

Avalanche

REVIEW

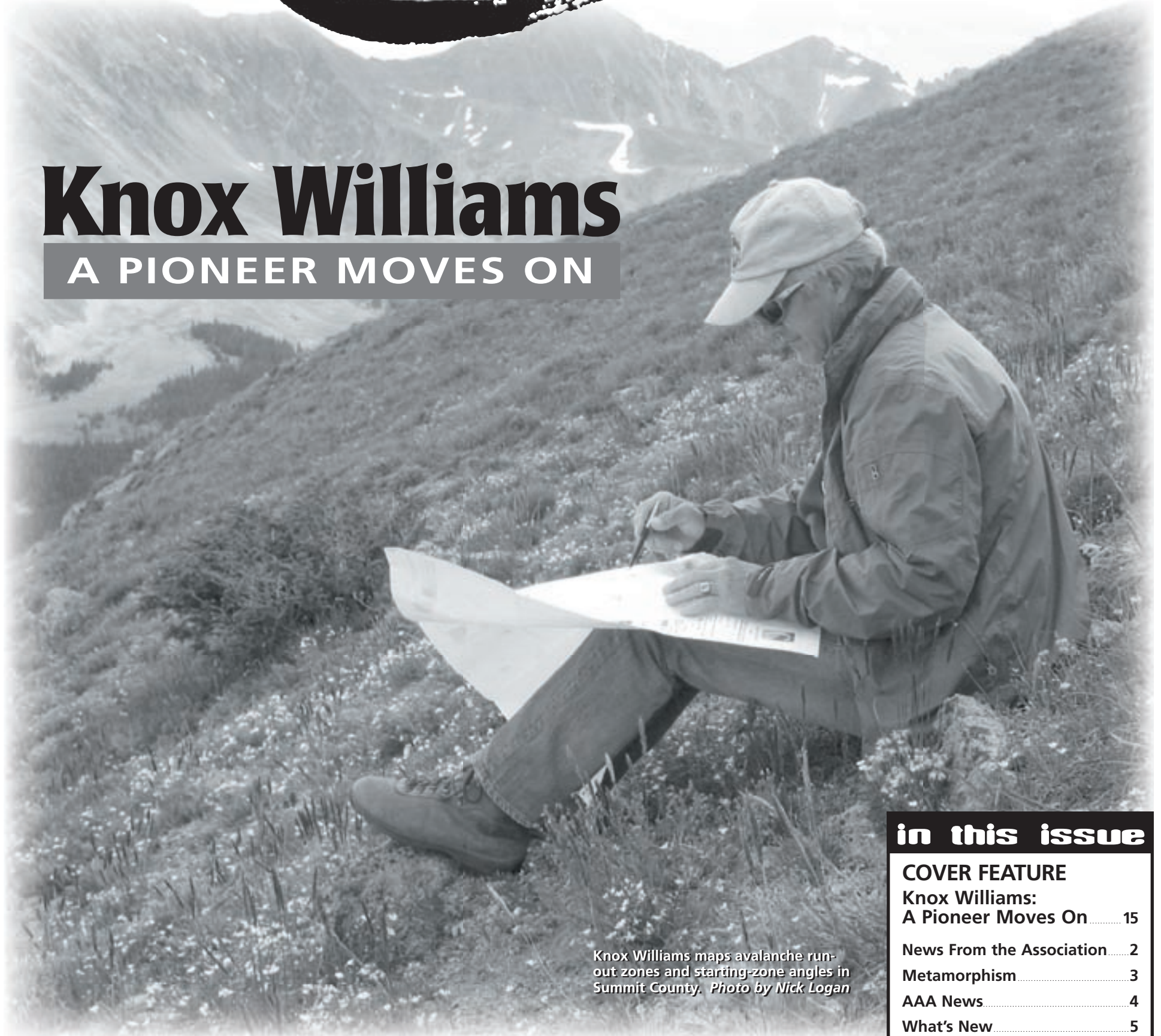
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Web site: www.AmericanAvalancheAssociation.org

Knox Williams

A PIONEER MOVES ON



Knox Williams maps avalanche run-out zones and starting-zone angles in Summit County. Photo by Nick Logan

This coming spring, Knox Williams will retire from the CAIC. He has worked there for 34 years. A lot changed in the avalanche community throughout those years, and Knox has been a part of almost every aspect of that growth. His wife Suz says, “The guy just doesn’t toot his own horn; I can’t find much of anything on all the things he’s done.” But from a variety of sources, here’s some of the avalanche history Knox has seen come and go. As you will see, it’s been a wonderful story.

—story begins on page 15

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The heli work was done with a considerable sense of awe as we watched entire alpine basins rip out as the failing slabs jumped over ridges into neighboring basins pulling out Class III & IV avalanches...

—Jerry Roberts
The Office, pg 10



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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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news from the association

Most of us are home now after another amazing ISSW. I probably speak for many in congratulating everyone involved in putting together ISSW 2004. It was great to see that folks with funds furnished in part by AAA academic and practitioner grants made a number of presentations and contributed posters. I enjoyed meeting the many AAA members who stopped by the AAA booth in the commercial exhibits. ISSW is a time for many of us to reconnect with folks that we only see at this great biannual rendezvous. Friends, colleagues, and acquaintances are moving in new directions, taking on new responsibilities, and in some cases retiring (yeah, right). Some friends need our best wishes sent their way. Get well soon Sue, Liam, Norm and Dave; our thoughts are with you.

I was pleasantly surprised at the attendance for our annual meeting. This is a great indicator of member interest because we have so much going on. We've recently heard and read about the development of a Certified Avalanche Instructor program, explosives handling and use training materials, and most recently the production of the AAA and USFS National Avalanche Center, *Snow, Weather, and Avalanche Guidelines for Observations*. All these projects happened because dedicated members spent countless hours making these projects successes from which we all see benefits. Our next project will be the development of a professional avalanche operations course. The membership showed overwhelming support for this idea in an informal vote at the annual meeting. The always hard-working Education Committee will be relying on our membership to be involved in this project to insure its success. If Michael Jackson or Don Sharaf gives you a call, see if you can help them. Better yet drop them a line—your efforts will help the entire avalanche community. E-mails sent to aaa@avalanche.org will be directed to the appropriate folks.

At the annual meeting we introduced the Governing Board that will represent AAA for the next two years until December 31, 2006:

- Russ Johnson, *President*
- Doug Richmond, *Vice-President*
- Andy Gleason, *Secretary*
- Dave Ream, *Treasurer*
- Bill Glude, *Alaska Section Rep*
- Bob Bailey, *Eastern Section Rep*
- Peter Höller, *European Section Rep*
- Fay Johnson, *Intermountain North Rep*
- Sam Davis, *Intermountain South Rep*
- Evan Woods, *Northwest Rep*
- John Brennan, *Rockies Rep*
- Gary Murphy, *Sierra Rep*
- Halsted Morris, *Member Affiliate Rep*

Doug Richmond will take Bill Williamson's place as Vice-President. Bill will take Onno Wierenga's spot as Ski Area Committee chair. New section representatives will be John Brennan for the Rockies section and Evan Woods for the Northwest Section. We owe a big thank you to outgoing board members Woody Sherwood from the Rockies, Jon Andrews from the Northwest, and Onno Wierenga. Thank you for your hard work and dedication in helping to pilot our association.

In addition, the Governing Board filling un-elected Committee Chairs are:

- Denny Hogan, *Awards*
- Dan Judd, *Data*
- Michael Jackson, *Education*
- Janet Kellam, *Ethics*
- Stuart Thompson, *Membership*
- Steve Conger, *Publications*
- Ethan Greene, *Research*
- Dale Atkins, *Search and Rescue*
- Bill Williamson, *Ski Area*
- Craig Sterbenz, *Standards Awareness*

Michael Jackson agreed to chair the Education Committee last winter with former chair Don Sharaf still solidly involved in that committee's efforts.

Last spring when I encouraged interested persons to become involved in AAA by seeking a board position, there was a discouraging—but not unexpected—lack of interest. Another election will be coming up the summer of 2006 and will be upon us before we know it. Many on the current Board have served multiple terms and their stamina is ebbing. The vitality of AAA comes primarily from the Board's energy. During the next two winters an effort needs to be made to develop and encourage potential Board members. The Board should reflect the variety of fields—ski area, guides, forecasters, educators, students and researchers—that our profession represents (see the activity breakdown in TAR 23-1) to be the most representative.

AAA is involved with more projects benefiting the avalanche community than ever before: The continued excellent production of *The Avalanche Review*; creating the new U.S. Observation Guidelines for weather, snow, and avalanches; and funding both academic and practitioner research to name a few. The general business operations, office operations, accounting, Web design and maintenance are perhaps more routine but no less important in keeping things running smoothly. The time when we could ask folks to provide these labors for free is past. These efforts cost money and those funds come primarily from your membership dues. As AAA expands its works and influence, more demand is made upon those dues. I would like to ask you to assist in advancing our common goals by encouraging your friends, colleagues and co-workers to become members of AAA. Our main product is *The Avalanche Review* and if it would help to have some recent issues to pass around, let me know and I can send you some. An AAA member joins an internationally recognized association that is known for its dedication to high standards of professionalism, furthering the dissemination of avalanche safety information, and representing member interests to various governmental and private interests. Month by month and year by year our labors have continued to build an association whose efforts we can all be proud of.

I would like to recognize the recent Life Membership donation of long-time Professional Member Dick Penniman. Life Membership involves a substantial financial contribution to AAA. Thank you Dick.

Now for a few friendly reminders in closing. If you haven't paid your dues recently this may be your last issue of TAR. Check the mailing label of this issue. If you have any questions do not hesitate to contact me. The U. S. Post Office does not usually forward TAR, so make sure that your address is up to date. A simple e-mail update to aaa@avalanche.org will do the trick. The AAA Membership Directory will go to press in the beginning of 2005. If you want your latest info—particularly current job and employer—to be listed, get that information to me by January 1, 2005.

By the time you read this, winter will be in full swing. The isolated white areas of fall will be filled in with the abundance of our passion. I wish you all a safe and successful winter season. Good luck, good hunting, and stay on top.

—Mark Mueller, your Executive Director

The Avalanche Review: A Call for Submissions

- Seen any good avalanches lately?
- Got some gossip for the other snow nerds?
- Developing new tools or ideas?
- Learn something from an accident investigation?
- Send photos of a crown, of avalanche workers plowing roads, 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; send it to us. *The Avalanche Review* is accepting articles, stories, queries, papers, photos.

Submission Deadlines

- Vol. 23, Issue 3... 12/15/04
- Vol. 23, Issue 4... 2/15/05
- Vol. 24, Issue 1... 7/15/05

The Avalanche Review

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metamorphosis



(l-r): Sam Parker & Larry Heywood at ISSW '04. Photo by Doug Richmond

Russ Johnson joined the Squaw Valley Ski Patrol in 1985 (hired by Mark Mueller) and became a supervisor in 1991. When Squaw decided to put in a state-of-the-art weather system, he was hired to install it in the summer of 1993 and that fall became the first avalanche forecaster for Squaw. Russ continued in that job until last year when he trained Will Paden and Lel Tone to take over; Will is now the lead forecaster.

Larry Heywood has stepped down as Alpine Meadows Mountain Manager but continues his consulting business mainly as an expert witness defending ski areas in lawsuits. He also consults on zoning and building in avalanche terrain.

Woody Sherwood has stepped away from his job as Patrol Director at Crested Butte to follow new directions. He is now part owner of the Gunnison-Crested Butte airport shuttle and can also be found in Bonners Ferry, Idaho, tending nursery spruce trees and managing a timber harvest. He may have more time to ski: shecas@crestedbutte.net.

Chuck Tolton is moving from his position as risk manager at Vail to become the new general manager at Keystone.

Sam Parker will no longer be the Patrol Director at Copper Mountain. He will assume the duties of Interwest Risk Manger for Copper Mountain and Winter Park.

After his ISSW presentation on avalanche mitigation in Highlands Bowl, Kevin Heinecken is leaving Aspen Highlands to spend more time with his family. ❄️

50 years on the job and the man's only 45*

*Resumé Man by the String Cheese Incident

Big changes at the Silverton Avalanche Forecast Office. Mark Rikkers recently joined the CAIC/CDOT forecast team after a two year stint interning. Mark has spent many years in the San Juan mountains as a skier and educator and has a Masters Degree from the University of Colorado in snow hydrology. We're excited and happy to welcome him and the skills and knowledge that he brings to the table.

Mark has moved into a position vacated by Andy Gleason who forecasted the "Tigers of Red Mountain Pass" for 9 long seasons. Andy has saddled up and moved to Boulder, Colorado, and will be riding the #7 bus to Denver to work as a geologist with the Colorado Geological Survey. He will also be a "Guest Forecaster" at the CAIC Mother Ship in Boulder several times a week. His good humor and extraordinary forecasting skills will surely be missed. —Jerry Roberts ❄️

New Alpine Meadows Ski Patrol Director

Alpine Meadows Ski Resort Ski Patrol Manager Ray Belli will retire after 35 years of continuous service and dedication at the North Lake Tahoe mountain.

Tahoe City resident and long-time Alpine Meadows ski patroller Jeff Goldstone has accepted the position as the new Ski Patrol Manager. "This is my dream job," Goldstone beamed, relishing the possibilities of his new position. "I get to ski every day."

True. Ski every day he will, but this on-mountain job is highly specialized and Monster.com-ers needn't bother. Goldstone is about to inherit the ski patrol management duties of one of the country's most unique, difficult and dangerous mountains. "There are probably no more than 40 people in the country qualified to do this particular job at this particular mountain," said Larry Heywood, Alpine Meadows Ski Resort Director of Mountain Operations.

Alpine Meadows is one of eight ski areas in the country (there are around 400 U.S. areas) to use military artillery to control avalanches. Tools of the trade for this program include a 105 Howitzer, a 75-mm Howitzer, and avalaunchers, supplemented by high-explosive hand charges. Goldstone will become one of fewer than 10 people who manage a ski area with avalanches that require control via military artillery.

He'll also oversee one of the country's longest established and most respected search dog programs. With nine working dogs (his search dog is Zachary), Alpine Meadows trains each dog in-house, following a rigorous two-year certification regimen.

While many of the nation's ski areas regard patrolling as a temporary



Jeff Goldstone takes over the reins of the Alpine Meadows ski patrol.

mountain job, both Belli and Goldstone represent a career path at a mountain that demands decades of experience with snow safety/forecasting and mountain rescue.

Seems like a lot. How do folks at Alpine Meadows feel?

"I'm jealous," said 34-year veteran Larry Heywood, who held the position up until five years ago, when he became Mountain Operations Director. "Within that patrol department there is a great esprit de corps and camaraderie not found elsewhere. Those mornings after a snow storm when the sun comes up while you're working... it's breathtaking. And it's your job! How many people get to do that?" Big challenges equal big rewards.

Ray Belli is from northern California and lives with wife Laurie, daughters Samantha and Stephanie, and search dog, Kimber. His daughter Rhonda, son-in-law Einen, and grandsons Cash and Chase live in Loyalton.

San Francisco native Jeff Goldstone has been a Tahoe resident for 25 years and lives with his wife Anne, twin daughters Victoria (Tori) and Veronica (Roni), son Cameron (Cam), and Alpine Meadows search dog, Zachary. ❄️

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aaa news

American Avalanche Association Fall Board Meeting Summary

Editor's note: The following is a summary of the AAA Fall Governing Board Meeting, held Sept 19 at Teton Village. Contact any Governing Board member with questions; the masthead on page 2 of this issue lists their names, positions and contact information.

Treasurer's Report— Dave Ream

We're solvent, but we are continuing to spend more than we are taking in, depleting our budget reserve. We run on an operational budget of around \$50,000 per year. We have ambitiously expanded and improved our services to our members with projects like education seminars, observations guidelines, improvements to *The Avalanche Review*, a better Web site, and development of explosives and professional operations courses, but more and better services have meant more expenses.

The sense of the Board is that we need to be careful to trim costs wherever we can, but continue to offer good service to our members. The money spent up front to print the observations guidelines and purchase inventory for the AAA store had depleted our budget at the time of the meeting, but dues are coming in, and sales of clothing and observations guidelines at ISSW were quite successful. We appear to be close to a balanced budget now.

You can help our organization by recruiting members. Dues are still our major income source. Also, do your holiday shopping at the AAA online store. The gear is good, the prices are competitive, and everyone I have given it to loves our stuff. This organization does some very impressive work on a shoestring budget. Anything you can do to help us out will come right back to you in the form of more and better services.

The Avalanche Review— Blase Reardon & Lynne Wolfe

The biggest news is that *The Avalanche Review* will be using color for at least a few pages in the upcoming season. Advertisers have indicated a preference for color and willingness to pay enough to cover the additional cost, so it improves our publication and is revenue neutral.

We will stick with 20 pages per issue, and move the production schedule forward so the last issue is out April 1.

Marcia LeMire is our new advertising coordinator, paid on commission. The Board thanked Halsted Morris for his years of volunteer advertising coordinator work. We could not find another volunteer, so we shifted to paying commissions, funded by eliminating the volume discount on advertising in less than four issues.

We need material for *The Avalanche Review*, and welcome contributions. This really does mean you; the quality of TAR is dependent on what we receive, and it is our members who write most of the material in it. Think over what you are doing in the field; there may very well be a story worth sharing.

Executive Director's Report— Mark Mueller

Changes to the Board from this election are Doug Richmond as new vice president, Bill Williamson will chair the Ski Area Committee, John Brennan will take over from Woody Sherwood as the Rockies section representative, and Evan Woods will take over from

John Andrews as the Northwest section representative. The next elections are in two years.

We have over 800 members now. Professional and affiliate memberships are up, though subscriber numbers are down a bit. The largest member groups, in order, are patrollers, guides, and educators. We all need to work to recruit new members; they are the life of our organization.

We have an abundance of back issues of *The Avalanche Review*, as well as copies of the ISSW '98 and '02 proceedings, available through the AAA office.

The Board decided to get a service mark designation for our name, to protect it against use by others, but not to get one for the logo, as it may change in time and we want to keep expenses down.

We would like to take credit cards for payment on the AAA Web site, but the expense is prohibitive. We will stick with Pay Pal. People can also order on-line and mail a check.

Fundraising and AAA Merchandise— Russ Johnson

We had a large inventory for ISSW sales, reports are that it sold well, and we will have memberships, observations guidelines books, and AAA logo clothing available from the on-line store this winter.

Observation Guidelines— Ethan Greene

We printed a first run of 600 copies and they are going fast. We have moved all but 175 of them as of mid-October. Pricing is \$20 for non-members, \$15 for members, \$12 for schools or bookstores, with a minimum order of 10 copies on the school discount. It is available in a free non-printable PDF format online at the AAA and National Avalanche Center Web sites, and we will have links to avalanche-specific resources on the Web site.

Research Committee— Ethan Greene

We have \$2,500 available annually for grants, practitioner and academic. The one proposal received this year is still under review.

Membership Committee— Stuart Thompson

The board approved new professional members Matt Hubert, John Colter, Chip Morrel, Brian Davies, affiliate members Kingsley Murphy and David Sweet.

The membership committee emphasizes that applications must be complete. Our bylaws state that Professional members need four full seasons of avalanche work. To fairly evaluate applicants, we need full detail on number of days of avalanche work each season and nature of that work.

Our requirements for Professional membership are stringent, but we want to be sure that all qualified applicants are successful. We encourage those who may not qualify for Professional membership to use member affiliate as an interim status allowing participation



Board meetings needn't be boring. (l-r): Andy Gleason, AAA secretary and Michael Jackson, AAA education committee chair.
Photo by Bill Glude

in the organization while acquiring more experience.

The membership committee is currently reviewing how the guidelines for qualifying experience apply to the various branches of avalanche work, with the aim of clarifying expectations and ensuring fair and equal treatment to all applicants.

Awards Committee— Denny Hogan

All five awards were given out. All were kept secret through the meeting until the time to award them at the banquet and annual meeting.

Education Committee— Michael Jackson and Don Sharaf

The education committee has been working on a proposal for a professional operations course. They met with the Canadian Avalanche Association (CAA) and the American Institute for Avalanche Education and Research (AIARE), and explored several options for course development. Licensing the CAA course was rejected due to cost and the need for a course specific to US needs. AIARE was not interested in taking on the role of professional course developer or provider.

The sense of the Board was that we should develop our own operations course, setting our own standards, about 7- to 8-days long, taught by AAA certified instructors. The Board also agreed that the course development job is too big to be done as an all-volunteer effort. The education committee was charged with a feasibility study to outline the curriculum, develop a budget and identify possible sources of funding.

Pinedale High School Snow Science Program— Stuart Thompson

Liz David, a high school science teacher from Pinedale, Wyoming, gave a short presentation on an excellent program that integrates snow studies, including avalanche, hydrology, and blowing snow studies and fieldwork into the high school curriculum.

Search and Rescue Committee— Halsted Morris

Dale Atkins will attend the International Commission on Alpine Rescue meetings this year. They are working on flagging standards for avalanche search. Homeland Security funding is being used to purchase search and rescue equipment in many areas, some of which is useful for avalanche SAR. The Incident Command System (ICS) is becoming the prevalent

organizational form for search and rescue nationwide.

Data Committee— Dan Judd

The Westwide Avalanche Network site has been averaging 2.2 million hits a month in season, or 16 million a year. The Northwest Avalanche Center has been added to Westwide hosting. New scripts have been developed for the Avalanche Notes section.

Old Business, S.931 Avalanche Bill— Don Bachman

The problems with earlier versions of the bill have been fixed in the current committee substitute. Funding and administration is now through the US Forest Service and the National Avalanche Center, with an advisory committee tasked with directing funding to areas that have shown a history of or potential for high avalanche risk. The bill still includes artillery and ammunition programs, but also addresses the full spectrum of avalanche needs. Sponsor Sen. Ted Stevens (R, AK) attached substantial funding of \$15 million.

Post-meeting update: Unfortunately, though the bill passed the Senate, time ran out before it passed the House. Sen. Stevens has indicated that he will introduce similar legislation when the new session begins in late January and try to move it quickly. This would be the largest boost to avalanche funding and development of a systematic nationwide avalanche program ever, so this is one worth letting your representatives know about.

New Business

The fall 2005 educational seminar will be a one-day event at Bridger Bowl near Bozeman, Montana. The venue and audiovisual equipment are free and there are good speakers available locally, so we can put on a great event there for minimal cost. The fall AAA Board meeting will precede the seminar and the annual membership meeting will be in the evening. Dates will be on the first or second weekend in October, timed to coincide with the National Avalanche Center meetings. Plan now on attending.

Spring Meeting

The Spring Board meeting will tentatively be in Salt Lake City on April 9-10, 2005.

Instructor Certification

There are now 18 AAA certified avalanche instructors.



AAA Honorary Membership Award: Rod Newcomb

Rod Newcomb's first close encounter with avalanches occurred in 1963, while taking part in the first ascent of Mt. McKinley's East Buttress. Like many mountaineers of that period, he lacked any formal avalanche training. Later, as a ski patrolman at Snow King Resort he witnessed the avalanche death of a fellow patrolman, Dick Pitman. Rod recognized that his natural instincts as a mountaineer were not sufficient to survive the complex challenges posed by avalanches. He would later serve on avalanche mitigation teams at Vail and Alta. When Jackson Hole opened in 1966, Rod was on the ground floor of yet another one of America's most challenging snow safety problems. From 1974-76, Rod worked with Ed LaChapelle and the INSTAAR research team based in Silverton, Colorado, where he learned from many of the nation's leading snow scientists, while they in-turn benefited from his extensive field experience.



Rod Newcomb on the Teton Pass field trip.
Photo by Chris Stethem

Rod has always been an entrepreneur at heart. In 1975 he began the American Avalanche Institute (AAI), the first independent, commercial avalanche school in the US. AAI is based on a master/apprentice model of education, relying on the industry's leading researchers, engineers and field practitioners to share their knowledge and passion for avalanches with a diverse group of students. For over twenty-five years, AAI has served as an extraordinary platform for many of the nation's up and coming avalanche professionals, an open forum to share their wisdom and expertise. His perpetually open mind and genuine interest in new developments within the field have allowed Rod to incorporate current theory into his life and teaching.

AAI's roster of instructors has been and remains today a who's who of North American avalanche experts. Countless patrolmen, guides, backcountry skiers and research scientists have cut their teeth in one of Rod's backcountry courses. Rod remains steadfast in his commitment to the highest standards in avalanche education. Though it can be difficult to measure the impact of an educator, in Rod Newcomb's case there is no doubt that his efforts have influenced countless lives. His inquisitive mind has posed challenging questions for a number of scientists and he has inspired others to carry out important research that might have otherwise evaded us.

Finally, one of Rod's most notable qualities is his humble nature. It is probably this humility that has kept him alive given the extraordinary life he has lived in the mountains.

Petitioners: Kelly Elder, Mike Friedman, Jerry Roberts, Rick Wyatt, Evelyn Lees, Don Bachman

AAA Special Service Award: Ethan Greene



Ethan Greene, recipient of the AAA Special Service Award, looks over the shoulder of Gary Murphy, Sierra Section Representative. Photo by Bill Glude

The American Avalanche Association is grateful to Ethan Greene for his dedicated work on the new joint A3/National Avalanche Center publication: Snow, Weather and Avalanches: Observational Guidelines for Avalanche Programs in the United States. As A3's research chair, and a former ski patroller and backcountry avalanche forecaster, Ethan saw a definitive need for these guidelines and decided to take this project on as the chair of the working group. It was a daunting task to turn an idea

into a document, and he probably regrets his decision! He worked out a licensing agreement with the Canadian Avalanche Association to use their guidelines, put together a document for review, and solicited reviews from throughout the U.S. avalanche community. There were nearly as many opinions on observational guidelines as there were avalanche professionals. But with tenacity and countless hours of phone calls, e-mails, discussions, writing, and formatting, Ethan used common sense, built consensus, recognized good ideas, and rejected bad ones. He eventually crafted a final document that will be valuable to the U.S. avalanche community for many years to come. He did his best to capture both what is going on in the field today and what is consistent with data collected in the United States since the late 1960s. In the work of the American Avalanche Association, few single projects have required this many hours or this much focus. By sticking to his guiding principles and his deadlines, Ethan has created a blueprint within the AAA for getting a quality job done on time and on budget. His work has guided the formation of a document of which A3 can be proud. For this exemplary effort, the American Avalanche Association thanks Ethan Greene and awards him its Special Service Award.

Petitioners: Karl Birkeland, Avalanche Scientist, USDA Forest Service National Avalanche Center; Knox Williams, Director, Colorado Avalanche Information Center; Ian McCammon, Avalanche Educator, National Outdoor Leadership School

what's new

Avalanche Education Study

Christian March and Nancy Pfeiffer are requesting help from avalanche safety instructors for a nationwide study. Their nationwide study examines the effectiveness of avalanche education; it investigates the question of how much students are remembering and actually using from their Level I avalanche class. The study consists of two questionnaires issued to students one week and one year after course completion.

Among the participants are the Alaska Avalanche School, Alaska Pacific University and Avalanche Level I educators and schools across the country. Christian and Nancy invite you to participate. For more information contact them at: avaledu@alaskapacific.edu

BCA Offers On-Snow Avalanche Training Tours

Backcountry Access (BCA) and Alpine World Ascents (AWA) have announced they will offer on-snow avalanche training tours for people interested in leading informal groups in the backcountry. They are calling the multi-day programs BCA On-Snow Field Sessions. They will be guided and taught by AMGA Ski Mountaineering Guide Markus Beck of Alpine World Ascents (AWA) and Bruce Edgerly, co-founder of Backcountry Access, Inc. (BCA), will guide and teach the programs, with special appearances by other BCA experts. Program locations, dates and costs are:

Silverton, Colorado, Dec 11-13, \$450

Washington's North Cascades, May 6-9, \$550

Andermatt/Gotthard region of Switzerland, Feb 12-16, \$1490

The sessions are designed to provide supervised field experience to recreational skiers and snowboarders who have already taken some form of basic avalanche instruction in the classroom. The objective is to increase the participant's confidence in routefinding, snow stability analysis, group management, and decision making. Instruction will also include advanced transceiver rescue exercises. Morning meetings and evening debriefs will not include PowerPoint. No thermometers, field books, or ram penetrometers will be used on this course. Students will not receive any certification at completion of the course. For more information, contact AWA at (303) 485-1511 or BCA at (303) 417-1345.

European Geophysical Union General Assembly

The European Geosciences Union (EGU) will hold its General Assembly in Vienna, Austria, from April 24 - 29, 2004. The program will include oral and poster sessions, as well as various short courses, workshops, lectures, and meetings. Topics will be disciplinary and interdisciplinary and cover the full spectrum of the geosciences and the space and planetary sciences. The deadline for receipt of abstracts is 21 January 2005; the deadline for pre-registration is April 8, 2005. The official language of the conference is English. For more information, go to: www.copernicus.org/EGU/ga/egu05/index.htm

1st Alexander von Humboldt International Conference on El Niño

The European Geophysical Union (EGU) and the Centro Internacional para la Investigación del Fenómeno de El Niño (CIIFEN) are hosting the 1st Alexander Humboldt International Conference on the El Niño Phenomenon and its Global Impacts in Guayaquil, Ecuador from May 16-20, 2005. The meeting is a forum for discussing the El Niño-Southern Oscillation (ENSO) in all aspects related to the Ocean, Atmosphere, Climate, Biology and Human Dimensions, its impact in South America and teleconnections worldwide. It is the first of a series of Alexander von Humboldt Conferences initiated by EGU; these conferences are international meetings related to geophysical topics of particular importance to South America, which are jointly organized by South American and EGU experts. Conference languages are English and Spanish. Registration fees are \$100 before January 31, 2005 and \$120 after that date. For more information visit www.copernicus.org/EGU/topconf/avh1 or www.ciifen-int.org

11th International Conference on Landslides and Avalanches

Several Norwegian agencies are hosting the 11th International Conference on Landslides and Avalanches (ICFL) in Norway from September 1-10, 2005. The ICFL is divided into three parts, including a 3-day cruise along the coast of Norway, several days around Trondheim, and a bus trip through alpine areas. Snow avalanche topics are scheduled for Sept. 2-4.

The Japanese Landslide Society and the International Landslide research group founded the ICFL; previous meetings have been held in Japan, USA, Australia/New Zealand, Switzerland, Austria, Italy, Czechoslovakia, Spain, England and Poland. The ICFL's goal is to provide a favorable environment for scientists, engineers and planners concerned with landslides to meet in the fields to discuss and exchange ideas about landslide processes, investigations and monitoring.

The 11th ICFL concentrates on the aspects of landslides and avalanches that affect human life in Norway. The field trips cover a broad range of the types of landslides found in the country. Themes for the 11th ICFL include landslides in quick clay and other soil types, rock slides, submarine slides, landslide-generated flood waves, snow and slush avalanches, and the impact of climate change. For more info go to: www.ivt.ntnu.no/ICFL05/

A Recap of the 2004 International Snow Science Workshop

Story & Photos
by Doug Richmond



The new larger-than-life screen at this year's ISSW enhanced every speaker's presentation. Anyone have a big truck to transport it to Telluride?

The 2004 International Snow Science Workshop was held in September in Jackson Hole, Wyoming. It was the



Dan Howlett and Craig Sterbenz (Howie & Sterbie) discuss Sterbie's plans to give everyone at ISSW 2006 a nickname.

twelfth *Merging of Theory and Practice* and it lived up to expectations. There were four days of presentations and one field day. There were also posters and commercial booths. The presentations and posters covered theoretical science, field studies, data collection tools, operational methods, and other miscellaneous snow and avalanche topics.

The organizing committee rose to the challenge and ran a great show. Rod Newcomb was the workshop chairman. He was at his usual low-key best, leading a team of volunteers

that handled the complicated logistics with flying colors. Kelly Elder was the Papers Committee Chair. He also acted as master of ceremonies, keeping the show moving with his succinct eloquence. Ron Matous and



Don Bachman gives co-editor Lynne Wolfe the scoop for this issue of TAR.

his crew were outstanding in their audio/visual efforts. One of the best things about the whole conference was the visual presentation, through a huge, 10,000 lumen Sanyo projector onto a 25-ft-wide screen. I was talking to artillery man Terry Onslow and asked, "Did you see the size of that projector?" He just nodded and said, "one-o-five." The screen hung from the rafters to the floor. Behind it was

the auditorium's normal screen — maybe a third as big—good enough for doctor's conferences, movies or other events. But our hosts went out and got the monster screen where we saw terrain photos, avalanche movies, 3-D microscope images and New Zealand hanging snowfields that made it all worth the price of admission.

The proceedings, with all of the



Bill Williamson explains to Doug Fesler that ski area management won't allow him to grow a beard like that.

papers presented, should be out about the time you read this. Get a copy to see the most recent work in snow and avalanche science. Here is an incomplete summary of what one guy found memorable, followed by a list of some of the papers I'll be reading in the lift shack this winter.

I always like the field studies. It takes a lot of hard work to cobble together field equipment and battle the elements for the sake of data collection. Cameron Campbell and Spencer Logan each presented interesting work based on extensive snowpit work. Bruce Jamieson and Paul Langevin's paper showed how they did a lot of digging to verify theories about facets over buried crusts. Jamie Yount presented the results of a lot of hard work, erecting 53 sails to influence



(l-r): Avalanche legends Larry Livingood, Larry Heywood and Dene Brandt.

deposition in a starting zone above a highway.

For laboratory studies, we saw Andy Gleason's work with "particle image velocimetry." He had a contraption that pushed down on field samples



Cookies, coffee and a mortar demonstration—all during a break in the presentations.



How did the Canadians get this weapon across the border in a rental truck?

DOUG'S READING LIST**Data Collection and Decision-making Tools**

- Patty Morrison: human observation tool.
- Hendrikx and other New Zealanders: GIS applied to dramatic Road problem
- Andy Gleason: loaded snow cubes in the lab
- Blake Morstad and others: environmental chamber for growing near-surface facets
- Modroo: ground penetrating radar, (the one with the "BME")
- Comey: infrasound sensor work
- Ernie Scott: cool color data readout and "detection maps"
- Hans-Peter Marshall: Frequency Modulated Continuous Wave (FMCW) radar contraption
- Bob Rice: avalanche guard, cache and mortar technology
- Roger Atkins: pretty good hazard evaluation checklist for backcountry decision-making
- Ian McCammon and Pascal Hageli: evaluation of several backcountry decision-making frameworks against accident statistics
- Dan Moroz: Computer tools for avalanche control record-keeping
- Blase Reardon and Chris Lundy: two talks in a row on highway wet slide problems in Glacier Park; spectacular photos on the big screen
- Karl Zeller and others: high-resolution weather forecast maps, including winds. Karl said check out their stuff at: FireWeather.info

Fieldwork

- Mike Cooperstein: localized field data collection to characterize near-surface faceting
- Cameron Campbell: lots of snowpits in starting zones
- Spencer Logan: more lots of pits
- Berthet-Rambaud, P. and others: incident in the classic defense structure battle in the Alps
- Jamie Yount: 53 sails to influence a highway starting zone
- Bruce Jamieson and Paul Langevin: field study of facets over buried crusts; "above-wet-layer faceting" that occurs in narrow elevation bands
- Kevin Heinecken: huge early season stabilization program to combat deep slab instability in Highland Bowl, at Aspen Highlands
- Hal Hartman: Snowmass data showing consistent characteristics of Colorado depth hoar. Hal thinks, "It's pretty risky to assume that your boot packing lasts more than a few weeks."
- Mark Moore: history and challenges of measuring mountain weather. Entertaining as always. "I'd like to apologize to those I'm about to offend."

Modeling

- Pam Hayes and Craig Wilbour: simple model uses storm weather inputs to predict and plot strain from loading vs. strength of subsurface layers
- Karl Birkeland: computer-generated spatial patterns

Science

- Erica David: model snow fences in homemade wind tunnel
- Patty Morrison: qualitative—to know there, go there—wind data collection

Other

- Ian McCammon: packed the house, followed up on his heuristic tools work, compared success of avalanche education to that of sex and drugs education efforts



(l-r): Chris Stethem, Ethan Greene, Doug Chabot and David Lovejoy enjoy catching up.

("snow cubes") in the lab, and he had great pictures showing that strain is concentrated at snow layer boundaries. Blake Morstad showed a sophisticated environmental chamber that he and others built for growing near-surface facets in the lab. But the best laboratory presentation was by a Wyoming high school student, Erica David. Her talk was one of the most popular at the conference. I think the lab was in her barn. She built a homemade wind tunnel and used it to test various model snow-fence designs. She concluded, among other things, that the thickness of snow-fence boards is an important factor in the shape and size of the drift that forms. Hers was a clear, organized presentation of pure science:

worthwhile question, hypothesis, data collection, and conclusions. Even legendary wind man R.A. Schmidt was impressed with her effort.

Kevin Heinecken gave an interesting operational presentation on an ambitious early season stabilization program to combat deep slab instability in Highland Bowl at Aspen Highlands. They are using employees and volunteers to conduct 4000 hours of boot-packing per year. They also open the bowl in stages after a storm, to effect more complete skier stabilization.

There was more work with modeling and statistics. Karl Birkeland showed computer-generated patterns to

Continued next page ➡

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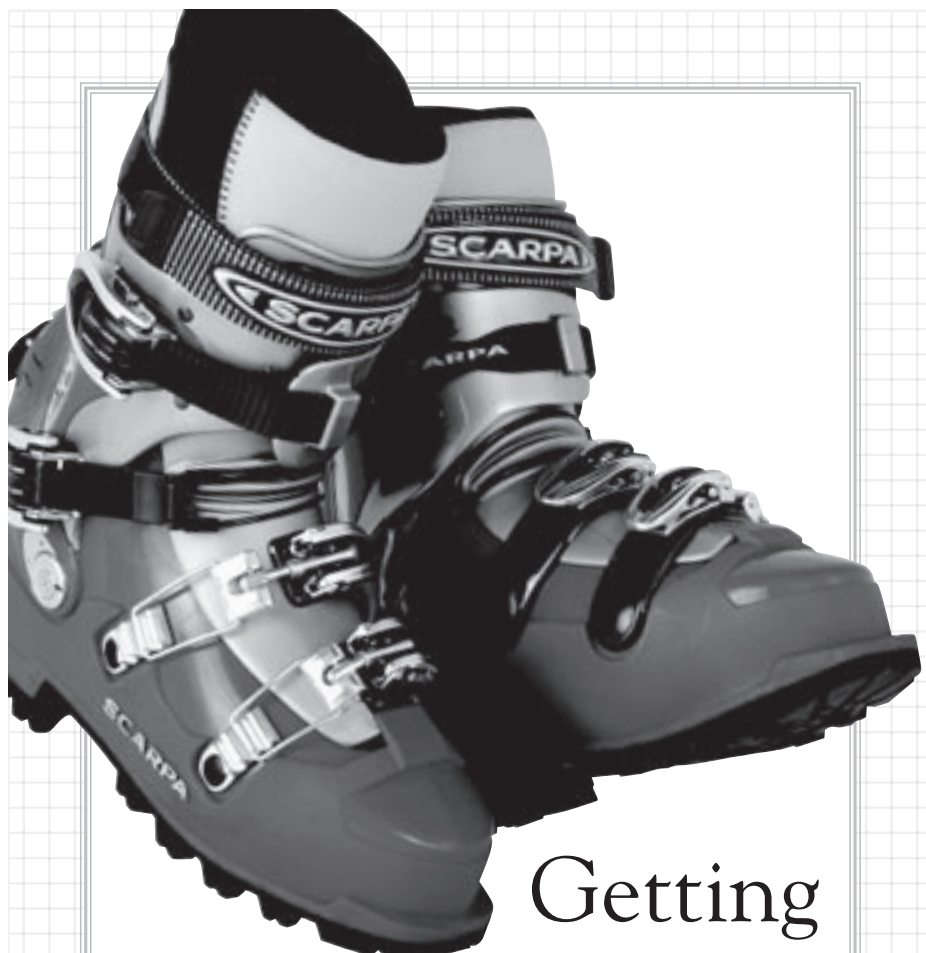
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ISSW 2004 RECAP

continued from previous page

address spatial variability in the snowpack, and he pondered the question, what scale is appropriate for stability evaluation: micropen, Rutschblock, bigger?

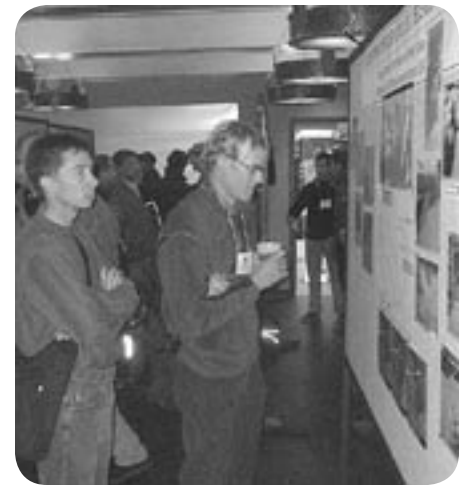
Pam Hayes and Craig Wilbour showed a simple model (SNOSS) that uses storm weather inputs to predict and plot strain from loading versus strength of subsurface layers. They applied it to avalanche forecasting for highways in Washington. They still can't say that when the two lines meet on the graph, you'd better have the road closed, but it looks like one more tool to help with difficult closure decisions.

There were other efforts at models and statistical conclusions based on existing data. Read them for yourself. For stability evaluation, I'd rather have tools and methods that look directly at the snowpack, rather than models based on weather inputs and historical records. Hey, some of those data were haphazardly recorded by ski patrollers like me.

Speaking of tools, this workshop had lots of great stuff: ground penetrating radar, infrasound sensors, avalanche guard mortar technology, decision-making tools, high-resolution weather forecast maps, and more. I'm going to try out Dan Moroz' computer tools for avalanche control record keeping. Ask me next spring if the Bridger patrol traded in the clipboards for keyboards.

Patty Morrison, from Stevens Pass, Washington, gave an interesting talk based on another important tool: human observation. She was the portable data collector that recorded wind direction at multiple unmonitored locations on ridges and in starting zones. She used the data to map complicated wind patterns and relate them, for forecasting purposes, to available data from the two or three electronic instrument stations.

I watched for progress toward my two favorite future tools: 1) stability goggles that show you the weak zones, and 2) a better tool than explosives for starting avalanches. On starting avalanches, most of the work is with shape, delivery, and initiation of the existing types of explosive. There has been a lot of good work on slab fracture characteristics. Is anyone working on matching these to the type of shock we should apply?



Making sense of a poster during the Tuesday afternoon poster session.

So far the most promising progress toward the stability goggles is radar work. We heard from Hans-Peter Marshall and others about their portable, high frequency (8-18 GHz) Frequency Modulated Continuous Wave (FMCW) radar contraption. This thing is carried by two skiers and takes 50 readings a second. They took it to the field and compared its data to detailed snowpit data. The radar sees the larger density contrasts and sees "a large degree of spatial variability at very small length scales (<10 cm)." Now if we can focus it a little more and look at the starting zone from a safe distance, we'll know where to aim the hexagonal resonator...

Probably the most important things we heard about at this conference were accidents, near misses, and rescue tools. These subjects are powerful reminders for all of us to keep safety and rescue skills as our top priorities.

Still, the best part of ISSW is the people: high-energy young folks, avalanche legends, eccentric eggheads, friendly funny-talkers, youthful gompers. Maybe a few old-before-our-time middle-aged gompers. I've sent in a few photos I took with my hundred-dollar Fuji pinhole camera.

Thanks again to everyone who helped make the 2004 ISSW such a great success. Show up at Telluride in 2006.

Doug Richmond has thirty years of experience working for ski areas in California, Colorado, and Montana as a professional ski patroller, avalanche control technician, safety manager, snow safety director, and assistant ski patrol director. AAA members recently elected him Vice-President of the organization.

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left on the podium at the Jackson Hole ISSW

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Bill Glude presents his investigation into the Alaska Block, complete with Alaska-size snow saw, during the ISSW 2004 poster session.
photo courtesy Bill Glude

Graphical Representation of Ski Area Avalanche Control Results

Using Photoshop Elements, a picture really is worth a thousand words

Story by Dan Moroz

For years, avalanche-mitigation data has been stored in three-ring notebook binders. Information from weather reports to avalanche activity to control recommendations to storm profiles has found its way onto paper and into a binder. To be able to sort out information one would have to read through many layers of reports. Many ingenious ways to use the strengths of computer data storage and processing have been developed by snow workers and used successfully. However, the one field of data storage and processing which seems to be lacking improvements is the portrayal of the avalanche control route itself. How do we as avalanche mitigation workers record our data in a user-friendly way to show explosive placements, ski cut routes and their results, boot packing locations, avalanche activity, etc.? Xeroxed pictures of the control-route terrain have been used for years, adding the above information with pencils and paper pictures to show the “hows,” the “whats,” and the “what happened.” We became more sophisticated by using higher resolution digital cameras, better printers, colored pencils, and in some cases, numerous clear acetate sheets to write over a picture so we could better “distinguish” the methods used and results over a period of time.

Unfortunately these documents once again lived in a three-ring binder or a three-ring flip clipboard. If you wanted to review all the work performed or activity in one area you would have to look at the individual sheet of each control mission. You were relegated to using your memory as you looked at each sheet to try to get the “big picture” of what was going on, what you were doing to it, and what to do next. If a resort had perhaps 75 avalanche paths with work being done on a daily basis you could quickly have hundreds of entries over a short period of time. For the average human being, that is just too much data to be easily digested. The seasoned snow worker has a general “feel” of what has been done or happened, but if this wasn’t your route or you were new to the program you would be quickly overwhelmed absorbing data. Getting specific details of a certain area has become a time-consuming process. What is really needed is a way to digitally make “transparent page layers” which could be superimposed over each other. In this way you could see the area of concern, what methods were used on the area, results, if too much focus was placed on one part and not enough in another, and so on.

Fortunately, about three years ago Adobe came out with Photoshop Elements 2.0. This product doesn’t come with a high price tag (retails for under \$89 US), is commonly bundled for free with software packages for digital cameras or flatbed scanners, and is easy to use. The beauty of this program is that it can save data as a dated “layer” over a high-quality digital image. Imagine the ability to save each day’s data on digital “acetate” sheets in a computer. Each “transparency” can show a range of information from explosive placement; type and amount used; results; ski cutting passes showing where, how many, and any releases; ski or boot packing passes; natural activity; or any other mitigation techniques

used. One day, several days, multiple days or the whole season’s mitigation efforts can be over-laid and easily brought up on a computer screen. An area’s hazard and mitigation characteristics are easily discerned. It will quickly be apparent if certain areas have had too much or not enough mitigation. Repeated slide activity might point to an underlying problem within the snow pack. A visual assessment and comparison of how past work is related to present activity can be made. Using Photoshop Elements, the old adage “a picture is worth a thousand words” is very apt.

The program is able to handle up to 8000 individual layers per file depending on the power of your computer. This is more than enough for a season’s work on one particular area. Tools within the program range from written text, to freehand pencil tools for outlining ski cuts and explosives placement, to colored “fill in” functions within outlined areas to show areas that avalanche and the extent of the debris field, to “locking layers” so they cannot be changed. Zooming in and out abilities, cut, copy, and paste functions also exist. The list of what you can do is almost endless and up to a good snow worker’s imagination on how they want to “view” and store their data.

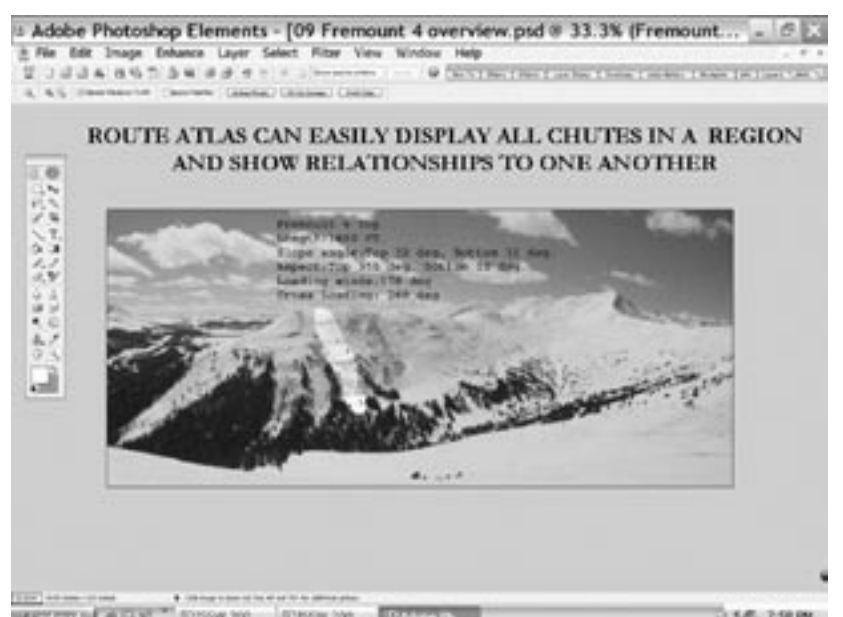
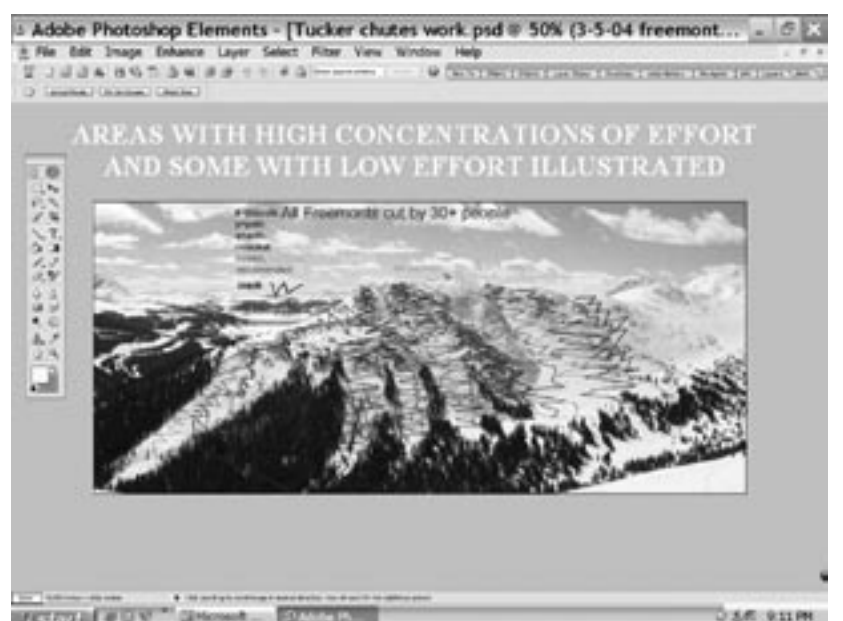
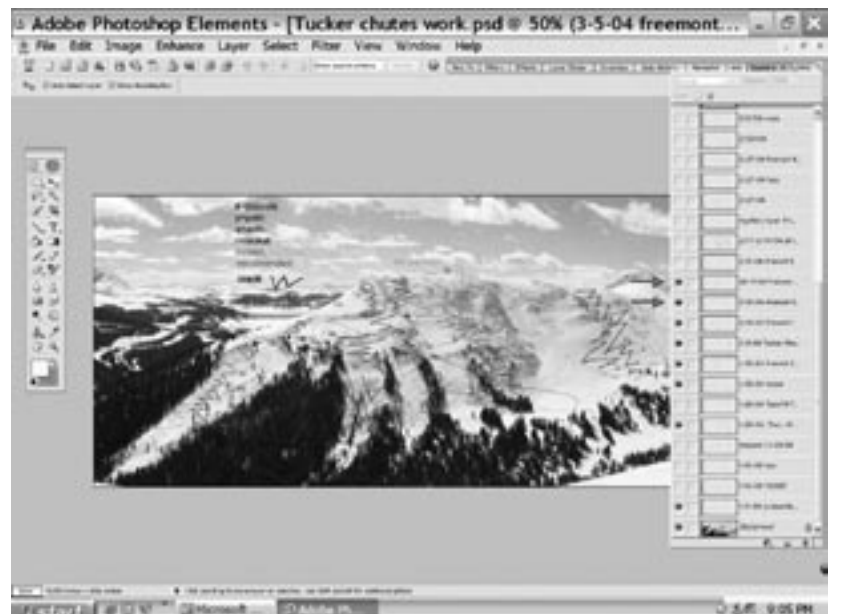
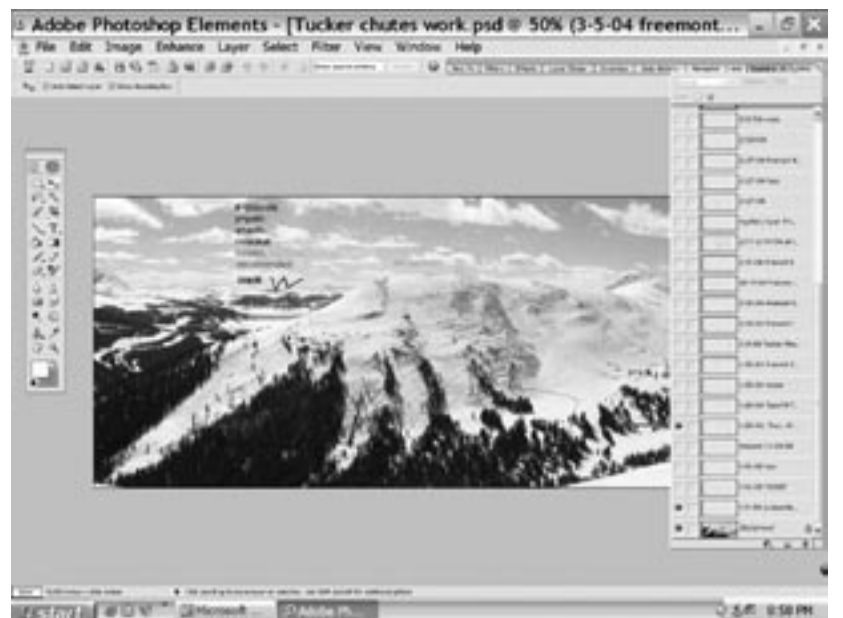
This application can also be used to create a route atlas for all your areas of concern. A high-quality image representing an area of concern can be labeled with all the contributing hazard characteristics, i.e. name, slope angle, bed surface, loading winds, shot placements, etc. Gray or highlight adjacent areas to show how one area is related to another. The entire route atlas can be done in this manner and then easily accessed by networked computer or to print copies for use in the field.

Photo merge functions are also available for making panoramic images of large areas. A complete bowl, ridge or large avalanche event can be “stitched” together—helping to view entire areas or events that would otherwise be impossible to observe. Again, imagination will fuel how and what data is used and stored.

In conjunction with the above, a database using Microsoft Access records avalanche control methods, manpower, explosives used, and results. Digital pictures and/or movies of activity, snow pit studies, and weather data from Campbell units can be linked in the database. Summaries of manpower, explosives used, and slide activity are easily obtainable. This catalog of data can help the snow worker better understand and negotiate the season’s problems and be stored for future use by successors to the program.

Dan Moroz is currently a snow-safety coordinator at Copper Mountain and in his 30th season with Copper. He has been presenting Level 1 courses for many years for AAI and locally at Colorado Mountain College, and recently became a AAA-certified avalanche instructor. He can be contacted for more information or consulting work at:

Dan Moroz — Copper Mountain Ski Patrol, P.O. Box 3890, Copper Mountain Ski Resort, Copper Mountain, CO 80443, 970-262-0155, moroz@colorado.net



crown profiles



A cold Tecate bottle sweats on a stained table as I hunker down in music crackles loudly from blown speakers, my motorcycle rests on I'm thinking of snow... My mind fades to a February storm on Red

The Office

Story by Jerry Roberts

The morning of Feb. 27, 2004, the leading edge of a very large Pacific storm had entered the San Juan mountains on a moist southwest flow. It had dropped 6" of rain in California, and we eagerly anticipated at least 30" of snow from the juicy system. The storm temperatures were fairly warm, but the first 5" had

.2" of water and would become a built-in weak layer accompanied by slab-building 60-mph winds. We also had a persistent weak layer of near-surface facets that formed during a dry, cold period in mid-January. This buried layer was the weakest in the snow pits, and its depth generally determined the crown depths of natural and artificial

activity during February. We had experienced a mid-month thaw, and wet point releases were pulling out slabs on this buried layer.

It was an ugly night. 4"/hour precip. rate and high winds forced us to pull the plug on Red Mountain, Molas, and Coal Bank passes. Vehicles were stuck under major avalanche paths, and a plow driver quit in mid shift — we were up to our asses in alligators! We finally got everyone off the roads safely and closed the gates with an Extreme Hazard rating for the first time in many years. The tigers had come to life and had started running, depositing debris 10' deep on the highways. The natural cycle had begun with 18" of new snow and brought us another 17"+ before the storm died.

By 6 am on the 28th we had received 25"/2" water that stressed the snowpack, and the low-pressure center had not yet entered the San Juans. As we rolled into the afternoon we dropped the Extreme Hazard to High and headed out to work on Molas/Coal Bank and Lizard Head passes.

The priority of opening the highways in the San Juans is first Lizard Head pass (Hwy 145) between Ophir and Rico. Second is Molas/Coal Bank (Hwy 550) south of Silverton to Durango, and the last priority is Red Mountain Pass (Hwy. 550), north from Silverton to Ouray. At Lizard Head we shot 11 avalauncher rounds and had six Class II and three Class III soft slabs with debris 1-10' deep x 155' on the centerline. Only 1.5 hours of spot closures were required. We shot 85 avalauncher rounds and 8 Howitzer rounds on Molas/Coal Bank with good results. We brought down 15 Class II and five Class III soft slabs. We had debris 2-8' deep on the center line of the highway x 860' in length.

We gave RMP (Red Mountain Pass) time to heal and didn't begin mitigation work until February 29. Two crews fired 87 avalauncher rounds and 14 Howitzer



(above): Jerry Roberts & Dennis McCoy. photo by Mark Rawsthorne

(right): Jerry loading shells. photo by Mark Rawsthorne

(top): montage of East Riverside slide. photos by Gary King

(left): Cement Fill slide path. photo by Jerry Roberts

(far right): Eagle slide path taken via telescope from the air. photo by Jerry Roberts

Continued on pg 12 ➡



in a dark corner of a border cantina. Ranchero
 outside the door in 100-degree September heat.
 Mountain Pass.



CAIC/CDOT AVALANCHE HAZARD CONDITION RATING and RECOMMENDATIONS

NONE: Insufficient snow for any avalanche activity.
 Recommendations: None, and no advisory issued.

LOW: Mostly stable snow, avalanche activity is unlikely. If one should occur, it would be of small size.

Conditions: Insufficient snow cover in starting zone and track; recent avalanche release of sufficient size to remove threat of further avalanches; weather factors contributing to increasing hazard all negative; snowpit stress tests, ski tests, and explosive tests all negative.

Recommendations: None, except spot closure for explosive testing if necessary.

MODERATE: Areas of unstable snow, avalanche activity is possible.

Conditions: Adequate snow cover in starting zone and track to cause avalanches; weak layers observed but slab overburden of small depth only; slab present without significant weak layers; minimal recent or current weather factors, increasing load; minimal temperature factors decreasing strength (thaw); snowpit stress tests and ski tests negative or inconclusive; explosive tests negative or producing small avalanche release only.

Recommendations: Highway may be closed for further evaluation, or traffic can move until closure for control is necessary.

HIGH: Mostly unstable snow, avalanche activity is likely.

Conditions: Adequate snow cover in starting zone and track to cause avalanches; weak layers known to be present with sufficient slab overburden for moderate or deep releases; weather factors occurring to an extent to add significant snow load in starting zone; temperature factors decreasing strength (thaw); snowpit stress test, ski tests, and explosive tests all positive.

Recommendations: Highway Closed. Maintenance, Avalanche Control and Emergency traffic may travel certain sections if hazard evaluation from CAIC/CDOT personnel indicates acceptable risk.

EXTREME: Very unstable snow, avalanche activity is certain, large avalanches expected.

Conditions: Excessive volume of snow in starting zone and track; large slab buildup due to recent or ongoing weather factors causing heavy snow loads; extreme thaw conditions in deep snow cover; snowpit stress tests, ski tests, and explosive tests all positive; widespread natural avalanching in surrounding backcountry.

Recommendations: Highway Closed to all entry until condition lowers to level of acceptable risk for maintenance, avalanche control and emergency traffic.



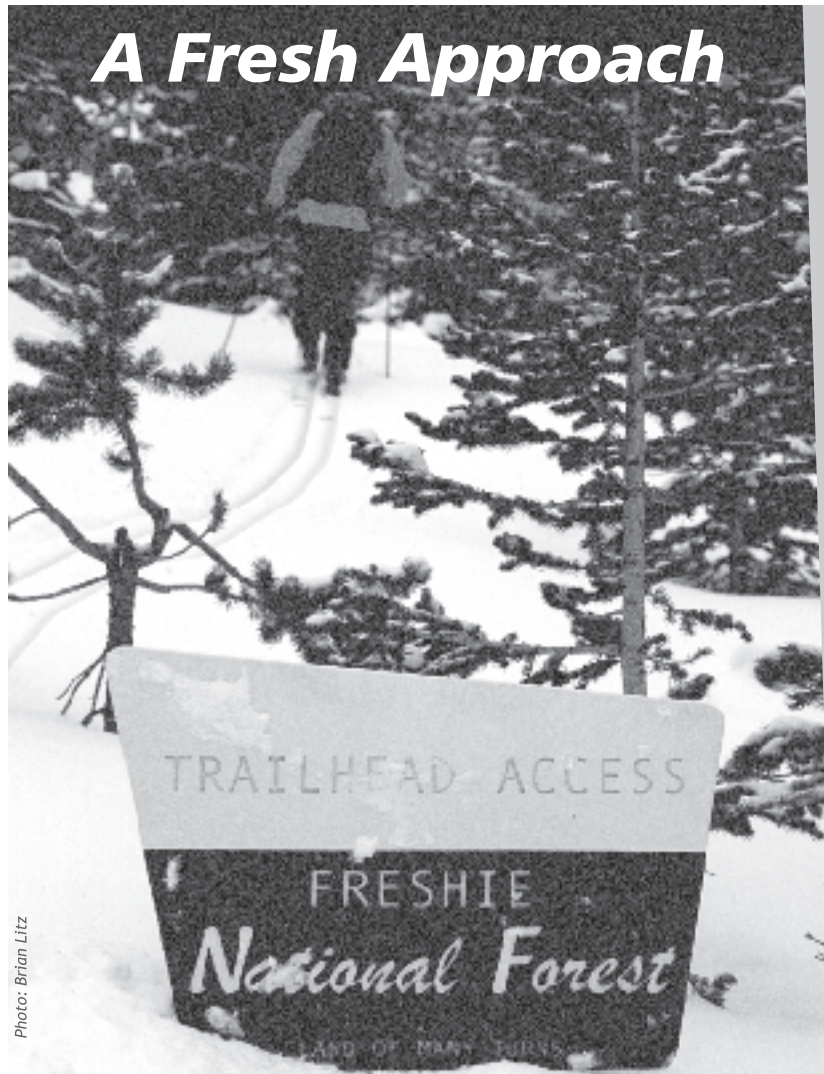


Photo: Brian Litz

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THE OFFICE

continued from pg 10

rounds as we shot our way toward the pass from both Ouray and Silverton. We triggered eight Class IIs and three Class IIIs. Debris on the center line was 2-15" deep x 560' in length.

On the morning of March 1, residual clouds remained from the three-day storm, but we felt we could get the ship in for extensive work from the air. We shot 39 avalauncher rounds, tossed 37 anfo charges, and produced 13 Class IIs, 11 Class IIIs and five Class IVs by the end of the day. Debris on the center line was 2-15' deep x 2,708' of highway was covered. The road was closed for 77.5 hours.

It was a good show from the air. We dropped 1,000 lbs of explosives and had good shot placements with impressive action. We were feeling pretty good about ourselves until we realized that, with the tender condition of the pack, we could have thrown a closet full of old boots and gotten the same results. Rotor wash from the helicopter triggered a Class III slab, and the impact of a thrown shot triggered another major avalanche. The heli work was done with a considerable sense of awe as we watched entire alpine basins rip out as the failing slabs jumped over ridges into neighboring basins pulling out Class III & IV avalanches that ran over 3,000-vertical feet onto the highways.

The East Riverside path that has killed six people was on the hit list. It worried us because of its size and various feeder

paths. There is a snow shed that protects much of the highway from the main path, but it is a nightmare. The upper starting zone of East Riverside contains 75 acres with multiple catchment basins that load from the SW, W and N winds. The SW flow of the storm switched to N-NW winds as the low moved east and "wrapped around" to spin its energy into the north and western aspects of Mt. Abrams.

A CDOT avalanche crew of Gary King and Greg Stacy had shot their way south into the Uncompahgre Gorge and was just north of the shed. We dropped several charges into the upper starting zones of East, and as they detonated, the main path released and sympathetically triggered several lower paths on the mountain that looked like they could hit King and Stacy. Greg Roth, bombardier and CDOT jefe, shouted a warning into his mike. The consummate pros in the orange rig below were already set up in a safe zone, and Gary took some fine photos of the Riverside covering the snow shed.

I've been living and working in the San Juans for almost 30 years and have seen the snowpack this fragile a half dozen times, and it's usually pretty tender. Paths that hadn't been active since the '70s became active. It was another day of education at the office.

Jerry Roberts reports from Silverton, Colorado, where his home is refuge to desperados from around the globe. He forecasts the highways of southwest Colorado for CAIC/CDOT and does the same for the Chilean mining industry.



Another view of the Eagle slide. photo by Jerry Roberts

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SNOW SCIENCE

Comments on Using Shear Quality and Fracture Character to Improve Stability Test Interpretation

Story by Karl Birkeland

At the 2004 ISSW in Jackson Hole, a few questions and comments came up regarding shear quality (Birkeland and Johnson, 1999; Johnson and Birkeland, 2002) and fracture character (van Herwijnen and Jamieson, 2003; 2004a; 2004b). Both methods have been used in some form by some practitioners for many years, and both aim to assist in the interpretation of stability tests in the field. I'll try to clarify three issues regarding these two methods: 1) how shear quality and fracture character relate to each other, 2) what specific stability tests have been used for defining these two schemes, and 3) the spatial variability of shear quality and fracture character.

FIRST, after Alec van Herwijnen's nice presentation on the usefulness of fracture character for interpreting stability tests (van Herwijnen and Jamieson, 2004a), a person in the audience asked about the comparability of fracture character and shear quality with the implication that one system might be better than the other. Though it would be great to eventually move toward a common system to make international data exchange easier, I'd just like to emphasize that there is no real competition between these two systems. They are both attempting to characterize the same general things, but fracture character is more specific and provides a little more information, while shear quality is more general. Bruce Jamieson has posted up a table that compares the two systems at: www.eng.ualgary.ca/Civil/Avalanche/Papers/FractCharNotes.pdf. In essence, sudden planar (SP) and sudden collapse (SC) fractures are equivalent to Q1 shear qualities, resistant planar (RP) fractures would rate Q2, and breaks (B) would be Q3. Progressive compression (PC) fractures could be either Q2 or Q3, but would probably often be Q3. On a trip to Canada last season I managed to get in a pit with Bruce, and we confirmed his table. While fracture character is slightly more complicated than shear quality, the system may provide some additional useful information for some operations. For example, Jamieson and his group have found the sudden collapse fractures to be more commonly associated with whumpfs than the other fracture types, including sudden planar fractures.

I also overheard someone comment about the inclusion of shear quality in *Snow, Weather and Avalanches: Observational Guidelines for Avalanche Programs in the U.S.* (Greene and others, 2004). This document was intended to reflect what is currently being done in the U.S. Since shear quality has found a reasonable level of acceptance south of the border, it was included in SWAG. The exclusion of fracture character was not because the SWAG working group made any judgment about its usefulness. Rather, fracture character has yet to find wide acceptance in the U.S. If fracture character or any other system becomes used by a reasonable number of U.S. avalanche personnel, it will be included in future versions of SWAG.

SECOND, I'd like to comment on the stability tests used thus far for shear-quality and fracture-character research. Fracture-character work has focused almost entirely on compression tests (literally thousands of them!) with a limited number of rutschblocks thrown into the mix (Jamieson, pers. comm., 2004). The shear-quality work we have

done here in southwest Montana also has utilized compression-type tests: the compression test, the stuffblock, and the rutschblock (Johnson and Birkeland, 2002). How well fracture character and shear quality can assist in the interpretation of other types of stability tests has not yet been rigorously studied. On the final day of the ISSW, Jon Andrews presented some interesting work on assessing the stability of faceted layers in the maritime snowpack. In this work he utilized a non-standard shovel shear test whereby the block was isolated to 30 cm above the weak layer, and he emphasized that this test might only be appropriate in maritime areas. When the shovel was pulled, he noted both the effort required to fracture the rest of the slab and to initiate weak-layer fracture as well as the shear quality. Because of the test used, his results are not directly comparable to previous shear-quality (or fracture character) work. However, his work does suggest that assessing the shear quality in this way might be quite useful in some situations.

THIRD, I heard several folks asking about the spatial variability of shear quality and fracture character. Ron Johnson and I suggested that the spatial variability of shear quality might be less than for stability test scores based on our experience, but we didn't have any solid data to back up those statements (Johnson and Birkeland, 2002). Other practitioners have also noted the more spatially uniform nature of shear quality and have found it useful for helping to assess difficult deep slab instabilities (e.g., Savage, pers. comm., 2003). Luckily for us, more rigorous work on the spatial variability of fracture character has been ongoing in Canada. Of 17 arrays of compression tests, Campbell and Jamieson (2003) found that 13 of them had sudden planar fractures (Q1 shears) in every test. Our initial results have been similar, with uniform shear qualities on most days but a few days

with more widely scattered values. We still need additional data for more reliable conclusions. Note that shear quality/fracture character are not always completely spatially uniform; sometimes variations exist. For example, on one day with a thin snowpack consisting of a windslab over some depth hoar, we observed Q1, Q2, and Q3 shear qualities all within a couple meters of each other. Further, before we get too excited about the "uniformity" of shear quality, we need to remember that it only has three possible outcomes (Q1, Q2, and Q3), making a uniform spatial distribution more probable. For example, if rutschblocks had only three possible outcomes (e.g., RB1 = fracture during block isolation, RB2 = fracture when approaching or jumping on the block, RB3 = no fracture) we might judge a slope to be "uniform" if all the tests were RB2, but this assessment would not be particularly useful, especially if it was considered separately from other available data.

ALL SAID, the general consensus on both sides of the border is that augmenting stability test scores with shear quality and/or fracture character is one way to improve stability assessments. However, like other improvements, we cannot solely rely on stability test results. A holistic approach utilizing a wide variety of data is the best way to minimize our uncertainty in assessing avalanche potential.

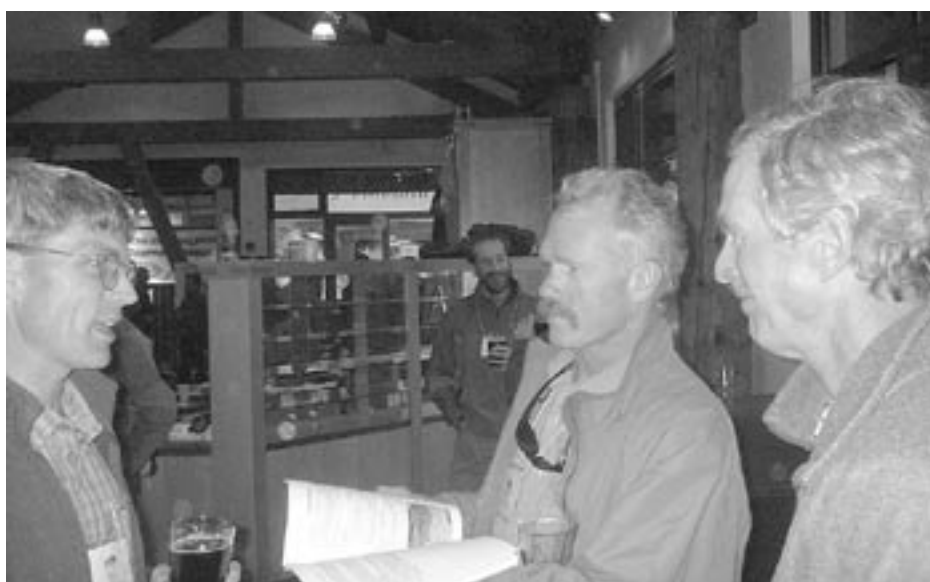
For additional information, check out some of the references below. Most are posted on the web. Further, if you have any comments or observations about shear quality (or fracture character) that you would like to share, I'd love to hear them. Feel free to e-mail me at kbirkeland@fs.fed.us.

ACKNOWLEDGEMENTS

I'd like to thank Bruce Jamieson and Alec van Herwijnen for their discussions on this topic and for reviewing this short paper.

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Karl Birkeland is the father of two young daughters who love to play in the snow. In his spare time he works as the Avalanche Scientist for the Forest Service National Avalanche Center, where his focus is transferring new and emerging technology to the regional avalanche centers. In spite of his high tech job he still enjoys telemarking in leather boots, a passion for which he endures much scorn and ridicule from his peers! ❄️

(l-r): Author Karl Birkeland, Rip Griffith and Tom Leonard discuss the new AAA SWAG over a beer at one of the many socials at ISSW 2004.

Photo by Doug Richmond

Obsolescence and Analog Avalanche Transceivers: Ensuring Downward Compatibility

Story by Bruce Edgerly and John Hereford

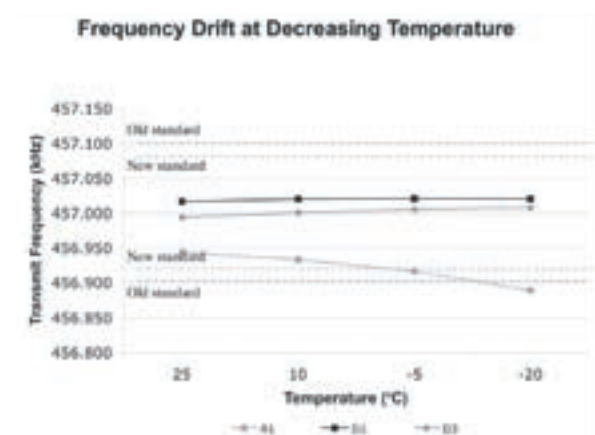
Older analog beacons are becoming increasingly susceptible to frequency drift with age, temperature and abuse. Often the frequency drift becomes severe enough that the beacons do not comply with the latest European standard for transmit frequency. To extend their receive range, some newer digital transceivers have narrow receiver bandwidth, which inhibits their ability to detect poor transmitters. To ensure downward compatibility—reliable performance between new and old technology—an international standard should be created for receiver bandwidth. Users should consider bandwidth when selecting new transceiver fleets. Those with analog fleets should institutionalize a regular inspection program—and eventual replacement with units containing crystal transmitters and wide receiver bandwidth.

BACKGROUND

In 2001, the French avalanche research institute, ANENA (Association Nationale pour l'Étude de la Neige et des Avalanches), reported that one widely used model of analog transceiver (A1)* was failing to meet the European standards for transmit frequency at cold temperatures. The report suggested that some newer transceivers could experience compromised receive performance when used in conjunction with these transmitters, especially those with narrow receiver bandwidth. In 2004, Backcountry Access and Rescue Technology hired an independent lab, Apex Wireless, to determine the receiver bandwidth of the newest generation of avalanche beacons and their compatibility with these "drifted" transmitters, specifically A1.

TRANSMIT FREQUENCY

Since 1996, the worldwide standard for transmit frequency in avalanche transceivers has been 457,000 Hz (457 kHz). In 2001, the European Telecommunications Standards committee on avalanche transceivers changed the tolerance allowed under the ETS 300 718 standard from 457,000 +/- 100 Hz to 457,000 +/- 80 Hz.



LEGEND—
 A1 = Ortovox F1
 D1 = Tracker DTS
 D2 = Ortovox M2
 D3 = Mammut Barryvox
 D4 = Ortovox X1
 D5 = Pieps DSP

Figure 1: The ANENA data shows that transceiver A1 often transmits outside the European standard, especially at low temperatures. D1 and D3 were well within the standards and less sensitive to temperature.

One reason for drift of transmitting frequency lies in hardware differences between beacons made currently and those made previous to the onset of digital beacon technology. It is not directly related to analog vs. digital technology. Instead, it merely depends on what components were used at the time of manufacture. Most older beacons used ceramic or X-cut reference oscillators to create the 457 kHz signal. These are unreliable in producing a signal meeting the new transmit frequency standard and are susceptible to frequency drift induced by time, temperature, and trauma. The new generation of digital and hybrid beacons generally use higher quality, higher cost oscillators made of AT-cut quartz crystal. This has proven to be more reliable for transmitting within the specifications (Fig. 1).

RECEIVER BANDWIDTH

Receiver bandwidth is a measure of a beacon's sensitivity to the transmit frequency it is receiving. Wide bandwidth means a beacon can receive a wider range of frequencies. Narrow bandwidth can help increase receive range under optimal transmit frequency conditions. But it can also significantly compromise performance when receiving a poor signal. Compromised performance includes reduced receive range and/or inconsistent readings.

Receiver bandwidth is mainly defined by the center frequency and "steepness" of the filter used in signal processing. A steep filter might prevent "seeing" a poor signal. There is no specific European or North American standard for receiver bandwidth. However, ANENA states that all receivers should be equally sensitive to transmit frequencies that fall inside the specification of 457 kHz +/- 100 Hz.

According to ANENA, only transceiver D1 meets its criterion of equal sensitivity within a +/- 100 kHz bandwidth. The Apex tests revealed a wide range of bandwidths among the newer beacons (Fig. 2) and inconsistent performance by transceiver D5.

DOWNWARD COMPATIBILITY

The data from both Apex and ANENA suggest that compatibility is an issue when narrow-bandwidth receivers are used in conjunction with drifted transmitters. The receiving beacons can show decreased range, unreliable readings, and false detection of multiple signals.

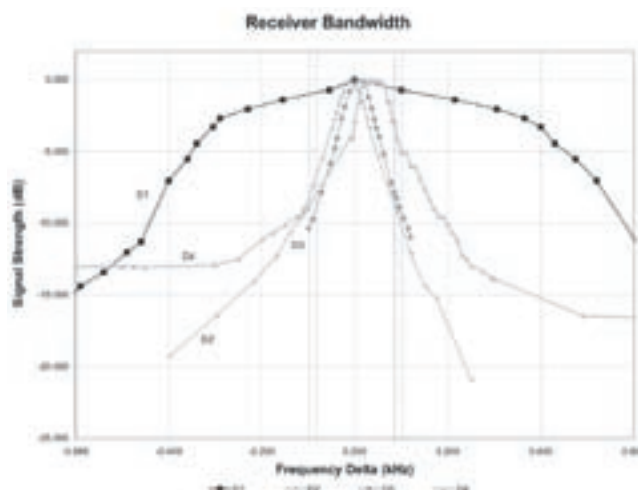


Figure 2: The Apex data shows that transceiver D1 has the widest receiver bandwidth and the least sensitivity to frequency drift. D2, D3 and D4 show narrower bandwidths, steeper filters, and less compatibility with drifted transmitters.

D5 showed widely varying inconsistencies the farther the transmitter drifted from the center frequency, indicating multiple signals despite the existence of only one. As a result, Apex could not determine its bandwidth.

To determine the extent of this problem, the authors collected a sample of ten used A1 transceivers from various professional ski patrol and guiding organizations. Since the ANENA study just included new beacons—and therefore just analyzed the effects of temperature—the authors collected used beacons to help determine the effects of age and abuse. The authors then hired Apex to

perform transmit frequency tests on these units at room temperature. The variation in frequency was significant. Two of the ten beacons were transmitting outside the +/- 80 Hz standard: one at -90 Hz and the other at +423 Hz. Considering the limited sample size, this calls into question the variation in transmit frequency among the approximate 300,000 other A1 transceivers currently in use worldwide.

The authors then performed field tests with the +423 Hz transmitter to determine the "worst-case" effect on receive range. The transmitter was oriented in-line with the receiving units, all with fully charged batteries. For digital beacons, maximum range was recorded when consistent distance and directional readings were displayed. For hybrid analog/digital beacons, maximum range was recorded when output from the speaker registered at 60 dB. Results indicated a significant variation in range: from approximately 35 to 0 meters. Transceiver D1 was the most compatible with the drifted transmitter; D5 was the least compatible.

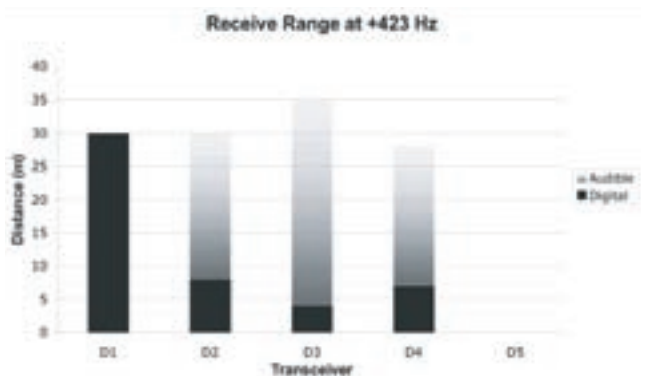


Figure 3: In the receive range tests, D1 showed reliable distance readings and insignificant loss of receive range. D5 detected no signal at all. The hybrid analog/digital units (D2, D3, D4) showed decreased range and inaccurate readings. The gradient shown in the analog/audible phase indicates the relative strength of the audible signal.

CONCLUSION

While today's new beacons are adequate to accommodate the effects of poor initial transmit frequency and temperature-induced drift, some cannot accommodate the cumulative effects of time and trauma, two factors that will continue to exacerbate frequency drift problems with the aging of the world's analog beacon fleet.

The authors recommend that an international standard be created for receiver bandwidth. It should require equal sensitivity to signals within both the old and the new European standard on transmit frequency. It should also require the reliable detection of signals transmitting significantly outside this tolerance.

Users should strongly consider receiver bandwidth when selecting new transceiver fleets. Those with analog fleets should at least institutionalize a regular inspection program with the manufacturer. They should also consider eventually replacing those fleets with units containing high-quality crystal transmitters and wide receiver bandwidth.

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Bruce Edgerly is Vice President of Backcountry Access, Inc., in Boulder, CO, and John Hereford, is President of Rescue Technology, Inc., also in Boulder, CO. Their companies manufacture and distribute one of the beacons included in the tests. You can reach them at edge@bcaccess.com and herf@qwest.net. If you have a fleet of analog transceivers at least five years old, the authors are interested in testing their transmit frequency as part of this ongoing research.

Knox Williams

A PIONEER MOVES ON

Story by Scott Toepfer • Historic Photos courtesy Suz Williams

It was the winter of 1978-79. One of my jobs as a sophomore professional ski patroller at A-basin in Colorado was to gather the morning weather observations and disseminate the information to a host of recipients. The local marketing departments, lift crew, ski area management—they all wanted this information before O-dark-thirty every morning. Another one of the early morning calls went to the Colorado Avalanche Information Center. This routine would start around 5 am when I would pull into the base area, get dressed, jump on the snowmobile and start up the mountain to get the upper-station weather obs.

A-basin sits just off the Continental Divide in central Colorado; it is one of the highest and most exposed ski areas in the country. I would normally arrive at patrol headquarters at the top of the Norway lift about 6 am. That's when the phone calls would start. I'd usually be finished by 7:30, in time for breakfast at the base area before the real day got started. Winds were 20 to 30 miles per hour on one particular day. Within maybe 15 minutes of arrival at Norway, there was a dramatic increase in wind speed. Our Esterline Angus anemometer was located at Norway, the top station of the old Norway Ribblet chairlift. Norway was starting to make some rather disturbing noises as I tried to finish up my morning routine. It was soon after winds started pushing 70 miles per hour that I realized breakfast was going to be a little delayed.

By 6:30 am the old Esterline Angus anemometer was pegged at 110 miles per hour. Hurricane-force winds were a bit out of the ordinary, even for A-basin. It was pretty obvious that we would have trouble running the lifts with winds like this, so I called Clyde Wiessner with the lift department and told him what was happening. Naturally he wanted to know what the forecast was and whether we could get the upper lifts running. My personal concern was whether or not I was going to end up in Kansas without breakfast. The only reliable source for an accurate forecast lay with the Colorado Avalanche Info Center (CAIC).

I had never had an actual conversation with Knox Williams before this day, but I knew he was the weather forecasting guru at the CAIC. Knox answered the phone, and I told him our concerns with the winds at the 12,400-foot top station. Knox was a little surprised when I told him our anemometer was pinging off the top end. He said, "Hang on a minute; I'll call you right back." Within a few minutes he called me back and said he had checked some of the other reporting sites in our area—Berthoud Pass, Keystone, Breckenridge—and said no one had winds anywhere near what we were seeing that morning. He did have a forecast for us though:

"I would not expect these winds to continue; there is nothing to support them—it has to be unique to your site, so I'd think they will decrease in about a half hour or so. And by the way, you'd probably better stay in the building until they do."

Sage advice, from one of the best mountain weather forecasters I have ever known. Within a half hour the winds were back to their steady 20 to 30 miles per hour. It was not the last right-on-the-money forecast I would get from Knox.

Little did I know at the time, but 12 years later I would have a job interview with Knox at the Breckenridge Brewery. A few Avalanche Ales into the interview and Knox became my next boss. Until this season, 14 years later, I was considered the new guy. What follows is just a little bit of the history of our boss, Knox Williams.

This coming spring, Knox will retire from the CAIC. He has worked there for 34 years. A lot has changed in the avalanche community over that 34 years, and Knox has been very fortunate to be part of almost every aspect of those changes. His wife Suz told me, "The guy just doesn't toot his own horn; I can't find much of anything on all the things he's done." What follows is some of the avalanche history that Knox has seen come and go. As you will see, it's been a wonderful story. I would suspect more will surface, once his friends find out he's really headed out onto another path.

The Formative Years

Knox's mother Nancye Taquard, of French heritage, grew up in Galveston, Texas. Nancye's mother survived two giant hurricanes of the time, one in 1900 and the other in 1915, events that most likely played a role in Knox's future interest in tropical meteorology.

Knox's father, Timothy Hart (T.H.) Williams was the owner of T.H. Williams Department Store in Austin, Texas, a purveyor of fine women's wear. During college at the University of Texas, T.H. became good friends with Lyndon Baines and Lady Bird Johnson, a friendship that would last his entire life. The Secret Service would deliver a bottle of good scotch to the Williams' door every Christmas.

Knox Taquard Williams was born in Austin, Texas, September 6, 1943, the middle of three children. His younger sister is currently the executive director of the Texas Democratic Party, showing that Knox wasn't the only Williams willing to take on a huge challenge in life.

Continued next page ➡



A recent photo (above): Knox at the CAIC 3rd annual Avalanche Jam fundraiser on September 10, 2004. *Photo by Rich Marriott*

An earlier photo of Knox (right) confirms a long-term flair for casual, comfortable, yet cutting-edge fashion.



KNOX WILLIAMS

continued from previous page

Knox took an interest in meteorology at an early age, keeping daily weather observations through high school; this early interest in meteorology may have come from stories he heard from his grandmother about the big hurricanes of the early 1900s. Austin also gave Knox a taste for both Mexican food and what was to become one of his favorite vices—the margarita. He would later find these tastes useful within the Colorado avalanche community.

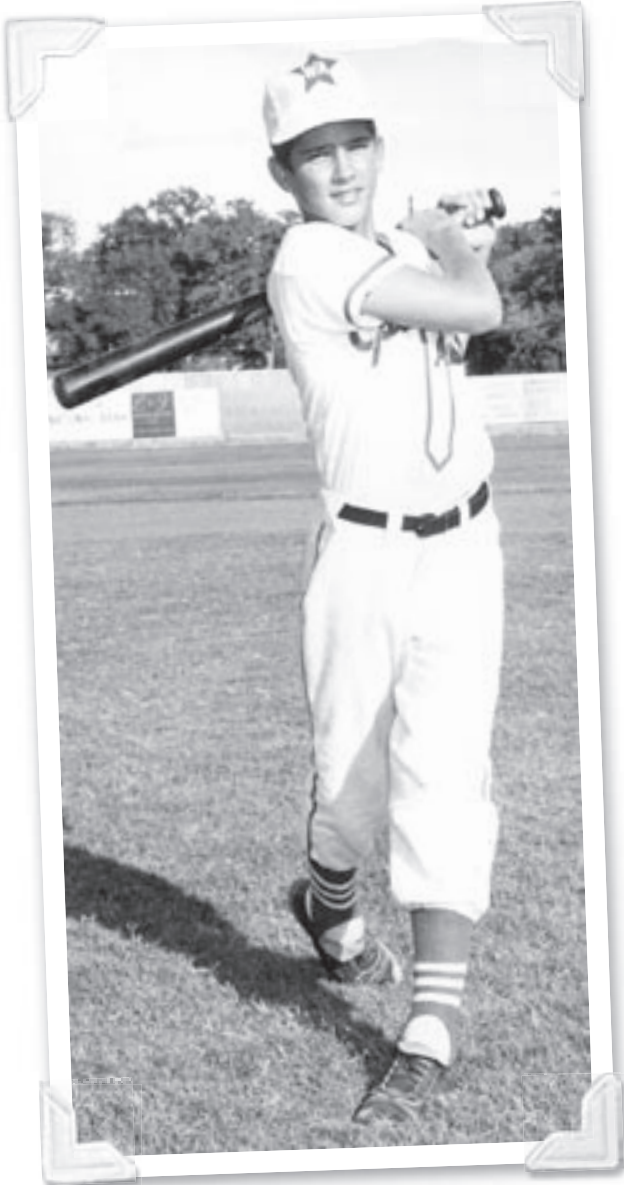
Besides Knox's interest in meteorology, he was a talented shortstop through his high school years, and his passion carried over into signing up for the first draw for Colorado Rockies season pass tickets. He often took the CAIC staff to early season games. We'd usually make it till the seventh-inning stretch before retiring to a local watering hole to warm up. Rockies games are notoriously cold in April.

Knox finished high school in 1961 and then attended the University of Texas in Austin where he majored in math. He graduated from the University of Texas in 1965 and took his degree to the Boeing company in Seattle where it is rumored he first tried his hand at skiing.

The 1970s

After working for Boeing for about a year, Knox was accepted into the masters program for atmospheric sciences at Colorado State University in Ft. Collins, Colorado. He was to study cloud clusters, hurricanes, and tropical winds in the tropical meteorology program. He earned his masters degree in 1970 and soon found a job as an aspiring young meteorologist at the Rocky Mountain Range and Experiment Station, where he found himself working with Art Judson, Pete Martinelli Jr. (co-author of *Agriculture Handbook 489, The Avalanche Handbook*), Dick Sommerfeld (studying snow physics), and R.A. Schmidt (who was involved with wind-transported snow). These guys were some of the leading avalanche researchers of the time. It was a banquet of knowledge for Knox to feed from.

The Rocky Mountain Station was the experimental end of this fledgling avalanche program in Colorado. The associated Colorado Avalanche Warning Center grew out of this as a part of



Knox Williams: doesn't the name have just the perfect ring for a major-league ballplayer? Knox was in fine form during his high school career, on his way to slugging avalanche forecasts out of the ballpark.

the operational end of the program. There was an enormous amount of data being collected to support the research and modeling program. The problem of what and how to deal with the piles of paper fell to a young Knox. One of Knox's responsibilities was to build some order to what was then called Westwide—the data collection and storage aspect of the research program. Knox had to tackle the old garbage-in, garbage-out problem of data collection prevalent even in those days. Bruce Tremper with the Utah Avalanche Center called Knox "...the glue that held the avalanche community together when he ran Westwide, as well as the glue that still holds the Colorado avalanche community together." Another of his jobs was to standardize weather instrumentation from the observation sites and the data recording of avalanche and weather observations. Most ski area and highway observers had their own methods of collecting these data at that time—it was quite a

stew of numbers. Naturally, this proved to be a great opportunity for Knox to get out on the road and visit the various ski areas and highway observer sites around the state. It also gave him some much-needed experience on skis.

Most observers at the time had no structure to their methodology. Knox was instrumental in developing a trained observer base throughout Colorado along with standard methodology to be accepted by the rest of the western U.S. Class A avalanche areas. In the 1970s, computers were less user-friendly than they are today, so storing and accessing the data was a huge project. Knox started out by inventing the Blue and Green Sheets that many avalanche workers of the day used to record their weather and avalanche observations. From these sheets Knox wrote up a month-by-month synopsis of weather and avalanche data from across the western U.S. that he called *Avalanche Notes*. The data from the observers around Colorado were also used on an "as needed" basis to build accurate avalanche warnings for the state.

Art Judson and Knox developed the wording of these nascent avalanche bulletins and warnings during the early years of avalanche forecasting in Colorado. It was challenging to develop the structural format for these bulletins into something that both media outlets and the general public could understand. Amazingly, 30 years later, the format remains essentially the same as that used today by the CAIC

staff to issue avalanche warnings.

Art Judson recalls that Knox was an okay skier when he started his new position in Ft. Collins. He had little choice but to rapidly improve, given the limited options presented while standing on top of 40-degree avalanche starting zones. Even though Knox was never a professional ski patroller, he earned his honorary professional ski patrol jacket at the 1994 Snowbird ISSW.

After working at the Rocky Mountain Station for about a year (1971) with Art Judson and crew, Knox met Suz, his eventual wife, at a party hosted by the atmospheric sciences department, where Suz worked. Suz has recently retired from her job with CSU, though they still pull her back to fill in from time to time. Knox and Suz have a very active life as they both love skiing, traveling, camping and, one of the best aspects of world travel, tasting really good food. Knox was even able to take some of his tropical meteorology skills to the Caribbean on a two-week sailing trip in 1977 with some of the crew from the Rocky Mountain Station. Their next big project is to design and build a new home in Buena Vista, Colorado—right on the Arkansas River. I suspect a number of brown trout will learn about the hazards of flyfishing once Knox and Suz get moved in.

In the early 1970s Mark Moore, at the time a graduate student under Ed LaChapelle at the University of Washington, met Knox for the first time at a *Snow in Motion* conference held in Ft. Collins. He said to himself, "Boy, this guy's really got it together." In 1975 Knox would help Mark Moore set up the Northwest Avalanche Forecast Center in Seattle. Mark has always considered Knox to be one of the main focal points in our avalanche community. He said that one of Knox's best qualities is that he encourages others to take on projects and goals that they may not think they can accomplish and inspires them to succeed.

In August of 1979 Knox and the rest of the Rocky Mountain Station held an international conference of snow and avalanche researchers at Ft. Collins. They held field sessions at Aspen, Vail and the Climax and Henderson Mining concerns around the Fremont and Jones Pass areas near the Continental Divide. Connections that developed with the management at Climax would eventually pay dividends with funding to help keep the Colorado avalanche program afloat in the late 1970s.

While teaching at one of the first two National Avalanche Schools in Reno, Nevada, Art Judson recalled that, while visiting the casinos, Knox used his mathematical background to develop a system reducing the house percentages to 51 percent at craps. Consequently, they won a fair amount of spending money for the rest of the trip. Whether it comes from his craps formula or just memories of those days is hard to tell, but Knox has a



Love must have been in the air at the atmospheric sciences department party where Knox met Suz in 1971. The two tied the knot in 1980 (left) and remain happily married today.

long history of involvement with the National Avalanche School. He's been an instructor from 1971 to the present, Chairman of the Steering Committee from 1986-1999, and he remains on the steering committee at this time.

Another Art Judson recollection was flying to Washington state to observe a large avalanche cycle taking place in the Cascades. After flying around numerous passes all day long in a floatplane arranged by Ed LaChapelle, they headed to Seattle for some personal refueling. Knox did not have his ID and of course was carded; they would not let him into the establishment until he could prove he was just a youthful-looking 30-years old, which he still closely resembles. Maybe it was the Beatles-style haircut?

Center in Ft. Collins for years. As the current Associate Director of the CAIC, Nick is involved in all the budgeting aspects that help keep the CAIC financially sound; he contributed the following numbers. As a program administrator in 1983, Knox had a budget of \$100,000 that included 10 sponsors. This budget was to support the staff for a season that ran from late October until early May. Compare that to a budget of roughly \$570,000 and 60 sponsors for the 2004-05 season.

Next in the career of Knox Williams was the 1986 ISSW in Squaw Valley. Sue Ferguson and a small group of avalanche professionals, including Knox, came up with an idea to form the AAAP, or American Association of Avalanche Professionals, (today's



The 1980s

All avalanche forecast centers in the United States have faced at least one critical juncture in their existence. After the 1982-83 season, the CAIC faced a situation that could be thought of as analogous to the typical avalanche-victim's plight. It was either fight for all you were worth to keep on top, or give up and expect to get buried deeply. The USFS was facing severe cutbacks and was no longer able to support the program at the Rocky Mountain Station. By working with Governor Roy Romer and members of the Colorado State Legislature, Knox fought for and found a niche within the State Department of Natural Resources and office space with the National Weather Service in Denver. Interestingly enough, the USFS provided the seed money for this new home, as the CAIC was to receive no state funding. Not only was Knox a meteorologist and avalanche forecaster, he now discovered that he had become a politician, an accountant and PR and marketing director for the state's avalanche program.

Nick Logan has been with the CAIC longer than anyone else, so he has a good idea of some of the hardships and successes that Knox and the CAIC have seen through the last couple of decades. He started with Knox in 1983 after coming to a crossroads in his own avalanche career. Nick was the weather and snow guru at the Breckenridge ski area in the 1970s. He coordinated the flow of information from Breckenridge to Knox at the Avalanche Warning

His future's so bright, he had to wear shades.

AAA). He remained on the governing board until 1999. Although none of the early power figures of the AAAP have been willing to divulge many details about these early years, we do know that Knox was a frequent contributor to TAR in the early days and served as AAAP president from 1994 through 1998.

Knox also earned a speaking role in the rarely performed *Avalanche Acres: the Continuing Saga of the Lives and Loves of Mountain Folk at Snowfall, USA* by Snow Lips. Knox played the role of "Doc" Nilliams, detailed in the character descriptions as, "Previously unemployed since infancy, Doc now chronicles avalanche fatalities in Runout Valley, when he's not out smashing frozen croquet balls on the local miniature pitch 'n' putt, [at] the lovely Debris Dunes Country Club." A couple of his now famous lines were: "Suppose this was not a natural?" and "Hey, where do you suppose they got that snow snake oil?"

Continued next page ➡

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KNOX WILLIAMS

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In addition to his brief acting career, Knox has written a number of books: two volumes of *The Snowy Torrents*, *The Avalanche Book* with Betsy Armstrong, *Avalanche Wise* with Dale Atkins, and of course our daily bulletins from the CAIC.

April 1987 brought the last big move in the history of the CAIC; the fledgling state agency found a new home with the Colorado Geological Survey—a good fit given that avalanches are considered a natural hazard in Colorado. It wasn't until 1995 that the CAIC finally became a line item in the budget.

(right): Carnak the Magnificent

(below): Knox at ISSW 2004, where he was testing the latestest Weiner Transceiver, which epitomizes Knox's pioneering nature.

photo by Rich Marriott



The 1990s

On March 5, 1992, Eddie Imel and Danny Jaramillo were driving a rotary snowplow down the north side of Red Mountain Pass in southern Colorado. A slide had crossed the highway just on the north side of the avalanche shed, and Eddie and Danny were working to clear it. Unfortunately a chain fell off the plow and both Eddie and Danny were out of the truck trying to get it unraveled when the East Riverside path ran again. (For photos of East Riverside, please see Jerry Robert's article *The Office*, on page 10 of this issue of *TAR*.) Eddie became the third plow driver to die in a slide under East Riverside. Danny dug himself out some 18 hours later. This accident proved to be the straw that broke the backs of many residents along the Highway 550 corridor. A town meeting was called in Ouray to address the dangers faced by Colorado Department of Transportation workers. Both Nick Logan and Knox attended this stressful meeting. Ed Fink, with the Colorado Department of Transportation, approached Knox about a plan that would reduce the risks associated with working under the longest stretch of avalanche-prone highway in the lower 48. From here the successful highway forecasting program was born in Colorado.

Somehow Knox was able to convince Don Bachman and Denny Hogan to head up the virgin program. Both Don and Denny had learned a lot of their avalanche forecasting skills while employed by Knox in the 1970s and '80s. Don and Denny would work with

CDOT crews, providing forecasting skills to reduce the risk of avalanche accidents to both the traveling public and CDOT workers. A savvy Knox knew that both Don and Denny had spent decades hiking and skiing along the Highway 550 corridor. They were the two best people for the job and their skills were needed to make this program a success. Thanks to Knox's diplomatic and administrative skills, the program has grown to include six forecasters around the state who work closely with avalanche-reduction crews from CDOT and the CAIC.

In the fall of 1992 Knox saw the fruit of years of lobbying effort to bring the ISSW to Colorado again after Aspen in 1984. He acted as the coordinator and chief bottle washer for the conference in Breckenridge, Colorado. This conference, as many of us in the United States avalanche community know, is the premier event for avalanche experts across the western hemisphere. Knox and his staff ran the event without a hitch.

Within a couple years he became aware of the increasing costs to host an ISSW, costs which were passed along to attendees. He saw a need, and began to formulate an idea that would allow the average avalanche worker in Colorado to attend a mini ISSW that would remain affordable and be centrally located for avalanche workers around Colorado. Eventually this idea became the Colorado Snow and Avalanche Workshop (CSAW); 2004 will be the third annual event. Considering that

avalanche workers tend to enjoy travel, it has been one of Knox's goals to pull in a learned colleague or two to speak at CSAW, thereby helping reduce up-front costs and present expert speakers in the avalanche world.

It wasn't until 1995, when House Bill 1314 passed, recognizing the Colorado Avalanche Information Center as a true agency within the state Geological Survey, that survival became more than just a hope for Knox and the staff at the CAIC. Knox had been working towards the passage of this bill for many years; now he could finally feel that the financial future of the CAIC was relatively secure. It also meant he was further drawn into accountant/political/marketing roles than he maybe really wanted to be. Knox's next project became to stabilize and diversify the CAIC portfolio.

In the 1996-97 season, the CAIC adopted a "Friends" program—an idea initially and successfully developed by the Utah Avalanche Center. During its first season, the Friends raised \$15,000; last season \$33,000 went directly toward CAIC's operating budget. Knox's influence upon and respect from the people of Colorado made the CAIC a high-quality program citizens were willing to support. He created a perks package that brings value to membership for a small donation: daily e-mail forecasts, an informative *The Beacon* newsletter that comes out three times per season, a pocket book he and Dale Atkins co-wrote called *Avalanche Wise*, and the coolest window sticker in the state.

The Next Millennium

Back to Nick Logan for a moment for some observations about Knox: as a boss and supervisor Knox has always been fair—consistently—throughout his tenure for the last 20-some years. For example:

- ❄ On top of his duties as state administrator for the avalanche program, he still continues to schedule himself as a forecaster on an equal status with the rest of the staff.
- ❄ During the historic March 16-21 blizzard of 2003, Knox worked six straight days in the Boulder office. When Nick Logan tried to drive down to relieve his shift, Knox told him to stay on the west slope, as it would be too dangerous to try and come down from Breckenridge. Dale Atkins was finally able to get to the office to help Knox with the enormous crush of work that came from this incredible avalanche cycle.
- ❄ As three of the four staff live well away from the Boulder office, we need to rent an apartment each season. Knox has always insisted upon paying more than his fair share of the rent, simply because he makes more money.
- ❄ Knox will always tell you when you are wrong, but he's also the first to commend you for a job well done. He always works with

his staff by providing constructive criticism. A straight shooter—a rare trait in a boss.

❄ He does not just delegate; he will often take on extra workloads so the rest of his staff can get on with their normal duties.

❄ He has built the CAIC reputation within the United States as well as internationally to be one of the best avalanche forecast centers in the world. (He was invited to present papers in Davos, Switzerland, in 1996 and St Vincent, Italy, in December 1999.)

❄ He has shaped the CAIC into a reputable and respected avalanche center, which is reflected in the longevity of his staff. Why else would we subject ourselves to 4 am starts and office days that can run to 18 hours?

❄ He always seeks input from his staff, on any and all decisions both minor and major in how the CAIC is run.

If we estimate that Knox has taught an average of 10 avalanche courses per year since 1970, that would be some 340 classes in his career. I learned a lot of what I know about mountain weather and snowpack from listening in on Knox's lectures at classes I have co-taught with him. Bruce Tremper had this to say about Knox's teaching skills, "He is one of the best avalanche instructors I have worked with, as he has a gift for clear, concise explanations of complex phenomenon."

Lest we forget, Knox has his weak moments and will even tell it as he sees it. Take this forecast for example:

This is Knox in the Avalanche Center at 1:00 pm, Saturday, January 4, 2003.

DISCUSSION

A lot is going to happen with our weather the next 24 hours. I wish I knew what it was, but here's a shot...

Proof in writing that Knox really could have a sense of humor when it came to his job.

Here's another of his forecast zingers from the snowpack discussion at the end of the Thanksgiving Day forecast from Thursday, November 27, 2003:

The backcountry avalanche danger for all mountains...on NW- to SE-aspects near and above treeline: LOW but with pockets of MODERATE for triggered releases in the new snow layer...while S- through W-aspects are still rated LOW. A flock of 20-lb turkeys, overly exuberant from drinking fermented cranberry juice (because they survived Thanksgiving), might trigger a 1-ft slab on a 35- to 45-degree wind-drifted slope. If they can do it, so can you, so be careful.

Happy Thanksgiving.
Williams

Here's how I will remember his forecasting—it generally goes more like this:

During the 2003 FIS World Cup Downhill and Super G races in Beaver

Creek, Colorado, we were asked to provide a site-specific weather forecast. The Beaver Creek downhill is considered to be one of the three hardest courses on the circuit and the Super G is thought to be the top course in the world. Each day I would meet twice with the jury to give a weather forecast. The downhill races were held under fairly safe conditions—safe being a relative term to someone hurtling downhill at 75 miles per hour on a sheet of ice. The Super G weather forecast was another matter. The night before, the Chief of Course was looking over a wide variety of forecasts from other sources: some said clear, some said major winter storm. I was asked what we thought. Knox had told me only minutes before, "...expect very light snow to begin about 6 am. You will see from 1-3 inches during the race. Winds will not be an issue." The safety delegate then asked me what is the percent chance of this forecast being true? I was confused for a moment. I asked, "Do you mean whether it is a 20-, 30-, or 60-percent chance of being right?" He said, "Yes." My response was, "We don't work that way; Knox said snow begins about 6 am, 1-3 inches expected. That's what we'll see." The next morning as we were getting on the lift at 6 am, the first flakes began to fall. By the race's end, 2 inches of snow had fallen and the race went as scheduled. I think there were some very impressed Europeans that day. For me, it was just another forecast from Knox Williams.

Something not quite tangible will be missing for us when the 2005-06 season starts, yet we have been fortunate. The foundations of avalanche forecasting in the United States were laid by some of the best in the world: Monty Atwater, Ed LaChapelle, Norm Wilson, Rod Newcomb, Dick Stillman, Art Judson, Mark Moore, Pete Martinelli, Ron Perla, Sue Ferguson, Richard and Betsy Armstrong, to name just a few. The walls and structure of our house have been hammered together by these folks and others. One of the builders and designers of our small community has been Knox Williams. His professionalism has been an instrumental part of making our chosen profession as avalanche workers a highly respected job. Even as that generation of experts retires to riverfront properties to watch the cycle of water continue, others are stepping in to add the roof and the trim for the next generation.

Who knows, maybe it was luck or possibly destiny that Knox decided to go to school at CSU, and that Art Judson brought a young meteorologist from Austin, Texas, into a field that needed his youth, ideas and energy at just the right time. It's not often people get the opportunity to work with one of the world's acknowledged experts in a given field. I know that everyone who has worked with or taken a class from Knox feels privileged.

Since getting info about Knox from Knox would be impossible, I have gone to other sources: *TAR*, *The Beacon* newsletter, Don Bachman, Art Judson, Nick Logan, Mark Moore, Bruce Tremper, Rich Marriott, Jerry Roberts, his wife Suz, and a host of others.

Scott Toepfer has worked with snow and avalanches around the world since 1977 and has been with the CAIC since 1991. He lives in Breckenridge, Colorado. ❄



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This coming spring, Knox Williams will retire from the CAAC. He has worked there for 34 years. A lot changed in the avalanche community throughout those years, and Knox has been a part of almost every aspect of that growth. His wife Staci says, "The guy just doesn't look his own age!" But from a variety of sources, here's some of the avalanche history Knox has seen come and go. As you will see, it's been a wonderful story.

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