird, UT

New Professional Members
Kevin Quinn, Olympic Valley, CA
Gabe Chladek, Sisters, OR
Shawn Connor, Colorado Springs, CO
Jamie Yount, Jackson, WY
Doug Scott, Boulder, CO
Matt Wade, Ridgeway, CO
James Doenges, Littleton, CO
Ken Bokelund, Truckee, CA
Joe St. Onge, Hailey, ID
Mark Baumgardner, Sun Valley, ID

New Member Affiliates
Richard Grubin, Golden, CO
Oyvind Henningsen, Bothell, WA
George D'Angelo, Missoula, MT

Congratulations to **Leslie and Andy Gleason** who welcomed Charlie Max Gleason into the world on Sept 28.

New Faces at CAIC

Avalanche Forecaster, Boulder: John Snook John received his Ph.D in Atmospheric Science from Colorado State University and spent 14 years working at NOAA's Forecast Systems Laboratory. He has worked on weather-forecast systems and mesoscale atmospheric models for private and government groups. He was the main modeler behind a system to deliver weather-forecast products to the fire-fighting community, as shown at www.fireweather.info. John is an avid backcountry skier and has been on the volunteer ski patrol at Arapahoe Basin since 1985.

Avalanche Forecaster, Boulder: Ann Mellick Ann has a B.A. in Environmental Education from Prescott College and has been a climbing and mountaineering guide for the last 10 years, most recently for Sierra Mountaineering International. Ann taught avalanche forecasting at Prescott College for seven years and taught snow and avalanche courses at Sterling College and the Silverton Avalanche School. She was a CAIC-Silverton intern last winter.

Avalanche Forecaster, Silverton: Susan Hale Susan worked in the Colorado avalanche industry since 1995. She has worked on the Snowmass Ski Patrol as patroller, lift-evacuation technician, rescue-dog handler, and snow-safety coordinator. Susan has CAATS Level I and II certifications and enjoys backcountry skiing and mountaineering. For the last two winters, Susan interned in the CAIC-Silverton office.

Avalanche Educator: Ben Pritchett Ben has been guiding in Colorado for the last eight years. He has a B.S. in biology from Western State College and is an AMGA-certified ski guide. Ben spent five years as a forecaster at the Crested Butte Avalanche Center and is one of the national curriculum editors and the Level 3 Program Coordinator for the American Institute for Avalanche Research and Education (AIARE).

aaa news

Pete Peters Receives Special Service Award

Pete Peters (left) posed with Monty Atwater and an early Avalauncher. *photo by Jerry Nunn*

Pete Peters has been awarded the AAA Special Service Award; he was nominated by John Brennan, Craig Sterbenz, Doug Richmond, Jerry Roberts, Don Bachman, and Tom Murphy.

Pete Peters was introduced to Monty Atwater in 1973. Peters believed so adamantly that plastic molds needed to be designed for the next generation of avalauncher projectiles that he quickly put up $16,000 so that this goal could be accomplished. Because of his investment, Peters and Atwater formed a partnership and incorporated Avalanche Control Systems.

When Atwater died in 1976, Peters took over the company and continued to manufacture avalaunchers and projectiles. Since the company's inception, 100% of the profits have been reinvested into research and development. He is personally responsible for producing over 340,000 tailfins and over a hundred avalaunchers.

A one-man show, Peters hand-assembles all aspects of the fin himself. In stark contrast to other related companies, Peters sold avalaunchers at cost until he quit making them in the early '80s. Similarly, Avalanche Control Systems continues to maintain a thin profit margin on their fin/fuse assemblies. Customers can still buy directly from Peters for a mere $4.20 per fin – including shipping! Peters' products are used by a variety of industries worldwide. His intelligence and motivation have insured the avalauncher a prominent spot among avalanche mitigation tools.

The Special Service Award recognizes Pete Peters's specific and outstanding achievement in the service of North American snow-avalanche activity.

AAA Sets Logo and Title Usage Guidelines

The American Avalanche Association name has been registered with a service mark (similar to a trademark). We announced during the annual 2006 meeting at ISSW how members may represent their affiliation in resumés and in any advertising. The following information can also be found on the ethics committee Web pages.

Individuals may use the AAA logo and name as shown. 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 advertise adhering to Level 1 and 2 AAA guidelines. The name or logo cannot be used on its own without a qualifier, except in AAA applications.

American Avalanche Association AAA
Professional Member

American Avalanche Association AAA
Member Affiliate

Pro Member..... Professional Member AAA [full name or logo]
Member Affiliate..... Member of AAA [full name or logo]
Certified Instructor.... Certified Instructor AAA [full name or logo]

ALL MEMBERS: register your use with the executive director. Contact Mark Mueller at aaa@avalanche.org for high-resolution jpeg image files.

Call for Proposals: Avalanche Practitioner Project Grant

The American Avalanche Association presents both a practitioner and a graduate student grant competition each year.

Practitioner grants are due March 1. Proposals for projects whose results will directly benefit avalanche field practitioners or will extend our understanding of snow and avalanche phenomena are given preference. Upon request, the research committee will match interested practitioners with a snow scientist to help guide the proposal development. Requests for up to $1000 can be made, and the AAA will fund at most two projects. These funds are intended as seed money to get a project started, and can be used for field equipment and instrumentation but not salary. Members enrolled in an academic institution are not eligible, but are encouraged to submit a proposal to the graduate student grant competition, which has a due date of September 1.

More information and application materials can be found at www.americanavalancheassociation.org/research.html. Send inquires and applications to HP Marshall: marshalh@colorado.edu, 30 Lewis Mountain Lane, Durango, CO 81301.

Graduate Student Grant Competition Results

The AAA awarded grants to two students this fall: Erich Peitzsch of Montana State University and Nicholas Thompson of University of Alaska, Fairbanks. Erich will be studying the relationship between the radiation balance of the snowpack and wet slab avalanche formation. He will be relating the surface energy balance to the production of water and the subsequent transport of that water through the stratified snowpack. Nicholas Thompson will be comparing AK-block tests performed by skiers and snowboarder at several different study sites.

what's new

CAIC staff and friends gathered near the New Belgium Brewery booth during this fall's Avalanche Jam. (l-r): Mark Kelly, Alpine World Ascents; Nick Logan, CAIC; Bruce Edgerly, VP, BCA; Mario Magtanong, Avi Jam volunteer; Scott Toepfer, CAIC; Brad Sawtell, CAIC

Avalanche Jam Raises $10,000 for CAIC

The 5th annual Avalanche Jam raised just over $10,000 this fall for the Colorado Avalanche Information Center (CAIC). Held on September 22 at the American Mountaineering Center in Golden, Colorado, the music was moved inside due to rain, which made the Jam even more intimate for the roughly 400 attendees. Music was provided by Damage Done (which is comprised mainly of staffers from Boulder retailer Neptune Mountaineering) and from local teen sensations Route 7. Vendor tents were set up outside. Beer was provided by New Belgium Brewery; Mexican fare by El Senor Sol restaurant. The event was hosted and organized by Backcountry Access (BCA) with support from Marmot, Scarpa, Cloudveil, Black Diamond, Outdoor Research, Patagonia, Arapahoe Basin, and numerous other generous sponsors.

BCA and TGR release Group Rescue DVD

Backcountry Access (BCA) and Teton Gravity Research (TGR) teamed up to produce a second training DVD on avalanche rescue. *Take Charge: Leading a Group Rescue* was released this fall.

The 18-minute DVD was filmed at Jackson Hole and is hosted by TGR's lead guide, Jim Conway. Freeskiing icon Erik Roner takes charge in a rescue re-enactment involving seven skiers and snowboarders. The DVD opens with a primer on the "five red flags of the backcountry"—tips on how to avoid avalanches in the first place. It then illustrates the process of appointing a leader, ensuring rescuer safety, performing a transceiver search, probing, shoveling, and first aid. The DVD has a particularly impressive live demonstration on how to perform a primary search with a small group in a large deposition area.

Take Charge is the second in a series of educational DVD's jointly produced by the two companies. Last year's release, *Tracker 101: Mastering Your Digital Transceiver*, has been duplicated twice due to popular demand. *Take Charge* takes a more holistic view of the rescue, addressing the overall search strategy rather than focusing solely on the transceiver search.

DVD extras on the disk include Flash animations of single and multiple burial searches using a transceiver and a preview of TGR's 2006 feature film, *Anomaly*. *Take Charge: Leading a Group Rescue* will be included on all copies of *Anomaly* purchased through TGR and its distributors. *Take Charge* is available for $10 on BCA's Web site: www.bcaccess.com. *Take Charge* and *Tracker 101: Mastering Your Digital Transceiver* can also be purchased as a set for $15.

Climbing Skins Direct Provides New Product

A new company has begun marketing climbing skins for backcountry skiing. The staff are former employees of Ascension™ before the company was sold to Black Diamond™. While other companies utilize cheaper off-shore materials, Climbing Skins Direct seeks to maintain the legendary Ascension quality while improving it with more advanced materials, all made in the USA of domestic materials.

Other brands have switched to a plush where the fur exits the fabric perpendicular to the fabric and then ironed over. The Ascension plush utilized solely by Climbing Skins Direct, on the other hand, exits the fabric at an angle, producing better glide and climbing performance.

Climbing Skins Direct products have returned to a tip stretcher/tail hook attachment system with a significant improvement in the tip ring. By bending the ring, it actually cams onto the skin, making accidental kick-offs much less probable. This system is superior for twin-tip skis.

The skin material is impregnated with a durable water repellant (DWR) that improves glide and will help with long-term waterproofing.

Climbing Skins Direct retails their products on-line at www.climbingskinsdirect.com. They promise the lowest prices in the industry, with the most expensive product at less than $100 (130mm skins w/tip & tail attachment).


Alaska's first avalanche victim of the season was given the deep freeze.

Alaska Avalanche Claims First Victim

Story and photo by Reid Bahnson

Alaska's first recorded avalanche victim of the winter season perished October 9 in a relatively small hard-slab avalanche in the Brooks Range near Atigun Pass.

The deadly slide occurred while a group of eight was traversing a broad undulating mountainside near mid-slope. Before the accident, a day-long storm had dropped nearly a foot of new snow with moderate winds. The leader of the group, a 230-pound five-year-old male, was crossing a 35- to 40-degree wind-loaded pocket that fractured out approximately two feet deep. The slab was less than 100 feet across, but it captured three of the mountain travelers carrying them more than 300 vertical feet down the slope. Two of those caught were able to work their way to the edge of the slide and stopped on top of the debris, while the third unlucky victim was almost completely buried with only a portion of his leg barely visible in the debris.

The members of the group that were not caught in the slide panicked and ran back down the trail where they had entered the slope. The two unburied victims were badly shaken and wandered aimlessly down the slope to the valley floor, not realizing that one of their group had been buried in the slide.

A member of the local highway maintenance crew witnessed the slide and responded to the scene on snowmobile only to find the victim deceased. He recruited additional help for the body recovery, and now the freezer at the remote maintenance camp is filled with about 80 pounds of steaks, chops, stew meat, and burger. This avalanche was classified as a HS-AC-1.5 (hard slab, artificial caribou, size 1.5) with three caught, one killed.


Dean Cardinale explained route-3 management at Snowbird to 2005 PAWS course participants.

AAA Professional Avalanche Worker School

Story by Sarah Carpenter, photo by Don Sharaf

The second PAWS course has been scheduled for February 3-10 in southwest Montana. The first successful course was held in Utah last winter.

PAWS is a comprehensive professional course aimed at all levels of avalanche workers. It introduces the American Avalanche Association's *Snow, Weather, and Avalanche Guidelines* and sets a proficiency standard of education for the U.S. avalanche community. 60% of the course is conducted in the field with the remaining 40% in the classroom. The course is an intensive eight days of 9-11 hours of instruction per day.

This course is designed to give participants the opportunity to become accurate and efficient in snowpack observation. The course will solidify the participants' understanding of snowpack physics and avalanche formation and give them tools to apply that knowledge to the assessment of avalanches and avalanche potential. Terrain assessment, route finding, group management, and decision-making will be examined and practiced daily. Avalanche rescue and beacon use will be extensively practiced, and participants will be expected to meet a standard.

Additionally, the course will provide an overview into highly organized avalanche-control programs (both at ski areas and highways) and provide industry-norm instruction into avalanche-control practices. The course benefits a large audience, including forecast-center avalanche observers, ski patrollers and guides, search and rescue coordinators/trainers, highway technicians, and experienced recreationists who want to pursue a career in the avalanche realm.

Participants are required to have completed either a three-day Level 2 avalanche course, both phases of the National Avalanche School, or the equivalent with in-house training and experience. Participants need to be proficient with beacon recovery and will be tested on single-burial recovery at course commencement. Participants must bring skis or splitboard, boots, and skins. Skiing or riding skills must be at least intermediate level in most snow conditions. Participants should be in physical condition to comfortably climb 3000' vertical over the course of a day.

For more information, go to www.americanavalancheassociation.org/PAWS or contact Sarah Carpenter at sarahlovessnow@yahoo.com or (208) 787-4235.

left: Targa in tour mode
right: the "Actuator" in tour mode and in ski mode

G3 Delivers Power to Backcountry Telemarkers

Inspired by the needs of working backcountry guides and refined with their direct feedback, the TARGA ASCENT recently won the 2006 ISPO Outdoor Award. It is the first telemark touring binding that allows effort-free ascents on skins without sacrificing any downhill performance.

Conserving uphill energy through an innovative patent pending free-pivoting system, the TARGA ASCENT eliminates the resistance created by stiff boots and spring cartridges, which work against the climbers' efforts to ascend. To maximize downhill power, an active, built-in 3° wedge reduces rocker launch and improves the transfer of energy from boot to ski by immediately engaging the G3 spring cartridges upon initiation of the turn, producing a more active binding. While in tour mode, G3's patent pending, biomechanically correct free-pivot system allows for exceptionally efficient touring. For the descent, a pole-activated switch easily and securely engages the retention system, locking the binding in ski mode. The ASCENT is built on the platform of G3's multiple award-winning TARGA T/9 binding. With aerospace alloy aluminum toe plates, stainless steel toe bars and aluminum heel tubes, weight is kept to a minimum (only 1440 grams) without sacrificing performance. The ASCENT is sold with choice of G3 XRace or WorldCup cartridges and includes a new pole-activated climbing heel, anti-ice plates in the toe and heel, and optional crampons *(sold separately)*.

G3 News Bites

G3 Hires Sepp Stenger To Head European Sales And Marketing

Ski industry veteran Sepp Stenger has joined G3 to head the company's European sales and marketing efforts. Stenger officially began working with G3 on November 1, 2006.

As a long time member of the European ski and snowboard industry, Stenger brings over 12 years of marketing and product promotion experience to his new position, as well as a deep knowledge of the European snow sports marketplace.

Stenger's job description will cover a broad range of responsibilities, including sales and sales team management, marketing, event promotion, distributor relations and assistance with European-focused product development.

Prior to his hiring by G3, Stenger held several positions in the European snow sports arena, including Head of Exports at Mammut Sports Group in Switzerland (2006), Sales Manager and Customer Relations expert with Völkl International in Switzerland (2002-2005), and the Marketing and Business Manager with Adidas-Salomon in Germany (1996-1998).

G3 Welcomes New Athlete Coordinator Naheed Henderson

Telemark adventurer and mountaineer Naheed Henderson joins G3 in the new role of Athlete Coordinator.

Responsible for growing G3's relationships with guides and athletes worldwide, Henderson will also be a part of G3's team of sponsored athletes.

Henderson's ski career began during a childhood in Vermont, and matured as she explored the mountains and backcountry of the world. As a coach, a guide, and an explorer, Henderson earned the respect of the backcountry community with a telemark descent of Denali in the spring of 2006 and with new telemark adventures planned for the coming years.

As Athlete Coordinator, Henderson will work with G3 sponsored guides and athletes to promote G3's innovative products, and to provide feedback to G3 product designers.

G3 teams with Pale Morning Media for strategic public relations support

G3 Genuine Guide Gear, creators of backcountry ski equipment for guides and avalanche professionals, has selected Pale Morning Media LLC as their public relations agency of record in North America.

The G3 team includes ski designer Paul Parker, a veteran staff based in British Columbia, and an extended team of product testers and friends throughout the backcountry ski community.

Pale Morning Media, LLC, based in the Mad River Valley of Vermont, was founded in 2001 as a product publicity, public relations, and communications firm specializing in the outdoor world.

BCA introduces Snow Study Kit

Avalanche equipment manufacturer Backcountry Access introduced a new line of snow study tools this fall at the ISSW conference in Telluride. The lineup includes a new slope meter, digital thermometer (in degrees C and F), aluminum crystal card, 6x magnifying loupe, 30 cm snow saw, 1m and 2m fiberglass rulers, and AIARE field book. Perhaps the most innovative is the BCA slopemeter, a lightweight and compact version of the rugged slope meters found on heavy equipment. The slopemeter, thermometer, crystal card, loupe, and a pencil can be stored in BCA's protective, compression-molded case. For pro pricing, contact Backcountry Access at (800) 670-8735 or see www.bcaccess.com.

White Book Challenge Tests Avy IQ for Chance to Win Heli-Ski Trip

A free heli trip is the ultimate goal for anyone who has made an untracked turn. Yet entering the backcountry requires respect for avalanches and knowledge about how to stay safe. This season, RECCO®, Quiksilver, and Bella Coola Heli Sports have linked both facets of this sphere with a contest aimed at increasing awareness while rewarding two lucky souls with a five-day trip to pow-turn paradise.

The winners will sample Bella Coola Heli's 1.5 million acres of terrain and 300 established runs in British Columbia's Coast Range for five days. They will also be equipped with two head-to-toe sets of Quiksilver Gore-Tex® outerwear for the trip. To earn entry into the Challenge, riders must read *The White Book* and answer 11 avalanche-related questions correctly at recco.com. Two grand prize winners will be chosen on May 15 from all correct entries and posted June 15 at www.recco.com.

The White Book is a pocket-sized publication written by renowned avalanche expert Dale Atkins. Against a backdrop of big-mountain imagery, the book provides avalanche awareness information, eye-opening statistics, and words of wisdom from patrollers, guides, and pros.

The White Book is available free of charge at any of Quiksilver's 800 storefronts worldwide or by download at www.recco.com/avalanche/safety.asp.

Glacier Park Draft EIS

The first Draft Environmental Impact Statement developed exclusively for an Avalanche Hazard Reduction Project has been released by Glacier National Park. It addresses a proposal by Burlington Northern Santa Fe Railroad to target GNP lands with artillery. Comments are due by December 30. For more information visit: www.parkplanning.nps.gov/document.cfm?parkId=61&projectId=12355&documentID=17106

A skier contemplates entering obvious avalanche terrain in the Caribou Range of British Columbia.

OBVIOUS CLUES METHOD: A User's Guide

Story and photos by Ian McCammon

Years ago, forecaster Dale Atkins and I were talking over beers in the wake of several horrific avalanche accidents. "It's weird," he said, "how the names change, but the accidents stay pretty much the same."

Dale and other avalanche professionals have long recognized that there is a recurrent pattern to avalanche accidents. The pattern goes something like this: A group of experienced skiers or riders, often with avalanche training, seemingly ignores obvious signs of avalanche danger and ventures onto a steep slope. There they trigger an avalanche that catches and kills some or all of them. Viewed from the outside, the group's decision to enter the slope seems starkly at odds with the obvious danger.

There is mounting evidence that this recurring pattern arises, at least in part, from *human factors*: mental habits and shortcuts that help us navigate the civilized world but can be deadly when we use them in avalanche terrain unconsciously.

A few years ago, I found that some of my research on decision-making had inadvertently resulted in a simple method to minimize the influence of human factors in avalanche terrain. The method is by no means perfect, but it seems to help students recognize when their decisions begin to fall into the classic avalanche accident pattern. Many students have been excited to learn a simple decision guide that doesn't rely on years of experience or detailed knowledge of snow science. In this article, I'll describe the method and how it can be taught, in hopes that others may find it a useful starting point in helping their own students avoid becoming avalanche victims.

Origins

Before an accident occurs, all outcomes seem more-or-less equally probable. But once the bar fight breaks out, your buddy's sled falls through the ice, or the porch catches fire, the signals of impending doom seem obvious, and the chain of events, viewed in retrospect, seems to have led inexorably to the outcome. This effect, known as the hindsight bias, is especially pronounced when we look at the actions of other people. So an obvious question is whether the classic avalanche accident pattern really exists, or is it just a result of hindsight bias?

To find out, I examined over 700 avalanche accidents in the U.S. for evidence of seven obvious clues *(see sidebar, next page)*. These clues have long been cited in avalanche training materials as unequivocal signs of avalanche danger. In accidents where all seven clues could be accounted for (about 250 cases), no single clue stood out as being a causative factor. But what was striking was the large number of obvious clues (median 5) that were apparent to victims in the majority of accidents. In other words, the pattern that Dale and others had observed through the years wasn't an illusion. The typical avalanche victim did seem to ignore many signs of avalanche hazard.

In a series of follow-up studies, I looked at how this pattern correlated with avalanche training (low correlation: McCammon, 2000) and human-factors cues (high correlation: McCammon, 2003). As an analytical tool the number of clues is admittedly pretty coarse metric, but it had the advantage that it didn't depend on knowing accident rates or the exposure frequency of any user group.

Along the way, the list of the seven obvious clues became useful for quickly explaining to beginners how to recognize dangerous avalanche conditions. It formed the basis of an informal three-minute avalanche class that I still find useful when folks ask me about avalanche conditions at the trailhead. More recently, it has found its way into the Avalautor™, a decision support tool for recreationists in Canada (Haegeli and others, 2006; McCammon and Haegeli, 2006).

Obvious Clues Method

Using the obvious clues method is pretty straightforward. A person simply runs down the checklist and counts up the number of clues that they have observed. Table 1 shows how the number of clues relates to conditions under which past accidents have occurred.

History tells us that the vast majority of avalanche accidents could have been prevented if victims had re-examined their plans when at least three obvious clues were evident. This trend is robust across different avalanche climates, avalanche types, elevation, mode of travel, and level of training. As an added bonus, a threshold of three observed clues would have prevented a significant proportion of accidents under low and moderate avalanche danger, ratings where decision systems like the NivoTest and the Reduction Method generally break down for North American users (McCammon and Haegeli, 2004).

From a practical perspective, I've found that things start to feel serious when I've observed three of the seven obvious clues on a tour. Turning around at this point may not be mandatory under all circumstances, but this is certainly a point where I take a deep breath, re-assess my goals, and weigh my next decisions very carefully. Students likewise have found three clues to be a reliable warning flag that their exposure to avalanche hazard is rising sharply.

Things start to get tricky at a threshold of four clues. Field experience shows that this is when the

Number of clues	% of accidents	% of accidents prevented
2 or less	2%	98%
3 or less	8%	92%
4 or less	23%	77%
5 or less	53%	47%
6 or less	90%	10%
7 or less	100%	0%

Number of obvious clues present in historical avalanche accidents in the U.S. Third column shows the number that would have been prevented had the victims avoided avalanche slopes with the given numbers of clues present (N=252).

situation starts to feel "out there," margins of safety grow thin, and finding a safer route starts to seem like a Really Good Idea. At four clues, the actual proportion of accidents prevented varies by avalanche climate and elevation.

When more than four clues were present, the percentage of historical accidents prevented drops dramatically. The actual decrease varies significantly with avalanche climate, elevation, and other variables. Field experience indicates that under these conditions, advanced terrain knowledge, well-developed route-finding skills, and a solid stability assessment are no guarantee of safety. Sadly, it seems that these are precisely the conditions where human factors kick in with a vengeance, as people convince themselves that things aren't really that bad or that they have the skills to mitigate the rising danger. In these moments, the more alert members of a group can use the obvious clues method as a tool for communicating their alarm and hopefully stopping an accident before it happens.

Prevention vs Prediction

One of the biggest obstacles to teaching the obvious clues method is dealing with people's expectation that it somehow predicts avalanches. If a simple checklist could reliably predict avalanches, then we wouldn't need snow-safety experts, forecasters, or seasoned guides. It turns out that the best we can do is identify conditions that were typical of past accidents (those patterns again). An accident may not happen if there are many clues present, but if one does, it will fit the classic pattern. Someday, when we have reliable data on the conditions under which people don't trigger avalanches, we'll be able to develop predictive tools. But until then, past accidents can only tell us how to prevent similar accidents in the future.

I've found it helps to explain the distinction between prevention and prediction using the metaphor of an aviation checklist. When preparing for takeoff, pilots use a simple checklist to make sure they've examined the key variables that would prevent most crashes. If they ignore a few items on the checklist, it doesn't predict that the plane will crash. But if a crash does occur, it may well be due to the items that the pilot ignored.

Teaching with the OCM

Like most people, I have trouble remembering the complete list of obvious clues. The following are two memory aids that I've found helpful.

ALP TRUTh: Avalanches, **L**oading, **P**ath, **T**rap, **R**ating of considerable or higher, **U**nstable snow, **T**haw instability

This was the original mnemonic for remembering the seven clues, but it presents them in a different order than you are likely to encounter on an actual tour. The result is that you have to skip around in the checklist in order to keep track of the total number of clues.

Another memory aid avoids this problem by creating a running checklist in about the right order:

Crazy Ava's Unstable Patter Traps Local Thugs: Considerable, **A**valanches, **U**nstable snow, **P**ath, **T**raps, **L**oading, **T**haw

Both memory aids appear to work well, despite the fact that poor Ava suffers all manner of unsavory attributions on high-hazard days.

One advantage of the obvious clues method is that it can be used for all stages of travel in avalanche terrain: reading an avalanche bulletin, planning a tour, route finding, and slope evaluation. Students seem to appreciate its flexibility and how it reinforces the importance of staying alert for key clues at different points in a tour. I've found that introducing the method early in a course saves time since it provides a framework around which later phases of the course (especially the field portions) can be constructed.

The Future

Like other decision tools for avalanche terrain, the obvious clues method is in a very early stage of its evolution. More work remains to be done on refining the clues and studying the ways that people use them to make decisions. Over time, it is possible that consistent use of the method among recreationists might actually change the pattern of avalanche accidents, with more accidents happening at lower clue thresholds as people avoid avalanche slopes under more serious conditions. Such shifts in the classic accident pattern may be one way of tracking the widespread use of this and other decision methods (McCammon and Haegeli, 2006).

Although it has gained some popularity, the obvious clues method is certainly not perfect. It is a starting point on which I hope that others will build. But in the meantime, it seems to be a practical tool to help novices recognize the conditions that have taken lives in the past and start them on the road to developing avalanche skills that go beyond simple checklists.

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Ian McCammon is an avalanche researcher, educator, and consultant who lives and thrives in Salt Lake City. Trained as an engineer, he often wonders how he ended up studying Really Hard Problems like why people die in avalanches when they know better. In his spare time he enjoys skiing in the Wasatch Range, where the snow is usually crusty and shallow. Really. Tell everyone you know.

OBVIOUS CLUES

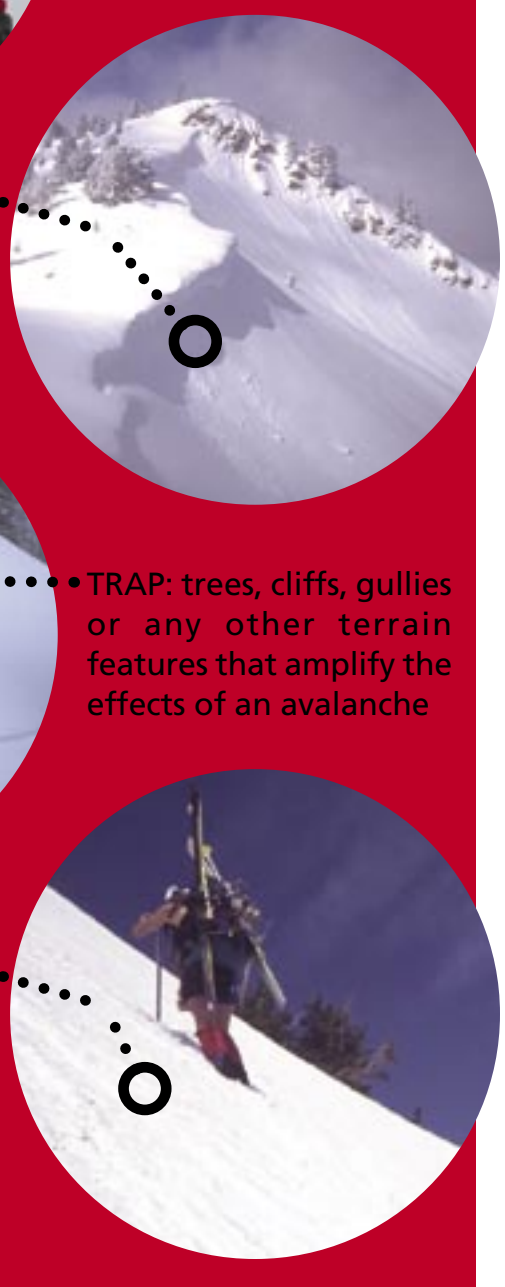
The Obvious Clues Method is a simple way to see how a route choice or a slope compares to past avalanche accidents. It doesn't predict if an avalanche will happen, but it helps novices recognize when they are entering a potentially dangerous situation. To use the method, simply add up the number of clues that are present. Here are the clues, in the approximate order that someone might encounter them on a typical tour.

RATING: of considerable or higher in the current avalanche bulletin

AVALANCHES: in the last 48 hours, reported in the local avalanche forecast or observed in the area

UNSTABLE SNOW: collapsing, cracking, deep trail-breaking or bogging down on a sled

PATH: entering an obvious path, recognizable by a novice. Trimlines, nervous trees or, above treeline, slopes steeper than ≈ 30°



LOADING: by new snow, wind or rain in the last 48 hours

TRAP: trees, cliffs, gullies or any other terrain features that amplify the effects of an avalanche

THAW: melting of the snow surface, accompanied by sinking in to your boot tops (skis) or bogging down (sled)

In general, having three or more clues present is a sign that your next decision should be made with care. At low and moderate hazard, be especially cautious if the bulletin mentions deep weak layers.

STRATEGIC SHOVELING: The Next Frontier in Companion Rescue

Story by Bruce Edgerly and Dale Atkins • Photos by Bruce Edgerly

During the past eight years, great attention has been focused on avalanche transceivers and their use. Not only are more avalanche transceivers being sold now than ever before, but more avalanche courses are being taught and more opportunities are being created for beacon practice.

Analysis of U.S. accident data collected by the Colorado Avalanche Information Center (CAIC) and the authors shows that this trend is paying off. Mean rescue times with a transceiver for recreationists from 1977 to 2000 was 29 minutes (including search and excavation). From 2000 to 2006, the mean dropped to 18 minutes.

However, there have been no corresponding advancements made over the last decade in excavation technique or education. Incremental product improvements include shovels with oval shafts and stronger, lighter aluminum blades.

Evidence suggests that the great majority of time in companion avalanche rescue is consumed in excavation, after the victim has been located. The greatest potential for decreasing overall rescue times is in this phase. If excavation times can be decreased at the same rate that beacon search times have, then we can expect an even greater improvement in survivability.

As important as excavation time is excavation quality. In at least two U.S. avalanche rescues, the victim's air pocket was severely compromised as rescuers dug down to the victim. In other cases, excavation progress or treatment of the victim was severely compromised by lack of maneuverability within the excavation area: for example, stepping on or knocking substantial amounts of snow onto the victim.

A search of international literature revealed little published research on the subject of avalanche victim excavation. Most books do not mention how to dig, and few even offer tips. Freudig and Martin (1995), Tremper (2001), the German Alpine Club (Semmel et. al., 2005), and various publications from the Canadian Avalanche Association, Mountain Equipment Co-op, and Parks Canada focus on the basics of starting the excavation downhill of the probe and chopping the snow into blocks before removing (Ledwidge, 2005).

Field research performed over 20 years ago by Willy Pfisterer of Parks Canada offers the most detailed advice for avalanche excavations. His research supported the creation of terraces extending away from the probe strike to enable snow to be removed more efficiently. The authors contacted Pfisterer for his comments, but his findings are not published. Likewise, the Association of Canadian Mountain Guides (ACMG) teaches a method based on Pfisterer's research. While quite insightful, these guidelines have also not been published.

The aim of our research was twofold: to provide a proposal to the snow-safety community for increasing the efficiency of avalanche-victim excavation and to stimulate interest in the subject among avalanche educators. By providing educators with a set of efficacious strategies for the excavation phase, they are more likely to include this important phase in their curriculum when teaching students about avalanche rescue.

METHODS

Our research was performed in three stages: the initial literature review described above, interviews with individuals who have been involved in companion rescue excavations, and three days of on-snow research in the Colorado Front Range during the spring of 2006. The objective behind the first two stages was to determine the "state of the art" in excavation technique; the objective of the field testing was to determine which of the techniques were most effective in a companion-rescue situation and to test a basic set of guidelines that could be offered in a proposal to the snow-safety community.

At all three sites, the tests were performed on slope angles ranging from 0 to 15 degrees. This is typical of avalanche runout zones, although depositions from small avalanches are sometimes found on steeper slope angles. The "victims" were either life-sized dummies or large canvas duffel bags filled with snow. The aim was to provide the rescuers with an object of about the same size and weight as a human to best approximate what kind of maneuverability would be required to locate the head and to roll and/or treat the victim. The dummies or duffels were buried in varying orientations with respect to the fall line. All were buried parallel to the snow surface, as this is the most common orientation in which avalanche victims are found.

Burials were between 1 and 1.5 meters deep. This depth was chosen because the average burial depth in the U.S. is 1.16 meters, according to CAIC data. Below 2 meters, the chances of survival are extremely low: only 11 of 126 people (9%) have survived burials deeper than 2 meters. All rescuers were equipped with the same-sized BCA Traverse EXT aluminum shovel with extendable shaft. The victim was first located with a probe by the test organizers. Rescuers were advised to leave it in place.

The test results were all qualitative, despite repeated efforts to generate quantitative data. At all three sites, excavation times were recorded for each individual or team and the final excavation areas were measured. However, the excavation times were variable enough so they were statistically insignificant. It became obvious that changing snow conditions and the motivation and conditioning of the shovelers played an even more important role in excavation times than shoveling technique. In a real companion rescue, motivation, conditioning, and snow conditions are not variables; technique becomes a critical factor in rescue time.

Loveland Basin 4/9/06

These tests were performed in consolidated snow in a non-skier compacted area at Loveland Basin ski area, with nearly two dozen volunteers from the Loveland Basin National and Professional Ski Patrols, as well as several other non-affiliated volunteers. We took advantage of this manpower to test techniques for multiple-rescuer excavations.

All excavations were performed in a dual format, and the excavations were timed to stimulate competition and urgency. Rescuers were first advised to dig with no particularly strategy. Upon reaching the dummy, they were required to roll it over to establish an airway. In the next round of tests, volunteers were provided instructions on how large to make the initial hole and how to organize the excavation team. For large excavations involving three or four rescuers, they were briefed on the methods developed by Pfisterer.

Digging with no strategy created a hole in which it was nearly impossible to roll or treat the victim. Often the rescuers were standing directly on top of the victim, compromising the air pocket. Rescuers would invariably excavate in a cone shape down to the victim. Once deeper than their waists, rescuers were no longer able to throw snow clear of the hole, but had to lift it above the sides and deposit it. This creates high walls around the hole and exacerbates the problem of removing snow from the excavation area.

To prevent the problem of digging straight down to the victim and creating a non-workable hole, we determined that it was essential to clearly define the excavation area before digging. This area, called the "starter hole," should be excavated first, preferably starting on one's knees. Once this hole is up to the rescuers' waists, then the next level can be excavated. Without this starter hole, rescuers tend to get tunnel vision and lose the opportunity to create a hole that

Digging with no strategy often created a cone-shaped hole with high walls that left rescuers standing directly on top of the victim.

Digging a hole with a terrace effect enabled shovelers to throw snow clear of the hole instead of lifting and depositing it on the sides.

will be workable when the victim is reached.

In burials deeper than the rescuer's waist—approximately one meter—the hole will need to be deepened further to reach the victim. This next level can be excavated closer to the victim, creating a "terrace" effect up to the surface, as suggested by Pfisterer. The starter hole already excavated enables shovelers to throw snow clear of the hole instead of lifting and depositing it on the sides.

Pfisterer suggests that the excavation starter hole should always begin at the probe strike and the terracing should extend down the fall line (if the deposition area is sloped). This decreases the probability of rescuers standing on top of the victim and trampling the air space. The ACMG suggests that the starter hole should surround the probe and the terracing should proceed on multiple sides. This increases the probability of locating the victim's head so an airway can be maintained.

Our finding was that it is more efficient and faster—at least with limited manpower—to build the terrace system on one side (downhill) rather than multiple sides. This enables the rescuer to excavate deeper faster and therefore to reach the victim earlier. When revealing the victim, the snow can be removed relatively easily by flaking it from the wall rather than lifting. One shoveler can do this while the other removes the snow from the hole.

It should be noted that in our research we drew a clear distinction between companion rescue and organized rescue. In a companion rescue, it is often necessary to allocate limited manpower most efficiently. In an organized rescue or mechanized operation with greater resources, it indeed might make more sense to excavate the starter hole around the probe and extend the terracing in more than one direction.

In the multiple-rescuer scenarios, it became clear that it is not always efficient to have all four shovelers excavating. When the starter hole is shallow (below the waist), all shovelers can throw snow to the sides, creating minimal interference with each other. But when it becomes necessary to jettison snow out the terraced side, both downhill (secondary) shovelers should leave the hole to enable the uphill (primary) shovelers to throw their snow aggressively clear of the area. This provides the opportunity for one shoveler to rest while the other prepares the area for first aid and evacuation. In longer excavations, this opportunity for rest becomes very important.

After experimenting with various hole sizes, we determined that the optimal y-axis (downhill) length of the initial starter hole is approximately 1.5 times the burial depth *(see illustration below)*. Hole sizes shorter than this tended to become too steep and high on the sides and therefore difficult for snow removal. A starter hole longer than this would delay locating the victim's head. A starter hole length of two times the burial depth felt excessive to the shoveler, who would often resist starting this far away from the probe strike.

While it seemed counter-intuitive to the test subjects at first not to dig their starter hole directly at the probe strike, eventually they would determine that a hole that large would need to be excavated anyway to adequately be able to remove snow when the hole got deeper. Our experience was that if the entire starter hole is not dug immediately, then it will not be dug at all. Once the excavation is underway, shovelers tended to get "tunnel vision" and keep digging straight down until the victim is reached.

One alternative is to initially dig the portion of the starter hole nearest the probe first, and then extend it once the shoveler is up to his or her waist. This increases the probability of revealing a body part closer to the surface than the probe strike. This is the best option if the deposition area is flat and the shovelers are disciplined and well-trained. On a steeper slope, however, it is more ergonomic and efficient to start downhill and work into the probe.

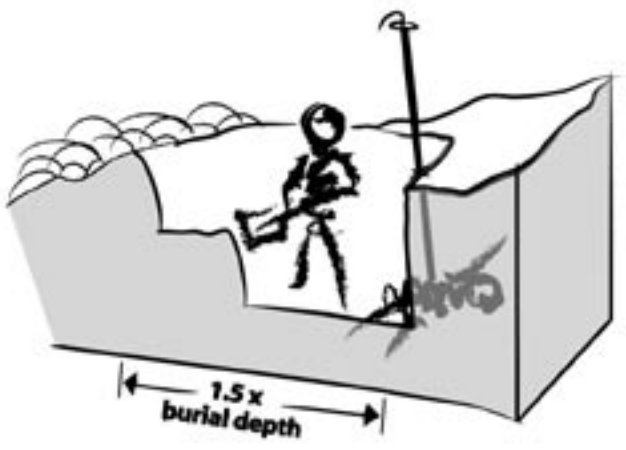
Berthoud Pass 4/19/06

These tests were performed in slightly skier compacted snow at a popular ski touring destination. Since we knew that the optimal downhill length of the starter hole is about 1.5 times the burial depth, the next objective was to determine the optimal width.

We began by excavating what we determined to be "ideal" holes for rolling and treatment of the victim, using ourselves instead of dummies as the victims. This was extremely time consuming and most likely, extremely conservative. According to the CAIC data, only half the time will it be necessary to roll the victim to create an airway. In 235 U.S. accidents where the victim's body position was recorded, 13 percent of avalanche victims were oriented on their side, 16 percent were vertical (sitting or standing), 26 percent were supine (face up) and 45 percent were prone (face down).

Since the victim's orientation is not known, we determined this dimension is more a function of the number of shovelers available at the site. Field-testing at Berthoud Pass convinced us that if two shovelers are working side by side, then a two-meter width is most efficient to prevent interference with each other. If only one shoveler is available, then a 1.25-meter width—or about one "wingspan"—is optimal to prevent interference with the sidewalls.

We also tested the German Alpine Club (DAV) shoveling method in which one shoveler excavates just downhill of the probe and any other shovelers are positioned further downhill to move the jettisoned snow away from the hole. These exercises indicated that it is more efficient to operate side-by-side than in line. In instances where the burial depth is less than two meters, it is almost always possible for the shovelers to throw snow clear of the hole if properly terraced. Therefore the second shoveler is not necessary for removing snow from the area. That resource is more valuable in making the hole wider close to the victim, to increase the probability of locating the victim's head earlier and providing an airway.



The optimal length of the hole should be 1.5 times the burial depth. Width should be 1.25 to 2 meters, depending on the number of shovelers. *Illustration courtesy BCA*

Shoveling side-by-side (background) was more efficient than shoveling in line (foreground). In the latter technique, the primary rescuer shoveled tentatively and the secondary shoveler was often idle.

Pass Lake 5/25/06

Tests at this site near Loveland Pass were performed on hardened avalanche debris from a slab avalanche that released two days earlier. The debris softened over the course of the day due to rising temperatures. Volunteers included BCA employees, forecasters from the CAIC, and lift employees of nearby Arapahoe Basin ski area.

At this site, we confirmed that a hole length of 1.5 times the burial depth was optimal even in hardened avalanche debris and at varying slope angles. Shorter hole lengths resulted in final holes with steep sides and lack of maneuverability. Tests with more than one rescuer confirmed greater efficiency operating side-by-side, as described above, than in line. Rescuers using the latter technique would always shovel more cautiously and tentatively to avoid striking the secondary shoveler with snow or their shovel blade. Invariably the secondary shoveler would be waiting for shovelfuls of snow from the primary shoveler so he could then move that snow from the area. While this provided needed rest for the secondary shoveler, it was an inefficient allocation of manpower compared to the side-by side method.

FINDINGS

Based on the preliminary research, interviews and field testing, we established the following guidelines for excavating avalanche victims in a companion rescue:

a) Leave the probe in place to confirm the exact depth and location of the victim. This also creates an imaginary line past which rescuers should not operate, so that they will not stand over the victim and trample the air space. Using a probe with depth markings is extremely valuable in determining the optimal size of the starter hole.

b) Clearly mark the area to be excavated. By marking this rectangular area and establishing a starter hole of that size, the shoveler will avoid excavating a restrictive tunnel or cone to the victim. This excavated area also enables snow to be thrown clear of the area once the snow surface is above the rescuer's waist.

c) The initial starter hole should be 1.25 meters or one "wingspan" wide for a single shoveler. With more than one shoveler, it should be 2 meters wide to ensure adequate working space and to increase the probability of locating the victim's head. This is a fixed dimension unrelated to burial depth.

d) The starter hole should extend downhill 1.5 times the burial depth. In a flat area, it should extend in the direction where snow can most easily be thrown. This dimension ensures that snow can be thrown rather than lifted and deposited on the sides, and that it will clear the area and not have to be shoveled twice.

e) Begin the excavation process on the knees, removing snow to the sides of the excavation area where it won't have to be moved again. Excavate by

Continued next page ➡

SHOVELING

continued from previous page

chopping the snow into blocks, then removing it from the hole. Stand up when the sides of the hole are up to the waist. Continue throwing snow to the sides.

f) On a slope, it is most ergonomic to start downhill and to move uphill while excavating, digging two blade depths down before moving forward. In a flat area, it is best to start at the probe, to increase the probability of reaching a part of the victim that is closer to the surface than the probe strike.

g) Once the sides of the entire starter hole are up to the shoveler's waist, then the starter hole is complete. From this point, all snow should be removed to the downhill side, clear of the hole, rather than to the sides.

h) Once the starter hole is complete, excavate the next level. This should start approximately half the distance to the probe. By starting downhill of the probe rather than at the probe, the shoveler can create a bench on which to sit while excavating into the probe. From the sitting position, snow can very ergonomically be thrown from the hole at waist level.

i) Special attention should be paid to keep the downhill side of the probe exposed, particularly if the probe is perpendicular to the snow surface instead of plumb. If the probe is perpendicular to the snow surface and the uphill wall of the hole is excavated plumb from the surface down, then it is possible to excavate below the level of the victim without revealing the victim.

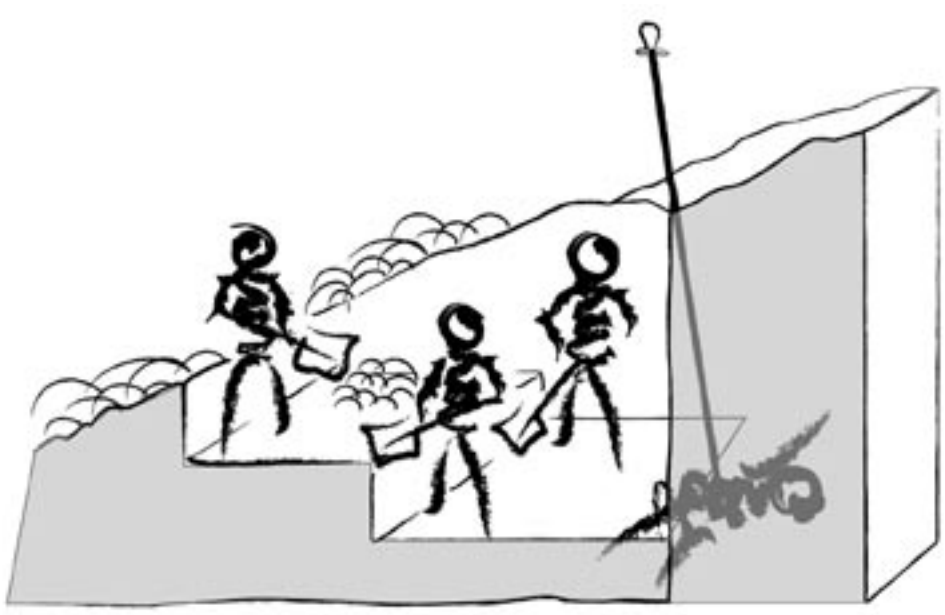
j) Once the victim has been revealed, determine the location of the head and concentrate on revealing the victim's face. Establish an airway as quickly as possible.

If two shovelers are available, they should operate side-by-side, moving snow to their respective sides of the hole. Operating in line is inefficient, for the reasons explained above.

Once the victim is revealed, the primary shoveler should remove adequate snow to provide an airway or roll the victim to provide an airway. This snow can be moved within the hole and then removed by the secondary shoveler, who is responsible for enlarging the hole to treat the victim.

If more than two shovelers are available, the two primary shovelers should begin the starter hole at the probe and the third and fourth (secondary) shovelers can begin the starter hole downhill, at 1.5 times the burial depth. All shovelers should clear snow to the sides. Once the primary shovelers are up to their waists in the hole and it becomes necessary for them to clear the snow downhill, then the secondary shovelers should exit the excavation area to rest and prepare for administering first aid and evacuation. For maximum efficiency, rescuers should rotate shoveling and resting approximately once every minute.

Deep burials of two meters or more may require an intermediate step in removing snow from the excavation area. At this depth it can be difficult to throw snow clear of the hole even with a terraced design. In this case, the primary shovelers should lift their snow to the level of the secondary shoveler(s). The secondary shoveler(s) can then clear it from the hole. One secondary shoveler may need to exit the hole to create room for this intermediate step.



In burials deeper than two meters, it can be difficult to clear snow from the hole. Instead, it should be lifted to the next terrace, where it is removed by a secondary shoveler.
Illustration courtesy BCA

CONCLUSION

Strategic shoveling techniques show promise for decreasing excavation time and improving workspace during victim recovery. The excavation phase is the most time-consuming portion of most companion avalanche rescues. Now that transceiver search times are on the decrease, the excavation phase holds the most promise for improving the chances of live recovery. We believe avalanche educators should include these strategic shoveling techniques in their curriculums.

Bruce Edgerly is co-founder and vice president of Backcountry Access Inc (BCA), which manufactures ski touring and snow-safety equipment. He religiously undertakes a pilgrimage north to a different Canadian backcountry hut every spring.

Dale Atkins is technical representative for Recco AB, U.S. Delegate to ICAR, former CAIC forecaster, and 30-year veteran of Alpine Rescue Team. The Mountain Rescue Association recently gave him the Outstanding Contribution to Avalanche Education and Safety award.

Both authors live in Boulder, Colorado.

Extended Column Test: A Field Test For Fracture Initiation & Propagation

Story and photos by Ron Simenhois

On July 21st after a snowfall of 41cm and strong SW winds, five ski patrollers went to the south face of Mt Hutt, New Zealand, to do avalanche control. Explosive work yielded minimal to no results and by the end of the route the slope was well-peppered with explosives. The patrollers felt confident. They let their guard down, stood in what would turn out to be an unsafe spot, and waited for the last charge to go off. This charge triggered a slide that propagated all the way to the top and across the entire slope. Three patrollers were caught in the slide and were partially buried with no serious injuries. While looking at the snowpack during the route, they got three lemons and CTM with shear quality 2 in three different locations. However, they also used the extended column test (ECT) and got a clear indication that a fracture would likely propagate in the snowpack if initiated.

Most avalanche workers that I spoke to about this incident could remember a similar case where a slope was loaded by explosives or skiers and didn't fail until someone hit the right spot and triggered a surprisingly big slide. In these cases, the snowpack is likely to propagate a fracture; however, trigger points may be very hard to find. On the other hand, recent research shows that fractures are commonly initiated underneath a skier but in most cases these fractures don't develop into an avalanche. Clearly, fracture propagation should also be assessed to improve avalanche forecasting.

Popular stability tests like compression, stuffblock, and rutschblock tests help us evaluate snow stability. However, these tests are primarily designed to evaluate fracture initiation. We use indirect methods such as shear quality and/or fracture character, rutschblock release type and other methods like lemons and/or flags to help us predict fracture propagation. However, there is no commonly used quantifiable test that specifically targets fracture propagation. The ECT (extended column test) and Dave Gauthier and Bruce Jamieson's Propagation Field Test both target fracture propagation.

The ECT is a modified compression test. The column is extended and becomes 90 cm across the slope by 30 cm downslope. This allows a slab to transmit stress across the column. So, if conditions are favorable for fracture propagation one can assume that initiated fractures will quickly propagate across the column.

One end of the column is dynamically loaded in the same way a compression test is loaded, using 10 taps from the wrist, 10 taps from the elbow and 10 taps from the shoulder. The tester notes the number of taps it takes to initiate a fracture and the number of taps it takes a fracture to propagate across the entire column. The test results are recorded in the format of ECT I/P@_D, where I is the number of taps it take to initiate a fracture, P is the number of taps it takes a fracture to propagate across the entire column, and D is the fracture depth. Fractures that initiated but never propagated beyond the boundary of the shovel are recorded as NP for no propagation. Fractures that propagated, but never crossed the entire column we record as PP for partial propagation.

Interpreting the test is fairly straightforward. Comparing the test results between stable and unstable snowpacks revealed that, in our dataset, the number of taps it takes to initiate a fracture doesn't clearly delineate between stable and unstable snowpacks. However, the number of taps it takes a fracture to propagate across the entire column once initiated seems to do quite a good job of separating stable from unstable snowpacks. Fractures will typically propagate across the entire column on one layer and within one or two additional loading steps of fracture initiation on unstable slopes.

Once I realized that the ECT might actually work, I tried to get in touch with Karl Birkeland, hoping to get his opinion on the new test. Karl encouraged me to continue to get more data, added suggestions on what data needed to be collected, helped analyze the data and wrote the majority of the paper for the proceeding of ISSW 2006.

Fracture initiated but didn't propagate beyond the boundary of the loading area (shovel).

Fracture propagated beyond the boundary of the shovel, but didn't propagate across the entire column.

Fracture propagated across the entire column.

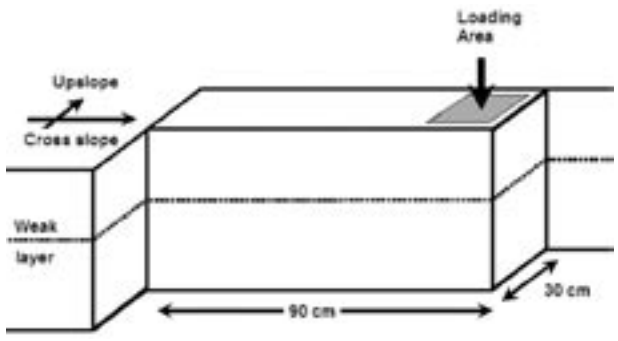
To evaluate how effective the extended column test discriminates between stable and unstable slopes, we compared our results from stable and unstable slopes. All our pits were from Colorado's continental snowpack and the maritime snowpack of New Zealand's Mt Hutt range. In addition to ECT results we collected the necessary data to assess structural weaknesses using lemons and compression test score with its associated shear quality.

Out of the 324 pits in our dataset, 256 (79%) were on stable slopes and the other 68 (21%) were on unstable slopes. We defined "unstable" slopes as those with obvious signs of instability like cracking, collapsing, or recent avalanche activity. Our "stable" slopes are steep enough to slide (≥30°) and were tested by skiers or explosives, and did not present any of the above signs of unstable slopes. We know that our definition of stable slopes is debatable, but one has to start somewhere.

We found that the ECT effectively discriminates between our stable and unstable slopes. Of all 68 tests on unstable slopes (100%), a fracture propagated across the entire column on the same or the next tap from fracture initiation. Out of the 256 tests on stable slopes a fracture crossed the entire column only 25 times (10%). Further, in only six cases did the fracture cross the column during the same step or the next loading step after the fracture initiation. The important point is that in only four cases (2%) of stable slopes the ECT indicated snowpack instability. Thus, for our limited dataset the ECT showed strong promise as a tool to discriminate between unstable and stable slopes with very few misclassifications.

Being encouraged by the ECT results so far, Karl suggested that I try to assess the spatial variability of ECT results while ski patrolling in New Zealand. I collected data from 21 stable snowpack pits in the Mount Hutt range. In a grid spanning an area 30 m across the slope by 15 m down on a relatively planar 32° slope, ECT results were spatially uniform. There were no cases of a fracture propagating across the entire column. In 17 cases the fracture did not propagate at all (NP), and in four cases in the top row of tests the fracture partially propagated (PP) across the column. Even in those partial propagation cases the fracture never propagated more than 10 cm beyond the edge of the shovel, and in this part of the slope the overlying slab was slightly thicker and stronger than across the rest of the slope. The spatial uniformity of ECT fracture propagation results is encouraging since many stability test results are quite spatially variable. In fact, the fracture initiation scores, which are often similar to CT scores, varied from 11 to 18 taps over distance of 5 m. However, these results are from only one stable slope. We do not know how ECT fracture propagation results vary spatially across a variety of slopes or under unstable conditions. Still, these results are consistent with the idea that the potential for fractures to propagate is more spatially uniform than stability test scores.

The ECT does have limitations that are important to be aware of. First, the ECT may overestimate snowpack instability in some cases where a weak layer sits under a thick hard slab. Second, the ECT is not a good tool to assess soft (F+ or less) upper layers of the snowpack. In these cases the shovel edge tends to cut those soft layers and sink through. Finally, as always, the data you collect is as representative as the site you choose to collect your data.



The preparation of the ECT involves isolating a column 90 cm across the slope by 30 cm upslope. The column is then loaded from one side using the same technique as the compression test.

Our initial results suggest that the ECT might be another valuable tool for stability assessment. In particular, we are encouraged by how effectively

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EXTENDED COLUMN

continued from previous page

the ECT discriminated between our stable and unstable slopes. Further, on one stable slope the ECT demonstrated spatial uniformity in its fracture propagation results; none of the tests fractured across the extended column. Despite the promising results, please be cautioned that these results are preliminary. The test has only been used by a few people in a couple of areas, and the study of spatial variability was only on one slope. In coming seasons we hope to investigate the use of the ECT in other locations, with other snowpacks, and with a variety of observers to further validate its usefulness. Also, the readers should remember that all stability evaluation techniques must be supplemented by additional information such as detailed avalanche and weather observations to effectively evaluate the snowpack stability. We encourage others to try the ECT in addition to their other tests, evaluate its effectiveness, and share their results and experiences with us.

Acknowledgment: I would like to thank Karl Birkeland for proofreading this article and his many constructive comments.

In 2002, Ron decided to find a real job. He quit his job developing algorithms for computer companies, left his home country, Israel, and started ski patrolling at Copper Mountain, Colorado. Since 2004, Ron has been splitting his time between Copper Mountain and Mt. Hutt, New Zealand. Please send your comments about the ECT to him at ron_si@yahoo.com

Notes on Compression Test Simulations and Systematic Error

Story by Spencer Logan

The compression test is an internationally standardized stability test (Greene et. al., 2006). A column of snow is isolated, then loaded by taps with three levels of increasing force: easy, moderate, and hard. A shovel blade is placed on top of the column. The easy step is 10 taps from the wrist, striking the blade with the fingertips. The moderate step is 10 taps from the elbow, striking with fingertips or knuckles. The taps "should be harder than the easy taps, [but] not as hard as one can reasonably tap" (Greene et al., 2006). If the moderate taps are too hard, the final 10 taps from the shoulder (hard) may hurt the operator's hand. The test score is the total number of taps at which the weak layer failed.

Compression test scores are typically comparable between operators. In one study, the test scores of operators performing adjacent tests were statistically different, but fell within the same range most of the time (Jamieson, 1999). Thus, if I tell a colleague "I got a compression test score of 15 on a weak layer 40 cm below the surface," I expect them to get a moderate score on the same layer in the same pit. If they do not, we have to examine why. Do snow properties change over the distance between the tests or do our techniques differ?

Every measurement has some error associated with it. The goal of both a standardized technique and careful preparation is to minimize the error. Therefore, differences between tests should mean a difference in snow properties rather than variance in tapping force.

I became interested in measurement error while researching spatial variability in Montana using shear frames. I have no plans to pull frames in the future, but since I use the compression test frequently, I wanted to examine the measurement error associated with it. Because the compression test can be simulated without snow, examining measurement error is simpler as well.

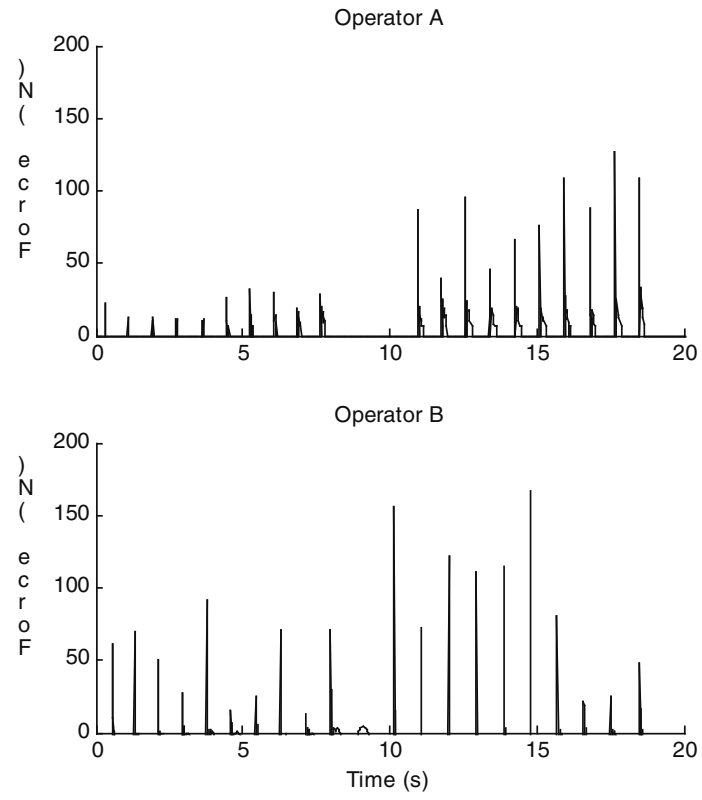
With a Practitioner Research Grant from the American Avalanche Association, I purchased a force plate and data-logging software. The force plate is similar in size to an avalanche shovel, and it records the force of an operator's taps with precision of 0.3 N. The software records the force and allows me to synchronize video with the taps to examine in detail any differences in technique.

I began collecting data at the International Snow Science Workshop in Telluride, Colorado. During the poster session, 53 different operators cycled through my display. Each operator did at least two trials. Thank you very much to the participants and for all the conversations and suggestions. Analysis of the data is far from done, but I have several observations from the ISSW:

1. Technique matters. Operators with careful technique had less variation in their tap force. Careful operators also had better differentiation between the easy and moderate taps *(see figure at right)*.
2. Operators from a maritime-snow climate generally applied more force for easy taps than those from a continental climate. Among the gentlest tappers was an operator from the San Juan Mountains of southern Colorado. His easy taps averaged 19 N. He explained that he frequently looked for shallow, very fragile weak layers. His moderate and hard taps were similar in range to most other operators.
3. For most operators, the mean of easy taps fell between 40 and 80 N and the mean of moderate taps fell between 70 and 200 N. These ranges are quite large. Averages of operators with careful technique tended toward the lower end of the ranges. Hard taps were quite variable, and I did not collect hard taps from everyone.
4. There was no correlation between time of test and operator variability. This suggests that while alcohol drinking rates at the ISSW poster session varied among operators, it does not need to be controlled in future trials.

Having so many operators cycle through the experiment brought up some potential problems that I will address this winter. The primary problem was the feel of the force plate; it did not respond like a column of snow. Instead, it sounded and felt like metal sheets on a 2x4 stand. As one operator explained, he would tap, get a clunking sound, and he would lighten his next tap. Then, realizing that the tap was too light, his next tap would be harder to make the force plate clunk again. The result was a cycle of lighter and harder taps. The hard taps proved to be a problem as well. A few operators hit with forces above 700 N, bouncing the force plate off the stand. The hard taps also increased the plate's strange feel. For these reasons I stopped collecting the hard taps about halfway through the session.

Spencer Logan collects tap data from Bruce McMahon at an ISSW poster session. *photo by Doug Richmond*



Force plate readouts for easy and moderate taps from two different operators. The maximum force for each tap—the peaks—was used in the analysis. Timing of taps was not used. Operator A was very careful in his technique, Operator B less careful. Operator A's mean force for easy taps was 21.5 N with a CV of 0.37 and a mean of 70 N with a CV of 0.39 for moderate taps. In contrast, Operator B's mean force for easy taps was 54.8 N with a CV of 0.57 and a mean of 97.6 N with a CV of 0.43 for moderate taps.

Several people expressed interest in using a force plate as a training tool in order to standardize tap forces. A force plate could be useful, but the operators would need to practice enough so that the feel of the plate is no longer an issue.

This project is not an attempt to standardize the tapping forces in the compression test or to criticize anyone's technique. I also do not want to discredit the test. Rather, I want to examine and better understand the variations in conducting one of my favorite stability tests. With a sufficiently large database, I hope to quantify SOME of the potential differences in score between operators. Filtering out measurement error and differences in technique will allow us to concentrate on the differences in snow properties. Doing so will improve our ability to communicate and share compression test results in the future.

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Spencer is currently an avalanche forecaster for the Colorado Avalanche Information Center after forecasting in northern Utah and digging too many study pits in southwestern Montana.

HALL OF FAME

continued from the cover

Now 58, Roberts peppered his presentation to the entire ISSW the next day with witticisms about Chief Ouray and the removal of the Utes—"a bad real estate deal"—and the 19th century miners who so often placed themselves in harm's way by "spending their gold nuggets on soiled doves."

Down the table from Jerry sat Chris George, another INSTAAR veteran and proprietor to this day of the St. Paul Lodge—at 11,400' on Red surely the highest gourmet backcountry destination in the country. An outspoken, white-bearded Englishman, George is credited with bringing the Outward Bound School from Britain to Colorado after the war. He and Don Bachman were in charge of hazard forecasting and mitigation for the International Speed Skiing Championships in Colorado Basin (now Silverton Mountain) in the early '80s, competitions which produced new world records: over 135mph for the men (Franz Weber) and 120mph for the women (Telluride's own Marti Martin Kuntz).

Bachman was there at the dinner, too, his booming laugh rising above the din. Don had been Crested Butte's ski patrol director and was running Tony's Tavern in the Butte when the San Juan Project called. In Silverton from the beginning, he arranged for the rental of a Main Street house/base of operations. He got permission for the five study sites and coordinated missions with the Colorado Department of Transportation, all of which must have been scary for a skinny guy with long black hair tied in a bandana. "Silverton in '71 was essentially a redneck town," Bachman told me later. "Pete Peterson used to joke about my 'hippie hair.'"

Noel "Pete" Peterson sat across the table. He was the CDOT engineer in charge of firing the war-surplus howitzer during the INSTAAR years. A friendly, gentlemanly, "get 'er done" kind of guy, Pete liked working with the young skiers and snow geeks. He understood that they were trying, as was he, to understand what made the San Juan snowpack so fragile and unpredictable.

Every time Pete shot a slide down (or one came down on its own), Rod Newcomb climbed up on skis to do a fracture-line profile. Newcomb is one of the certified legends. Slight and quiet—and forever in climbing shoes—respect hovers around him as it would have surrounded Joe DiMaggio or Roberto Clemente. He is co-owner of Exum Guides in Jackson Hole and founder/director of the American Avalanche Institute, whose courses have provided snow wisdom to over 8,000 backcountry users since 1975.

If you didn't take your first avalanche course from Newcomb, then chances are you took it from Don Bachman (that was me in 1979) or the guy sitting opposite him at the table, Knox Williams. Knox is familiar to radio listeners hereabouts as the voice of the Colorado Avalanche Information Center (CAIC). It is a high-pitched, Texas-inflected voice, but the distinctive twang cannot disguise the intelligence there, especially the weather smarts. Williams contributed forecasting support to the San Juan Project, though it was secondary to the forecasting provided by BuRec's cloud-seeding contractor in Durango. At the same time, he was the first full-time weather guy for the U.S. Forest Service Avalanche Center in Fort Collins. When the USFS terminated that program, Knox spun around and created the CAIC in 1983. Invariably, he ended his radio broadcasts with a Cronkite-like signoff: "As always, be careful out there."

The man (or the couple, really) charged with managing the San Juan Avalanche Project was Richard Armstrong and his wife, Betsy. They hardly look old enough to have been adults in 1971, but there they were near the head of the table, reminiscing. Betsy was pregnant the second INSTAAR winter, a fact that earned her the respect of the howitzer crew, whom she followed at every opportunity. In 1977 she published *Avalanche Hazard in Ouray County, Colorado 1877-1976*. It is a fascinating, occasionally poetic, look at hundreds of avalanche incidents, including 62 deaths, gleaned from the newspapers of the day. Together, she and Richard compiled avalanche atlases of Ouray and San Juan counties and authored over a dozen INSTAAR-supported studies on snow mechanics, metamorphism, avalanche forecasting, and control methods.

The Armstrongs and all of the other INSTAAR gurus would tell you that their work would not have been possible without the man at the head of the table. From where I sat he was barely visible, his 80-year-old body slightly stooped, his shiny dome surrounded by a skirt of snow-white tufts. This gnomish figure, mentor to all the others, was Ed LaChapelle, "the Wizard of Snow and Ice," come down from his lair in Alaska to be the keynote speaker at ISSW.

Lest anyone doubt his wizard characterization, ISSW banquet master of ceremonies Mark Moore (one of LaChapelle's many grad students at the University of Washington Department of Atmospheric Sciences) ran off this list of accomplishments: USFS snow ranger at Alta in the 1950s (where he hunted snowslides with Monty Atwater and was married to Dolores LaChapelle, author, powder skier, and now deep ecologist), led the avalanche-control team at the 1960 Winter Olympics in Squaw Valley, professor at U. of W. 1960-1983, renowned glaciologist, co-developer of the avalanche rescue beacon, originator of the GazEx exploder idea.

(In his talk, LaChapelle said he was inspired by Don Bachman blowing up his lunch bag one day on Red Mountain Pass. "So you see, some innovations don't come from these keen engineering ideas; they come from people screwing around!")

Finally, Moore asked for a show of hands: "Who out there owns a copy of Ed's (1969 classic) *Field Guide to Snow Crystals*?" Four-hundred arms—half of all the arms present—shot skyward.

As lead scientific consultant for the San Juan Project, LaChapelle was the first to describe these mountains as a "radiation snow climate." The combination of southerly latitude (sunny days), high elevation (extreme nocturnal radiation), and thin continental snow cover created a recipe, many recipes, for instability. Ed nailed it 30 years ago, and he and everybody else is still trying to figure out how it all works.

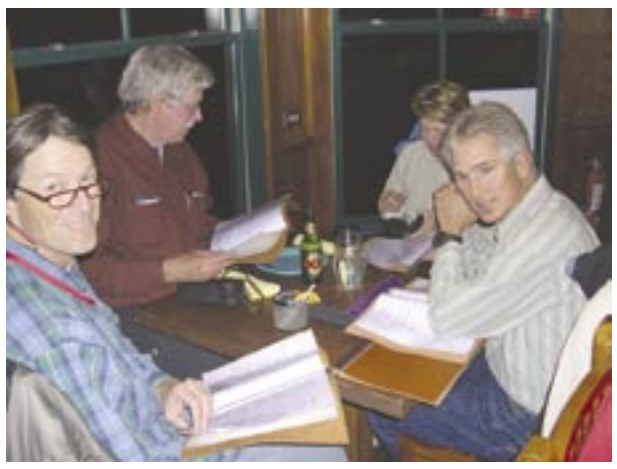
So, what about the Bureau of Reclamation's Project Skywater? "A bunch of reports were prepared," says Bachman, now a semi-retired consultant (without the bandana) in Bozeman. "The outcome was that the weather modification program came under state auspices. There was a lot of local resistance to cloud seeding. And the INSTAAR project proved (the obvious, proved scientifically) that if you make a big storm bigger there will be more and more-destructive avalanching."

A quarter century later, cloud seeding remains controversial; it never has proved the kinds of snow-water increases BuRec was hoping for. Nevertheless, some INSTAAR contract veterans continue to provide cloud-seeding services to water conservancy districts and ski areas on the western slope of Colorado.

A few project alums, like Jerry Roberts, stayed on to ski, to teach, and to help mitigate the hazard threatening the high-pass highways. The rest of the INSTAAR team rescattered to mountain ranges around the West. Much of what they are doing now saw its genesis in a decade of intense, high-spirited and highly creative work at the top of the San Juan Range.

While Peter Shelton teaches an occasional field session at the Silverton Avalanche School, he says he is otherwise unqualified to talk about snow, unless you count the fact that he listens well and spends as much time as possible with the mentors mentioned above, and with others too numerous to name and too generous to want credit.

Denny Hogan points out that Chris George is the real deal.



l-r: Peter Shelton, Don Bachman, Suz Williams, Knox Williams

l-r: Rod Newcomb, Mark Mueller, Knox Williams, Jerry Roberts

clockwise from left: Richard and Betsy Armstrong, Ed LaChapelle, Sam Colbeck, and the back of Don Bachman's head visit at the INSTAAR dinner.

Jeff Campbell chews the fat with Rod Newcomb

From: "rnewcomb" <rnewcomb@wyoming.com>
To: "Jerry Roberts" <snowviewer@montrose.net>
Sent: Monday, October 16, 2006 8:45 PM
Subject: San Juan Project

Jerry, truly a memorable evening. A good project, like a good expedition, is when everyone ends up friends for life. The San Juan Project was certainly a winner. I could not have started my avi courses without those three years of working with those folks, particularly Ed. Good to see the Armstrongs again. Interesting that they got married again. They always seemed a good fit. Thanks for making the effort to make the evening a great one. Rod

education

Doug Richmond (left) and Bill Williamson celebrate Bill's 50th birthday in Big Sky powder.
photo by Tom Leonard

NEEDED: A Few Good Folks

A Reflection on Mentorship

by Bill Williamson

It was during the mid-'70s when I decided that I wanted to get a job at a ski area. I had absolutely no idea what I wanted to do or what I was in for. I had spent my teens in Hawaii, a lot of that time at the beach, and I had only passed through the mountains when I was much younger. It wasn't until the previous spring when I had moved to the "Mainland" that I had gone skiing a few times. All of those days were beautiful California spring days; if they hadn't been I doubt that I'd be writing this today. I was surprised at how easy it was to get a job at an area. I ended up picking an area that had employee housing to simplify the transportation and rental hassles. The first job I had that fall was as a porter in the hotel; it didn't take long before I decided that was not a career path I cared to pursue. After about a week and a half I was lucky enough to get a job as a snowcat operator (a much cooler job).

Just before the holidays in December I was assigned a roommate for my 8x10' room. My new roommate attended Dartmouth—for the last three years he had taken the winter semester off to work on the Professional Ski Patrol there in the Sierras. We had a pretty short list of main conversation topics; the primary ones were surfing, girls, beer, and a new subject matter for me: ski patrolling and avalanches. Doug was a self-proclaimed "Avalanche Hunter" and had a huge influence on me; he became my first true mentor. Over the next several months he would help teach me how to ski and give me information about the trees, the geological formations, different types of snow crystals, and how being a ski patroller doing avalanche control wasn't a job, it was the best thing that could ever happen to someone.

It took me almost a year and a half to get on to the patrol. I worked several different jobs at the area and then got in with the volunteer patrol, and by the end of my third season I was a professional patroller. My first full season as a pro patroller had a huge learning curve associated with it; my partner and I were both caught in a couple slides each (we were clueless). I saw major medical carnage—everything from fatalities to leg injuries that only safety straps and plate bindings could produce. Then of course my skiing ability improved to the point that I could practically get down anything in any condition (although it wasn't pretty—still isn't).

During the next couple of years, I went into education overload, became an EMT, signed up for a weather course, and attended four avalanche courses. The first course I took was led by Norm Wilson, another man who would have a strong influence on me. I'm not sure when he went from being an insightful instructor to mentor to good friend, but throughout our entire relationship he taught me to appreciate the field that I had luckily stumbled into.

After a couple years of doing control and patrolling, I went to New Zealand where I was fortunate to get on at one of the few fields that was doing avalanche control at the time. I was even more fortunate when I was able to attend the first New Zealand Avalanche Workshop. Ed LaChapelle was the lead instructor.

When I returned from N.Z., I felt I was ready for a bigger area with a notably progressive avalanche program. Once again, I lucked out. After a couple months of calling, stopping by, having friends call the mountain manager, and helping the Patrol Director frame a few walls on his new house, I got the only job given out there that year.

This was a patrol where 10-15 years experience was the norm and everyone had a few hairy stories to tell. There was lots of knowledge to tap into. One man in particular became not only a good friend but another true mentor. When Tom would talk about what he felt while traveling across or probing the snow, a whole new aspect of forecasting opened up for me.

Those were some of the most inspiring years of my life: dealing with life-and-death situations, the tragic losses of friends and co-workers, peppered with the best skiing and best times one could imagine. The friendships from that time are indescribably strong. That's not to say we were all best friends—we weren't—but we did share a camaraderie and respect with the knowledge that there was a two-way "I got your back" attitude with all the co-workers.

This story is probably very similar to countless others who have or still patrol at numerous ski areas throughout the West. I consider myself extremely lucky that I worked with progressive patrols where avalanche control was the priority, but luck was not the only factor. There was persistence—in getting a toe through the door, in taking the right classes, in meeting the right people (usually patrollers and forecasters), and being around, making yourself available, letting them know you're interested but not annoying them too much (sometimes a fine line). Once you've got the position, befriend the experienced, the knowledgeable, the true experts, and remember that experience is where the majority of your training will come from.

In those years there was little turnover, which created an almost exclusive group. If you were allowed in, you usually brought years of experience at that area or patrol experience from somewhere else. This is the way it still is at a few areas, but not all. Getting on many patrols has gotten easier.

Personally, I think this is closely related to the cost of living in or near resort areas. It used to be that if you found a reasonably decent-paying summer job, you could figure out how to make it work doing what you loved in the winter. Many of us were and are carpenters, wildland fire fighters, surveyors, window washers—I even heard of a guy who was a roadie on world tours—whatever it took. Now it takes an even stronger commitment because if you weren't lucky enough to be born with money, smart enough to marry it, or bought your house 20 years ago, you'll probably be living on poverty-level wages and eating Top Ramen.

So the good news is that there are more openings and that finding yourself at the all-necessary "right place at the right time" is more likely. The bad news is that it could possibly be years before you can reach what might be considered a livable wage in the community you work in.

The bottom line is that it is still challenging, if not tougher, for the new avalanche workers entering the ski industry, primarily because of the financial (or lack of finances) commitment. But as far as getting the job, the basics are the same: be persistent, get to know the right people, get some experience (hands on and educational), and then hope you're there at the right time.

Those were some of the most inspiring years of my life: dealing with life-and-death situations, the tragic losses of friends and co-workers, peppered with the best skiing and best times one could imagine.

Bill Williamson is currently the Mountain Manager/ Operations Director at Ski Schweitzer in northern Idaho. He is the ski area representative on the AAA board. If you have further questions on getting into ski patrol work, please contact Bill at bwilliamson@schweitzer.com

To: Michael Jackson
From: Craig Patterson
Re: Avalanche Mentorship
Date: Sat 23 Sep 2006

Michael,

You may remember me from the Black Diamond Warranty Center where I used to work as a customer service rep. I e-mailed with you last season concerning the PAWS class that you all conducted here in Utah. I also tried my damndest to breathe life into your old faithful T2s.

I read your article this morning in the most recent *Avalanche Review* concerning mentorship. I thought I would throw a little feedback your way.

I have wanted to make my living as an avalanche professional since I moved from skiing in-bounds to the wide-open world of the backcountry as a teenager. I went to college and earned a geology degree, as it was what was available for those who wanted to study and work professionally in the mountains. As far as I knew, there wasn't a snow-science degree offered.

Disenchanted with the possibilities of working for an oil company or remaining in the world of academia, I moved to Alaska and chanced into work helping teach avalanche classes. This led to guiding and eventually moving to Salt Lake where I now work with Exum Utah Mountain Adventures, where I guide, teach avy awareness classes, Level 1s, assist with Level 2s, and work as a field observer for the UAC.

I feel like I am on the "less-than-linear progression" that you cited in your article towards developing a full-time career as an avalanche professional, piece-mealing guiding work with avalanche education and work as a field observer. I would love to find "handrails" for guidance through this whole process to turn my job into a full-time career. I understand that no one is making money in this field, but I am one of those idealists out there who drives an '86 Toyota and lives off of rice and beans if it means that I get to earn a living doing what I love. My wife and daughter aren't always enamored with this decision, but they are supportive and love seeing me smile.

This is where I think that the mentor program and developing career-path flow charts and contact lists would be an invaluable service for those aspirants among us. I remember not long ago searching for jobs in the industry, talking with ski patrol directors, searching Dept. of Transportation and Forest Service job Web sites, only to come away frustrated and discouraged. Landing a job in the industry seems to be more about who you know, not what you know. And when you're starting out and you don't know anyone, it's tough.

I have reached that point where I feel like the only direction for me to go to turn my passion into my career is to go back to school and study snow. I could continue to guide and teach classes, but I would really like to get more involved with the esoteric side of avalanches, and maybe even contribute something to the collective knowledge that exists out there about snow and its dynamics. Mainly though, I have arrived at this decision because it seems like the only means to work as a full time professional and land a job forecasting, doing control work on highways or land-use planning in avalanche terrain. Applying for one of those jobs, if they are ever posted publicly, seems like a shot in the dark with a geology degree and a guiding background on my resume.

I truly think that what you, Lynne, Bill, and Andy are trying to do by setting up a mentorship program has been needed for years. There are enough folks out there who would love to contribute to this industry with their fledgling knowledge and work ethic, but just don't know how. People like me. I hope that you guys succeed in this and would love to help out however I can. I am only a member affiliate of the AAA,and don't even come close to wearing the shirt of a mentor, but I am an aspirant who wants to get involved and learn as much as I can so that one day I might be able to give back to someone else willing to work for peanuts in the one of the great offices of the world.

Regards,
Craig Patterson

NEXT STEPS IN THE MENTORSHIP PROJECT

We have asked the AAA section reps to help us by contacting professionals in the avalanche fields of Ski Patrol, Forecasting, Highways, and Guiding. These professionals are requested to send a short description of what skills, traits, and experience they would like aspirants to bring to a job interview in their field, so that we can compile them for an article and for your use. We hope that some of these professionals will then be available to act as mentors themsleves.

media

Photo Contest

Size 5 avalanche crown on Mt. Baldy
Perla's Chute in Alta, Utah
January 11, 2005

STORM DURATION
16 days: 12/27/04 to 01/11/05

STORM TOTAL
134" / 13.96"

AVALANCHE CYCLE
started 01/10/05 after 122.5" / 12.44"

Area had been shot with 105RR and avalauncher thoughout storm with little results. Powder burn in crown is from multiple 4 lb handcharges shot on 01/07/05 with surface snow results. Alta's Snow Safety Director, Titus Case and "Gunner" Jackson (the trigger man) are measuring up the results.

Photo by Howie Howlett,
Alta's Assistant Director of Snow Safety

Howie started patrolling at Alta in 1979 and continues to enjoy watching avalanches.

crown profiles

ISSW 2006: A Practitioner's Overview

Story and photo of ISSW banner by Doug Richmond

There we were again. This time almost 800 of us snow and avalanche geeks met in Telluride, Colorado, for the 2006 International Snow Science Workshop. There were retired legends that aren't really retired, like Knox Williams, Sam Colbeck, and Ed LaChappelle. There were prolific contributors, like Bruce Jamieson, Karl Birkeland, and others who inspire bright students to contribute. There was an array of foreign folks, with strong showings from Switzerland, France, Norway, Iceland, New Zealand, India, and others. The Japanese were back with their special brand of understated humor and their fearless presentations in our very foreign language.

Our hosts did a commendable job of dealing with the hoards. Sterbie was great. He had lots of help from the Telluride Mountain Village and a host of local volunteers. They brought back the simulcast room that was a hit in Penticton, and they sent the feed to all of the TVs in the Mountain Village. That left room in the convention hall for me to sit in the front row.

The public transportation was deluxe. Eight-person gondolas ran 7am to midnight from the town of Telluride and from mountain lodging to the convention center in the Mountain Village. The commute home to our condo in town was spectacular, dropping down black diamond runs to the town, wedged into a narrow valley floor and surrounded by craggy peaks.

The schedule was similar to past ISSWs, with presentations Monday, Tuesday, Thursday, and Friday. There were 20-minute talks from 8am until early afternoon, then a different poster session each afternoon, with plenty of complimentary beer. Wednesday was an outside day, with several different field trips, a golf tournament, and a 20th anniversary party for the AAA.

The banquet featured the incomparable humor of Mark Moore, roasting Knox and providing us with rigorous logical proofs, and some history from Ed LaChapelle on experiments that didn't work. There was a ladies night that honored some of the great women in our field, and there was lots of time to catch up with old friends.

As far as what we learned from the cutting edge, you can see it all in the big city phonebook-sized proceedings that they handed out at registration. Borrow it from a friend. Put yours in the patrol shack. It is nicely organized into 20 sections, so you can find your topics of interest. Here are a few papers that interest me:

BRAINIAC STUFF

There are plenty of formulae, models, and theories in the proceedings for you geniuses to puzzle over. Try reading this one by Faillettaz and others: *Cellular Automaton Modelling of Slab Avalanche Triggering Mechanisms from the Universal Statistical Behaviour to Particular Cases*. Most of these talks baffled me, but some get points for style. Like Peter Gauer on instrumentation and theory behind measurements of avalanche dynamics: "Ya… it's complex."

FIELD STABILITY TESTS

Mark Moore gives a good overview and comparison of several field tests and relates them to decision-making.

Two papers discuss "extended column tests" to better evaluate fracture propagation potential: Simenhois and Birkeland use a cross-slope extended column, where they triple the normal compression test column width and tap on the shovel at one end. Gauthier and Jamieson isolate a down-slope extended column and start at one end, sawing along an identified weak layer until it fractures. Interestingly they say their results are independent of slope angle and even work on the flats.

Spencer Logan had a great interactive poster, where he set up a computer, a force plate, and a video camera and let participants take a whack at calibrating their shovel-tapping technique.

FIELD MEASUREMENT TOOLS

Steve Conger tests a "capacitance-type snow sonde" for measuring snow-density profiles. Dave Hamre describes an Alaska railroad program that integrates advanced technologies in avalanche forecasting, detection, and control. Show this one to the boss if he complains about your budget.

Deems and Painter discuss airborne laser altimetry (lidar) for mapping snow depth. Jorg and others present a "terrestrial laser ranging system" that measures snow-depth distribution at a range up to 1km. Their handout shows the "LPM-i2K," which looks like the closest thing yet to stability goggles.

AVALANCHE INITIATION

Still not much progress on replacement of explosives, but there were a few papers on the effects of explosives on snow. Check out Binger and others, and Chernouss and others. These and other papers that look at slab properties and their reaction to external forces will eventually lead to better tools for rattling the slabs loose.

TRANCEIVERS

There were a few papers on this important topic, including one by Felix Meier on formalizing receiver bandwidth standards. His conclusions state:

"Receiver bandwidth should be optimized for best performance and not for accommodating out-of-spec

One of the ISSW field trips visited Chris Landry and the Center for Snow and Avalanche Studies' Swamp Angel research site near Red Mountain Pass north of Silverton.

1. A laminated sign informs visitors about the Swamp Angel site. *photo by John Stimberis*

2. Chris Landry explains the site's instrumentation. *photo by Keith Roush*

3. Jayne Thompson, Amy David, and Erica David (the amazing Pinedale high school grrls), and Sarah Carpenter, the PAWS course organizer, pay close attention to Chris's explanantion. *photo by John Stimberis*

1. The Northwest Avalanche Center relaxes at the AAA anniversary party. (clockwise from left): Linn Baugher, Rob Hunter, Knox Williams, Mark Moore, Rich Marriott, Paul Baugher, Suz Williams.
2. Tom Kimbrough and Ron Matous share dinner and a chat during the AAA anniversary party.

photos by Lynne Wolfe

transmitters. The users of such transmitters should be encouraged to replace their devices."

When questioned, Felix did not name models to replace, but suggested looking at his references.

CASE HISTORIES

We heard some interesting mining and avalanche history of Colorado and the Telluride area from Dale Atkins and from Betsy and Richard Armstrong. Jerry Roberts, Mark Rikkers, and Pete Peterson gave a great first-hand history of their many years of control work on Red Mountain Pass.

Scott Savage gave a good summary of terrain and climate at Big Sky, Montana, then looked at 74 deep hard slab events and discussed their forecasting and mitigation. The New Zealand folks, Hendrikx and others, and Carran and Conway, were back with photos of their spectacular scenery and tales of eight meters of water per year in the starting zones above the Milford Highway. And Blase Reardon showed us the odd nature of glide avalanches in Glacier National Park, USA. He used more understandable scientific terms like "house of mystery" and "rotten bastards" (he wasn't talking about the government).

EDUCATION

The great strides continue in getting the avalanche-education message out. This is thanks to efforts like Craig Gordon's avalanche awareness for "teens with rad genes." His was the most energetic presentation, and he got the most laughs (OK, he tied with Mark Moore's banquet effort). Craig's enthusiasm is reaching lots of young folks in Utah and beyond.

There were some eye-popping graphics presented by several educators and forecasters, including Tremper and Conway on "graphics-based" methods for presenting not only an internet daily forecast, but incorporating some effective education.

The most impressive education graphics were presented by Stephan Harvey, who showed us the Swiss interactive avalanche learning CD called *White Risk* which achieves "…presenting and illustrating the entire complexity of avalanche education in an attractive and interactive way." No kidding! The CD user can engage in self-teaching and self-testing by navigating through great 3-D graphics. I was sitting near Blase during Stephan's presentation, and I heard him say, "We just lost our jobs." You can see some of the graphics in the proceedings paper. They had the CD on sale at the Swiss booth for $20, but it was in French. I almost bought it anyway, then settled for a Swiss army knife and the promise that the English version will be available soon.

OTHER PAPERS OF NOTE

This was the second ISSW where we had remarkable science presented by Liz David's high school students from Pinedale, Wyoming. Amy David and Jayne Thompson presented a study on windblown dust, and Erica David presented two papers that address the science behind water conservation. One adds to her previous work on improving snow-fence design, and the second looks at snow accumulation on tree branches. These were all well-organized and well-presented, interesting papers.

Also look at Jon Andrews's excellent overview of avalanche-control history, methods, and safety. This is a timely reminder to evaluate and update your avalanche control program on a regular basis.

There are many more valuable papers in the proceedings. My copy will be at Patrol Headquarters, collecting coffee stains and hopefully providing some insight for our team. Spread the word, and do some science of your own.

Thanks to Marmot and to all of the other great sponsors who brought us this workshop and who continue to provide us with gear, technology, and beer! See you in Whistler for the 2008 ISSW.

Doug Richmond is the Snow Safety Director at Bridger Bowl, Montana, and the Vice President of the AAA.

Ode to Oscar

by Rich Marriott

The wiener has been sighted, it would seem he is delighted!
Astride a fearsome horse beneath his gleaming helmet,
on the tram at Telluride it seems that we were well met.
With leaves tumbling down and snow visible up above,
all of us were smitten with a curious wiener Love...
Summer has come and gone Winter is just ahead.
It's tough to study spatial variability with a two-foot wiener lounging on your bed.
Our tubular friend is in our possession
Yet in Telluride, 5,000 dollars isn't much of a concession.
So off we'll go to Canada, only 2 years hence,
will the wiener be reunited? I can't bear such suspense!

A Snow Geek's Perspective on ISSW

Story by HP Marshall

First off, from a science geek's perspective, ISSW is by far the coolest meeting on the planet. Scientists and practitioners in one place coming together over a love for snow…and beer…and mountains. In comparison with the other science meetings I go to, this one has by far the highest percentage of people with social skills who like to have fun. It brings together avalanche practitioners with the experience and intuition that no differential equation or integral could ever match, with snow scientists who are applying and adapting the latest math, physics, and technology to one of the most complex and dynamic materials on the Earth.

Once again, this year's meeting was full of interesting presentations and great ideas. There's not nearly enough room to mention every insightful study, but here's what still sticks in my mind after a week packed full of long days of presentations, late nights full of rambling about new ideas, and blurred by more than my share of brewskies.

I'm leaving out names so no one feels left out, and also to get you to dig into that enormous and wonderful book full of proceedings papers (Great job, Andy!).

Several new stability tests were presented, two of which look at the propagation of fractures, and one that accounts for the size of the tester. A study comparing the strength of compression test taps between observers was performed during the meeting. Avalanche education has taken a great step forward, integrating new forms of media. Forecasts are now being produced for a wide range of user experience levels, from basic forecasts intended for media distribution to highly sophisticated interactive computer-based forecasts for the experienced backcountry skier.

Snow pack and stability modeling are continuing to improve from simple rule-based cellular automata models to sophisticated microstructural models. Stability models are being adapted to different areas, and new DEMs are allowing radiation and wind drift to be modeled at very high resolution. New large-scale avalanche dynamics experiments were presented from both Switzerland and Norway.

Many high-tech instruments are being developed and improved for snow research including the use of LiDAR aircraft surveys for snow depth measurements, infrasonic sensors for montoring avalanche activity, radar for measuring snow depth, stratigraphy, and locating avalanche victims, density and depth probes, particle image velocimetry for measuring snow deformation, and penetrometers for measuring hardness and mechanical properties. These new tools are allowing spatial variability to be studied at a new level, due to the great increase in measurement speed.

Many great historical presentations were made, on the history of Colorado avalanche accidents, avalanche research in the San Juans, forecasting and mitigation in the San Juans, and the Avalauncher. Several presentations focused on wet slab and glide avalanches, which may become more important with rising global temperatures. Several high school students made excellent presentations that show snow science will continue to teach us new things in the years to come. Don't miss ISSW 2008 in Whistler, B.C.!

HP Marshall is the research committee chair of the AAA. Despite his hip demeanor, he is one of the most highly educated geeks around. photo by Lynne Wolfe

ISSW WRAP-UP: Thank You Note

From Craig Sterbenz and Nicole Greene

left: ISSW organizer and Telluride snow safety director Craig Sterbenz. *photo by Nicole Green*

right: Nicole Greene and her dog Moki skiing Ophir's backcountry. *photo from the Nicole Green collection*

The peaks were white and the aspen leaves were golden in the San Juan Mountains during the first week of October when 810 snow and avalanche professionals converged in Telluride, Colorado, for the 2006 International Snow Science Workshop. With arguably the most avalanche-prone snowpack in North America, notoriously steep terrain, several world-class ski resorts, extremely avalanche-prone highway corridors, and with endless recreational opportunities for backcountry skiers, snowboarders, snowshoers and snowmobilers, our region has long been a hotbed for the study of snow and avalanches. Hosting the ISSW in Telluride provided ISSW participants with a global forum to discuss pure and applied science together with the practical frontline duties of avalanche safety and mitigation as well as to learn about the history of the San Juans through lectures, field trips and film.

An event of this kind is years in the making and can only be made possible with the commitment of many individuals, organizations, and companies. On behalf of the ISSW 2006 Organizing Committee we would like to take this opportunity to acknowledge everyone who contributed to make our event a success.

Most notably, we would like to thank our Sponsorship Chair, Mike Friedman, who not only worked diligently to make our sponsors feel welcome, but also provided integral leadership in all aspects of planning the ISSW and our Guest Services Chair, Deedee Sterbenz who put in countless hours to take care of all the little details, to make the ISSW a smooth event. Our gratitude goes out to our Papers Chair, Andy Gleason (and his wife Leslie who gave birth to their second child only days before the ISSW!) who led his Papers Committee comprised of Richard Armstrong, Dale Atkins, Karl Birkeland, Jeff Deems, Ethan Greene, Hal Hartman, Denny Hogan, Spencer Logan, HP Marshall, Mark Mueller, and Jerry Roberts to creating a program that was well-balanced and stimulating.

Without the support of Rod Newcomb and the ISSW 2004 Organizing Committee as well as the guidance of Rich Marriott and the ISSW Steering Committee, we may never have gotten the 2006 ISSW off the ground. Jeff Proteau and the TSG Ski and Golf Company provided us with the means to secure our venues and the staff at the Telluride Conference Center helped us to fathom hosting the biggest conference in Telluride history.

Local support of the 2006 ISSW was integral in the planning of such a massive event. The Telluride-based, non-profit San Juan Field School hosted the ISSW and made the planning of this event a part of their programming for the last two years. We received generous funding from a variety of local entities to make our event possible. Most notably, we were granted both in-kind and cash donations from the Mountain Village Owner's Association. Additional local sponsors included the Telluride Foundation, and the Town of Telluride's CCAASE fund. We would also like to thank Chris Colter, Mountain Village Cable, Kieth Prather of Presentation Services and Kellie Erwin-Rhoads who worked together to simulcast the ISSW Proceedings to the Peaks Resort and your hotel rooms. Jeff Campbell, TCTV, and the staff at the Palm Theatre made Movie Night possible, and Johnnie Stevens and Bill Mahoney Senior provided the entertainment.

Corporate sponsorship of the ISSW is perhaps the most important ingredient in creating a successful event. We're thrilled that our presenting sponsor for the 2006 ISSW was Marmot, offering a great selection of technical outdoor clothing and equipment. Our supporting sponsors Arc'Teryx, Patagonia and Pieps provided critical support to make the ISSW possible and we would also like to thank our contributing sponsors: Backcountry Access, CIL-Orion, Life-Link, Mammut, Ortovox, and Wasatch Touring. And, of course, everyone appreciated the extremely generous beer donations from Big Sky Brewing of Missoula and Steamworks of Durango.

We would also like to thank our keynote speaker Ed LaChapelle and his supportive wife, Meg Hunt, for coming out of retirement to join us for ISSW 2006 – Ed's keynote speech was both enlightening and inspiring and Mark Moore's eloquent and hilarious commentary throughout the evening of the banquet provided the perfect context for a wonderful evening.

The first ever Ladies Night, hosted by ISSW 2006 and Babes In The Backcountry is a new addition to the ISSW and was an incredible evening made possible by a generous donation from the American Avalanche Association as well as support from Athleta, Black Diamond, Backcountry.com, Clif Bar, G3, Jagged Edge, Isis, Mountain Hardware, Patagonia, and Pistil. The evening incorporated a special tribute to Sue Ferguson and honored eight other female pioneers in the field of snow and avalanches and provided the women of ISSW with a means to create a network of support in the predominantly male-dominated field of snow and avalanches.

An integral part of the ISSW experience is the Field Trip – this day provides participants with an opportunity to look at a variety of operations in the host area. This year, attendees visited a variety of local venues including the Town of Ophir, Red Mountain Pass, the Pandora Mill, Silverton Mountain the Telluride Ski Area and for the less motivated, the Peaks Resort Spa. We would like to express our gratitude to all of our Field Trip hosts including Art Mears, Joe Shults, Chris Landry and the Center for Snow and Avalanche Studies, Don Bachman, Pat Ahern and Silverton Mountain, Johnnie Stevens, Senior Mahoney, Gary Richard and the Telluride Ski Patrol, Jerry Roberts and Susan Hale of the Colorado Avalanche Information Center, and CDOT and Mark Rikkers.

We would also like to pay tribute to all of our volunteers who worked so diligently on the behind-the-scenes aspects of the ISSW. They include: Pat Ahern, Bill Allen, Kai-Uwe Allen, Heidi Attenberger, Erik Aura, Matt Beck, Florence Bocquet, Leah Boelman, Josh Butson, Tara Butson, Kevin Cahalane, M.Kale Casey, Lisa Chism, Byron Curfman, Jill Curtis, Tony Daranyi, Seth Dennis, Rob Deyerberg, Chris Drew, Mary Duffy, Thomas Emilson, Mike Gianola, Kim Grant, Lynn Gray, Jim Greene, Susan Hale, Tom Hays, Denny Hogan, Peter Inglis, Sandy Kobrock, Ian Kirkwood, Nick Kyle, Eric Larson, Gabe Magtutu, Dan Malloy, Meg Margeson, Ellie Martin, Ann Mellick, Jessie Morgan, Sonja Nelson, Andy Nichols, Aleph Pippin, Keith Renke, Gary Richard, Kim Richard, Mark Rikkers, Jan Robberson, Jason Rogers, Leslie Ross, Brad Sawtell, Peter Shelton, Russ Skousen, Joseph Sprick, Matt Steen, Eric Tanguay, Scott Toepfer, Lance Waring, Bill Wells, Doug Wewer, and Kevin Wright.

Creating a week-long event for 800 people in a small resort town is no small feat and it simply would not have been possible without the contributions of so many individuals and organizations – in addition to those listed above, we would like to thank: Mark Mueller and the American Avalanche Association, NSAA, Richard and Betsy Armstrong, Noel Peterson, Art Judson, Bob Rule and the San Juan Ski Company, Ellen Stein and the Mountain Studies Institute, INSTAAR, TSG Ski and Golf and the Telluride Ski Patrol, Lynne Wolfe and TAR, Erinn Kruser and Omnipress, Outdoor Engineers and the San Juan Outdoor School.

And finally, we would like to thank all of you – thank you for making the trip to Telluride, for presenting your research, and for bringing your enthusiasm to our community. The opportunity to host the ISSW was both a privilege and an honor.

ISSW 2006 — The First Ladies Night

Story by Leslie Ross

As the haze continues to clear from our avalanche eyeballs in the aftermath of ISSW, the buzz of Ladies Night continues to roar. Don't let your mind wander too far—Ladies Night was not an escort service for ISSW attendees, but rather an evening created to gather female avalanche professionals and honor the contributions of several pioneering women in the field of snow and avalanches.

The event, which hopefully marks the first of many gatherings of this nature, proved to have an impact on many levels. Upwards of 90 female ISSW attendees and local mountain women gathered on October 2 in the Alpenglow room at the Peaks Hotel. Female professionals at all levels of their career met to engage in dialogue and inspire collaborative efforts on future projects in the field.

The evening was also an opportunity to honor and pay tribute to Sue Ferguson, a long-time avalanche professional who recently passed on from cancer. Honorary Babe Ed LaChapelle (the only man in attendance—his new claim to fame) kicked off the evening with a heartfelt tribute to Sue. He shared his memories of her driven spirit, humor, and commitment to the world of snow. She achieved many accomplishments as educator, leader, teacher, and author. Sue, founding mother of the American Association of Avalanche Professionals (now the AAA), authored numerous scientific articles and a book on glacier ice and updated *The ABC of Avalanches*, first written by her mentor Ed.

Jill Fredston followed Ed's colorful tribute with a poem by Mark Moore, which was printed in *The Avalanche Review* 24/4 as part of a wide-reaching tribute to Sue.

As the women snacked on nibbles from the Peaks, the eight honorees tag-teamed introductions for each other as slides from their careers projected in the background. Those honored include Betsy Armstrong, Christine Pielmeier, Evelyn Lees, Fay Johnson, Jill Fredston, Janet Kellam, Sandy Kobrock, and Patti Burnett.

The evening was a collaboration of effort by Nicole Greene and Babes in the Backcountry. Ladies Night was made possible by the contributions of the AAA and ISSW 2006. A gracious thank you to Patagonia, Black Diamond, G3, Clif Bar, Jagged Edge, Athleta, Isis, and Pistil who supported the event with raffle prizes and gifts to the honorees.

Stay tuned for more details on the honorees in the next edition of *The Avalanche Review*.

Leslie Ross operates Babes in the Backcountry from the driver's seat of her van "Astro-sister." She is hoping to stay home in Colorado and ski more than drive or type this year.

Check out **www.babesinthebackcountry.com** *for more information on women's backcountry ski clinics and avalanche seminars.*

2005-06 SEASON SUMMARIES

Editor's note: These summaries (NAC, Manti-LaSal AC, and French avalanche accidents from 2005-2006) were inadvertently omitted from the Season Summary issue in September. Our apologies to the National Avalanche Center, Manti-LaSal Avalanche Center, and David George.

Cupped and striated depth hoar crystals. *photo by David George*

Forest Service National Avalanche Center

Story by Karl Birkeland and Doug Abromeit

The Forest Service National Avalanche Center (NAC) continues to successfully meet its objectives, including coordinating the Forest Service's military artillery program, coordinating the regional avalanche centers, transferring new and emerging technologies to the avalanche centers, providing avalanche education to the public and training to FS employees, and serving as a national point of contact for all things avalanche for the Forest Service. Directed by Doug Abromeit and staffed by avalanche scientist Karl Birkeland, the NAC is what we like to call "the little center with the big name."

The NAC has been working closely with the Las Vegas Ski and Snowboard Resort (LVSSR), the Humboldt-Toiyabee National Forest, and the U.S. Army to develop a new 105 Howitzer Program at LVSSR. This will be the first new military artillery program at a Forest Service-permitted ski area in 35 years.

The NAC worked on two international projects this past year: the avalanche-forecaster exchange with Switzerland and an update of the avalanche-danger scale with Canada. After a highly successful exchange between Mount Shasta's Matt Hill and SLF's Thomas Wiesinger two years ago, Bob Comey of the Bridger-Teton Avalanche Center (BTAC) was chosen to go to Davos this year. Bob worked with the Swiss forecasters for three weeks and came back with a bundle of new ideas. One feature he added to the BTAC forecasts this year was an afternoon update patterned off the afternoon forecasts issued in Switzerland. The U.S. avalanche centers are planning to host a Swiss forecaster next season, and we are excited about the continuing exchange of information between forecasters from our two countries.

The avalanche-danger-scale project has proven to be as challenging as expected. After collecting comments and going through a number of ideas and revisions over the past year, the U.S. and Canadian committees came up with a preferred alternative. This alternative, which had received significantly more input from the broader U.S. avalanche-forecasting group than the Canadian group, was presented to the Canadian forecasters at the CAA's annual meeting in May. The consensus at that meeting was that the new alternative addresses some of the deficiencies of the old scale, but that more work is still required. Both groups continue to be committed to working together on a common North American standard. We'll continue to work on this project through the 2006-07 operating season.

The NAC also initiated a study of wet-slab avalanches with Ethan Greene of the Colorado Avalanche Information Center and Kelly Elder of the Forest Service's Rocky Mountain Research Station. This study involves a number of partners: the Chugach National Forest Avalanche Center, Alyeska Ski Area, Alaska Railroad, Glacier National Park, Mammoth Mountain Ski Area, Eastern Sierra Avalanche Center, Arapahoe Basin Ski Area, Fraiser Experimental Forest, and the Center for Snow and Avalanche Science. We are currently in the process of collecting observations of wet-slab avalanches with associated high-quality meteorological data, including radiation-balance measurements. So far we have a number of wet-slab observations from Alaska, Montana, Colorado, and California. We plan on building a wet-slab database which might provide insights into wet-slab avalanching, and we hope to add a graduate student to help with this project in the near future.

In addition to our investigations of wet slabs, other current projects include our continuing work on spatial variability, work on relating shear strength to loose wet-snow avalanches, analyzing the SnowPilot database (which now includes over 1000 pits), and a paper on the implications of sintering after weak-layer fracturing. These topics were covered in a number of presentations at the ISSW in Telluride. Papers on these and many other subjects are posted on the NAC tech papers Web site, which you can find at www.fsavalanche.org/NAC/techPages/techPap.html. We currently have 44 papers and 15 theses posted at the site, with more on the way. Additionally, we have been talking with Ed LaChapelle about posting all the old Alta Avalanche Study Center reports on the NAC Web site.

We continue to work on avalanche-awareness products for the public and for Forest Service employees. We are in the process of updating our Web site, including installing new avalanche-awareness video footage, a revised interactive tutorial, and a new glossary developed in conjunction with the Friends of the Utah Avalanche Center. We are also working with Paul Baugher and the National Avalanche School to revise sections of both the classroom and field portions of the NAS.

We hosted the annual avalanche centers meetings in Bozeman in the fall of 2005 in conjunction with the American Avalanche Association meeting. One day of the meeting was dedicated to technology transfer and included a number of talks related to the wide variety of different projects we are working on. This past year we participated in the Forest Service Winter Sports Workshop at Mammoth and provided and coordinated avalanche training for the workshop participants. We are working with a national team to provide tools, guidance, and training to snow rangers who monitor avalanche programs.

The NAC has a number of diverse projects going on, but the backbone of the Forest Service avalanche program continues to be our regional avalanche centers. We are extremely proud of what these centers have been able to accomplish in the face of often daunting budgetary conditions.

Manti-La Sal Avalanche Center

Story by Max Forgensi

The Manti-La Sal Avalanche Center opened its doors on November 14, 2005. The first advisory of the season was issued on the 25th of November for the La Sals, the 26th for the Manti Skyline. The dominant high pressure through early December was a blessing in disguise since Max Forgensi had to start the season alone—Evan Stevens left the Center to pursue guiding ops in British Columbia, and his veteran replacement, Dave Medara, was slated to start on December 20. With weather stations down, snow study plots to set up, classes to book, along with the rest of Avalanche Center duties, there was plenty to do. For most of the season it seemed that a high-pressure dome was centered over Moab. It kept the Abajo Mountains almost completely barren throughout the winter, and gave the La Sals just enough snow to form a shallow continental snowpack. The Manti Skyline, the northern-most range in our forecast area, was affected positively by this weather pattern. Instead of skiing in December in Moab, locals enjoyed perfectly smooth and solid ice on the Colorado River sluice to ice skate on.

Finally, December 20… Dave Medara walked into the Forest Service office as a full-time employee. It had been 10 years since he walked out of the same door as the Avalanche Center Director in 1995 to pursue other exciting occupations. Dave's wealth of experience, knowledge, and insight immediately bolstered the Center's mission: to provide information and education to promote safe winter recreation. Equipped with what appeared to be skis from the late '80s on his feet, Dave ventured out into the backcountry that afternoon so Max could show him the omnipresent poor stability.

The Manti Skyline was favored by the northwesterly flow last season. The first heavy snow of the season on December 3 doubled the snowpack and gave way to the first significant avalanche cycle of the season. By the end of December, snow fell consistently and continued that way throughout the season. The first HIGH avalanche danger was issued on December 27. Snow continued to fall throughout January. Basal weak layers disappeared and gained strength with each new blanket of snow. By the end of January, we were concerned only with new snow instabilities. The first break in the weather pattern happened in the second quarter of February, when high winds and rain visited the region on the 16th, and another rain event up to 10,000' occurred on the 26th. The snow kept falling in March, which turned into the snowiest month of the season. Avalanches in March were limited to D2 or smaller in nature and some moderate-sized cornice failures. Overall, the season on the Skyline was noted most for great snowmobiling and skiing conditions. Winter enthusiasts stormed all over the mountain range with few avalanche incidents.

The La Sal Mountains of Moab had a different story. It was "gang warfare" out in the mountains for most of the season until mid-March. There were days when planned travel to our weather station at 11,700' required us to retreat right back down the ridge. Skiing favorite slopes had consequences: core shots, scree fields, rotten snow, and other obstacles would joust you right off your mounts. It wasn't until January 26 that we surpassed the 100cm mark at the Gold Basin study plot at 10,000'. Even so, cold air and the shallow snowpack made at least half of the pack cohesionless depth hoar. A red-dust layer that settled on the snow surface during a wind event in mid-February then became reactive when loaded.

During the second quarter of March, the jet finally switched to the southwest and dumped over 160cm of snow in six days. Finally, avalanches were failing on the dust layer; some even stepped down to the ground.

For the 2005-06 season, the Manti-La Sal Avalanche Center taught 10 classes and 176 students. We taught one Level I and one Level II AIARE course. We worked with UDOT and private agencies to develop more weather stations on the Skyline. The La Sals now have grooming equipment for Nordic and skate-skiing trails, made possible by a grant from Utah State Parks. The final advisory was issued on April 9. Five advisories were issued per week for the La Sal Mountains. Two to three advisories were issued per week for the Manti Skyline.

This photo was taken after an accident at Tignes on December 18 that caught a British snowboarder just off-piste. Two snowboarders traversed across the gulleys when one was caught in the slide. It was a small slide, just meters from the open runs, which demonstrates how dangerous these areas can be under certain conditions.
photo by Henry Schniewind

An Analysis of French Avalanche Accidents for 2005-06

Story by David George

Anyone who picked up a newspaper last year noticed that France had a pretty unusual winter in terms of avalanche deaths. Headlines ranged from the factual: *Alps See Climb in Avalanche Fatalities*, to the more lurid: *Skiers Dicing with Death Off-Piste*. The number of fatalities (55 in 49 accidents) was the highest since ANENA (Association Nationale pour l'Etude de la Neige et des Avalanches) began keeping track in 1971. I hope to address the question of whether these accidents were due to unique weather patterns or a shift in skiing mentality.

While the autumn was generally warm, the first French avalanche fatality occurred at the start of October when a storm blew in from the Italian side of the southern Alps, bringing around 80cm of snow. The victim was a policeman from Valgaudemar in the Hautes-Alpes who died while ski-touring. The accident occurred just over the Italian side of the border of the Col d'Agnel and is not featured in our statistics. This storm left just 20cm of snow at 2500m in the northern Alps.

The weather turned colder in November. In the Belledonne mountains in the northern Alps on November 22, for example, the air temperature was -6°C. The 15cm of snow was composed entirely of faceted snow crystals with a temperature gradient of 60°C/m; this was a worrisome start to the winter season. A couple of days later, winter arrived in the northern Alps, Pyrenees, and on the island of Corsica. High and even mid-mountain ski resorts opened their doors and welcomed the ski-touring season. A number of avalanche incidents were reported in the area including a spectacular slide on a north-facing rollover at the ski resort of Piau on November 28, caught on helmet camera by Jérôme Buc.

At the start of December, two Spanish ski mountaineers were caught in a slide near Andorra. One man was buried and severe weather conditions prevented rescuers from recovering his body until the following day. This would be the first fatality in France over what would become a grueling five-month period. Next, a member of the specialist mountain police unit at Le Lioran in the Massif-Central died while patrolling a closed run prior to the opening of the resort. On December 18, a British student was caught in Tignes. The man was snowboarding with his brother when they decided to take a closed run. 20cm of fresh snow along with strong westerly winds the day before caused crossloading in terrain traps with just enough snow to prove fatal. The man was not wearing an avalanche beacon.

Just before New Year's Eve, a storm with strong winds traversed the northern Alps and Pyrenees. Four deaths ensued in separate incidents, including Ajay Tambe from California on holiday in Courchevel. This small avalanche occurred between marked runs and is a reminder that French in-bounds skiing is largely unsecured. A father and son escaped death while skiing a couloir above the resort of Romme-Sur-Cluses. Completely buried by an avalanche, they were rescued 10 minutes later when a passing group noticed tracks and began a beacon search.

The winter was cold at all altitudes until the end of January. Despite a short jump in temperatures at New Year's, there was no freeze-thaw cycle to stabilize the snowpack. In Val d'Isère in mid-January, practically the whole 80cm snowpack, except on south-aspect slopes, was composed of faceted crystals.

A storm cycle on January 17 brought nearly half a meter of fresh snow to the northern Alps, accompanied by strong winds from the south to southwest. Seven fatalities occurred following the storm: five while off-piste and two while touring. A British ski instructor from Méribel died while skiing with a guide at the neighboring resort of Les Menuires. The guide was wearing an ABS pack and escaped with minor back injuries. Two young men were not so lucky in a notorious avalanche couloir at les Arcs when they did not have time to operate their ABS system before being engulfed in a slide. A ski patroller was also killed at les Deux Alpes, and a second slide in the same area killed a local man 15 minutes later.

While no new snow had fallen in the interior mountain ranges of the Savoie since the middle of January, a powerful chinook had raged in the area and transported snow onto northern aspects, increasing the instability already present. Thirteen people died between January 28 and February 4 in 10 separate incidents. Three soldiers perished in an avalanche close to the Pic de Bure observatory. At Tignes, a Polish skier was killed crossing between two ski runs on a frequently used link. At neighboring Val d'Isère, a local skier with a guide was killed on the popular Grand Vallon route, despite being located quickly with his beacon. Another skier was killed in Les Arc's Combe des Lanchettes.

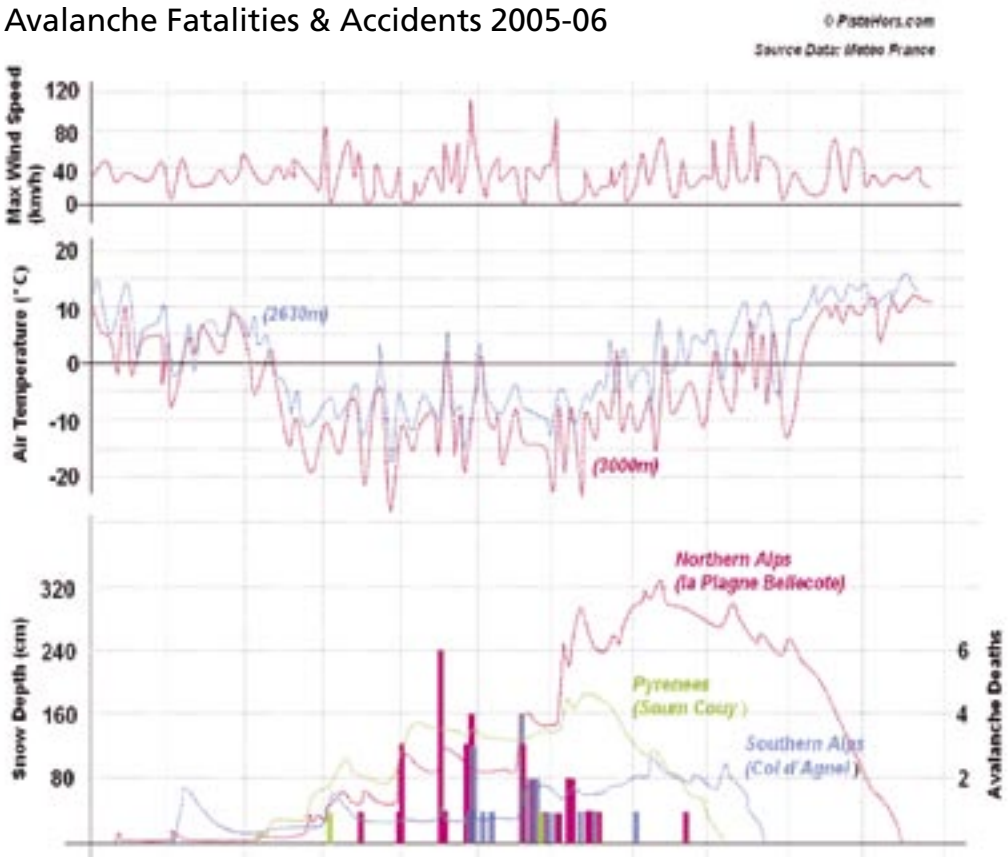
A storm moved across the Pyrenees and the Alps around February 18, bringing significant snowfall. In the week that followed there were 15 fatalities in 14 incidents, with over half the deaths in the southern Alps. Among the fatalities was American Jon Seigle from Aspen.

Further snow fell in the first fortnight of March, which was also the end of the French school holiday. Showing rare black humor, the avalanche forecaster for the western Pyrenees commented, "The most stupid will be able to ski down to 1000m on all slope aspects." There were 11 deaths in 10 incidents over this period, the majority of them in the Savoie. Among the incidents was a member of the high-mountain police during a rescue exercise in the southern Alps resort of Auron.

In April, a good freeze-thaw cycle and rain at altitude stabilized the snowpack, and just a couple of incidents were logged. The last fatality was that of an Italian skier in an incident at 3pm in the Mont Blanc range when the zero isotherm was at 2800 meters and the group seemed to be following the more dangerous "summer route" to the Leschaux refuge.

Was weather or human factor to blame?

Just how exceptional was last winter? What characterizes 2005-06 is the sheer volume of fatal accidents. The number of fatalities was double, and the number of fatal accidents was nearly three times the average. It is important to look at the winter's



Warning signs are prominently posted in the Alps. This picture was taken at la Clusaz in January on the day a group of French skiers were caught by a slide that buried one of them. They later claimed to be unaware of the risks. *photo by David George*

tragedies in order to understand if the weather was particularly unusual or if usage and demographics have moved in a more dangerous direction.

Some commentators blame a higher risk tolerance among backcountry travelers, citing youth, adrenaline, and lack of mountain knowledge as key factors, no doubt encouraged by resort marketing and extreme ski videos. The deaths of teenage freeriders in separate incidents at Pra-Loup and Saint-Gervais on February 22 correspond with this picture, but extreme skiers do not account for a majority of the deaths. The relatively stable figure for avalanche fatalities in the Pyrenees, which represents around 13.5% of French skier days, almost the same as the southern Alps, contradicts the argument that higher risk tolerance is to blame.

A higher number of mountain professionals were among the fatalities as compared to previous winters. Avalanches claimed two members of the mountain police and two ski patrollers. The ANENA had recorded 10 such fatalities over the previous 16 seasons. Also, there were a number of victims who had been with guides or ski instructors, or were considered local or experienced. Amongst this group, a couple of accidents stand out. Pierre Chapoutot, a highly experienced ski mountaineer and climber, and Eric Michel, a guide from the Maurienne, were on routes considered "reasonably safe" in the Lauzière area. These accidents do not inherently point to complacency or commitment as the cause; rather, they further suggest that weather's contribution to instability was the major factor in the fatalities last winter.

The statistics over recent years have shown an increase in the number of fatalities skiing and snowboarding off-piste (53%) as opposed to ski touring (36%). Snow professionals have noted a change in the attitudes of these off-piste skiers as well. Last winter Val d'Isère-based ski guide Wayne Watson said that skiers in his resort "were attacking the mountain like there was no tomorrow." Jean-Louis Tuaillon, the director of piste security at Tignes, said that skiers and snowboarders have a tendency to nibble away at the off-piste areas in the resort, "but when they go too far, it is far too late." He put some of the blame on a "consumer attitude that views the mountains as a theme park" and "a lack of mountain culture." Tuaillon believes that education is the only way to encourage responsibility, and any attempt to restrict access is unworkable.

A recurring theme among survivors of avalanches, especially off-piste incidents, was a lack of knowledge of the avalanche conditions, despite postings, flags, and accessible bulletins at the resorts. Tuaillon says that 50% of visitors to Tignes don't even realize there are avalanche warning flags and thinks skiers may actually be suffering from general information overload while in resort. Thierry Arnou, the avalanche forecaster for the Savoie department, said, "Avalanche bulletins are already in my opinion out of reach to the majority of the skiers," and is open to ideas on how to improve the bulletin. One suggestion would be to adopt a similar graphic complement to the text bulletin as introduced by the Utah Avalanche Center. They are easy to adapt to different languages and provide an easy-to-understand symbolic representation of the dangers in terms of avalanche types, slope aspects, and trends. Currently the Bulletin is only published in French, and only a few resorts produce an English translation.

While lack of education has contributed to an increase in deaths at resorts, weather's irregularities seem most to blame for the increase in deaths. The cold autumn and early winter with thin snow cover and clear sunny days caused depth hoar and general faceting. Unlike most previous winters, these conditions were prevalent throughout the Alps. The southern Alps added 19 to the overall number of fatalities (35% of total) compared to the long-term average of 19%. Avalanche deaths in the Hautes-Alps, including La Grave, are not unusual, but nine fatalities in the two most southern areas (Alpes-de-Haute-Provence and Alpes-Maritimes) are. Typically, the maritime climate stabilizes the snowpack in this southernmost region, but that stabilization did not occur this year.

One possibility for the increase in the southern Alps is that the cold start to the season in the north encouraged more skiers to travel to the more hospitable south. Figures for ski resorts from January to March show that the number of skier days in the southern Alps was 13.8% of the total with a progression of just 3.5% compared to a very poor 2004-05 season and just 0.9% over the 2002-2005 average. The northern Alps showed a progression of 1.3%. The Jura, Vosges, and Massif-Central, which all had exceptional winters, showed progressions between 22% and 34% but no corresponding increase in avalanche fatalities. It is possible that skiers in the southern Alps, home to the large resorts Serre Chevalier and Isola 2000, were unaccustomed to unstable conditions, leading to a higher number of fatalities and the apparent overrepresentation in the data set.

There were previous winters in France with high fatality rates and increased instability due to weather. Volume 36 of the ANENA's house publication *Neige et Avalanches* says of 1984-85 that the winter "had thin snow cover and was chilly… in particular an intense cold spell in January transformed the snowpack into a fragile layer." Similarly in 1995-96, Météo France blamed the increased number of accidents on snow conditions rather than a change in skier behavior, in particular a "slow stabilization of a fragile snowpack" which lasted until March. In both seasons, conditions were very similar to last winter. The distribution of fatalities by month also confirms the weather created instability during November and December, causing a peak in incidents in January when the snow started to fall followed by a drop-off as conditions slowly stabilized. This is even more significant when one takes into account that February and early March are the main French winter holiday periods, yet had many fewer deaths.

One of the many warning signs posted by town halls at the foot of alpine valleys to warn the unwary of the dangers they face. *photo by David George*

Conclusion

This past winter is one that few are likely to forget due to the high number of fatalities that occurred. The weather caused deep instabilities for much of the winter, which caught many skiers by surprise and led to tragic conclusions. There is no doubt that more avalanche education, especially at resorts, is necessary to prevent a similar winter in the future. Moreover,

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the weather did not behave in a typical manner, which ensured that even the slightest dismissal of the conditions proved fatal.

Finally, here is a quick note that avalanches are not the only danger facing backcountry travelers. Over a single week at the start of June, seven people slid to their deaths in icy conditions. Over an average season, falls into crevasses and falls due to icy conditions probably rival avalanche fatalities as a cause of death. The greatest risk is in the spring when strong freeze-thaw cycles can render slopes glass-hard; a tragic example of this phenomenon was the deaths of Doug Coombs and Chad Vanderham at La Grave early in April when they fell in the Couloir de Polichinelle during icy conditions.

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David George runs a Web site devoted to French off-piste conditions: www.pistehors.com. He regularly contributes to The Avalanche Review as our French correspondent.

WHAT THE MOVIES DON'T TELL YOU—This slide occured in Val d'Isère early January during filming of an extreme ski movie. The skier, a Scandinavian, started on the ridge line above, got some air, and landed on the first lip, got some more air on the second lip, and landed on the open slope triggering the slide. He was buried up to his neck but survived with only minor injuries.

photo by David George