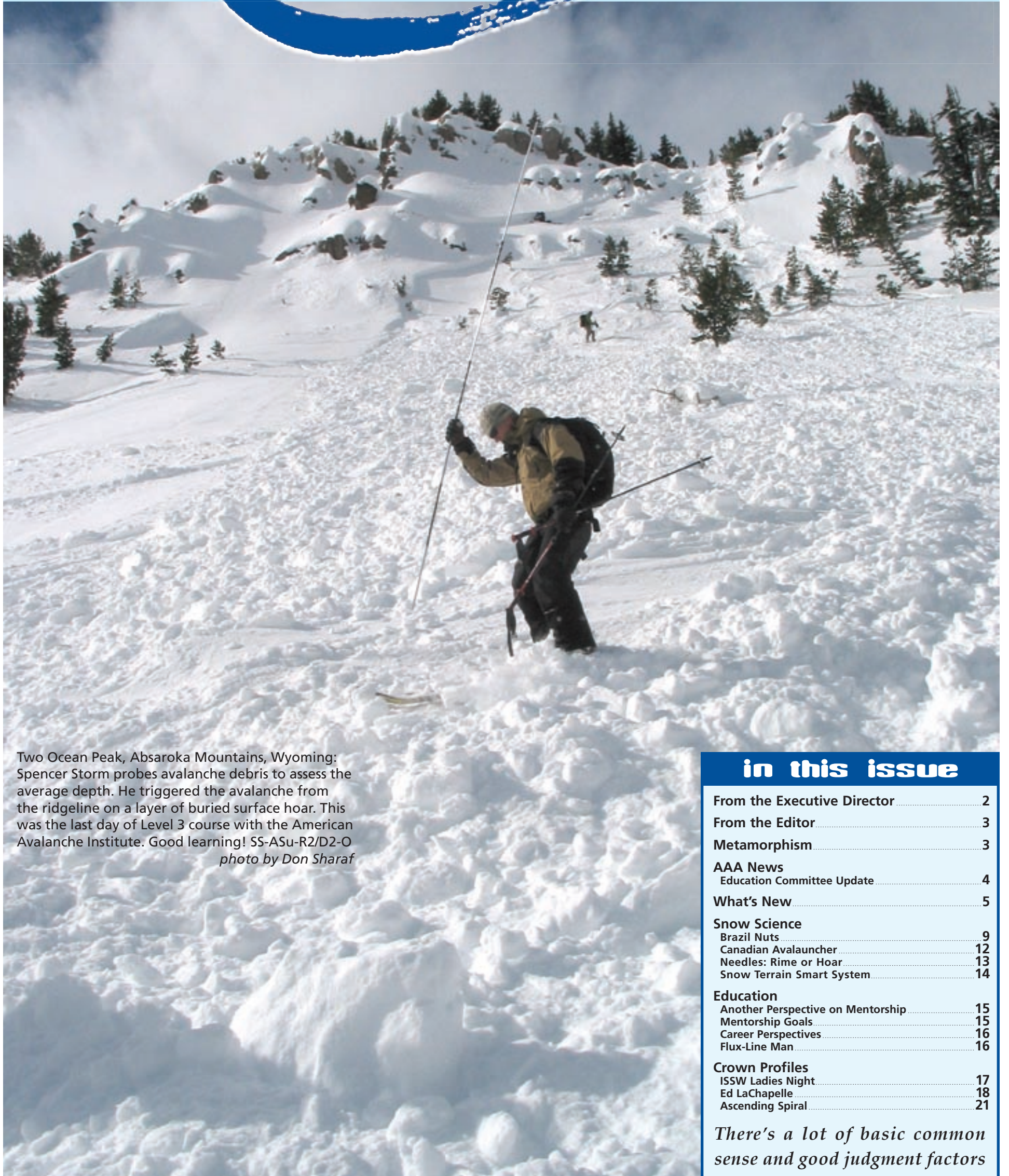


Avalanche

REVIEW

VOLUME 25, NO. 4 • APRIL 2007

www.AmericanAvalancheAssociation.org



Two Ocean Peak, Absaroka Mountains, Wyoming: Spencer Storm probes avalanche debris to assess the average depth. He triggered the avalanche from the ridgeline on a layer of buried surface hoar. This was the last day of Level 3 course with the American Avalanche Institute. Good learning! SS-ASu-R2/D2-O
photo by Don Sharaf

in this issue

From the Executive Director	2
From the Editor	3
Metamorphism.....	3
AAA News	
Education Committee Update.....	4
What's New	5
Snow Science	
Brazil Nuts	9
Canadian Avalauncher.....	12
Needles: Rime or Hoar.....	13
Snow Terrain Smart System.....	14
Education	
Another Perspective on Mentorship.....	15
Mentorship Goals.....	15
Career Perspectives.....	16
Flux-Line Man.....	16
Crown Profiles	
ISSW Ladies Night.....	17
Ed LaChapelle.....	18
Ascending Spiral.....	21

There's a lot of basic common sense and good judgment factors that you don't have to have a slide rule to use...the important thing is terrain recognition. Good route finding is the secret of staying out of avalanche trouble.

—Ed LaChapelle, from the
Alpenglow Ski Mountaineering History, p20



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The mission of the AAA is:

- A. To provide information about snow and avalanches;
- B. To represent the professional interests of the United States avalanche community;
- C. To contribute toward high standards of professional competence and ethics for persons engaged in avalanche activities;
- D. To exchange technical information and maintain communications among persons engaged in avalanche activities;
- E. To promote and act as a resource base for public awareness programs about avalanche hazards and safety measures;
- F. To promote research and development in avalanche safety.

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

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from the executive director

It's mid-February, and we're all deep into the winter now. It's been a busy winter. Hey, it's always busy – sometimes it's just busier. As February began in this end of the San Juans, we had our first avalanche fatality (details can be found on the CAIC Web site) in 20 years. Keeping the wheels of the American Avalanche Association turning, along with highway forecasting and running a hut business, can be about all one can handle. Fortunately we have a great crew at AAA, each keeping a part of the whole running smoothly and of course my wife, Sandy Kobrock, who is always ready to step up when things just get too crazy. Thanks.

So, what's happening with AAA you ask? Your membership dues remain the main source of funds for your Association. The membership of AAA has increased by about 12% during my five years as executive director with almost 750 members – nearly 500 are Professional or Affiliate Members. The greatest increase is in the number of Professional Members: 357 as of the fall of '06. The rest are paid or complimentary subscribers to *The Avalanche Review*. We have another strong group of professional and affiliate applicants for this spring. The current level of dues has been maintained for over 10 years despite rising costs. We will try to keep costs reasonable, as affordability is an issue for many who choose to pursue a life in the mountains. For as many members as we gain, we seem to have an equal number lose interest for whatever reason and leave the organization. Thanks to all members who have made the effort to promote AAA among their colleagues and increase our membership. Members can now renew their membership online at our Web site. New member applicants cannot use the Web site to join due to the resumé requirement.

The founders of AAA envisioned it as an organization that would foster communication between snow and avalanche professionals in the United States and abroad. Our publication, *The Avalanche Review* (TAR), is the vehicle that facilitates that communication and remains our primary focus. In recent years we have begun to print TAR in color and expanded its content. We are very lucky to have a dedicated editor in Lynne Wolfe and an enthusiastic designer in Karen Russell. One can now subscribe to TAR online at our Web site: www.americanavalancheassociation.org. This should help our international members in particular with the hassle of currency exchange now eliminated. Payments are made through PayPal, an online secure payment service. I have used PayPal for many years without any problems.

The publication of *Snow, Weather, and Avalanche Observational Guidelines*, (SWAG) continues to be a success story. We just did our third printing and sales continue to be steady if not strong. About 2200 copies of SWAG are in use across the U.S. and worldwide; the proceeds from sales have strengthened our financial situation. SWAG is a part of an increasing number of U.S. avalanche schools and is used as a text at several universities. A second edition is still several years away.

In its second year, PAWS is seeking recognition among U.S. avalanche programs. It shouldn't take long given the

top-flight instructor team we've assembled. This winter's course was held at Bridger Bowl, Montana, and we hope to expand from one course offering per winter to up to three in different locations in the western U.S. in the near future. See the PAWS course report in this issue on page 6.

Our instructor-certification program, which began in 2003, has certified 31 instructors to date. AAA instructor certification enjoys the support of Rod Newcomb's American Avalanche Institute and the American Association of Avalanche Research and Education (AIARE). AAA is currently reviewing our Avalanche Course Guidelines for the first time in nearly eight years. Education Committee members will present a draft at our spring Governing Board meeting, then a period of member review will follow. More about this in this issue of TAR on page 4.

Financially, AAA is in a very strong position due in large part to SWAG sales and generous donations made by members in addition to their annual dues. AAA looks for groups and individuals to partner with in order to advance our mutual goals: promoting high standards of professional competence and advancing the pursuit of avalanche safety through both professional development and recreational-user education (and maybe drink a beer or two along the way). We continue to provide grants for both academic and practitioner research. Interested persons can get additional information about grants on our Web site: www.americanavalancheassociation.org.

The AAA Governing Board consists of 24 professional members representing all aspects of the avalanche field: forecasters, researchers, educators, a government snow ranger, ski-area operators, snow-safety directors, and technicians. Many are engaged in multiple activities in the snow and avalanche field. Newly elected board members began their two-year stint on January 1, led by our new president Janet Kellam, director of the Sawtooth National Forest Avalanche Center.

Entering my sixth year as executive director, I believe the main challenge that AAA faces is continuing to create and maintain value in AAA membership. We are geographically far flung and basically have me as the only paid part-time staff person. We are planning a Professional Development/Continuing Education meeting for the fall of 2007. Details will be in our summer letter and will be posted on the Web site. I look to the internet to streamline some of our operation and help keep AAA in touch with our membership and the membership in touch with one another. We're working on making some of those things happen, starting with renewing memberships online.

By the time you read this, winter will be winding down for most of us. The next AAA Governing Board meeting is scheduled for April 21 at Alpine Meadows, CA. For those traveling to or residing in the southern hemisphere, I wish you a safe and successful winter. On a hot summer day cutting firewood I'll cast a glance to the south and think of you. For those content with six months of snowpits and ski boots, I wish you an enjoyable summer. I hope our trails cross soon.

—Mark Mueller, executive director ❄️

mailbag

Art Judson presents a question below for the avalanche community about the possible development of a central Web site for avalanche activity. Anyone have thoughts or replies for him? Send your letter to the editor by August 1, 2007: lwolfe@tetontel.com

Share Your Avalanche Conditions

Hey Lynne,

Any current avalanche activity up your way? Not getting anything to speak of in the Steamboat Zone, and I could see just two slabs at Alta on their cameras – in E. Greeley. Otherwise nothing and nothing over at Brighton. Sun Valley not reporting anything either. I think with current conditions, avalanche conditions at any of the following areas could help those in adjacent areas, even if hundreds of miles away. Areas: Wasatch, Colorado Rockies, Sun Valley – Sawtooths, Tetons, Absarokas, Beartooths, Wind Rivers, etc.

There ought to be a site where any current major activity could be shared, maybe on avalanche.org or ? It might help all of us.

Jud

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. 26, Issue 1..... 08/01/07
- Vol. 26, Issue 2..... 10/15/07
- Vol. 26, Issue 3..... 12/15/07
- Vol. 26, Issue 4..... 02/15/08

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from the editor

March 20, 2007, 9 pm— I just finished correcting the final proof of TAR 25/4. In doing so, I re-read the memories and stories of your interactions with Ed LaChapelle. I am filled with admiration for our mentor, colleague, and friend who has left us with vivid memories and valuable inspiration. I want to highlight Ed's closing words from *The Ascending Spiral*, which we were able to reprise from 2005:

As the spiral ascends and scientific and technical knowledge about snow continues to grow, are we coming closer to improved training and safety practices for avalanche risk management? Or are we locked into Wilde's (1994) risk homeostasis trap? The dialog needs to continue.

Ed continues to challenge us and our profession; as his students and peers we are driven to respond to his questions with thoughtful action.

In this issue of TAR we have a number of topics to present to our readers. Dale Atkins expands our understanding of avalanche flow and how entrained victims should react. Don Sharaf offers another view in a sidebar to Dale's article. I was party to their friendly exchange; Dale's openness in inviting Don's critique of his research stands as an example:

Got to read Don's piece last night and send him back some thoughts. As usual, it's classic Don, which means it's very good. I really hope – and I think it will – that my piece and Don's counter-point will stir up the pot and get people thinking and even researching an assumption that has long been unchallenged.

So what do *you* think about swimming or not-swimming, Halsted's teaching tips, or the AAA avalanche course standards work that is underway? Ed exhorts us to continue the dialog, so express your opinions and perspectives on how theory influences practice – how practice refines theory. The ultimate result can only improve and become a finer basis upon which subsequent generations will continue the exploration and refinement.

While putting this issue together, I was surprised one day by a phone call from Bob Ferguson, Sue's brother. He expressed his condolences to the avalanche world on Ed's death (see page 27), and we moved on to discuss *The Avalanche Review*. He was thrilled with its quality and told me that Sue would be proud. TAR continues to flourish as the voice of the American avalanche community due to your dedication to excellence both personal and professional. As our readers share their research, insights, and near-misses, I feel sure that both Sue and Ed would continue to be proud.

—Lynne Wolfe, editor ❄️

metamorphosis

Congratulations to **Mike Friedman**, who has just become one of 31 AAA Certified Avalanche Instructors in the U.S.

From Craig Patterson, Wasatch Range, Utah—

We are having a less than so-so winter so far here in the Wasatch. It's not over yet...but time's a wastin'. I haven't heard anything more about the mentorship article from Michael Jackson or any others involved. I wrote the letter mainly to express my support for what you all were trying to do. I would have loved to have gone through a mentorship process on my path through the avalanche industry. I easily sympathized with Michael's initial article and felt obligated to share my thoughts to provide some validation for the project. I would still like to help other aspirants along their path some day when I have a little more to offer.

Funny enough, a forecasting job was posted for a position working for UDOT in Provo Canyon, just south of Salt Lake City. I applied in October, got an interview, and was offered the job. Excitedly, I now work as a forecaster. Just wish there was more snow for forecasting purposes. There's always next year...or maybe this spring? About one month into my new job with UDOT, TAR arrived in my office and there was my letter. I received some good-natured heckling from Drew Hardesty and the folks at the UAC. ❄️

Jerry Nunn Receives AAA Special Service Award

On February 20 the American Avalanche Association honored Jerry Nunn. In a full house at Ski Lift Lodge in Flagstaff, Arizona, she was presented with the Special Service Award by B. J. Boyle, President of Kachina Peaks Avalanche Center and Director of Ski Patrol at Arizona Snow Bowl Resort. The multi-generation event was festive as many in the skiing community offered a variety of "roasts and toasts." Highlighted were Jerry's contributions as one who broke barriers for women in the world of avalanche studies and snow safety. In her acceptance speech Jerry once again reminded everyone that "anything men can do, women can do better." It was a wonderful night of shared fun and fond memories. ❄️



Jerry and B.J. Boyle (in matching attire) admire her biography, featured in TAR February 2007. Photo by Dave Smith



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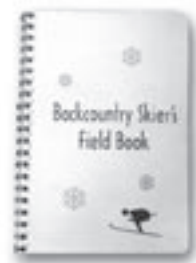
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aaa news

DRAFT Recommendations for US Avalanche Education

Summarized by Janet Kellam

In 1999, the American Avalanche Association developed recommended guidelines for level 1 and level 2 avalanche education programs. Many course providers have successfully adopted these guidelines, but increasing numbers, diversity, and interests of winter backcountry users are placing new demands on avalanche education. Recent trends include:

- Demand for avalanche skills at the introductory level is large and growing rapidly. Low-cost introductory avalanche workshops frequently fill to capacity, and there is currently no guidance or standards for their instruction. Many attendees of these programs do not go on to take Level 1s, meaning these programs may be one of the few chances to reach them with a coherent message about avalanche safety.
- Currently there is significant variation in content and outcomes of both Level 1 and Level 2 avalanche programs. Students routinely come to Level 2s with marginal skills and knowledge, resulting in a net decrease in course quality among providers.
- The nature, content, and outcomes of Level 3 avalanche programs (for which no formal guidelines exist) have not been consistent among providers. The result has been confusion in students' minds about what these programs are meant to accomplish.

The goal of this effort has been to address these and other current issues in avalanche education in order to provide students with a clear progression of expected outcomes, and to provide instructors and course providers with a consistent yet customizable template for achieving those outcomes.

PROCESS

The current Education Committee (composed of 14 professional members involved in diverse educational programs) has been working collaboratively since ISSW 2006 to develop the draft recommendations. We backtracked to some fundamental questions and philosophies. Two key components entered our process:

1. What does today's student need (not what do we want to teach them)?
2. What realities does a course provider face in offering programs?

March 10, 2007

This draft will be e-mailed to professional certified A3 instructors for review and comment to edcomm@avalanche.org by April 7.

April 7, 2007

- Deadline for Pro Cert Instructor comments
- A version of this letter and the Education Pyramid Diagram will be published in the spring issue of TAR and posted on the Web Education pages to give all educators a heads-up as to schedule and opportunities for accessing the draft (draft posted on the Web after April Governing Board Meeting) to review and provide comments.

April 21-22, 2007

Alpine Meadows, CA

- The resulting product (after review and edits with ed comm and pro cert comments) will be presented to the A3 Governing Board at the Spring Meeting.

May 10, 2007

- Released to the A3 professional membership – posted on the Web for review and comment to edcomm@avalanche.org

July 1, 2007

- Professional Member comment deadline

August 1, 2007

- A FINAL RECOMMENDATION will be issued by the Education Committee on August 1, 2007, for TAR 26/1 publication and posted on the A3 Education Web site to allow course providers ample time.

October 2007

- Continuing Education Seminar will include a short overview of the new education recommendations and full presentation including format and training for the Avalanche Skills Advancement Workshop (ASAW), which is an optional (not prerequisite) bridge between Level 1 and Level 2 programs, provides options for education, and helps ensure quality of Level 2 programs.

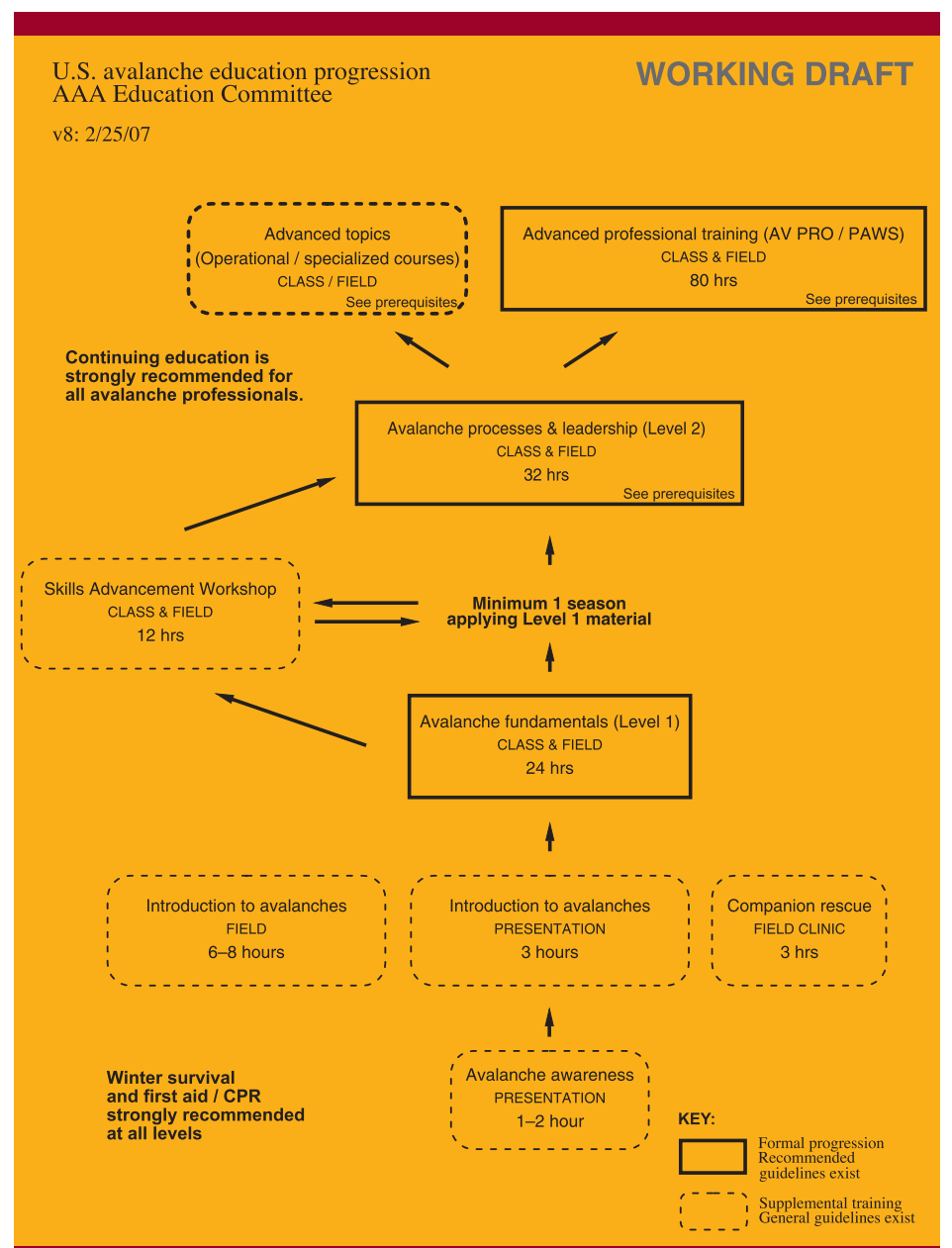
OVERVIEW OF NEW RECOMMENDATIONS

- Introduction to Avalanche Concepts provides entry-level avalanche information for backcountry travel

in or around avalanche terrain for the general public.

- Companion Rescue Clinics teach avalanche rescue skills and provide practice for the general public.
- Current Level 1 and 2 courses meeting 1999 A3 guidelines should fit Level 1 and 2 programs with little or slight revision.
- There are no prerequisites for Level 1 courses.
- Current Level 3 courses will fit into Level 2 programs (preparation for leadership/guiding) or Advanced Skill Development Workshops (focus topics with varying time lengths and content such as Mountain Meteorology; Applied Avalanche Forecasting; Ski Guiding, Snowcat, Heli-Ski, Backcountry Transportation Operations; Explosives Use; etc.)
- Avalanche Skills Advancement Workshop provides preparation for a 2008 Level 2 program or a refresher of 2008 Level 1 skills. This will not be a prerequisite for Level 2 courses.
- Continuing Education Programs are an important component for professional development or serious recreationists.
- Winter Backcountry Travel/Overnight Skills and First Aid are strongly recommended for any backcountry traveler but are beyond the scope of avalanche specific training.

The product being developed is a chart including: Outcomes, Content, Ratio of Classroom/Field Time, Prerequisites (if any), Performance Measures, Recommended Instructor Qualifications, and Instructor/Student Ratios. ❄️



media

Avalanche Film Probes at Choices, Consequences and the Science of Snow

Story by Lucia Stewart



Amber Seyler and
Sam Kavanagh

Amber Seyler, director and writer, created the film to play off the conundrum that all aficionados of the backcountry face: the lure of a big powder slope as the sweat cools from skinning to the top, versus the powerful desire to descend in big turns confronting the decisions of snow stability and group safety.

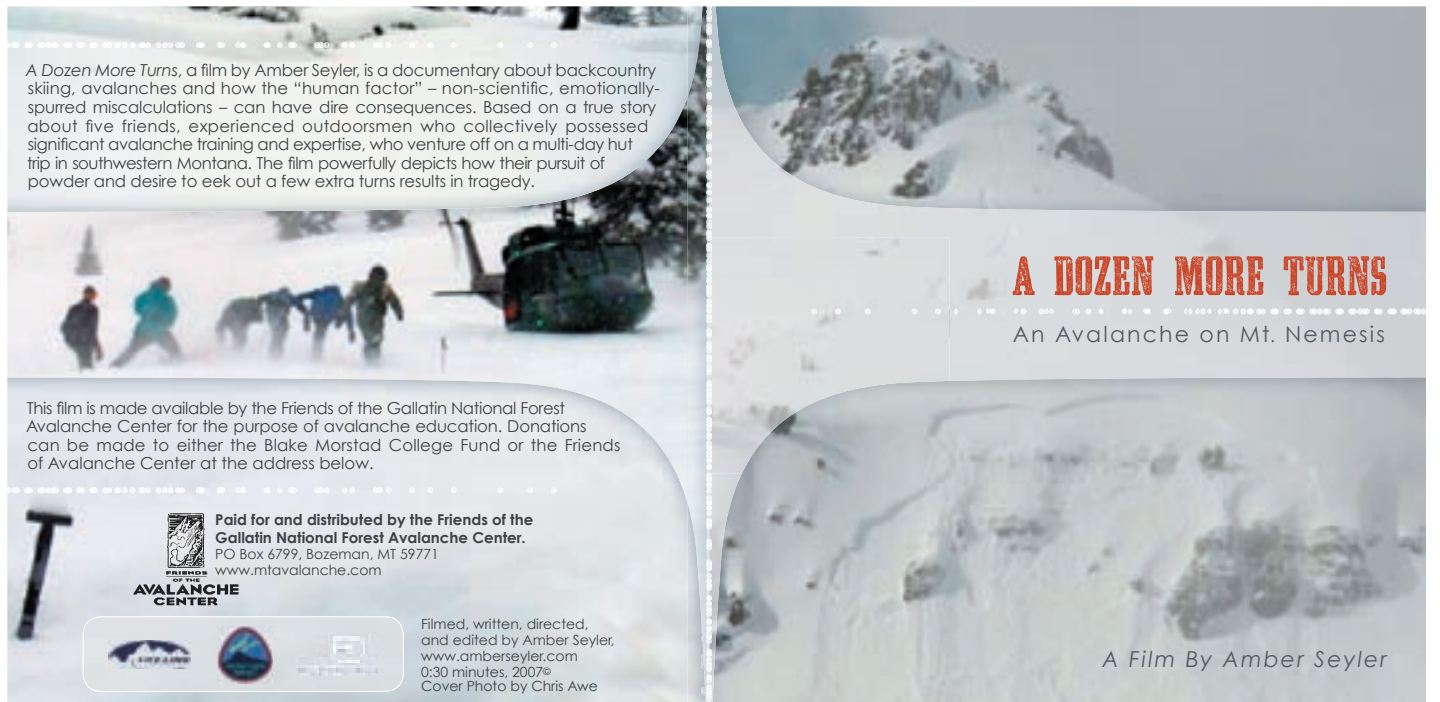
The day the avalanche happened, there was a warning out for an area 15 miles away from the Gallatin National Forest Avalanche Center. "The reason for warning was there was a buried surface hoar layer three feet deep with two feet of fresh snow. And there had been lots of natural avalanche activity," said Doug Chabot of the GNFAAC.

The group of four was skiing lower-elevation and lower-angle slopes in the trees – where surface hoar rarely occurs – without negative consequences. But they got bolder and ventured out into open areas above tree line with each run, and as soon as they did, they triggered an avalanche.

"Unfortunately, they didn't dig a pit up high because if they had, they would have seen the surface hoar that was a large stripe in the middle of the snowpack," said Chabot. "There was an avalanche warning, new snow, and wind-loading. We know all these things can equal trouble and yet the skiing was really good. They keep pushing it a little more, which we've all done but this time, they didn't get away with it."

When the avalanche hit, it resulted in the loss of the right leg of Sam Kavanagh and the death of his good friend, Blake Morstad, from trauma impact.

"I wasn't surprised to hear there was a fatality," said Chabot after he had received the call to access the scene, "but when I got there, I was shocked to see Sam still in the hut because it was now close to



It was New Years Day.

A group of close friends were enjoying the best way they knew to christen the crisp winter's day: a backcountry ski tour.

Equipped with the knowledge, the gear, and the insight into the current avalanche conditions, the Centennial Mountains in Montana were the destination for what seemed to be a perfect weekend hut trip.

Instead, the weekend held a single event that would change their lives forever.

The 30-minute film, *A Dozen More Turns*, is a story that a thousand people could tell, but not the story of the lucky ones. The film is more about the human factor than the snow science.

40 hours after the incident. That is a long time for a injured person to wait for a rescue."

Kavanagh barely made it out due to the blood loss, but in turn has taken his story and his strength into paralympic cycling.

"When we interviewed Sam, there was more to his story than just getting the footage," said Chabot. "Sam gave it weight and emotion, and instead of being a dry lesson, the film took on this whole life of its own."

One of the extraordinary aspects is that the buried video camera found the following summer still contained footage from the moments leading up to the avalanche. "It was almost like fate wanted this story to be told," said Chabot.

The vivid human factor in this story is incomparable. They all were avalanche-educated, avid backcountry skiers, and a few were even ski patrollers and snow scientists.

"There is a lot to learn from their story," said Seyler. "It examines what went wrong with the snowpack in the area and how important it is not to only have info and knowledge of snow science, but to use it and make good judgment and decisions that apply what you know."

Amber learned to ski at age 33, where she just "fell in love with it because how can you not." With an undergraduate background in molecular biology and zoology, she wanted to know more about the science behind the not-quite-understood phenomenon of snow.

As a student of the Graduate Film Program at Montana State University, Seyler is required to have an undergraduate degree in the sciences, from which she draws much of her inspiration. In this film, it was motive behind binding the powerful

facets of interviews from avalanche survivors to the dry science behind snowpack.

After getting to know Doug Chabot, who now sits on her graduate advisory committee, and the rest of the snow geeks at the Gallatin National Forest Avalanche Center, she realized her first film was going to be an educational film for their use.

A Dozen More Turns is to become a staple element in the Gallatin County Avalanche Center's educational programs and classes. There are also plans of sending it out to other avalanche centers for their use.

"I'm looking forward to having the film reach people," said Seyler. "This is a dangerous season. I hope people remember the film the next time they are up on the slope, which might save them from being caught."

The GNFAAC has made the DVD available for free to increase awareness and education; avalanche centers and schools are to receive complimentary copies as well.

"What gives the story such power," said Chabot, "is seeing these guys who made a decision and realizing how I've made those same decisions but gotten away with it."

A Dozen More Turns is available for only the cost of shipping and handling. To order, go to www.backpackinglight.com. You can also watch the film on the Web site or download it as a podcast.

Lucia Stewart is the editor for NewWest.net/Bozeman, an online network of writers and elevation – enthusiasts examining the growth and feeding the pulse of the Rocky Mountains. After growing up in Utah, she retreated to more remote mountains of Montana where you encounter wildness more often than fellow travelers. ❄️

NEW FOR 2007

Recent improvements to the AAA Web site americanavalancheassociation.org include:

- online subscription to *The Avalanche Review* (follow links to the Publications page)
- members and subscribers can renew online
- downloadable PDFs from *The Avalanche Review* archives
- current listing of AAA Certified Instructors

Stay tuned as we continue to update the site.

ISSW 2006 Proceedings Now Available Online

Kellie Erwin and Avalanche-Research.com have released the proceedings from the 2006 ISSW in video format. The video footage, all shot by Kellie, has been converted to internet files available at www.avalanche-research.com/site/issw06.asp. The video files are listed in order of appearance and available for viewing in a streaming video format created by the Adobe company.

The Avalanche-Research.com site was created to act as an online library for avalanche media. Video, documents, and photographs can be stored and shared. For more information, visit www.avalanche-research.com. ❄️

IKAR Avalanche Medical Recommendations: *Time Is Life*

Review by Aaron Parmet and Brian Taylor

The medical management of avalanche casualties is part of the avalanche rescue process that sometimes receives the least specific emphasis among American organized rescuers. Avalanche training and literature is usually focused on the other unique aspects of avalanche rescue such as searching and snow safety. However, recommendations from the International Commission for Alpine Rescue (IKAR) as well as research published in medical journals, such as *Resuscitation and Physiology*, over the past 11 years have revealed that there are unique aspects to avalanche medicine that should be taught. IKAR provides an excellent educational tool with their 78-minute DVD, *Time is Life: Medical Training in Avalanche Rescue*.

The video is essentially a narrated multimedia presentation covering the IKAR-MEDCOM recommendations. The DVD menu is well organized into several chapters. It is an amazing conglomeration of information new and old that previously had to be hunted down piecemeal by a determined researcher. Though there are a few differences in the way European rescue teams operate, most of the information applies well to the American environment. The information and new research will benefit any BLS or ALS provider.

A rescuer who understands the underlying cause of their patient's condition can better care for them. The pathophysiology chapter covers acute asphyxia and triple-H syndrome, especially emphasizing critical criteria used to determine resuscitation protocols. After building that critical understanding, the organized rescue chapter gives rescue considerations, diagnostic

criteria, and recommended treatments for each etiology. The presentation is replete with statistics and supporting documentation for all of its learning points and protocols. Yet it is never dull, as every background is an outstanding image or video from an avalanche incident or rescue training.

There is also a section on 10 common mistakes in avalanche rescue. Two of the mistakes are addressed by detailed algorithms that help ALS providers determine when to resuscitate a patient. These algorithms may differ from local protocols, but provide a framework for medical directors and their teams to improve and update their protocols as appropriate to each organization. The algorithms are based on large studies of avalanche rescue outcomes and are meant to give hope to those patients who may have a chance, such as those with an air pocket despite a long burial, without forcing rescuers to resuscitate those who have no chance. There are a few other recommendations which may be controversial. All are certainly interesting points to be brought to your medical director as they may differ from your local protocols.

There is a short segment on Post Traumatic Stress Disorder, its incidence and effects in avalanche victims. Avalanche educators will also find the short companion-rescue chapter useful in their Awareness and Level I courses.

The DVD presentation is best played on a laptop through a projector because a normal DVD player has some image shake. Viewers may notice pauses in the presentation due to time differences between the



10 translations available for the narration. If you have a computer with a DVD drive, you can also narrate the presentation yourself using the included full PowerPoint presentation. A full transcript of the video narration is included as well as an interactive quiz.

Time is Life is an excellent educational tool for the professional rescuer. Even for the veteran already familiar with IKAR's guidelines, the DVD is a great review sprinkled with some interesting statistics and new ideas. For the training director, it is a valuable resource for introducing less experienced providers to the unique medical considerations in avalanche rescue. It can be purchased from www.trickhouse.com/timeislife/

Aaron Parmet, WEMT, NREMT-B is a member of the Summit County Rescue Group Avalanche Deployment Team and is the medical officer of the Summit County Water Rescue Team.

Brian Taylor, WEMT, NREMT-P is a member of the Summit County Rescue Group Avalanche Deployment Team and is the director of Colorado Mountain College's Wilderness EMS program. ❄️

what's new

PAWS Course Report

Story and photos by Sarah Carpenter

The 2007 Professional Avalanche Workers School (PAWS) course was held February 3-10 in southwest Montana. It was a jam-packed eight days looking at terrain, snowpack, avalanche mitigation programs, and instrumentation at Bridger Bowl, Big Sky, and the Yellowstone Club, as well as touring for two days in the surrounding backcountry.

Don Sharaf and Ian McCammon led the list of instructors and were joined at different times by a star-studded cast of guest instructors. Fay Johnson eloquently presented the rescue procedures and protocols of Bridger Bowl and then oversaw a rescue scenario on day 1. Doug Richmond spent the next day with the group, presenting information on avalanche-mitigation programs and explosives, taking the course on two different control routes at Bridger Bowl, and finishing the day with an excellent presentation: *Repeated Mistakes by Avalanche Professionals*.

After three days at Bridger Bowl and in the Bridger Mountains, the course moved south to Big Sky. The group skied to the Yellowstone Club, where Tom Leonard presented his strategies for maintaining snow and weather data. He also gave a great talk on incorporating Monty Atwater's 10 contributory factors into creating an operational forecast. Mike Cooperstein played tour guide during the day, showing off the instrumentation that the Yellowstone Club uses to track snow and weather data, as well as research sites for Montana State University.

Ron Johnson and Karl Birkeland brought their senses of humor with them to Big Sky, entertaining everyone on the tour out to Wyoming Bowl the next day. Ron spoke about some of the forecasting challenges of the Gallatin National Forest Avalanche Center and the solutions he has come up with for these hurdles. Karl coalesced several research papers into a comprehensive overview of spatial variability, in addition to his findings on sintering rates following fracture. Nick Armitage gave a great talk the next morning on the merits of the Incident Command system and how Big Sky has incorporated this system into their rescue protocols. Scott Savage spoke of the challenges he faces as the head of Snow Safety at Big Sky in dealing with deep-slab instabilities and hard-slab avalanches. Last but not least, Doug Chabot



(l-r): Don Sharaf, Ian McCammon, Karl Birkeland, and Ron Johnson take a break with Cedar Mountain in the background.

spent the afternoon with the course, presenting his and Karl Birkeland's research regarding minimizing false-stable results in snowpits. He finished up the day by grilling Don Sharaf during a presentation on how to deal with the media.

Students came from all over the West, from backgrounds that varied from ski patroller to ski guide to educator, to participate in this rigorous eight-day course. Everyone worked hard, learned a lot, and went home tired. All 12 students passed the course due to their own hard work and determination, as well as that of the instructors.

The course was a great success, in large part due to the efforts of Don Sharaf and Ian McCammon, the course instructors. Don and Ian worked hard to provide a well-rounded, high level of education to the 12 students on the course. The American Avalanche Association also owes a large thank you to Bridger Bowl, Big Sky, and the Yellowstone Club, for hosting the PAWS course. Without their help, this course would not have been a reality or the success that it was.

Next year look for at least one, if not two, PAWS courses. We're hoping to run one early season in the Little Cottonwood Canyon area of Utah and a second one in a location to be announced. Check the Web site at www.americanavalancheassociation.org/PAWS.html for details this spring. Due to the rigorous nature of this course, we are considering scheduling a day off in the middle of the course next year. An extra unstructured day would ease the workload on the students, as well as give them time to practice any skill areas they may need to work on. If you are interested in taking this OUTSTANDING avalanche course, come prepared. Practice often with your transceiver, be able to locate both single and multiple beacons efficiently, and dig/document multiple snowpits before the course starts. This is a demanding, high-level avalanche course. The more prepared you are, the more you can get out of it. A detailed introduction letter will be posted on the Web site outlining student comments from the past two years about areas they recommend practicing in advance.

We hope to see you next year. And thank you to all who participated this year.

Sarah Carpenter lives in Teton Valley, Idaho, where she can be found sliding on snow, digging in snow, teaching about snow, breaking trail in fresh snow for most of the year. She has been working for the AAA in both paid and volunteer capacities this year, as PAWS course organizer, TAR editorial assistant, and member of the AAA education committee. ❄️



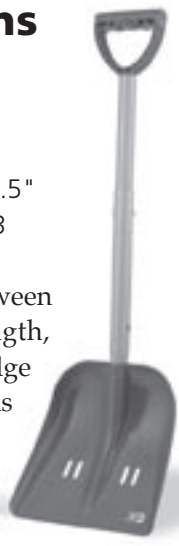
Ian McCammon captures the interest of Alex Pinchot (Crystal Mountain), Brandon Woolley (Copper Mountain), and Scott Quirsfeld (Mammoth Mountain).

Shovel Comparisons

G3 Avitech/Voilé comparison

Weight: G3 26oz, Voile 28oz
Length: Handle/extended/Total
G3: 18"/26.5"/34" Voile: 20"/28"/39.5"
Blade: Both are approx 10" x 10.5" G3 flat, Voilé has slight curve

The most notable difference between these two shovels is the total length, which gives the Voilé shovel an edge as a digging tool. The Voilé shovel feels more solid as well. Both shovels cut through knife-hard debris with a similar success rate. The flat G3 blade might be preferred by people who are very picky about pit work. The G3 packs a little better (it doesn't have an extended attachment point on the blade) and is lighter (noticeable by feel although only 2oz on scale). —Dan Powers



debris (roughly translated as I tried to break this shovel in REALLY hard snow, but could not.) All in all, I like my flashy red shovel. I just wish that the handle didn't freeze as often as it does.

—Sarah Carpenter

Black Diamond Transfer

Weight: 24oz
Length: Handle/extended/total: 16.5"/23.5"/34.5"
Blade: approx 10" x 12" slight curve

This is a great shovel. It's strong, light, and well-built. It did a great job chopping plow debris and has so far proven unbreakable. It creates a smooth pit wall and can move a decent amount of snow per shovel. One thing to be aware of with the BD Transfer is that the shaft is triangular shaped and thus only fits together with the blade one way – a potential minor stumbling block during a rescue. —Don Carpenter



Backcountry Access Companion Shovel

Weight: 26oz
Length: Handle/extended/total: 19"/28"/40.5"
Blade: approx 10" x 10" flat

I like the BCA Companion Shovel. The flat blade makes a clean pit wall, and the oval handle with a D grip is nice to hang on to. The handle has frozen on me quite a few times, making extension virtually impossible at times. It's a lightweight, sturdy shovel. I don't find the graphics on the blade particularly useful, but I think using the blade to convey some sort of information is a step in the right direction. This shovel performs well in knife-hard



The G3 AviTech Shovel weighs in light at 27oz (see additional stats above). The blade has a flat top, so it fits nicely into the small shovel pocket of my BCA Stash pack. The handle extends with two buttons and a resounding solid click. The housing where the handle inserts into the shovel is welded solidly and doesn't wobble, and the shovel itself, although small, held up to my enthusiastic attack of rock-hard plow debris. Since I got this shovel, however, I have had problems with the single-button attachment of the handle to the blade. It has always been a bit off center in the corresponding hole, thus reluctant to deploy, and finally, even repeated banging failed to achieve

connection (not the best strategy, perhaps). Knowing G3 and my local dealer, I am sure I will get only the highest quality service/repair/replacement, but I wonder if G3 could set that button more positively in the handle or even put in two? —Lynne Wolfe

Black Diamond Deploy 3

Weight: 20oz
Length: handle/extended/total: 17"/16"/26"
Blade: approx 10" x 12" slight curve

Backcountry enthusiasts – from weekend warriors to snow professionals – will appreciate Black Diamond's newest entry into the ultra-light shovel market. The Deploy has a quick set-up time because of the simple yet innovative design of the shovel shaft stored with the blade instead of in two separate pieces. This enables an almost immediate deployment for any digging project by simply sliding the shaft out to its extended and locked position. The shovel shaft is ergonomically designed, with a slight curve that is perfect for moving huge volumes of snow. The blade is designed to both cut through thick avalanche debris and provide a flat surface for stability tests. One of the best features of this shovel is that you can't misplace the handle, and the package deal fits together beautifully in the most minimalist of packs. This is THE shovel for anyone looking to upgrade to a lightweight shovel.

—Dave Brown (aka Casual Brown)



Thanks to Penn Newhard of Backbone Media, media rep for Black Diamond; Gina Brodess and Bruce Edgerly of BCA; Simon of G3; and Dustin of Voilé for their generosity. ❄️

SAVE THE DATE

October 5 - 6, 2007

AAA/ NAC Professional Development Education Seminar Jackson, Wyoming (venue and schedule to be announced)

Friday, October 5: NAC forecasters meeting and AAA board meeting

Saturday, October 6: National Avalanche Center and American Avalanche Association (open to all members) Professional Development Education Seminar with curriculum planned by Karl Birkeland, Lynne Wolfe, and Rod Newcomb. AAA membership meeting and beer to follow.

Canadian Avalanche Association Update

Story by Mary Clayton

According to the calendar winter is nearing an end but here in B.C., but the season shows little sign of winding down just yet. We've had record and near-record snowfall throughout the province, giving those of us who work and play in the snow a year to remember and plenty of white stuff to keep us busy. It's been just as busy inside the offices of the Canadian Avalanche Association (CAA) and Canadian Avalanche Centre (CAC). We've recently had funding approved for two new big projects, both of which build on recent successful initiatives.

At the CAA, we'll be working on an eTraining project, which will be an expansion of the online training program we call Avalanche First Response. This program aims to teach users the highlights of self and companion rescue in the case of an avalanche accident. The online program is interactive and uses lots of video clips, while imparting some targeted lessons about taking care of yourself and your friends in avalanche country.

Our new eTraining project will take this concept a few steps further. It will be aimed at the wide range of organizations, both professional and volunteer, that could be called on to respond to an avalanche accident. The project will create an online interactive course that will effectively establish national guidelines for avalanche search and rescue.

At the CAC, where we focus on public avalanche safety, the big news is ADFAR 2. This new project will build on the success of ADFAR (Avalanche Decision Framework for Amateur Recreationists), the project that developed our new decision-making tool, the Avaluator. The Avaluator provides a simple and elegant rules-based approach to decision-making in avalanche terrain. ADFAR 2 will focus on bridging the gap between this approach and the knowledge-based system used by professionals to produce a sort of "advanced Avaluator." This new tool will provide a science-based method for more nuanced decision-making, using more complex avalanche concepts for users with advanced backcountry skills.

Those are just some of the highlights from our office. If you want to know more about what we're up to up here, why not attend our annual general meeting this May in Penticton, B.C.? This year marks our 25th anniversary, and we're throwing a party! Check out our Web site at avalanche.ca where more details will be posted as we get closer to the event: May 7-11. Hope to see you there. ❄️

Review: Anarchist with Avalung Pack

I never thought the day would come when I would get a backpack with an instruction manual attached...or that I'd actually read the manual. The Anarchist with Avalung pack, made by Black Diamond is an addition to my ski gear that I truly needed. No more broken zippers or busted straps of the old pack – I'm now up-to-date. The Anarchist pack has a 32L capacity and weighs 1.88 kg (4 lb 2 oz). It has the ability to carry skis or a snowboard, in addition to an ice axe or ice tools, and is thoughtfully designed to do this well. The "Y-Rod" suspension on the pack makes it very comfortable to carry, even with the mountain of snow study, rescue, first aid, and repair gear I shove in it. The separate rescue gear compartment is great for easy shovel, probe, and saw access. I only wish the zipper extended a little further or down and around the compartment to make putting my shovel back in the compartment as easy as taking it out. The side access panel has not proven very useful, as it only runs a partial length of the pack. All in all, I've enjoyed my new Anarchist with Avalung backpack. It's sleek, stylish, comfortable, and has plenty of room in it. The only thing that I would change about it is making access easier to the main compartment and the rescue compartment by extending the zippers. But how can I complain – I'm still finding new bells and whistles on it after 2 months of use. —Sarah Carpenter ❄️



G3 Holds Backcountry Fiesta Competition

Host a backcountry fiesta this winter, and you could win a complete G3 guide kit, including a pair of skis.

To enter, merely enjoy a south-of-the-border inspired celebration during any backcountry trip over the course of the 2006-2007 winter, record the moment on digital video or imagery, and send the documentation to G3. Legitimate venues may include huts, yurts, snowcaves, bivy sacks and 1996 Ford F350 campers.

Backcountry Fiesta submissions will be judged by the G3 staff on innovation, creativity and authenticity. All images and video will become the property of G3, so don't do anything we wouldn't do.

One Grand Prize winner will receive a G3 Guide Kit, including a pair of 2008

G3 skis, G3 Targa Ascent bindings, G3 Climbing Skins, G3 AviTech Shovel, G3 Bonesaw and G3 SpeedPro Probe.

Two runner-ups will each win a G3 Targa Ascent binding, the lightest touring telemark binding on the market today.

To enter: send your non-returnable submission along with your name, address, phone, and email address, to G3 Backcountry Fiesta, 200 Donaghy Avenue, North Vancouver BC, V7P 2L7 or email your entry to: fiesta@genuineguidegear.com. All entries become the possession of G3 Genuine Guide Gear, and may be used for future promotional materials.

Entries are due on or before Cinco de Mayo (May 5, 2007). Winners will be notified by June 1, 2007. ❄️



New Telemark Norm Binding Debut

Rottfella's new NTN binding is the first telemark binding developed in a cooperative effort between binding and boot manufacturers. The system has a new attachment behind the ball of the foot and is based on the norm for alpine touring boots. It is designed and built by Norway-based Rottfella AS, the world's largest manufacturer of nordic ski bindings and the inventors of the original 3-pin binding. Leading boot makers Scarpa and Crispi are supporting the new norm with NTN boots.

The NTN binding features superior lateral stability and increased control through improved edge pressure and Rottfella's new spring technology, resulting in better turns.

The front-operated binding is semi step-in for easy on and off functionality. The binding is releasable, though currently not in accordance with industry standards. The NTN can be moved forward or back on the ski, depending on skier preference. The binding also has a free pivot mode which reduces forward flex resistance for improved stride and touring.

The new NTN boots feature a bellows and flex pattern that is improved beyond existing telemark boots. Both the Scarpa Terminator X and the Crispi EVO NTN boots can be used interchangeably in both NTN and AT bindings, though approval for AT use is pending.

The NTN and all Rottfella telemark products are now distributed in North America by Backcountry Access (BCA). For more information, call BCA at (303) 417-1345 or see www.rottfella.no. ❄️

Black Diamond Opens Demo Center in La Grave and Adds Staff

Black Diamond Equipment Ltd., announced the opening of a Demo Center in La Grave, France. The Demo Center is located in La Grave's storied Edelweiss Hotel. One of the steepest ski areas in the world and the cradle of freeriding, ski mountaineering, and alpinism, La Grave is a prime locale for testing BD equipment. European retailers and consumers are invited to demo both ski and alpine climbing equipment. For more information, contact the Auberge Edelweiss at 0033.47679.9093 or visit www.hotel-edelweiss.com.

Laurel Hunter, BD's new graphic designer, will focus on Web and print design. A former college art teacher and freelance designer, Hunter's work has

appeared in *Artweek*, the *Oakland Tribune*, and in numerous exhibitions. When she's not designing, Hunter enjoys racing her road bike, riding her backcountry snowboard, and climbing.

BD's new Athlete and Event Coordinator, Charlie Lynch, comes to Salt Lake City from the North Face, where he supported the sales team, coordinated events, and participated in product testing. At BD, Lynch will focus on supporting and expanding the athlete team and promoting the Black Diamond brand through grass roots sponsorship and core outdoor events. Lynch is a passionate freeskiier and triathlete.

Colleen Graham Nipkow, BD's marketing manager, has been recognized

by REI and regional non-profit organizations for her work with the Friends of the Utah Avalanche Center (FUAC). "Colleen was an ideal choice for our Wasatch Outdoor Volunteer Award," comments Eric Spreng, REI community outreach coordinator. "As president of FUAC, she has contributed countless hours directing the fundraising efforts required to keep the Utah Avalanche Center operating at a high standard, and she has done so selflessly, without ego or expectation of recognition and reward. Not only does Colleen epitomize the spirit of volunteerism, I sincerely believe that her personal contribution has helped save lives in the backcountry." ❄️

Willywaw's Avalanche Booklet No.5 LIVE LONGER - PLAY LONGER

Now in its fifth printing, *Willywaw's Avalanche Booklet* is a resource of information connecting backcountry players to the avalanche community. Our goal is to promote avalanche awareness and inspire outdoor enthusiasts to acquire the skill, knowledge, and experience needed to play safe in avalanche terrain.

Ortovox, Black Diamond, Patagonia, and Sterling Rope sponsor this edition. We partner with the Alpine Safety Awareness Program.

Core features include:

- Avalanche Forecasting Hotlines in the US, Canada and Abroad
- Listings of Avalanche Educators
- Avalanche Rescue and Survival Strategies
- Wilderness First Aid Quick Guide
- Good Reading, Viewing, and Links
- Hazard Evaluation Check List

The 32-page color booklet is 4.25" x 5.5" with a loop of climbing cord through the top. It is printed on 100% post-consumer recycled paper with soy ink. It is a must-have for backcountry adventurers. Retail price \$4, wholesale \$2. Willywaw, 23 South River Drive, Narragansett, RI 02882, 401.783.2275, ashley@willywaw.com, www.willywaw.com ❄️



SpadeTECH Shovel Available August 2007

Taking a new angle on a critical piece of backcountry safety gear, G3 Genuine Guide Gear introduces the guide-inspired SpadeTECH shovel, a more efficient way to move snow.

Ideal for digging hasty pits, evaluating snowpack, chopping cornices, setting track, and a multitude of other crucial functions, the versatile SpadeTECH is designed to stow easily for quick access; perfect for guides and backcountry skiers who are constantly using their shovels.

Simple yet versatile and always handy when needed, the SpadeTECH's key advantage is a low-angle blade with a rounded leading edge that effectively penetrates consolidated snow. The new ergonomic T-Grip and innovative blade shape allows users to efficiently pull snow away instead of scooping and throwing.

The SpadeTECH utilizes aircraft-grade aluminum in the blade and shaft connector tube to maximize shovel durability and minimize weight. Utilizing the same proven construction as the AviTECH shovel, the blade and connector tube are TIG welded by hand to create a stronger blade to shaft interface.

The SpadeTECH is available with a lightweight, ergonomic T-grip handle (22oz overall weight) or the classic, powerful D-grip handle (24oz overall weight). Blade dimensions are 8" wide by 10" long with an overall packed length of 22". ❄️

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To: Lynne Wolfe, Editor, The Avalanche Review
From: Doug Abromeit (dabromeit@fs.fed.us)
Subject: Pulse Barryvox Beacons
Date: March 6, 2007

Recent discussions have revealed some confusion about the Mammut Pulse Barryvox's wireless link (W-Link).

First of all, it is important to understand that the Pulse Barryvox complies with the international standard for avalanche transceivers EN 300718 and that the device is compatible with all other transceiver brands and models on the market.

The W-Link is a separate frequency only used for communication between Pulse Barryvox transceivers. At this time, the W-Link is used to communicate the presence of motion data, as detected in buried subjects by the unit's built-in

accelerometer, to other Pulse Barryvox units. Since this motion may indicate the presence of a pulse or respiration, Mammut refers to it as vital data and depicts it with a heart symbol next to the icon of the buried subject. The W-Link is completely separate from the transceiver's 457 kHz functionality and can be deactivated in the user settings.

In Europe, the frequency used for the W-Link is 869.8 MHz. In the U.S., FCC regulations require the use of a frequency range between 916 and 926 MHz for this purpose. Due to these FCC regulations, units sold in North America are configured to use the 916-926 MHz range. Units sold in Europe, on the other hand, are preconfigured to use 869.8 MHz. However, the user of a European unit can toggle to the North American W-Link frequency in the user settings. If users of North American units travel to Europe and wish to use the W-Link functionality, they can send their units to a Mammut service center in the U.S. or Switzerland and have the European W-Link frequency activated.

IMPORTANT NEWS

After this one-time activation, the user can toggle between the European and North American W-Link frequencies on their own through the user settings.

Adding to the confusion, there is a red card in the packaging of North American units designed to explain the different frequencies used for the W-Link in North America and Europe. Unfortunately, the way that text is phrased, it suggests that the W-Link does not work in North America. Mammut is aware of this problem and may change the wording in the future.

In summary, the Pulse Barryvox complies with the international standard for avalanche transceivers EN 300718, and the device is compatible with all other transceiver brands and models on the market. The wireless link (W-Link) used solely for device-to-device communication between Pulse Barryvox transceivers and has nothing to do with the transceiver's basic 457 kHz functionality. The frequencies used for the W-Link are different in North America and Europe. ❄️



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This shot of Berthoud Pass was taken just minutes before an avalanche occurred on the Stanley path, just out of frame to looker's right. The slide caught a couple of cars and created more headline news than anyone cared.

Bloodletting, Water, Brazil Nuts, Swimming, and Dying in Avalanches

Story and photos by Dale Atkins

You probably never wondered why or how bloodletting, Brazil Nuts, and swimming have anything to do with dying in avalanches. If, however, you spend any time in avalanche country, you may want to keep reading because there is a connection. Basically, bloodletting, like swimming in an avalanche, seems like the logical thing to do, but the premise on which both are based is wrong. While avalanches may flow like a river, an avalanche is not a liquid. Because avalanches are not a liquid, Brazil Nuts, not swimming, better explain how and why one gets to the surface. For those who couldn't get to the surface their burial was more about bad luck than actions, and worse, swimming leads to dying. Curious to learn more? Let's start with bloodletting.

BLOODLETTING

For two millennia, bloodletting was a standard and very popular treatment provided by doctors (and others, like barbers) to treat nearly all physical and psychological ailments. From long before Hippocrates to just over one hundred years ago, bloodletting, or bleeding out a pint or two (or more) of blood seemed like the logical way to free the body of bad things and to restore health. The reason bloodletting endured such a long run of popularity was that it seemed to work – but for all the wrong reasons. Because bloodletting seemed to work, early doctors kept at the practice for thousands of years. With no understanding of physiology, the explanation for bloodletting's success was simple. Bloodletting either seemed to help or it didn't, and if it didn't help at least the doctor could say he had tried. It wasn't until the very end of the 19th century when physicians gained insight to human physiology that the recklessness of bleeding was recognized.



Fraser was probably not the first English-language writer to order those caught in an avalanche to swim.

But ever since, every avalanche instructor in North America has commanded, "Swim!" Even Hollywood presented the advice in Robert Redford's 1972 mountainman-epic *Jeremiah Johnson*. At the end of the movie Redford's Johnson meets back up with his mentor old Bear Claw Chris Lapp (played by Will Geer) who tells Johnson in a slow, matter-of-fact tone that an "Avalanche took the cabin. Lost my mule. We swum out of it."

To swim has become an axiom of avalanche educators everywhere. The problem is that swimming is unproven. Unproven? What about all the victims who every winter said they swam in the avalanche and swear it is the reason they got to (or stayed on) the surface?

Isn't that sufficient proof, you ask?

No, it's not. It's simply a very biased sample of survivors. The words of all those who swam but ended up buried and killed were never recorded. So bear with me and keep in mind that, while I can't present sound statistical conclusions that swimming does not work, there is no statistical evidence or even science that suggests swimming works.

The physics of swimming to the surface of an avalanche do not make sense or even compute. The reason a human body floats in water is because our bodies are about the same specific weight (think density) of water. Some people (and you know who you are) are better floaters than others, but everyone with a chest full of air will float. This works in water, but in an avalanche the specific weight of the moving snow may be only one-third the specific weight of water, and snow can be a whole lot less. It is not buoyancy that causes us to float to the surface. Swiss avalanche researcher Martin Kern found that even the avalanche airbag system that adds another 150 liters of volume to a body "is not sufficient to keep a skier on the surface of a flowing avalanche." So if hydrostatic buoyancy doesn't keep one on the surface, what does?

BRAZIL NUTS

Before getting into nuts there is some good news and bad news about getting caught in an avalanche that should be reviewed. First, the good news: total burials don't happen very often. Data collected by the Colorado Avalanche Information

WATER AND AVALANCHES

Just like bloodletting seemed like the logical thing to do, swimming seems like the logical thing to do when caught in an avalanche. Fortunately, modern medicine exposed the folly of bloodletting when the premise (bad things in the body can be released by bleeding) was learned to be faulty. I hope to do the same by explaining how the premise for swimming in an avalanche is faulty. To do this I will discuss nuts, but first, we have to rethink the analogy of avalanches and water.

How often have you heard or described an avalanche as being like a river? Flowing water has been used as a metaphor to describe avalanche motion for nearly 100 years. When in water, what's the most natural thing to do? Swim! When it comes to the mention of swimming – when caught – in an avalanche the record goes back well over 100 years.

The first mention of swimming is found in Colin Fraser's seminal classic *The Avalanche Enigma*, where he cites a Swiss man, Philip Gosset, who swam in an avalanche in 1864. Of the experience, Gosset said, "I was aware of the avalanche... to prevent myself sinking...I made use of my arms...as when swimming." Ever since, the accident record is filled with people attributing their survival to swimming. In fact, 40 years ago, Fraser wrote "...make strong swimming movements with arms and legs in an effort to stay on the surface."

Continued next page ➡

BRAZIL NUTS

continued from previous page

Center shows that in Colorado from 1970–2005 a total of 1748 people were reported caught in avalanches and 309 people or 18% were buried. But before saying this number is significant, keep in mind the bias in reporting of serious – buried victims – accidents. While the actual number of people caught is unknown (reported + unreported), it is reasonable to estimate that perhaps two times (or more) as many people were caught in avalanches than reported. Assuming that most burials do get reported (a reasonable assumption) this means the actual burial rate might be only one-half (or less) the reported burial rate. The bottom line is simple: few victims get buried.

The bad news is pretty sobering: once buried, about half the victims died. Since 1970 a total of 170 victims in Colorado were killed, and nearly every one was buried. Certainly getting buried is bad news, but why do most people not get buried? The answer can be explained with a bowl of mixed nuts.

While avalanches move in a fluid-like state, avalanches are not liquids and are certainly not water. Avalanches are gravitational granular flows, a phenomenon that has both fluid and solid aspects. In granular flows the biggest particles end up on the surface. Granular flows are found all around in nature, industry, and home. Besides avalanches, other examples of granular flows include river sedimentation, dune formation, soil liquifaction, pharmaceuticals, animal feed, coal, breakfast cereals, and mixed nuts.

Under the influence of gravity, smaller particles settle to the bottom and force larger particles to the top where they tend to stay. This process, known as the Brazil-nut effect, is formally called inverse grading (or segregation). Rather than mixing, granular flows de-mix, as smaller particles settle to the bottom and the flow becomes laminar. Shake a bowl of mixed nuts and the large nuts (like Brazil nuts) rise to the top. You may have noticed the same effect in your morning cereal box. The crumbs settle to the bottom and the large pieces rise to the top. The same thing happens in an avalanche. Little

trees get buried; big trees tend to stay on the surface. Snowmobiles tend to stay on the surface far more often than their riders. Relative to slab fragments, a person tends to be a pretty big “nut” and is forced to the top of the flow. Becoming a big nut, so to speak, is why avalanche airbags, and exclusively the German ABS system, has been shown to significantly increase the chances of survival by helping prevent burial. Inverse grading Brazil-nut effect explains why relatively few people get buried in avalanches and why people swept under can reach the surface.

Once the avalanche starts down the mountain the particles tend to segregate quickly and flow in parallel layers. As chaotic as they look, avalanches actually tend to present pretty laminar flows. If you doubt this, check out the parallel striations in the snow cover in tracks and runout zones after an avalanche has plowed through the snow cover. Certainly, terrain irregularities can upset the smooth flow and cause some mixing. This is why avalanche victims describe the flow as like that of a river or waves. In some long-running avalanches, victims have described what seems like a wild swim down a raging river. They start on the surface but find themselves dragged down, but are able to struggle or “swim” back up to the surface. Some victims describe several cycles of being pulled down and fighting back to the surface. This up-down motion can easily be explained in granular flows. When the avalanche flows over a terrain feature (steeper slope or surface irregularities), the flow can become turbulent (mixing) causing the victim to be pushed down. As the flow smoothes out, it is the particles segregating (de-mixing) that force the person back to surface.

For nearly 150 years people have declared how swimming helped them not get buried, but armed with a modern understanding of avalanche flow a logical deduction bears out that getting to and staying on the surface had nothing to do with swimming. Like bloodletting, the logic of swimming seems sound, but the premise is wrong. It’s not swimming or buoyancy (floating) that gets a body to the surface, it is the physics of the flow (particle size) forcing one to the surface.

“You’ve got to fight. Fight like hell!”

—Tom Kimbrough, *Winning the Avalanche Game*

How many avalanche educators have repeated these words? Indeed, how many students have reiterated them? Tom’s segment on what to do if you’re caught in an avalanche sticks with most everyone who has seen it. I believe it, as do many others. I first read Dale Atkins’ article as a reprint from the *Boulder Camera*. I found it intriguing yet disturbing at the same time. I had the opportunity to read the draft of his article for *The Avalanche Review* and feel I better understand his argument. I won’t argue with inverse grading, laminar flow, or turbulent suspension versus gliding flow. I am not an engineer, but Dale presents a consistent picture of avalanche mechanics with what I understand and have read. BUT I feel the take-home message from his article could use some elaboration.

In my time as a backcountry skier, outdoor educator, and heli-ski guide I have ski triggered a lot of avalanches...scores even. I have been caught by three of those avalanches and have had several friends/colleagues caught in my view as well. Without going into a case-by-case analysis, I can say that clawing into the bed surface, pushing blocks around yourself, log-rolling out of moving debris, and generally *fighting like hell* does work to get people out of moving debris, or at least to the top of it. I agree that swimming may not be the mechanism that allows people to surface in a moving avalanche, but doing everything you can to escape the flow seems like better advice than solely focusing on your airway. I would hate to leave it to luck whether I end up as a Brazil nut close to surface or as a hazel nut at the bottom of the debris pile.

Dale has dug up a lot of avalanche victims and his observations carry a lot of weight with me. I think the missing parts of the equation are the many who were caught, but not fully buried. Part of their luck may have been inverse grading, but for a great many avalanche practitioners, it is because they fought with every ounce of their strength to get out of the avalanche, and they did (even in some larger avalanches – D3s). They aren’t part of a data set, and like me, they hope never to be part of one.

I think Dale’s article brings up good points, and I will be less likely to tell my students and clients to swim in an avalanche. Air pockets are critically important, and knowing when to get one hand in front of your face and the other up out of the snowpack is an impossible concept to teach. You can bet though that I’m going to tell them to heed Tom’s words. Many of my friends have done just that and they are still here to argue their case over a few beers...and a bowl full of mixed nuts.

Respectfully,
Don Sharaf

BAD LUCK

While the motion of an avalanche tends to force people to the surface, it is simply bad luck that determines who gets buried (terrain traps not included). In some avalanche accidents, two people caught very close together – even as close as a few meters apart – have ended up in vastly different circumstances when the avalanche stops.

One person – lucky – stops on the surface, buried just to the ankles, while their friend – unlucky – ends up buried under a meter of snow. They both took the same ride and swam (or sometimes neither could swim because the avalanche was too powerful), but one gets buried and one is on the surface. To understand what happened to the two victims we need to look again at avalanche movement.

When an avalanche *slows* (but before it stops), the snow fragments interlock, resulting in a change in state from a fluid-like flow to that of a sliding block (everything moves as a single unit or block). In large avalanches this sliding block can travel long distances. When the flow becomes a sliding block a person inside the flow is immobilized and if below the surface, stays buried. The person at the surface stays at the surface. It is all a matter of luck whether the victim is on the surface or engulfed in the flow when the debris becomes a sliding block. The victim trapped beneath the surface in the sliding block suffers bad luck and stays trapped in the sliding block as the avalanche comes to a stop.

AVALANCHES SLOWING DOWN — IT’S TOO LATE

In the paragraph above I highlighted the word *slows*. When considering people caught in avalanches we need to rethink our use of words like *slows* and *decelerates*. How many times have you heard and read something like the following: “When the avalanche slows down (decelerates or comes to a stop) get your hands in front of your face to create an air pocket or try to extend a hand to the surface.” Reading and hearing people talk about what to do when avalanches slow down makes one think it is very possible and reasonable to create an air pocket. However, talk to buried avalanche survivors, and you hear a very different story.



Paramedic Kevin Kelble, long-time Copper Mountain patroller, waves in the Flight For Life air ambulance during an avi-dog drill.

Survivors seldom say their avalanche slowed down and that they had time to get their hands in front of their face. Usually survivors use words like *abruptly*, *suddenly*, and *quickly* to describe how the avalanche *just stopped*. These survivors generally add to their narrative that they either had *no time*, *no chance*, or was *not possible* to get their hands to their face. There are two simple reasons why they couldn't do it.

First, avalanches that catch people (typically falling between 100-200 vertical meters) tend to stop rather abruptly, perhaps in just a second or two. In these cases there simply isn't enough time to get the hands in front of the face. The second reason has to do with the change in state from a fluidized flow to a sliding block described earlier. This transition happens abruptly once a certain velocity threshold is reached. An avalanche may still be traveling at a relatively speedy rate when it transitions to a sliding block – immobilizing the person – before the avalanche starts to noticeably decelerate. If you're busy swimming when the flow suddenly and unexpectedly transitions to a sliding block, your hands will remain stuck far away from your face, and this is why swimming leads to dying.



Certainly getting buried is bad news, but why do most people not get buried? The secret can be found in a bowl of mixed nuts.

SWIMMING LEADS TO DYING

It's pretty simple why swimming is so harmful. Swimming keep the hands away from the face, and a crisis occurs before the avalanche even stop. When the slab fragments interlock, the ability to get hands in front of one's face is lost even though the avalanche is still moving. Once the snow stops, it is nearly impossible to move the hands to the face to create the essential air pocket. Without an air pocket the consequences of a burial are too often fatal, unless uncovered in minutes. Having dug out well over a score of victims (all deceased) and having seen pictures of scores more, a common condition was that the hands and arms were nowhere near the face. Based on interviews, many burial survivors – nearly all – got their hands in front of their face early and created an airspace. (In addition, most also had fast-acting friends.)

WHAT SHOULD YOU DO?

If you have gotten this far, it should be pretty clear I don't favor swimming. In Europe many avalanche educators and guides for decades have suggested trying to "log roll" out of an avalanche. While this may work in small avalanches, it will not work in larger, faster avalanches. So if you're wondering what to do if

caught, my answer is pretty simple. Once knocked off your feet you should get your hands up to your face. Of course, if you can grab on to some fixed object, do. (Each second hanging on means that much snow goes past and can't bury you.) But don't wait to get your hands in front of your face. In shorter running avalanches, stopping occurs quickly. In longer and larger avalanches there might only be a few seconds where you have control over your actions before the slide is moving too fast, and suddenly you are tumbling and rag-dolling in an out-of-control ride. Keeping your hands in front of your face is always much easier said than done however. Halsted Morris – former long-time education coordinator for the Colorado Avalanche Information Center – suggests a simple technique that could keep the hands near the face. Halsted suggests reaching across the face and grabbing a jacket collar or the pack strap where it crosses the shoulder. You may not have your hands in front of your face, but you can use the crook of your elbow to create an air pocket. While hanging on to a collar or pack strap does not place your hands immediately in front of your face, it is more apt to maintain airspace in a tumbling ride.

A FEW FINAL WORDS

It is my opinion that swimming leads to dying, and I hope this essay convinced you of swimming's potentially harmful outcome. Whether you are convinced or unconvinced about swimming (or of my argument), I hope you will question the long-held belief about swimming, and I hope others will research this issue. Telling people not to swim is a major departure from how we all were trained and how we may train future generations of snow enthusiasts. While we ponder what to teach in the future, we also need to look at what we have missed from the past. The concepts about avalanche motion – granular flows, laminar flow, inverse grading, deceleration rates, inter-locking fragments, sliding blocks – are not new. Quite the contrary, these principles have been around and are well accepted to describe avalanches by the science and engineering communities for years. Unfortunately these principles, their meanings, and their implications have not been communicated to field practitioners and sports enthusiasts.

Some of you may remain unconvinced about not swimming, especially in the absence of statistical confirmation. Skeptics must also remember there is also no statistical confirmation about the efficacy of swimming. Sure, there is a vast record of first-hand reports that swimming saved lives; however, this outcome does not make sense with our modern understanding of avalanches. Perhaps the more important – but seemingly forgotten – record is the long list of dead avalanche victims who knew to swim and who relied on swimming to save their lives. Tragically, swimming didn't work for them and their families.

*Dale Atkins is the US representative to IKAR, the International Commission on Alpine Rescue. After many years working for the CAIC, he now consults for RECCO AB. He is writing another volume of *The Snowy Torrents, 1987 to 2005*, which is due out in 2008, to add to the now out-of-print set of classic volumes.*

The views expressed in the above article are those of the author and do not necessarily reflect official positions of RECCO AB.





above: Tim Ricci and David Sly check classic snowlauncher stock at Marmot Basin's powder magazines. *Photo courtesy Tim Ricci*
 left: David Sly and Mike Rubenstein of Kickinghorse Mountain work their Avalanche Pipe gun. *Photo by Adam Sly*

WHAT'S HOT in Avalanche Control

The Return of the Avalauncher

Story by David Sly

My latest tour to visit people in the industry was primarily to introduce our new avalauncher bullet, "The Stubby Snowlauncher System." The evolution and development of the avalauncher has been well documented and its value to the snow control industry is unprecedented. We developed this new bullet in order to address some of the problems with the classic bullet. The "classic" style avalauncher had been unchanged for about 30 years or so; setting out to improve on this system has been a difficult but rewarding task.

Quality control of the "classic" system was a challenge. Since many corporations were involved in the manufacturing of required parts, the system's quality control was spread throughout California, Utah, Ohio, Quebec, and BC. Well-known problems included broken or crooked nose cones (which ruined flight), loose or extremely tight adapter molds, often poor tail fin connection (which caused separation in flight), poor flight characteristics, supply interruptions and delays, and little or no field technical service. The biggest problem was determining which part of the supply chain was responsible.

Our new Stubby Snowlauncher System, we believe, addresses all of these issues. CIL/Orion uses experienced field technical support as well as extensive staff support in R&D at our head office and plant levels. A large part of our commitment to the avalanche industry is to ensure a continued unmatched track record for safety, quality, and reliability. Collectively, Everett Clausen, Andre Gagnon, and I have contributed 100 years to the explosives industry. We analyze our product performance in the field providing feedback to our scientists, chemists, and engineers at Austin Powder Company. As a result, you can be assured they are not homemade charges; they are meticulously designed and backed by a network of companies with depth and bench strength. This is an important liability-plus that only CIL/Orion offers.

Our products must be safe, reliable, and affordable. It is incumbent upon CIL/Orion to ensure this is the case. Therefore, all of our products must be properly introduced on-site to specific clients with initial and follow-up field visits. We set the procedures and guidelines for each of our products and systems to ensure safety. This is an essential part of our customer service commitment and our valued customers have

depended on it. Our products are designed specifically for use in the Avalanche Industry and we have full liability-assurance partners who understand and support our Snow Control Division. Some explosives companies issue forbidding warnings that their products should not be used by avalanche practitioners. We, on the other hand, support and encourage our customers to use our products in such applications since we design and manufacture them specifically for use in the avalanche industry.

CIL/Orion and the Austin Powder Company make and design all parts of the Stubby, allowing for quality control that was lacking in the past. The primer is made in Ohio with the patented Austin Powder enviroprime COMP-B blend. This blend contains 5% microbial inoculants for self-destruction. When visiting Rob Hemming at BC Highways in Revelstoke, I realized how well this can occur. The highway department had recovered a 4kg COMP-B Avalanche Guard primer dud containing the enviroprime blend. The dud on Laurie Mountain was from the Avalanche Guard system, target registry, in October 2005. The soggy rugged cardboard wrapper was intact but the COMP-B inside was almost completely decomposed. I was delighted by the discovery because we can safely expect that our COMP-B products will decompose in the field and not in magazines.

Rob also reported that our Avalanche Guard system is definitely doing its job in this large avalanche field.

The Avalanche Guard is artificially triggering class 4 avalanches when forecasted to do so, allowing some much-needed stress relief. News like this just can't be matched in any lab setting.

As I continued on my industry tour, I made many other small discoveries. At several sites, I found three different gun barrels in which the Stubby would not fit. One barrel actually fit the Stubby on one end and not on the other. Fluctuations in temperature play a large role in the diameter of an aluminum barrel; our Stubby procedures address these barrel issues. CIL/Orion has specially designed barrels for sale to fit both breach and tray loaders.

A few accounts, like Telluride, Mount Hood Meadows, and Fernie Alpine Resort, have some very difficult high-pressure targets to hit. The difficulty comes from long distance and indirect targets. One target at Telluride has to fly over a large shoulder and drop down into a start zone. High pressure lobes are needed to hit this important target. The larger diameter, one piece, shoulder driven forebody allows the charge to exit the barrel true. Improved aerodynamics translates to target accuracy.

At two of these locations we are test firing the Delta K round alongside our Stubby. The Delta K round has some desirable features. It flies straight and accurately. The patented Delta K arming system is very reliable and provides a very fast detonation linkage enabling the charge to explode closer to the



David Sly joined the Jasper Parks Canada crew at Marmot Basin below their Avalauncher gun. *Photo by Adam Sly*

surface. The tail fin connection has been a topic of much discussion. This feature is dealt with through precise and detailed procedures. Many thanks to Daniel Howlett (Howie) at Alta for his assistance with this. CIL/Orion has a distribution agreement with Delta K Explosives Engineering Systems Ltd from Kent England. We purchase the parts from Delta K and manufacture the charges at our plant in Ohio. This gives CIL/Orion another quality avalauncher system in our tool box.

Stevens Pass Ski Area is now using our new low-temperature Emulsion charge with cap wells. This enhanced energy charge is working very well. The rugged wrapper over a 2" x 12" payload provides reliable high energy at an affordable price. The cap wells enable charges to be dismantled without contamination to the detonator.

I visited Aspen Highlands to introduce our Avalanche Guard system. The Highland bowl is a great spot for this large 4 kg COMP-B primer. We lobbed one charge on each side of the bowl from a mobile Avalanche Guard Pipe. The pipe was mounted on a snow-cat and launched from above the bowl in a safe area well back from the lip. As it happened, the testing day came right after the largest snowfall of the season. The large explosions emptied the large bowl of any dangerous new deposits.

This season we are really seeing an increase in sales of our factory-made Mildet Fuse Assembly. The Mildet has been exclusively used in Canada for the past six years. The entire USA market appears ready to switch from homemade fuse assemblies to a reliable factory-made fuse assembly. Our Mildets are made in the USA at our plant in Tennessee. This year has been one of our best ever for reliability. We can boast a performance rating of more than 99.99% detonation. At Lake Louise, Dave Isles said, "We have never had a dud with Mildets in the six seasons we have used them." Mildets are the backbone of our business and this is great news indeed.

I would like to take a moment to list all our clients and to thank everyone for the warm reception. Your input is crucial to the development of our systems and products: Mount Hood Meadows, Telluride Ski and Golf, Colorado DOT, Emrick and Hill Inc., Dyno-Nobel Inc., Aspen Highlands, Breckenridge, Copper Mountain, Stevens Pass, Mount Norquay, Lake Louise, Marmot Basin, Jasper Parks Canada, Kickinghorse Mountain Resort, Mustang Powder Ranch, Whistler, Blackcomb, Fernie Alpine Resort, BC Highways Revelstoke and Victoria. Thanks Craig Sterbenz (Sterby), Anton Horvath, Tony Sittlinger, Jon Andrews, Asa Mueller, Tim Ricci, John Thornton, Mike Rubenstein, Daniel Leslie, Dave Isles, Rocket Miller, Garth Lemke, Mike Eider, Rob Hemming, Doug Wilson, Howie, Brian Johnson, Mark Vesley, Garret Boyd, Mike Wilson, Ray Munford, Jack Steiber, Peter Carvelli, John Adams, Mike Clark, Rob Tierny, Kevin Ahern, Stu Schaefer, Roger Peart, and Stephen Kintigh.

With these new avalauncher bullets now available I am sure you will see a renewed interest in the avalauncher system.

At CIL/Orion we are committed to this industry. We have an answer for your avalanche explosives needs on both sides of the border. Through quality equipment, quality products, and quality people, our field support never stops.

That's a wrap for this trip. See y'all on the mountain, eh!



David Sly, shown above holding a new Stubby Snowlauncher round, is an enthusiastic product rep for CIL/Orion, which is a strong supporter of the AAA. Photo by Daniel Leslie ❄️

Calling All Snow Geeks

RIME OR HOAR: What do you think?

Photos by Sarah Carpenter

INITIAL INQUIRY from Don Sharaf:

Hello all,

I think these were formed by very slow-moving, very humid clouds, BUT I don't know. Do any of you know definitively? There was general riming at the ridgecrest, but on all sides of the trees, not just windward.

I have seen these form before, but not this large. These formed below tree line on Mt. Oliver between 7000 and 8600' last Monday (January 8, 2007), at the end of a storm (10,450' temps in mid-teens). All trees had this needle build-up to some degree, but they were larger near the ridge crests.

thanks for any insight. Cheers, Don Sharaf



From Rod Newcomb:

Greetings, I was on Teton Pass years ago with Duane Bowles and we saw these. I thought that Duane would have the answer, but no, he was confused also. I think they are surface hoar, but without reading all the papers on SH don't remember at what temp SH forms as needles.

Rod Newcomb

From Ethan Greene:

Hi Don, Sarah and everyone else, Thank you for sending the photos. The needles are beautiful!

I agree with Rod's description.

I think it is unlikely that the needles formed as supercooled water impacted and froze on the trees (rime). It is more likely that they formed from vapor deposition. Needles tend to form in the -5 to -10 C range. They also require relatively higher levels of supersaturation. So good conditions for formation could be a cloud in that temperature range resting on a mountain top.

I think we typically call this type of formation surface hoar, although the mechanism that forms them is a bit different. It is closer to ice/vapor processes you find within a cloud. It is similar to surface hoar in the sense that vapor is deposited directly onto a terrestrial feature (a tree in the photo). The size of the crystals is probably due to the "slow moving" nature of the cloud (i.e. more time in the environment=bigger crystals).

Sounds like a fun day walking around in the clouds. Ethan

From Ed LaChapelle:

Don— Without a closer photo, I cannot for sure call these rime needles or hoar frost. Growth on one side of branches suggest former, but the overall shape make hoar frost possible. Ed LaChapelle

From: Sam Colbeck:

Hi Lynne: I agree with Ethan's comments. They are clearly vapor-grown, not due to accretion of liquid droplets. Since needles grow in two distinctive temperature ranges, it could be either range. However, the size of these shows rapid growth so it would have to be the upper temperature range. Some advection would probably be necessary to get this size, but too much movement would probably have produced riming. Did anyone look at these with a hands lens to see how much they are rimed? Sam

From Ian McCammon:

Hi Everyone,

In LaChapelle's *Field Guide to Snow Crystals*, Ed calls something similar rime spikes (plates 56 & 57), though they are smaller. He even has a nice close-up photo that looks convincingly like rime. But maybe it really is surface hoar. Beats me.

Don, I remember years ago seeing these together on a tour up Maverick, on the trees near ridgeline. We had a lot of fun speculating about how they formed, and even came up with some theory about boundary layer flow and the riming process. I recall emailing Sam Colbeck about this, who uncharacteristically had no profound insights as to their formation.

My two cents. Hope everyone is well! Ian



The STS — Snow Terrain Smart System Hazard Forecasting for Backcountry Travel

Story by Jeff Gfroerer and Leni Neumeir

Beyond the enjoyment of travel through natural landscapes, the physical and spiritual awards of being in the mountains, and the rush of the turn, we are all faced with the same very important question: How is the snow stability? There are many important pieces to this puzzle, and large amounts of research, observation, and documentation have gone into enhancing our understanding of how these pieces fit together. The main objective when answering this question is to make the right decisions so that we can get our “powder fix” or help guests get theirs and still return home in one piece at the end of the day.

I have been actively involved in the ski industry for the past 28 winters. Scratching my head along the way, digesting numerous perspectives in relation to snow stability, and having experienced both ends of the spectrum – from emotional mountain bliss to near death – I have come to the conclusion that the stability question is bigger than us. That doesn’t mean I burned my skis. It just meant that I needed to come up with a solid system for snow stability evaluation for myself and for Kootenay Mountain Holidays.

As this system was being developed, I asked myself, “Is a bomb-proof system for snow-stability evaluation even possible?” Beyond all the complex environmental considerations such as snowpack, weather, and terrain, there is one key component that makes or breaks this system: the buffer zone. If the snowpack is in the gray area, we should leave a buffer zone, factoring in the possible consequences of our decisions, based on the destructive potential of an avalanche and the probability of one being triggered.

At Kootenay Mountain Holidays, we have developed a hazard forecasting system based on hard-core data as well as these probability factors and their potential consequences. We refer to our system as the STS© or Snow Terrain Smart system©.

The STS consists of our daily weather observation data from our remote weather station and our snow stakes and storm boards. Key weather factors such as temperature, precipitation, winds, new snow amount, etc., are recorded on our Stability Factor Avalanche Hazard Graph© (SFAH). The SFAH© graph displays these avalanche factors in various color-coded graphs, so each daily weather factor appears in one of the colors representing a hazard rating. For example: -2 degrees Celsius = yellow or moderate hazard for this factor, intense snow transport = orange or considerable hazard, etc.

Other factors such as suspected weak layers and avalanche observations also appear on our SFAH graph. Stability factors and other observations are then totaled up to give us our “Potential Avalanche Hazard.” With this potential hazard rating created, we also ask ourselves, “What is the avalanche size potential?” We have now created an Avalanche Hazard Forecast specific to our area. We then zoom out and grab two of the regional CAA forecasts which are relevant to our area and integrate them into our system.

Next, we transfer our hazard ratings to another form, known as the STS Day Form. We also include a simple, short 24-hour weather forecast on this form. The potential size of avalanches that may release is noted next to our hazard rating / forecast. And *voilà* – a piece of paper with hard-core data as well as the potential avalanche hazard.

This STS Day Form is then paired with a terrain classification: low, moderate, steep, extreme, and further – referred to in degrees (for example, steep = an incline between 30 and 45 degrees).

A series of color-coded flip charts for each hazard rating, potential destructive size of avalanches, and all elevation bands (Alpine, Treeline, and Below Treeline) can be found on a display board in the lodge. They are interchangeable, easy to read, and offer – in a simple message – the daily hazard rating, the size of potential avalanches, and what terrain to avoid.

This system keeps us on our toes, no matter what level of experience we have, and takes us a matter of 15-30 minutes to put together. When all is said and done, we all still end up at the final decision-

MODERATE HAZARD
Fair Snow Stability

Avalanches up to class 2

Isolated reactive week zones

SKIER TRIGGERED AVALANCHES large enough to bury a person are POSSIBLE IN STEEP TERRAIN

M2
Use caution and proper spacing in steep terrain. Avoid certain steep terrain features.

Refer back to Glossary for more detailed information.

CONSIDERABLE HAZARD
Poor Snow Stability

AVALANCHES UP TO SIZE 3

Widespread reactive week zones

LARGE SKIER TRIGGERED AND NATURAL AVALANCHES POSSIBLE

M3
Stay out and clear of steep terrain that has the potential for large avalanches.
REFER TO RECOMMENDED AREAS AND RUNS TO AVOID UNDER A CONSIDERABLE HAZARD

Refer back to Glossary for more detailed information.

making place when standing on top of a line or planning our ascent, asking, “To ski or not to ski; that is the question,” or is it “To be or not to be?”

Jeff Gfroerer is 46 years old and lives in the Kootenays, north of Nelson, B.C. He has been active in the backcountry skiing industry for 28 winters and for the last 20 has worked as a ski guide for heli, snowcat, and lodge-based ski touring. Future aspirations: to get a complete body replacement so I can do it all over

again. Contact info can be found at: www.skihikebc.com

Leni Neumeir has been working in the outdoor-adventure industry for 16 years. She has run her own adventure company, taught avalanche-awareness courses, and worked as an assistant avalanche forecaster. Leni is part owner of the Mount Carlyle Lodge and contributed to the development of STS through her interest in the relationship of human behavior to Mother Nature’s mountain terrain and complex weather patterns. ❄️

STS SYSTEM		STABILITY FACTOR AVALANCHE HAZARD GRAPH															
Month	2007	Date	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
STABILITY FACTORS	F1 PRES TEMP AM	4 or(>)															
		2															
		0															
		-2															
		-4															
		-6															
		-8															
		-10															
		-12															
		-14															
		-16															
		-18															
20 or(<)																	
Pres Temp																	
F1 HAZARD RATING																	
F2 SNOW TRANSPORT Highest rate last 24hrs.	F2 HAZARD RATING	EXTR															
		INT															
		MOD															
		NIL															
		ALP WIND DIRECT.															
F2 HAZARD RATING																	
F3 HN 24	F3 HAZARD RATING	RAIN															
		40															
		35															
		30															
		25															
		20															
		15															
		10															
		5															
		0															
HN 24																	
ACCUMULATED HN																	
Accumulated HN = 50cms or > over 48 hrs = F3 Rating of Considerable																	
F3 HAZARD RATING																	
SUSPECT SNOW SURFACES FORMED																	
SUSPECT WEAK LAYERS	LAYER																
Surface Hoar = SH	Depth																
Depth Hoar = DH	LAYER																
Faceted = FC	Depth																
Crusts = CR	LAYER																
Graupel = GP	Depth																
Record with A if ACTIVE																	
AVA. ACTIVITY OBSERVED Y / N / S Size																	
F4 POTENTIAL AVALANCHE ACTIVITY FORECAST	F4 HAZARD RATING	CLASS 1															
		CLASS 2															
		CLASS 3															
		CLASS 4															
FACTOR SCORE TOTAL		# Low															
		# Mod															
		# Cons															
		# High															
KMH	POTENTIAL HAZARD (PH)	ALP															
		TL															
		BLT															

MODERATE Hazard = Factor score total = 2 Moderate. ELEVATION ZONE HAZARD RATING is subject to terrain and may vary...

CONSIDERABLE Hazard = Factor score total = 2 Considerable.

HIGH Hazard = Factor score total = 2 High. EXTREME = MAJOR NA AVI CYCLE - HEAVY RAIN ETC.....

F4 Hazard Rating always over rules factor score total = KMH POTENTIAL HAZARD (PH) Avi Activ Obs. Yes - No - Unknown

Mentorship: seeking paths & identifying career goals



A bootpack follows the ridge at Bridger Bowl, 2003. Photo by Doug Richmond

Another Perspective on Mentorship and Career Paths

Story by Blase Reardon

My mentors let me tag along, patiently answered my questions, and – more importantly – clarified things I hadn't thought to ask.

When I moved from West Virginia to Salt Lake City in 1989, I knew almost nothing about avalanches. I wouldn't have guessed that I would spend most of the years since then studying and forecasting snow and avalanches. So my way into avalanche work did not follow a planned trajectory. Nor has it taken the traditional route of ski patrol and then snow safety, nor the recently instituted formal progression of guiding certifications. Those might have provided a more comprehensive curriculum – and quicker, clearer career paths – than piecing together a snow and avalanche education from scattered courses, regular volunteering, and lots of backcountry time. But that informal way – a result of circumstances as much as choices – had the advantage of allowing me to seek out and learn from a variety of mentors with a host of approaches and ideas.

I don't have a formal scientific education. I barely passed "Physics for Poets" in college. When I moved to Salt Lake City, I was starting a Masters of Fine Arts degree. It was great preparation for avalanche forecasting. It taught me to analyze and synthesize information and to communicate a hierarchy of ideas. Those critical thinking skills seem to me the essence of forecasting. A solid understanding of what science can tell us about snow and avalanches is also critical. But day to day, avalanche forecasting seems less about calculations or statistics and more about insight and experimentation, about figuring out which slopes to test and how to test them, what weather data to watch and what to ignore, what nuances matter and what principles don't. That is where my mentors proved invaluable. They let me tag along and patiently answered my questions and – perhaps more importantly

– clarified things I hadn't asked about. In doing so, they demonstrated the white art of forecasting, of knowing where to look when, and at what.

When I hire a forecaster, I look at who they've worked for or with as a clue to what kind of mentoring they've had, and thus how they'll approach situations. I look for variety – someone who's had a series of mentors and experiences in different snow climates

yet has intimate knowledge of a home range. I want to hire someone whose resume shows a balance between gaining experience in an established program and striking out on their own, and a balance between getting along with people and skepticism of groupthink. And I look for someone with complementary skills. Put more bluntly, I look for someone who has skills that make up for the weaknesses in the forecasting team, whether those weaknesses are mine or another forecaster's. I don't want clones or disciples; they would only bring more of the same blind spots. Credentials and certifications matter too, as evidence of knowledge of the physical processes involved in snow, avalanches, and meteorology. But ultimately I'm looking for particular cognitive skills and personal qualities, which can be developed multiple ways, but ultimately show me that this person can pay attention and make good choices when it matters.

Blase Reardon was the editor of TAR for five years, during which he worked hard to improve its consistency and production quality. He was the avalanche forecaster for the Going-To-The-Sun Highway in Glacier Park for many years. He is currently in grad school at the University of Montana in Missoula, where he is using math rather than correcting commas. ❄️

MENTORSHIP PROJECT: Perspective on Forecasting Jobs

From: Hal Hartman

To: BRENNAN, JOHN

Subject: AAA Mentorship project

JB,

The foundation: experience and targeted education. Regarding the former, it occurs episodically or exposure by exposure. The unfortunate side of this is that solid experiences that stay with an individual simply don't occur every day. Thus, in the aggregate, some winters may pass where a forecaster's skill is only lightly supplemented with new knowledge. About the latter, targeted education, there is certainly a deficit of individuals who understand physical laws (which requires a good grasp of mathematics). The ability to construct models based on physical laws and couple them to inductive reasoning (subjective, dynamic and time-dependent thinking) is a powerful system, especially useful when dealing with natural phenomena. Speaking of which, a firm grasp of the true nature of uncertainty is mandatory because here the language of uncertainty is probability. That said, here is my wish list:

- 1) Experience with multiple mountain ranges and snow climates
- 2) Targeted education regarding weather, snowpack, terrain, and human traits
- 3) Solid scientific background, preferably physics based
- 4) Excellent at coupling "forecasting" to decision-making...

Hal

Hal Hartman is an avalanche consultant in Colorado and the former snow safety director at Snowmass, CO. ❄️

AAA Mentorship Project: GOALS

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 needed to find a productive niche in the avalanche field.

From the Mentorship Project:

Back in the fall of 2006 I wrote the AAA section reps asking them to help me gather career path suggestions from professionals in different aspects of avalanche work. I want to especially thank John Brennan and Carl Skustad for their work on this project, contacting and following up with their constituency.

Next year in the mentorship project we would like to compile a list of organizations that offer internships in some aspect of snow. Please contact me over the summer with your information.

Thanks, Lynne

Lynne Wolfe, PO Box 1135, Driggs, Idaho 83422
lwolfe@tetontel.com • (208) 709-4073

MORE MENTORSHIP next page ➡

MENTORSHIP PROJECT: Perspective on Forecasting Jobs

From: Dick Jackson

To: BRENNAN, JOHN

Subject: AAA Mentorship project

Hello JB,

Here is a short piece on guide qualifications and what my expectations would be for someone interviewing with me as a potential ski guide.

In general, the balance between vast personal backcountry experience and formal education with its related certification(s) is the ideal scenario for this position. Certainly Level 3 avalanche training and, minimum, the completion of the AMGA Ski Guides Course, would be prerequisite for baseline entry level. I also prioritize the resume, personal references and actual "guiding" experience level that this potential ski guide brings to the table, especially the formal internship under the supervision of a certified guide that the aspirant has achieved after the formal training process.

Should this aspirant have AMGA Ski Guide Certification, then my attention would shift to his/her experience level in this specific area, meaning the Colorado Central Rockies and the Roaring Fork/Elk Range highcountry. Only time together may demonstrate the "soft skills" necessary to manage clients in the winter backcountry, and this is certainly a mandatory component in the maturation from the aspirant status to the qualified professional mountain/ski guide. Therefore to itemize the documented requisites:

- AMGA Ski Guides Course (ultimately Ski Guides Certification)
- AAA or AIARE Level 3 Avalanche training (or equivalent)
- WFR or WEMT First Aid training
- Resumé/references of backcountry experience
- Guiding internship with appropriate documentation of guiding experience (min 40 days)
- Supervision and initiation within Aspen Expeditions core programs with AE/AMGA Certified Guide(s)

I hope this brief outline helps you with the project. Ciao for niao, Dick

Dick Jackson is owner and director of both Aspen Expeditions and Aspen Paragliding in Aspen, Colorado. He is a fully certified AMGA/IFMGA mountain guide, an AIARE Level 2 instructor, and has served as President of the AMGA for five years. www.aspenexpeditions.com. ❄️

Carl Skustad sends TAR comments from JIM KENNEDY (snow safety director, Alyeska Resort):

Hey Carl,

I think that a person's attitude is the most important trait. I would rather train someone with the right attitude and no experience than a person with lots of experience and the wrong attitude. The person must also have the feel for the snow. Some folks have all the book learning, but have no feel for the snow.

Anyway a few thoughts from my twisted view.

Take Care, JK ❄️

From JERRY ROBERTS

Just some random thoughts about our internship in Silverton. I've worked with eight interns over eight years.

They've got to be very hungry! Only a \$500 stipend, so it keeps them hungry. It takes a special person to come here for seven months, work their ass off, and keep a good attitude. Mark Ridders, Susan Hale, and Ann Mellick are good examples. They all are working for CAIC/CDOT because of their intern positions with this office. It's a training program, and when someone leaves here after a season or two in some cases they know what is going on. They are also acquainted with the CDOT boys and are either liked or not. Most cases so far they are extremely well liked and CDOT plays a heavy hand in the hiring of new CDOT forecasters.

I take a big interest in training interns because if I've asked them to work with us I usually know them or have gotten to know them somehow with few exceptions. I want them to understand how things work or don't work. There's the right way, the wrong way, and the CDOT way. People who intern are going to have a pretty good chance of getting hired somewhere because of their education at the Silverton Forecast Office. I'm proud of the program and want to turn out very good people because I might have to work with them. ❄️

FLUX-LINE MAN: An Avalanche Transceiver Teaching Aid

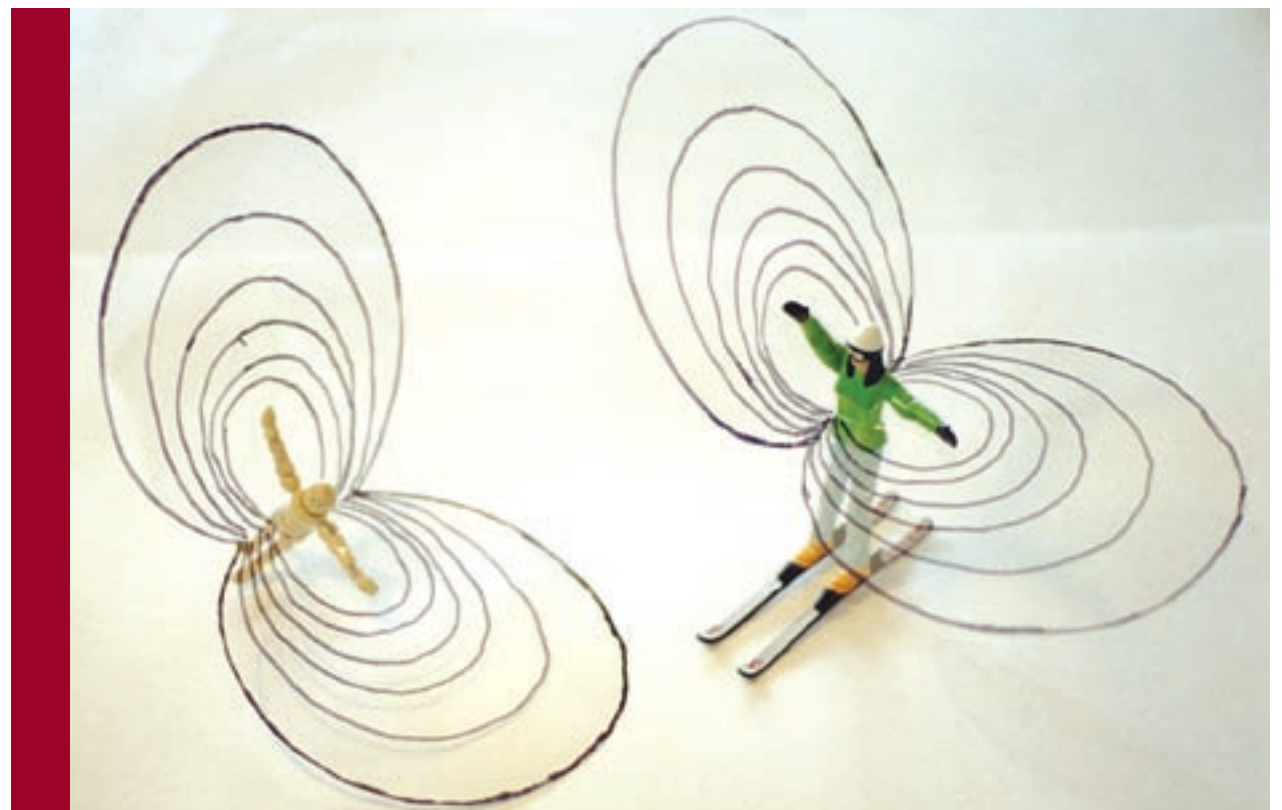
Story and photo by Halsted Morris

I was recently reading an article in *USA Today* about how troops are using cans of Silly String to detect tripwires attached to booby traps in Iraq. The author of the article commented that the troops had forgone using "hi-tech" bomb detectors in favor of using Silly String. This reminded me that sometimes the simple methods and tools provide the best results.

TEACHING STUDENTS how to use avalanche rescue transceivers has always been problematic. Instruction on the "electromagnetic flux-line theory" (isn't that a tongue twister) is essential for a basic understanding of how transceivers work. Over the years, there have been a number of ways used by educators to help students visualize how electromagnetic flux lines radiate out around a transceiver. One classic method is to cut a quarter out of an apple or onion. This method allows students to visualize the horizontal and vertical aspects of flux lines. Unfortunately, the apple/onion teaching aid has its field limitations.

In 2000 the good folks at Backcountry Access, based on Dennis Doyle's concept, introduced flux-line banners to the avalanche safety education community. A flux-line banner is a 3' x 4' vinyl mat. On one side it shows the electromagnetic flux-line pattern of a transmitting transceiver. On the other side is a diagram of the phases of a transceiver search.

Flux-line banners provide educators a practical means of showing students how electromagnetic flux lines radiate out from a transmitting transceiver. The only major criticism I've ever heard of the flux-line banners was from Knox Williams, when he said that he'd like to see them in a larger format so students could better see the full flux-line patterns. Knox is right; the flux-



Just think of all the things you could do and places you could go with your very own Flux-Line Man...

line banners are not big enough. Nor are they easily adaptable for showing different burial orientations.

In December 2005, I happened to be in Ketchum, Idaho. I visited Backwoods Mountain Sports and found a small stuffed teddy bear with a box (transceiver) attached to its chest. The box had wires that looped out of it to represent electromagnetic flux lines. This teddy bear got me thinking. It was the perfect teaching aid for showing students exactly how electromagnetic flux-lines radiate fully from a transceiver. The only problem was that the teddy bear and its protruding wires were a bit too large to carry around in one's pack while teaching.

I attempted to make my own version of the teddy bear with a Huck Doll (www.huckdoll.com), but the wires representing the flux lines looked a bit crude. So I started to experiment with other means of representing flux lines. I finally settled on using clear acetate 0.50mm plastic. I enlarged a flux-line pattern to fit on 11"x17" piece of paper, placed the clear plastic over it, and drew the flux lines onto the plastic. It was a simple task to then cut out the plastic flux-line pattern.

It's nice to have an action figure Flux-Line Man with moveable arms. Place the action figure in a center cutout hole of the flux lines and tape the flux lines to the figure's arms. If you place one arm vertically and the other horizontally, Flux-Line Man can show

both flux-line planes.

With Flux-Line Man, students can better visualize how the flux-line pattern radiates outward from a transceiver. Looking at the central axis of the flux-line pattern and the common position of a transceiver on a user's side, one quickly realizes that a vertical orientation transceiver burial can be quite common. Flux-Line Man can also easily demonstrate what sort of flux-line patterns one might see with burials on a variety of slope angles.

In conclusion, by using a smaller teaching aid, students can actually see the bigger picture and thus gain a better overall understanding of electromagnetic flux lines. Like the Silly String, sometimes the low-tech teaching aid serves up the best results.

If you want to make your own Flux-Line Man, send a stamped business-size return envelope to me, at 867 Hill and Dale Rd., Unit A, Golden, CO 80401. I'll send you a free copy of the flux-line pattern. Of course, you'll have to purchase own Huck Doll and clear plastic.

Halsted Morris says that he doesn't mind being known for coming up with the Nerf Ball transceiver practice method or Flux-Line Man. He was the education outreach director at the CAIC for seven years. He now teaches as an independent instructor and runs Hacksaw Publishing, Inc. ❄️

crown profiles

Ladies Night Honorees: ISSW 2006

Photos below courtesy of the honorees

In a field dominated by men, women avalanche forecasters, patrollers, snow scientists, writers, and mountaineers can find themselves overshadowed by their male colleagues. Last fall, the International Snow Science Workshop, along with Babes in the Backcountry, honored seven incredible women who've lent their own first ascents, first studies, first tracks and first findings to the study of snow science and avalanches.

These women have devoted themselves to the nature of mountainous climes, the beauty, spirit and transcendent gifts of powder skiing, and the peril and instability of its objective science.

Leslie Ross and Nicole Greene, the forces behind Ladies Night, wish to thank the AAA and ISSW 2006 for their financial sponsorship of this important event. They hope that the tradition of Ladies Night will continue at the Whistler ISSW in 2008.



above: Betsy Armstrong talks with Ed LaChapelle, honorary woman for the evening. During the event, he spoke about Sue Ferguson and her vision and energy.
Photo by Nicole Greene

Leslie Ross and her organization, Babes in the Backcountry, are dedicated to creating more opportunities for women to experience the outdoors and learn skills and techniques to enhance their backcountry adventures.



EVELYN LEES

Evelyn Lees has been on board with the Utah Avalanche Center for nearly 20 years, beginning with a stint as a meteorology field technician for one of the state's cloud seeding projects. Evelyn has ascended peaks all over the world, including Mount Everest. During the summers, Evelyn is a senior guide in Grand Teton National Park with Exum Mountain Guides. "She always has a laugh and a smile and a cheerful word," says Babes in the Backcountry founder Leslie Ross.



BETSY ARMSTRONG

Author, instructor, researcher, mountaineer, and mountain lover, Betsy Armstrong's experience runs deep. Throughout the 1970s and '80s, Betsy was a researcher, working winters with the University of Colorado and the INSTAAR San Juan Avalanche Project in Silverton, Colorado, and summers with the University of Washington's Blue Glacier Project in the Olympic National Park. Armstrong authored several books on mining history while with INSTAAR, and co-authored *The Avalanche Book* with Knox

Williams. She has instructed at a slew of workshops and schools including the Silverton Avalanche School, American Avalanche Institute, National Avalanche School and Babes in the Backcountry. Most recently, Armstrong has been working as a publishing consultant specializing in glaciological topics.



SANDY KOBROCK

Sandy Kobrock now runs her own show, having worked in the snow and avalanche field for a long time. Sandy's resumé includes jobs as Wolf Creek Ski Area Ski Patrol Director and Snow Safety Supervisor; ski patroller, supervisor and avalanche control route leader at Squaw Valley; avalanche rescue-dog handler; Outward Bound Course Director; and longtime Babes in the Backcountry instructor. With two decades of backcountry ski mountaineering behind her, Kobrock has accumulated an impressive number

of descents and multi-day tours in the Sierra Nevada, Cascade, and Rocky Mountain ranges, Austria, and the Italian Alps. "Sandy offers a depth of knowledge and experience, not only in the backcountry, but in life," says Leslie Ross.



CHRISTINE PIELMEIER

Christine Pielmeier is a snow scientist and avalanche forecaster for the Institute for Snow and Avalanche Studies in Davos, Switzerland. Pielmeier forecasts in the Swiss Alps and focuses on the very essence of the science of snow. (The title of her PhD dissertation was "Textural and Mechanical Variability of Mountain Snowpacks.") Pielmeier received her PhD in 2003 from the University at Berne, Switzerland, and continues her passion – studying snowpack stability and spatial variability in the Alps

– much to the benefit of all of us in the snow and avalanche world.



JANET KELLAM

Janet Kellam is director of the Sawtooth National Forest Avalanche Studies in Ketchum, Idaho, and has been an avalanche forecaster in the Sawtooths for more than a decade. Kellam evolved from a Nordic ski racer to a backcountry enthusiast, and with this evolution came a focus on avalanche forecasting and snow science. In 1981, Janet became the first woman in Idaho to achieve the title of licensed lead ski guide and her experience includes heli-ski guide in Sun Valley, avid backcountry skier in Idaho and the Sierras, and river guide in the Rocky Mountains and Alaska. Kellam has even spent time studying a group of wolves on the Antarctic Peninsula as a winter specialist for documentary films.



JILL FREDSTON

Jill is no stranger to avalanche education, having directed the Alaska Avalanche School for more than two decades. Fredston is an expert in the field, gaining her vast knowledge in a variety of roles in the world of snow and avalanches – from being project leader at the Alaska Avalanche Forecast Center and snow and ice specialist for the University of Alaska, to co-authoring *Snow Sense: A Guide to Evaluating Snow Avalanche Hazard* and writing *Snowstruck: In the Grip of Avalanches*.

Jill has a master's degree in glaciology and polar studies, and is most at home in Alaska's mountainous frontier. She is also an avid boater, having rowed more than 25,000 miles of remote coastlines around the world.



PATTI BURNETT

Patti Burnett jump-started Summit County's first canine search and rescue program as a ski patrol supervisor at Copper Mountain. Her first dog, Hasty, is well-known for his work responding to avalanche, water, and wilderness searches and was trained solely, expertly, and patiently by Burnett. Patti wrote *Avalanche Hasty Search*, an instructional book for training avalanche rescue dogs. Burnett and her husband were central figures in developing the Summit County Avalanche Deployment

Program, promoting the use of dog teams in all search and rescue scenarios.



FAY JOHNSON

Fay Johnson is a perfect example of a true leader, leading by empowering those around her. As the patrol director of Bridger Bowl ski patrol, Fay has built a tight-knit crew through leading by example and creating strong rapport with every patroller. She is an inspiration to all those around her. In the summer, Fay teaches first aid courses for Wilderness Medical Associates. Fay has climbed peaks around the world and is still making her husband, Ron Johnson, work hard to keep up with her. ❄️



Ed and his partner Meg at their Alaska cabin.

Photo by Mark Moore

Excerpts from

There was always the mountain: the passing of Edward LaChapelle

first printed in the *Silverton Standard and Miner*, reprinted by permission

Story by David LaChapelle

On the morning of February first, the eve of a full moon in the heavens, Ed LaChapelle went powder skiing at Monarch Pass, Colorado. On this day he was to ski his way into another world. At around noon, with the sun high in the sky, his heart began to falter. He left this plane of existence by mid-afternoon.

I remember first consciously seeing this aspect in my father one bright powder morning at Alta, Utah. I watched from inside the warm living room of our cabin as my father scooped up a handful of snow crystals, examined them with his pocket magnifying lens, and then let the snow fall from his hands. It was in the time the powder snow took to fall from his fingers and reach the ground that I saw a side of my father which transcended the science that anchored his life. He was, in that moment, reverent, as if listening to a greater voice than his senses could convey. He stood for a moment and I witnessed him encounter the world as if it were sacred. He turned from that moment, came inside and began to call the lodges to tell them that there would need to be some avalanche control work before the ski area could open.

He rooted his actions in a profound empiricism, and yet he had his heart tuned to a quality of intuition which made him exceptionally gifted at understanding the movement of snow and ice amongst the mountains of this world. This gift had immediate and very real consequences. The safety and well-being of many mountain dwellers rested upon his discernment and judgment of avalanche conditions.



Edward R. LaChapelle
May 31, 1926 - Feb 1, 2007

And so it is important for me to honor that my father wove the passage of the moon, the movement of the planet and the deep rituals of ancient peoples into his passing. I think he would listen patiently to this explanation, bowing to his son's artistry, but would keep a sharp eye on the true conditions being described. For he was a scientist, and his science was the extension of this competency and the fruition of his being. He would want us to examine carefully the conditions of his departure.

To understand why my father would leave us on a perfect powder day on a Monarch's slopes we need to go back to his childhood. His childhood and his destiny were arranged around "The Mountain." Ed's early days were spent at the foot of Mount Rainier, near Seattle. He played, hunted, hiked, and explored the landscape that was dominated by the volcano. His love of mountains began within the embrace of "Tahoma" (The Mother of all Waters). He would need the strength of this mother mountain and his own mother as he would face a most difficult test.

My father remembered very clearly reaching for a salt shaker at the dinner table as a young child and missing the object. He knew something was seriously wrong. Ed had contracted polio. He quite rapidly lost motor control of significant portions of his body. His mother took him to a family physician in Tacoma to seek help. This practitioner would alter the potential path my father's life greatly. In his official capacity, the doctor explained that there was not much that

could be done except to alleviate the symptoms and let the disease run its course. But as my grandmother was leaving he took her aside and said that he had a theory about the disease which might help her son. His theory was that if she could keep Ed immobile for a period of time then the damaged nerve tissue would grow back and he might regain more function. My grandmother put her faith in the doctor's knowing. She kept her five-year-old son immobile for a month, covering his legs with a cardboard box and reading stories to him to keep his attention focused on something other than his body. My father drank the waters of Tahoma, was sheltered in the fierce protection of his mother's faith, and drew his own strength as the doctor's hunch was shown to be true. Slowly, steadily, my father's leg strength did begin to return. He was to walk with a limp his whole childhood. In high school, determined to change his limp, my father joined the high school track team. He never once placed in any events, but by the end of the year he no longer had his limp.

With the force of his determination my father had honed his body so that it would serve him in his life's passion. On his twenty-first birthday he climbed Mt. St. Helens, Mt. Adams, and Mt. Hood in three consecutive days. All three of these mountains afforded him an excellent view of Tahoma, the anchor of his childhood.

I remember speaking with an acquaintance of my father's in Alaska a few years ago about his amazing stamina in the mountains. This man was marveling at my father's ability, at 75, to leave much younger men behind as they made their way up a nearby mountainside. He said, "He simply set a pace, slow and measured, which he never altered. In the end we were left behind by the steady of strength of his maturity."

The only remnant of polio for my father would be an occasional intense leg cramp that usually would happen at night when he was sleeping. I remember, as a child, hearing him writhe in pain from the intensity of these cramps. I asked him about his cramps only a few days before he skied into eternity. He said that he hadn't had one in a while, and that even though he had been trying all his life, he couldn't figure why the cramps happened when they did. The scientist in him had still been trying to unravel this mystery.

Some mysteries we take with us when we leave. His cramps were the shadow of his astonishing physical ability. An ability which enabled him to climb mountains, ski powder, launch glacier expeditions in Greenland, Alaska, and Washington state, and to live self-sufficiently in the Alaskan bush until his eightieth year.

My father had a mountain "conversion" while he was in his late teens. At this time he was working at the Paradise lodge on the side of Mount Rainier as a bellhop. In a letter to my mother which I found for the first time this week after both of their passings, he described his experience of the mountain:

"One day 15 years ago when – oh this itself is a miracle – I looked out from the porch of employee's dorm at Paradise the second day I had come up there to work for the first time, and saw the storm clouds lift away and reveal evening sunlight on Mt Rainier...I can still remember to this day as clear and simple as the note of a bell – this was the single biggest turning point in my life, when in a single blinding moment I knew what I must do and where I must live with my life."

The conviction of my father's mountain-born insight lasted him until the final morning of his life. His contributions to snow and avalanche science, his practical ability to translate ideas into usable actions, his organization of glacier projects and the contribution he made to glaciology in general, the mentoring of a whole generation of avalanche experts, the numerous rescues he oversaw, the books he wrote, and the spirit of inquiry which was so alive in him all pivot around that moment on the flanks of Mount Rainier. My father's destiny carried him surely through the Great War and the incredible growth of the ski industry in the last 60 years.

This conviction was honed by the bodily condition he had overcome. My father's capacity for hard work, discipline, organization, and thoroughness was deep. Whatever he turned his attention towards he would master. He sewed his own backpack, building the aluminum frame himself; he made his own sleeping bag; created a whole pantheon of instruments for his different experiments; created a unique snow crystal photo lab and mastered calligraphy, photography, woodworking and financial management. After he "retired" from teaching and working for others, he created, with his partner Margaret Hunt, a self-sufficient Alaskan home. For years I have been proud to say that my father is the only one of my extended circle who lives completely off the grid.

Ed loved electronics. His passion for the discipline carried him to the top of his naval radio school. As a teenager, he graduated first in his class ahead of over 200 men of all ages and experience. He joined the Pacific Fleet right at the close of World War II. (My father said that one of the most impressive sights of his life was seeing the American naval power arrayed in Tokyo Bay for the signing of the armistice.) His skill in electronics served him well in developing the various instruments for his science. It also helped launch the first portable avalanche beacon (now a main necessity of back-country skiers worldwide).

Yesterday as I pored through the various items he brought on his last ski journey, I found his short-wave radio. The current version is a small hand-held device that is dwarfed by the radios I remember from my childhood. But the fact that it was included in his orderly set of clothes and tools for his fateful road trip testifies to the deep love he had of listening to the echoes of humanity across the electromagnetic spectrum.

Ed also loved good practical jokes. He tempered the rigor of his science and the discipline of his work with various schemes and mischief events. As a teenager he and a partner developed something called "power pills" which were small bombs made of gelatin capsules and bb's mixed with a proprietary blend of now illegal explosive substance. He took great delight in setting these incendiary devices off in a variety of locations. His pranks with the power pills earned him a visit from the Tacoma police.

While directing the Blue Glacier project, a multi-year research station on Mount Olympus in Washington state, he decided to try his hand at bit more dramatic explosive activity. You probably have heard of or seen young boys putting a firecracker under a tin can and using the explosion to send the can as a rocket into space. My father went them one step better. He put a stick of dynamite under a used 55-gallon fuel barrel on the glacier to see if he could send it into space. He should have done his calculations a bit better, because instead of sending the drum into the atmosphere the explosion shredded the steel sending shrapnel flying everywhere. It was a miracle that no one was hurt.

I was at the receiving end of one of his pranks while I was with him on the glacier. I must have been nine or ten and was reading the *Narnia* books by C.S. Lewis. The books were populated by dragons and such, and I was enjoying the fantasy of imagining such creatures in a distant place and land.

My father decided to bring them closer to home.

He had one of the men who worked for him on the project dress up in a parachute camouflage with a cardboard dragon's head and hide in the small rock crevice above the research station. The man also carried a fire extinguisher.

I was led up the crevice on some pretext I do not remember. As I climbed down into the crevice I heard a bellow, saw rolling carbon dioxide smoke clouds coming towards me, and the dim shape of a dragon behind. I was literally ejected from that crevice by the adrenaline that ran through me.

That wasn't our family's only encounter with dragons. Many years later, my mother would name one of her favorite Tai Chi sites, the "Dragon's Back."

It was only eleven days after my mother left her body that my father passed on from his. Given that, I cannot but bow to the depth of their connection. My father had driven down from Montana, where he was skiing with his partner Meg, to be at the memorial

for my mother here in Silverton. It was apparent in the unspoken grief in his eyes that her passing had stirred his soul.

He first met my mother in the Canadian Rockies during a summer climbing camp. They were walking along a glacier and my mother was knocking snow bridges from a recent snowfall out of the top of crevasses with her ice ax. She slipped and began to fall towards the heart of the glacier. My father, with startling reactionary speed, grabbed her, saving her from a possible early death.

I want to honor the difficult truth that my mother tested my father, and he her, in very strong ways. Their marriage was not easy. It served as a fire of purification which gave both of them the steady wisdom of their later years. It allowed him to rest in the tranquility of his Alaskan life with his beloved Meg, and it allowed my mother to endear herself to her extended community in Silverton. His years with Meg nourished my father in ways that he never was able to experience with my mother. I am deeply grateful for companionship, love, and patience that Meg wrapped around my father during their 25 years together. His love for her was tender to witness and carried him with great strength through the long years of his Alaskan life.

My mother and father were teachers for one another. Sometimes we are not allowed to live with our teachers full time. The fire is simply too hot. My mother's uncompromising search for her own spiritual integrity, and my father's determination to hone the scientist's discipline of observing the world, took them in different directions for a time.

My mother was raised Catholic; a faith she renounced in her adult years. At the end of her life, two of the people who were serving her in her last month reported to me that she asked them to pray with her.

In these humble requests I see a revolution in my mother's being. A surrender she had searched for her entire life was beginning to manifest. On the wake of her surrendering, my father took to the powder slopes and followed her. This is a remarkable testimonial to the depth these two beings shared.

It was a depth ringed in mountains, suffused with clear high-altitude light, filled with driving determination, passion for truth, and the knowing of this world and others. My father tended this world with great care while my mother sought the Source of experience with great determination.

I have my father's skis, boots and poles now. Several days ago I put them on and skied a few runs in his honor. It was not powder, but the memory of powder lives in his skis and in my legs. The steady strength of my father's being carried me down the slopes. I can no longer turn to him for help with my Alaskan cabin, or any of the other myriad ways he expressed his love for me in the small details he tended, but I can ski again in the high mountains marveling that this man gave me, and so many others, a way of the mountain.

Thank you my dear father for the integrity of your life.

Your turns are true now, no longer limited by an aging body. The fall line is clean and the crystals are eternal that slip under your skis as you descend the mountains of light that live within us all. ❄️



Ed playing with son David in Alta, Utah, where Ed helped pioneer the snow ranger program. Photo courtesy Rick Grubin

Alpenglow Ski Mountaineering History Project: Edward R. LaChapelle, personal communication

Excerpts from a taped phone interview
5 December 2001

Used by permission of Lowell Skoog

Ed LaChapelle's interest in mountaineering began when he was in high school in the early 1940s. In 1942 and 1943 he spent summers working for the national park company at Mt Rainier. He served in the Navy for two years (1944-46) after high school. He spent another summer at Mt Rainier after leaving the Navy. Ed got into skiing while in college at the University of Puget Sound (UPS), beginning in about 1947. He was active in skiing and mountaineering during college, making climbing trips to the Canadian Rockies and serving as climbing committee chairman for the Tacoma Mountaineers. In 1949, he graduated from UPS with degrees in physics and math.



Above: The American Geographical Society sent Ed to the Greenland icecap for glacier research, summer 1953.
Photo courtesy David LaChapelle

Top: Ed and Meg at Dolores's memorial service in Silverton, Colorado.
Photo by David LaChapelle

SNOW AND AVALANCHE CAREER OVERVIEW

Ed spent the winter of 1950-51 at the Swiss Avalanche Institute at Davos. This experience led to a job with Monty Atwater at Alta, Utah in the fall of 1952. Atwater was a 10th Mountain Division veteran, about 20 years older than LaChapelle. Ed started at Alta doing general snow ranger work and assisting Atwater in avalanche studies. Later, Atwater transferred to Squaw Valley, California to lead U.S. Forest Service avalanche control efforts for the 1960 Olympic Games. Atwater stayed at Squaw Valley after the Olympics and it fell to Ed to carry on the research at Alta. Eventually, he spent all his time doing research, while day-to-day snow ranger work was handled by others.

For many years, Ed had parallel careers. In winter he was employed by the Forest Service doing snow and avalanche research in Utah. In summer, he did glaciology studies. He began working for the American Geographical Society of New York in 1951. In 1952, he did research for this organization on the Juneau icecap in Alaska. In the summer of 1953, they sent him to the Greenland icecap. Later, he did glacier research for the University of Washington (UW). He was appointed to the UW faculty in 1967. He taught autumn and spring quarters at UW and continued working winters at Alta through 1972. During that year he spent time in Japan in support of the Sapporo Olympic Games.

From 1973-77, Ed was involved in avalanche studies at the Institute for Arctic and Alpine Research of the University of Colorado at Boulder. He spent winters at Silverton in the San Juan mountains. After 1978, he went on an extended leave of absence and in 1982 he retired formally from the UW faculty. He is now retired in McCarthy, Alaska, where he keeps track of the local glaciers and does a little consulting work. He is currently involved as a snow consultant with the architect designing the new visitor center at Paradise, to replace the Space Needle-like building put up in the 1960s. "The flying saucer decoy's days are numbered," he said.

POST-WAR SKI MOUNTAINEERING

We talked about the growth of the ski industry after World War II and the impact of the 10th Mountain Division. Ed noted that many of the people who got into the mountain troops were skiers to begin with. He thinks that after the war many of them would have gotten into the ski industry anyway. It was not their 10th Mountain experience that directed them that way. The real boost provided by the mountain troops was cheap equipment.

Continued on page 22 ➡

The following article was first published in *The Avalanche Review*, 24-1, October 2005

The Ascending Spiral

Story by Ed LaChapelle

Decisions, decisions... the February issue of TAR spoke from several informative points of view and the editor invited a dialog. Here is one contribution to the perpetual questions of how to evaluate avalanche hazards, consider human factors, and communicate (or execute) decisions.

Here is what I mean by the title. Rather than seeing our mastery of snow and avalanche science and decision-making as linear progression, I see it as the same issues and ideas coming around again and again, but each time at a more sophisticated and technically advanced level—hence the ascending spiral.

I take as my theme the wisdom that Whymper (1871) handed to us many years ago. He spoke of mountaineering in general, but his words are just as cogent today in this decision context: "Climb if you will but remember that courage and strength are naught without prudence, and that a momentary negligence may destroy the happiness of a lifetime. Do nothing in haste, look well to each step; and from the beginning think what might be the end."

DO NOTHING IN HASTE. This speaks loud and clear to the pressures of time, planning, and economics, plus the perpetual urge to action that drives so much of our modern life. Here is where the human factor in avalanche-related decisions comes to the fore.

And this brings us to Elbert's Rule. When I first worked at Alta in the 1950s, the daily mail was brought up the Little Cottonwood Canyon road by Elbert Despain, who had been doing this for many years and was still carrying the mail at age 90, when he achieved the distinction of being the oldest mail carrier in the United States.

As we all know, that canyon is beset by a horrendous series of avalanches. I once asked Elbert how he managed to miss getting caught in an avalanche in all that time. His answer was the epitome of common sense, "After a heavy fall of new snow, wait two days." Note that even the United States Mail, famed for a high determination to deliver, could at least in those times wait two days.

Elbert was mostly dealing with natural releases where his rule is hard to beat. Artificial releases, intended or accidental, can stretch out the safety wait depending on snow conditions, but the concept of giving the landscape a chance to stabilize and "do nothing in haste" points to the fundamental problem of including the human factor in decisions. The idea of waiting two days, or almost any kind of wait, just doesn't fit today's activities in avalanche terrain. Is there a heli-ski manager who can get away with asking his guests to wait two days before skiing 50 cm of new powder? No way! A ski area operator who will close half his runs in similar circumstances, or a highway foreman who will garage his plows until the snow sets up? Only in dreamland!

The basic human problem with decisions in avalanche terrain is not so much personal attitudes, group interactions or risk management. It is the expectation that human activities can be scheduled by artificial constructs like calendar and clock in a natural world that moves at its own independent pace. A weekend ski tour is not going to be put off until Monday because a snow dump on Friday created avalanche hazard, so we might as well adapt to this behavior. But at least recognize the root of the problem in training for decision-making. That tour might still take place on a hazardous weekend, but with a revised destination.

LOOK WELL TO EACH STEP, covers many individual actions or observations on the way to acquiring bases for decisions. Here I will look at a couple in detail.

First, there is the eternal business of digging snow pits...how many, how often, where, and in what detail (the ascending spiral is spinning fast here). McCammon and Sharaf (2005) cite Peter Schaerer's sensible admonition to be quick—an approach to snow pits I can readily endorse.

Let's look closer at this whole pit-digging business, one that sometimes can become the tail that wags the very large dog of avalanche data collection. Snow-pit digging is a necessary but far from sufficient action to understand snow stability. If it is only part of the picture, why does it so often come so much to the fore? I suggest this is because we can observe and record a select body of detail—like crystal type and size, hardness, density, layer thickness, etc. And why do we record these particular features? Because they are readily rendered into numerical values and logged in notebooks, an act that may convey comfort in having acquired "objective" data but not always be what we need to know.

For example, rate of change of viscosity in a snow layer might be more informative, but this is a tough one in a cold laboratory and impossible in the field. So we are often led down the easy primrose path of the possible. Let me put forth the heretical notion that we do not need more data from a given snow pit, but less. The act itself of digging with a shovel is the culmination of the Schaerer Quick Pit concept. By the time I have finished digging a snow pit, I usually know about 90% of what I am going to find from it about snow stability. Logging pit details is a good educational tool and expands knowledge about a wide range of snow properties, but should not be confused with the backbone of avalanche forecasting.

In the larger picture of snow stability, snow pits provide a quick but static snapshot of conditions at a given time and place. From the external perspective of a passing observer, snow on a mountainside is just sitting there, apparently dormant. The snow cover, however, is neither static nor dormant, but a positively seething mass of activity. Snow is constantly gliding, creeping, and settling. Layer by layer, the physical properties are constantly

changing as crystals metamorphose. Waves of changing temperature sweep through the snow cover while radiation works at the surface. Snowfall and wind drifting change the amount and distribution of loading with each passing storm.

Understanding the complex behavior of snow is a problem in rheology, the science of deformation and flow of matter. In this case, the problem is further compounded by the matter in question being a granular visco-elastic solid close to its melting point. You can't make it much more complicated than that.

The observational role of the snow pit in all this compared with a broader and more lengthy data collection is clarified by a concept in rheology put forth by Meiner (1964): the Deborah Number. Meiner pointed out the significance of the Prophetess Deborah singing, "...the mountains flowed before the Lord." In the limited time frame of human perception, the mountains are static and eternal, but for the Lord, whose time frame is infinite, they flow. Meiner defined the non-dimensional Deborah Number as follows:

D = time of relaxation/time of observation

A high Deborah Number means the subject in question appears to an observer to be a static and unchanging solid. The brief observation from a snow pit implies a high-D snow cover and hence a static view of what actually is an active ("flowing") snow cover. To gain insights into the dynamic character of the latter, observations extended in time are needed to lower the value of D. In other words, stability evaluation has to be an on-going process, the longer the better. Ideally, the estimate of snow-stability evaluation on a given avalanche path begins with the first snowfall of winter. More about this in a moment.

A second relevant action, consulting some sort of checklist, appears when George (2005) describes the NivoTest. This is where the ascending spiral really starts to spin. Checklists have been around for a long time and in various formats; the NivoTest stands out as possibly the most sophisticated one to date. Looking into history, the earliest checklist I can find is G. Bilgeri's Six Points (three for terrain, three for snow conditions) in use by the 1930s, described by Seligman (1936). Later, as an example, we have Atwater's Ten Contributory Factors (1952), initially with equal weight but later informally modified by various weighting schemes.

I like the NivoTest because it nicely condenses terrain, snow features, current avalanche activity and human factors. However, it is disquieting to see it illustrated in TAR by a photo of a guide consulting it in the field in the middle of what appears to be avalanche terrain. This brings the checklist concept into play far, far, too late. If you wait until standing on the edge of an avalanche path before considering snow stability and risks, very poor decisions can ensue. Again, evaluating snow conditions is an ongoing process, not a single


Continued page 28 ➔

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ALPENGLow HISTORY

continued from page 20

In the late 1940s you could buy boots, skis, and poles for \$20, with a parka thrown in for good measure. That really boosted skiing.

Ed did some spring ski mountaineering in the late 1940s, while in college. He remembered a spring ski ascent of Mt St Helens, on the east side, near the Shoestring Glacier, probably in May. Everyone still used wood skis, but Ed had acquired a new epoxy ski base that you could paint onto the skis. It had a durable surface and you could put various climbing or downhill waxes on it. He recalled that the snow on St Helens had melted to expose a layer of volcanic dust on the surface. "I was astonished to get to the bottom of the mountain and find that my fancy epoxy ski base had vanished," he said. The pumice had sanded it right off. "But I also remember it was excellent skiing." Ed did a lot of ski mountaineering during summer research on the Juneau icefield in 1952, 1954, and 1956.

GENERAL POST-WAR AVALANCHE WORK

The ABCs of Avalanche Safety was a by-product of Ed's original 1961 USFS avalanche handbook. Ed realized that "the avalanche handbook was all fine and good, but it seemed like there ought to be a handy pocket reference for people going out on a tour." Ed wrote the original edition "off-hand in a couple weeks" in his spare time, and it has been going strong ever since, after several revisions. There were no compact books on avalanche safety at the time he wrote it, but there are several today.

I mentioned that although the 1950s have been described as the "dark ages" for ski mountaineering, they seemed to have been a boom period for avalanche studies. Ed said that in the 1950s and 1960s the Forest Service suddenly found that they owned a lot of avalanche paths that were being developed for ski areas. Ed was occasionally sent out to investigate prospective new ski areas in the intermountain area. He would make recommendations on how to lay out the area and so on.

"You can't try to outguess the snow. You may stop and poke around, maybe even dig a pit, but well, that's some evidence, but you still have to make some practical decisions on the next slope you're going to cross, and it could be entirely different."

It was easy to get explosives and artillery for avalanche work in the 1950s because it was war surplus. Ed recalled, "You could just call the Tolila ordinance depot and say I need some powder and they'd say, 'Come out and get it.' You could just take a government pickup out and fill it up." TNT, tetrytol, plastic explosives, whatever you needed. Ed remembered a time when they went to get some explosives and the fellows said they'd just melted down and poured a lot of it, so "go help yourself from that pile over there." They were 50-pound blocks. Ed replied that that wasn't exactly what they had in mind. They were looking for something more like two-pound blocks. So the guys said, "Here, take this sledge hammer." Ed explained that, being military explosives, the stuff could not be set off by impact or even rifle bullets.

BIRTH OF THE AVALANCHE TRANSCIEVER

Around 1968, Ed began experimenting with the use of a radio transmitter to locate a person buried in an avalanche. Ed built a tiny transmitter that operated in the broadcast radio band. It was about the size of a cigarette pack and could be put in your pocket. He used a small portable transistor radio to pick up the signal. He was trying to figure out how much power to use and what sort of antenna it needed to work well, but hadn't advanced too far when he talked with John Lawton, a regular Alta skier. Lawton was an electrical engineer with some connection to Cornell University. (Ed thought he may have worked as a



After overcoming childhood polio, Ed learned how to ski in 1947 and continued skiing until his death February 1, 2007, on the slopes of Monarch Mountain in Colorado. Here Ed enjoys a day at Bridger Bowl in Montana. Photo by Don Bachman

private consultant.) Lawton said, "I think I know a better way to do this."

Lawton's idea was to use an audio-frequency induction field, in which the strength of the field diminishes with the cube of the distance to the transmitter. By contrast, ordinary electromagnetic radiation diminishes with the square of the distance. The third-power relationship of the audio-frequency induction field makes its signal more sensitive to how close you are to the buried transmitter.

Lawton made several versions of the device and sent them to Ed to test. The first one had a wire coil about 15 inches in diameter which was intended to be sewn into the back of a parka. The transmitter and battery fitted into a pocket and the coil acted as the antenna. It worked great, Ed recalled, and had quite a long range, but wasn't practical because it was integrated into a garment. The next version was what Ed called a "ferrite loop-stick thing" with a nice compact antenna. The first operating model was known as the "hot-dog Skadi." It was long and narrow, about the size of a hot dog. Lawton continued to improve the design and started a company with his son to build and market Skadi avalanche transceivers. (I found a note about the Skadi in *Summit*, March 1971, page 29.)

The Skadi was the primary avalanche search beacon for a number of years. Ed recalled that the audio-frequency induction signal was virtually free of interference and "would penetrate anything." You could follow someone walking through a tunnel in bedrock with it while walking on the surface. The Swiss subsequently did a lot of research and eventually moved to a higher frequency (457 kHz) which has since become the international standard. The higher frequency gives better range with less power. The third-power relationship doesn't apply for the newer higher frequency models, but they have other advantages. One is that they can use an entirely different antenna which is less sensitive to antenna size than the Skadi. Several companies in Europe and the U.S. now manufacture avalanche beacons.

AVALANCHE WORK IN WASHINGTON

Ed participated in a study of the North Cascades highway for the Washington state highway department. The engineering was complete at that point and the road was already under construction. Willow Milroy, chief research engineer for the Department of Transportation (DOT) realized "they were buying themselves into a lot of avalanche problems," so she visited Ed at UW to request the study. He produced a thick report that included an atlas of avalanche paths, recommendations on how to set up control programs, maintenance requirements, and so on. The DOT used the report to argue against winter plowing of the highway because of the cost. Ed noted that the hairpin turn below the Early Winters Spires gives avalanches two opportunities to hit the road, on either side of the switchback. He recalled that during the highway study he brought some visiting

Japanese colleagues to Washington Pass to observe the avalanche problems. "They looked around," recalled Ed, "and saw how the road comes up the west side and goes down the east side. Then they shook their heads and said, 'We would tunnel.'"

During the controversy in the 1970s over developing an open pit copper mine on Miners Ridge in the Glacier Peak Wilderness Area, I remembered reading a letter to the editor of the *Seattle Times* from Ed pointing out that the proposed mine was located in a huge avalanche path. Ed said he remembered writing that letter. He'd never made a formal study of the area, but when he saw a picture of it in the newspaper, it was just an obvious case of somebody looking for trouble, so he felt obliged as a citizen to point this out.

As a result of the work Ed did for the Washington state DOT on the North Cascades highway, the state became more interested in snowfall and avalanche forecasting. Pam Hayes, one of Ed's graduate students at UW, did work on detailed snowfall forecasting for the Cascades that was quite successful. The highway department was able to demonstrate that they could save a lot of money deploying highway crews if they had more accurate snowfall forecasts. Around the same time they started considering the possibility of central avalanche forecasting. Mark Moore and Rich Marriot, two of Ed's graduate students in geophysics and atmospheric sciences, did masters theses related to avalanche studies. Their timing was just right. According to Ed, "The highway department pirated their masters theses and turned them into a couple of jobs." That was the birth of the Northwest Weather and Avalanche Center.

AVALANCHE SAFETY EDUCATION

In the early years, avalanche training was mostly for snow rangers and professional ski patrollers. The Forest Service avalanche school has a long history. Monty Atwater started it and Ed helped develop it. Today there are many safety courses for recreationists taught by private industry. We talked about some of the new systems for avalanche hazard evaluation and Ed offered this bit of wisdom:

"There's a lot of basic common sense and good judgment factors that you don't have to have a slide rule to use. I always emphasize to people that the important thing is terrain recognition. Good route finding is the secret of staying out of avalanche trouble. Especially if you're going to an area where you haven't been and nobody else has been, where there's no data. You can't try to outguess the snow. You may stop and poke around, maybe even dig a pit, but well, that's some evidence, but you still have to make some practical decisions on the next slope you're going to cross, and it could be entirely different. Whenever I work with people on avalanche education, I put a strong emphasis on safe route-finding."



Skiing Community Loses a Pillar

Story by Bob Berwyn

SUMMIT COUNTY — The avalanche and snow science community lost one of its founding fathers when Ed LaChapelle died of a heart attack while skiing powder at Monarch Mountain Feb. 1, 2007.

LaChapelle, who was 80, was skiing with a group that included his partner, Meg Hunt, Paula Mears, former Colorado Avalanche Information Center director Knox Williams and Art Mears, another Colorado-based avalanche expert.

LaChapelle was known for his groundbreaking research on basic snow safety and avalanche control work, as well as for his writing and his involvement in the development of the first practical avalanche rescue beacon.

Speaking from his home in Buena Vista, Williams said the group was enjoying 17 inches of fluffy powder that had fallen at Monarch the previous two days.

“Ed said, ‘Let’s go ski some powder.’ So we got some skiing in before things went bad,” Williams said, explaining that LaChapelle appeared to succumb to a heart attack that came on gradually over the course of about an hour. LaChapelle was transported toward medical care via ambulance but died later that day.

“It was a great day, but a sad ending,” Williams said. “Like his partner, Meg, said, here’s a guy who lived for skiing and the mountains, and he was skiing some pretty good powder on his last day on the planet,” Williams said.

LaChapelle died just a week after his ex-wife, Dolores LaChapelle died of a stroke in Durango. Dolores LaChapelle was another legendary figure in the world of powder skiing. She pioneered groundbreaking routes and powder skiing techniques in Alta, Utah, while her husband was based there as part of a seminal U.S. Forest Service team of snow rangers.

“He contributed so much to basic avalanche research and forecasting,” Williams said, explaining that everyone today involved in the field has been touched by LaChapelle either directly or indirectly. “Almost everyone knows him or knows of him,” Williams said, explaining how LaChapelle’s expertise and mentoring spanned three generations of snow safety experts.

“He was the experimenter. He had this huge base of knowledge and an inquisitive mind, always asking how can we look at the snowpack and understand it better,” Williams said.

“He was a mentor to us,” said Don Bachman, a retired avalanche professional now living in Montana who worked with LaChapelle in Silverton during the 1970s. “He taught us with an enthusiasm that was contagious,” said Bachman, who also served a very short stint as ski patrol director at Arapahoe Basin. “We’re walking in Ed’s sizable footsteps, or ski tracks, rather, since he would rarely walk if he could ski.”

Bachman recalled LaChapelle’s distinctive, sonorous voice, “always speaking with purpose, always with a twinkle and a wry sense of humor.”

Out of the work that Bachman and LaChapelle (along with others) did in Silverton during the 1970s grew the current Center for Snow and Avalanche Studies, now headed by Chris Landry.

LaChapelle was born in 1926 in Tacoma, Washington and started his snow science career at the renowned Swiss Avalanche Institute as a guest worker in 1950-1951. He served as a U.S. Forest Service snow ranger at Alta, Utah from 1952 to 1972, with breaks to do glacier research in Greenland, Alaska and Mt. Olympus. He was appointed to the faculty of the University of Washington in 1967, retired as Professor Emeritus of Geophysics and Atmospheric Sciences in 1982.

LaChapelle was part of the pioneering crew of Forest Service snow rangers at Alta who laid the basic groundwork for avalanche control programs at ski areas and for highway departments. As well, he authored *The ABCs of Avalanche Safety*, a slender, pocket-size how-to manual that has for decades been a mandatory text for winter backcountry travelers. Another book he authored that graces the shelves of many snow enthusiasts is the *Field Guide to Snow Crystals*, beautifully illustrated with spectacular photos of different types snowflakes.

The Alta snow rangers were dubbed the Avalanche Hunters in Monte Atwater’s on the Forest Service research program. They refined the use of explosives for avalanche control work with some dicey and exciting field experiments, well-described in Atwater’s book.

While Atwater wrote the first Forest Service avalanche manual, LaChapelle refined the work and published the agency’s first official avalanche handbook in 1961. *The ABCs of Avalanche Safety* was a direct outgrowth of that work, according to a telephone interview with LaChapelle, taped by Lowell Skoog in 2001.

He was also involved with another ground-breaking innovation that has become a standard piece of equipment for backcountry powder skiers — the avalanche transceiver. LaChapelle began experimenting with the use of radio transmitters as a locator for buried avalanche victims in 1968. Working with John Lawton, an electrical engineer who skied regularly at Alta, LaChapelle refined the device, which gradually evolved as the “Skadi,” which remained the primary avalanche search beacon for many years.

Ed LaChapelle was a well-loved and respected member in the brotherhood of avalanche experts, and his passing leaves a big void. Comments on several online ski forums reflect the respect he engendered, as other avy pros recalled their last meetings with him at the International Snow Science Workshop in Telluride this past fall.

This story reprinted courtesy of the Summit Daily. Bob Berwyn can be reached at (970) 331-5996, or at bberwyn@summitdaily.com. ❄️



A recent picture of Ed at his home in Alaska.

Photo by David LaChapelle



Dolores LaChapelle (née Greenwell) was a mountaineer, skier, Tai Chi teacher, independent scholar, and leader in the Deep Ecology movement. She graduated from Denver University in 1947 and then spent three years teaching skiing in Aspen, Colorado. In 1950, she made the first ski ascent of Mount Columbia, the second highest peak in the Canadian Rockies, and also of Snow Dome, the hydrographic apex of the continent. After marrying Edward LaChapelle, she spent a year with him in Davos, Switzerland from 1950-51, and then moved to Alta, Utah in 1952, where her son David was born. She moved to Silverton, Colorado in 1973, where she spent the rest of her life and directed the Way of the Mountain center.

LaChapelle died on January 22, 2007, just 11 days before Ed passed away.

She was the author of a number of books, among them were *Sacred Land, Sacred Sex: Rapture of the Deep* (1992) and *Deep Powder Snow: Forty Years of Ecstatic Skiing, Avalanches, and Earth Wisdom* (1993)

Photo of Dolores LaChapelle by Ed LaChapelle, courtesy Lou Dowson and WildSnow.com

Memories of Ed



Ed and Meg enjoyed life off the grid at their cabin in Alaska.

Photo by Mark Moore

I was lucky enough to know Ed for 30 years. And like so many others, I had the amazing experience of knowing Ed as a professor, mentor, colleague, and mostly as a friend who shared the love of mountains, snow, and ice. For me the most distinctive memory of Ed was his creativity in solving problems – both in research and in the everyday.

Everywhere Ed lived or worked, he left a trail of inventions and creative solutions (often with a common theme that could be traced back to successfully making gunpowder as a child in Tacoma!). He may have been at his peak when he ran the Blue Glacier Research Station (established for the International Geophysical Year (IGY) in 1957). I had the pleasure of listening to Ed relate a lot of stories about those early days, when I spent time with him on the glacier in the '70s.

The station is located 20 miles and a mile of vertical from the trailhead and is often inaccessible during bad weather – sometimes for weeks. Ed and his colleagues overcame many scientific and technical difficulties on the glacier – some more mundane than others. Like showering. Hot water was in short supply on a glacier. So Ed and his cohorts developed a piping system to act as a heat exchanger between the generators and the melted snow and presto – hot water for the tiny shower stall built in the corner of the generator shack. Or when they decided to prefab a fiberglass shack and fly it in with a helicopter. They carefully calculated the weight that the helicopter could lift and built to that, but they forgot about the downwash of the rotor on a large object. They couldn't get over the ridge of the High Divide! The solution: land in the backcountry, get out a saw and cut the building in half, fly it in parts, and "glue" it back together. It lasted for over 30 years. But the best was the Fourth of July when they were reminiscing about the times as kids when they would make a rocket out of a small juice can. They would cut out one end, punch a hole in the other, put a firecracker in the hole, place the open end in a bucket of water, light the firecracker, and watch it propel the can tens of feet into the air. Now they didn't have those components, but Ed realized they had empty 55 gallon drums and plastic explosives. Again another problem solved – though Ed admitted it took numerous tries to find the right amount of plastic explosive that would lift the barrels without turning them into lethal shrapnel!

The stories could go on and on because Ed never stopped finding solutions on the Blue, on an avalanche slope, or in the quiet of his office. I saw this most recently two years ago when Mark Moore and I visited Ed and Meg in McCarthy – 60 miles down a dirt road in Alaska (the theme of remoteness was constant in Ed's life too). Here at the foot of glaciers, Ed continued to invent and overcome. No electricity – Ed had solar panels on what seemed like every sunlit surface. He showed us the banks of batteries that they charged in the cellar – dug in the permafrost under his cabin. And not just a simple system. Two banks and two sets of circuits through the house. One for straight DC and another through an inverter produced AC for more civilized devices like a clothes washer (Ed had moved beyond the washboard he left for us on the Blue). Finally it was time for a shower and Ed escorted Mark and me to the greenhouse (whose ventilation was controlled by ropes and pulleys that automatically adjusted for the heat of the day and the coolness of the evening) where we showered with hot water from a wood water heater amongst the happy tomato plants. That's when I told Mark, "Ed has built another Blue Glacier Station, just this time a little closer to sea level."

We'll all miss Ed, but I know we will all feel his presence when we're out somewhere on a snow-covered slope, crossing a crevassed piece of ice, or amongst the tomatoes facing a problem that requires a "creative" solution!

—Rich Marriott

Ed LaChapelle was my first teacher in the avalanche field and remained my best mentor and teacher to the end. He helped me troubleshoot balky solar power systems, provided insights as a peer reviewer for my highway studies, and was always willing to bat new theories of snow processes and tests around in freewheeling discussion.

But I remember best the days of working for him on the Blue Glacier project in the Olympic Mountains of Washington State. After I had gotten myself into a near-miss avalanche while a geology student at the University of Washington, Ed took me under his wing as a glaciology student and field assistant on the glacier project.

Much of the summer at Blue Glacier was spent as one of two hutkeepers for the research hut on a saddle by a large glacial dome high on Mt. Olympus, on a rocky saddle beneath a small but abrupt mountain that was named Panic Peak for its overhanging summit cliff beneath a perfect mountain-watching flat spot and backrest ledge. We did routine snow and weather observations and maintenance chores deep in the peaceful wilderness.

But for several weeks the glacier was transformed into a bustle of activity as floatplanes landing on the snow brought in a small team of scientists from Cal Tech and the University of Washington. I ran a thermal hotpoint drill to place thermistors to measure the internal temperature of the ice to thousandths of a degree, while the main crew drilled core samples a mile up-glacier.

Ed's example always taught us to think across disciplines and outside any known boxes, but I remember being especially impressed by his approach whenever I would break from drilling and watching Dolores do Tai Chi while silhouetted against the sky atop Panic Peak.

In a large snow cave, the Cal Tech scientists were busy thin-sectioning glacier cores, photographing through crossed Polaroids, taking copious notes, making sketches, measuring, and sampling. Meanwhile, Ed would be stretched out on a foam pad in the sun, hat over his face, seemingly sound asleep until the next core section needed to be raised. He'd then appear to wake to assist and then return to sleep. It was only after observing for a week or so that I realized that Ed was not asleep at all, but was spending the time in deep contemplation of the mysteries of the snow and mountains.

He'd stir and sit up with a light in his eyes and a new theory to ponder and eventually to discuss. He knew his internal process well enough to trust it and swim against the social grain, seeking the grand patterns while those around him focused entirely on the details.

I took that lesson with me and have used it all my life. It was not so much the concrete lessons I learned from Ed, it was his example that taught me the most. I thanked him for it at ISSW last fall. I'm glad I had the chance to pass on the appreciation, and I'm glad I had the chance to learn from a true pioneer in the field.

—Bill Glude

I have a little story, inconsequential to most but cherished by me. I was amazingly lucky to be sitting at a table next to Ed's – in fact our chairs were back-to-back – at the 2006 ISSW Banquet. I had brought along my copies of *Field Guide To Snow Crystals* and *Secrets of the Snow* in hopes of turning them into autographed copies. Also in my possession were color prints of slides my father-in-law had taken at Alta in the 1950s of Ed and Dolores LaChapelle; the intention was to give them to Ed.

My wife and I nervously approached Ed, and I asked if he would be so kind as to sign one of my books. He inscribed "Many fine powder days!" in the *Field Guide To Snow Crystals*. We handed him the color prints, and his genial demeanor changed to one of surprise. He had never seen the images, and he smiled broadly as he remarked on his memories of those days. He thanked us and said that he was going to show them to Dolores when he saw her next. Given his delight, I hope he was able to do so.

I saw Ed briefly on the day he died, on a fine powder day at Monarch Mountain in Colorado. Very bittersweet.

—Rick Grubin

Rick Grubin works at the National Center for Atmospheric Research, developing tools to process and visualize all sorts of geophysical data. He is also a ski patroller for the Bryan Mountain Nordic and Loveland Ski Patrols in Colorado.

I am writing on behalf of Ed LaChapelle's partner Meg and his son David to let you know of Ed's death on Thursday, February 1. By now, many of you have heard of Ed's passing, for the internet, though impersonal, is efficient. Meg asked that I try to convey yesterday's events in a little more personal note to Ed's friends and acquaintances in the avalanche community.

Ed and Meg were on their annual ski roadtrip around the western U.S., when Dolores LaChapelle passed away in Silverton, Colorado. Ed and Meg came to Silverton to attend Dolores's memorial service last Sunday, and then they went to Gunnison to visit Art and Paula Mears for several days. A two-day storm dropped 17 inches of light powder at Monarch Mountain. Ed was excited at the prospect of a good powder day, so on Thursday morning Ed, Meg, Art, and Paula came from Gunnison and I came from Buena Vista, and we skied.

It was a cold day, one of those when fingers and toes make their presence known and beards and neck gaiters freeze solid. But the skiing was good – damn good. Ed was skiing well and loving it. We should all be so lucky when we are 80. But after several runs, he mentioned that maybe he was overdoing it and thought he should go down to the lodge to rest. While at the lodge, he showed symptoms of a heart attack. The Monarch ski patrol responded, and Ed was rushed by ambulance to the Salida hospital. He died there a short time later. Meg was at his side.

It was a beautiful day that suddenly and tragically took a wrong turn. Certainly, we who were there will never forget that day. Not because of the tragedy of it, but because we got to spend a day skiing powder with a great man. Meg said it best last night: Ed loved to ski, and could there be a more fitting final day than the one he had?

—Knox Williams

Like most of us, the last time I saw Ed was at the Telluride ISSW this past fall. Several of us old-timers went out to dinner with Ed and Meg one evening. There was Doug Fesler, Jill Fredston, Art and Paula Mears, Karl Birkeland, Janet Kellam, and me. As is usually the case when I'm in Ed's company, I unrelentingly quizzed him on every avalanche question that has ever confused me.

I asked him what he thought of the presentations at ISSW and the current state of avalanche research. He said something to the effect, "Well, there's lots of hand waving and hot air, but really nothing new. They are all still missing the point." He went on to explain that it was the deformation within the weak layer prior to avalanching that was the critical piece of the puzzle and that no one was studying it properly. We discussed ideas for various sensors that could measure deformation on a real-time basis – sensors which did not exist when he was in his prime and are only now becoming small enough and sensitive enough to measure the critical parameters on a real-time basis.

And, of course, he will be forever remembered by his comment on the same subject at ISSW when he went to the microphone after someone's talk and said (if my memory serves correctly):

"I see all of these static tests being presented and the snowpack is dynamic. Is there any dynamic testing going on? Otherwise don't you think it is like throwing a blanket over a herd of cats and trying to follow what the cats are doing? Are you really getting to the problem?"

For four years, I was one of the lucky few people who got to live in the Upper Guard Station at Alta, which has housed so many famous avalanche scientists and practitioners including Monty Atwater, Ed LaChapelle, Ron Perla, Ray Linqvist, Onno Weirenga, Peter Lev, Binx Sandahl, Duain Bowles, and Doug Abromeit among others and roughly in that order. I used to sit there and hope that the floors and walls had absorbed some of the accumulated wisdom and was re-radiating it back to me.

There were still dozens of old, cut-off electrical wires hanging out the side of the building that used to be connected to a plethora of gizmos that Ed built through the years to monitor weather and snowpack characteristics. On one of Ed's annual visits to Alta I quizzed him at length about the wires and what they monitored. He relished in retelling his old, famous story about when they had all their weather instrumentation set up near the Guard Station and in the middle of one stormy night, he was awakened with a huge booming and cracking noises as the avalanche deposited all his instrumentation into the parking lot below and ripped all the instrumentation wires out of the house. "But we made the best of it," he said with a twinkle in his eye, "we published a study about the distribution of objects in avalanche debris."

One fine summer day, a man knocked on my door and he introduced himself as David LaChapelle, Ed and Dolores's son (he was originally called Randy, but he later changed his name to something he liked better). He was born and raised in the Upper Guard Station and wondered if he could come in and have a look around. "Wow," I stammered, "come on in." So I spent the next couple hours quizzing him about the old days and what it was like living with two legendary parents. Later that winter, David came and stayed for a week or so.

Among the stories I can remember, an old loudspeaker was still mounted to the outside of the building, which Ed had installed as a way to broadcast avalanche information in case of a rescue, but most of the time Dolores and Ed used the speaker to monitor David's crib so they could ski while he was sleeping and return when they heard him crying.

David seems to have followed more in his mother's footsteps than his father's as he worked as a youth councilor in Alaska and he was deeply interested in spiritual matters, which we discussed at great length.

Ed gave me boxes of his old files, photographs, and film from his research days at Alta and trusted me to get them into the proper hands. I brought most of the files to the Center for Snow Science at Alta library and I stored his old film and photographs at the University of Utah Marriott Library.

Once when Ed visited me at my house in Salt Lake City, I sat him down with a tape recorder and got him to tell me as many old stories as I could coax out of him. But the stories were disappointingly sanitized versions of the great colorful tales I remember him telling at other times when his tongue was lubricated with a few beers in the company of friends.

I always meant to record his stories again under more favorable circumstances. One year, I brought the tape recorder with me to Alaska when we boated the Tachanchini River, after which my wife Susi and I were going to stop by McCarthy and spend some time with Ed and Meg. But Susi's father died during that trip, and we headed back south instead. Then last summer we were in Alaska again, but despite Doug Fesler and Jill Fredston urging me to pay him a visit because his health was deteriorating rapidly, we lingered in Denali too long on an extended backpacking trip, and we ran out of time, so we put it off yet again. And, of course, now I wish we had done otherwise.

—Bruce Tremper



The LaChapelle family enjoyed a sunny winter day in Alta, Utah.

Photo courtesy Rick Grubin

For Ed

A long time ago in a place far away,
A place that it rains most every day—
A young student came, fresh off the beach,
He came to be molded for his mentor to teach.

He didn't know very much about snow,
What made it stay or what made it go—
He didn't know that it had energy and strength,
Or that it had structure along its whole length.

But the master was patient and chuckled a lot,
And I'm sure to himself he gave it some thought—
What do I have here, that I'm expected to mold?
To teach so that he'll learn and live to grow old.

This youngster must think about weather and terrain,
And how new layers form through snow and from rain.
And he's got to be quick to respond and transform,
Even through stability is often the norm.

Now this scene's been repeated an amazing number of times,
I could fill in lots of your names by just having more rhymes.
You've touched many lives with deep wisdom and thought—
And many of us here say, "Thanks Ed, thanks a lot."

—Mark Moore



Meg and Ed share conversation during a visit from Mark Moore and Rich Marriott at their home in the Alaska bush. Both photos this page by Rich Marriott



Dolores and Ed...very strange weekend for Dolores's memorial. Richard/Betsy Armstrong (INSTAAR director and worked with Ed) were down for the Silverton Avalanche School. First time in 20 years. I'm good friends with them so we spent a lot of time, and Dolores died just before the school, so we all attended the memorial. Ed showed up on Saturday night before Sunday memorial and we had dinner with him and caught up. I gave Ed my last "excellent" bottle of Pisco from Chile, and my girlfriend met him and heard some old stories about all of us. My Prescott group got to meet him and the Armstrongs who all are legends in the snow field, and Lane and I got to work with all of these folks... Ed's passing was truly an end of an era...

Our time together was often punctuated with stories about Chile and the mines that we both worked but just as much time was spent talking about recipes for the "perfect Pisco sour." He truly was a mentor to many of us and to many snow people who didn't even know him. He was a universal zeitgeist (*the ethos of a cohort of people, that spans one or more subsequent generations, who despite their diverse age and socio-economic background experience a certain world view, which is prevalent at a particular period of socio-cultural progression*). He loved empirical evidence as a scientist, but as his son said he was just as intuitive. I remember taking my first avalanche course from him back in the early 70s, and I think it was Denny Hogan, Tim Lane, and myself who stood on a side of a peak with Ed and Rod Newcomb after digging a pit that probably was a typical weak San Juan hole. They asked us what we wanted to do, and we jumped in and skied the line. Later after the two of them carefully worked their way down the old-man route (safe route), I remember Ed saying "You're going to die skiing lines like that. You can never trust a slope with depth hoar on it." And it was a matter-of-fact response, not a sermon or pissed off reaction. That stayed with me. He was a great teacher and a very humble human being that I enjoyed spending time with.

—Jerry Roberts

The news of Ed LaChapelle's passing hit me hard. Certainly Ed was getting on in years, but seeing his usual feisty self at the Telluride ISSW mistakenly assured me that he had at least a couple more ISSWs in him. It softened the blow a little to know that Ed lived a long and productive life, and that when he passed away he did so surrounded by Meg and other close friends, and after a morning of powder skiing.

I really only got to know Ed over the past 10 years or so. For many years he would tour around the western U.S. (often accompanied by Meg), visiting friends and skiing at some of the smaller ski hills. His trips invariably included a stop in Bozeman to see his friend Don Bachman, and when they weren't up at Bridger Bowl they would often stop by my office to chat about avalanches, recent research, and the National Avalanche Center. One time he even left me with his old snowpit kit. During Ed's visits, Don generously hosted several parties for the local avalanche community so we could talk with Ed, and at these gatherings he would regularly challenge us to come up with new answers to age-old questions in the avalanche business.

One thing I will miss is sending Ed research papers. Sending him a paper was always a little nerve-wracking, since I knew he wouldn't shirk from challenging poorly supported points. However, I couldn't resist since our e-mail exchanges and discussions were always interesting and enlightening, and it was certainly rewarding to see him delight in small discoveries that might help explain some of his observations from his many years spent in the field.

It's a well-worn cliché, but Ed really was a giant in our field. I looked up to him, as did almost everyone I know. Who wouldn't want to be like him? He had two successful careers – first as a Forest Service snow ranger at Alta and then as a professor at the University of Washington where he mentored many of the leaders in the avalanche business. He was revered by both practitioners and scientists. His 1980 *Journal of Glaciology* paper on avalanche forecasting still stands as one of the seminal works in our field after over 25 years. He was more mentally acute at 80 than most folks half his age, and he was still out skiing when many others his age move to Arizona and hang out on golf courses.

For me, I'll miss having a connection to the "good old days," someone who could tell stories about the Alta days with Atwater and Perla, and offer a different perspective on the Forest Service. Mostly though, I'll miss having him continue to provide lively challenges our papers, research, and ideas about avalanches – thereby improving them.

We'll all miss Ed. Luckily for us, he chose to put his energy and time into our field. Those efforts yielded answers to some difficult problems, while his inquisitive mind left us with many other questions to ponder.

—Karl Birkeland

Regarding Ed LaChapelle, I'm sure you won't have any trouble getting lots of good information on his contribution to the industry. There are lots of us working with snow and avalanches who owe much of our success to his encouragement. He had more to do than any other person to steer the development of modern techniques of avalanche forecasting and control that we all use today in our work. I could go on at length about how he was the major player in the development of avalanche education in the U.S., beginning with the early Forest Service Schools held in the late 1950s and 1960s. He trained us well.

—Rod Newcomb

When I arrived at the University of Washington as a prospective graduate student in Atmospheric Sciences in 1973, I was younger, cocky and frightened all at the same time. I was younger because it was several (?) years ago, cocky because I hadn't started to forecast anything other than food for the next meal, and frightened because Ed was larger than life. His disarming smile and easy manner put the initial fears to rest, at least for awhile. Then on my first wintertime field trip with Ed, I came to the realization that here was someone really thoughtful about life. In early December, back in those years when winter arrived early and stayed late in the Pacific Northwest, my wife and I drove with Ed in his old Ford pickup from Seattle to a snowcat pickup enroute to Washington Pass. We were heading up to check on one of Ed's research programs that involved avalanche path mapping and path characteristics along the proposed highway corridor for State Route 20 across the North Cascades (stretching from Newhalem to Winthrop). In any case, Ed's pickup was slow and the trip was long – about three hours or more of side-by-side camaraderie in the front seat. Trying to engage in conversation and learn from the master, I asked a great many questions. As I recall, to each question Ed replied rather simply “Yes” or “No” with either little or no elaboration on any point. Quite flustered, I sat there thinking what was wrong, and how could I possibly endure perhaps years of this “failure to communicate.” Then it came to me. Ed was waiting for me to ask an “intelligent” question – perhaps something about all of the important observations that I was probably missing as the world flowed by the pickup window.

Anyway, when we arrived at the closed highway gate above Ross Lake, piled out of the pickup, and got our touring gear together to await our snowcat pickup, I noticed Ed keenly looking around and intensely interested in most everything around him. When I realized that this was the learning process that he hoped I'd pick up on, we immediately got into an engaging and quite interesting conversation about hoar frost (which was everywhere), when and where and how it formed, and how important it was as a weak layer. From then on, if I was observant and thoughtful about the world around me, from variable snow depths to wind effects to changes in terrain, I never seemed to be at a loss while talking with Ed – who was always intimately examining and analyzing everything natural surrounding him. The rest of the trip was mind-expanding for me as we ski-jored up behind the Thiokol for some 15 miles from the gate to the Washington Pass summit. There a small portable A-frame lay between the base of rather imposing Liberty Bell Mountain and adjacent Cutthroat Ridge and acted as the winter home for Frank and Donna, the UW/Washington State Department of Transportation avalanche activity observers back in the winter of 1973-74. As we observed and examined the multitude of avalanches that had recently hammered the basin all around us, and Ed's keen eyes sparkled with interest and enthusiasm, I knew that my true education as an avalanche forecaster had begun.

For the next several years as a graduate student, I was fortunate to have Ed as a rather constant source of enlightenment, and an excellent critic of

my fledgling thesis abilities. His guidance ensured that I critically evaluate everything that I wrote, and that I stated each point as carefully and completely as possible. Though he attempted, unsuccessfully, to refine and shorten (succinctify?) my somewhat lengthy and verbose writing style, it is to his credit that he persevered and at least made what I did say have some reasonable content, rather than just a ramble without purpose. Yet Ed was certainly not all grim work, re-writing papers, teaching, or research. He enjoyed laughter more than most and when he laughed it was a whole body deal. Ed had a great passion for many things, and shared his passion for snow and weather science through great classes and teaching expeditions. His “Ski the West” college course (a nickname for a more profoundly named research class) at UW was imminently popular, and why not – after several weeks of classroom instruction, Ed loaded his students into a UW van, embarking upon a snow and avalanche survey of many Western mountain locations to verify and expand on what they had learned. Of course this involved lots of downhill time at a variety of powdery areas. Though we all garnered lifetime benefits from the course, we also learned that mountain time was fun time with Ed. Rich Marriott, Sue Ferguson, Pam Hayes, and Dave McClung all participated in this course which received uniformly high marks for student satisfaction. Ed took every opportunity to be away from the office and out in the field, and I don't remember any of his graduate students having research projects that didn't involve many, many field trips.

Although many of us knew or think we knew Ed well, I believe that there is a part of him that is/was quite unknown. It's the part that was “Obie Juan,” the mystical Ed, the snow wizard whose mind was often a step or two ahead of his colleagues. One evening while celebrating the anniversary of *The Avalanche Review* with Sue Ferguson, Rich Marriott, and several other graduate students, Ed pranced into a rooftop party/meeting of the UW Atmospheric Sciences Avalanche Group wearing long purple robes, a pointed magician's hat, and bearing a large flask of a potent mix dubbed “Snow Snake Oil.” Unfortunately, as the evening evolved, Ed brought the level of levity way up, was way too generous with the SSO concoction, and I was far too eager to sample it. I do believe that he chuckled continuously later that evening as he and Meg drove my semi-comatose body home in the old VW microbus. But what else could you do while watching the hit movie *Avalanche* starring Mia Farrow and Rock Hudson? While my recollection of this stunning box office flop is dim, I do remember that it was not noted for either its acting or special effects. In any case, it was a history of antics such as this interspersed with amazing insights and wisdom about most anything that for me sealed his reputation as a grand snow wizard, a reputation which has been reinforced many times in many ways over the intervening years.

Many of us have special memories about Ed: what he meant to us personally and to the avalanche community as a whole. But the common theme is that we will all miss Ed. Although I presented this at Ed's intro at the ISSW06 banquet, it seemed fitting to include it again here. It sums up my ramblings above, and Ed would have been pleased for such brevity, with content of course.

—Mark Moore

Hi Lynne,

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

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

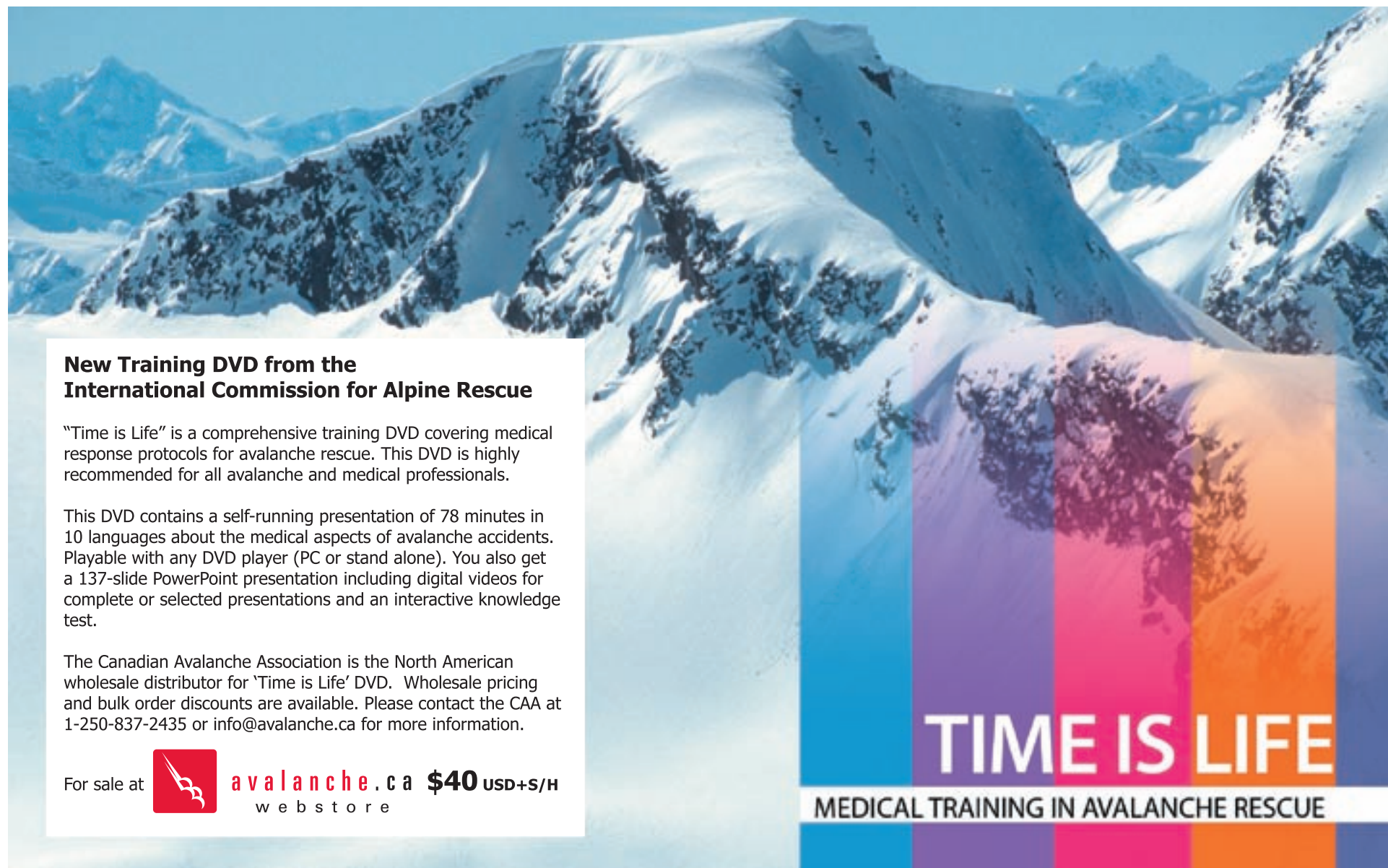
They will both be missed.

With Love, Brother Bob (Sue Ferguson's brother)

—Bob Ferguson



Ed and Don Bachman share a light moment at the Red Mountain Pass field trip at ISSW 2006. Photo by John Stimberis




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ASCENDING SPIRAL

continued from page 21

event (reduce the Deborah Number!). The NivoTest, or any similar scheme, needs to be constantly in play days prior to any avalanche exposure, when evolving weather conditions contribute to the checks. Early entries to the NivoTest may be hazy as to detail, but even then a picture will start to evolve than can be constantly updated until the final moment of decision in avalanche terrain.

Seligman (op. cit.) nearly seventy years ago placed strong emphasis on anticipating snow conditions from weather patterns long before going into the field. More recently I have made the same point (LaChapelle, 1980). Of course, the weakness of any checklist system is the risk of rigidity and thus locking out unusual thinking demanded by unusual conditions. Whether a NivoTest or any other scheme, check lists have to be reminders and not substitutes for constantly paying attention to a wide spectrum of clues about snow behavior. I view George's mention of mandate to use checklists like the NivoTest with much alarm. Plaintiff's lawyers can have a field day with mandates.

Among the various TAR articles about decisions, only Stewart-Patterson mentioned luck, where he named it one of the three main factors in decision-making, though only in passing. This topic needs wider recognition. Let's face it, most of us in the avalanche game have been saved many times over by luck. George (op. cit.) mentions that even experts say they are right only 50% of the time. Now we know that experts don't get caught in avalanches 50% of the time, so the obvious conclusion must be that luck along with undocumented skills is right in there as a major player.

This is not surprising when we consider that most places and most times the alpine snow cover is stable

in the face of normal triggering forces. The whole business of evaluating snow stability and making decisions hinges on recognizing those fewer times when it is not. Thus the odds more often favor a mistake on the safe side than one that raises risk. Of course, by random chance, bad luck as well as good can follow even the most skilled and careful decisions.

FROM THE BEGINNING, THINK WHAT MIGHT BE THE END— This really gets to the heart of the matter, emphasizing the idea of stability evaluation as an ongoing and continuous process. Whymper spoke to anticipating risks in mountaineering; his words speak with equal force to anticipating risks in avalanche terrain.

Here is where the experts get sorted out from the beginners. My idea of an expert is a person who constantly follows evolution of the snow cover and repeatedly thinks ahead to "what might be the end" for one risk situation after another. The end might be an avalanche fall and, even more important, might be consequence of an avalanche fall.

I learned this many years ago from Andre Roch (personal communication) who pointed out that two questions are involved. First: will an avalanche occur, and second: if it does occur, what will be the resulting risk?

For example, a small avalanche poses less risk to a skier if it has a gentle outrun onto safe ground than it does if it carries a victim over a cliff or into a crevasse.

The whole business of expertise is examined by Conger (2005), who allots analytical skills in decision-making to persons ranging from novice to proficient, but reserves the role of intuition for experts. He is onto something here, raising the whole question of just what constitutes intuition.

Perhaps this is a case of not being able to define intuition but being able to recognize it when we see or exercise it.

Certainly we can all recognize the "seat-of-the-pants" factor in evaluating snow stability, but just what do we mean?

Here I will make a stab at answering this question and defining intuition in this context. To begin, consider what intuition is not. It is not some magical quality bestowed on mature people of wide experience along with gray hair and slowing reflexes. It is not some sort of extra-sensory perception—quite the contrary. Intuition is the lifetime accumulation of precisely those sensory perceptions of snow, weather, and avalanche behavior that have accumulated, often in the sub-conscious, that cannot readily be quantified, logged in a notebook, or clearly explained. Such perceptions, nevertheless, are based on the physical behavior of the real world, not on vague mental constructs.

An example is the meteorological perception of a mountain-snowstorm evolution based on subtle changes in the spectral distribution of light filtering through clouds as the sun descends in the sky and cloud layers come and go in shifting fashion. No doubt a wide-spectrum recording light sensor could construct graphic records of these changes and eventually build a quantitative document. But the expert integrates all this under the guise of intuition and recognizes the likely next storm trend.

Here is another example from my own experience. I once was involved in a field-training program for heli-ski guides. The exercise was preceded by a very light fall of fluffy snow, followed by a substantial fall of mixed-snow types and mid-range densities. This combination produced widespread instability with the fluff acting as lubricating layer. Two days of field training produced ski releases everywhere, excellent for demonstrating how, and how not, to test ski an avalanche path.

On the third day the first helicopter flight took several of us to a ridge top.

One of the experienced guides skied 100 yards down the ridge and stopped. I followed close behind and joined him. He turned and said, "There is no tension in the snow today." I replied, "I agree." That day-long exercise never started another ski release no matter how hard we tried. So here were a couple of presumed experts putting their intuition accurately to work.

What did we actually sense about the snow? We can throw around words like kinesthetic perception and psychorheology, but what we actually had was many years of experience with the way our skis and legs reacted to snow structure, accumulating this experience somewhere in our heads. Did we actually experience "tension" as physics would define it? Probably not; this is another convenient word to toss around, but we both knew what we meant.

How many TAR readers know what we meant? As the spiral ascends and scientific and technical knowledge about snow continues to grow, are we coming closer to improved training and safety practices for avalanche risk management? Or are we locked into Wilde's (1994) risk homeostasis trap? The dialog needs to continue. ❄️

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