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THE Avalanche REVIEW

VOLUME 21, NO. 4 • JUNE 2003

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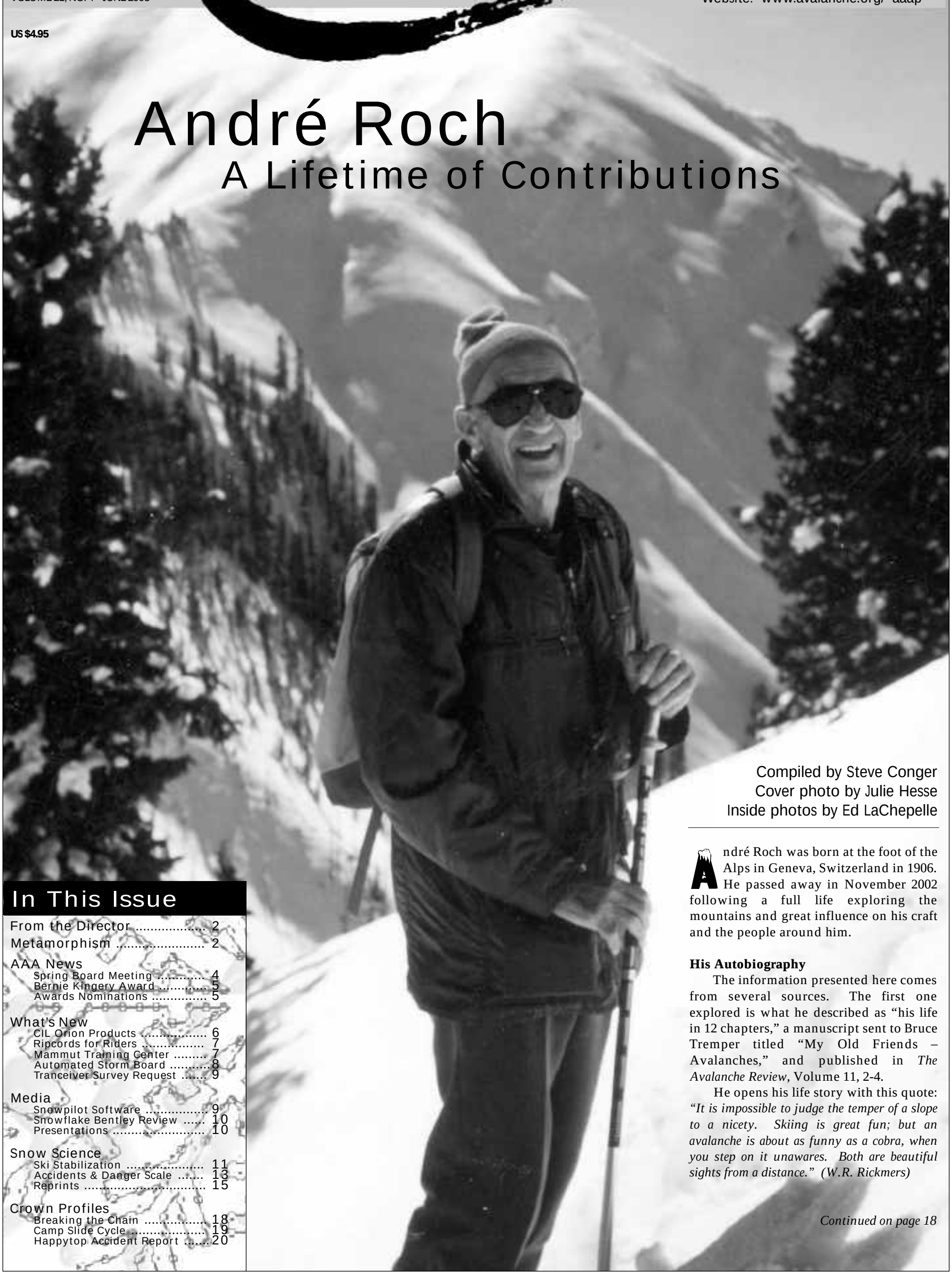
André Roch
A Lifetime of Contributions



Compiled by Steve Conger
Cover photo by Julie Hesse
Inside photos by Ed LaChepelle

André Roch was born at the foot of the Alps in Geneva, Switzerland in 1906. He passed away in November 2002 following a full life exploring the mountains and great influence on his craft and the people around him.

His Autobiography

The information presented here comes from several sources. The first one explored is what he described as "his life in 12 chapters," a manuscript sent to Bruce Tremper titled "My Old Friends – Avalanches," and published in *The Avalanche Review*, Volume 11, 2-4.

He opens his life story with this quote: *"It is impossible to judge the temper of a slope to a nicety. Skiing is great fun; but an avalanche is about as funny as a cobra, when you step on it unawares. Both are beautiful sights from a distance." (W.R. Rickmers)*

Continued on page 18

In This Issue

THE Avalanche REVIEW

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

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

FROM THE DIRECTOR: MARK MUELLER

There I was, driving along, doing the road patrol for the Colorado Highway Department, and looking for avalanches. At Wolf Creek Pass, it snowed more in February than the first three months of our winter combined. As February progressed, it snowed more each week with the final week culminating in over four feet of new snow. The avalanches had been getting bigger as well, but the pass had remained open and everyone was safe and happy. I was dreaming of finally getting some rest, taking the remainder of the day off (I work solo) and hitting the local hot springs for a good soak after days of sometimes brutal trail breaking during field reconnaissance. Feeling pretty satisfied and on top of it, I rounded a corner to check out the last spot, Alberta's Cousin, and there it was; a big soft slab, with a wall-to-wall crown, three to five feet deep. My heart sunk, no, I obviously didn't have it together and there went my soak. Sure, it didn't affect the highway, but this didn't match my analysis of things: recent ski tests had been negative, results with the launcher were only sluffs, and other observed naturals had been pretty shallow with little propagation. As forecasters and avalanche professionals we take pride in the intimate local knowledge we possess about our areas of responsibility. But we have to be careful that that knowledge doesn't force us into a rut- "oh, that slide behaves in this manner." Obviously some of that attitude is necessary and good, but just how much?

We've read and heard a lot about the human factor, heuristics, and their workings. It is really interesting and pertinent because it applies to everyone, novice to seasoned pro. The recent and not- so- recent works on the importance of trying to understand our decision-making processes are vital contributions to avalanche safety for both recreationists and professionals. Thanks to those folks for looking into this aspect of avalanche safety and for sharing their findings.

Many of us are dealing with exceptionally fragile snowpacks this winter and February brought abundant snowfall to many areas. After a relatively quiet early winter, news of avalanche incidents and fatalities are being heard more and more. Be safe out there.

AAA will be organizing a continuing education avalanche workshop to for this fall that will coincide with our fall Annual Meeting. Earlier workshops have had themes organized around avalanche education and explosives handling. The location, time, and theme for this fall's workshop are in the planning stages now. Ideas from the membership will surely be appreciated and can be submitted to the Governing Board by emailing aaa@avalanche.org. Snail mail and phone calls work as well. Check the AAA contact information on *The Avalanche Review's* masthead. Information about time, location, and theme will be sent to everyone as a mailed announcement this summer.

View of Alberta's Cousin slide path and snow shed, US Highway 160, Wolf Creek Pass. *Photo by Mark Mueller.*

I want to thank the Editors, designers, and contributing authors for their hard work in producing this year's *Avalanche Review*. TAR is the most prominent product AAA produces with the aim of getting up-to-date avalanche information to you: and it may be the reason that many of you support AAA.

The AAACertified Avalanche Instructor program has been up and running since early this winter. Details about qualifications are in TAR 21-2 and on the Westwide Avalanche Network at www.avalanche.org / ~aaap / membership.html. My congratulations to those individuals accepted as Certified Instructors.

By the time you read this, spring will be here and cold, deep powder will be slowly replaced by soft, silky corn snow and afternoons on the sundeck….with the usual spring snowstorm interruption, of course. I wish you all you all an enjoyable summer, and a safe winter to our members and readers in the southern hemisphere. See you next fall.

— Mark Mueller, *Executive Director*

METAMORPHISM

Ethan Greene, Greeley, CO, has been accepted as an AAA Certified Avalanche Instructor. **Tom Kimbrough**, Salt Lake City, UT, has retired after three decades as an avalanche worker. See articles later this issue for details. The San Juans Public Lands Center has hired **Denny Hogan** as its "Snow Ranger" for the BLM and FS lands in the Silverton area of the San Juans. His official starting date was January 13th and his duty station is in Silverton.

Hogan is the first such ranger in the country to patrol BLM land. His duties will be extensive. Primary duties initially will be to monitor day to day operations at the new Silverton Mountain Ski Area and ensure compliance of BLM permits for avalanche study / mitigation and guided skiing. He will be a member of the Silverton Mountain EIS study team, headed by Richard Speegle of the San Juan Public Lands Center.

Also under Hogan's jurisdiction will be the Molas Pass winter management area, where snowmobiles and skiers intermingle. Commercial snowmobile and snowcat guides hold permits in the area that he will monitor.

Finally, Durango Mountain Resort, which has most of its lifts and runs on National Forest System Lands will be under his purview as well. During the summer, he will supervise the Alpine Loop seasonal rangers and monitor lands in the Weminuche Wilderness and San Juan National Forest.

Hogan feels at home in Silverton. He was based there as an avalanche forecaster on Hwy 550 for the Colorado Department of Transportation / Colorado Avalanche Information Center from 1992 to 1997, first with Don Bachman as Lead Forecaster and later with Andy Gleason. He has regularly returned to Silverton to teach classes for the Silverton Avalanche School and the American Avalanche Institute. He has worked the last few seasons with the Colorado Avalanche Information Center in Boulder as a staff forecaster and taught education classes throughout the State.

New Professional Members Spring 2003

David Haake,	Bend, OR
Robert Tierney,	Breckenridge, CO
Timothy Haag,	Breckenridge, CO
Will Barrett,	Fairplay, CO
Chad Hults,	Skykomish, WA
Charles Rubin,	Ellensburg, WA
Tom Mattice,	Woodenville, WA
David Lovejoy,	Prescott, AZ
Eric Geisler,	Mead, WA
Will Spilo,	Vail, CO
Brian O'Neill,	Telluride, CO
Ray Price,	Bear Valley, CA
Eric Peterson,	Ashland, OR
Mark Kozak,	Wilson, WY
Max Forgensi,	Breckenridge, CO
David Charles	Rintala, Tahoe City, CA
Rob Gibson,	Snoqualmie Pass, WA
Hans-Peter Marshall,	Boulder, CO
Aaron Rodriguez,	Ophir, CO
John Gibbons,	Crested Butte, CO
J. Bristow,	Truckee, CA
Matt Lutz,	Hailey, ID
Sonja Nelson,	Telluride, CO
Joe Blanchard,	South Lake Tahoe, CA
Brian Gannon,	South Lake Tahoe, CA
David Williams,	Bend, OR
Michael Olson,	Snowbird, UT
Kevin O'Rourke,	Salt Lake City, UT
Rusty Dassing,	Snowbird, UT

METAMORPHISM continued

New Member Affiliates, Spring 2003

Evan Stevens,	Moab, UT
Stefano Scaini,	Parma, Italy
Sam Wyssen,	Reichenbach, Switzerland
Nick Caselli,	Durango, CO
Sue Purvis,	Crested Butte, CO
Matt Rutledge,	Mt. Hood, OR
Karl Bausler,	Douglas, AK
Alexander Nejelev,	New Westminster, BC
Stefan Martensson,	Lulea, Sweden
Roger Damon,	St. Johnsbury, VT
Rick Hudson,	McCall, ID
Steve Wiseman,	Minturn, CO
James Giglinto,	Keene, NY
Ian Fairweather,	Laramie, WY

AAA Membership Profile as of March 31, 2003

Note: The Board approved the applicants listed below at the Spring Meeting.

Honorary Members	14
Life Members	9
Professional Members (in good standing)	341
Professional Member applicants	22
Pros expired, 2002	29
Pros expired, 2001	16
Member Affiliates (in good standing)	87
Member Affiliate applicants	14
Members expired, 2002	14
Members expired, 2001	10
Subscribers	224
Subscribers past due	43
Trade	18
Complimentary Subscriptions	34
Total Members in Good Standing	763
International Membership (members in good standing):	
Canada	38
Switzerland	8
Japan	5
Austria, Sweden, New Zealand	4
Norway	3
Chile, Spain, France, Italy	2
Germany, Scotland, Russia, Iceland	1
Membership by Section (members in good standing):	
Rockies	179
Northwest	76
Sierra	102
Intermountain South	119
Intermountain North	72
Alaska	28
East	67
Europe	27

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The Avalanche Review: A Call for Submissions

Seen any good avalanches lately?
Got some news for the other snow nerds out there?
Developing new tools or ideas?
Learn something from an accident investigation?
Tell us about a particularly tricky spot of terrain;
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;

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

TAR is currently accepting articles, stories, queries, papers and photos. We can help if you're not sure how to write it up.

Deadline for Vol. 22, Issue 1 is August 15, 2003
Deadline for Vol. 22, Issue 2 is October 15, 2003
Deadline for Vol. 22, Issue 3 is January 15, 2004
Deadline for Vol. 22, Issue 4 is March 15, 2004

Send text as .doc or .rtf files.
Send photos as black and white 300dpi .jpg files.

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AAA NEWS

A Brief Report from the AAA Spring Board Meeting, April 5, 2003.

Story and Photos by Mark Mueller

The AAABoard got together for its Spring meeting in early April in Silverton, Colorado. Silverton is a small, unique community surrounded by high mountain passes with an avalanche history that exceeds 100 years. Along with Alta, UT, Silverton probably has more AAA Pros and Members per capita than any other community.

Although many Board members were unable to attend due to the early date of the meeting and its remote location, those that did were rewarded. Kudos to Alaska Section Representative Bill Glude for making it all the way from southeast Alaska to attend.

AAA Pro members and Silverton Mountain's Snow Safety Dept. leaders: Pat Ahern (L) Dir of Snow Safety, Aaron Rodriguez (R) Asst. SS Director.

With President Russ Johnson presiding, the Board efficiently worked its way through the agenda. A review of Finances showed that the AAA is pretty healthy in that regard. The Board ratified 36 new Professional and Affiliate Members. See the list in this issue's Metamorphism column. The Board also spent considerable time planning this fall's AAAContinuing Education Seminar. This seminar is designed to fill in between ISSW years and provide AAA members with an opportunity to increase their knowledge and skills, and just plain get together. This fall the seminar will last two days and have two themes; avalanche education and avalanche weather. The fall AAA board meeting will take place the on Friday, the Annual meeting Friday night, and the seminar Saturday and Sunday. The location will be in or around Little Cottonwood Canyon, Utah, one of the first three weekends in October. A formal announcement with exact dates, location, and more details will be sent to everyone in this summer's mailing that will include membership renewal information for many of you.

After a day of inside business, the new Silverton Mountain Ski Area hosted the board for a day of skiing at their area. On behalf of the Board, I would like to thank owners Aaron Brill and Jen Ader for a great day of skiing and the Silverton Mountain Snow Safety Team, AAA Pros Pat Ahern and Aaron Rodriguez, for an informative presentation of their program and a tour of their terrain. The spring weather cooperated with 6" of new snow and clearing skies. Spirits ran high as locals and newcomers alike bathed in the magic of snow and mountains.

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The Board getting the tour of terrain at Silverton Mountain.

Board Members atop Silverton Mountain.

Tom Kimbrough Retires After 37 Years in the Avalanche Business

By Bruce Tremper

Tom Kimbrough gave his last avalanche advisory for the Utah Avalanche Center in April. After 37 years in the avalanche business, he began his retirement by heading to Tibet to trek to various Buddhist temples. He has worked at the Utah Avalanche Center since 1987 and has become one of the most respected and well-loved avalanche forecasters in the country. In Utah, he is famous for his clearly written and often humorous advisories, delivered in his characteristic deep, clear voice. I often called him the Walter Cronkite of the avalanche world.

As far as we know, Tom is the only professional avalanche forecaster from the state of Tennessee. Born in 1938, there are photos, prophetic of his future life spent in the mountains, which show him at the age of four, 15 feet up on a steep cliff face with his mother spotting him from below. After a stint as a racecar driver, he began climbing in the hills of Tennessee in 1960. After a hitch in the Army, he soon began climbing in the Tetons and Yosemite by the mid 60's. Then a friend mentioned that ski patrolling was the perfect way for a climber to earn money in the off-season, and he started his long avalanche career at Badger Pass in Yosemite in 1965. By 1967, he moved into the major leagues at Alpine Meadows, the most active avalanche area in the U.S., and became the Patrol Director in 1972. After one season as the Director, he discovered that he didn't care for being an administrator; he demoted himself and spent the rest of his career wisely avoiding the entanglements of boss-hood.

Tom reminiscing in front of his Jenny Lake cabin, with the same ice axe behind him. *Photo by Bruce Tremper.*

He was present at the famous Alpine Meadows avalanche accident in 1982, when a massive avalanche killed seven people in the base area. Tom had to extricate his boss and mentor, Bernie Kingrery, who was one of the victims. He then patrolled at Alta for several years with a two-year sabbatical as an avalanche consultant for the Galena Project, a proposed ski area in California. He began working at the Utah Avalanche Center in 1987, where he has remained ever since.

Kimbrough clearly found his niche at the Utah Avalanche Center. He put his writing, speaking and avalanche skills to good use each morning by explaining the complex avalanche phenomenon in carefully constructed, informative and humorous avalanche advisories, read in his deep, clear voice. On many Christmas mornings, Tom would deliver the advisory in verse.

For the past 30 summers, Tom has worked as a climbing ranger in Grand Teton National Park and he is now the head seasonal climbing ranger. He became famous for reading poetry to the climbers standing in line for a permit each morning before he allowed them into the ranger station. He also developed a keen ability to size up a climber and line them up with routes they could handle, yet still offered them a challenge, and he would coach them on how long it would take and the exact route to get there and back safely.

Kimbrough is also a spiritual mentor as he has maintained a daily Zen practice for the past dozen years and leads a Sunday night "Sanga" for Zen students. Combining his Zen practice with a lifetime of giving advice on backcountry activities, Tom developed an uncanny ability to tell people exactly what they need to hear, not only about the mountains but what they needed to learn in their particular stage of life. I have heard many people use the word "Yoda" to describe him, not for his short stature, but his patient, wise and intuitive council.

During our staff meetings, I often push everyone to come up with new and innovative ways to do our job better, and these sessions prompt wild-eyed, evangelical schemes of various sorts, often involving computers. Tom invariably listens patiently to the increasingly fevered discussions and then finally says something, which in a couple succinct sentences, shuts us all up. We all look at each other and say, "He's right. This is crazy. It won't work." He can always see when siren song of technology is luring us away from our core—from what really mattered—people and avalanches.

I decided a number of years ago, like many others have, that Tom was a good role model for me. Being 15 years older, he had negotiated many of the same twists and turns that I was going through and he had come out on the other end as exactly the person I wanted to become. At the age of 55, he not only ran 10K races, he was leading 5.12 rock climbs, and he won a climbing competition in Salt Lake City against a crew of sub 20-year-old gym rats. I also saw how, year by year, his Zen practice made him increasingly wise, patient, aware and egoless. So for the past several years, I too, wake up every morning at 5:30 and walk to a world class Zen center which happens to be two blocks from my house where I sit with 30 other people dressed in black, and I go to the retreats, and I am working my way through 159 esoteric Zen koans (puzzles) like "What is the sound of one hand clapping?" and "How do you stop a distant sailing boat?" and other foolishness. I'm hooked. I'm the lead member of the Tom Kimbrough fan club.

Tom Kimbrough in one of his early climbing trips to the Pacific Northwest in the mid 1960's. Note the ice axe. *Photographer unknown.*

At the age of 65, when most people buy a mobile home and head for Arizona, Tom began his retirement by spending a month in Tibet, trekking to various Buddhist temples. Then he will return to the Tetons as his last season as a climbing ranger, where he will continue to do climbing patrols in the high mountains, give advice to young climbers and occasionally rescue the ones who don't follow it. He still lives his life like the bumper sticker on his car, "my best vacation is your worst nightmare."

Tom with his son Paul, teaching him how to fish. *Photographer unknown.*

Bruce Tremper is Director of the Forest Service Utah Avalanche Forecast Center, where he was Boss in name only to Kimbrough-san.

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AAA Bestows Awards

At the general meeting held in Penticton, BC, the AAA announced four awards. They were: **Doug Fesler**, Honorary Membership; **Tom Kimbrough**, the Bernie Kingery Award for Distinguished Professional Practice; **Dr. Horst Schaffhauser**, Honorary Fellowship, and **Mr. Kazuo Fukuyama**, Honorary Fellowship. The citation for Doug Fesler appeared in Volume 21, Issue 2 of *The Avalanche Review.* The citations for the Honorary Fellowship awardees are appeared in Volume 21, Issue 3. The citation for Tom Kimbrough appears below.

Bernie Kingery Award for Dedicated Professional Practice:

This award emphasizes dedicated avalanche field professionals in honor of Bernie Kingery, who was Mountain Manager at Alpine Meadows Ski Area at the time of his death in an avalanche. Its purpose is to recognize sustained career contributions of dedicated field professionals engaged in avalanche forecasting, hazard mitigation, research or education. Only AAA Professional Members are eligible for this award. The nomination process is the same as for honorary membership. However, members of the Governing Board are eligible during their terms, and the award requires a quorum of the Governing Board with approval by two-thirds majority of the voting board. Recent awardees include: *Don Bachman* (2000), *Liam Fitzgerald* (1998), *Jim Hackett* (posthumously) and *Binx Sandahl* (1997) and *Larry Heywood* (1996).

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Tom Kimbrough

By Ethan Greene

Tom Kimbrough has had a long and varied career as an avalanche worker. After spending a few years wandering through the Yosemite Valley, a fellow climbing enthusiast persuaded him to join the ski patrol first at Badger Pass in 1966 and then Alpine Meadows in 1969. Tom worked in various roles on the ski patrol at Alpine Meadows until 1983 when he became a consultant for a proposed ski area on Galena Summit. In 1985 Tom moved to a new snow climate and joined the Alta Ski Patrol in the Wasatch Mountains. After several seasons at Alta, Tom decided to make the Wasatch his winter home. He took on a new role as a backcountry avalanche forecaster at the Forest Service Utah Avalanche Center (FSUAC). After fifteen years at the FSUAC Tom still gets to work at 4:00 am, makes a cup of tea, and provides the benefit of over thirty years in the field to Utah's backcountry travelers.

The sheer length of Tom's avalanche career is impressive. Remaining in the avalanche business for over thirty years requires a level of endurance that only a few possess. But Tom has accomplished much more than a lengthy career. Through the years Tom has served as an avalanche mentor to countless individuals. Many of the young punks that Tom schooled on mountain slopes have lasted and become veteran avalanche workers in their own right. Tom did not save his pearls of wisdom for only the dedicated avalanche professional. He is a passionate avalanche educator and his ability to connect with people from many walks of life coupled with his years of experience make him a very effective teacher. Through his insatiable search for knowledge and his ability to instruct and inspire successive generations Tom has made lasting contributions to avalanche safety in North America and is fully deserving of the American Avalanche Association's Kingery Award.

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WHAT'S NEW?

CIL-Orion Avalanche Control Products

By John Brennan

After the Big Sky tragedy, avalanche control programs in the U.S. faced problems with the availability of explosive components. Some operations were forced to go south of the border for detonators and safety fuse. Recently, a Canadian corporation, CIL-Orion, stepped in to fill the void for our niche market.

CIL-Orion has been doing business in Canada for six years, after Company President Everett Clausen and partner Andre Gagnon bought the rights to the CIL name and formed CIL-Orion. The company has provided the Canadian avalanche industry with tailored products since its inception. It recently expanded its distribution circle to the US by collaborating with Austin Powder and unveiling several new products. The more interesting products for snow safety programs include a military spec, statically shunted cap/fuse assembly, multiple sized primers made with 'environmentally positive microbial inoculants,' 'Snow Crusher' shaped primers and multiple sized ANFO bags (25kg, 12.5kg and 7 kg) that are packaged within an antiskid 'Surefoot' bag.

The first of these, the Mildet cap/fuse assembly, has been in the design and early production stage for four years. The product has many unique characteristics that ensure it works reliably and safely for avalanche control. These include ruggedness, resistance to condensation, ability to work in extreme temperatures and static protection. While not mandated in the U.S., these assemblies have a static shunting staple installed in them. Also of note is the fact that the exposed end of the fuse train is covered with a PVC nipple- a technique I recommended in the Fall 2002 issue of *The Avalanche Review*. Although these assemblies appear to be expensive at over $7 each, CIL-Orion has had a zero dud rate with them under heavy use conditions for over six months.

In conjunction with Austin Powder, CIL-Orion has also made some interesting advances in their primers. They have a line of 1 and 2 pound shaped charges that go under the brand name of 'Snow Crushers.' These products are designed to direct the energy of the explosive into a cornice or any other desired snow feature. Their similarly monikered 'Cornice Crusher' is an emulsion based explosive laced with det cord. It looks like a conjoined string of sausage links, and it is easy to understand how it got its name! CIL-Orion makes its 1 kg TNT/ PETN blended hand charge line-up and their 1 kg "Snow Launcher" (the company's avalauncher round) with optional RECCO chips and a moisture loving degrading agent. This bio-organism agent consumes the explosive in the event duds can't be found quickly. As of this writing, the company hasn't fully established the exact time to full decomposition in various environmental conditions.

In addition, CIL-Orion also carries various ANFO primers, pull wire igniters, shock tube detonation systems, emulsion based hand charges, detonators, and more. Their full product line can be viewed at **www.cilorion.com.** Direct product and pricing questions to David Sly, their Technical Sales Rep at 250-744-8765 or davidgsly @ mapleleafpowder.com.

CIL-Orion certainly deserves to be complimented for directly addressing the explosive needs of snow safety programs. The company also gives a portion of all its avalanche related sales back into our industry. Their present arrangement in Canada includes a 3% rebate to the Canadian Avalanche Association from purchases by CAA members. Last year's donation was over $8000. Some of this money went into the writing of the CAA's meticulously prepared *Explosive Training Manual*. A similar donation agreement could be set up with the National Ski Area Association - which is looking into purchasing a licensing agreement from the CAAto begin distribution of the CAA Manual in the U.S.

John Brennan is Snow Safety Director at Snowmass Ski Area, a member of the International Society of Explosives Engineers (ISEE) and its Colorado Chapter, and a member of the National Ski Area Association's (NSAA) Explosives Committee.

Photos courtesy CIL-Orion.

Top: Sure Foot; L to R: Cast Booster, Mildet Fuse Assemble, Cornice Crusher

Snow Launcher

Ripcords for Riders:

A Simple Solution for Releasable Snowboard Bindings

By Trevor Deighton

Recently, I was working a Prescott College Avalanche Forecasting Course for skiers and snowboarders. We were troubled that, in contrast to AT and some telemark bindings, a rider has no quick method to escape a snowboard in an avalanche. We set out to engineer a simple, economical and quick solution to this problem. After some testing on the Prescott College course, we then installed the following system on the National Outdoor Leadership School (NOLS) split boards. We set up approximately 12 Voile split boards with Nidecker soft bindings with these ripcords, and then used them on a 10 day backcountry trip. From browsing my local board shops it would appear that this system would work on most soft bindings on the market.

Soft snowboard bindings work on a ratchet principle with the buckles towards the outside of the foot (i.e. away from the center of the board). In order to release the bindings you pull the release lever towards the inside of the foot (towards the center of the board). Here are the steps to alter the bindings. The rigging process should take less than 30 minutes. See the diagram for clarification.

drawing by Laura Schmonsees

Step 1: Drill a small hole in each of the four release levers (two per binding/foot).

Step 2: Attach a 10 inch long (approx) piece of P-cord (3-4mm) and attach each end to the release on the same binding. Repeat this step for the other binding. We used a simple overhand on each end of the release hole to prevent the p-cord from sliding around. This should give each binding a release handle that when pulled firmly will release the binding.

Step 3: Cut another piece of P-cord approx 30" long and attach this to each of the binding release handles. This is your central "ripcord" that when pulled will release both bindings. On a fixed/regular board the ripcord connection can be tied and semi-permanent. For the split boards we put a small "key chain" carabiner on each end of the ripcord so it could easily be removed while in ski/travel mode and then quickly replaced before each descent.

Some Hints: Take a little time getting the sizing of both the handles and the ripcord right so it is neither to slack or too tight; otherwise it will get in the way. Don't use the ripcord or the handles except to test them and in an emergency. Yanking the ripcord for daily use seems to cause a lot of wear and tear on the bindings.

We found the ripcord system to be quick and efficient. It was easy to use and didn't interfere with riding or skinning. Hopefully, this simple solution will gain popularity or act as a basis for further experimentation, so that when riders get caught in avalanches they may be able to quickly release, stay on top, and have a greater chance of survival.

Trevor Deighton works year-round as a climbing and backcountry guide. His enthusiasm for sliding is matched only by his ability to break and repair bindings in the field. He is planning an expedition this summer to unnamed cirques in the northern Coast Range.

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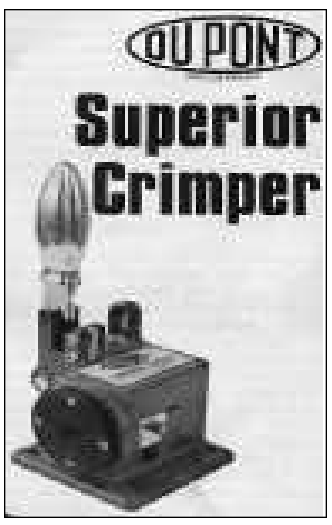

Enders Speed Blades Available

The Dupont 'Superior Crimper' uses Enders Speed Blades. Although these blades have been obsolete for some time, I have a limited quantity avalable for sale.

Price is $5 per blade, which includes shipping.

Confirm orders at
jbrennan@aspensnowmass.com
or
970-923-8724.

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Mammut Opens

"Avalanche Training Center"

Nowadays, everyone dreams of escaping from daily routine and gliding down a slope of fresh, virgin snow. However, many people have no idea how to handle the hazard of avalanches. The Avalanche Training Center (ATC) in Zinal is based on the realization that it is a waste of time trying to prohibit freeriding because this sport satisfies a demand and is becoming steadily more popular. Seen from this point of view, it makes sense for people who engage in this sport to be properly informed through a system of active prevention and to be taught how to react in an emergency.

The joint efforts of Bergbahnen Zinal SA, Mammut AG, the School of Engineering in St. Imier and Girsberger Elektronik AG have produced permanently equipped training terrain, where people learn how to use an avalanche beacon in a lifelike avalanche simulation.

The ATC terrain is a triangular zone with ca. 100-meter-long sides, representing an avalanche site. Within this zone 16 fixed transmitters have been installed, which can be activated by an electronic command. The training center is open free of charge to all guests during the winter season. Freeriders can learn how to use their transceiver in a lifelike simulation of an avalanche because they do not know where the transmitters are hidden. In addition, an electronic module makes it possible to randomly select the transmitters, thus obtaining a large number of possible combinations. This is not the case in most avalanche courses: someone has to bury the transmitter and their footprints give away the location of the device. The courses held in Zinal with the participation of Mammut are based on a scenario that is much more true-to-life.

Background

Innovation

In Zinal, the users of avalanche rescue transceivers have an opportunity to practice using their device in a realistic simulation of a multiple-burial situation. During the courses, it has become evident that many people who carry an avalanche rescue transceiver do not know how to use it correctly. Logically, this situation will be even worse in panic situations where friends or family members have been buried by an avalanche or snowpack. The time factor is of prime importance for the survival of avalanche victims. Only a proficient transceiver user has a chance of saving life, especially if several persons have been buried under the avalanche simultaneously.

Zinal: a pioneer resort for freeriding

In 2000, the cable car operators of Zinal in the Val d'Anniviers created the first commercial freeriding area in Switzerland. The "Garde de Bordon" area, named after the nearby range of mountains, offers snowboarders and skiers the possibility of honing their skills in unprepared terrain. This area is located between 2300 and 3000 meters above sea level and consists of expansive, untouched fields of snow, interspersed with a number of gullies. Unlike most ski resorts, Zinal aims to cater for the new demands of winter sports enthusiasts.

Since 2001, two electronic doors named "Snowadvice" have stood at the entrance to the freeriding area. Zinal created these solar-driven electronic doors in cooperation with the School of Engineering in St. Imier. The special feature of the doors is that they will only open if you are equipped with a properly functioning avalanche rescue transceiver. This system is part of the concept of active prevention, since freeriders will be motivated to equip themselves with the necessary technical material to limit the risks of off-piste riding. The Snowadvice doors can be controlled and operated by SMS. In the case of a power shortage the piste services will receive a warning via SMS and the doors will be automatically blocked. A notice near the doors provides advice in four languages to the users of this area. For example, it states that risks are minimized if you are equipped with an avalanche rescue transceiver, a probe and a shovel. However, the doors will only open if the danger level is lower than 3 (= high). The ATC is a further development of the active prevention educational concept.

How does the Avalanche Training Center function?

Select number of buried persons: 1 – 3 persons

Select time for locating the transmitter: 1 – 10 minutes

The required number of transmitters (= persons) is now randomly activated and the selected time begins to run.

The participants locate the buried transmitters with the Barryvox avalanche rescue transceiver.

The participants identify the buried transmitters with a probe, as should be the case in a real-life situation.

If the selected time has expired, a signal sounds and the transmitters switch off. Thanks to this function, searches are always carried out under a certain pressure of time.

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Flipper:

A Self-Cleaning Storm Board

Story and photos by John Brennan

Snowmass ski area has semi-dedicated four automated weather stations to providing data for the Aspen Skiing Company's internal web site. Two of these stations record 24-hour snow totals. For many seasons, Snowmass employees installed the weather stations before October 1st, and prior to the lifts opening, any new snowfall meant daily trips to the two snow sites to clean the 24-hour storm boards. The challenge was to develop a 'self cleaning board.'

In the mid 1990s, it was common to load PC208W software onto the company's Snow Reporters computers. When Campbell Scientific introduced their Real Time Data Monitoring (RTDM) software, it was apparent that it would provide a sensible solution. RTDM graphically presents data from any number of data loggers, a function accomplished with one server scheduled to call the data loggers on an hourly basis. While the resulting file can be uplinked directly to an internet site, marketing departments typically like to put their spin on things prior to feeding the public.

In order to provide forecasters and the public with the most accurate information, most ski areas utilize a 24-hour snow total in addition to a settled depth value. While it is certainly possible to program a data logger to determine depth change over a given time period, settlement and other factors can skew what info is being presented. To keep matters consistent, the boards need to be cleaned at the same time daily.

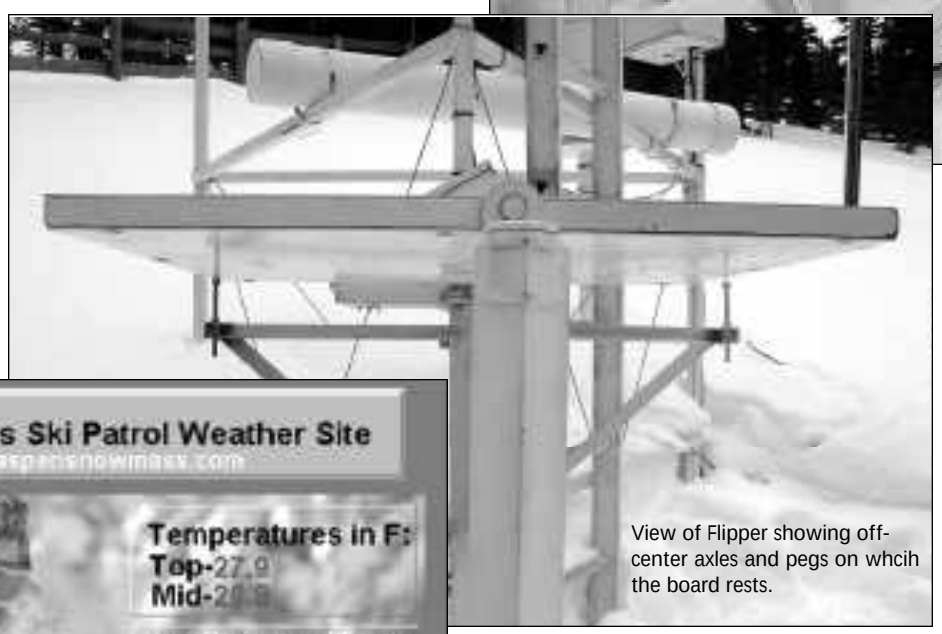
Snowmass presented the challenge of designing a self-cleaning storm board to Greg Hoffman, an electrician and lift mechanic at Snowmass. His design consists of two fiberglass sheets separated by tubular steel. Laminated to the back of these sheets are heat panels originally manufactured to keep bathroom mirrors fog free, and Styrofoam insulates the void between the top and bottom panels. The 3/4 inch axle rides in automotive pilot bushings and is located 1 inch off center to enable the board to rest on adjustable pegs after each flipping cycle. A solid state relay takes the 5-volt pulse from the data logger and steps the current up to the 24 volts necessary to operate the circuitry. Six magnetic relays create the logic necessary to reverse the direction of the servomotor and to heat the correct side of the board. The motor is a vintage war surplus affair originally used to crank the wing flaps on B52s. It is a super high torque unit that has built-in limit switches so the board can be stopped firmly on the pegs. While the servomotor would be the major power user, the 5-6 amp draw for less than 10 seconds daily shouldn't affect the batteries on remote sites too severely.

We have programmed the data logger to check the 9 a.m. new snow total. If this number is above 1.5 cm, the data logger rotates the board 180º. When the board is triggered to rotate, the heat panels on the appropriate side of the board are turned on for a preset time period to remove any residual snow. It is also possible to trigger the board remotely from a PC or laptop using Campbell software. Most of the equipment came off the shelves of the Lift Maintenance department, and we estimate 30 total man-hours to build and install it. However, all the parts are available from Grainger, and we estimate that total cost of building a similar board using parts from that source would be around $1000.

This was our prototype unit so if anyone has any questions, suggestions or modifications, contact me at jbrennan@aspensnowmass.com

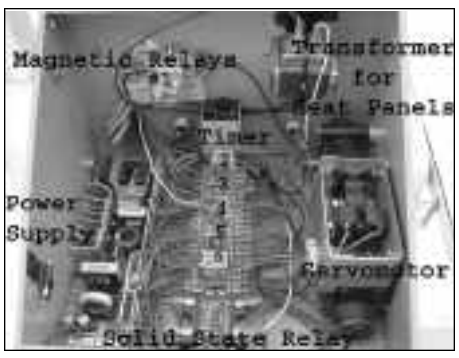
References:
www.clearproducts.com
www.grainger.com

Flipper installed.



View of Flipper showing off-center axles and pegs on whcih the board rests.

Screen capture showing output from the Flipper



Top: Flipper designer Greg Hoffman wiring the bathroom mirror defrosters.

Left: The guts of the flipper.

Awards Committee Calls for Nominations

Denny Hogan, the Chair of the AAA Awards Committee, has called for nominations for the AAA's various awards and honors. The deadline for submitting nominations is September 1, 2003. The AAA will present the awards at its Annual Meeting in Alta, UT, in October. The awards petitions are available from Denny Hogan at , or PO Box 74 Silverton, CO 81433. Contact Denny with any questions about the various awards and nomination procedures.

Honorary Membership: Honorary Membership is the highest award that the AAA bestows. It is given to a person who has distinguished him or herself by special achievement in the field of snow avalanches. Such distinction typically comes from outstanding research, avalanche forecasting, control or education accomplishments. Nomination requires a petition by five AAAProfessional Members in good standing, a short biographical sketch of the nominee and a citation of no more than 300 words. Current members of the Governing Board are not eligible for the award. Recent awardees include: *Doug Fesler* (2002), *Bob Brown* and *Sam Colbeck* (2000), *Sue Ferguson* (1998), *Peter Schaerer* (1996) and *John Montagne* (1995).

Bernie Kingery Award for Dedicated Professional Practice: This award emphasizes dedicated avalanche field professionals in honor of Bernie Kingery, who was Mountain Manager at Alpine Meadows Ski Area at the time of his death in an avalanche. Its purpose is to recognize sustained career contributions of dedicated field professionals engaged in avalanche forecasting, hazard mitigation, research or education. Only AAA Professional Members are eligible for this award. The nomination process is the same as for honorary membership. However, members of the Governing Board are eligible during their terms, and the award requires a quorum of the Governing Board with approval by two-thirds majority of the voting board. Recent awardees include: *Tom Kimbrough* (2002), *Don Bachman* (2000), *Liam Fitzgerald* (1998), *Jim Hackett* (posthumously) and *Binx Sandahl* (1997) and *Larry Heywood* (1996).

Honorary Fellowship Award: This award is made to individuals who have contributed significantly to the quality and success of avalanche related programs in countries other than the United States. It recognizes avalanche workers or researchers who have made significant contributions and communicated their work to peers in the U.S. Membership in the AAA is not a requisite for the award. Members should submit a petition and 200-word citation to the Awards Committee Chair. Recent Awardees include: *Kazuo Fukuyama and Dr. Horst Schaffhauser* (2002), *Karstein Leid* (1998), *Pavel Chernouss* (1996), *David McClung* and *Tsutomu "Tom" Nakamura* (1994).

Special Service Award: This award honors specific and outstanding achievements in North American snow avalanche work. The Governing Board generally initiates the nomination and approval. The recipient need not be a member of the AAA. Recent awardees include: *Steve Conger* (2000), *Alan Dennis* (1998), *Bruce Jamison* (1997), *Liam Fitzgerald* (1996), and *Betsy Armstrong* and *Rob Faisant* (1994).

TRANSCEIVERS

Do the New Generation of Avalanche Transceivers Save More Lives?

Help us find out.

By Dale Atkins and Halsted Morris

While teaching any avalanche awareness program or course, "the beacon question" always seems to come up. The question is "Which avalanche transceiver is the best?" It's followed by a pregnant pause. The students go silent, leaning forward and awaiting the instructor's edifying answer, just like characters in the old E.F. Hutton TV ads. After a deep breath, the instructor says…

"The best transceiver is the one that you buy and practice with A LOT." Within seconds the "tech-weenies" in the audience chime in with, "But, but…." The simple truth that all transceivers require practice gets lost quickly– unless the instructor keeps a tight rein on the group – in the debate of digital versus audio. Alas, during such debates you might wonder if the new generation of transceivers has saved more lives. Well it's time we find out.

Background Information

Historically, avalanche transceivers have had a dismal record of saving lives, especially in the hands of recreationists. In a 1997 study of avalanche rescues with transceivers, our European colleagues (Brugger, Falk, Buser and Tschirky) concluded "Further technical developments of the transceiver is mandatory to increase the proportion of saved persons during the first 15 minutes after the avalanche, and hence to significantly lower the death rate." This study was published before the introduction of the new generation of digital-display avalanche transceivers. The authors called upon academia and industry to develop easier-to-use transceivers with the hope of saving more lives.

The industry, driven by market pressure, has produced. Since the late 1990s, manufacturers have introduced several new digital-display avalanche transceivers, but until recently the total number of avalanche rescues effected with these new units has been too few to report meaningful statistics. In recent years there have been more cases of transceiver rescue then ever before. It is our hope to collect specific data on transceiver rescues since 1998 to the present, to learn if digital-display transceivers have increased the survival rate of buried victims.

Data Collection

To answer the question of whether the new generation of transceivers has saved more lives, we need the help of the AAA membership. The reporting of avalanche rescues and especially close calls has become spotty at best. We need detailed information about any avalanche rescue involving transceivers, and here is what we need:

Accident date (month / day / year)
Victim's activity at the time of the accident (i.e., skiing, snowmobiling, snowboarding, patrolling, guiding, etc.)
User category: professional (guide or ski patrol) or recreational
Burial time
Burial depth (head and chest)
Outcome: fatal or survived
Transceiver model: used by the rescuer
Comments
Source and contact information: name and phone number / e-mail address, etc. (if available)

The specifics as to subjects' names, transceiver brands and models will be confidential. All incidents reported must be verifiable. If you don't have all the information, please pass along available information and we will try to follow up upon the details.

Data Submission or Additional Questions

Rescue information and / or questions can be submitted to the Colorado Avalanche Information Center (CAIC) at caic@qwest.net or at transceiverstudy@aol.com For additional information please contact Dale Atkins or Halsted Morris at the CAIC.

Colorado Avalanche Information Center
325 Broadway, WS1
Boulder, CO 80305
303.499.9650

Look for the results in an upcoming issue of *The Avalanche Review*.

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MEDIA

Snow Pilot: Using PDAs to Collect and Share Snowpit Data

By Doug Chabot

The idea of using Personal Digital Assistants (PDAs) to collect snowpit data isn't new. Ever since they arrived on the scene a few years ago, people envisioned using them as tools in the field, as has been done successfully in other branches of science. However, the main stumbling block to creating a program for avalanche professionals was always money. We knew the brainpower existed to write the software, but it was cost prohibitive. This situation changed last fall when Conrad Anker, working with the Friends of the Gallatin National Forest Avalanche Center, secured a grant from the Omega Foundation to hire a programmer to write snowpit data collection software. In addition to this grant, PDA manufacturer Handspring donated 75 PDA's to the Friends that we'll hand out to avalanche centers, researchers and other snow professionals once the development is completed. The project was launched last fall and has been in development all winter; we're currently testing the fourth version, and with a little more beta testing it will be ready this spring. The official launch of the program won't occur until next fall, since we want it to coincide with the start of the avalanche season. Best of all, the program will be downloadable for free off of our web site www.snowpilot.org, hosted by avalanche.org.

Let's face it, standing in a snowpit and writing in your notebook, especially in adverse weather conditions, is slow, tedious, and cold! Further, once the data have been scribbled into a pit book and possibly rewritten a second time back at the office, there's no simple way to share this difficult-to-collect information with other avalanche centers, researchers or with the public. In addition, any scientific analysis of these data is difficult or impossible.

Snow Pilot will provide an easy, fast, and standardized way to collect snowpit data and will have the additional advantage of providing researchers with a way to seamlessly share this information. It will bring the recording of field observations, snowpits and stability tests into the digital age, where instead of islands of disparate paper records, there would be a vast uniform database for all to share.

This robust scientific data collection system will allow avalanche forecasters and snow scientists to utilize a PDA to easily record snowpit information. Drop down menus and "point and click" entries will allow for rapid data collection and field validation. The program will also allow users to set their own preferences. Do you like zero at the top of your pit rather than at the bottom? Do you use Fahrenheit instead of Celsius; measure in inches instead of centimeters? No problem, Snow Pilot can accommodate you. In the field, the user will be able to beam snowpit information to other PDAs, allowing real-time sharing. Once in the office, the data will be seamlessly synched to the user's PC, where information will be compiled into a snowpit profile. These profiles can also be posted on websites to provide the public with additional snowpack information. While this application is a new and innovative way to collect data, the real beauty of the program is that all the information will be sent off to a centralized database at avalanche.org. Once in the database, these records will be instantly available to researchers and forecasters via the Internet.

I have high hopes for this project. I'm tired of rifling through my pit books, hand-scribing data for different research projects. And I certainly won't miss redrawing my snowpits once I get back to the office. Stay tuned for the official release next fall. We'll soon be standing in snowpits beaming each other.

Doug Chabot is Director of the Gallatin National Forest Avalanche Center in Bozeman, Montana. He guides for Exum Mountain Guides in the Tetons during the summer season, and is a board member of The American Alpine Club. He has worked as a ski patroller at Bridger Bowl ski area and is a Professional Member of the AAA.

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Book Review: Snowflake Bentley

By Andy Gleason

Snowflake Bentley is a children's book about the famous snow scientist/farmer who first discovered how to photograph snowflakes in his barn in Vermont in the 1920's. This delightful book was written by Jacqueline Briggs Martin and illustrated by Mary Azarian with wonderful woodcut block prints. It won the Caldecott medal for excellence in children's literature. I received the book as a gift a few years ago and thought it was a cute introduction to the story of Snowflake Bentley. But now that I have a daughter of my own, both Madeline (8 1/2 months) and I (470 months) are enthralled by the excellent story and the captivating illustrations that accompany the life of the first person to capture the intricate beauty of snow in its variegated forms.

The story of Wilson (Snowflake) Bentley begins with his childhood on a farm near Jericho, Vermont where he was born in 1865. He lived in the snow belt of Vermont which got about 120 inches of snow a year. He was fascinated by snow. He received a small microscope as a child and used it to look at the snowflakes that fell from the sky. He tried to draw the shapes he saw, but most of the crystals melted before he could finish. When he was 18 he learned about a microscope that could take photographs. Although his father said, "Fussing with snow is just foolishness," his parents reluctantly used their savings to buy the microscope for him. It cost as much as their entire herd of cows. Within a few years he was able to photograph snowflakes outside in his barn using a black velvet background and small wooden stick to pick out individual flakes.

Snowflake Bentley was not appreciated in his time. His neighbors laughed at the idea of photographing snow and said "Snow in Vermont is as common as dirt. We don't need pictures of it." But he persevered and took photos during almost every storm. He knew that there were treasures in the snow and said, "I can't afford to miss a single snowstorm, I never know when I will find some wonderful prize."

Soon he had a collection of snowflake photographs with no two alike. At first he would make cards out of his photos for friends and family and have evening slide shows projected onto a sheet hung over a clothesline. Eventually other people began to take notice. Advertisers in New York City used the snow designs for ads, and scientists began to ask about the beautiful patterns. He was asked to lecture on snow at major universities around the country. Many different universities acquired lantern slide copies of his snowflakes for their museums. Other scientists around the country raised money so he could put his best photos in a book. When he was 66 years old, Wilson Bentley published what he called his gift to the world, the book *Snow Crystals*. Less than a month after his book was published, he walked home in a blizzard and contracted pneumonia. He died two weeks later.

There were a number of Bentley's original glass plate photographs in the geology museum at the University of Vermont, which I attended as an undergraduate. These were about 10 inches square and showed the geometric intricacies of the unique crystalline designs in a way that was sure to inspire any budding snow scientist. They inspired me enough to go to Jericho, Vermont to see the plaque in the town square that commemorates the renowned snow photographer. I know many of us have probably heard from our fathers that fussing with snow is just foolishness. But like W.A. Bentley, we have persevered and come to understand the wonders that the tiny snow crystal holds for those who care to take the time to look closely at one of nature's most intriguing forms. So if you have kids or just have a kid inside you, Madeline and I highly recommend this book. It sure helps Maddy get to sleep by 7:00 pm. If you have an early control morning, it might just help you too.

Andy Gleason is an avalanche forecaster for the CAIC in Silverton, Co. He is currently Secretary of the AAA and is working on his PhD at the University of Wyoming. He is a new father and spends his time digging snowpits and changing diapers.

Snow Crystals; by W. A. Bentley and W. J. Humphreys, 1962, Dover Publications, Inc. New York, ISBN 486-20287-9, Library of Congress # 63-422.

Snowflake Bentley; by Jacqueline Briggs Martin, Illustrations by Mary Azarian, 1998, Houghton Mifflin Co., New York, ISBN 0-395-86162-4, Library of Congress # 97-12458

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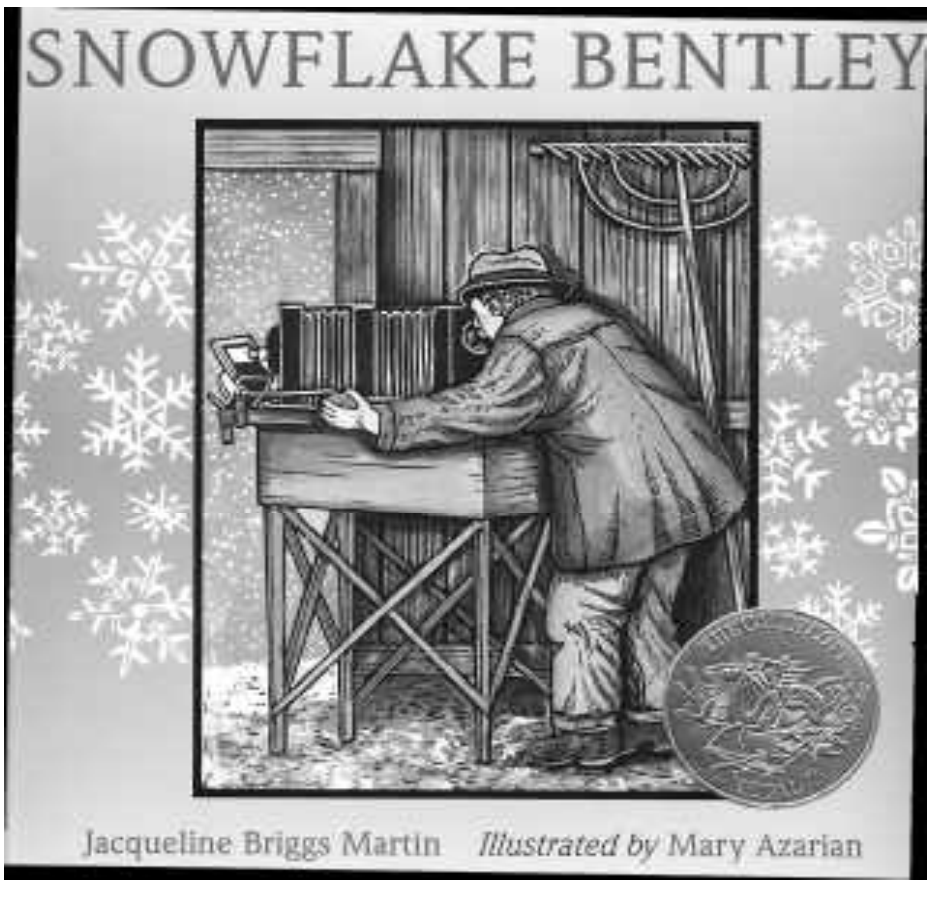

Presentation Tips

By Woody Sherwood

With the advent of the instructor certification program, the AAA has developed core curriculum standards for our courses and minimum resume standards for Instructor Certification. As practitioners, we can be good with the hard facts, but soft on effectiveness with the presentation. The following is a basic checklist of things to think about before the actual presentation and tips to improve our formal teaching.

A Checklist for your Presentation:
You owe your audience and yourself an effective presentation; creating one takes planning and practice.

1) Start preparing early; don't wait until the last few days.
- Prepare it early, let it rest a little bit and come back to it.
- Practice your entire presentation- including your slides.
- If you can, practice it before a group of colleagues or friends.

2) Think about your audience.
- Who are they and why are they here? An initial ten minutes for introductions is worth your time.
- What are their interests? Is this a special-interest group?
- What do they know? What do they want to know? What is a worthwhile investment of their time?

3) Be clear about your purpose.
- Are you informing or persuading?
- Be methodical: tell them what you are going to do, tell them, tell them what you told them.
- What do you want the audience to know, feel, or believe afterwards?

4) Use an effective introduction:
- Orient the audience; explain why your topic is important; set the tone.
- Establish a relationship between the speaker and the audience; establish credibility.
- Avoid weak introductions such as apologies, bad jokes, rhetorical questions.

5) Organize your presentation clearly and simply:
- Prioritize topics and allocate time accordingly
- Stick to only 3-5 main points.
- Have a cohesive pattern (examples are problem/solution, chronological, cause and effect, topical).
- Use transitions to move smoothly from one point to the next.
- Allow time for questions from the audience.

6) Use supporting materials to flesh out main points
- Use examples, statistics, expert opinions, and anecdotes. Students love war stories.

7) Compose for the ear, not just for the eye:
- Use simple words, simple sentences, markers, repetition, images, personal language ("You" and "I")

8) Create an effective conclusion:
- Summarize, set final image, provide closure; don't trail off, don't use trite phrases
- Don't just present data or summarized results and leave the audience to draw its own conclusions.
- Scenarios can involve your audience and force them to use the conclusions in real decision-making.
- You have had much more time to work with your information than your audience; share your insight and understanding and tell them what you've concluded from your work.

9) Tips for presenting well
- Sound spontaneous, conversational, and enthusiastic.
- Use key phrases in your notes so you don't have to read, use the overhead instead of notes.
- Vary your speaking volume, don't be afraid of silence, and don't use fillers like "um..."
- Practice, Practice, Practice
- Use body language effectively: relaxed gestures, eye contact; don't play with a pen or pointer.
- Use visual aids to enhance your message:
  - If you use PowerPoint or overhead transparencies in your presentation keep it simple and accurate.
  - Your visuals should reinforce and clarify, not overwhelm; the aids should be the messenger not the message.
  - Keep visual aids uncluttered; use titles to guide the audience.
  - If you use tapes or disks, make sure the equipment is compatible.

- Analyze the environment:
  - Adjust size of room, placement of chairs, time of day, temperature, distractions.
  - Check out AV equipment ahead of time, ensure that the computer and LCD are compatible;
  - Have a spare bulb
  - Cope with stage fright: remember that it's normal, it can be helpful, everyone feels it.

Reference:
Edward G. Wertheim, Associate Professor in Human Resources Management, Northeastern University, Boston

Woody Sherwood is the AAARockies Section Representative and director of the Crested Butte Ski Patrol.

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SNOW SCIENCE

Ski Stabilization in Avalanche Terrain

By Doug Richmond

This is a two-part article about ski stabilization as an avalanche control tool at ski areas. The first part is a general discussion of ski stabilization. The second part is an example from Bridger Bowl, Bozeman, Montana in 2002-2003.

Avalanche control strategies at Bridger Bowl and elsewhere have changed over the years. In the 50's and 60's, a common approach was to wait until high hazard conditions developed and then to bring down large avalanches with artillery or explosives. By the 70's, proactive efforts were being used during lower hazard conditions to prevent large cornices from forming and to keep more terrain open.

By the 80's, in the colder climates, we were attacking the basal layers with boots, skis, and explosives in the early season, before avalanche conditions developed – trying to prevent future deep slab instabilities. An important tool for this strategy is ski stabilization.

Definitions

Ski cutting:

Attempting to cause an avalanche with one's skis. Also used as a stability assessment tool. Requires special skills.

Ill-advised for some terrain:

Larger slidepaths; cliffs below; terrain traps below; potential for victims below.

Ill-advised for some snowpack conditions:

Major storm depositions; hard slab; bed surface at or near the ground (don't get raked over the rocks).

Ski stabilization:

Attempting to increase snowpack stability *before* hazardous conditions develop. Can be conducted by more than one person at a time, due to lack of hazardous snowpack conditions. May or may not prevent/reduce future hazard.

These definitions make ski stabilization sound safer than ski cutting. Most things are safer than ski cutting. But hazards do exist for the ski stabilizer, such as: buried obstacles, sharp rocks, and rusty, early-season skills and conditioning. And there is a gray area between these two activities.

When in doubt, follow procedures for ski cutting: don't go alone; ski one at a time in starting zones; use safe stopping points; don't cross or park above your partner.

Fundamentals

Enough about safety. Avalanche educators tell us that, for a slab avalanche to occur, we need four things: a slope, a slab, a weak layer, and a trigger. The objective of ski stabilization is to prevent avalanches by preventing this set of conditions from developing. More specifically, ski stabilization is an attempt to prevent weak layers or slabs from forming, or to destroy weak layers or slabs in their early stages. The effectiveness of ski stabilization efforts will vary with weak layer properties, slab properties, and terrain properties.

Some of the fundamental conditions and principles that affect these properties are:

- Snowpack stratigraphy
- Basal layer characteristics
- Strong layer development
- Bonds between layers

Weak layer types;
formation, destruction, strength

9

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variations:

- Basal depth hoar layer
- Surface hoar
- Graupel
- Near-surface faceted layers
- Bonds/metamorphism at ice crusts or other layers
- Other low-density layers

Terrain properties:

- Aspect
- Slope angle and shape
- Anchors
- Elevation
- Wind-loading characteristics

Avalanche hazard principles

- Slab characteristics
- Terrain configuration
- Loading rates

Individual skier impacts on snowpack:

- Effects on density
- Age-hardening
- Depth of impact as a function of stratigraphy
- Depth of impact as a function of skier size, equipment, technique

Multiple skier-pass impacts on snowpack:

- Depth of impact variables as above
- Cumulative effect on slab or weak layer is dependent on timing and skier density

When It Works

Ski stabilization is most effective when the skis are able to penetrate the slab or weak layer. This penetration may prevent formation of a continuous slab, or it may create stronger regions due to age-hardening or destruction of weak crystals. The effective timing window may be small. In the case of slab prevention, we may need continuous skiing during the storm or wind-loading event. As the loading progresses, skier passes may change from ski stabilization to ski cutting. In the case of weak layer destruction, we need efforts before the weak layer is buried under a strong enough layer to support the skiers. For surface hoar or near surface faceted layers, this often happens with normal skier traffic between storms. In the case of basal weak layer prevention/strengthening, this means ski traffic in the early season, often in very thin snowpack (Photo 1).

In addition to timing, skier stabilization requires enough passes (skier density) to impact the overall stability of the starting zone. The minimum skier density will vary with snowpack conditions and with terrain characteristics. Obviously, the more passes the better.

When It Doesn't Work

Conversely, ski stabilization is not effective if avalanche hazard has already developed (i.e. rapid loading, midseason backcountry conditions, etc.) or if overlying, supporting layers prevent weak layer impacts. Photo 2 shows a skier who has been jumping on a dense hang-fire slab with little impact on the basal weak layer.

Ski stabilization may also be ineffective if the skier density is too low. I recall a story told by some Aspen Highlands patrollers; they described a few early season ski packing passes visible on the bed surface of a large climax avalanche. In that case, the strengthening effect was not widespread enough to prevent failure.

There will usually be starting zones, or parts of starting zones, that few skiers reach. These may become isolated areas of higher avalanche hazard, and if they are big enough, they may negate the stabilizing effect of adjacent skier traffic.

Strategies

The following strategies will help to maximize the effectiveness of ski stabilization as part of an avalanche control program:

Identify the terrain that needs it.

There are several types of terrain in this category:

- Steep pitches on heavily skied runs. These may present a hazard only in the early season, or in seasons with particularly weak basal layers. They may benefit from early season, basal layer stabilization.
- Worst basal depth hoar areas. These may be rock bands, north aspects, or timbered starting zones.
- "Stubborn angle" starting zones. These may also be areas that only present a hazard in years with particularly weak basal layers. Some attention in the early season, or whenever weak layers are recognized, may prevent avalanche activity on these slopes. Photo 3 shows some of the stubborn angle terrain that gets attention at Bridger Bowl.
- Starting zones that don't get skied by the public. These may be above lift-served areas, above cliff bands without exits, etc. Road cuts or gullies in otherwise non-hazardous terrain. These need attention, especially where they are terrain traps. Photo 4 shows an example of a steep gully in lower intermediate terrain.

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Allocate time and resources for ski stabilization.

- This may be a hard sell for some programs. The critical time is often before ski areas have opened. Management can be reluctant to pay labor costs for high-risk work when the lift ticket money hasn't started rolling in yet.

Enlist the public to help.

- Open terrain early and often. In the early season, post warnings about thin snowpack, and encourage a cautious approach. Keep terrain open when possible during storms to strengthen bonds and break up slabs. Be cautious with this one. Close avalanche terrain early enough to avoid mid-storm rescue efforts in bad visibility.

The Bridger Bowl 2002-2003 Example

At Bridger Bowl, ski stabilization has evolved in two ways. First, early season ski patrol efforts have increased through identification of problem terrain and allocation of resources to attack basal layers; and second, the expert skier/snowboarder population has increased to the point where their constant trampling has reduced the avalanche hazard to a new-snow-only problem for much of the mountain – for most seasons.

In 2002-2003, however, the early season snowpack developed a persistent buried weak layer and overlying supporting layer before we had enough snow to put skiers in the starting zones. This weakness involved a Thanksgiving Day ice crust that persisted through the season and acted as the sliding surface for several avalanche cycles, including widespread natural activity in February throughout the Bridger Range backcountry. Some of these slides were 5 to 10 feet deep. Drought conditions through December and the first half of January kept much of Bridger's avalanche terrain closed to the public and made patrol access difficult – thus limiting ski stabilization efforts. Photos 5 and 6 show some of the conditions we were up against. We still tried to stabilize the problem areas, sometimes substituting explosives to avoid skiing across exposed, rocky areas. Photos 7 and 8 show early January avalanche activity. We also pushed the limit for opening some terrain in thin snow conditions, requesting extra caution from the locals. Photo 9 shows how well that worked.

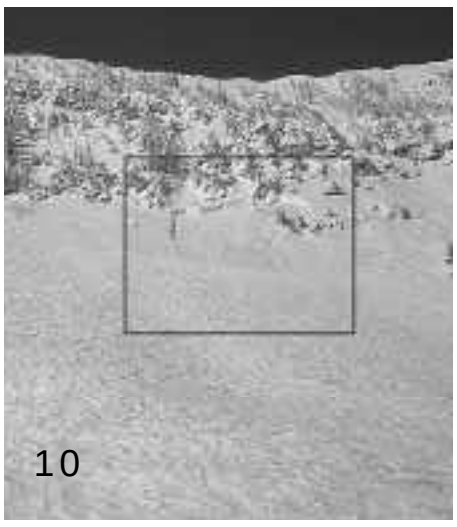
By late January, when enough snow had accumulated for us to move around more easily and to open all of the steep terrain, the weak layer was too deep for much additional ski stabilization. As a result we used large explosives charges after each storm, hoping to impact the weak layer by causing settling – or large avalanches.

On February 10, 2003, after several days of snowfall, we got one. A two-pound charge caused a 7-foot avalanche that ran on the Thanksgiving Day ice crust in an isolated area along the base of a North Bowl cliff band (Photos 10 & 11).

Subsequent efforts with large charges over the next several days produced no additional deep-slab avalanches within the ski area boundaries, despite the spectacular natural activity in the adjacent backcountry. By March, snowpits and ski pole testing were showing a gradual strengthening in most locations, but enough weak areas persisted to keep us concerned. We predicted larger than normal wet slides, if the right isothermal conditions developed. But as of early April, the only additional slides to run on this layer were small pockets released by a snow cat pushing large amounts of snow off the end of a road. Bridger closed on April 6, 2003 without a major wet slide cycle, leaving the late season hikers with the lingering hazard that began back on Thanksgiving.

The 2002-2003 season at Bridger Bowl showed that some years the snowpack is less conducive to ski stabilization efforts. We had to resort to more blasting, more closures, and more worrying about accidents than in the past several years. It was an interesting season, with extra man-hours — and woman-hours — and extra explosives use. We'll be hoping for a return to a stronger, ski stabilized snowpack next year.

Doug Richmond has spent twenty-eight years working for ski areas in California, Colorado, and Montana. He has made both oral and poster presentations at ISSW. He holds an M.S. in Earth Science from Montana State University and is a Professional Member of the AAA. He continues to master the fine art of learning from his mistakes. To that end, Doug has two corrections from his review of the 2002 ISSW in The Avalanche Review *V. 21, Issue 2. For those who are working on the future tools he requested: "sweet spot goggles" should be "stability goggles", and "hexagonal resonator" should be "portable hexagonal resonator".*



Photos Doug Richmond except where noted.

PHOTO 1: Early season ski stabilization effort. *Photographer unknown.*

PHOTO 2: Jumping skier is not impacting the basal weak layer. *Photographer unknown.*

PHOTO 3: Stubborn angle terrain that gets ski stabilization attention at Bridger Bowl

PHOTO 4: Steep gully with terrain trap in lower intermediate terrain

PHOTO 5: Thin snowpack conditions, Bridger Bowl, Dec. 28, 2002

PHOTO 6: Thin snowpack conditions, Bridger Bowl, Jan. 12, 2003

PHOTO 7: Bridger Bowl early season avalanche activity, Jan. 5, 2003

PHOTO 8: Bridger Bowl early season avalanche activity, Jan. 6, 2003

PHOTO 9: Enthusiastic locals stabilizing 12 inches of new on the rocks

PHOTO 10: Seven foot crown under "Kneil's" in the North Bowl, released Feb. 10, 2003

PHOTO 11: Inspecting the Kneil's crown and sliding surface, Feb. 10, 2003. *Photo by Phil Sgamma.*

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Avalanche Incidents in Switzerland in Relation to the Predicted Danger Degree

By Stephan Harvey

Editor's Note: Stephan presented an earlier version of this article at the 2002 International Snow Science Workshop in Penticton, BC.

Abstract: All known avalanche incidents from 1987/88 to 1998/99 (12 years) have been analysed with respect to the scale of avalanche danger of the Swiss avalanche bulletin (European danger scale 1-5). The database contains information of 1800 avalanches causing damage to people and property. 45% of fatal avalanche accidents occurred at danger degree "considerable" (level 3), 30% happened at "moderate" (level 2). The mean size of the spontaneous avalanches causing an incident increases with the danger degree. For degree "low", "moderate" and "considerable" the fracture depth is 50 to 60 cm, for "high" and "very high" the depth is 150 cm. On the other side for human-triggered avalanche accidents, the avalanche size and fracture depth does not depend on the danger degree level. The inclination of the starting zone of these avalanches is 39° for all danger levels except level "low", where it is 41°. At danger level "considerable" 24% of all human-triggered avalanches occur under 35° inclination, at "moderate" there are 18%. Human-triggered avalanche accidents are more or less the same size and occur in similar terrain independent of the avalanche danger degree. Most avalanche accidents on ski tours and most accidents with experienced people occur at level 2 ("moderate"). The largest number of avalanche accidents in out-of-bound terrain (off piste) happens at level 3 ("considerable"). The ratio between the number of injured or killed people to the number of days at which a given danger degree occurred can be used as a "risk index". It turns out to increase exponentially with the danger degree.

Introduction

In the last years an avalanche database was developed at the Swiss Federal Institute for Snow and Avalanche Research (SLF). This unique database contains all known naturally triggered avalanches causing damage over the last 100 years and all human triggered avalanche incidents in backcountry terrain of the last 30 years. It contains totally around 11,000 datasets.

The predicted avalanche danger degree of the Swiss avalanche bulletin published by the Swiss avalanche warning service is also stored over 12 years in a database. This makes all sorts of comparisons possible between avalanche incidents and forecasted danger degree over 12 years (for a description of the danger degrees and products of the Swiss avalanche warning service, see Ammann, 1998). The current study includes partly the same avalanche incidents in controlled and uncontrolled data as in Schweizer et al. (2000) and Tschirky et al. (2000). But for the first time a large data set of terrain could be compared with the predicted avalanche danger degree. In this paper, detailed investigations of recreational avalanche accidents (back country terrain) for each danger degree are presented (Harvey, 2002).

Overview: Avalanche forecast and incidents

During 12 years (1988-1999), for 45% of the days, danger degree 2 (moderate) was predicted, for 30% it was 3 (considerable) (Figure 1).

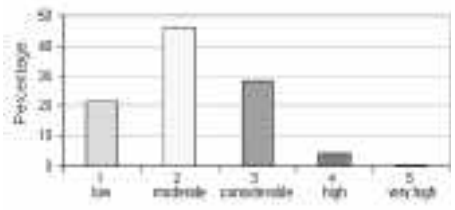

Figure 1: Frequency of the five avalanche danger degrees 1988 to 1999 (12 years).

For statistical evaluation in this study all avalanches causing damage from 1988 to 1999 were analyzed by size. Further, a more detailed analysis was made for recreational avalanche accidents. These include all avalanches where people (skiers, snowboarders, mountaineers…) got caught in backcountry terrain (tours and off-piste). 95% were human, 5% naturally triggered. Typical danger degrees for recreational accidents were level "moderate" and "considerable", whereas all avalanches causing damage to property are settled at danger degrees "considerable", "high" and "very high" (Figure 2).

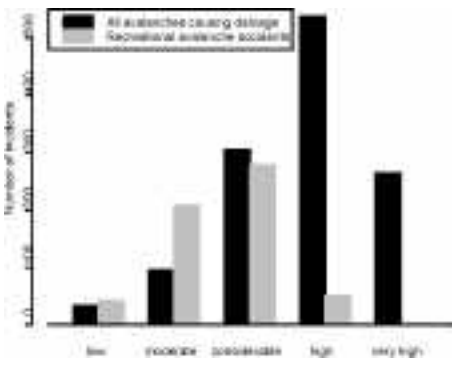

Figure 2: Avalanches causing damage 1988 to 1999 (12 years).

In the period between the winters 1987/88 and 1998/99 23 people were killed yearly by avalanches. In the long-time mean over 63 years the number of fatalities is 25. Since 1987 most fatal avalanche incidents occur at danger degree "considerable" (45%; Figure 3). 87% of the people were killed in backcountry terrain. About 30% of all avalanches causing damage to people are fatal.

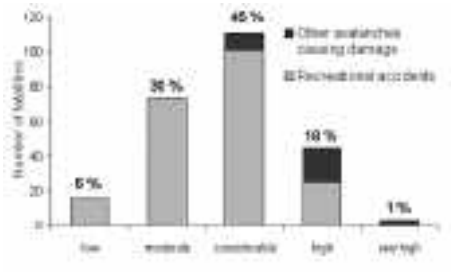

Figure 3: Number of fatalities for each danger degree during the period between the winters 1987/88 and 1998/99. Total number of fatalities during the forecasting periods: 248 (Recreational accidents: 215, others: 33).

Avalanche Size

As shown in Figure 4, the avalanche size of all avalanches incidents increases with the avalanche danger degree. Significant differences of the parameters length, width, and depth of fracture can be found between danger degree "considerable" and "high". For danger degree "high" and "very high" median length is around 1500 m, width around 200 m and depth of fracture 150 cm. At degrees "low" to "considerable" the typical length of avalanche incidents is around 300 m, width around 60 m and fracture depth 50 cm.

The avalanche size of nearly 500 recreational avalanche accidents is different from the size of all avalanches causing damage. Length, width and depth of fracture are practically the same for all danger degrees ("low" to "high"). Median length is about 200 m, width 60 m and depth of fracture 50 cm (Figure 4).

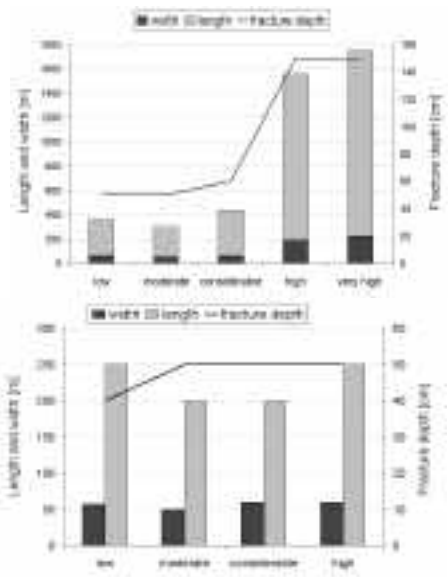

Figure 4: Median size of all avalanches causing damage (top) and of recreational avalanches (bottom) for different danger levels.

The comparison of recreational avalanche accidents with the predicted avalanche danger degree had to be done without danger level "very high" because of insufficient number of accidents. McClung (2000) analysed fatal accidents of a 10-year database with the five-part-public-danger scale and concluded that a four-level danger scale is sufficient for backcountry applications.

582 incidents of recreational avalanche accidents could be analysed with regard to terrain features (aspect, altitude, slope inclination, slope shape).

Aspect and altitude

At all danger degrees recreational accidents occur mostly in northern aspects. The mean altitude of the fracture line drops the higher the danger level gets. At "considerable" the slice of the aspect circle reaches from West over North to Southeast with a mean altitude of 2440 m above see level (a.s.l.). For "moderate" the aspect slice is tinier (mainly Northwest over North to East). The mean altitude a.s.l. is higher and lies at 2560 m (Figure 5).

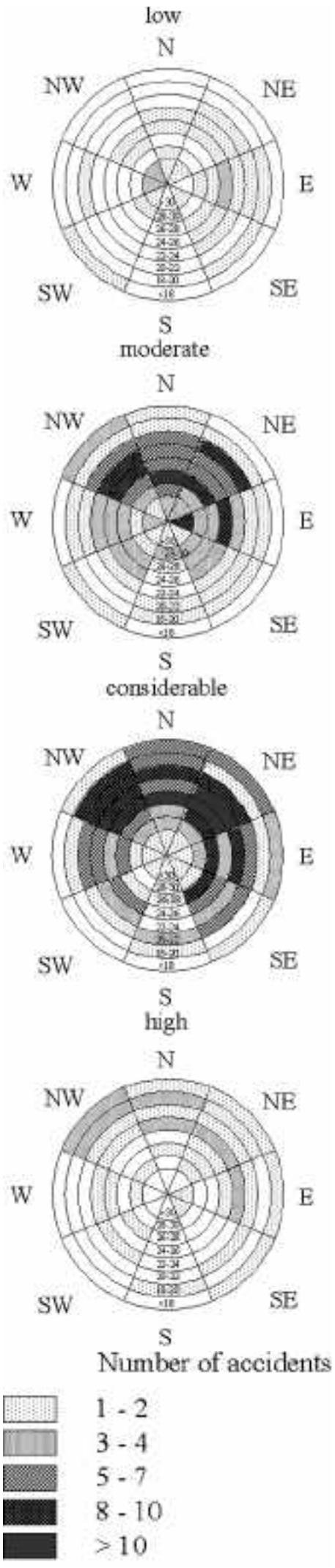

Figure 5: Aspect and altitude for recreational avalanche accident at each danger degree 1988 to 1999 (12 years). (The altitudinal belts are specified in 100 m steps: e.g. 22 correspond to 2200 m a.s.l.). Total number of cases considered: 575

Slope inclination

Slope inclination is an important key parameter for judgement of avalanche danger. As in the studies of Munter (1997), the slope inclination was measured in the steepest part of the slope out of the Swiss topographical map 1:25'000. For danger degrees "moderate", "considerable" and "high" the median inclination is 39°, for "low" it is 41°. At "moderate" danger 18% of recreational avalanche accidents are less steep than 35°, at "considerable" it is 24% (Figure 6).

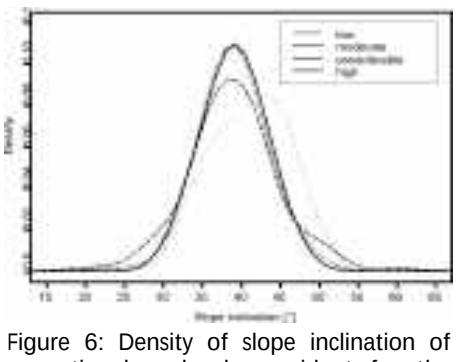

Figure 6: Density of slope inclination of recreational avalanche accident for the avalanche danger degree "low" to "high". The steepest part of the slope of recreational avalanche accidents is for all danger degrees roughly the same. However the trigger probability and the distribution of danger spots are different for each danger degree.

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Slope shape

Recreational avalanche accidents happen in similar slope shapes, independent of the danger degree. About 80% of the terrains are bowls, gullies, rocky terrain (rocks looking out of snow cover) and areas close to ridge top. Only 20% of the accidents happen in open slope terrain without any special features.

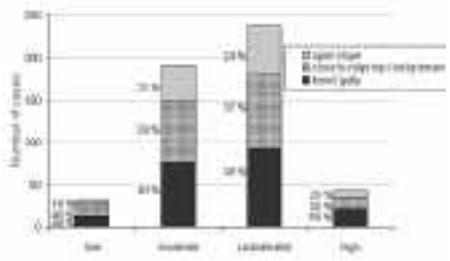

Figure 7: Frequency of slope shapes for each danger degree.

Figure 8: Independent to the danger degree of the avalanche bulletin, all recreational avalanche accidents in Switzerland have similar size and fracture depth, and release on similar slopes concerning aspect, inclination and shape. The only differences among the danger levels are the frequency of accidents and the behavior of people. (Foto: Parsenn Skipatrol Service).

Risk Index

With the division of the number of caught people (Figure 9) by the frequency of the avalanche danger degrees over 12 years (Figure 1) a simple risk index (Engler et al., 2001) was calculated for a probable occurrence for damage to people (Figure 10). For all avalanches causing damage to people the ratio turns out to increase exponentially with the danger degree. The individual risk for a single person at each danger level would be very interesting to know, but for this purpose the number of people in potential avalanche areas would be required.

The risk index for people caught in recreational avalanche accidents was split up in tours and off-piste activities. At "moderate" danger degree most people get caught on ski

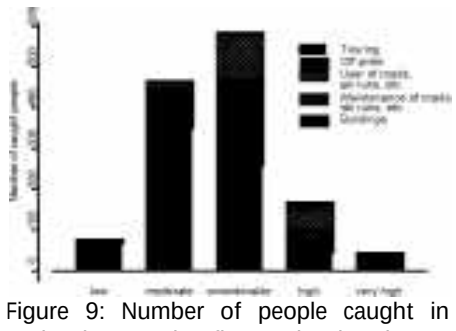

Figure 9: Number of people caught in avalanches at the five avalanche danger degrees over 12 years (dead and survivors). Total number of people caught: 1341.

tours where the majority of off-piste-skiers cause avalanche accidents at level "considerable" (Figure 9). 2/3 of people doing winter sports get caught on ski tours, 1/3 while off-piste-skiing (Signorell, 2001). The risk index for people being caught in backcountry terrain increases exponentially for activities in off-piste terrain, whereas the index for ski touring grows linear (Figure 11). With the actual behaviour of people doing winter sports in backcountry terrain, off-piste-skiing is safer at level "low" and "moderate" than touring. Unfortunately the number of people doing ski tours and off-piste-skiing at the different danger degrees is not available. Therefore the risk index should be understood as an index and not as an individual risk for a single person.

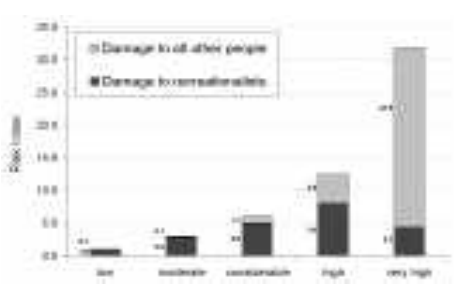

Figure 10: Risk index for the occurrence of damage to people. (Ratio of number of caught people (survived or dead) to frequency of avalanche danger degree).

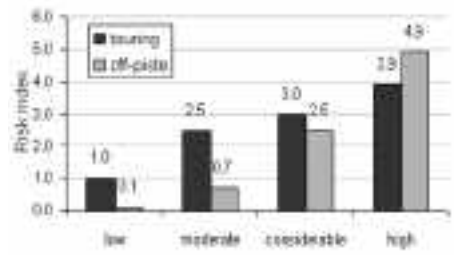

Figure 11: Risk index for damage to people doing winter sport on tours and off-piste. For comparison the touring-risk-index for degree low was set to one and the other indices were adapted accordingly.

Conclusions

Recreational avalanche accidents are, at all avalanche danger levels, very similar in size (length, width and depth of fracture) and in characteristics of terrain (slope inclination, aspect and slope shape). Independently of the danger degree the typical avalanche slope is 35° to 40° steep, northern aspect and bowl-shaped or close to ridge top. Obvious differences between danger degrees occur only in the frequency of accidents and the altitude above see level. Certainly varieties exist for the trigger probability and the behaviour of people in backcountry terrain at each danger degree. But in this investigation these parameters were not available. For this reason we cannot conclude, that steep slopes are the same risk at all danger levels. The following points must be considered:

The steeper a "skiable" slope the higher is the trigger probability for a slab avalanche.

At lower danger degrees the trigger probability for slab avalanches decreases and danger spots are less widespread.

Especially for ski touring at danger degree "moderate" many avalanche accidents happen. The risk index for this category is not much different to the one at degree "considerable". One of the reasons can be a much more careful behaviour at "considerable" than at "moderate", where first of all more people are touring in backcountry terrain and second typical avalanche slopes get touched more often. Furthermore the danger degree "moderate" is very difficult to judge in avalanche terrain and should not be underestimated. Most accidents with experienced people (like mountain guides) happen at this danger level.

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Teton County Articles

Reprinted from the Jackson Hole News&Guide

Introduction by Lynne Wolfe

As Blase and I were planning this issue of TAR back in March, Teton County was in the news yet again for a record number of avalanche accidents and fatalities. The following articles from the *Jackson Hole News & Guide* approached the issues thoughtfully. In the first, Angus Thuermer interviews Bridger-Teton Avalanche Forecaster Bob Comey, and presents us with trends and insights into Teton County's accident types and victims. In the second article, Bill Curran examines an accident and fatality in the Hourglass Couloir at Jackson Hole Mountain Resort. This particular accident account raises issues of transceiver durability and standards.

The *Jackson Hole News & Guide* articles raise a series of troubling questions, and allude to others. And several articles in this issue of TAR also address human behavior, particularly the question of why people make the choices they do in certain situations. What are the shortcuts we make in deciding a slope is safe to ski or ride? Recent research by Ian McCammon and Dale Atkins has examined the shortcuts, or heuristics, that are common threads in avalanche accidents. I hope this research raises awareness of filters such as familiarity, group size, and whether we encounter others in the backcountry. As educators and practitioners, a central question remains: How do we translate that awareness into action? How can the extreme culture that gets caught when conditions are 'considerable" learn to make better decisions?

Thanks to Angus Thuermer and Bill Curran of the Jackson Hole News&Guide for permission to reprint these articles.

Hourglass Couloir, Jackson Hole Ski Area, Wyoming. Photo by Jimmy Hartman

Published 4/1/03

County leads U.S. in avalanche deaths

By Angus M. Thuermer Jr.

A spate of avalanche deaths in Teton County in the last three winters has put this community at the top of the U.S. list of such fatalities, an avalanche forecaster said Monday. Ten people have been killed by avalanches in the county during the last three winters, more than 10 percent of the 94 fatalities in the U.S., according to statistics compiled by federal avalanche centers and this paper. The 10 Teton County deaths during the period represent an unprecedented figure; in the previous decade there was an average of one avalanche death every two winters, according to an analysis by the News & Guide. The tally is significant and worrying, a Jackson Hole avalanche forecaster with the Bridger-Teton National Forest said.

"Our community has certainly established itself as the leader in avalanche fatalities in modern times - the last three years," said forecaster Bob Comey. "It's a very significant statistic and very significant to the community."

A review of the ten deaths and the circumstances surrounding them show several patterns. Victims tended to be young, male, skiers who were in the steep, southern Teton terrain when slide danger was considerable, records show. "That fits all the criteria they teach at the national avalanche school," Comey said. The lesson is that victims tend to be between 20 and 29, male, accomplished skiers with some avalanche education, he said. "Their skiing skills exceed their avalanche skills," he said. Records show that 90 percent of the Teton County victims were men. The average age of those who died was 31.3 years.

Most of the deaths - 70 percent - were in the southern Teton Range. Victims did not have to extend themselves to reach dangerous slopes. Eighty percent of the Teton County victims were within an hour of the trailhead. One was on a full-day trip, another on an overnight excursion. Comey said that points to the easy access in the area. "With Teton Pass, the access from Targhee and Jackson Hole Mountain Resort, you have instant access to very active avalanche terrain," he said. Highway 22 runs over Teton Pass, giving skiers and snowboarders a free lift up more than 2,000 vertical feet to the spine of the range. The two ski resorts have lifts and open-gate policies that allow customers to ski into areas where patrollers do not try to reduce the slide hazard.

Equipment has also contributed to easier access, Comey said. Today, there is "just a tremendous difference in the availability of equipment for non-telemark backcountry skiers," he said. "It's a lot easier for an accomplished Alpine skier to jump into randonee gear and get into this avalanche country from these access points." As few as 10 years ago, backcountry skiers had to learn how to telemark, or ski with a free heel, a process that usually took a period of time and involved learning on shallower slopes. Randonee gear allows the skier's heel to be attached to the ski, giving more control on steeper terrain and in difficult conditions, like heavy or crusted snow.

In 70 percent of the Teton County deaths, terrain was a key factor; the victims were either swept over cliffs, were trapped in gullies or were carried significant vertical distances, approaching 1,000 feet. "I think it's a potential contributor for these incidents being fatalities," Comey said of the terrain. Had the incidents not involved the cliffs, gullies or long falls, some of the victims might have survived, he said.

Records also show that victims ventured out in the face of known danger. The average forecasted slide danger at the time of the 10 deaths was slightly higher than "considerable," a condition when human-triggered avalanches are probable. The scale runs from low to moderate, considerable, high and extreme. "We used to say most people die in moderate hazard," Comey said. "It seems for our community, considerable is when people are getting caught in the modern days. I think that's a trend not only in our little area but in this country." "Are people paying attention to forecast?" Comey asked. "That's a hard thing to gauge. Did they check the forecast before they went? If they did, did they put that into their decision-making process?" Comey said the avalanche hotline - an Internet and phone service available at 733-2664 and jhavalanche.org - had about a quarter of a million contacts this winter, up 39 percent from the winter before, 142 percent from the prior season and 273 percent more than the 1999-2000 winter.

Comey also believes that all the victims, or someone in their parties, triggered the fatal slides. Sixty percent of those who died were skiers, 30 percent snowboarders, and 10 percent snowmobilers. Comey said that did not fit with national or regional trends, with snowmobilers usually accounting for more deaths. But, he said, one doesn't have to expand the sample area far to find an increasing number of snowmobile victims. Forty percent of those killed were solo skiers or snowboarders. Forty percent died of trauma, the rest by suffocation. "I think the 40 percent 'alone' and 40 percent 'trauma' are significant, even though they are not above 50 percent," Comey said. The lessons are obvious; those who go solo can't expect help and even when help is available, it may do no good. "The bottom line is don't get caught," Comey said.

Avalanche deaths in Teton County 2000-2003

Victim	age	activity	danger* (1-5)	terrain** a factor?
2000-01				
Joel Roof	28	snbd	3	yes
Jonathan Beall	29	ski	3	yes
Sarah Campbell	26	ski	4	yes
Ralph Toscano Jr.	43	ski	4	yes
Allen Wagner	24	ski	3	yes
2001-02				
Mike Dollarhide	32	ski	3	no
2002-03				
Tristan Picot	19	snbd	3	yes
Marshall Heverly	44	snomo	3	no
Pavel Volf	27	snbd	2	yes
Steve Haas	41	ski	3	yes

*Danger - BTNF avalanche hazard forecast for the day of the incident. Assumptions supported by records: Pavel Volf died on Jan 27, Mike Dollarhide died on a day of "considerable" danger. Scale 1-low; 2-moderate; 3-considerable; 4-high; 5-extreme.

** Terrain is always a factor in avalanches. To register "yes" as a significant factor, victim had to be swept over a cliff, down a large exposure approaching 1,000 vertical feet, or been buried in a gully terrain trap.

published on 2/19/03

Death starts beacon query:

Skier whose partner died in slide questions standards for transceivers.

By Bill Curran

Avalanche survivor Tom Burlingame says Monday he was "blown away" when he learned his broken transceiver was not built to withstand the impacts of a deadly avalanche. Burlingame survived a 600-foot ride in an avalanche Feb. 10 that killed his ski partner Steve Haas. During the slide Burlingame's transceiver, a device used to locate buried victims who are wearing similar beacons, was smashed by a rock and rendered useless. Burlingame said he was shocked that his beacon was ruined by the slide, but even more surprised to learn of the limited industry standards. Industry representatives confirmed this week that there are no U.S. impact-resistance requirements for avalanche transceivers.

European standards, which many U.S. manufacturers meet and exceed, require only that transceivers survive a one meter drop onto wood or a two-meter drop on compacted sand. Those standards are set by a telecommunications institute that oversees electronic devices like cell phones and radios, not climbing or skiing organizations that are charged with setting standards for Alpine gear like ropes, ice axes and crampons. Industry representatives said they make transceivers tougher than required by the European institute, that Burlingame's experience was unusual, and that constructing transceivers requires a balance to ensure they don't become cumbersome and, as a result, left behind.

Burlingame's education in transceivers came rudely after the avalanche swept Haas and him down Hourglass Couloir in a closed area at Jackson Hole Mountain Resort. Burlingame said he reached for his transceiver to begin a search for Haas, who was buried. But his transceiver, a 2002 Ortovox M2, had been warped by the impact of the slide and reported contradictory information. The high-tech digital beacon indicated Burlingame should switch it to the setting that allows for the greatest range of detection. But it was already at that setting, he said. After a moment of despair, Burlingame abandoned the beacon search and was able to locate and assemble his probe poles. Burlingame, in a state of fear and disbelief, looked for visual clues and deposition areas, he said. He probed in vain for five minutes until another skier arrived on the scene with a functional transceiver. Burlingame and Morgan Wion used Wion's Ortovox F2, an older analog transceiver, to find Haas in about seven minutes. They spent eight to 10 minutes uncovering Haas, who was buried face down with his head downhill. Haas had suffocated under about four feet of snow.

Security blanket

The nine-year veteran of the Tetons and former ski guide compared the realization his beacon was broken to a child waking up without a security blanket. "It was like my blanky, and my blanky didn't work," he said. Burlingame then contacted Ortovox to report the tragedy and the performance of his beacon. Marcus Peterson, general

manager of Ortovox USA, said the transceiver was not manufactured to survive the kind of impacts it suffered when Burlingame was swept over rocks and cliff bands. Ortovox beacons are built to exceed a standard that requires beacons function after being dropped from a height of two meters onto compacted sand, he said. The France-based European Telecommunications Standards Institute states the beacons must be dropped three times onto a different side each time to pass the test, Peterson said.

Durable as a cell phone?

Burlingame, 32, was amazed. "When they told me me the European testing standards, I was absolutely blown away," he said. "It should be able to take a better shot than my average Motorola cell phone."

Peterson declined to say by how much Ortovox exceed the industry standards or what tests beacons pass. "The standard is what it is and our beacons pretty much adhere to that standard and then some," he said. "If I take a beacon and throw it up against a fireplace, it's not going to work."

Bruce Edgerly, co-owner of Backcountry Access Inc., which makes the Tracker DTS beacon, said transceivers should be treated with the same care as a climbing rope. "Your life depends on that thing so you should treat it accordingly," he said. While climbing rope and avalanche beacons are survival gear relied upon by mountaineers, their safety standards are set by vastly different organizations. The International Climbing and Mountaineering Federation, an organization dedicated to Alpine issues and safety, sets thresholds for rope safety. The European Telecommunications Standards Institute, on the other hand, is a technology group. The institute works toward worldwide standardization in telecommunications, broadcasting and information technology.

'Drilled' into rocks

Like many backcountry users, Burlingame incorrectly believed beacons were built to withstand the enormous falls and impacts that avalanches can produce. The last thing he expected to fail him was his transceiver, a fundamental piece of snow country survival gear. "Imagine my shock when I whip it out" to prepare to search for a buried friend, he said. But Peterson is quick to point out the Ortovox did not fail, at least according to industry standards. He would not expect any transceiver to survive the kind of impact that changed Burlingame's life Feb. 10. Burlingame said a wave of snow washed him 100 feet down the couloir and into rocks at the top of a cliff band. He "drilled" the rocks, beacon-first. "The corner of the transceiver took most of the hit," he said. The impact drove the beacon into Burlingame's side, cracking two ribs and tearing the muscle between them. The beacon snagged the rocks, momentarily slowing Burlingame's slide before he plummeted over a 50-foot cliff band. Burlingame said the transceiver's collision with the rock may have slowed him sufficiently to keep him above the rush of snow that buried Haas.

'Secure against accidental knocks'

An Ortovox casing is designed to protect the device against everyday handling, such dropping a beacon when handing to a friend, Peterson said. The Ortovox Web site, www.ortovox.com, describes the M2 casing as "secure against accidental knocks." The European Telecommunications Standards Institute Web site, www.etsi.org, reports a different, though not necessarily more stringent, impact standard than the one cited by Peterson. Beacons must function after being dropped six times on a hard wooden surface from a height of one meter, according to the site. Both standards are insufficient, Burlingame said. "If it can't survive at least a 30-foot fall onto pavement, then don't sell ... them."

But Peterson said bolstering the casing would be expensive. "There has to be a happy medium between strength and cost," Peterson said. "We're not going to do something 20 times the standard if it's going to cost us $30 more at wholesale because nobody will buy the beacons." Peterson said Ortovox focuses on designing "user-friendly" beacons that allow for easier searching rather than making devices bulletproof.

Edgerly said he found the Institute standards "inadequate" when his company entered the beacon market in 1997 with its Tracker DTS. "When we initially designed the Tracker we thought the drop test standard was pretty weak," he said. "I think there's been good progress, but in general they're not stringent." Edgerly said the Tracker, a popular digital beacon and competitor of the Ortovox M2, is designed so it will function after being dropped from two meters onto concrete. The Institute's standards leave room for companies to enter the transceiver market with even more fragile gear. One such company produced an inferior version of an Ortovox beacon, Edgerly said.

Transceivers also are subject to a test to make sure they are waterproof, among other standards. Beacons must transmit during and after a one-hour submersion in 15 cm of water. North American companies do not have to meet the standards set by the Institute, Edgerly said. They only need to produce beacons that transmit at the set frequency of 457 kHz. However, if American companies want to sell their product in Europe they must comply with rules, he said. Since Europe comprises a large percentage of the transceiver market, American companies have a major incentive to meet the European standards.

Fatal 5 minutes?

Transceivers are rarely crushed in slides and when they are, the impact with rocks and general trauma of the slide that breaks the beacon often kills the skier as well, Edgerly said. One-third of avalanche victims are killed by trauma, not suffocation, said Tom Kimbrough, longtime Utah avalanche forecaster and Grand Teton National Park climbing ranger. But Burlingame survived the Feb. 10 slide and his transceiver did not. And the lack of a working transceiver cost Burlingame five precious minutes in his search for Haas. Burlingame is not sure a functional beacon would have saved his "ski mentor." "Even if it had worked, there's not a guarantee I would have been able to get him out," Burlingame said. He said he believes that fate dictated "Steve Haas was supposed to die." However, turning the clock back five minutes would mean Haas would have spent about 15 minutes buried rather than 20. And 15 minutes is a threshold of survival. If found within 15 minutes of burial, there is a 90 percent chance avalanche victims will not suffocate, Kimbrough said. Burlingame said he is certain the transceiver was working before the slide. He and a friend have since tested it, confirming the transceiver no longer functions properly. Skiers set transceivers in broadcast mode when setting out. After an avalanche, searchers switch them to receive to home in on buried victims. The damaged Ortovox turns on and receives a signal, but it reports information inaccurately and inconsistently, Burlingame said. He hid a beacon 10 feet from the Ortovox, which indicated the other transceiver was first 40 meters, then 28 meters and finally 32 meters distant within three minutes.

Broken beacons rare

Several experienced backcountry skiers and avalanche forecasters recalled a few instances in which transceivers were crushed. Mike Keating, who buys transceivers and other hard goods for Teton Mountaineering, said a customer brought in a transceiver with a broken casing last year. But Keating said it look as if a car had been driven over the beacon. "It had definitely been abused," he said. Kimbrough said a "smashed" beacon is mounted on the wall of the Alpine Meadows, Calif., ski patrol cabin. The beacon was crushed in 1982 when an avalanche struck the cabin. "It's kept as a trophy of what can happen to a beacon," he said. Kimbrough said beacons are usually more durable than their owners. "Lots and lots of people are dug out dead with operating beacons," he said. "I consider them pretty darn sturdy, but I don't toss my beacon around either. I'd be interested in knowing what sort of forces Ortovox applies to the beacons." Rod Newcomb, director of Wilson-based American Avalanche Institute, said this is the first incident of beacon breaking of which he is aware. But Newcomb said when evaluating slopes, backcountry skiers should look for the type of rocky, avalanche run-out areas that could break a beacon or kill a skier upon impact. "The way I look at, when you're in avalanche terrain, it's not only if you're going to trigger an avalanche, but what kind of ride are you going to take," he said. Burlingame said such rocky terrain traps are the trademark of backcountry runs in the Tetons.

Wear it well

Keating added, how a skier wears a beacon can affect how the device is protected in a slide. Wearing a transceiver in an armpit, for example, may help protect it in a fall, he said. Burlingame wore his transceiver on his left side and lower back and said he would have worn the beacon in a more protected area if he had known how fragile the equipment is. Keating said the brands carried by Teton Mountaineering are sturdy. "Nobody builds a bad product but this impact issue does have us concerned," he said. All beacons are electronic and hence somewhat sensitive, he said. "It would certainly hold up better than your Walkman if you dropped it," he said. "But a Walkman isn't survival gear." While transceivers rarely break during slides, Keating said customers have brought a wide variety of defective transceivers to his shop looking for information about warranties and how to return them to manufacturers. He said beacon manufacturers, including Ortovox, have an excellent track record of honoring warranties. "But if you're out in the field and need to use it, that doesn't help you," he said.

To protect against this problem, the experts universally advocate testing beacons before every expedition or ski tour to make sure they transmit and receive signals. However sturdy or fragile beacons may be, Kimbrough said backcountry travelers should not consider the protection offered by their transceiver when making terrain decisions. "If you ski something that you wouldn't [normally] ski because you have a beacon, you are making a mistake," he said. "Call the avalanche hotline and listen to what they say, and if things are touchy, be conservative."

The "king" is dead

While Burlingame was shocked at the performance of his transceiver, he said he should not have needed it. "We shouldn't have been there in the first place," he said of avalanche-prone Hourglass Couloir.

Avalanche danger was "considerable" at high elevations on Feb. 10. Burlingame said he arrived at the Mountain Resort about noon, boarded the tram and ran into his old friend Haas. Haas and Burlingame triggered the avalanche at midday in Hourglass Couloir, an in-bounds but closed area north of the Aerial Tram at the Mountain Resort. A snow slab broke and swept the men 600 vertical feet down the long, steep couloir and deposited them in Tensleep Bowl. The skiers were edging their way into position to ski the couloir; neither had begun a descent, Burlingame said. Haas was about 25 feet below his partner when the slab broke above them. Hourglass Couloir is a "very active and dangerous avalanche path," according to the Bridger-Teton Avalanche Center. The slide began at about 10,100 feet above sea level on a wind-loaded northeast-facing slope with a pitch of about 40 degrees. Burlingame, who was not planning on skiing the backcountry on Feb. 10., said he would have skied the couloir even without a transceiver. "I still would have gone over there because I trusted Steve with my life," he said. Haas had skied similar aspects earlier that day, but Burlingame said far more snow had blown into the couloir than the pair expected. "The last thing he said to me was, 'It'll be fine,'" Burlingame said. Haas knew the terrain and had outstanding judgment, but on Feb. 10 friends say he made a mistake. Burlingame said the events leading to his death were driven by something more than bad luck. "It breaks my heart and I really don't think I was supposed to save him." Burlingame said the avalanche felled an unlikely "king" of the Tetons. "Steve was the soul of Jackson, that's all there is to it," he said. "You'd think the king of Jackson Hole would be some cowboy skier, but it was actually some Jewish kid from ... Long Island." Haas's death is the fourth avalanche fatality in Teton County this season and the sixth in Wyoming. One snowboarder died of trauma after a slide left him on the surface. But skier Tony Piva was buried for 12 minutes near Targhee and saved by a Ortovox F1 Focus beacon.

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Homing in on beacon standards: Tests reveal inconsistent performance but do not measure durability of avalanche transceivers.

By Bill Curran

As avalanche survivor Tony Piva lay buried beneath as much as five feet of snow from a slide Dec. 19, he thought of his beacon as a link to life. Knowing he was wearing his Ortovox F1 avalanche transceiver, Piva had faith his friends would dig him from the slide he triggered in the Grand Targhee Ski and Summer Resort backcountry. "I was thinking, 'I've got my transceiver on, they have their transceivers, they'll find me,'" Piva recalled in an interview last week. "That was one reassurance that I had." Piva's ski party initiated a search for their buried friend and, using their beacons, they found and uncovered him in 12 minutes. Piva's transceiver likely saved his life.

It never occurred to the experienced backcountry skier that his link to life might have been snapped by impact during the slide. Piva said his perception of beacons as durable survival gear was turned on its head when he learned of the standards - or in the U.S., the lack thereof - that govern the industry. "What good are they if they can't take a hit?" Piva asked. That lesson crashed into the consciousness of the Jackson Hole skiing community when the death of skier Steve Haas in an avalanche Feb. 10 triggered questions about the durability of beacons, and the forces they are built to withstand. Tom Burlingame, Haas's final ski partner, survived the Feb. 10 slide in a closed area at Jackson Hole Mountain Resort, but his Ortovox M2 transceiver did not. Burlingame lost precious minutes probing in vain for Haas until a third skier with a functional beacon joined the search.

Beacon confirmed broken

Burlingame turned over his transceiver to Marcus Peterson, general manager of Ortovox USA, who confirmed last week the device is not functioning properly. It does not transmit and receives to a range of only about 15 meters, he said. Peterson sent the beacon to Ortovox engineers in Europe so they can

determine the malfunction. Peterson, and independent industry experts, were not surprised the massive impact caused by Burlingame's slide damaged his transceiver.

The France-based European Telecommunications Standards Institute states beacons must function after being dropped six times on a hard wooden surface from a height of one meter, a test designed to mirror everyday handling, not the impacts generative by a massive snow slide. Avalanche professionals question the adequacy of that standard and say most beacon manufacturers build a sturdier product than is necessary to pass the drop test.

While there are no U.S. standards for beacon durability, a representative from Consumer Products Safety Commission said Friday that, as retail products, beacons fall under his federal organization's jurisdiction. The commission, which is reactive in its policy-making, could issue a standard governing beacons. But industry representatives say such regulation would be counter-productive, and companies operating in the U.S. should continue to meet European rules. A smattering of institutes, mostly European, have tested beacons in the last five years for performance as well as comparison as digital technology was introduced into the marketplace. Tests did not measure durability, though they did raise questions about compatibility and range of different brands.

Finally, a retrospective study found beacons aid professionals, such as ski patrollers, in finding victims, but provide no statistical benefit to recreational backcountry enthusiasts. Technology introduced since that 1998 study may date that finding.

American rules?

Mark Ross, spokesman for Consumer Products Safety Commission, said Friday his agency, based outside of Washington, D.C., has the authority to create standards for beacons. Ross said he does not believe the safety commission has yet studied the devices. "But it is something we would be interested in." Ross forwarded the News & Guide report of Feb. 19, "Death starts beacon query," to the commission's Hazards and Compliance group for further consideration. The commission has the power to recall products that it finds to be a danger to consumers, as well as to set minimum safety standards for industry groups. "If there's an across-the-board problem with beacons, that's something we would considering issuing a voluntary standard for," he said. Ross said Hazards and Compliance will determine whether beacons require his organization's oversight. Companies usually comply with voluntary standards, he said. "But even voluntary standards have the power of a recall behind them." The safety group largely relies on consumer complaints and company reports for its information, Ross said. An onslaught of consumer interest spurs the commission to action. While frequently dealing with household goods, such dangerous toys, the commission took part in the recall of a climbing harness in 1998. The group also conducted a comprehensive analysis of the benefits of ski helmets in 1999 and produced the standard that governs bicycle helmets sold in the U.S. The commission is prohibited by law from doing pre-sales testing, Ross said, and is focused on safety, not performance. By contrast, European Telecommunications Standards Institute is a technology group. The institute works toward worldwide standardization in telecommunications, broadcasting and information technology. The safety standards for other alpine survival gear, such as climbing ropes, are set by International Climbing and Mountaineering Federation (known as the UIAA after its French name), an organization dedicated to Alpine issues and safety.

Dangers of over-regulating

Ortovox representative Peterson criticized adding further regulation to the beacon industry. "You put an oversight committee on this, then they start talking about putting unrealistic standards on these things," he said. Peterson said high-trauma incidents, such as the slide that broke Burlingame's beacon, usually are fatal. "If I'm going to get into an avalanche and I'm going to get slapped into a rock band, 99 times out of a 100 it's not going to matter because I'm going to dead," he said. "So why engineer a standard in there that's going to cost money for a standard that doesn't make a lot of sense?"

Trauma kills one-third of avalanche victims.

Peterson said research and development funding would be better spent on making transceivers more intuitive to use and to increase the distance in which they can detect signals. Dale Atkins, longtime forecaster with Colorado Avalanche Information Center, agreed ramping up U.S. beacon regulations would be mistake. "The market is so incredibly small in United States and North America, that [increased oversight] would probably stifle innovation and it would probably increase the costs," he said Monday. The burden of added paperwork and regulation might be too much for the small American market to bear, he said. Rather, European regulations should be revisited and tightened, and U.S. companies should continue to follow those standards, he said. And while Atkins would prefer a "stouter test of the durability," he said sturdier beacons might become cumbersome or pricier, discouraging use. "If it gets too expensive, too big, people won't use it." Edgerly estimates worldwide annual beacon sales at 70,000 units. He said North American sales represents 25 percent of the total or about 17,500.

Packaging engineering Mike Macy, a backcountry skier who lives in Salt Lake City and worked for a year testing the durability of Zip drives, said the current drop test of one meter onto hardwood should be combined with a defunct standard, in which a beacon was dropped two meters onto sand. Macy said the sand drop is a useful measure because sand would lengthen the impact of shock on the electronic components. Sustained shock can be more damaging than a quicker impact, as would occur with wood or concrete. Macy also said a "flat" drop, as is done in the testing, generates forces more powerful than might be apparent to a layperson. After a beacon is dropped, one surface will strike the ground first. The beacon will bounce slightly upon contact, but the internal electronics will still be traveling downward. The result to the components is an impact many times the force of gravity, he said.

'A recovery tool'

Peterson worries focusing on the characteristics of beacons could distract backcountry travelers from more important issues. "I think the real emphasis needs to on using good judgment," Peterson said. "That's where the debate needs to be." Avalanche professionals universally agree the best way to survive an avalanche is to avoid one by sagely selecting terrain. Atkins added beacons often become more of an aid to rescue teams than to victims. "An avalanche beacon is never a guaranteed survival," Atkins said. "All too often, it's sad to say, it has been a recovery tool." Beacons make it easier for search-and-rescue teams to find and extricate bodies from slide debris. The devices make searches faster and hence safer for rescuers. Atkins published a study in 1998 that considered the effectiveness of beacons in helping searches save buried skiers. The study found "few recreationists can use transceivers fast enough to save a life." Out of 60 burials in the United States between 1977 and 1998, ski parties rescued 28 victims using beacons. The other 32 were found dead. Atkins warns that his statistic of 28 saves by beacons in 21 years could be a low estimate. All deaths are reported and investigated but successful saves with beacons are not.

Whether the search parties were comprised of professionals, such as ski patrol, or recreational skiers, proved a deciding factor in survival rates. Professionals, who likely practice more with transceivers, found and uncovered victims in an average of 18.3 minutes and rescued 59 percent of those buried. Recreationists required 32.3 minutes to locate and dig out victims, resulting in a survival rate of 32 percent.

In an earlier study, Atkins determined that searchers without transceivers found 42 percent of victims alive by probing randomly with a probe pole. However, Atkins' study does not contemplate the impact of digital beacons, dubbed user-friendly, on search times. The study used historical data and was published in 1998, just as digital beacons were hitting the market. Digital beacons use a microprocessor to translate signals into distance estimates, which are displayed as numbers on a screen. Some digital beacons also have indicators that point to the transmitting beacon. Older beacons, called analog, indicate distance to a transmitting beacon by the volume of a "beep" emitted by the receiving speaker. Louder beeps indicate that the receiving beacon is drawing closer to the one that is transmitting. Analog beacons also can use lights to indicate the direction of a transmission. Atkins said he expects the new, digital beacons to improve the effectiveness of searches conducted by amateurs. "I think they actually have made a difference," he said. "The success might increase to one in two, but that's still incredibly poor odds on which to risk your life."

Bandwidth vs. range

Backcountry Access Inc., a Boulder, Colo. company, changed the beacon industry when it introduced its Tracker DTS, the first digital transceiver, in 1997. The German company Ortovox and Swiss manufacturer Barryvox since have produced beacons that use digital technology. Those three companies, along with Pieps, an analog beacon, constitute the major players in the beacon industry. Innovation in the beacon market, relatively stagnant for years, spurred a serious of comparison tests for performance but not durability. Francois Sivardiere, director of the French avalanche institute ANENA, stated in a 2001 paper Ortovox beacons transmitted their radio signals outside of the range permitted by European Telecommunications Standards Institute. That group, as well as the Federal Communications Commission in the U.S., requires beacons transmit at a frequency of 457 kHz. The ETSI permits a range of 80 hertz above or below the standard, but at cold temperatures, -4 degrees Fahrenheit, two Ortovox beacons out of four tested transmitted at 105 to 117 hertz below the standard. The study also found Ortovox receivers displayed diminished sensitivity to frequencies ranging from between 50 to 100 hertz below 457 kHz. No standards exist to govern receiver bandwidth.

Ortovox representative Peterson dismissed the study.

"The deviation from the tolerance is really very small," Peterson said. "We're talking about numbers that are really inconsequential to the performance of the beacon and their compatibility with other beacons."

Peterson touted the range of Ortovox beacons, saying they receive signals up to 80 meters. Increased range allows searchers to cover more area in less time when they are first looking for a signal. But Bruce Edgerly, co-owner of Backcountry Access, said long range and wide bandwidth are mutually exclusive. Tracker beacons offer wide bandwidth instead of long range, he said. As such, they ensure reception of other "sick" beacons whose signals may have strayed from the norm. "By allowing a wider assortment of signals into the beacon, we have to clean out more noise," which means less range, he said.

Atkins, in his study, called range a "red herring." It helps professionals search large areas quickly but can actually confuse amateurs who have are challenged to follow a weaker signal for a longer distance.

A December 1998 study by the Swiss Federal Institute for Snow and Avalanche Research determined the Ortovox had an average range of 30 meters versus 20 meters for the Tracker. The Tracker produced the fastest search times in the field study, but the Ortovox was named a better transceiver overall, in part because Ortovox uses a combination of analog and digital technology for searching. The study, which compared digital transceivers to analog, recommended backcountry enthusiasts continue to use analog models, such as the Pieps Opti 4, while manufactures work to correct some imperfections with their new technology. A 1999 field test, by Dr. F. Michael Swangard of the International Commission of Alpine Rescue, found the Ortovox M1 to be the best transceiver. Twenty-one of 25 Canadian ski patrollers preferred the Ortovox while three picked the Tracker. The M1 is the predecessor to the M2, Burlingame's transceiver. They praised the Ortovox for ease of use while criticizing the Tracker for its "difficult" on/off switch. Swangard also wrote the face of the Tracker seemed "vulnerable," but no durability tests were performed.

Self testing

Backcountry Access funds independent testing by TUV, a private company in Germany that test more than 4,000 products. Volker Kron, product service agent, said TUV tests the standards set by European Telecommunications Standards Institute. Tracker met the standards. "Most of [the companies] say they meet the standards, but they don't have a certification body involved," Kron said. "On the other hand, it's okay as long as they work. Testing is pretty expensive." Peterson said Ortovox does not pay for external testing. The company employs three electrical engineer who uphold European and internal standards.

And Peterson iterates Ortovox beacons are durable. He said he tested a transceiver by dropping it from two meters onto concrete and it worked afterward. "We save a lot of people every year with beacons that don't fail," he said. "That never gets written about."

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CROWN PROFILES

Breaking the Chain

By Russ Johnson

Ever since the deaths of Brendan Allan and Bryan Richmond on the backside of KT-22 between Squaw Valley and Alpine Meadows, California, I have been struck by what I call the "chain" of bad decisions that it takes to get caught in an avalanche. I think avalanches are rare enough and there are so many thousands of uneducated backcountry users that simply making one bad decision isn't enough in most cases to get nailed. We usually don't say, "Man, if he had just done this one thing right…" Of course, there is the fatal "last straw," but what about the decisions which led up to it? It usually takes an unbroken chain of bad decisions to arouse the wrath of the dragon.

I use the Allan-Richmond case of Feb. 21, 2001 as example due to my familiarity with it. In that accident, an ongoing storm had deposited 20" of new snow over the previous two days. Temperatures have warmed over the last 24 hours. The Forecast Center rated the hazard as "considerable." The boys, expert racers each 17 years old, decide to go through the closed ski area boundary to ski to Brendan's house on the Alpine Meadows Road, which they have done many times previously. They ski together into the West Gully, a terrain trap with a history of slides onto the Alpine Meadows Road. They trigger a slab in the gully and are buried 3 feet apart and 3 to 4 feet deep. Although they confided to another racer their plan, no one knows they are missing until Bryan doesn't show up at work. The search doesn't begin until the evening.

In this scenario, there are several decisions, any one of which, if decided the other way, would have broken the chain. Now, some of these "decisions," it can be argued, are not decisions at all. They didn't "decide" not to call the Forest Service to get the backcountry hazard forecast. I'm sure it didn't occur to them. But this is 2001, and the information is out there, so not checking this information, I argue, amounts to a decision. So, (1) they decide not to check the backcountry forecast or get any information on hazard. They (2) decide to go into the backcountry during a warming storm. Then, (3) they decide to go through a closed area boundary. But these decisions on their own don't get them killed. They (4) decide not to take any backcountry rescue equipment with them. They (5) decide to ski together, and finally (6) they ski in a gully which is a terrain trap.

It is also true that having rescue equipment with them but doing everything else the same way would not have affected the outcome. But suppose they take all the same decisions except two. They decide to take rescue equipment and they decide not to ski together. The outcome may have been that no one dies. Or forget the rescue equipment, and they just don't ski together. Maybe only one of them dies. Perhaps the only good decision they make is to ski 30' to the left out of the gully. In that case, they are fine even after having made five bad decisions previously. The point is that they only needed to make one good decision out of six to change the outcome.

Besides decisions, there are "contributing factors" in this case as well. The victims are young men – the demographic most likely to be caught in avalanches. They are expert skiers; therefore the terrain is anything but intimidating and may seem barely steep enough to slide, although the top of the gully is 40 degrees and the main slide path goes 38 to 35 degrees. They are very familiar with the terrain, having skied this route many times in the past, so again, they have no hesitation to ski it. And they are buddies so their camaraderie and perhaps competitive spirit drives them to ski right together.

These classic contributing factors along with an unbroken chain of bad decisions led the boys to a tragic end. I'm not arguing that accidents haven't happened even though a group or individual did everything right or perhaps just made one mistake. But, in general, as I look through The Snowy Torrents and at the recent accidents on the web, I am struck that very few appear to be in the "only one mistake" category. In the avalanche classes I have taught this year, I have tried to emphasize that among the things people should take away are enough good decision making skills to avoid a chain of bad decisions. They need to break the chain; they need to make the one good choice that diverts their fate away from tragedy.

Russ Johnson is President of the AAA and has been Squaw Valley's avalanche forecaster since1993.

Photos by Glen Baker
Searchers in the long, steep West Gully on a second rescue several days after the Allan-Richmond accident of Feb. 21, 2001

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The Avalanche Cycle of January 26-30, 1957 at Wolf Creek Pass, Colorado

By Mark Mueller

Introduction:
Wolf Creek Pass in the East San Juan Mountains of Colorado is known for deep snowfalls. A major east-west highway, U. S. Highway 160, crosses the Continental Divide here. Efforts to keep the highway open year-round began in 1934. The storm of late January 1957 may have produced the most severe avalanche cycle on record that Wolf Creek Pass has seen. This report will attempt to look at some factors that made this avalanche cycle so severe.

Weather Summary:
Weather data for this report was collected from the Colorado Climate Data Center (CCDC) and articles from the *Pagosa Springs Sun*. Avalanche data is collected from the Westwide Avalanche Network (WWAN). The early months of the winter of 1956/57 were dry. Precipitation in Pagosa Springs was measured at .24" in November (1.54" average) and .46" in December (1.81" average). Early in January, winter finally arrived when a storm deposited 6 feet of snow at the Pass. Avalanche data from this storm is limited, with only two slides recorded in WWAN data. The *Pagosa Springs Sun* states, Jan. 10, 1957, "The storm on the Pass was marked by high winds, lots of snow, and some rain. The snow was exceedingly wet (18" with 2.77" Hnw on 1/9, CCDC data) and most of the slides on the west side of the pass went down Tuesday and Tuesday night." the same article states that in Pagosa Springs, "…better than one foot of new snow fell and in addition it rained most of the day Tuesday."

Another storm hit the area two weeks later, leaving one foot of snow in town and two feet at the pass. They had barely gotten this storm cleaned up (avalanching to the highway was not reported) when a bigger storm hit. Snowfall began January 24 and continued through January 30. Avalanching was again widespread, and this time a less obvious avalanche path ran big with near fatal consequences.

The Colorado Highway Department staffed a maintenance facility (The Camp) four miles west of the summit with some homes at the site of the present day upper runaway truck ramp. Two families and 3 to 4 additional men lived there. Weather data was collected at this site from the late 1930s into the early 1970s.

January, 1957 is the snowiest month on record in Pagosa Springs with 109" of snowfall and January 26th, 1957 is the snowiest day on record.

Avalanche Activity:
Twenty-two avalanches reached the highway during this storm cycle according to WWAN records. Two are recorded as Class 5, the largest size classification and the only two Class 5 avalanches recorded in 50 years of record keeping. Several are identified as "Unknown" and several known paths are recorded as reaching the road more than once during the cycle. On January 31, 1957, the *Pagosa Springs Sun* reported, "every known slide, and a few new ones, has come down." The article goes on to say, "the road on the Pass from the top down on this (west) side is practically one continuous slide. There are many slides that are at least thirty feet deep and chock full of rocks, trees, and other debris." WWAN avalanche data reports nearly 15,000 feet of the highway covered with debris from this cycle, almost twice the next greatest amount. In my personal experience during the last decade, 1,000 to 2,000 feet of the highway covered by debris would be considered a big avalanche cycle.

The Camp Slide on the morning of January 27th buried much of the snow removal equipment and the fuel storage shed. With no equipment and little fuel, plows from the east side of the pass had to work their way down the west side in order to dig out the camp and its equipment so that snow removal could continue. The highway remained closed until early February.

The Camp Slide is classified as having an "erratic" return interval (Frutiger 1962), with a slide affecting the highway every ten to twenty years. The starting zone at 11,600 feet has a southerly aspect and the predominant southwesterly wind flow during storms can erode snow from the starting zone as well as deposit it. The starting zone and track are moderately treed and an initiation point is not obvious. The avalanche path descends more treed terrain, enters a gully, turns slightly to the left, continues over a small waterfall, across the site of the former camp and onto the highway at 9400'. Active avalanche control is only attempted here when helicopter delivered charges are used. The target is not visible from either howitzer firing position. The launcher could be used, but it is thought that the small warhead is not sufficient to be effective and as mentioned above, an obvious initiation point to target is not obvious.

Camp slide: Diagram of Camp Slide path and US Highway 160, Wolf Creek Pass, CO. From the CAIC/CDOT Highway Avalanche Atlas. Photos by Ernest Yamaguchi

Weather Data from West Side Camp, 9400'				
	1/24	1/25	1/26	1/27
Snowfall	4"	12"	14"	Weather data not available due to avalanche overrunning the Camp
Precip	.23"	.62"	1.14"	
Density	5.8%	5.2%	8.1%	
Max Temp	19	19	24	
Min Temp	4	3	14	

*Note the increasing density and air temperature as the storm progresses.

Weather Data from Pagosa Springs, 7200'						
	1/24	1/25	1/26	1/27	1/28	1/29
Snowfall	4"	6"	22"	18"	6"	4"
Precip	.15"	.22"	1.39"	1.58"	.32"	.10"
Density	3.8%	3.7%	6.3%	8.8%	5.3%	2.5%
Max Temp	35	33	33	35	28	29
Min Temp	2	20	25	29	19	7

*Note the increasing snow density and air temperature as the storm progresses.

In the early morning darkness of January 27, 1957, the Camp Slide ran, damaged a house, buried some equipment, and buried a highway worker, Ira Longwell. He was found quickly with just his fingers sticking out of the snow, uninjured but shaken. Reported total snowfall amounts with this storm were in the 12-15 foot range. Avalanche debris was reported 30 feet deep in the front yard of Camp and on the highway. A photo from the *Pagosa Springs Sun* shows a truly impressive pile of avalanche debris.

The Camp Slide has reached the highway on only one other recorded occasion, January 19, 1979 (a record snow year at Wolf Creek). In this case, 36" of light density snow (4.6%) was followed by only 10" of denser snow (9.1%), a known recipe for avalanche activity. In January 1997, another big storm hit the San Juans. Seventy-three inches of snowfall in 88 hours was measured at the summit. The ski area recorded eighty-five inches of snowfall. I measured forty-eight inches of snowfall at my house in Pagosa Springs (compare this to the 60" recorded in Pagosa in 1957). The Camp Slide ran big again. The debris stopped several hundred feet before the highway at the waterfall (you can see this small waterfall from the highway).

Summary:
From the *Pagosa Springs Sun* of 1/31/57, "This is one of the heaviest snow storms in a like period of time for a great many years. The last years that we had heavy snows were in 1948-49 and 1951-52….., but neither of these years resulted in so great a fall of snow or moisture content in such a short period of time."

Over several recent winters, an analysis of highway avalanche activity was undertaken by this forecaster, resulting in several published papers (Mueller, 1998 and 2000) and one unpublished paper. It was found that the new snowfall density measured before and during storms could assist in making highway avalanche hazard evaluation and decision making. An increase in new snow density during a storm or increased snow density from one storm to the next could be taken as an indicator that avalanche activity threatening the highway could be expected. The weather data above would support that observation. New snow densities increased as the storm progressed, and maximum and minimum temperatures also increased as the storm continued as measured at both sites. An increase in air temperature is usually accompanied by an increase in snowfall density. Another important observation from the newspaper articles and the weather data indicated the presence of very heavy snow and/or rainfall. On several occasions in my experience, during major snowstorms snowfall turned to rain in Pagosa Springs. Serious avalanching on the Pass soon followed, resulting in closure of the highway. This pattern occurred in February of 1993 and March of 1995.

The reason the Camp Slide was so large in 1957 may be attributed to the large amounts of new snowfall and the increase in snow density and air temperature. With the erratic return interval for the Camp Slide, it may be assumed that when the Camp Slide runs, it runs big. This has been my limited experience with this erratic slide path over the last decade. With limited natural activity, snow may build up here without sliding more often than other nearby paths that are active more frequently. A bigger stress may be required at this site. When it does slide, there is often more snow involved which contributes to the increased mass necessary to support avalanche flows to the highway.

My hope is that these investigations will aid future highway avalanche forecasters at Wolf Creek Pass. In closing, I would like to suggest to any future forecaster here to be attentive to air temperature and snow density trends during storms. Often highway forecasting decisions have to be made when visibility is limited or non-existent and access to the starting zones virtually impossible. Although avalanche forecasting does not often lend itself to easy explanations or generalizations, it has been my experience that successful avalanche forecasting decisions can be used with these data.


Nearly buried residences and stranded travelers at The Camp, Wolf Creek Pass, January, 1957.

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Happy Top Avalanche Case Study

By Don Sharaf

One of the biggest lessons that I have learned from skiing and mountaineering is that no matter how well you study the snow, you will encounter surprises. Two springs ago, when I was avalanche forecasting and guiding for Valdez Heli-Ski Guides, I had a close call with what I consider an unpredictable avalanche or the "one percent" that fall outside the fold of avalanche prediction. Looking back, I can see several contributory factors to this avalanche, but I would be hard pressed to predict a similar event even now.

Weather and Avalanche History

The winter of 1999/2000 was an especially wet one for the Chugach Mountains. It started warm and wet, and there were several occasions where rain extended to the upper elevations of the range around Girdwood. January and February had fairly continuous snowfall. Alyeska ski area is the only consistent, winter-long alpine information for the range, so observations for the Thompson Pass area are fairly limited above 2600 feet. When the guides started arriving for the season (late February/early March), they remarked that the runs were filled in better than they had seen in the previous eight years. Early season 'recon' showed little evidence of deep instability in the pits and on the peaks. The one exception was the 53° face of Pyramid Peak, where there was an old, 3-meter tall crown face well above the bergschrund (see photo #1). In mid-February, high pressure built up in the northern interior of Alaska, producing the dreaded outflow winds that turn hero powder into boilerplate in the matter of two days. On March 19th, a pilot noticed a large slab on Happy Top Mountain had avalanched down to the neve and white ice on the glacier. Flying out to investigate, we saw that the slope had failed with comparatively little loading (other than some cross loading from the side). We classified it as a HS-N-3.5 with an average crown depth of only 35 cm but increasing to one area of 5 meters in depth. The avalanche was the only deep avalanche that we saw for the months of March and April, excluding the avalanche to which I'm leading.

Following the comparatively short hard slab cycle on the newly transported wind slabs, we returned to a series of small storms with clear periods in between. Numerous soft slabs ran naturally, and skiers triggered a few others, but none were much deeper than the new storm snow. On April 7th, we skied the East Shoulder of Happy Top for the first time with two groups of five people. The bergschrund at the top of the glacier was filled in, and it had good stability and great snow. Other parties subsequently skied the run on the 13th and the 23rd with nothing more than surface sluffing in the new snow.

April 28th 2000: We left our morning guides meeting with an overall stability rating of good, but with caution for weakening cornices and warming south aspects. Throughout the day, we had excellent skiing on 40-50 degree terrain with limited sluffing and no signs of instability. Four groups had skied off the East Shoulder LZ of Happy Top prior to my arrival. The last group had skied the same run I was planning to ski just 30 minutes prior to my arrival. As it turned out, I left my extra radio on the seat in the helicopter, so I asked my clients to ski down to an area 100 feet down from the LZ where I said I would meet them once I got the radio from the next group who were following us in. They did so, stopping at a point where the slope angle was only 30°. Once the ship landed, I got the radio and started down slope to the spot where my clients were waiting. When I was 3 meters away from them, a crown formed right at their feet and the whole slope started pulling away. Two clients stepped off the slab, while a third scrambled six feet to step off the carpet as it slowly accelerated.

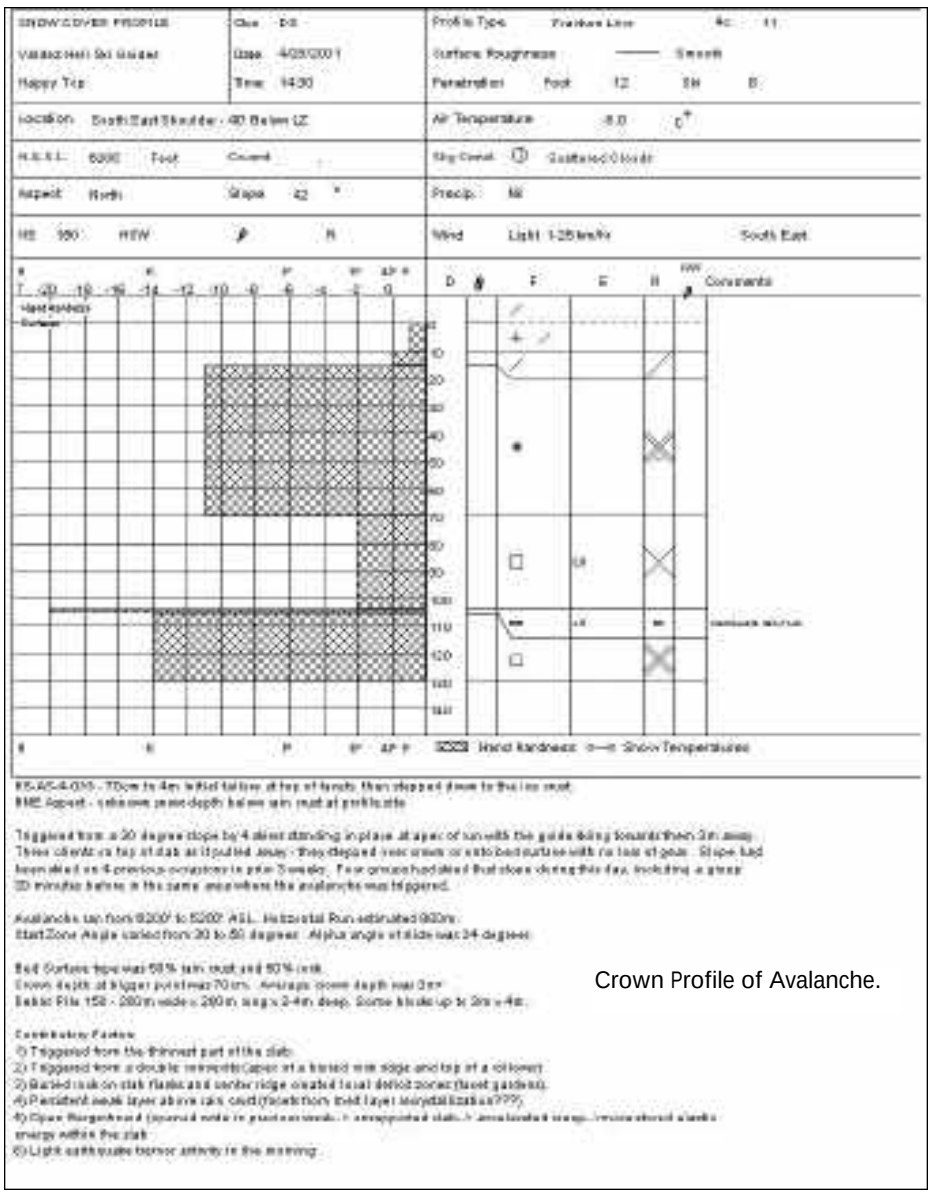
3-meter crown on Pyramid Peak. Photo by Don Sharaf.

Once I knew everybody was all right, I watched the show as a size 4 (Canadian Sizing) avalanche rumbled down the slope and onto the glacier below.

Analysis

The crown depth was 70cm to 4 meters, and the average was between 3 and 4 meters. The trigger point was the thinnest part of the crown at the apex of a ridge where the slope rolled over into the main part of the run. The slope angle at the trigger point was just under 30 degrees and the slope below averaged in the mid-40's. The avalanche ran from 6200 feet to 5200 feet ASL. Horizontal Run 800 meters. Start Zone Angle varied from 30 to 50 degrees, and the alpha angle of the slide was 24 degrees. The slope faced NNE and had not started receiving sun during the season, so the snowpack on the slope was still relatively cold at the time of fracture. Air temperature was well below freezing throughout the day and was not significantly warmer than in previous days.

I classified the avalanche as HS-AS-4-O/G (using the Canadian Size Scale) and the bed surface type was 50% rain crust and 50% rock. The debris pile was 150 - 200m wide x 200m long x 2-4m deep. Some blocks were up to 3m x 4m in surface area.



Crown Profile of Avalanche.

Contributory Factors

1) Triggered from the thinnest part of the slab.
2) Triggered from a double convexity (apex of a buried rock ridge and top of a rollover).
3) Buried rock on slab flanks and center ridge created local weak zones (facet gardens).
4) Persistent weak layer above rain crust is a weak snow structure especially when it lies within a meter of the surface. Four out of five lemons if you look at the research done by Ian McCammon and Jurg Schweizer.
5) The bergschrund had opened wide in the previous week. It seems as though that would take some of the compressional support away at the bottom of the slab and may have accelerated creep and created more stored elastic energy within the slab. While this is pure conjecture, it is one of the lessons that I am taking away from this one.
6) Light earthquake tremor activity in the morning. I followed up on this rumor and found that there were a few tremors, but nothing out of the ordinary. Seismic activity is a factor very few people consider when making avalanche stability assessments, but can play a huge role when there is significant activity.

Lessons

- We are very small and the mountains are very big.
- No matter how aware you feel you are of the general stability patterns, there are always surprises.
- Deep persistent instabilities need to be examined carefully and considered for a long time in your stability assessments.
- Supported slabs can lose their support in some cases (e.g.

opening bergschrunds).

- Realistic safe zones for size 3+ avalanches are a long, long way away from the slope.
- Fatter parts of the snowpack are often far stronger than thinner areas – starting the run from the ridgecrest was probably biggest factor in triggering this slab. Two people had stood at the trigger point two hours before, but our group of five was too much at this one thin location.

I hope you learn from this avalanche as I did. While there are some interesting mechanics to the triggering, the biggest thing I learned was humility.

Safe travels.

***Don Sharaf** has taught avalanche courses for the American Avalanche Institute for 7 years and has worked as a Senior Winter and Mountaineering Instructor for the National Outdoor Leadership School (NOLS) for 11 years. Currently he splits his time between avalanche education, bending nails, and guiding/forecasting for Valdez Heli-Ski Guides in Alaska.*

Debris detail - the largest chunks were the size of an A-Star Helicopter. Photo by Jeff Conaway.

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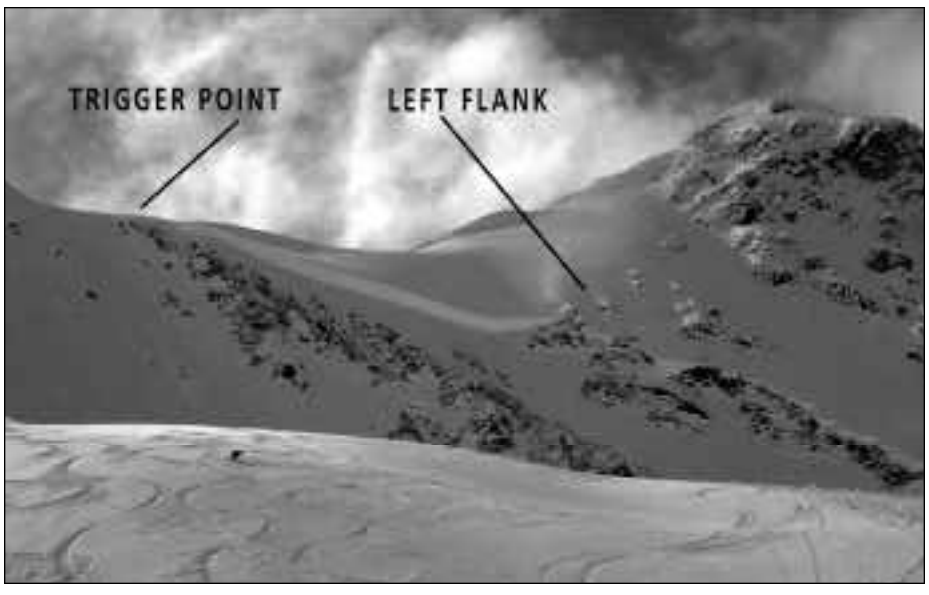
Crown: Double overhead... Yikes! Photo by Jeff Conaway.

View from toe of debris looking back at the SE Shoulder of Happy Top. Photo by Jeff Conaway.

Debris and Crown. Photo by Jeff Conaway.



Crown and Flanks. Photo by Jeff Conaway.

View of the Southeast Shoulder of Happy Top, 2003 season. The diagonal rock ridge that was the apex of the crown was mostly buried in 2001 before the avalanche. Photo by Don Sharaf.

Continued from cover.

André Roch listed his beginnings as taking part in ski competitions every weekend and climbing mountains during vacations while studying in Zurich. After failing his exams at Zurich, he left for Corvallis and OSU to study engineering. Upon completing his studies there, he spent a winter at Government Camp on Mt. Hood before returning to Geneva. While in Oregon, he climbed Hood four times, and is credited with the first ski ascent and descent of the mountain.

In 1934, he completed a ski ascent of the southeast summit of Baltoro Kangri (7250 meters) on an expedition with Norman Dyhrenfurth. In 1936, he was summoned to Aspen, Colorado for what would become one of his most publicized accomplishments: evaluating the terrain for a ski area to compete with Sun Valley for Ted Ryan and Billy Fiske. His report suggested the Ashcroft area on the east and north slopes of Mt. Hayden as the most suitable, Snowmass as second choice, and as a third possibility the north facing slopes directly south of Aspen. Before he left the area, he organized clearing the steepest slope above Aspen, which was christened "Roch Run."

At the beginning of WWII, he was engaged as an instructor of avalanche courses for officers of the alpine troops in Switzerland. He described the adventures as resulting in "a certain amount of experience." After two years of military life, he was offered a post at the Federal Institute for Research into Snow and Avalanches. One of the responsibilities of the group he oversaw was the investigation of insufficient or defective snow protection devices.

André Roch worked on countless avalanche protection projects in the Alps, Lebanon, and Iran; he described the work he was most proud of as the blasting of a gully at the upper end of the Brembana valley, the source of Pellegrino mineral water. Here a rocky promontory was removed to allow an avalanche to shoot straight down a valley without continuing to endanger the community.

One of Roch's contributions to snow science included comparing the shear resistance of the weakest layer with the tension along the slope caused by the weight of the snow above the layer. The result provided for the first time what has come to be known as the "stability index." To do this comparison, he developed the shear frame and took measurements at the fracture line of slab avalanches. All but 3 of 35 slab avalanches had a stability index greater than 1. This seemingly contrary indication of stable snow pushed him further to elaborate a theory on how avalanches are triggered. "In order for an avalanche to start, either the resistance of the weakest layer must diminish to become less than the tension, or the tension must overtake the resistance until the weakest layer ruptures."

The Great Western Ski Area Excursion

During the 1940's a New York man lost three friends in an avalanche east of Aspen. His determination to prevent future tragedies led the Forest Service to seek expert advice. The expert they invited to the USA to advise ski patrols on how to avoid avalanche accidents was André Roch. The National Ski Patrol System sponsored the trip.

Information about this trip comes from the report published by the Federal Institute for Research on Snow and Avalanches. The trip represented a watershed moment for the North American study of avalanches. Roch visited sixteen ski areas: Berthoud Pass, Loveland Pass, Arapaho Basin, Aspen Ashcroft, Mineral King, Squaw Valley, Sugar Bowl, Mt. Rose, Mt. Hood, Mt. Baker, Stevens Pass, Snoqualmie Pass, Alta, Brighton, and Snow Basin. Over the course of his visit, he gave ten lectures to 500 people on snow craft and avalanches as well as three courses, one each at Aspen, Alta, and Berthoud Pass.

While at Berthoud Pass he recommended avalanche advisories to be issued to the public, use of ram profiles, and creation of avalanche maps. At Aspen, he recommended one person be responsible for opening and closing the runs and if this person were absent, another should automatically take his place. He also recommended the patrol change from rebar to oval tubing for avalanche probes and at least one avalanche dog be available.

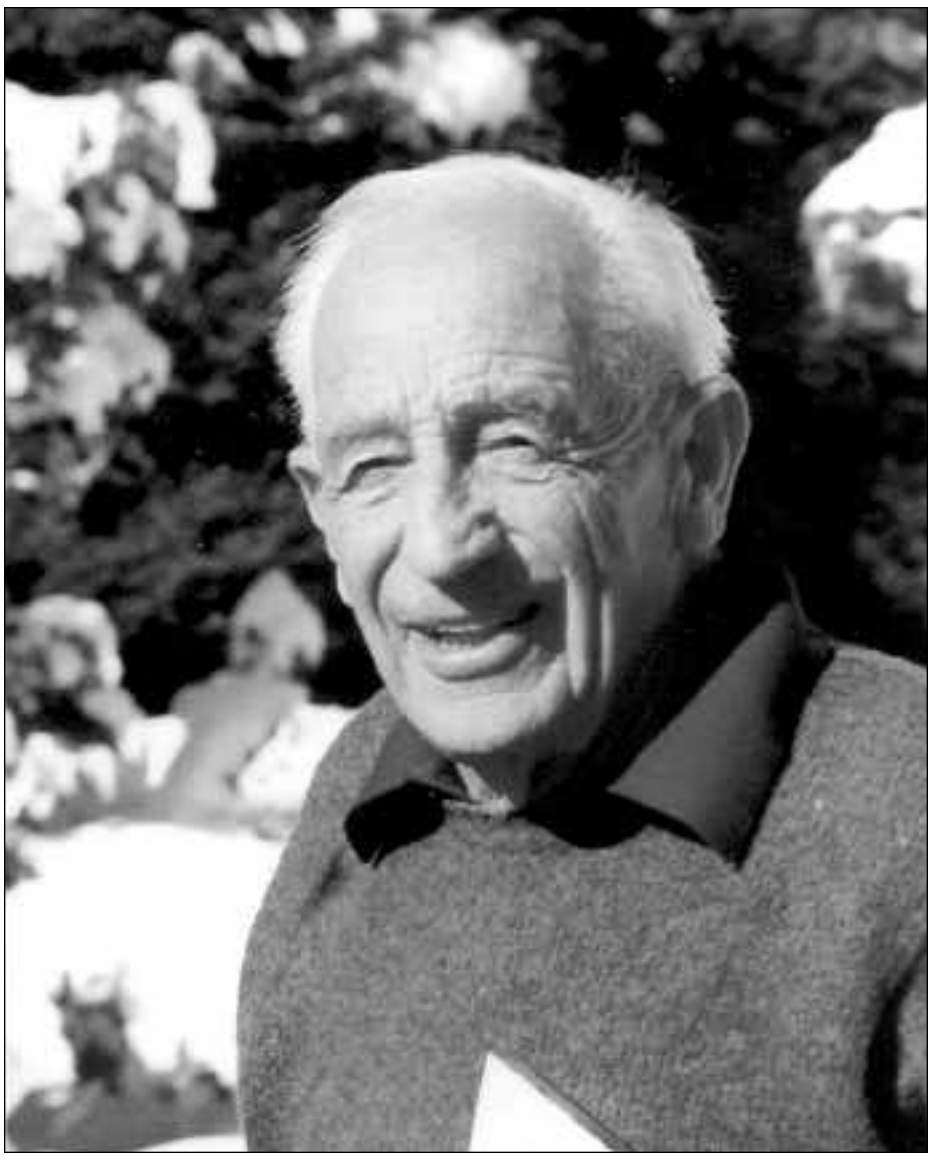
He avoided the politics of Mineral King by only describing avalanches. He outlined the route and shedding that would be optimal for access to the proposed ski area. He stated all ski runs there would be exposed to avalanches. Roch described Squaw Valley as the best skiing place in California. Here he recommended a double chair lift to accommodate the weekend crowds. Though he stated avalanche danger existed there, it was thought to be rare because the snow does not develop unstable conditions. Sugar Bowl had no avalanche problem in his observation.

He did not see Mt Hood an area of avalanche danger except under the most extreme conditions. This was not the case at Mt. Baker, where he stated the area very good for spring touring but very restricted for safe winter skiing. Here he said conditions should be posted, as they exist and that it was too risky to forecast dangerous avalanche conditions there. He also recommended a rescue team be trained and a dog always available. The only danger he saw at Stevens Pass was an avalanche threatening the Constam T bar; here he recommended a retaining structure in the starting zone. Snoqualmie Pass's main problem was an avalanche threatening the road.

Roch was both praiseful and critical of the avalanche situation at Alta. He described the avalanche problem there being the most important of all the places he visited, and the persons in charge being the most experienced in the U.S. But he also stated "however, some of the conclusions are rather erroneous because they are not based on the scientific explanation of the occurring phenomenon…Even if science does not replace experience, it explains the phenomenon and allows [one] to judge correctly." His largest concern was seemingly the lack of use or appreciation of the Ram penetrometer. The problem at Alta was two parts, the ski area and the road. He recognized the responsibility to open or close a run of a sole person not involved with the lodge or chairlift as critical and absolutely right. He felt help from the patrolmen would open the ski area quicker and that the only safe protection for the road was to build at least two snow sheds. He saw that every area for parking or building was susceptible to large, low frequency avalanches and should be built with protection.

In conclusion, he said that like the Alps, it did not seem possible to avoid the danger of avalanches, and this danger must be faced in the most efficient way. He left a library of slides and literature to help with the education of patrolmen, forestry men, and skiers. And in the last segment of the report he gave the U.S. avalanche community a fundamental concept of three primary avalanche climate zones within the western states.

In 1985 he returned to the U.S. to serve as an expert witness in the Alpine Meadows trial.



Andre Roch in Aspen, Colorado, 1984

Pictured left to right are Peter Lev, Andre' Roch and Bob Bates. Boston 1980.

Andre climbing the Sciahorn near Davos, 1951.

Quotable Roch

Other writings include an excellent article for *The Avalanche Review* in 1989 entitled "The Avalanche will Always Trick Us." Here he related a number of stories, among them an incident in which his son was caught in a slide and André is attributed with the saying "*the avalanche does not care you are an expert*."

Remembrances by Colleagues and Friends

André Roch made a profound influence on avalanche science and safety both here and in Europe. He cites many of the pioneers in the field as friends. I contacted them to garner their stories of André. Their admiration of him is evident in their words, and I am very grateful they have shared them with the snow community. I've paraphrased or quoted those communications below.

Andre & Mrs. Roch, Davos, 1965.

John Montagne: Dr. Montagne described attending a meeting in Davos during the early 1960s with Charles Bradley. There, Marcel de Quervin and André kindly showed them the installation of the avalanche warning systems at the Weisfluchjoch. They continued the day, hiking down to Davos for dinner with André and his wife at their home. This meeting was the beginning of a long friendship between John and André. André provided many illustrations and comments in response to John's work on snow cornices and their control. Following the 1984 ISSW in Aspen, John drove André north through Wyoming to Bozeman, where he gave presentations to the Montana State University and Bridger Bowl groups.

André was a skilled landscape painter with an interest in alpine mountain scenes. A painting of the Matterhorn by Roch proudly hangs in the Montagne dining room. Dr. Montagne offered in closing, "André was one of those fine people who devoted his life to service to others, and whose friendship was a guarantee for all time.

Peter Schaerer: André lived at Davos where the ski run from the avalanche research institute at Weissfluhjoch ended. Often, after skiing to the valley from work, he invited his co-workers for afternoon tea and pleasant discussions.

André Roch demonstrated his feel for snow stability in an avalanche course in Switzerland. Several groups of students with staff members of the avalanche research institute as leaders toured the area and attempted to start avalanches with hand charges. The group with André was the only one who found an unstable slope and was able to release an avalanche. At another time, he had carefully selected a slope for filming an avalanche. While André waited with the camera at the bottom, we treated the slope with two hand charges and ski cutting without success. Only when I skied across in the middle, did the snow slide. André had already packed up the camera when the avalanche occurred, but at least his evaluation of snow stability proved to be correct.

Numerous ideas appeared from André Roch's brain. At a meeting of the International Commission of Alpine Rescue, he suggested that, rather than developing means for finding people buried in avalanches, we should prevent burial by lifting people with a balloon before they are buried. The idea initiated the development of the avalanche rescue balloon. At a later meeting, he proposed that dogs should be trained in finding buried persons with a rescue transceiver, because dogs can move across avalanche deposits quicker than men can. The dog handlers, however, found it difficult to train dogs from using their nose to the use of ears.

André was a person with many talents. He was not only a competent mountaineer in the Alps and in the Himalayas and a researcher and engineer for avalanche control, but he was also an educator, painter, photographer, and a sociable host. He made his knowledge available generously, including telling stories about unfortunate experiences with avalanches. He gave unselfishly to friends his paintings of mountain scenarios. We are happy that André Roch reached an old age and was able to contribute so much to avalanche safety.

Andre in Ponte Sieve, 1951.

Dave McClung: André Roch entered his career of 25 years at the EISLF from the perspective of an extensive background in skiing and mountaineering. During the 1930's and 40's he was one of the leading climbers of his day. He made numerous first ascents in the Alps and on expeditions which included: 5 major expeditions to the Himalaya, several expeditions to Greenland and the second ascent of Mt. Logan in Canada. As a member of the 1952 Swiss Everest expedition he came very close to making the first ascent of Mt. Everest only to be called back from the South Col by the leader: a frustrating experience for André. In 1931 with Robert Greloz he made the first ascent of the icy north face of the Triolet with no protection placed. He was an honorary member of the American Alpine club and other prestigious alpine clubs for many decades. His extensive mountain background, combined with a practical engineering education, is largely responsible for the fact that his papers are still quoted today in spite of being retired for 30 years.

Roch was not just a snow scientist and a mountaineer/skier. He was a superb painter, photographer and writer. He wrote 13 books. His paintings often depict mountain scenes from his photographs with a similar colour combination: shades of blue, white and brown: sky, ice, snow and rock!

From André I was reminded that some risk is a good thing and a life without risk isn't worth much. He also anticipated the modern approach to avalanche forecasting based on human perception: "Our best way of judging consists of knowing the influences that provoke an avalanche situation and observing nature which usually shows its tricks in a generous fashion." He avoided being called an expert. In the Alpine Meadows court case, a lawyer asked André: "Are you an expert?" and André replied: "No, but I've seen a lot!"

I knew André as a person who was exceptionally generous, kind and as a person with high principles. He had strong beliefs and he stuck to them. The term 'role model' is supposed to be outdated; on thinking about André's life, perhaps some re-thinking is in order.

Ed LaChapelle: André came from the French-speaking part of Switzerland and much preferred the French culture. Working for the Swiss Federal Institute for Snow and Avalanche Research in Davos, he lived for many years in German-speaking Switzerland and was never entirely comfortable in that culture. He once told me he actually preferred speaking English over German as a second language.

He engaged in many mountain climbing exploits other than those already mentioned; some are recounted in a book he wrote entitled *Climbs of my Youth*. He was a warm and generous man, always ready to befriend and assist climbers, skiers and snow people from all walks of life. He had a notable sense of humor. Which brings to mind an anecdote. I once was skiing with him in Switzerland after a fall of new snow. We approached the top of a steep slope, looked it over, and he took off for a downhill run. I followed him to the bottom, where I asked him if I had misjudged the conditions, for I thought there was avalanche danger on this particular slope. With a twinkle in his eye, he said, "Your estimate was absolutely correct, but it sure was a good ski run."

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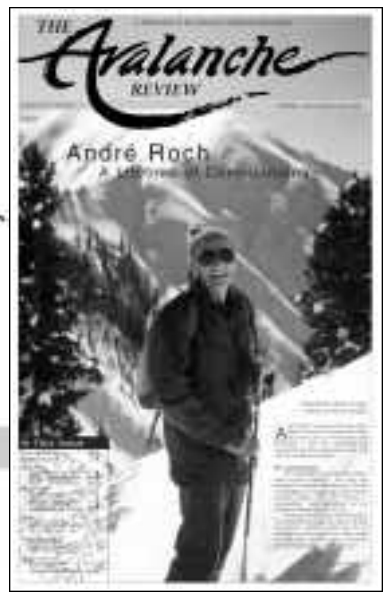

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