THE Avalanche REVIEW

A Publication of the American Avalanche Association

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www.AmericanAvalancheAssociation.org

SNETTISHAM POWERLINE AVALANCHE

— Juneau, Alaska

On April 16, 2008, two separate avalanches ran through the powerline that connects the Snettisham hydroelectric facility to the city of Juneau, AK, 40 line miles to the NW. These avalanches destroyed two towers by a direct hit with avalanche debris. One other tower was destroyed as the power lines were yarded downhill by the moving debris and three towers were damaged as the lines came taut.

Prior to this prolific avalanche cycle, surface hoar formed in the alpine on the last five days of March. April brought fairly continuous rain and snowfall to the area 20 air miles south of Juneau, until the 14th and 15th of April when more than 7" of rain fell at sea level. Snowline hovered around 1500' to 2000' ASL and the winds howled from the SE.

An avalanche April 16, 2008, on Crater Peak and Bride Peak near Juneau, Alaska, demolished Tower 3/5 and pulled over Tower 3/4.
Cover photo by Mike Janes, inset photo by Eric Nielson

Although the upper start zones of Bride Peak (4697') are quite low angle for avalanches (high 20s/low 30s), the terrain breaks over to much steeper angles between 2500' and the ocean.

The upper start zones had stayed consistently cold all winter and had built up more than two meters of snow since the surface hoar formed. The resulting series of avalanches began with glide avalanches below the rain line. Then deep dry slabs ran from the alpine, hit the wet snow transition at 2000', and

Story and photos by Don Sharaf, Bill Glude, and Mike Janes, continued on page 20 ➡

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

in this issue

It almost makes me laugh that I could have even thought of skipping the class to go skiing, when what we ended up learning that day were the skills that keep us and our friends skiing safely, hopefully for the rest of our lives. **—Ian Bezubiak**

Shoveling Case Study in Review, p13

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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 (CD or DVD), using any popular word processing program. Submit any figures as an EPS (preferred), PDF, TIFF or JPG file (300 dpi resolution at 100%). We will return materials if you include a stamped, self-addressed envelope.

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

Layout & Design: Karen Russell, Fall Line Design, (208) 354-6500, karen@FallLineDesign.com.

from the executive director

Well here we go into another avalanche season. The season of pre-season meetings is upon us and began with ISSW 2008 in Whistler. Thanks to everyone who stopped by the booth to say hi and take care of business if necessary. The annual meeting was well attended as well, even with the beer flowing at a raging bbq that was taking place across the village.

We have several new board members to introduce: Mike Bartholow comes in as our new secretary with Andy Gleason stepping down after many years of service, Scott Savage takes over as Intermountain North Section Representative while Fay Johnson steps aside; Patty Morrison is your new Pacific Northwest Rep taking Evan Woods's place. Thanks to our new board members for stepping up and helping guide the Association for awhile, and many thanks to our outgoing board members for your many years of service. In addition, Craig Sterbenz is stepping down as chair of the Standards Awareness Committee. Thanks Sterbie.

As you know, the Governing Board voted to increase the dues and subscription rates by $10 across the board, effective November 1. This increase doesn't really cover our increased operating costs over the last several years, but we want AAA membership to remain a value as well as valued. We've operated in the red for the last two fiscal years (our fiscal is July 1 through June 30). Increased operating costs are one reason as well, underwriting our AVPRO course as it gets established. However, we refuse to offer less so that we can balance the books.

In fact, we are working hard on an upgrade of www.avalanche.org as well as trying to develop a way to support an increasing number of regional one-day professional development avalanche workshops, to which we will contribute a modest amount this fall. A working group of board members volunteered to come up with a model that we can use to offer some regular support to these increasingly popular regional events. How do we make this happen financially? I see a couple of ways. 1) Increase the membership; this remains our primary source of revenue. 2) Encourage your peers and colleagues to join. You are our best advertising. Membership information can be found on our Web site.

We can look to AVPRO to provide some additional income; this should become a reality even this season as the course gains in reputation, and we are able to offer more courses in more locations. And we can try to reduce our operating expenses. We spend a lot of money on paper, ink, stamps, etc. We need to take advantage of today's technology, using the internet primarily to facilitate communication and reduce costs. For example, this means emailing renewal reminders and providing members with an electronic membership directory.

We hope to have an electronic membership database available this winter that members can use to connect with each other. We need you to keep your contact information up to date. This isn't always easy with our dynamic, widely-traveled group, but your assistance will save us money that can be funneled into programs that directly benefit you and the avalanche community as a whole. Thanks in advance for your attention to this.

If you have comments or ideas about your Association, I invite you to email us at aaa@avalanche.org. If you want your comments to go to a specific committee or section I will forward them to the appropriate person(s). The Board is steering the Association in the direction we think you want it to go. Let us know.

Finally, it is with some sadness that I report the passing of two very long-time AAA members. Kathy Fritch of Durango, CO, and Mark Behan of Lolo, MT, passed away this summer. Both were AAA members from the beginning and served as patrollers and avalanche educators for many years. They are well remembered by those who crossed trails with them.

By the time you read this we will be deep into the season of our passion. I wish you all a safe and successful winter with many turns arced with grace and style in the company of friends.

—Mark Mueller, executive director

Another morning in April 2008 with new snow in Summit County. This time we had the luxury of a layer of desert dust to add some flavor to the spring snowpack. *Photo by Scott Toepfer, CAIC forecaster*

submissions

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

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

SUBMISSION DEADLINES

Vol. 27, Issue 3 . . . . . 12/01/08
Vol. 27, Issue 4 . . . . . 02/01/09
Vol. 28, Issue 1 . . . . . 08/01/09

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from the editor

It's early November; my post-election euphoria expended and the snow is flying, but it is too shallow for skiing, too cold to ride, and I hate to run. Though I'm struggling now to get psyched for another eight months of similar weather, I'll remember what I love about winter with the first flush of downhill speed in powder, the first clarity brought on by focusing on the skin track.

Assembling this issue of TAR is helping my head wrap around snow and weak layers, remembering that the easy questions for the beginners are the same as the hard questions for experts:

> What is the weak layer? What is its depth and distribution? What kind of force makes it fail and with what energy?

This year in my teaching I am going to use some of our new tools like the ECT and Prop test to track weak layers – giving them dates, maybe even names, and seeing how they evolve as they get buried deeper. See Ron Simenhois's clarification of these tests on page 23.

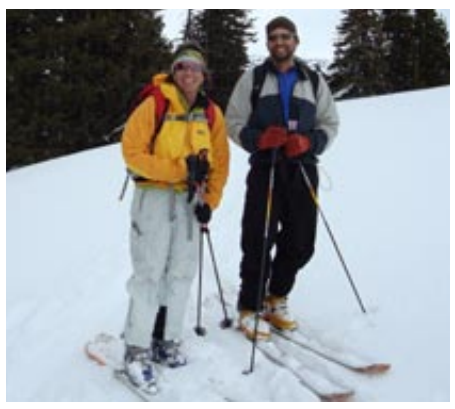
This edition of TAR also features some thoughts and updates about snowmobiles in avalanche terrain, some more explorations of multiple burials and the logical carryover of those precepts into companion rescue and strategic shoveling, with a dramatic case study of a rescue by two recent graduates of a Canadian AST (similar to the AAA level 1).

Once again Alaska's dramatic interface of mountain and ocean bring us the cover story and photos. For educators, Colin Zacharias brings us the importance of a debrief as a bridge from classroom and field lessons to making good decisions without a mentor or instructor present. We also bid farewell to two important figures in the avalanche/snow world: Mark Behan and Mike O'Leary.

In future issues of TAR this winter you can anticipate themes and articles such as terrain management using GIS, the ATES, and Google Earth; a look at fracture propagation with clarification from Karl Birkeland and Jurg Schweizer (thanks in advance, guys); and case studies with remarkable photos from Matt McKee and John Stimberis. We'll have in-depth looks at the biennial AAA awards recipients and the Avalanche Divas, follow-ups on ideas engendered from previous TAR articles and case studies, more news from ISSW and other continuing education venues, and room for your photos – send them on!

I really want to know what you are wrestling with as your season commences. What new tricks or subtle changes are you implementing? You know about my curiosities: what are your problems and potential solutions? Is there anything you'd like to share with your fellow avalanche geeks? Check out our TAR Guidelines for Submissions on the updated AAA Web site at www.AmericanAvalancheAssociation.org, and send us articles and photos.

—Lynne Wolfe, editor



Editor Lynne Wolfe and her husband Dan Powers, skiing near the Baldy Knoll yurt in March 2008. *Photo by Georgie Stanley*

mailbag

Officer Gibbs Killed in the Line of Duty in 1929 but not Forgotten

by Dale Atkins

Nearly 80 years ago deputy sheriff Charles Gibbs was buried and killed in an avalanche northwest of Steamboat Springs, Colorado. On May 2, 2006, officer Gibbs's name was added to the Colorado Law Enforcement Memorial, a tribute to officers killed in the line of duty. Gibbs is believed to be the first and only US law enforcement officer to die in the line of duty in an avalanche.

On March 21, 1929, deputy Gibbs set out to the Block Mine, about 22 miles northwest of Steamboat Springs. Gibbs's duty that afternoon was to serve eviction papers on men at the mine. He drove his horse team to a nearby ranch where he struck out on foot to cover the last two miles to the mine. The 48-year-old deputy expected to be back by sundown, but he failed to return.

That evening a search party set out and learned Gibbs had never reached the coal mine. Searchers did spot a "snowslide" in a "cut," and late that night the men started searching the avalanche. At two o'clock in the morning searchers uncovered Gibbs's body. He still stood upright but was buried under five feet of snow. One arm was extended "as to ward off the mass." The *Routt County Sentinel* reported Gibbs was "only a few feet from the end of the cut when he was engulfed by snow."

Routt County Sheriff Deputy Gibbs was said to be a "faithful officer of the law" and also "rigidly faithful in the discharge of his duties." Sadly, he lost his life to an avalanche while performing those duties. The formal recognition of Gibbs on the Colorado Law Enforcement Memorial resulted from the efforts of three members of the American Avalanche Association: Art Judson, Dale Atkins, and Jenny Paddock. Judson and Atkins provided historical research, and special credit goes to Paddock – a Boulder police detective and an avalanche rescue dog handler – for shepherding officer Gibbs's name through the nomination process and for tracking down surviving family members.

Dale Atkins is the rescue representative to the AAA board. He is known for his avid curiosity about avalanche incidents of the past.

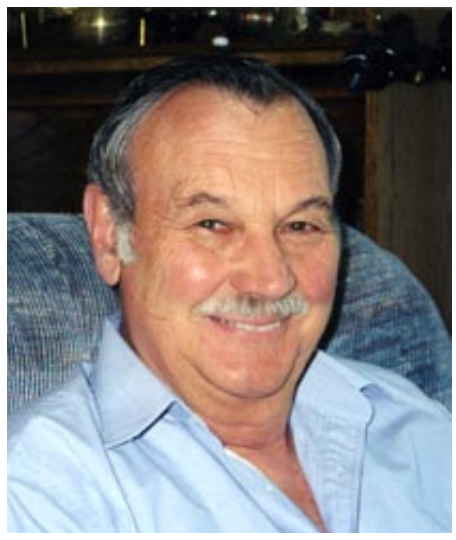
metamorphism

NEW PROFESSIONAL MEMBERS
Chris Sutton – Dillon, CO
Aaron Ball – Durango, CO
Margaret Wheeler – North Bend, WA
Chris Engelhardt – Reno, NV
Patricio Javier Graziosi – Bariloche, Argentina
Julie Rust – Vail, CO
Sheldon Kerr – Crested Butte, CO
Daniel Otter – Ashford, WA
Mike Duffy – Avon, CO
Laura Le Blanc – Fairbanks, AK
Scott Hart – Sundance, UT
Mike Gooderman – La Grande, OR
Mike Laney – Penn Valley, CA
Jeff Hamilton – Olympia, WA

NEW MEMBER AFFILIATES
Zachary Slutsky – Castle Rock, CO
Nick Springstead – Basalt, CO

Peter Gauer from the Norwegian Geotechnical Institute is the AAA's newest **LIFE MEMBER.**

Mark J. Behan
1/17/31 - 6/18/08



On June 18, 2008, a sunshine-filled morning, Mark J. Behan was jogging on his favorite trail on Blue Mountain when he suffered a massive heart attack, collapsed and died instantly. Mark lived his life to the fullest and couldn't have orchestrated a better exit for himself.

Mark, 77, a University of Montana professor emeritus of biological sciences, was born January 17, 1931, in Denver, CO. In 1953, he received a bachelor of arts degree in biology, chemistry, and education from the University of Denver. Five years later, in 1958, Mark earned a masters in science from the University of Wyoming, Laramie, and in 1963, a PhD in plant physiology and ecology from the University of Washington, Seattle.

In 1954, Mark married Darlyne Carr and raised three sons, Christopher, Timon, and Conan. Mark and Darlyne later divorced.

Also in 1954, Mark joined the United States Army, where he served in the Counter Intelligence Corps. The investigative skills he learned in the CIC held him in good stead throughout his life, particularly in his academic research and in his personal pursuit of his Irish heritage. He also was a member of the Colorado National Guard, which included training with the 10th Mountain Division.

Mark's love of the outdoors began in childhood, fostered by the Boy Scouts and by a church camp run by the Catholic Diocese of Denver in Estes Park, CO. Altar boys could stay free at the church camp for one week. Mark washed dishes to pay the $15 required for each additional week. That lifetime passion was passed to his sons and grandsons in the form of backpack trips throughout western Montana, cross-country and downhill skiing days, and long canoe trips.

An avid skier, Mark began ski patrolling in 1953 and was an active member of the Northern Division Ski Patrol all his life, serving with patrols in Colorado, Wyoming, and Montana. He was a familiar presence at Missoula's Marshall Mountain and Snowbowl and also at Discovery Basin. He was chairman of the board of Discovery during its development, helping with slope design and financing. He also served a term as director of the National Ski Patrol and was an officer of Snowbowl and the Missoula Ski Club during the 1967 National Alpine Championships. He taught search and rescue classes and certification courses in emergency winter care and avalanche awareness and safety. At the time of his death, he was a member of the Bitterroot Ski Patrol and had been a professional member of the AAA since 1996.

Mark also was an accomplished hunter who taught hunter safety and created Montana's Fish, Wildlife and Parks Department's online hunter education course.

In 1960, Mark joined The University of Montana's department of botany faculty. His academic work took him all over the world. In 1982, he received a Fulbright grant to teach at Tribuhvan University in Katmandu, Nepal, and returned to Nepal in 1984 as a USAID consultant. He also created a new curriculum and taught for one year at the Pakistan Forest Institute in Peshawar. For 12 years he was a consultant for the Bombay Natural History Society Grasslands Project, traveling throughout India as an advisor for scientific projects and academic development. During his last position in Nepal he met his soul mate, Jackie Cohen, whom he later married.

He and Jackie traveled to many parts of the globe, including Sri Lanka, Thailand, Borneo (where they climbed Mount Kinabalu), and Singapore. They traveled the Trans- Siberian Railroad from Beijing to Budapest, before the break-up of the USSR. They later traveled in Central America.

Mark was physically active to the end, jogging, skiing, and backpacking. When the load became too heavy, he purchased and trained a llama to carry the gear. Wherever Mark went in the backcountry, he would run into former students who always resurrected some story he had told them about plant life. Mark's love of the outdoors included a lifelong devotion to environmental causes, including his position as chairman of the Montana Environmental Information Center Board of Directors.

Mark thoroughly loved his sons and grandsons and felt fulfilled when they accompanied him skiing and backpacking. Mark loved laughter, and with a twinkle in his eye, he entertained all with his Irish gift of story-telling.

Donations in Mark's memory may be made to Jesuit International Missions, attn: Jesuit Mission Nepal, 2059 N Sedgwick St, Chicago, IL 60414; the Montana Food Bank Network; or the Poverello Center.

above: The avalanche that claimed Mike's life on Mount Eyak in March 2008.
Photo by Hoots Witsoe
Photos of Mike courtesy Michelle Hahn O'Leary

Mike O'Leary

Michael Charles O'Leary died on March 8, 2008, in an avalanche on Mount Eyak in Cordova, Alaska. He was 56. A third-generation Alaskan raised in the woods and mountains of Moose Pass, Girdwood, and Anchorage, Mike's trademark grin was as wide as the wild country he moved through with consummate grace and skill.

Mike learned the avalanche business from his snow ranger father, Chuck O'Leary. A keen observer respected for his intimate knowledge of snow and weather conditions, Mike was the avalanche forecaster for the city of Cordova and the Cordova Electric Cooperative. Cordova is a small town surrounded by big mountains. There has likely never been anyone in Cordova who knew those mountains better than Mike. He climbed every peak in the vicinity that afforded lines of descent and skied with a passion that reflected the beauty he found in the mountains. Devoted to teaching others, Mike trained hundreds of snow enthusiasts in avalanche rescue and hazard evaluation.

More than 35 years after Mike first came to Cordova to work a temporary job, it is impossible to walk through town without seeing tangible evidence of his creativity, competence, and energy. One of his favorite projects was the ski hill on Mount Eyak. He repeatedly nursed the ski lift – the vintage single chair from Sun Valley, Idaho – back to health. O'Leary expanded the ski area by 40% when he cut a half-mile trail and opened up the "Dark Side" of the mountain. In a 1998 citation for Cordova's Citizen of the Year award, Mike was touted as the "ambassador of the ski hill" for helping young and old discover the joys of skiing.

Mike not only championed resource and habitat issues but also put his back into physically rebuilding lakeshores and streambeds. Mike's trailbuilding skills were legendary, earning him not only awards but the gratitude of all those who love to hike. At the time of his death, Mike was vice-mayor of the city and a visionary member of the city council.

For Mike, the only consolation to winter's end was that it heralded the approach of fishing season. With his wife and partner of more than 30 years, Michelle Hahn O'Leary, Mike fished commercially in Prince William Sound, the Copper River Delta, and Bristol Bay. His uncanny ability to think like a fish helped to fill not only his net but also those of his partners. "Mike was a natural leader," said one of his long-time commercial fishing partners, "not because he wanted to lead but because we wanted to follow him."

It is not surprising that when, in the early 1980s, Mike and Michelle found the perfect spot on which to build a home, it required that they first build a half-mile trail through the rainforest. With a salmon creek on one side of the peninsula and ocean lapping the other shores, their home is a sanctuary where the light is always changing, and the sea otters are never far. It has been a beacon for family and friends of all ages. All it takes to get a sense of how close they lived to land and sea is a look inside their freezer, reliably packed with moose, deer, salmon, halibut, black cod, and berries of all shapes and colors.

Mike was a balm of kindness to those in need, a trickster who loved to wrestle with children and dogs, a gourmet cook. He made a habit of assuming the best in people and had a heart that knew no bounds. Mike is survived by his wife Michelle, dog Pepper, and a remarkably wide orbit of family and friends who can only strive to incorporate his exuberance and generosity of spirit.

Sources: Jill Fredston, Michelle Hahn O'Leary, and The Cordova Times.

left: Mike, shown here with Hoots Witsoe's son, was known as the "ambassador of the ski hill."
above: Mike and Michelle enjoyed a full catch during summertime commercial fishing.

aaa news

AAA Fall Board Meeting Report

The AAA held its semi-annual board meeting prior to the International Snow Science Workshop on September 21 in Whistler, BC, with 18 board members present. The general membership meeting was held on September 23 with dozens of affiliate and professional members in attendance. It was exciting to have so many people from the US in attendance at ISSW and the AAA meeting. The following are highlights of the governing board and committee reports from both meetings.

President Janet Kellam and Vice-President Doug Richmond reminded us of our mission as an organization and the responsibility the board has to properly and professionally represent our members and to promote bridge building and enhance communication within the avalanche community in the US and beyond. AAA represents a wide range of avalanche workers who are competing for our time and energy and resources (money) as an organization.

Treasurer Bill Glude reported that AAA earned approximately $21,000 and spent about $28,000 last fiscal year. Much of the loss was due to the rescheduling of the December AVPRO course and the associated loss of students who could not attend the rescheduled course. The membership dues increase will help offset these losses and ensure that we stay on a sound financial footing. Bill's full report can be obtained by contacting the executive board.

Executive Director Mark Mueller informed us that, overall, we in are good financial status, yet we need to be careful as we move forward. We need to formalize a program for funding AVPRO and regional continuing education programs. He also told us that while our overall membership is up slightly, we need to further our efforts at recruiting new professional and affiliate members. Subsequently, AAA has formed a new working group to put together a new recruitment presentation for events such as ISSW and regional continuing education events. Mark also told us that Craig Sterbenz has asked to step down as the Standards Awareness Committee chair after years of service. We'd like to thank Sterbie for everything he's done for AAA over the years.

Lynne Wolfe and Blase Reardon should be recognized for their efforts on the Publications Committee. Not only is TAR improving in scope and quality with color photos and thematic issues, it is selling more advertising than ever, which means less membership money is needed to produce and distribute it. Lynne is always on the hunt for a good story, and she asks that you refer to the recently updated submission guidelines if you'd like to contribute. Additionally, TAR is looking for a student to do some work indexing the last 5 years of TAR articles for inclusion in the Moonstone Avalanche Library. *(editor's note: Ned Bair of UCSB has stepped up to help with this project.)*

Education Committee Co-Chair Sarah Carpenter gave an update on ongoing projects, including further development of the AVPRO course. Two sessions will be offered this winter: January 24 to February 9 in southwest Montana and February 21 to March 1 in Breckenridge, CO. We are working to have AvPro recognized as meeting the American Mountain Guides Association ski guide requirements and also toward an independent audit of the course. We are reconsidering the policy adopted at the Spring 2008 meeting on funding regional continuing education. Due to the decrease in funding from government agencies, we received more requests for financial assistance than in the past. On the suggestion of Janet Kellam, we decided to fund each region with $200 for 2008. We have also formed a working group to come up with a better defined policy and application process for funding these very important events.

Research Committee Chair HP Marshall was unable to attend the meeting. In his stead, Mark Mueller reported that there were no research grants requested for the last period. Requests were made for travel expenses to present at ISSW, but these requests were denied because they were not for actual research.

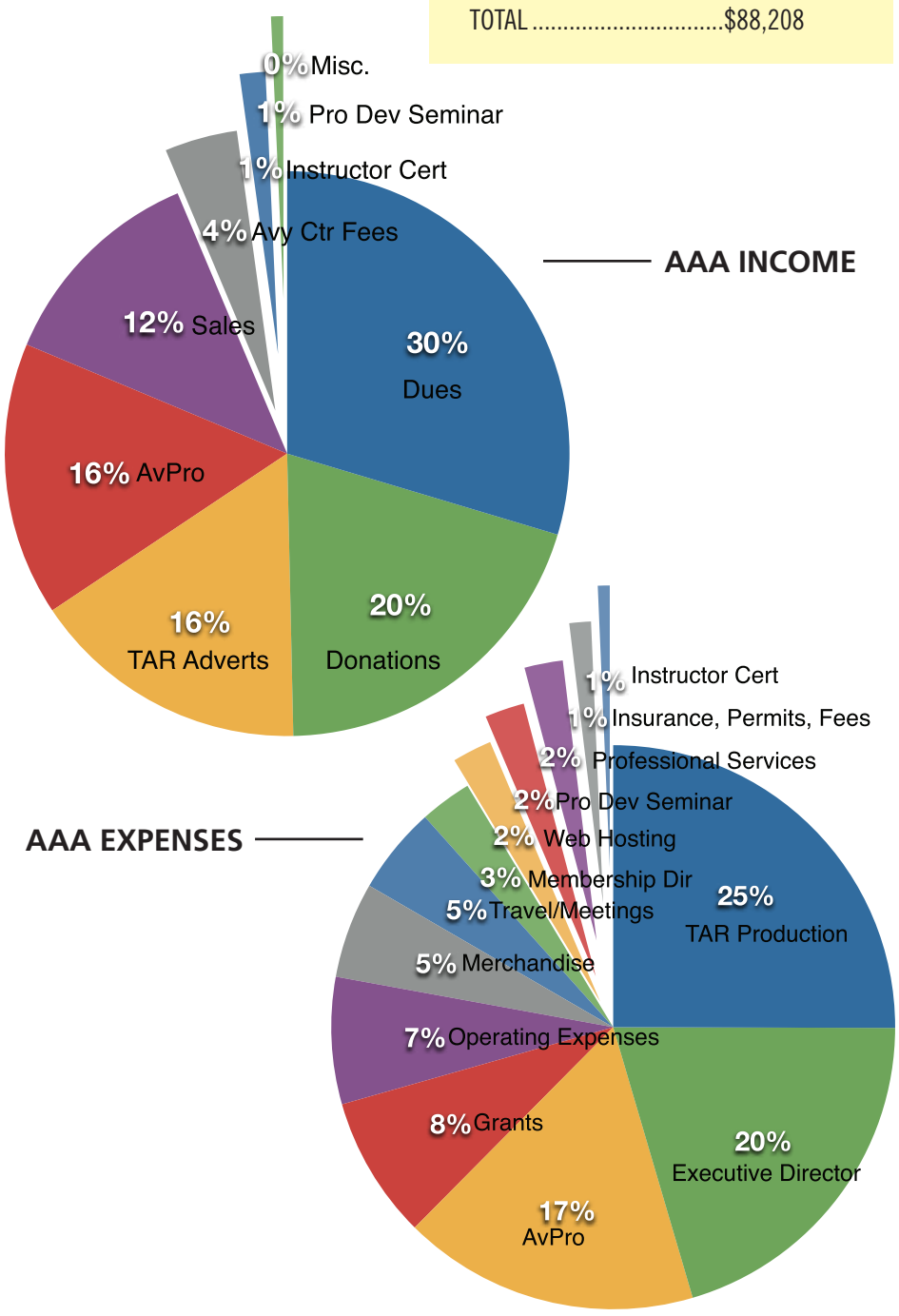
Merchandise Guru Lel Tone has worked out a deal with The Backcountry, a retail and online shop based in Truckee, CA (www.thebackcountry.net) to have them take over selling AAA merchandise. There is a link to the shop on the AAA Web site. New merchandise will be available soon,

AAA INCOME

ITEM	INCOME	%
Dues	24,195	30
Donations	16,347	20
TAR Advertising	13,048	16
AVPRO	12,800	16
Sales	10,085	12
Avalanche Center Fees	3,397	4
Instructor Certification	1,200	1
Pro Dev Seminar	560	1
Miscellaneous	2	<1
TOTAL	$81,653	

AAA EXPENSES

ITEM	EXPENSE	%
TAR Production	22,087	26
Executive Director	18,000	21
AVPRO	14,978	17
Grants	7,200	8
Operating Expenses	6,420	7
Merchandise	4,850	5
Travel/Meetings	4,417	5
Membership Dir.	2,627	3
Web Hosting	2,000	2
Pro Dev Seminar	2,000	2
Professional Services	1,940	2
Insurance, Permits, Fees	1,089	1
Instructor Certification	600	<1
TOTAL	$88,208	



PROGRAM BALANCES

ITEM	INCOME	EXPENSE	GAIN
AVPRO	12,800	14,978	-2,178
Sales	10,085	4,850	5,235
Instructor Certification	1,200	600	600
Pro Dev Seminar	560	2,000	-1,440
TAR Ads Only versus Cost	13,048	22,087	-9,039

Shop the AAA Online Store

by Lel Tone

The AAA online store is finally up and running again with a few changes – just in time for your holiday shopping! SWAG is still available on the American Avalanche Association Web site with payment through PayPal as in the past. There has been a slight change with the sale of our AAA clothing. The Backcountry, a store in Truckee, CA, will now be handling all the sales and shipping for us. So don't be surprised when you click on a retail item on the American Avalanche Association Web site and get routed to www.TheBackcountry.com.

Keep an eye out for two new items available online. We will be adding a trucker's hat and hooded sweatshirt. Also, for those of you who are wearing out those beloved fleece zip-Ts, we have a couple of new colors available…check it out. These make great gifts, so remember, only a few more shopping days until Christmas! Get online, boost the economy, and support the American Avalanche Association by "dropping in" on some stylin' AAA logo wear. ❄

This classic favorite, the AAA fleece zip-T with the embroidered logo, is now also available in black, red, and green.

Updated SWAG Available Soon

The 2nd edition of *Snow, Weather, and Avalanche Observational Guidelines* (SWAG) has been under revision by a team of experts including Ethan Greene (chair), Karl Birkeland, Kelly Elder, Chris Landry, Brian Lazar, Ian McCammon, Mark Moore, Don Sharaf, Craig Sterbenz, Bruce Tremper, and Knox Williams. The updated SWAG is expected to go to the printer in mid-November and will include the new International Classification for Seasonal Snow on the Ground as well as updated snow tests.

Prices remain the same at $20 per copy and bulk rates of $12 per copy for orders of 10 or more. SWAG can be purchased from the AAA Web site at www.americanavalancheassociation.org. Contact the AAA office for bulk orders. ❄

AvPro Courses Coming Soon to Montana and Colorado

2008 AvPro students examine the flank of a skier-triggered avalanche in Emma 2 in Little Cottonwood Canyon.
Photo by Don Sharaf

The AAA will hold two AvPro courses this winter. The first course will be in SW Montana from January 24 – February 1. The course will be based out of Bridger Bowl and the surrounding backcountry for half of the course and Big Sky the other half of the course. The second course is scheduled for February 21 – March 1 in Breckenridge, CO.

The AvPro is a high-level, comprehensive avalanche course geared towards professional avalanche workers. Sixty percent of the course will be conducted in the field with the remaining 40% held in the classroom. The course is intensive: eight days long (plus a day off in the middle) with between nine and 11 hours of instruction each day.

AvPro is taught by some of the top avalanche educators in the country, with guest appearances by leading experts in a variety of avalanche fields. Geared towards snow professionals, participants will be exposed to a wide variety of topics, including avalanche control strategies and techniques, guiding techniques, efficient and accurate snowpack analysis strategies, and the most current rescue technology and strategies.

In order to participate, one must have taken one of the following: a three-day Level 2 avalanche course, both phases of the National Avalanche School, or the equivalent of in-house training and experience.

For more info, go to americanavalancheassociation.org or contact Sarah Carpenter at sarahlovessnow@yahoo.com, (208) 787-4235. ❄

including a zip hoody and the super-steezy "Blaser" trucker's hat. Look for the new AAA thong on an avalanche professional near you.

Web Slave Chris Lundy gave us an update on the overhaul and redesign of avalanche.org to make it the avalanche information portal for the US. The redesigned site – scheduled to launch December 1 – is simpler, more attractive, and separates recreational and professional resources clearly. Future plans include an online membership directory, avalanche discussion forum, and a searchable database of TAR articles.

Ski Area Committee Chair Bill Williamson gave us an update on the explosives survey he sent out to ski areas last winter. The results of the explosives users' survey will be published at the International Society of Explosives Engineers meeting in Denver in February. A companion article will appear in TAR.

Awards Chair Halsted Morris presented the following awards: Christine Pielmier – Honorary Fellowship, Chris Landry – Special Service Award, Karl Birkeland – Bernie Kingery Award, Don Bachman and Knox Williams – Honorary Membership. Watch for an in-depth story on the AAA awards in the next issue of TAR.

Halsted presented a proposal from Member Representative Rick Grubin to hold the Spring 2009 meeting in Summit County, CO. It will be held on Friday, April 24, at a location to be determined, followed by a day at Loveland Ski Area at the CAIC's Corn Harvest fundraiser on Saturday, April 25.

—Mike Bartholow, AAA Secretary ❄

what's new

IKAR-CISA Meeting 2008

Story by Dale Atkins

Founded in 1948, IKAR celebrated its 60th anniversary at its annual meeting held this October in Chamonix, France. IKAR actively promotes innovation and progress in mountain rescue, not only for the people in need, but also for the safety of mountain rescuers themselves. IKAR provides a forum where rescue specialists from four different disciplines: avalanche, terrestrial (rock and ice), air (helicopter), and medicine to exchange knowledge, experiences, and skills regarding both successes and mistakes. Individuals are not members of IKAR, rather organizations are members, and the US member organizations are the Mountain Rescue Association, represented by this author; and Wasatch Backcountry Rescue, represented by Dean Cardinale and joined this year by Jake Hutchinson and Jim Collinson.

In the past 60 years IKAR has grown from 11 member organizations in the five European alpine countries to 57 member organizations from 31 countries from around the world. Over the years IKAR's Avalanche Rescue Commission has produced numerous international recommendations that have become standards, including the 457kHz frequency for transceivers, the five-level avalanche danger rating, and marking colors. The Avalanche Rescue Commission has also worked with the Medical Commission to produce treatment protocols for avalanche victims.

The meeting started with a field day organized by the Terrestrial Commission on the glacier at the top of the Grands Montets. Various technical rescue tools and techniques were demonstrated. The next day participants moved inside for three days of meetings and presentations. Some highlights of this year's IKAR meeting included the adoption the Avalanche Rescue Commission's recommendation to standardize terminology for the four phases of a transceiver search:

1. Signal Search: detect signal
2. Coarse Search: first signal to last few meters
3. Fine Search: last few meters
4. Pinpoint Search: use of a probe

The Avalanche Rescue Commission was busy; the working group on *Common Issues, Best Practices for Avalanche Safety Programs* chaired by Canadian Claire Israelson presented its results from a two-year international survey. The group's suggested five points for an IKAR best practices recommendation (to be voted on by the entire IKAR membership next fall) are:

1. A credible professional organization issues scheduled avalanche forecasts for popular winter mountain recreation areas.
2. Avalanche training courses for non-professionals are readily available.
3. Comprehensive programs protect highly used public places from avalanches.
4. Avalanche professionals require specialized training / credentials / certifications.
5. Organized avalanche rescue services exist for all avalanche prone areas of the country.

To become an official IKAR recommendation, one or more of the four IKAR sub-commissions must first approve a recommendation. It is then presented to the entire IKAR membership, but action is tabled for one year so nations and national organizations can take back the proposed recommendation for comments. At the next fall meeting action is taken on the recommendation where it is usually passed by the membership.

Another recommendation passed by the Avalanche Rescue Commission came from a working group chaired by Jürg Schweizer of the SLF regarding transceiver search strip widths. Jürg's group is recommending a radical but innovative change to determining search strip widths from simulations based on real-world conditions prepared by Manuel Genswein. These dramatically increased search strip widths optimize the chance of survival of the buried victim. Currently, search strip widths are optimized for a very high probability of detection, not for survival. This is a paradigm shift; look for more information in TAR later this winter.

The Avalanche Rescue Commission is always looking to improve rescue, and this winter a working commission on avalanche rescue dogs is chaired by dog handler Albert Lunde of Norway. Lunde's group will be reviewing the performance of rescue dogs and handlers to learn what conditions dogs and handlers perform well and poorly. Wasatch Backcountry Rescue will be active in this study.

A more thorough report about this year's IKAR meeting will be available from the Mountain Rescue Association's Web site at www.mra.org in December 2008.

Mark Renson (Mad River Glen and Mount Washington ski patrols) uses his beacon and the new Pieps iProbe to find a "victim."

Eastern Ski Patrol Avalanche Instructor Event Held this Fall

Story and photo by Jonathan S. Shefftz

The northeastern American Avalanche Association ranks may be relatively sparse, but of its 23 members (Professional and Affiliate combined), the majority (12) are also National Ski Patrol (NSP) members.

The NSP's Eastern Division kicked off the 2008/09 season with its annual fall event for instructors in avalanche, mountain travel/rescue, and Nordic backcountry skiing on September 6-7 at the Northfield Mountain recreation facility in Western Massachusetts. Previously a one-day administrative meeting with a small professional development component, the event expanded last year for the first time to focus more on skills refresher stations and continuing education.

The weekend started with avalanche beacon practice using numerous decoy boxes in an open field for the primary and secondary search phases, then a tarp-covered cubbie hole case laid down on a floor for pinpointing. Both were assisted by Marcus Peterson from Ortovox USA, complete with freshly updated 2.0 versions of the S1 beacon. Another avalanche station applied the Incident Command System to non-companion rescue. Other refresher stations included ropework (both knots/hitches and mechanical advantage raising systems), a GPS field exercise, and emergency sled construction featuring donated kits from Brooks-Range Mountaineering Equipment.

And if the attendees needed any confirmation for the importance of avalanche assessment skills and rescue work, Chuck Boyd delivered a presentation on his recent expedition to ski K2 (www.K2TallMountain.com). The team was on neighboring Broad Peak when K2 added yet another 11 lives to its tragic tally; they then quickly travelled to K2 to take charge of the rescue efforts.

Sunday morning featured a full search and rescue exercise for an "injured skier" suspected to be somewhere off trail in the steep woods. The search got off to a good start when a hasty team member found a returning real-life hiker who provided the general location of a rather conspicuous ski carrier. Fortunately some additional challenge was provided when the "victim" called in precise GPS UTM coordinates, only to have his cell phone battery "die" before revealing that the map datum was set to Liberia 1964. Once the victim was found, his leg was splinted, then a Brooks-Range emergency sled was constructed and hauled up to a nearby trail. The exercise was overseen by officers from the Central Massachusetts Search and Rescue Team.

In addition to Ortovox and Brooks-Range, avalanche and ski industry sponsors providing raffle items included AIARE, BCA, CyberSpace Avalanche Center, Rossignol, and Voile.

Any non-patrollers who are interested in attending next year's event can contact the author at JShefftz@NERandoRace.com.

The Rescue Bubble

Product review by Wren McElroy

How much stuff does it take build a rescue toboggan? Skis, shovels, tarps, hose clamps, tape, cord, ingenuity? The list goes on. Over the years I have had a few different set ups. Recently I've discovered the Rescue Bubble, a new option which is specifically designed as an efficient rescue toboggan and it's made in BC.

Working with local guides and keeping simplicity in mind, the Kootenay Bubble Refinery Co. of the Slocan Valley has created a foolproof design requiring no assembly and strong enough for long-term use. This business is the creation of entrepreneurs Elena Elder and Laure Perriere, who first worked with heavy-duty tarp material (cold crack to -45 °C) while developing herbal extraction bags. After consulting with skiers, guides and owner-operators of heli and cat operations, Elder saw a need for a durable rescue toboggan and she realized the waterproof tarp material already in her shop was the perfect vessel.

The design is straightforward—a .9 m x 2.6 m (3 ft by 8_ ft) piece of heavy-duty waterproof poly / vinyl tarp. On the inside are loops that hold skis in place at the level of the patient's shoulders and calves, giving the sled stability and creating a smooth and fast sliding surface. The loops are designed to accommodate even the fattest of skis.

Having the skis inside provides rigid support for the body in the event of multiple trauma or potential spinal injury. Any available padding can then be layered over the skis and the patient placed on top. The tarp material folds up over the patient and is laced with a piece of 3.5 mm nylon cord threaded though 1 cm poly / nylon webbing loops.

There are also six 2.5 cm nylon webbing handles attached with reinforced sewing along the sides, and another one at the head. These handles are purposely placed to support the heaviest parts of the body—the head, shoulders, hips, and thighs. These give the toboggan an even weight distribution and allows the patient to be lifted once secured in. The Rescue Bubble is designed to carry somebody up to 1.9 m (6 ft 6 in) tall and comes complete with a lightweight nylon stuff sack to keep it compact and contained. The total weight is less than .9 k (2 lbs).

I had the chance to try out the Rescue Bubble on a three-day avalanche / winter camping course in March 2006 with the Renewable Resource Program of Selkirk College. This trip is the culmination of a semester-long Advanced Avalanche Skills Level 2 Course. I brought the Rescue Bubble in case of emergency as well as for a practice run and demonstration.

A spring cycle dropped about 30 cm on the last night of the course. The third day dawned with heavy snow and freezing levels just barely hanging in there. While waiting for the 16 students to get packed up and ready, I found a volunteer willing to be my patient. We inserted a pair of skis into the slots of the Bubble and within minutes he was cocooned in with his gear.

The rescue bubble. *Photo by Wren McElroy*

Despite the smooth setup I still had a few reservations. I was concerned with how the bindings would affect the patient's comfort and, of course, the extra weight. Due to the proportional fit of using the patient's own skis as the frame, the binding height turned out to be a non-issue. For a 1.8 m (6 ft) person with 190 cm skis, the ski tips curl around the shoulders and the bindings ride just below the buttocks, with a slight flexion of the knees. I tried it out on myself with 170 cm skis. I am 1.6 m (5 ft 6 in) and I found it actually comfortable and very snug. However, in the event of a femur fracture the bindings would likely need to be adjusted or removed.

As for the weight, any misgivings I had about carrying the Bubble were soon dispelled as we plowed through the deep March powder. The strong, vinyl-coated material slid smoothly through the heavy snow, even though there was a good 40 cm of foot penetration. In fact, the material slides so well that a tail person for braking is certainly needed.

The burrito-like effect of the tarp wrapped up and around my patient kept him well-covered. In addition, I really liked the stability of the whole package. Even if a steep traverse rolled the patient onto his side, he would be protected as if in a full body splint.

The most valuable feature about the Rescue Bubble is that there are only two parts—the nylon cord and the tarp. There are no attachments, no metal parts and nothing to break. You could even make the sled into a sturdy emergency shelter or bivy in the unfortunate circumstance of an unplanned night out.

Another story of the Rescue Bubble's success comes from Rod Gibbons, an ACMG instructor / examiner and Operations Manager for RK Heli-Skiing. In his capacity on the ACMG courses he has had the opportunity to see many different toboggans, store bought and homemade. He calls the Bubble "the best, hands down, out of anything that I have seen. When people try to rig a rigid sled it takes longer and there are more pieces to come apart."

Gibbons' first experience with the sled was on an ACMG exam in the first week of December 2006 at Monashee Powder's Tsuius Lodge. As many of you will remember, the storm cycles at that time made for very deep conditions across BC. The foot penetration on that course was 40 - 50 cm of low-density snow.

During the mandatory toboggan assembly part of the exam, participants have to put their sleds together, package their patient and take them down a 300 m slope. The exercise must be completed in 45 minutes. One of Gibbons' students, Shawn West, showed up with a Rescue Bubble prototype he had co-designed with Elder. Two groups began their assembly at the same time. West had his patient in the sled and down the slope in 10 minutes. The deep snow billowed around the patient who was well-sheltered by the tarp. The other group, using another brand of toboggan, took 40 minutes.

> Without a doubt, in the event of a life-threatening injury, time is of the essence. The quicker you get moving, the better the chances of survival.

"If anything it was more of an issue to control the speed," said Gibbons. "With most sleds it is hard work to pull through deep snow. Clearly it was much easier to operate. The patient was in quicker and moving easier." The examiners weren't timing the students as such, but they do pay attention to time. Without a doubt, in the event of a life-threatening injury, time is of the essence. The quicker somebody is moving, the better their chances of survival.

I am excited to find a product that is not only very useful but is also made in a manner that fits with my personal values, in that it's BC-built and not mass-produced offshore. Elder and Perriere are also very aware that they are producing safety equipment. Each Rescue Bubble is individually sewn and carefully inspected. You won't find a missed stitch.

As an avalanche and first aid instructor, I believe all groups heading into the backcountry facing the unfortunate circumstance of having to rescue a client, student or friend would benefit from carrying this sled. As an emergency toboggan, the Rescue Bubble is appropriate for use by professional and recreational skiers alike and it makes a great crazy slide on a down day!

For more info, see www.rescuebubble.com.

This article first appeared in the Canadian Avalanche Association's journal, avalanche.ca, Vol 82, Fall 2007.

The reviewer cozy in her little bubble. *Photo by Chris Swetland*

Wren McElroy is a Professional Member of the CAA and has worked in the avalanche industry for 15 years. Wren got her start ski patrolling at Whitewater ski area in Nelson, BC, has taught avalanche and occupational first aid courses at Selkirk College for over 10 years, and is a member of the CAA's ITP instructor team. The rest of Wren's time is spent adventuring with her husband Chris Swetland and chasing after their two young sons, Conrad and River.

International Symposium on Snow and Avalanches Slated for April

The International Glaciological Society and the Snow and Avalanche Study Establishment (SASE) will present the International Symposium on Snow and Avalanches in Manali, India, on April 6-10, 2009.

For more information, contact the International Glaciological Society, Scott Polar Research Institute, Lensfield Rd, Cambridge CB2 1ER, UK. Tel: +[44] (0)1223 355 974 Fax: +[44] (0)1223 336 543, email: igsoc@igsoc.org, Web: www.igsoc.org/symposia/ or issa2009.in/

Try data-avalanche.org

From Alain Duclos: We offer you the use of www.data-avalanche.org for free. It's very easy to use, and we plan to develop an English version before the winter season.

Do let Alain know what you think, please! a.duclos@wanadoo.fr

ISSW 2008 Whistler

Story and photo by Doug Richmond

The Whistler folks did a great job putting on ISSW 2008. This workshop keeps getting bigger and so does the job of making it happen. Thank you to all the people who helped. There was plenty of room for the 800+ participants: a nice big meeting hall with nearby posters, vendors, and a simulcast room. The audiovisual guys did a great job. They brought us four days of presentations from all over the world, flashed on a big screen behind the speakers. The weather was gray enough that I made it to most of the talks, except on Tuesday afternoon, when the sun came out, so a few of us went golfing. For the Wednesday field day, I went up the gondola for a walk in a wet, sideways blizzard.

There was a big banquet, the second ISSW avalanche divas night, and lots of cool gear on display. But, as always, it was the people who made it for me. Like Alain Duclos from France, Peter Gauer from Norway, other great folks from distant lands, and all kinds of ski patrol buddies that I don't get to see often enough. We missed a few characters: Colbeck, Brown, Woodmencey, Decker, Fredston, Fesler. Where were you folks? In fact I had this fantasy that Doug Fesler would motor down and take us for yacht rides out of Squamish.

As for the snow science, there was plenty. A lot of it is relevant to the practitioner. At registration, they handed out the proceedings on CD. Find one and check it out. There are two main folders on the disc. One is named *pdf* and includes a single 1100-page pdf proceedings file with all the papers. The second folder is *ISSW08*. Open the application labeled *ISSW08* in this folder. It gives you the papers in a searchable format. There is a search tab, where you can look for author, title, and subject. Click on the subject box to choose from 14 subject categories. So under the subject *Mitigation Methods*, for instance, you can click to open any of 11 papers covering great stuff from Mt Rose to Rosa Khutor. There are papers in all 14 categories to interest the practitioner. Here are a few highlights:

While Dave Gauthier's image is broadcast on the big screen, the panel looks on (l-r): Ron Simenhois, Copper Mtn and Mt Hutt Ski Patrols; Cam Ross, University of Calgary; Kurt Winkler, SLF; Ivan Moner, avalanche forecaster from the Pyrenees; Karl Birkeland, Forest Service National Avalanche Center; Dave Gauthier, formerly of ASARC.

SNOWPACK MONITORING

Practitioners can benefit from tools that help them measure or see the snowpack. In the proceedings subjects search, there are two sections on stability and one on instrumentation. Once again, the radar presentations look the most promising for giving us field imagery of the snowpack layers. Hans Peter Marshall is working with radar systems that can be held between two skiers. He is also trying to perfect a system that works from a helicopter. The stability goggles can't be far behind. Achim Heilig presented work from the Austrian Alps with ground penetrating radar units buried in starting zones to measure overlying snow depths and accumulation rates.

There has been more good work with the Snowmicropen and with propagation tests. Fracture propagation presentations took up most of Monday and Friday mornings, with a good question-and-answer panel session by field propagation testers on Friday. It looks like propagation tests are proving to be worthwhile stability indicators. See Cameron Ross's paper comparing the Propagation Saw Test (PST) to the Extended Column Test (ECT). Ross shows a pit layout for conducting two of each of these plus two compression tests. You can tell the folks who dig a lot of pits from their perfectly straight walls. Another tip from Dave Gauthier: for the PST, use the blunt side of the saw to stay in the weak layer. *(editor's note: see Ron Simenhois' article on Propagation Tests in this issue of TAR, page 23)*

AVALANCHE INITIATION

The explosives and avalauncher folks were in attendance with interesting products and ideas for starting avalanches. Craig Wilbour gave us a poster on tram techniques at Snoqualmie Pass. There's still no portable hexagonal resonator, unless the military has a secret one. But the Gazex folks brought their new helicopter-borne hydrogen exploder, called the DaisyBell. That looks like a great tool. I missed the demo where they flew around and popped it off a few times on the field day at Whistler.

MODELER QUOTES

I'm not down on modelers. Their work gives important insights and perspectives, and it may be the inspiration for new methods and tools in the future. But predictive models are often based on incomplete subjective data from, guess who, meatball practitioners. Here are few out-of-context quotes from modeler presentations:

"It worked quite well, almost 80%."

"There are some limitations."

"Of course we need more data."

"Works already quite well, cannot probably go much beyond that."

So they still can't compete with the "To know there, go there," forecasting philosophy. Maybe it should be: "To know there, go there, then write it down accurately for future data users."

TRANSCEIVER WARS

Some of the transceiver makers were there. We heard something like: "Transceivers should have [our feature] due to the following science," and "You don't need [their feature] due to the following science." There was even a panel discussion where few panelists actually answered the questions. Some of it sounded more like marketing spin than science. A few important points I came away with:

Richmond's ISSW Recommendations in a Nutshell—

- ECT and PST propagation tests are very instructive and do-able. Try them both. Use the blunt end of the saw for the PST.
- Include shoveling strategy in your training program.
- Check out the DaisyBell – hydrogen gazex that hangs under your helicopter.
- Theo Meiners's *Escape from Capture!* is an outstanding guide. Make it part of your training programs and avalanche classes.
- Print out Matt McKee's story about forecasting in Chile for the patrol shack.
- Show up in Squaw Valley for ISSW 2010. And if the boss will send you, make it to Davos for ISSW 2009.

1. Figure out for yourself what you have for effective range.
2. Practice shoveling techniques, and teach your partner!

From this practitioner: Diligent practice will make you effective with any of these units. The most important transceiver feature then becomes durable reliability. This includes some reasonable battery life. Folklore from the 1970s has it that a European manufacturer brought a 2275 Hz transceiver over to compete with the US-made Skadi. Their rep showed his model to a group of avalanche professionals and discussed its merits. Then John Lawton – "Mister Skadi" – got up, held up his flat-pack unit, and threw it against the wall. He held it up again and sat down. Let's try THAT science.

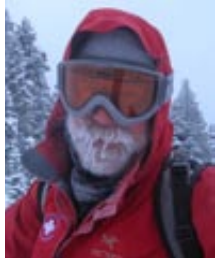
PURE PRACTITIONER

This might have been the highest number of practitioner presentations yet for an ISSW. All 11 papers under the search subject *Mitigation Methods* deal with practitioner work. Read them all. I especially liked Mike Ferrari's talk on Mount Rose ski area expansion into avalanche terrain and Peter Carvelli's talk on bootpacking at Aspen Highlands *(see Carvelli's article, "Bootpacking and Alternatives: Ongoing Avalanche Risk Reduction at Aspen Highlands," in TAR 26/2)*.

There are 31 papers under the search subject *Forecasting*, and many of these are practitioner-written as well. Some deal with problems or histories at specific locations. Others deal with specific forecasting challenges, like deep slab instability (Comey and McCollister), wet slides (Adam Brown), and glide avalanches (one by Stimberis and Rubin and one by Blase Reardon and others).

My favorite two talks were by Theo Meiners and Matt McKee. Theo Meiners presented his avalanche survival strategies and his *Escape from Capture!* diagram *(diagram and accompanying article can be found in TAR 26/3)*. These principles are powerful tools for the practitioner or anyone who might get caught. Include this stuff in your training program. We should thank Dale Atkins for firing up Theo with his outrageous and provocative "swimming might not work" hypothesis (TAR, 25/4). He provoked Theo to share some priceless insight. Dale looked at accidents where people didn't make it. They ended up in the last stage of Theo's seven-stage diagram, and Dale said swimming didn't work for them. Follow Theo's advice (including: avoid getting caught in the first place), and maybe you can stay out of Dale's dataset.

Matt McKee gave a riveting talk with beautiful photos and an amazing story of trying to mitigate hazard for a mine in Chile. His understated, deadpan humor sounded matter of fact as he calmly told his story of being on the losing end of a very lopsided battle with nature. If you only read one paper from ISSW 2008, read this one. Thanks Matt. And thanks to everyone else who helps to make these workshops so worthwhile.



Doug Richmond is a gray-beard ski-area practitioner. ❄

FROM PHOTOGRAPHER JOHN SCURLOCK, OF CONCRETE, WA: This shot was taken while on return from a photographic flight to the eastern Pasayten Wilderness and to the Cathedral Park area just across the border in BC. The cornices are on a ridge above the N fork of Devil's Creek, east of Ross Lake in the western Pasayten Wilderness. The ridge is a lateral off the main ridge known as Jackita Ridge. The photo was taken shortly after I had tried to photograph the east face of another mountain farther east, Ptarmigan Peak, but had given up due to severe turbulence, during which I had bashed my face against my camera severely enough that I thought I had broken my nose, although it later turned out to be simply a bad bruise. After that, I had decided to call it quits and head home until I saw those cornices and decided there was no way I was going to pass that up! My guess is the elevation of these cornices was about 7,000'.

Northwest Mountaineering Journal 2008 Now Available

The mission of the *Northwest Mountaineering Journal* is to be an edited, permanent, annual record of mountaineering in the Pacific Northwest. The journal documents the events, people, history and spirit of climbing and other mountain sports in this region. The journal is published by volunteers from the mountaineering community in collaboration with The Mountaineers. The 2008 issue of the journal is now available at www.nwmj.org. This issue has feature articles about alpine climbing, high traverses, avalanche safety, adventure running, influential mountaineers, and more. It includes reports of new climbing routes and first ski descents from April 1, 2007, through March 31, 2008. It also contains highlights from North Cascades National Park.

We'd like to thank everyone who contributed stories, photos, and information for this issue, both for your contributions and for your patience as we assembled this issue over the past several months. We'd also like to thank the great team of volunteers who edited the journal and the folks at CascadeClimbers.com and the The Mountaineers who provided invaluable support.

We hope you enjoy this issue and will begin looking forward to the next one.

The 2008 Northwest Mountaineering Journal Team: Ralph Bodenner, Steve Firebaugh, Matt Perkins, Rad Roberts, Lowell Skoog, Steve Smith, Alisa Stoffel, Curt Veldhuisen, Aaron Zabriskie ❄

photos from the field

PHOTO BY SIMON TRAUTMAN from a spring ski trip to the Cirque of the Towers, Wind River Range, Wyoming."We skied in to Lizard Head and set up shop for a week – lots to do. Makes me want to move back to Wyoming."

FROM JERRY ROBERTS— *above left:* The Brit (Mark Rawsthorne) holding the "Special San Juan Snow Saw" designed especially for our very shallow and fragile snowpack. Next year's model will be a folding model to fit in a backhoe, I mean pack.
above right: Photo taken at casa de jerry's house in April. standing in back: the Brit (Mark Rawsthorne); seated in front (l-r): Jerry Roberts, Frank Coffey, and George Gardner, who left us in a climbing accident on the Grand Teton in July.

snow science

SHOVELING EDUCATION AT WORK: A CASE STUDY
Success Story on Mt Proctor, BC

Story by Bruce Edgerly, Ian Bezubiak, Todd Weselake, and Janina Kuzma

It may sound fundamental, but shoveling education is an important new frontier in avalanche education. Teaching shoveling techniques can make the difference between life and death when students are involved in a rescue – especially when the burial is deep.

A success story near Fernie, BC, illustrates that learning to shovel properly can indeed save a life. In this case, a 23-year-old snowboarder was recovered alive after a large slab avalanche buried him two meters deep. The rescuers attribute their successful rescue to an extremely fast beacon search and the shoveling techniques they learned one month before in a recreational avalanche course. This case study provides evidence that shoveling education truly pays off in recreational avalanche courses.

On January 7, 2008, Todd Weselake, Janina Kuzma, and Ian Bezubiak were backcountry touring in Cold Feet Bowl on Mt Proctor in the Kootenay Range in interior British Columbia. Snowboarder Weselake, 23, was buried at least two meters deep in a slab avalanche that ran 200m wide, 400m long, and with an average slab depth of 150cm. He was located with an avalanche transceiver, detected with a probe, and extricated by skiers Bezubiak and Kuzma, both 22. Despite the depth of burial, Weselake was recovered alive. All three members of the party attribute this success mainly to the shoveling techniques they learned at a Canadian Avalanche Centre (CAC) Avalanche Skills Training (AST) avalanche course one month before the accident occurred.

The avalanche crown, flanks and debris pile are outlined above. The arrow points to the excavation area. *Photo courtesy Todd Weselake*

RESCUE SUMMARY

All phases of the rescue were performed efficiently, especially the transceiver search and excavation phases. The incident took place during considerable avalanche hazard at that elevation and aspect, according to Canadian Avalanche Centre (CAC) bulletins. At the time of the release, the party was moving one at a time between points of safety after having seen several signs of instability during their initial descent, including a smaller slab avalanche just 10 minutes before the incident. Both Weselake and Bezubiak were involved in the slide when it released; Bezubiak escaped the moving debris by grasping a tree. Kuzma was just above the crown when the avalanche occurred. Bezubiak performed a hasty search, looking for physical signs of Weselake and his transceiver signal. When the signal was acquired, Kuzma performed the secondary and pinpoint search while Bezubiak prepared shovels and probes. The two used various probing techniques to confirm the location and depth of the victim, whose helmet was struck two meters beneath the snow surface.

The beacon search was the easiest part of the rescue, according to both rescuers, consuming less than 15% of the overall rescue time. The probing phase was complicated by equipment problems, but eventually was consummated using a widely taught "spiral probing" technique. The shoveling phase was the most difficult, as the snow was dense and the victim was deep. The two dug a starter hole together, beginning two to three meters downhill of the probe. When Kuzma became exhausted, they rotated, with Bezubiak now shoveling blocks of snow to Kuzma, who then shoveled it clear of the hole. When Bezubiak reached Weselake, he cleared snow from the victim's face and chest. Once his chest was freed, Weselake gradually regained consciousness. The rescuers took approximately 15 minutes to extricate the rest of his body. At this time, Weselake was able to walk away from the excavation area.

The overall rescue time was approximately 20-25 minutes: 3 minutes for the transceiver search, 5 minutes to probe, and 15-20 minutes to excavate.

By starting the excavation well downhill of the probe strike, the rescuers were able to access and extricate Weselake from the side without compromising his air pocket. Bezubiak extricates Weselake's legs while the victim regains consciousness. *Photo by Janina Kuzma*

SHOVELING EDUCATION AND TECHNIQUE

This incident reinforces the importance of teaching strategic probing and shoveling technique in avalanche courses. In burials of this depth, the odds of survival are less than 10%, according to CAC statistics (Jamieson, 2007). This is mainly due to the time required to excavate snow at this depth, as well as the enormous pressures that decrease the permeability of the snowpack and limit the ability to expand the chest, even if an air pocket is present. Previous research (Atkins/Edgerly, 2006) has concluded that transceiver technology and education have improved dramatically in the past decade, driving down average rescue times for transceiver searches. However, this literature also proposes that advances in shoveling technique and education now stand to drive rescue times down even more, as this phase is vastly more time consuming. In the literature, two methods, sharing common themes, have been proposed: "strategic shoveling" (Edgerly/Atkins, 2006) and the "V-shaped conveyor" method (Genswein/Eide, 2008).

In this case study, the rescuers used techniques that are common to both methods:

1) leaving the probe in place and starting the excavation downhill of the victim
2) creating a large starter hole of a length one to two times the burial depth and approximately one "wingspan" wide
3) one shoveler chopping and moving snow in a deep burial as the other clears it from the hole
4) creating a platform downhill of the victim that can be used for first aid and evacuation

The rescuers had read papers on strategic shoveling and learned the V-shaped conveyor method at a Mountain Pursuits CAC Level 1 AST course in Fernie, BC. They used techniques common to both methods. In addition, there were several details not commonly taught in avalanche courses that helped to make a difference:

✚ Extra gloves/supplies

In this incident, Bezubiak lost his gloves while assembling shovels and probes. Kuzma provided him with an extra pair. It is common for rescuers to remove their gloves during a rescue. This is a mistake; gloveless hands quickly become cold and ineffective while shoveling. Instructors should teach students to keep their gloves on at all times and to carry spares. The group also had clothing and hot drinks to keep Weselake warm during the evacuation.

✚ Adequate manpower

It is unlikely that Weselake would have survived if only one rescuer had been available for shoveling. It is also unlikely he and Bezubiak both would have survived if Bezubiak hadn't escaped the slide at the beginning, as only Kuzma would have remained to excavate two victims. A recent study of avalanche incidents in France (Jarry, 2008) illustrates that shoveling manpower and technique are even more important than transceiver technology in the likelihood of success in a rescue.

Excavation is a critical phase in all avalanche rescues. Strategic shoveling should be taught in avalanche courses in addition to basic transceiver technique.
Photo by Janina Kuzma

✚ Good communication

This group was particularly effective because they were close friends who communicated well during the tour and the rescue. This included checking equipment and discussing contingencies at the trailhead. They carried cell phones and notified rescue authorities when they had service. This aided in Weselake's evacuation and fast recovery.

CONCLUSION

Shoveling technique has increasingly made its way into North American recreational avalanche courses. That's for a good reason: excavation takes the majority of time and energy in a transceiver rescue. Techniques such as "strategic shoveling" and the "V-shaped conveyor" save valuable time and create a better workspace for extricating, reviving, and treating the victim. This case study illustrates the importance of teaching not only basic transceiver rescue in avalanche courses, but also efficient probing and shoveling techniques. The increasing emphasis on shoveling and probing education in North America is now proving itself as a valuable tool for saving lives.

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Bruce Edgerly *is vice-president and co-founder of Backcountry Access Inc (BCA), a leading manufacturer of snow-safety equipment based in Boulder, CO. He was the presenter of "Strategic Shoveling: The Next Frontier in Companion Rescue" at the 2006 ISSW in Telluride, co-authored by Dale Atkins. Bruce is a big fan of Canadian ski touring and old-time hockey, and he's looking forward to the day the Stanley Cup returns to its rightful home north of the border. At age 23,* ***Todd Weselake*** *has been involved in the photography industry for 8 years. His interest began by taking shots of friends around the ski hill and in the backcountry. He is currently based in Fernie, BC, and spends his winters in the Rocky Mountains, ski touring and taking powder shots for Island Lake Resorts Group, while in the summer he chases snow in South America.* ***Janina Kuzma*** *is a professional skier who is based in Fernie, BC, where she grew up skiing. She does back-to-back winters by living in New Zealand in the southern hemisphere winter. This upcoming season she'll be competing for a spot on the Nissan Freeride world tour in Europe and plans to complete her level one avalanche certificate.*

Case Study in Review: Discussion Q&A

Story by Ian Bezubiak and Todd Weselake

IAN'S THOUGHTS

On beacon searching:

When the season is underway, I practice my beacon searching once or twice a week, either with friends or by myself.

It was very reassuring during my preliminary search when Janina came behind me with her Tracker beacon counting down the meters out loud to me. So the digital beacon was definitely an asset and aided in our search. It was nerve wracking, to say the least, to look for the signal, try to stay calm, and listen for the beeps and look for the lights on my F1. I was asked after the presentation by a patroller if I thought it would have taken much longer if I was by myself searching with my F1? Janina and her digital beacon as backup maybe saved 30 seconds at most, seeing as I am very quick with my F1. When it comes down to it and you are in an avalanche and trying to make a recovery, just having those numbers and someone counting down to you or the group can probably speed things up, and it did calm me a bit.

Also, an airbag probably would have kept Todd close to the surface in this case, but they are pretty darn expensive for the average ski bum.

On shoveling:

I was using a Black Diamond shovel with a T handle and extension. It has a rectangular shaft as opposed to a cylindrical one so it always snaps into place right away when you extend it. The other shovel we used had no extension; that's the only piece of equipment that I could say I would have changed.

The rescue techniques are really simple, and I did the exact same thing to find Todd as I had practiced in the course. We left the probe in and went down the slope about 1.5 x the length of our probe depth. We dug as fast as we possibly could to get to the end of the probe not knowing for sure it was Todd, then when I confirmed it was his head I started cleaning out around his face and chest while Janina constantly moved more snow from behind me to keep a good flat area for me to throw more out and to bring Todd out onto.

With only two of us, it wasn't exactly a pretty V-shape, but it turned into something that worked. Also, since I dug to him horizontally, I only had to excavate a tunnel of snow around his body as opposed to having to move all the snow that lay above him if I had dug straight down.

On the AST course:

Our AST 1 course was so valuable to Janina and me. We had a lot of fun doing it, but we also learned a lot. Some information was a good refresher and reassuring because I had been in the backcountry many times before, but the last day was when we learned this new shoveling technique.

It sits funny in my mind because we joked with Duncan (our instructor) about not showing up for the last day; it was supposed to dump that night, which it certainly did. But we did show up, of course, and only one person didn't. Luckily, Janina and I stuck it out and let everyone else make their turns. It almost makes me laugh that I could have even had the thought of skipping the class to go skiing for one day, when what we ended up learning that day were the skills that keep us and our friends skiing safely, hopefully for the rest of our lives.

Getting people stoked and wanting to take a course before they head to the backcountry is a hard task. I myself was out in the backcountry a lot before I took my course; I know lots of other folks that are the same way. At the ISSW banquet, I sat down beside an avalanche-course instructor and we got to talking, and he said one thing that stuck in my mind: "If you can ski it, it can slide, and it can kill you." Whether it is in-bounds, out-of-bounds, an open run, closed run, thick trees, low angle, skied 100 times, only a 5-minute hike from the chair lift – it doesn't matter.

Last season's December 5 rain crust proved that nowhere is completely safe, I think. I used to think low-angle trees could more or less be deemed safe. Now they can scare the crap out of me. The course should be pushed upon everyone, not just the backcountry enthusiast.

On decision-making and group communication:

Having already triggered a smaller slab avalanche in an area we thought was safe to ski, we collaborated as a group and tried to just find the safest route as possible out of there. The avalanche happened anyway, and Todd got nailed. He heard me yell right after the collapse. He was able to grab a tree, but the avalanche was way too powerful and pulled him off. We weren't skiing at the time, just standing at the trees to stay safe and waiting for the go-ahead from Todd, which was a damn good thing. Both Janina and I were able to avoid the slide completely, thus giving us lots of time to search for him.

TODD'S THOUGHTS

- I have my CAA level one, which is the minimum for guiding in Canada.
- We skied a variation of the same line the day before, actually a more conservative one.
- The Avalung got ripped out of my mouth.
- The weight of snow stopped me from even expanding my lungs and I passed out instantly.
- Training and good friends are major necessities in the backcountry.

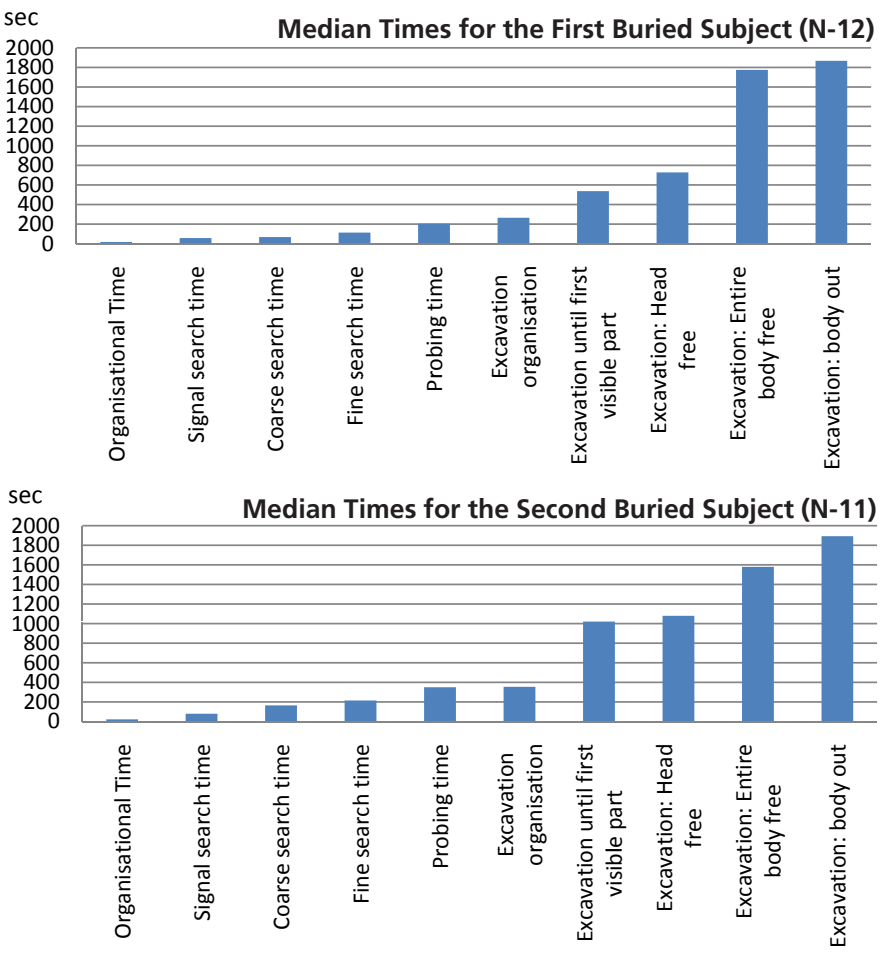
Ian is 23-years old and has been skiing out of Fernie, BC, and area for five years. His passion is skiing but he loves all outdoor pursuits as well. He is currently working on his Non-Destructive Testing apprenticeship but is putting it on hold to do another winter in Fernie.

Teaching and training for the beginner level, students were limited to three standardized 45-minute modules.

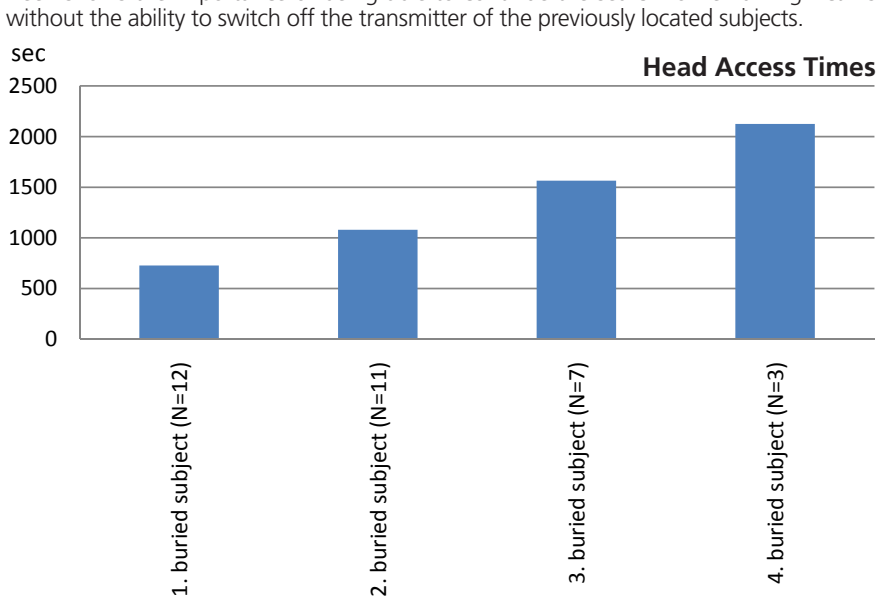
Data from all rescue scenarios were precisely recorded and filmed.

Time is life – every minute counts! The strenuous full-speed excavation effort for the last buried subject demands every bit of force from the beginner-level companion rescuers.

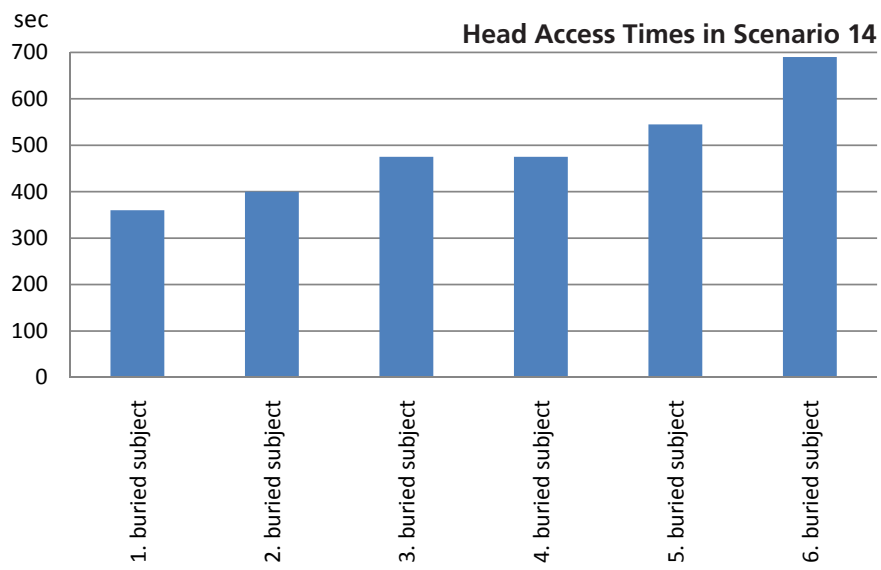
The V-shaped snow conv



Median times for the different states of rescue for the first and second buried subject within the listed scenarios. The important increase in time between "head free" and "entire body free" shows the importance of being able to continue the search for remaining victims without the ability to switch off the transmitter of the previously located subjects.



Median head access times for the first four buried subjects. Taken into account that burial depth and hardness of the debris was above average, results are very positive for companion rescuers with minimal training.



Head access times in a scenario with six buried subjects at 1m burial depths solved by eight companion rescuers.

HOW EFFICIENT IS COMPANION RE

Story by Manuel Genswein and Ragnhild Eide • Edited by Craig Dostie

Although the theoretical efficiency of companion rescue is never questioned, serious doubts are often expressed when it comes to the real efficiency and survival chances in multiple burial situations.

To verify the claim that companion rescue is indeed efficient, a field test was conducted with 30 participants provided by the BA Physical Education and Outdoor Life Program of Volda University College, Norway. They had each taken a one-week ski touring course plus had some experience on private ski tours – an experience level consistent with novice backcountry skiers. They were provided with modern search and rescue equipment designed for recreational users. They were taught "best practice" search and rescue methods in a manner that is pedagogically and didactically optimal.

TEST ENVIRONMENT

The test site was near the field laboratory of the Norwegian Geotechnical Institute. A spring snowpack with high density and hardness was used as a realistic simulation of dense avalanche debris. Test fields were either 50m X 80m or 80m X 120m – the median size of, respectively, "survived and deadly recreational avalanches" in Switzerland. Slopes were inclined between 5° to 15° in the low-angled fields or 15° to 25° in the steep fields.

The life-sized mock victims (straw-filled, oblong bags) were buried at 1, 2, and 3-meter depths. The snow around them was allowed to freeze one night, then stomped down by foot to increase density, and frozen a second night before being "rescued."

Rescuers were chosen randomly from 30 volunteers to work together in group sizes ranging from one to six. One of 15 different scenarios with one to six buried subjects were presented moments after groups were assigned. Each rescue was then recorded with video and still photography. The following times were recorded to document the efficiency of each rescue:

- Time until the rescuers started searching (organizational time)
- Signal search time
- Coarse search time
- Fine search time
- Pinpoint time (probing)
- First visual contact with the buried subject
- Head access time
- Full body free
- Body on the surface

RESCUE TRAINING: MODULES

A key component of this experiment was the training prior to performing rescues. Each participant was taught basic rescue techniques and procedures in three standardized 45-minutes modules. The first module dealt with Proper Use of Avalanche Equipment and Single Burial Search procedures. This included proper use of avalanche transceivers, deploying shovels and probes, and applying the "airport approach" to locating victims. The "airport approach" is an easily taught and understood metaphor for the search flow. Go fast during signal and coarse search while entering airport airspace, slow down and become more precise during fine search, or preparation for landing, and the probe brings the plane in to the gate.

Search techniques for Multiple Burials were taught next. This included scenarios of close and distant proximity. The use of advanced "marking" features were shown as well as the micro search strip method as a fall-back plan independent of transceiver capabilities. In addition, triage was taught in this module.

The last module dealt solely with Excavation. The V-Shaped Conveyor Belt method was taught here.

SEARCH TACTIC CONCLUSIONS

Signal Search—

The three-dimensional rotation of the receiver does not cause any problems for novice companion rescuers. The transceiver must be held sideways to the head while doing the 3D rotation with the hand only and with the speaker facing towards the ear of the rescuer during signal search.

Coarse Search—

The coarse search with modern avalanche rescue transceivers is fast, efficient, reliable

veyor in action.

Triage in companion avalanche rescue. A rescuer has freed the head of the first victim who was alert and responding; the rescuer immediately joins the effort in digging out the second buried subject.

Multiple burials in close proximity. With appropriate training methods, search strategies, and equipment, even companion rescuers with limited training have a realistic chance to save several lives!

The third and last buried subject was out of the snow in 21 minutes. The three companion rescuers successfully accomplished the demanding task of multiple burials in close proximity.

ESCUE WITH MINIMAL TRAINING?

The companion rescuers begin the signal search at the bottom of an 80x120m avalanche debris area with six buried subjects.

and does not usually cause any problems. While following the field line, guided by the device, rescuers should try to keep the big picture of the scenario in mind and avoid having multiple rescuers search for the same buried subject.

During coarse search, the presence of a direction indication is highly valuable, particularly for groups with novice to average experience. This is a clear warning that single antenna devices, analog or digital, are inadequate for these user groups. In the context of optimizing survival it is not advisable to sell, promote, or recommend single-antenna devices to novice or average rescuers. This statement is equally valid for either companion or organized avalanche rescue parties.

Fine Search—

It is critical in this phase to insist during training on a systematic application of a grid search pattern, especially with no rotation of the receiver. Furthermore the device must be held on the surface of the debris. Triple antenna devices show clear advantages in this phase of the search. Mark the spot with lowest distance / loudest sound with the shovel (=center of probing spiral).

Pinpoint Search / Spiral Probing—

Apply spiral probing pattern. 25cm between probe holes and 25cm increase in radius. Probe at 90-degree angle to snow surface, leave probe in place after hit. Always handle probes and shovels with gloves.

MULTIPLE BURIALS AND TRIAGE

If failures occurred concerning multiple burials in general and in the application of the "micro search strips" in particular, the cause of the problem has been – without exception – that the rescuers did not properly recognize the situation.

The four remote reverse triage factors – "terrain," "distance between rescuer and buried subject," "burial depth," and "vital signs" – have been introduced and the triage algorithms instructed. The triage algorithms make sense intuitively to participants, and instructors should not hesitate to address this topic in a very early stage of the training. *(see Manuel Genswein's paper on Reverse Triage Factors in ISSW 2008 proceedings.)*

EXCAVATION

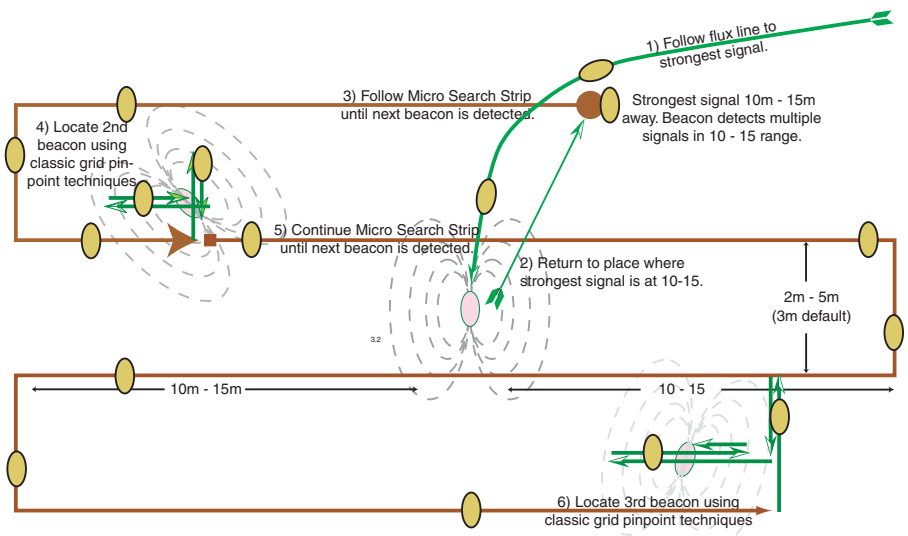
In the excavation stage the V-shaped strategy worked well; rescuers have to be taught the proper way to chop blocks.

CONCLUSION

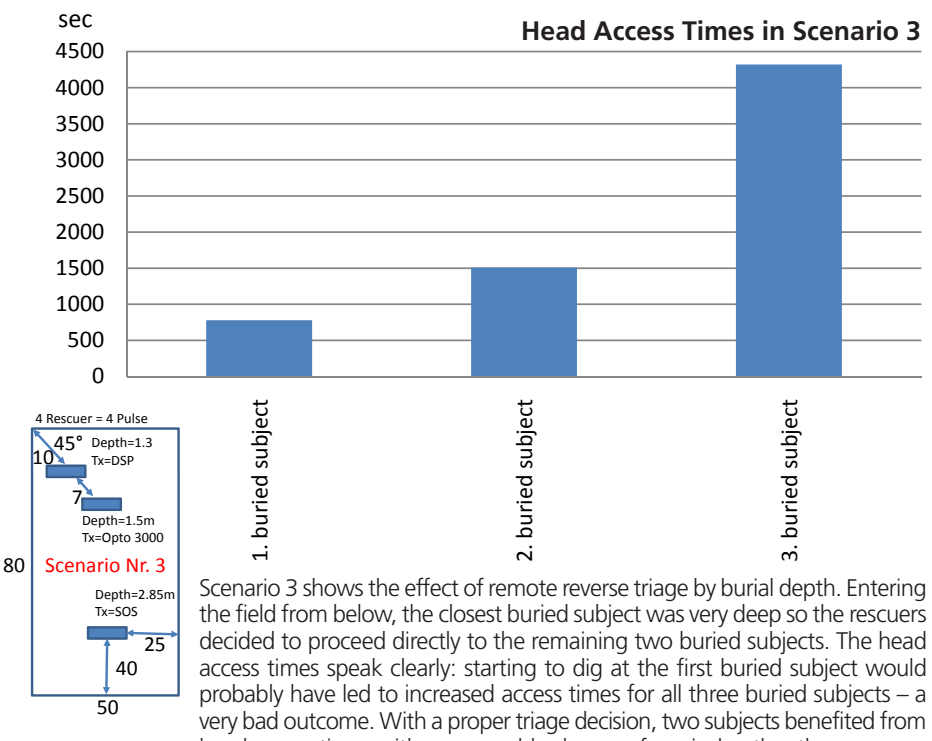
The results of our field tests prove that companion rescuers with minimal training can be highly efficient, even in situations which might previously have been viewed as particularly complex and "out of reach" for companion rescuers. Key to these results, however, is proper education. With proper training, strict adherence to search protocol and with search and rescue equipment designed for recreational users, companion avalanche rescue is highly efficient.

A detailed treatise on this subject is available in the papers published by ISSW 2008.

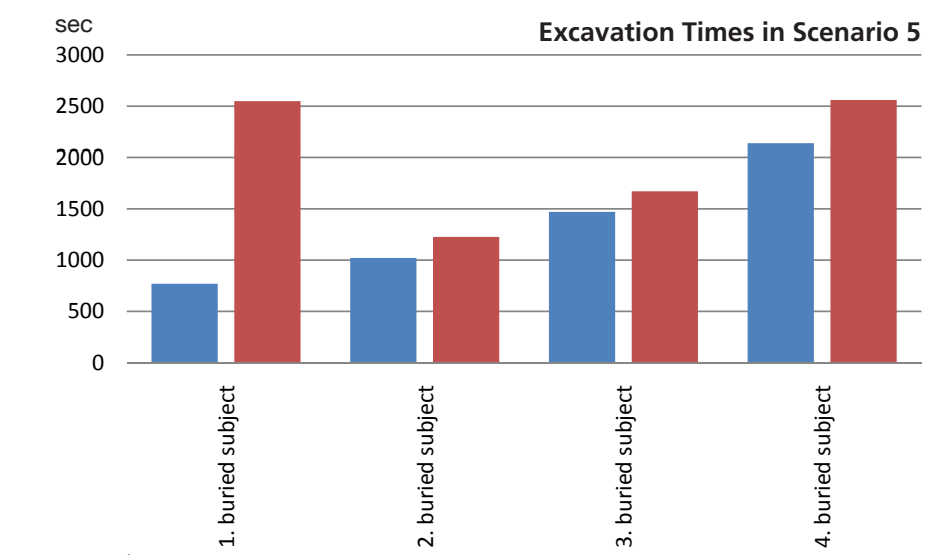
Manuel Genswein is an independent avalanche instructor. He can be reached at manuel@genswein.com. Ragnhild Eide has been working as a NF mountain guide in Norway since 1997. Since 2005 she and Manuel have been part of the development of the V-shaped snow conveyor technique for excavating avalanche victims.



The "Micro Search Strip" Method is recommended as a search strategy for multiple burials independent of receiver type. It has a systematic approach and application on the avalanche, good error tolerance, and very low chance of "missing" buried subjects.



Scenario 3 shows the effect of remote reverse triage by burial depth. Entering the field from below, the closest buried subject was very deep so the rescuers decided to proceed directly to the remaining two buried subjects. The head access times speak clearly: starting to dig at the first buried subject would probably have led to increased access times for all three buried subjects – a very bad outcome. With a proper triage decision, two subjects benefited from head access times with a reasonable chance of survival, rather than none.



Excavation times in scenario 5: The first buried subject was responding, so the rescuers immediately continued with the rescue effort for the remaining buried subjects before completely freeing the first body. The team gave an excellent performance, considering the complexity of the scenario and the above-average burial depths.

digging deeper

Everybody was located in a surprisingly short period of time. But the snow was like concrete compared to the Cool Whip we dig through when we practice beacon searches.

Durrand Glacier, BC, January 2003

A Brief Mathematical Note On MULTIPLE-BURIAL LIKELIHOOD

Story by Jonathan S. Shefftz

Dieter Stopper and Jon Mullen find in *How Common Are Multiple Burials* (TAR 26/2, p. 20) that "of 188 avalanches in Tyrol in which people were caught, just one or two incidents fit the description of a special-case multiple burial (with victims in close proximity and where a special technique was necessary)." They conclude that, "One thing is clear: a special-case multiple burial situation that requires a special technique (or technology) is very rare."

By contrast, Manuel Genswein in *Why Multiple Burials Are Now Nearly Nonexistent and Why Signals Almost Always Overlap* (TAR 26/4, p. 8) strongly disagrees with their conclusions. (His article's title is meant as a criticism of their methodology, not the underlying pattern of burials.)

So, which article is right? They both are! How can both be correct? Because they both correctly answer the mathematical questions they pose. The purpose of this note is therefore to rephrase the mathematical question(s) to be answered, and provide the varying results. (This note does not touch on any of the signal overlap issues raised in Genswein's article, which was simultaneously responding to a separate article in TAR 26/2.)

Why should we care about multiple-burial likelihood?

As an economist, I tend to view the world in terms of costs and benefits, even if they cannot always be quantified or monetized (despite economists' ceaseless efforts to do so). Although some beacons' features for signal separation in multiple-burial searches are very impressive, they nevertheless carry a cost. And by "cost" I do not mean the monetary value of the necessary product development and design, or even the retail price for the consumer, but rather the potential confusion that can arise from the added complexity in the user interface and controls.[1]

To the professional rescuer or well-practiced recreationalist, these drawbacks may seem insignificant, but what percentage of typical backcountry users practice regularly with their avalanche beacons? Furthermore, these advanced features do not always work perfectly. This leads to the difficult decision of whether to continue to let the beacon do all of your thinking for you, or instead overrule it and revert to thinking for yourself?[2] (Anyone who has used a GPS for car navigation will be familiar with the reaction of "that thing wants me to go where?!?")

With such costs come some impressive benefits for solving difficult multi-burial scenarios. How beneficial? And in what types of scenarios? This is a subjective assessment, whose controversies I would prefer to steer as far away from as I would an overhanging cornice.[3] But Stopper and Mullen do assess the multiple-burial incidents in their database for whether a special technique or technology was "necessary" or "required." Yet they have no way of knowing for sure whether a signal separation beacon would have reduced search times, even if only by a small (yet potentially valuable) margin. Furthermore, during the six-year period of their dataset, no beacon on the market had any sort of signal separation feature.[4] Therefore, the rescuers' perceptions as to whether signal separation would have helped might be colored by their lack of exposure to such technologies at the time.

So the mathematical question I propose to pose is, when a beacon is used in a backcountry avalanche rescue, how likely is signal separation to at least have the potential to be helpful? In other words, although the costs/drawbacks to advanced beacon features cannot be quantified, and although their benefits cannot be quantified either, at least the likelihood can be quantified for whether those benefits will be relevant to a search. Before answering this question from the dataset that Stopper and Mullen report, three data issues arise:

1. **How accurate is projecting into the future based upon past data, i.e., will future avalanche incidents look like past incidents?** Clearly far more recreationalists are venturing into the backcountry, especially in North America, and especially via ski resort access, but whether party sizes and travel patterns will remain the same is uncertain.
2. **How similar are Austrian Tyrol party sizes and travel patterns to other parts of the world?** I have no idea how to account for this.
3. **Is a six-season dataset sufficiently large to minimize the effects from statistical variation?**[5] Now this I do know how to account for, but it sounds too much like the work I get paid to do (and nobody is paying me for this article). Plus it is probably overwhelmed by any inaccuracies attributable to the two prior issues.

At long last then, the mathematical manipulations. The dataset contains 432 avalanches, of which 256 were "somehow human related," of which 188 caught at least one person (either carried or buried), and of which 68 buried at least one person fully. Of the 68 burial incidents, Stopper and Mullen report in detail on only the 31 avalanches in which both victims and rescuers had avalanche beacons. I would prefer to include all 68 incidents, since the party sizes and travel patterns of beaconless travelers might very well be nearly identical to those who better equipped.[6] But I currently lack any details for the other 37 incidents.

Of the 31 incidents in the dataset, eight included multiple burials. That means that a rescuer searching in one of these incidents faced a 26% likelihood of searching in the presence of multiple signals. Moreover, of the 61 total burials, 38 occurred in multiple-burial incidents, for a 62% rate.

However, I propose that a more meaningful calculation for the latter percentage tallies one burial in each multiple-burial incident as a burial in a single-burial incident. Why? (Or perhaps, "Huh?!?") Any modern digital-processing beacon with multiple antennas will automatically and efficiently lock onto the strongest signal. Therefore, signal separation is of potential value only after the first victim is located and the search proceeds to the additional victim(s).[7] With that adjustment, signal separation had the potential to be helpful in 49% of the victim searches.

I expanded this analysis to include two other readily available datasets:

WHEN SHOULD WE DIG?

Story by Frédéric Jarry

In their article presenting a multi-victim beacon search strategy, M. Genswein and S. Harvey noted that in Switzerland, between 1970 and 1999, 61% of buried ski tourers were buried with other victims. However during the 2007 Cisa-Ikar Dieter Stopper stated that in the Tyrol "true" multiple victim burials were in the minority and that backcountry skiers should master single victim searches and have an efficient shovelling technique.

The most significant technological advance of the latest avalanche beacons is the simplification of multiple victim searches. When victims are buried in close proximity the transmission flux lines of their beacons are mixed. New technology enables each signal to be isolated. The signal of the first victim that is found can be eliminated, allowing the searcher to continue looking for other victims.

In light of the two studies cited above and the advance in technology offered by recent avalanche beacons it seems interesting to analyze the French data to try and answer two questions:

1 Are multiple burial situations common in France?
2. When victim(s) are buried are there sufficient diggers to organize an efficient rescue?

The second point was inspired by a question asked by a professional member of the rescue services during the 2007 Cisa-Ikar when the "marking" function of a new beacon type was demonstrated : "yes, but, when do we actually dig?"

Being able to quickly and easily locate the 2nd (and 3rd etc.) buried victim without actually having to turn off the victims' beacons is a very useful skill for searchers. However it is important to view this advance in technology in the context of practical situations on the ground: what is the likelihood that a rescuer will actually need the marking functionality offered by the latest models of beacons? In that case are there sufficient resources to simultaneously dig out victims and so benefit from the time saved?

This study is based on 259 avalanche accidents recorded by the ANENA (French National Association for the Study of Snow and Avalanches) between October 1999 and September 2007. The incidents all involved at least completely one buried victim and occurred during sporting activities outside of secured areas (ski touring, out-of-bounds skiing, and climbing). A total of 333 victims were buried in these accidents. 112 of the accidents were during ski tours with 146 burials. 135 were during out-of-bounds skiing with 163 burials. Twelve involved climbers; however the limited data size for climbing means that no specific analysis can be made for that activity.

The data received by the ANENA does not enable cases of true multiple burials, that is victims that are close enough together that the signals from their avalanche beacons are superimposed, to be isolated from multiple burials where victims are buried far enough apart that no special search strategy is needed to separate signals.

The number of multiple burials in France

For the reference period and considering all sporting activities outside of secured areas, 20% of accidents involved multiple burials; 13% had two victims. The number of victims in multiple burial accidents represents 38% of the total. Statistically speaking, when a rescuer is out-of-bounds piste skiing or climbing, he is faced with a multiple burial incident one time out of five.

Multiple burials during ski touring

Does the fact that ski tourers are closely grouped when climbing make multiple burial incidents more frequent compared to off piste skiing? The results presented below seem to confirm this theory.

Multiple burials represent 21% of ski touring avalanche accidents. Of these, 14% involved two victims (fig 1). The number of victims in multiple burial accidents represent of 40% of the total for ski touring (fig 2).

If somebody had the basics with their transceiver, they did a pretty good job of it. People usually have the most problems with probing and shoveling – and organizing. It's become obvious to me we need to focus on the skills that take most of the time.

Connaught Creek, BC, January 2003

Statistics compiled by the ANENA for the period 1999/2000 to 2006/07, during ski tours and off-piste skiing show that:

- 74% of victims buried less than 50cm survived.
- 40% of victims buried between 50 and 100cm survived.
- 22% of victims buried more than 100cm survived.

In this study we use the American expression "out-of-bounds skiing" to refer to off piste. That is skiing slopes that are reached by gravity from ski lifts but outside of open and secured ski slopes. In Europe only marked ski trails are secured from the risk of avalanche. The rest of the ski area is left unsecured. Skiing includes snowboarding.

However, there is a marked difference between accidents during climbing and descending. Considering ski touring accidents that occur when ascending, those with multiple victims represent 26% of the total (fig 3). The number of victims is 46% of the total (fig 4). The number of multiple burial accidents drops to 17% when descending (fig 5). The number of victims is 34% of the total. (fig 6).

In other words, a rescuer involved in an avalanche accident where the ski tourers were ascending will be faced with a multiple burial scenario in a quarter of cases. However it is important to note that for the activity and circumstances, multiple burial incidents total nearly half the total number of victims. If the rescuer is involved with an accident that occurred where ski tourers were descending he will be faced with multiple burials in one out of six incidents. However the number of buried victims amounts to a third of the total.

Even if the data set is not large, these results tend to confirm our preconceived idea that when climbing the grouping of ski tourers and the difficulty they face escaping an avalanche increases the risk of multiple burials. In other words, one can assume that cases of true multiple burial situations are more frequent amongst ski tourers who are climbing.

Multi victim incidents when out of bounds

Amongst the out-of-bounds avalanches that buried at least one person, multiple victim burials represent 13% of the total. More than half the accidents had two victims. Multiple burials represent 28% of the total out-of-bounds skiing fatalities. Statistically speaking, when there is a burial rescue workers are faced with multiple victims in one out of eight incidents. As you can see, multiple victim burials are twice as likely ski touring when compared to out-of-bounds skiing.

It is interesting to note that the proportion of multiple victim accidents when skiing out-of-bounds (13%), and ski touring while descending (17%) are fairly close. The difference between climbing and descending, the ease with which participants can escape from an avalanche or not, and the size of groups can explain these differences to a certain extent.

Companions available for search and rescue

Companion rescue, where all buried victims can be recovered in the first fifteen minutes, implies not just that the group can effectively use avalanche beacons, probes, and shovels but also that there are sufficient buddies left on the surface to dig out the victims. Statistics show that the more man power that is available for shoveling, the greater the chances of survival for buried victims.

One can reasonably assume that a minimum of two shovelers are necessary to efficiently recover a victim. So for each victim the group should have three members. For two victims there should be four diggers available at the same time to offer the same chance of survival.

Continued on page 19 ➡

For victims to have a reasonable chance of survival, there should be at least two shovelers for each buried victim. According to Jarry *(story at left),* most recreational groups don't have that kind of manpower.
Photo by Bruce Edgerly

1. Swiss avalanches from 1970 through 1999, as reported by Manuel Genswein and Stephan Harvey in *Statistical Analyses on Multiple Burial Situations and Search Strategies for Multiple Burials* (International Snow Science Workshop, 2002: Penticton, British Columbia.).
2. U.S. avalanches from 1995 through 2007, as reported by Bruce Edgerly in *Revisiting Multiple Burial Statistics: U.S. Avalanche Incidents 1995-2007* (undated; viewed at www.bcaccess.com on July 10, 2008).

The table summarizes the pooled results (although unfortunately the victim counts are not reported in the US-based study). The likelihood that an avalanche search will involve multiple victims is 22%. The likelihood that a victim will be searched in the presence of other signals is 35% (after excluding the first victim in each multiple-burial search), or about one out of three victim searches. In other words, a rescuer at an avalanche has about a one in five chance that signal separation will be of any potential value, whereas about one in three victims have the potential to be located more quickly because of signal separation.[8]

Now just how many of those avalanches and their multiple victims are configured such that signal separation will actually be helpful (as opposed to potentially be helpful), and if so just how helpful…all I know for sure is that I want to stay far away from – and minimize the time I spend under – that overhanging cornice of controversy!

FOOTNOTES

[1] My review of these beacons is available at www.beaconreviews.com/transceivers/shefftz.htm. In a somewhat related field, I have often discovered while teaching training courses on the software applications I have created for state and federal agency staff that certain buttons or entry fields confound my user base, even though everything had of course seemed completely obvious and intuitive to the developer and myself. And on a personal note, when I showed my dear wife the beacons in the previously referenced review, her reaction was, why can't they just have only a number and arrows, with nothing else? (Ironically, her professional work involves software so complex that the annual license fee is in the thousands of dollars.)

[2] Acknowledgement is due here to Marcus Peterson of Ortovox USA for his insight that most of modern beacon design comes down to how much of your thinking do you want your beacon to do for you.

[3] A similar controversy applies as to whether multiple-burial searches should be taught and practiced at introductory-level avalanche courses, where the cost is the lost opportunity to spend limited course time on other topics (e.g., strategic shoveling).

[4] The first signal separation beacon, the Pieps DSP, became available in the U.S. market in November 2003. Even if it was available earlier in the year in Austria, which is also its country of manufacture, that would represent only a very small portion of the entire six-season period for the Tyrol dataset.

[5] To explain via analogy, think of how political pollsters determine the sample size necessary to obtain a margin of error within a certain number of percentage points.

[6] Note that the article's ancillary conclusions about beacon prevalence among backcountry users might also not reflect current patterns, as higher beacon sales in more recent years may have more than offset the higher numbers of backcountry recreationalists.

[7] An old rabbinical saying is typically translated from the original Hebrew along the lines of, "Whoever saves a single life, saves an entire world." However, that should not be interpreted as giving the okay to pat yourself on the back and then give up after locating the first burial in a multiple-burial avalanche!

[8] To illustrate this methodology with a very simple universe, assume three avalanches: two have one victim each and the third avalanche has three victims. My conclusion would be that a rescuer has a 33% chance of receiving any benefit from signal separation (i.e., one divided by three) and that a victim has a 40% chance of receiving any benefit from signal separation (i.e., the two victims in the multiple-burial avalanche who would not be locked onto by a beacon without signal separation, divided by the total of all five victims across the three separate avalanches).

Jonathan Shefftz lives with his wife in western Massachusetts, where he patrols at Northfield Mountain. He is an AIARE-qualified instructor, NSP avalanche instructor, and AAA affiliate member. When he is not searching out elusive freshies in Southern New England, he works as a financial economics consultant and has been qualified as an expert witness in Administrative Court and U.S. District Court. He can be reached at jshefftz@post.harvard.edu.

	Austria	Switzerland	U.S.	Total
	97-03	70-89	95-07	
Avalanches: complete burials	31	466	241	738
Avalanches: multiple burials only	8	127	28	163
Likelihood that an avalanche search will involve multiple burials	26%	27%	12%	22%
Burials: total	61	698	???	759
Burials: multiple	38	359	???	397
Likelihood that a victim will be searched in the presence of other signals	62%	51%	??%	52%
Modified to reflect single-victim nature of first search in multiple burial	49%	33%	??%	35%

digging deeper

Excavation took much, much longer than searching by a factor of about 10. The pit was so deep that it was hard to clear the snow out of it, and there wasn't much room to work.

Mt Tom, CA, March 2005

DIGGING DEEPER:

Uncovering the Real Issues in North American Multiple Burials

Part Two – Real Experiences From the Field

Story by Bruce Edgerly

Editor's note: Part One on this topic appeared in TAR 26/1

People are people. They are not numbers. To find out what the real issues are in avalanche rescues, we must go beyond statistics and speak directly to the select group of people who have actually had an avalanche transceiver in their hands during real, live avalanche rescues. This is what we have done in part two of our ongoing research on multiple burials. Our findings: in real multiple burial situations, it's not about beacon searching – it's about shoveling.

Part one of this research included statistical studies in North America and Tyrol, Austria, by Bruce Edgerly and Dieter Stopper respectively, who shared the services of US-based consulting computer scientist, Jon Mullen. Both of these studies were published last season in *The Avalanche Review*.

Since this research was published, there has been vibrant discussion about the subject, including whether the data should be analyzed "by incident" or "by victim." Jonathan Shefftz and Frédéric Jarry have done it both ways *(see stories beginning on the previous two pages)*. Shefftz has suggested looking closer at the incidents to see how many would *actually* rather than *potentially* benefit from special techniques or technology. The statistics on multiple burials could be overstated, he adds, if you consider that modern digital beacons automatically isolate the first victim, using signal strength, so that phase of the search is no different than a single burial.

Jarry has suggested that this might all be a moot point. According to Manuel Genswein, he argues, at least two shovelers are recommended per buried subject for that person to have a reasonable shot at survival – and most recreational groups simply don't have that kind of manpower.

No matter how you approach the numbers, they're not capable of telling the real story. What matters is people – and each individual incident is as unique as the people involved. This is why in part two of our research, we have chosen to "dig deeper" and speak to those individuals who have actually performed a multiple-victim transceiver search in the field.

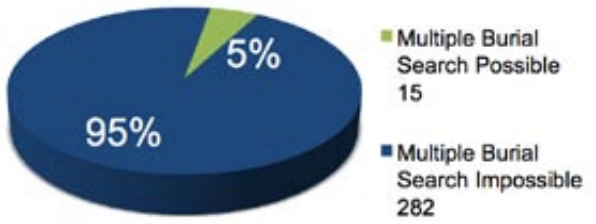
STATISTICAL REVIEW

Since *The Avalanche Review* is a North American publication, we will look only at North American incidents, which are listed at www.avalanche.org. This database is more complete than both the Swiss and the Tyrolean databases. For a review of the Tyrolean data, see *The Avalanche Review*, 26/2. This was recently presented by Dieter Stopper at ISSW 2008 in Whistler.

According to the www.avalanche.org database, from 1995 through April 2008, just 14% (45 incidents) of roughly 300 complete burial incidents involved multiple victims. Of these 297 confirmed complete burial incidents, just 5% (15 incidents) involved multiple-victim beacon searches.

Of these same 297 incidents, just 1.7% (5 incidents) involved close-proximity multiple burials, where a special technique (or technology) could have been applied. Normally, a multiple burial can be solved with common sense by searching for the victims "in series" or "in parallel" using the same techniques that are used in single burials. Only in "special case" multiple burials would a special technique or technology come into play. These involve cases where two completely buried victims are within roughly 10 meters of each other (close enough so their signals are hard to differentiate) – and where there is adequate manpower so some rescuers can start digging while the best searcher continues with the beacon search.

Complete Burials - 297 Confirmed Incidents



In 297 confirmed complete burial incidents, a multiple-victim beacon search was possible in only 15 cases (5%). Only five cases (1.7%) involved close-proximity burials. This is a significant departure from a 2002 Swiss study which asserted that 60% of avalanche victims were involved in multiple burials. It also contradicts a recent printed statement (from a German beacon manufacturer) that, "about 50% of all reported avalanche accidents involve two or more persons with interfering signals…"

DIGGING DEEPER: RESCUER INTERVIEWS

We began "digging deeper" by contacting members of the 15 parties in which multiple-victim beacon searches were performed. In addition, we contacted members of parties in which at least two people were reported killed from 1995 to 2008 on www.avalanche.org. The objective was to make sure these were captured in our research and to get "worst case" feedback from the field. This added up to roughly 35 incidents that we investigated through interviews with actual rescuers, coroners, search-and-rescue teams, and/or other witnesses.

To get a big-picture view of the entire rescue process, we asked the following questions to each person that we contacted:

- How many victims were completely buried with no surface clues?
- How deep were they buried?
- How far apart were they buried?
- Did you perform signal triage to prioritize those victims most likely to survive?
- Did the victim(s) die from asphyxia, trauma, or some other means?
- Was there a last-seen area?
- Did you perform a primary/signal search?
- Was there any confusion from interfering beacon signals?

In most cases, the technique for a multiple-victim transceiver search is the same technique that is used for a single-victim search. By moving systematically through the debris, a digital transceiver will isolate each signal as the searcher gets closer. Only in special cases involving close-proximity burials – and adequate manpower – should this technique change. *Photo by Simon Fryer*

WHEN SHOULD WE DIG?

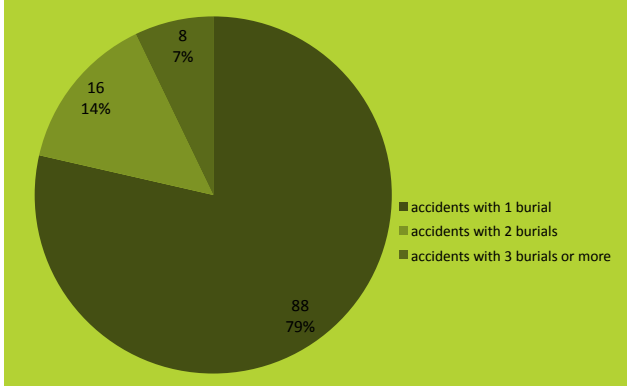


fig. 1 : distribution of avalanche **accidents** according to the number of burials by accident - backcountry activities - France 1999-2007. n=112

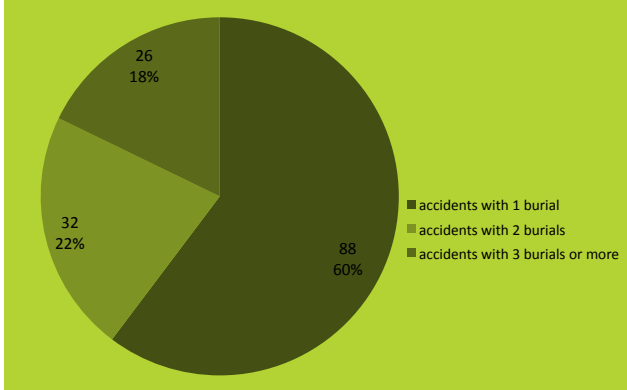


fig. 2 : distribution of **burials** according to the number of burials by accident - backcountry activities - France 1999-2007. n=146

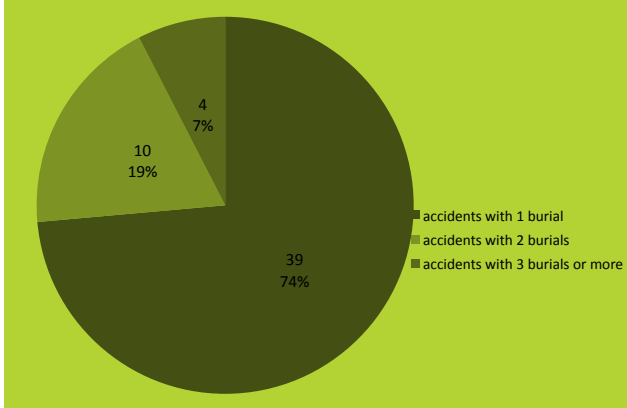


fig. 3 : distribution of avalanche **accidents** according to the number of burials by accidents - backcountry activities while ascending - France 1999-2007. n=53

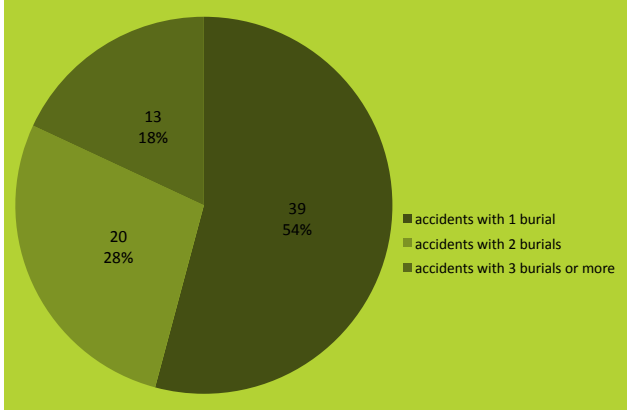


fig. 4 : distribution of **burials** according to the number of burials by accident - backcountry activities while ascending - France 1999-2007. n=72

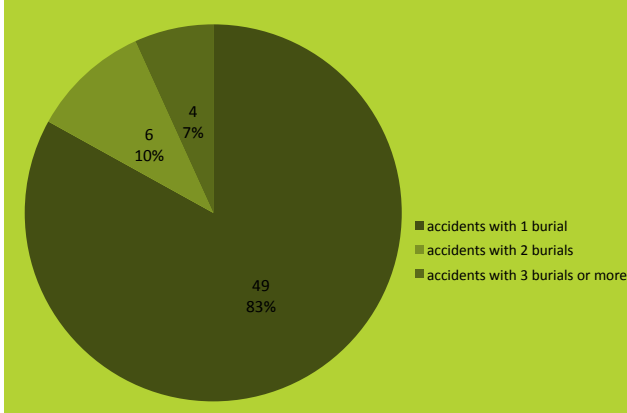


fig. 5 : distribution of avalanche **accidents** according to the number of burials by accident - backcountry activities while skiing down - France 1999-2007. n=59

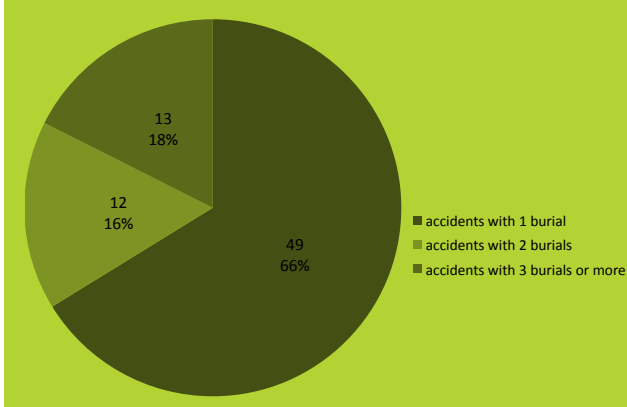


fig. 6 : distribution of **burials** according to the number of burials by accident - backcountry activities while "skiing down" - France 1999-2007. n=74

All said and done, the actual locating was fairly easy. The hardest part was getting down to where we thought they were in the debris pile – and seeing your friends dead.

Tonar Bowl, CO, March 2000

WHEN SHOULD WE DIG?

continued from page 17

Therefore the group should have six members etc. Below these figures the chance that each additional victim has of survival is hypothetical. Taking into account the French statistics, how many people were there in each group that was avalanched? How many buried victims could those groups hope to rescue simultaneously?

The analysis is based on 112 accidents that occurred when ski touring and 135 that occurred when skiing out-of-bounds.

Ski Touring

16% of accidents involved a lone ski tourer: in this case the victim has to rely on the availability of eye witnesses for a possible rescue.

54% of incidents had the necessary man power to efficiently manage the recovery of a single buried victim (three to five group members).

In 22% of cases there were sufficient resources to theoretically recover two victims in good time (six tourers or more). In just 6% of recorded cases were the groups big enough (9 or more members) to effectively organize the rescue of three victims.

Out-of-bounds

Considering the 135 avalanche accidents that occurred out-of-bounds where there was at least one burial, 27% of the incidents involved lone skiers. Skiing alone, out-of-bounds seems to be more popular than when ski touring.

In 52% of the incidents there were sufficient rescuers to efficiently recover a single victim. In just 13% of incidents were the groups sufficiently large to simultaneously recover two victims (groups comprising six free-riders or more). Finally in just 4% of incidents were there were sufficient rescuers to recover three victims without outside intervention.

Conclusion

Even if they are not as frequent as one thinks, accidents with multiple burials can happen to anyone and in certain cases they represent a significant number of victims.

The latest generation of beacons appear to offer real advantages for amateur backcountry travelers who have not perfected the art of multi victim searches with an old type beacon. However just having the latest technology is not in itself sufficient to solve all the problems posed by multi-victim avalanches accidents. At some point the rescuers have to decide to dig.

As has been shown, frequently there are not enough rescuers to dig out victims in an optimum and autonomous manner. In the case of multi-victim accidents the companion rescuers are often forced to decide which of the buried victims has the best chance of survival. An avalanche probe is an effective triage tool which gives the depth of burial.

In practice, if you want to avoid multiple burials and have sufficient rescuers to dig if there is a problem; the wisdom of our forefathers applies: groups should be at least three people if you want to have a hope of organizing a rescue in good order. When judged necessary, either during the climb or descent, leave sufficient gaps between skiers or ski one at a time and avoid stopping in the same fall line of another skier. When touring in certain circumstances it may also be a good idea to climb by a safer route with the disadvantage that snow conditions cannot be studied during the ascent.

This article originally appeared in "Snow and Avalanches" published by the ANENA, n° 121, April 2008. ANENA (French Avalanche Association – www.anena.org)

Fred Jarry has been head of research at the ANENA since 1998. Between lectures and training for a wider audience in the area of avalanches, studies and legal articles, not forgetting an analysis of avalanche incidents, he improves his understanding and experience of snow during numerous snowboard tours.

- What beacon search techniques were used: searching in series, in parallel, micro search strips, 3-circle method, Special mode, marking?
- Did you turn off the victim's beacon after pinpointing him/her?
- What technique was used for excavating the victims?
- How much time was spent searching versus shoveling?
- What was the most time-consuming part of the rescue?

In conjunction with these lengthy—and often emotional—conversations, we defined the primary cause of each fatality in each multiple burial incident, with the help of the witnesses and/or respective coroner. These results are summarized in the bar graph below:

Multiple Burial Fatalities (total deaths: 76)

Primary factors in multiple-burial fatalities.

In 76 multiple-burial fatalities, excavation time was cited 35 times as the primary issue. This was followed by "no beacon" (14) and trauma (13), respectively. There was only one case in which a confusing beacon search was cited as a problem. And in this case, the rescuer said it was mainly the depth of burial, not multiple signals, that caused the confusion.

ADDITIONAL FINDINGS

- **Close-proximity multiple burials were extremely rare.** They included the case above from Kokanee Glacier, BC, in 2003; the well-publicized incidents at Durrand Glacier and Connaught Creek, BC, also in 2003; a highmarking incident near Fernie, BC, several years ago and another snowmobiling incident near Afton, WY, last January (in this case, there were no survivors to perform a companion rescue). Confusing signals were cited as a problem only in the incident at Kokanee Glacier.
- **Burial depth and lack of shoveling manpower are the main contributors to excessive excavation time.** Non-releasable bindings can increase the depth of burial and also hinder the rescuer's ability to extricate and treat the victim.
- **Multiple burials are best avoided, as they almost always result in fatalities.** In only one of 45 multiple-burial cases did all the completely buried victims survive. In this 2004 incident, numerous rescuers were available to excavate the two victims, who were highmarking in a popular snowmobiling area near Lake Ann, WA. However, it's possible that other successful live recoveries have occurred; the database at www.avalanche.org is mainly limited to fatalities; live recoveries often go unreported.
- **In several cases (including Lake Ann), rescuers said they had a problem with errant signals coming from other rescuers.** While it can be extremely helpful to have multiple searchers on the scene, this can complicate the beacon search if there is a lack of site control.
- **Of all the complete burial incidents, just over half of the victims were wearing beacons.** This was higher in Canada (79%) than in the US (43%). This difference is partially explained by the prevalence of commercial guiding in Canada compared to the US. Canadian guided groups comprised a relatively high percentage of the multiple-burial incidents. In commercial groups, all participants are required to use transceivers.
- **Transceiver use is on the rise.** From the periods 1998/02 to 2003/08, beacon use rose from 52% to 57% of the victims.
- **Snowmobile avalanche incidents comprise roughly 40% of overall avalanche incidents.** This percentage did not change significantly from 1998/02 to 2003/08.
- **Transceivers are slightly less accepted by snowmobilers than by non-motorized users.** Just 44% of the snowmobiling victims were wearing beacons, while 55 % of the non-motorized victims were wearing them.
- **The concept of a "primary search" was irrelevant.** In almost all cases, there was a last-seen area, or the rescuers had a clear idea of where to begin the beacon search. In four cases, excessive time was spent traveling before a signal was acquired. This was attributed to difficult footing or an effort to avoid secondary avalanche hazards ("hangfire"), not to the lack of a signal.
- **Keep your gloves on!** In several cases, the excavation process was compromised by non-functional hands after the rescuer took off his or her gloves to assemble gear, then lost them.

Grim reality. On the avalanche debris pile, it's about shoveling, not beacon searching. Location: Sheep Mountain, MT.

Photo courtesy Flathead County Coroner

CONCLUSION

To understand the real issues in multiple burials, statistics are just a starting point. By interviewing the rescuers who have actually performed multiple-victim beacon searches on the snow, we see a clearer picture of what matters: excavation time and carrying beacons. For avalanche educators who are teaching courses to recreationists, time is limited. To

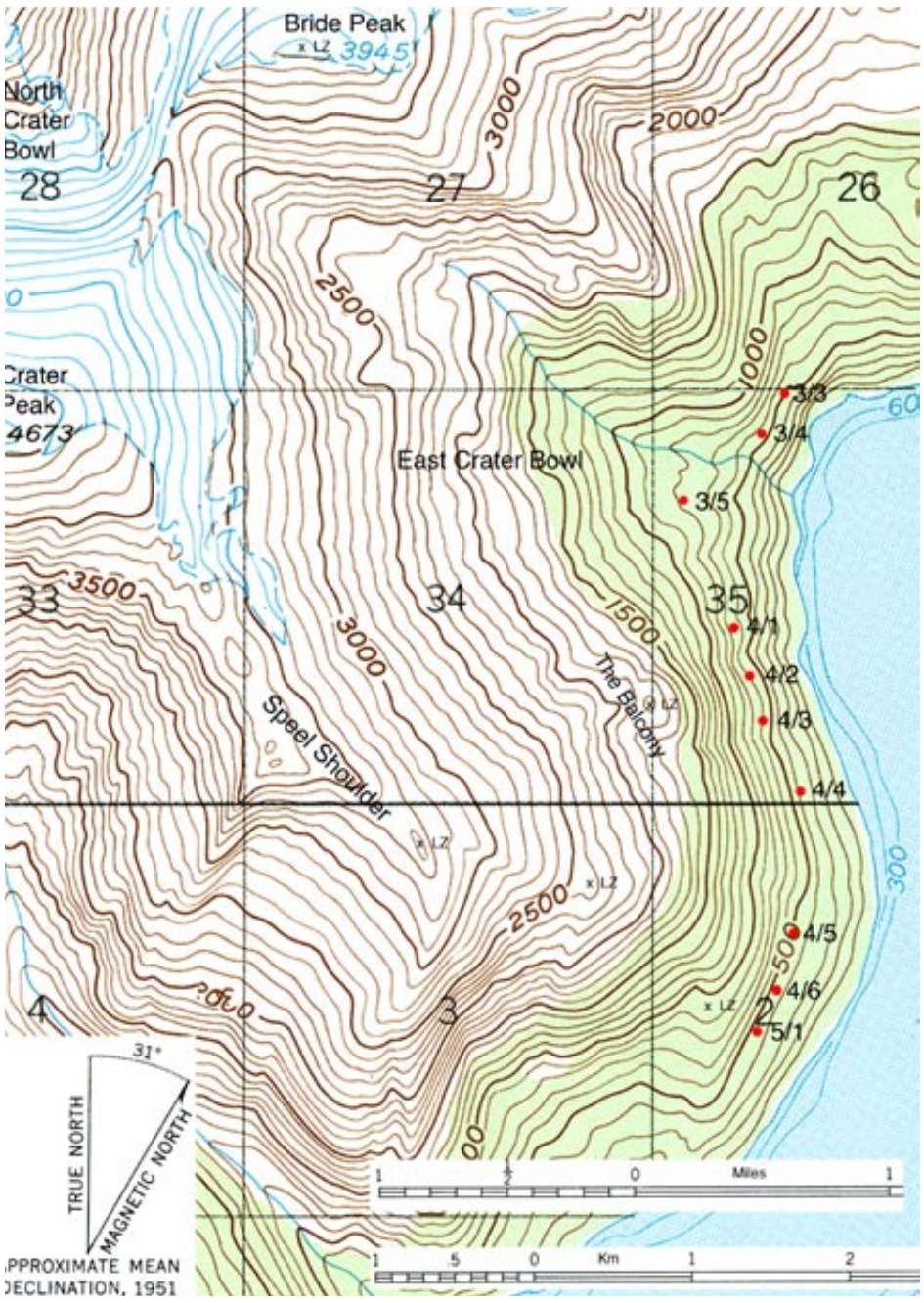
Continued on page 28 ➡

JUNEAU AVALANCHE

continued from cover

scoured to the ground on many of the paths. There were two separate avalanche series that we classified as HS/WS-N-D5/R5-O/G. The aluminum towers never had a chance as the snow entrained 200- to 400-year old trees on its way down to the power right of way…and on down to the ocean.

Alaska Electric Light and Power (AEL&P) lost power from Snettisham at about 3:30am and sent out a flight during a break in the storm on the morning of the 16th. Through the rain-covered windshield of the helicopter, they could see that one tower had been obliterated, one was ripped down and crumpled, and the fjord was FULL of debris. A flight the next day showed that another path had released following their initial recon flight and had destroyed another section of the line. AEL&P contacted Bill Glude of Alaska Avalanche Specialists to have a look at the site and soon contracted him to establish site safety, avalanche forecast, and perform control work for the upcoming line rebuild. Bill had to leave the day following his initial flyover to honor his undying commitment to the American Avalanche Association board meeting, so his assistant Mike Janes got the ball rolling for the first week of forecasting and control work. Bill knew he needed some more people to help with the coming months of work, so he brought in Laura Green from Mt Hood Meadows, Nancy Pfeiffer of the Alaska Avalanche School, and Don Sharaf from Ski-Bums-R-Us.



above: map of area
left: Nancy Pfeiffer carries her skis down Speel Shoulder through the remains of ancient trees.

We could go on and on about the project and how much fun it was, the challenges we faced, and the lessons we learned – which we do to a certain extent in a comprehensive report. If you are interested, you can find that at www.aelp.com/reconnecting/Avalanche%20report/20080512SnettAvalancheReport%20final%20small.pdf. In the interest of brevity and education, we will share the points that stood out from our efforts.

MARITIME SNOWPACKS ARE STRONG – MOST OF THE TIME

Stop the presses – that's news. Not really a surprise, except when you put a 40-pound explosive underneath a glide slab that has no perimeter bonding at all and…nothing happens. We tried pre-digging holes for bomb placement (thinking that would get the impact closer to the potential bed surface/ground), we tried dropping charges in the glide cracks above the slab, we tried hitting them at the toe, we tried lubrication from heli-drops of sea water from a Bambi bucket…we tried anything we could think of. Aside from blowing out a few shallow surface slabs and a few small chunks, we had insignificant results from more than 120 charges on five separate missions.

Two separate 24-hour 3" rain events and warmer May temperatures melted away most of the glide slabs that threatened the towers, while a few released at less predictable times.

LINEMEN DON'T LIKE AVALANCHES

Although the objective hazards found in the lineman's profession rank up there with running with the bulls, they were attentive to the avalanche hazard and our recommendations to avoid them. We had enough beacons to outfit the entire crew, but decided to go with Recco belts to make it easier for the crews to deploy in the mornings without the hassle of checking those beeper thingies. The availability of the helicopter (needed to access ALL of the tower sites) made it a good central location for the detector that wasn't currently charging in the office. Wet snow and one training session seemed to offer challenges of their own, so we were duly conservative in opening tower sites for the workers. Fortunately, there was so much work to do that we could afford to keep the most threatened sites closed until the glide slabs had mostly gone away.

The heli, fully loaded with a cargo of bombs.

TREE DENDROCHRONOLOGY IS NOT SEXY

…unless you use a chainsaw and a computer. AEL&P faced the wrath of their Juneau rate payers (where diesel generators drove up the electricity bill by 450%), so the company wanted information about the return period of these avalanches. Consequently we spent hours with the increment borer taking cores from the Alaska yellow cedar and mountain hemlock. Counting the rings on these slow-growing trees is tedious at best. It's tough to keep track of where you are on the core. From the areas that were totally wiped clean by avalanches we cut several "cookies" or slabs from the shattered stumps that made it somewhat easier to count. The big breakthrough was when we started taking digital pictures of the cores and cookies and then blew them up on the screen. Not only were the pictures larger, but you could leave the pointer where you stopped counting when you started to go cross-eyed or postal.

NOW WHAT?

The line was rebuilt a month ahead of schedule, the snow stabilized and melted rapidly throughout May, and the city got 'cheap' power back well ahead of schedule on June 1. The line is exactly where it was before the avalanches and is even more exposed, as many of the trees that protected it in years past are now driftwood on the shores of southeast Alaska. AEL&P is doing a comprehensive hazard survey of its powerlines and beginning design work for future protection of this facility and others. In the interim, forecasting and explosive avalanche-hazard reduction will be conducted through the winter to keep the avalanches "small" and less of a hazard to the line. With luck, we will be writing next year about the structural defense strategies that we have developed and implemented and not *Powerline Rebuild, Part II.*

Bill Glude is an avalanche forecaster, researcher, consultant, and teacher based out of Juneau, AK.

Mike Janes spends most of his time as the primary apprentice forecaster/assistant instructor for Alaska Avalanche Specialists in Juneau. Mike is also an assistant instructor for the Alaska Avalanche School in Anchorage and has been making more trips to the Alaska Range working as a guide/instructor for the Alaska Mountaineering School in Talkeetna, AK.

From Don Sharaf
May 10, 2008

Howdy,

For those who I haven't been in touch with recently, I'm up in SE Alaska, avalanche forecasting for a powerline that was damaged/destroyed by avalanches. The workers are here and want avalanche forecasting, control, and site safety. I've been out here since Monday and done a lot of different things, but here's a chronology of yesterday. Read on if you're interested.

Damn full day yesterday, I started work at 0630 and didn't return to camp until 1800. Started by cutting some alders at camp to use as visual references up at our LZs in the alpine (when the light goes flat, then the white-on-white is virtually impossible to land to). The day before we were trying to land on the ridge, and Mike couldn't see any texture on the snow surface at all. I had to dig in my pack and find my harness and climbing gear and drop them out the door so there would be something for the pilot to look at when he was landing.

Bill and I were going to wait for the flight to bring in Nancy, but we decided to just start in the field without her – good thing, as the flight was two hours late. We flew out to 4/5 (mile 4 from the powerhouse, 5th pole along mile 4) where we had to toe-in (land with just the front of the skids on the snow, while the pilot holds the ship level in a hover). We then took two hours to chop and shovel a metric mother ton of snow off the LZ pad. Each tower has a wooden and aluminum pad for the heli, but most of them were buried by snow and/or avalanche debris. I then hiked over to the tower and uphill for a few hundred feet to the lower start zones. It was fairly well forested, but avalanche debris still had made it down to the tower through relatively thick timber. The rock slabs had cleaned out above this tower, but it still is slightly threatened by the upper start zones 1200' above (the stability in the upper zones is pretty good, except for softening of the surface layers during the daytime).

Once 4/5 was squared away, Nancy flew in to meet us and we went up to the ridge 200' above 4/6 and 4/5 and skied down in perfect corn to the crown from April 16. Took a picture of Nancy Pfeiffer in one of the bomb craters from the previous day (40# shot AP explosive). Mostly we had just blown holes in the snow that were a meter ± deep and 3- to 4-meters wide. Once we broke over to slopes over 35 degrees we could sluff the top 10cm off and get them to run for a good distance, but they hung up before hitting the next breakover that would send them down to the tower sites. Good news for accessing those sites in the near future. Once we finished making avalanches we skinned up 500' to get to a bench where we could be picked up.

We flew to 4/4 next and had another shovel fest – three of us working made it go a little bit faster, but not much. I was fully Red-Bulled-up by this point and shoveled hard enough to make the blade smoke. 4/4 is a tricky work site, as the Snettisham side (powerhouse site in Speel Arm, 40 miles south of Juneau) has a good safe area, but the tower and the Juneau side are fully exposed to glide avalanches from above. We are letting the linemen know the safe zones at various sites. They are hard workers, agile, and quite bright. They listen pretty carefully when we are describing the avalanche situation and safe zones.

Once we finished, we flew by 4/3 and reconfirmed our prior assessment. Too threatened to access, except for the very early am. The tower has recent debris on all sides and has a lot of glide avalanche hangfire above it. 4/2 was straightforward with a good LZ already exposed and no avalanche threat. So we landed next at 4/1 and built a decent LZ on snow; we were able to shovel out the platforms at the other sites, but there wasn't even a hint of the platform location at this site. Once we finished at 4/1 we flew back to the airstrip at Snettisham (4 minute flight from 4/1) and waited for another helicopter to take us to Lake Dorothy.

Dorothy is another hydro project for Juneau, where they tap lakes from below and then run a penstock to a powerhouse with turbines. There is no damming and limited surface disruption, other than at the portal site and where the power lines will run. Unfortunately the portal is at the base of a 1000' avalanche path facing NW. The flight from Snett to Dorothy took 10 or 15 minutes and was through gorgeous country – lots of ski potential there! We plunked down on the top – knocked out a test + pit that showed the snow was stable, the top still frozen, and that it was significantly behind the Snettisham slopes in their transition to a summer snowpack (still isothermal though). We thought the lower elevations would be softer, so we got the workers to clear away from the slopes as we ski-cut our way down, but it was too frozen, so we didn't knock much off – not as much as we had hoped to, at least. We looked at where they wanted to keep their heli overnight, and it was safer than the customary LZ that they use, still well within a relatively high alpha angle but under a ridge instead of the face.

We flew back to Snett with John (the Scottish pilot from Temsco) and then got back in the Coastal ship with Mike Wilson and flew up to ski cut above 3/5 (the tower was obliterated by the April 16 avalanches).

Fun skiing from 3500' to 2600' on refrozen corn (skied better than it sounds – if you had wide-enough boards). Once we hit the steeper terrain we were able to ski-cut-out wet oozers (WL-ASc-D2-O) that built a lot of volume but not a lot of speed. Fortunately, they all stopped on a bench 500' above the future work site. The last 500' to the work site was horrendous tree-choked avalanche debris. I then spend spent an hour and a half probing survey points for 12 guy anchors and three tower bases. Snow depth varied between 130cm and 460cm with one guy-anchor spot erased by the deep scouring avalanche (now it's just sand and boulders). They had better fly an excavator to deal with this site, because the snow is so dense, I thought I was going to snap the probes. I had to use my carbon-fiber probe for a starter hole and then use the 1cm-wide bear spear to probe the deep ones. Really fun work at the end of a long day!?

Well that's more than any of you wanted to know, but I had some time today, and I wanted to stay in touch. I'm psyched to be doing so much out here; I'm learning a bunch about explosives, but generally feel pretty qualified to be doing this type of work. It's a nice change of pace from avalanche education and guiding.

Hope you are having a great spring! See you in June. —*Don*

"A 40# Dyno AP charge detonates on the glide slabs above 4/4…No results." *Photo by Bill Glude*

Don Sharaf currently divides his winters between avalanche forecasting and control for the Snettisham Line; avalanche courses throughout the Western US; and Heli-Ski Guiding on Thompson Pass, AK. It is his sincere hope that he doesn't get his jobs confused; it would be embarrassing to be waiting for a helicopter pick-up with a group of students who had 2-meter fuses sticking out of their ears.

education

WHERE DO WE GO FROM HERE?
A Plan For Post-Course Student Risk Reduction

Story and photos by Colin Zacharias

In December 2007, an avalanche occurred northeast of Tent Ridge in Kananaskis Country, Alberta. The posted avalanche involvement report stated two backcountry skiers were digging a snow profile on the 35-degree north-facing slope when the avalanche occurred. Both completely buried, both deceased.

The incident gave me, as an avalanche educator, pause. I wondered, when a student walks out the door at the course end, how relevant and lasting was my message?

Over the years I had heard avalanche course instructors discuss and relate "what they teach" to "how will the student apply the knowledge after course completion." There is no doubt we all hoped we were doing the best we could. We were convinced that the new information a student learns on an avalanche course reduced the likelihood of an incident by improving their decision-making and by making the choices of avoidance and mitigation ever-present options. We naturally worried that when we introduced methods to test snowpack properties, the students would want to go out and apply this new information and potentially increase their exposure to the uncertainties in avalanche terrain.

As so-called "experts" in the avalanche-forecasting industry, the only fact one knows for certain is that after 15 years at the job, one is barely good enough to do the job well. Regardless of the geographic regions and with the complexities in mind, most instructors keep course content basic and in line with the student's experience. Instructors urge the student to use a checklist-style decision-making tool, read the bulletin to compare what the experts say and note what others observe, watch out for the red flags or obvious clues, and use appropriate travel techniques. "Keep it simple," is the message, and as the conditions become unfamiliar or complicated defer to simpler terrain choices that experience and parameters tell you are less likely to avalanche.

Dwayne Congdon and a group of aspirant ski guides at Rogers Pass, BC, discuss trip planning and a detailed evaluation of the hazards they are likely to encounter.

COURSE DEBRIEF: BACKLINK & INTRODUCTION

The goal of this lesson plan isn't to challenge traditional avalanche course curriculum. It is to focus on one crucial lesson: the final course student debrief. It is the opinion of the author that the final debrief is an important instructional tool that is often inadequately scheduled, planned, or rehearsed. During the hour of the course debrief, the instructor has the opportunity to encourage and reduce post-course risk given the likelihood that the student will travel in avalanche terrain – and travel with a willingness to mimic the course processes of assessment, extrapolation, and terrain decisions.

At course start, the student is asked, "What do you hope to learn this week?" At course end, the student is asked, "What have you learned and how can you safely apply the skills when you leave this course?" The student should be made aware that during the week the management of the hazard and decisions were coached and modified by the instructor. It helps to review several decisions that were made to illustrate this process.

There is no reason not to complete a thorough course debrief. The instructor may implore that it is more fun to end on a social note over a beer, or find that the group is keen to get on the highway and beat Sunday traffic back to San Francisco, or worry that final debriefs may have the atmosphere of a soapbox sermon. No need to proselytize or end the course with a nervous warning! If the schedule is tight, plan an afternoon stop in a sheltered grove of trees and sit on your pack over a final cup of tea. The best scenario is to book a meeting room at the ski area or near the trailhead and facilitate a group discussion. Each course leader owes it to the students to contextualize the class and field sessions in light of the student experience and future pursuits: "Where do we go from here?" "Now what?"

STUDENT LEARNING OUTCOMES

By the end of the hour-long session the student will have:

- Reviewed the student pre-course goals – these are compared to those accomplished during the course.
- Understood the factors (such as weather, snowpack, travel conditions, and student skill level) that may have affected the course curriculum.
- Understood that the decisions made in avalanche terrain this week were introduced, coached, and modified by an expert.
- Realized that once they leave the course the expert may no longer be there to coach the decision-making process.
- Reviewed the knowledge and skills the student is encouraged to apply with their peer group.
- Reviewed the knowledge and skills the student is recommended to apply only with the oversight of a mentor and expert.
- Been introduced to where the student can go to learn more? Where the student finds an expert/mentor to travel with in the backcountry? What defines an expert?
- Been introduced to the additional resources that are available to the student?

MOTIVATIONAL STRATEGY – WHY SHOULD THE LEARNER PAY ATTENTION?

"The more experienced and confident recreationists are, the more likely they are to perceive the risk to be less than it actually is…" *Human Factors in Avalanche Accidents*, Atkins, 2001

"In a study of 546 avalanche accidents involving 1050 recreationists, avalanche training did not appear to decrease the level of hazard to which groups exposed themselves; groups with basic training often exposed themselves to higher levels of hazards than those with less training." *The Role of Training in Recreational Avalanche Accidents in the United States*, ISSW proceedings, McCammon, 2000

"Although exact accident rates for these recreationists are unknown, we do know that between one-third and one-half of all avalanche victims had formal avalanche training prior to their accident." *Sex, Drugs And The White Death: Lessons For Avalanche Educators From Health And Safety Campaigns*, McCammon, 2000, 2004

WHAT THE INSTRUCTOR WILL DO? WHAT THE LEARNERS WILL DO?

Prior to the start of the course debrief, the instructor should make a couple of important silent assumptions to help guide the discussion *(McCammon, 2000, 2004)*:

- Assume, during a short course format, the instructor hasn't altered student behavior or willingness to enter avalanche terrain!
- Assume the student will apply the skills and information learned this week to their future field decisions!

1. Schedule a time and place for the course debrief.

2. Place into context the key decisions made during the week:
- Review the key hazard management and terrain decisions made during the week.
- Ask the student to recall decisions made and determine how much was mitigated by the framework of the course, or the application of the group's combined experience, and the experience and knowledge of the instructor.


Ski tourers near Observation Peak, BNP, AB, travel high in the start zone on a short steep slope with a terrain trap below.

3. Use the same relevant scenarios to illustrate how and if the student was able to assess his or her own abilities:
- (Prior to the course start) and given the same described situation, what decision would the student have arrived at independently?
- Now that they have a method for making decisions, what would they do in the same place same conditions next week?
- How comfortable is the student applying new information and methods to a personal decision-making process? Would they wish they were with a more experienced person?

4. Review the skills the student can apply without oversight and those requiring the oversight and mentorship of a more experienced person. Emphasize that small groups with combined experience make better decisions than individuals:

Applications Made with an Expert's Oversight	Applications Made with a Group of Peers
Extrapolate (non "red flag" values) effects of weather on the changing mountain snowpack	Observe & record experts' accounts of recent & current avalanche danger (eg: bulletins)
Identify the structural properties of the snowpack	Identify terrain options during pre-trip plans
Verify & apply snowpack tests	Observe/assess avalanche danger factors with obvious-clues: human factors, wx, snpck, current avalanches, & terrain)
Understand spatial variability of snowpack across start zone & slope	Observe & confirm snowpack layers from avalanche bulletin
Assess snowpack instability	
Make & alter terrain choices based on conclusions drawn from on-site snowpack information	Assess physical characteristics of avalanche terrain & make fairly simple terrain choices
Choose ski lines based on relative snow strength & triggering likelihood	Apply travel techniques

5. Discuss how to choose and evaluate an expert. Who would they like to ski and ride with? Where would they find an appropriate mentor? It is important for the instructor to define what is meant by "experience." It helps to use the instructor's perspective. What did it take for you to feel comfortable applying personal terrain experience to your decisions? Experience isn't just numbers of days ski touring; it also includes:
- History of relating local weather patterns and specific snowpack characteristics to avalanches on specific terrain features.
- Recording daily wx and field observations and relating field test information to unstable snow and avalanche cycles.
- Comparative experience in other mountain ranges, snow climates, and snowpacks.

THE LINK FORWARD

One indelible impression left upon the student at course end is that making decisions in avalanche terrain requires the ability to make a personal risk assessment. Part of that risk assessment involves knowing how each individual is likely to make decisions. The less experienced traveler is likely to want to use snowpack evaluation in their terrain decisions. The same individual is just as likely to find the variables complicated and hard to prioritize and end up going where they have gone before and use new knowledge to justify their decision.

Continued on page 28 ➡

ECT & PST Easy Tips

Story by Ron Simenhois

The Extended Column Test (ECT) and the Propagation Saw Test (PST) are two new tests that aim to measure the snowpack's fracture-propagation propensity. Both tests use a long column where a fracture needs to propagate along a weak layer beyond the area of initiation to reach the other end of the column. Whenever we describe those tests to new folks numerous questions come up, such as how to isolate a column or how to saw along the layer of concern. People also want to know if the tests are overly time consuming. The aim of this short article is to review the ECT and the PST and propose easy, fast ways of conducting those tests.

Fig 1: Jordy Hendrikx demonstrates an ECT. The 90cm by 30 cm column oriented across the slope was cut with a cord and two probes. *Photo by Karl Birkeland*

INTRODUCTION

The ECT column is a 90cm by 30cm column oriented in the cross slope direction *(Fig 1)*. It is dynamically loaded on one end of the column. This is typically done by tapping in the same manner as in the Compression Test, though you can also load the ECT using Stuffblock loading steps. We note the number of taps it takes to initiate a fracture and the number of taps it takes for the fracture to cross the entire column. If a fracture propagates across the entire column on a single layer upon isolation (ECTPV) or on the same or the next tap it took to initiate it, we consider fracture propagation to be likely and record it as ECTP##, where ## is the number of taps it took to initiate the fracture. If a fracture was initiated but failed to cross the entire column we record it as ECTN and consider fracture propagation unlikely. If we failed to initiate a fracture within 30 taps we record it as ECTNR and consider fracture initiation unlikely. However, the ECT is a propagation test and when we get an ECTNR there is not much we can say about the snowpack's fracture propagation propensity and you may want to try other tests like PST or CT with shear quality or you might want to dig a pit in a shallower snowpack.

For example ECTP12 means that the fracture initiated and propagated across the column after 10 taps from the wrist and two from the elbow. If, for example, this fracture did not propagate across the entire column we record it as ECTN.

The PST uses an isolated column of 30cm by 100cm (or the depth of the weak layer if that weak layer is deeper than 1m) dug to the depth of the weak layer of concern *(Fig 2)*. We cut along the layer of concern from the down slope end of the column until a fracture starts to propagate in front of the snow saw. If a fracture propagates across the entire column on a single layer before we reached half of the column length with the saw cut we consider fracture propagation to be likely. Otherwise we consider fracture propagation unlikely. Recently the Canadian developers standardized the PST recording and it goes as follows:

PST (cut_length / isolated_length (z) down depth on yymmdd)

Where z = arr/sf/end, yymmdd = weak layer dateID, arr = self-arrest in weak layer before the end of the column (no slab fracture), sf = arrest of weak layer fracture at a fracture through the slab, end = weak layer fracture propagates to the vertical cut at end of the column.

For example PST 35/100 (end), down 45 on 080112 means: a fracture propagated across the entire column after we saw a 35cm cut along the weak layer. This weak layer is 45cm deep and was buried on January 12, 2008. If the weak layer was 115cm deep, and the fracture did not reach the end of the column because the slab itself fractured, we record it as PST 35/115 (sf) down 115 on 080112.

TECHNICAL SUPPORT

Questions like how to isolate a column, how to easily cut along the layer of concern, etc., are well justified. Isolating a long column is not as straightforward as isolating a small one and may also require additional tools. However, doing these tests is still fast, easy, and in most cases the only equipment needed is a string with knots every 10-20cm *(Fig 3)* to isolate a column. For an ECT we use the cord in a similar manner to isolating a Rutschblock test. One person can use two probes to guide the string *(Fig 4)*. After the column is isolated we typically use a snow saw or a shovel to make wedges on both sides of the column. It is also possible to use one probe or no probes if we choose to dig chimneys on one or both sides of the column. Isolating a PST column is just as easy with one probe guiding the string and two people sawing the column *(Fig 5)*. Also, my ski poles are marked with 30, 90 and 100cm lengths for easy, quick measurements, and sometimes I use them to guide my string instead of probes.

Isolating a column gets much harder when there are thick crust layers above the layer of concern. In those cases a string with knots is not enough, and an extension to a snow saw is needed. Without mentioning product names, I'll just mention that having the saw blade, the handle, and the extension on a single line and low saw handle and extension profiles all make for easier cutting.

In the PST, sawing along the layer of concern without crossing into the surrounding layers is easier when using the saw's non-serrated edge. When the hardness differences between the weak layer and the layers above or below is small, it is easier to mark the weak layer with a brush or a gloved finger and follow the marking with the saw. Also marking the layer of concern helps maintain the cut in this layer when it is too hard to use the saw's non-serrated edge.

We would like to remind readers that all stability evaluation techniques must be supplemented by additional information such as detailed avalanche and weather observations to effectively evaluate the snowpack stability.

ACKNOWLEDGEMENTS

I would like to thank Karl Birkeland, Bruce Jamieson, Dave Gauthier, and Cameron Ross for their help and useful comments. Karl and the ASARC also donated the photos for this article.

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Ron splits his time between Copper Mountain, CO, and New Zealand. About every other year he fills the lack of summer with two warm weeks in his homeland, Israel. Ron is always on the lookout for easy, simple ways to do his job. Please send him your thoughts and ideas on the ECT at ron_si@yahoo.com

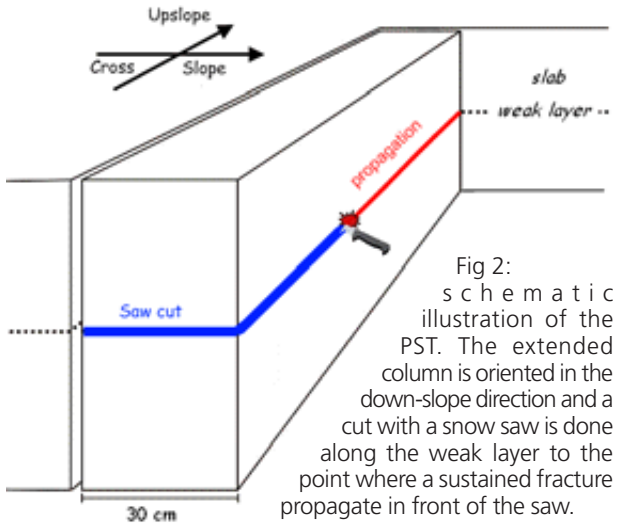


Fig 2: schematic illustration of the PST. The extended column is oriented in the down-slope direction and a cut with a snow saw is done along the weak layer to the point where a sustained fracture propagate in front of the saw.

Fig 3: the tool of choice for most cases: a cord with knots every 10 – 20 cm.

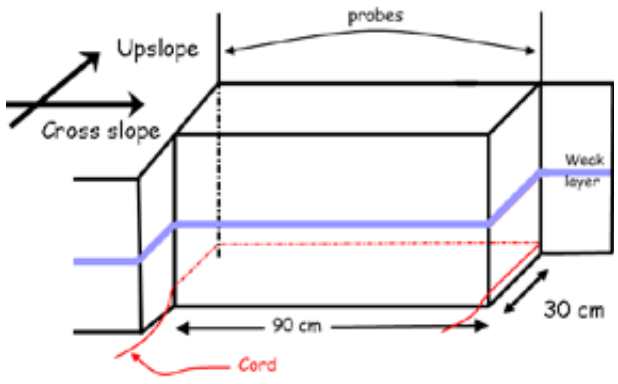


Fig 4: schematic illustration of isolating an ECT column with a cord and two probes.

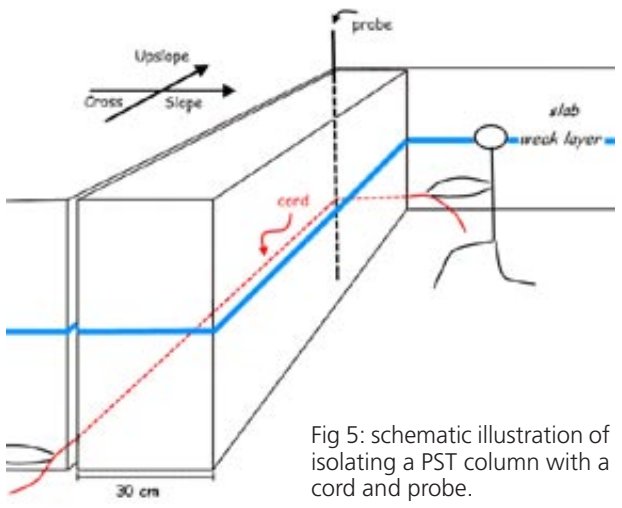


Fig 5: schematic illustration of isolating a PST column with a cord and probe.

Fig 6: PST cutting in the uphill direction a long weak layer with the snow saw's none-serrated edge. *Photo courtesy ASARC*

Fig 7: example of isolating an ECT column with a string with knots. *Photo courtesy ASARC*

Photo by Gallatin National Forest Avalanche Center

On these next three pages, we have collected an array of thoughts about snowmobiles, snowmobilers, and avalanches. Essays from Mike Bartholow and Jonathan Shefftz both come in response to Doug Chabot's article *Counting the Dead* in TAR 26/2. Jonathan looks at overall risk through a more in-depth investigation of snowmobiler avalanche statistics, while Mike muses about different types of riders on Vail Pass, CO. An email from Graham Predeger to Mike is also included here, where he provides insight into issues and emotions he's run across while managing varied user groups in heavily used terrain near a major population center.

Janet Kellam and Bob Comey both give snapshots of their successes working with the snowmobile community, planning with industry and community leaders to educate riders to be smart and well prepared in avalanche terrain. Doug Chabot outlines the GNFAC's successes working with the snowmobile community and cautions us to be humble in our attitude toward this user group.

In closing, I'll share an observation Bob Comey made as we assembled and edited this set of articles:

"Snowmobilers are just like the rest of us skiers and snowboarders. They go out in the backcountry because they love the feeling of flying through steep and deep powder."

Thanks to Bob Comey and Doug Chabot for their invaluable assistance and advice with this set of articles. —Lynne

A Brief Mathematical Note on SNOWMOBILER AVALANCHE DEATHS

Story by Jonathan S. Shefftz

Doug Chabot, in *Counting the Dead: Analyzing Avalanche Statistics* (TAR 26/2), rightly points out that the prominent component of snowmobiler deaths in avalanche statistics is greatly magnified by the prevailing practice of splitting up non-motorized snowsliders into numerous smaller components.

"My point in examining these numbers is to dispel the notion that snowmobilers are such a deadly bunch," Chabot explained. "Graphs on the Web, statistics in books, newspaper articles, and TV reports emphasize the fact that 55 skiers and 109 snowmobilers died in the last 10 years."

But when different types of non-motorized snowsliders are aggregated for comparability with the snowmobiler category, "A comparison of skier / snowboarder to snowmobiler avalanche deaths shows they are almost dead even with 103 skier / snowboard fatalities to the motorized 109 users."

In addition, these fatality statistics do not account for participation rates, so fatality frequency rates per outing might be far different from the fatality counts.

Why should we care about this?

Avalanche-safety education in the United States is targeted almost exclusively at non-motorized backcountry recreationalists, even though that means avalanche-safety educators are missing a sizable percentage – perhaps even the majority – of those who could benefit from this education. One explanation for this disparity is that avalanche safety has been a concern for backcountry climbers and skiers for many decades, yet became a concern for snowmobilers only relatively recently around the early 1990s when their technology advanced enough to expose them to potential avalanche terrain. (The term "hysteresis" is often used in the field of economics, among other areas, to describe a situation that continues on as-is despite changes in the original impetus for its existence.) Plus with avalanche educators typically coming from a non-motorized background, their "cred" among snowmobilers may be lacking.[1] After all, would you have ever taken an avalanche-safety course from a snowmobiling-enthusiast instructor who barely knew how to ski?

Yet another explanation is that our outreach efforts are dampened by a sense of hopelessness about the apparent attitude of snowmobilers toward avalanche safety. And I admit to sometimes wondering about fatality reports of snowmobilers who lacked any avalanche rescue gear, which costs in the hundreds of dollars, even though they must have spent thousands of dollars on their snowmobiles. The snowmobiling establishment is beginning to take more initiatives in avalanche safety as their fatalities mount *(see Janet Kellam and Bob Comey contributions on these pages regarding specific actions by the snowmobile industry)*, but as with any user group that is reluctant to be told what to do, some areas and riders are coming late to the table.

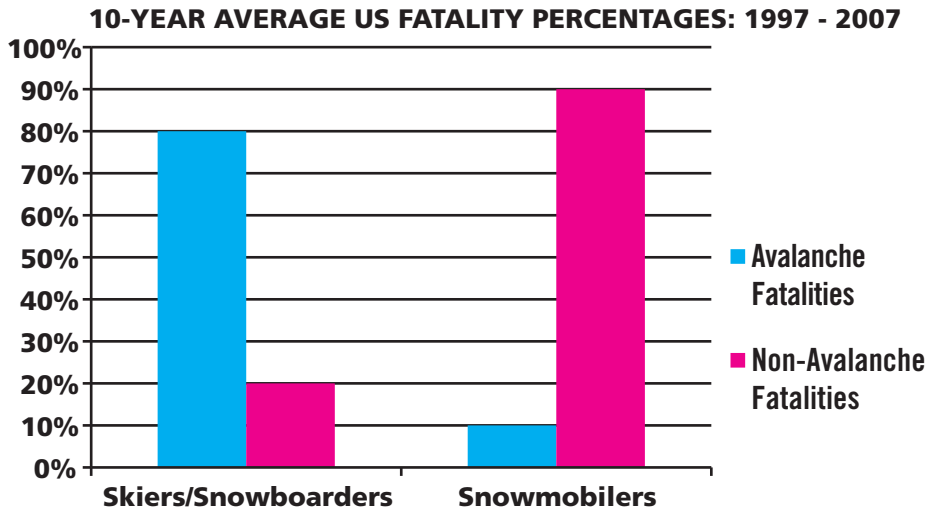
Doug Chabot's reclassification of the avalanche statistics reveals that snowmobilers do not account for significantly more deaths than non-motorized backcountry travelers; i.e., 109 over the past 10 years, for an annual average of just under 11. But an additional statistic puts the snowmobile avalanche deaths into a broader perspective and helps toward answering the preceding paragraph's question. Specifically, the US Consumer Product Safety Commission (CPSC) estimates that about 110 snowmobiler deaths are attributable to all causes combined – annually![2] So avalanches account for only 10% of all snowmobile deaths (i.e., 11 divided by 110). Now, one can certainly quibble and point out that many of those snowmobile deaths are from regions with no avalanche danger (e.g., the Midwest and below-treeline New England). But viewed from the national perspective of anyone concerned about snowmobile safety overall, avalanche deaths are only a relatively small component of the total safety picture.

By contrast, for backcountry skiers and snowboarders, how many deaths occur each year other than by avalanches? Averaged over the most recent 10-year period available, about 37 deaths occur each year at lift-served resorts, with a somewhat lower 22 deaths during the 2006/07 season.[3] But these deaths are overwhelmingly composed of high-speed catastrophic collisions with fixed objects adjacent to groomed slopes.[4] They therefore have almost no relevance to backcountry skiing and snowboarding risks. (And conversely, in-bounds avalanches have composed an almost negligible component of ski resort deaths in recent years.)

For backcountry travelers, falls onto rocks or off of cliffs or cornices, along with rock fall, certainly pose a danger. But outside of the ski mountaineering context or away from extremely steep routes, they are not a major risk to the typical backcountry skier or snowboarder. And mountaineering deaths while skiing average well under one per season.[5] What other foes stalk us when we leave the trailhead or the ski resort boundary? Non-Avalanche Related Snow Immersion Death (NARSID) is an especially scary killer. (Such a pretty spruce tree – how could skiing just a wee bit closer to its branches be dangerous?) But NARSID deaths have averaged only about 2.3 per year, and almost all of those seem to be within ski-area boundaries.[6] That leaves the rare tragedy from a navigational error or immobilizing injury that turns into an unprepared bivy in harsh weather conditions.

So if the annual backcountry skier and snowboarder fatality average of 10.3 is accompanied by two or three other fatalities each year, then that translates into an avalanche tally of about 80% of the total.

In conclusion, although backcountry skiers and snowboarders who are involved in avalanche-safety instruction can give themselves a big pat on the back (Go ahead, we all deserve it!), this effort is concentrated onto combating our undisputed and unrivaled Public Enemy Number 1. If the snowmobiling community doesn't seem to share our sense of priorities in the urgency of the battle against the White Death, the explanation isn't reckless fatalism, but rather a different set of relative risks. As determined earlier in this note, avalanches probably account for at least 80% of all backcountry skiing and snowboarding fatalities, but causes other than avalanches account for about 90% of snowmobile fatalities. This still does not detract from the valuable knowledge and skills we can offer to the snowmobiler community, but we should temper educational outreach efforts with the understanding that our ratio of avalanche:non-avalanche risks is reversed from their perspective.



The available data indicate that about 80% of backcountry skiing fatalities are attributable to avalanches with the remaining 20% from ski mountaineering falls and NARSID. By contrast, for snowmobiling the ratio is almost reversed: only 10% from avalanches and the remaining 90% mainly from collisions and drownings. Note that drownings are such a prominent hazard for snowmobilers that the upcoming Avi Vest snow-flotation devices for skiers and snowboarders has company ties to the drowning-prevention Nebulus Emergency Flotation Device for snowmobilers. Alcohol also plays a roll, as shown by Minnesota's 1998 crackdown on DWI, which saw annual snowmobiling deaths decrease from 24 averaged over 1992/97 to only 16 in the following years.

FOOTNOTES

[1] For more thoughts on this topic, see the following articles in TAR 24/2: *Making Tracks in Snowmachiner Education*, by Janet Kellam (p. 1); *Snowmachiner Lessons Learned*, by Bob Comey (p. 12); *Riders in the Storm: Catching a New Wave of Snowmobile Avy Education*, by Craig Gordon (p. 17); and, *Riding the Middle Line: Avalanche Forecasting in a New Backcountry*, by Toby Weed (p. 18).

[2] See www.cpsc.gov/cpscpub/pubs/541.html for the CPSC publication on snowmobile hazards.

[3] See www.nsaa.org/nsaa/press/facts-ski-snbd-safety.asp for more data and discussion on ski resort fatalities and injuries.

[4] See www.ski-injury.com/intro.htm#Fatalities for more details. Specifically, all types of collisions account for about 90% of resort fatalities, with tree collisions accounting for 60% of deaths and person-on-person collisions only 10%.

[5] For "skiing" as an "immediate cause" of mountaineering accidents in the United States, the 2007 edition of *The American Alpine Club's Accidents in North American Mountaineering* lists 53 accidents for 1951 through 2005, two for the 2006 season, and three for 2007. The fatality breakout is not reported for the skiing-caused accidents, but the overall fatality rate for all accidents is about one-fifth.

[6] For details, see *Risk Trends at U.S. and British Columbia Ski Areas: An Evaluation of Risk of Snow Immersion versus Avalanche Burials*, by Paul Baugher, available for download from www.nwac.us/education_resources/Non-avalanche_snow_immersion_fatalities.pdf. Specifically, 51 NARSID fatalities occurred over the 16-season period between 1990/91 and 2005/06, with 45 of these within ski resort boundaries. Of the 51 total deaths, netting out the 14 deaths in British Columbia leaves 37 in the United States. If the overall the same 45:51 ratio is applied to the US. tally, that computes to an annual average of 0.3 NARSID fatalities outside of ski-area boundaries.

Jonathan Shefftz plans to finally learn to ride a snowmobile this year as part of his Nordic patrolling duties at Notchview Reservation in western Massachusetts, but admits this won't add much to his "snowmo cred" since the ski area's speed limit is 5mph.

DISAGGREGATING THE "SNOWMOBILER" CATEGORY

Just Who are These Varied Backcountry Motorized Recreationalists?

Story by Mike Bartholow

Doug Chabot, in *Counting the Dead: Analyzing Avalanche Statistics* (TAR 26/2), illustrates that snowmobilers occupy such a seemingly dominant component in avalanche fatality statistics only because they are aggregated into one single category, whereas non-motorized snowsliders and other recreationalists are split into numerous smaller components. Jonathan Shefftz, in *A Brief Mathematical Note on Snowmobiler Avalanche Deaths (see page 24)*, demonstrates that although snowmobilers may still figure prominently in avalanche fatalities when non-motorized backcountry recreationalists are similarly aggregated, such fatalities do not figure prominently among all snowmobiler fatalities from all causes (whereas the reverse relationship is true among backcountry skier fatalities).

These articles go a long way toward informing avalanche educators – many of whom do not have any snowmobile experience – of the avalanche-related risk factors for the snowmobile community. But the snowmobiler community comprises very different types of riders seeking very different types of experiences, just as a ski mountaineer seeking a prominent ascent might have little in common with a nordic tourer on rolling logging roads. Understanding these different types of riders will help us to fulfill our responsibility for providing proper avalanche education to an ever-growing and changing community of backcountry users. When we start to look at improving avalanche education to snowmobilers, we first have to be very careful to make sure that we are targeting the right audience within the snowmobile community.

In my two seasons as the lead backcountry ranger for the Vail Pass Winter Recreation Area on the White River National Forest in Colorado, I was able to observe and make some distinctions between some very different types of snowmobile riders. With six backcountry huts; 55,000 acres; 50 miles of groomed multi-use trails; and 3,300 acres of motorized-assisted ski and snowboard terrain, Vail Pass is one of the most popular winter recreation areas in the country. The following observations are specific to Vail Pass, where backcountry recreation is highly regulated and intensively managed. While I understand that conditions may be very different at other areas, I think my observations are similar to what would be seen at other similar areas across the Western US and Canada.

First, the majority of Vail Pass riders stay exclusively on the groomed trails. Some bring their own machines, some rent, and some are guided. They have no avalanche-rescue gear and no avalanche-safety training yet also have no desire or intention to venture into

Mike Bartholow "working" on April 6, 2007. This shot was taken from the top of Ptarmigan Hill, a popular hybrid area at Vail Pass. *Photo by Adam Brown*

avalanche terrain. They simply stay on the groomed trails where they are told they are safe.

These riders are not our target audience for avalanche courses, but they are nevertheless at some potential risk. For example, during the well-publicized avalanche cycle in January 2008 that killed two people in two separate incidents within a week of each other at the East Vail Chutes, just up the road at Vail Pass, avalanches ran in places that long-time users had never seen them before. Groomed trails on Shrine Pass Road, Turkey Creek Road, Lime Creek Road, and Wilder Gulch were all buried in several locations long considered safe from avalanche hazard. Conversations with Nick Logan, formerly of the CAIC, and Chuck Ogilby, owner of the Shrine Mountain Inn, confirmed that avalanche activity had not been observed on many of these slopes in at least 30 years. One incident knocked a rider off of her machine and almost into a creek-bed terrain trap, where she could have been easily buried.

Although there are many backcountry riders who have avalanche education, there are many who do not and still get out there, riding the steep powder that snow junkies of all stripes are seeking. These are the riders we worry about all the time, because they constantly ride in dodgy conditions in highly risky terrain. Even after two seasons at Vail Pass, I still continued to be amazed at the highmarking that occurred every day – regardless of stability conditions – in places like Shrine Bowl. Avalanche-safety training varies enormously among such riders, along with avalanche-rescue-gear preparedness. This is probably the most challenging audience of all to educate, even after establishing credibility as a rider. And remember, some of these highly skilled and experienced riders on high-performance sleds seeking fresh backcountry snow far from the groomers are indeed already very well trained both in terrain selection and rescue. The more we can reach out to these educated riders to help us in turn reach out to their less-aware partners, the more effective we can be as educators.

And last, by no means least, a new category is developing of hybrid users who ride sleds to access ski and snowboard terrain from groomed trails. At Vail Pass, certain areas are even designated as "hybrid areas," with groomed routes for both snowcats and snowmobiles to access non-motorized ski and snowboard terrain. Hybrid users essentially have their own lift-served access to backcountry avalanche terrain.

Based on observations of Vail Pass staff over the last 10 years, I can say that the majority of Vail Pass hybrid users carry avalanche equipment and have some level of avalanche training. They are the riders most likely to interact with rangers and discuss backcountry snow and avalanche conditions, read the CAIC reports, and let us know what conditions they encounter. Many already had solid backcountry skills and experience before they ever started riding, which gives them an advantage over those whose only experience in the backcountry was being towed up a hill by an 800cc four-stroke snowmachine. In my opinion, hybrid skiers and riders are probably the most conducive group for our outreach efforts, both because they are a fast-growing user segment throughout many backcountry areas and because avalanche awareness already seems to have a foothold in their culture. If any group of snowmobilers is going to think that avalanche education is cool, this is it.

In conclusion, we need to remember that, like non-motorized recreationalists, not all snowmobilers are the same. Different users have very different avalanche education and experience, goals and motivation for being in the backcountry, as well as varied exposure and acceptance of risks associated with traveling in avalanche terrain. If we are going to better serve the avalanche education needs of the snowmobile community, we need to make sure that we target the appropriate audience and shape our educational approaches to suit their needs.

Vail Pass Winter Recreation Area Season Report 2007-2008 and Vail Pass Winter Recreation Area Map are both available by contacting the White River NF at www.fs.fed.us/r2/whiteriver/recreation/winter/vail_pass/.

Mike Bartholow is a backcountry ski guide and avalanche educator and consultant based in Sonora, CA. He'd like to thank Jonathan Shefftz for his editorial assistance. Mike can be reached at mikebartholow.a3@gmail.com.

North American Avalanche Programs and ISMA Collaborate on Snowmobile Avalanche Safety

This past summer in Boise, several key North American avalanche organizations met with Ed Klim, president of International Snowmobile Manufacturers (ISMA), and a number of representatives from the snowmobile industry. The mission was twofold. First, to provide the manufacturers with a clearer idea of what is being done to reach snowmobilers with avalanche awareness, education programs and advisories. And second, to examine partnerships and programs with the snowmobile industry that could successfully reach many more riders throughout the US and Canada.

Special thanks go to Bruce Edgerly of BCA and Canadian reps Deb and Dwayne Paynton for facilitating the opportunity. Other avalanche professionals in attendance included John Kelly, CAC; Canadian educator Lori Zakaruk, Zac's Tracs; Doug Abromeit, USFS National Avalanche Center; Janet Kellam, AAA and SNFAC; and Tom Murphy, AIARE.

This was the first time we've participated in a meeting of this type and emerged with some collaboration and positive discussion of future partnering between the professional avalanche community and the snowmobile industry.

First steps: The International Association of Snowmobile Administrators (IASA), with input from US avalanche centers, has developed their own avalanche information Web site for snowmobilers. Leaders in this program have been Rich Gummersall and Steve Frost of Idaho Dept of Parks and Rec. Avalanche.org and the Canadian Avalanche Center will provide visible links to the information created by snowmobilers, for snowmobilers. In turn, ISMA prints and distributes over 50,000 of their *Snowmobiling Fact Book* annually. They have added a segment for 2008/09 on avalanche awareness including direct reference to avalanche.org and avalanche.ca. Booklet content can be found at www.snowmobile.org/facts_avalanche.asp. Another resource is www.snowiasa.org//avalanche-education.

We are developing a network of stakeholders to become members of a snowmobile avalanche-safety coalition. Our mission: to keep communication open and ongoing and to promote and facilitate avalanche safety as a common practice for mountain riders. *—Janet Kellam, AAA president*

From: Graham Predeger
Date: Sep 10, 2008 at 9:28 PM
Subject: Motorheads vs Hybrids
To: Mike Bartholow

Mike- Good thoughts on the issue. The snomo stats are particularly interesting as I had never seen those numbers (approx 10% of deaths are from avys). So what constitutes the majority of snomo deaths? Trees? Machine vs machine? Exposure?

In my experience from making thousands of public contacts at Vail Pass, it is my observation that the hybrid community is a more avalanche-savvy crowd than the "motorheads" or the "trailriders."

The latter group I can understand as they don't knowingly put themselves in harm's way on their Sunday afternoon trail ride to Mango's. As we saw last season (historically unusual), avalanches were still ripping out above Turkey Creek, putting this group of riders at risk, albeit minimal.

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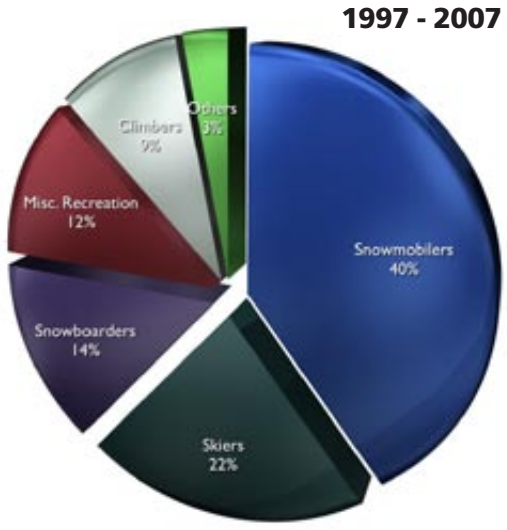
GNFAC forecaster Mark Staples investigates a snowmobiler-triggered slide outside West Yellowstone, MT.
Photo courtesy Gallatin National Forest Avalanche Center

US Avalanche Fatalities by Activity 1997 - 2007



Snowmobilers have now become tied with non-motorized snowsliders (i.e., skiers and boarders) as the most likely user group in the US to become involved in a fatal avalanche. The Bridger-Teton National Forest Avalanche Center and the Wyoming Department of Cultural Resources recently completed a four-year project that mapped the potential avalanche hazard to over 800 miles of groomed snowmobiles trails located in the mountains of western Wyoming. Avalanche hazard maps for these trails are available at www.jhavalanche.org/statetrailmaps/.

—Bob Comey, BTNFAC director

SNOWMOBILERS.

As soon as a skier hears the word he automatically conjures up images of this user group – images that will be different from person to person. As Mike Bartholow points out in his article *(previous page)* he mainly deals with uneducated riders and his views are influenced accordingly. However, my coworkers and I at the Gallatin National Forest Avalanche Center in Montana have a much different perspective. Every field day we meet riders who have taken avalanche classes, carry rescue gear and ride responsibly in high-consequence avalanche terrain. They take their sport seriously.

Over the last nine years we've taught hundreds of local riders about avalanches and in the process they've taught us how to ride. Three of us put on close to 2,500 miles on our two sleds every winter, and during the season we easily ride more days than ski. In essence, we're snowmobilers too. If you ride outside West Yellowstone or Cooke City, I guarantee you'll see most people sledding with beacons and packs holding shovels and probes. This wasn't the case 10 years ago, but it is now. Last winter our forecast area had four full burials, all of them saved by their partners with beacons.

Not all "motorheads" are clueless. A couple years ago another forecaster and I were walking on debris investigating a recent avalanche. From far away two riders raced towards us and jumped off their machines. Before we could say anything, one guy got his beacon out while the other snapped together his shovel and yelled, "How many are buried?" So much for stereotypes.

I urge everyone reading these TAR snowmobile articles to have an open mind, and rethink your hard-held beliefs about snowmobilers. I've seen riders do incredibly stupid things and I've seen skiers be complete dopes too. But we're helping more and more riders take responsibility and get educated. Our job as avalanche professionals is to be an unbiased part of the solution. If you think that all riders are careless, uneducated, and have a death wish, please stick to educating skiers or other user groups. If you don't, they'll immediately see through your façade, making legitimate snowmobile education much more difficult.

Doug Chabot is director of the GNFAC and rides a 2008 Yamaha Nytro-MTX 900cc when he's not kick-turning down 35-degree slopes in the backcountry.

MOTORHEADS VS HYBRIDS

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The "motorhead" group, however – the guys and gals who are out there highmarking Shrine Ridge or the steep shot back in Lime Creek – are knowingly taking a chance with avalanches, as does the skier (hybrid or other) who drops in on anything steeper than 30 degrees. The difference in my experience has shown the motorheads to be a bit less informed than hybrid skiers. Why is this? I think many in the hybrid category were backcountry skiers first and transitioned into hybrid skiing as sled technologies advanced, enabling them to gain and exceed vertical from skiing in-bounds or via skinning. Perhaps a basic backcountry awareness was instilled in this group early on (before becoming a hybrid skier). Additionally, as hybrid skiing is a sport which essentially involves two or more people, there may be some sort of social pressure for your partner to gain some basic avalanche education before venturing into the backcountry. The thought is that if I can save your life, you damn well better be able to reciprocate the favor, so get the gear and know how to use it. I think the fact that hybrid skiing is inherently slower, with numerous stops, participants have more ample opportunities to hastily evaluate snowpack throughout the day before exposing themselves to avalanche terrain.

The highmarker on the other hand starts at the base of a slope and attacks from the bottom up, putting themselves in avalanche terrain before they even reach the meat of a slope. I have seen this dozens of times, and it scares the shit out of me about half the time. I still find it amazing that avalanche deaths among snowmo's only account for roughly 10% of deaths, but if those are the facts, then so be it.

I disagree with you that the hybrid community needs to be an avy educator's main target. I see your point that it is a fast-growing population, but I think they have a good start already. I really see the need for educators to focus on reaching the motorheads. As sled technologies progress, the highmarkers are going further and higher, not only putting themselves at risk, but members of their party and adjacent parties. We've seen it at Vail Pass, sled marks topped out on Resolution Mountain or side-hilling the entire width of Shrine Bowl three quarters of the way up. It's these guys who are a risk to anyone below them or adjacent to them or to rescuers who end up digging them out (any stats on this group, the "death by association?").

As we all know, avalanches propagate and are quite unpredictable when they do. Examples: the 1999 tragedy in Turnagain Pass, where the avy propagated out a half mile taking seven or eight snowmachiners' lives; the two brothers who were buried and killed on Shrine Bowl a decade or so ago; Jeremy Stark and his buddy on Turnagain Pass last winter. Not only is it avalanche and snowpack awareness this group needs to be exposed to, it's terrain choices (escape routes/safety zones, one on the slope at a time, etc.), beacon/rescue procedures, and basic stuff such as, "Don't attach your beacon or shovel to your sled; attach it to your person!" All taught in a Level 1 course. I know the Alaska Mountain Safety Center offers snowmobile-specific Level 1 courses, but I have not heard of any others in the Lower 48. I do think it's important for this group to be educated by their own as your friend stated. Just as I would not want to be taught how to dive by a swimmer, I'd want to be taught by a diver. This seems to be the last and probably hardest audience of the backcountry users to target.

Not sure what the answer is. Maybe an increase in snowmo vs avalanche fatalities will rise this group into action, or maybe education priorities will change. In the meantime I am sure to keep a large berth between myself and high-markers and be ready to spring into action as I prepare for the worst-case scenario: multiple burial in Shrine Bowl.

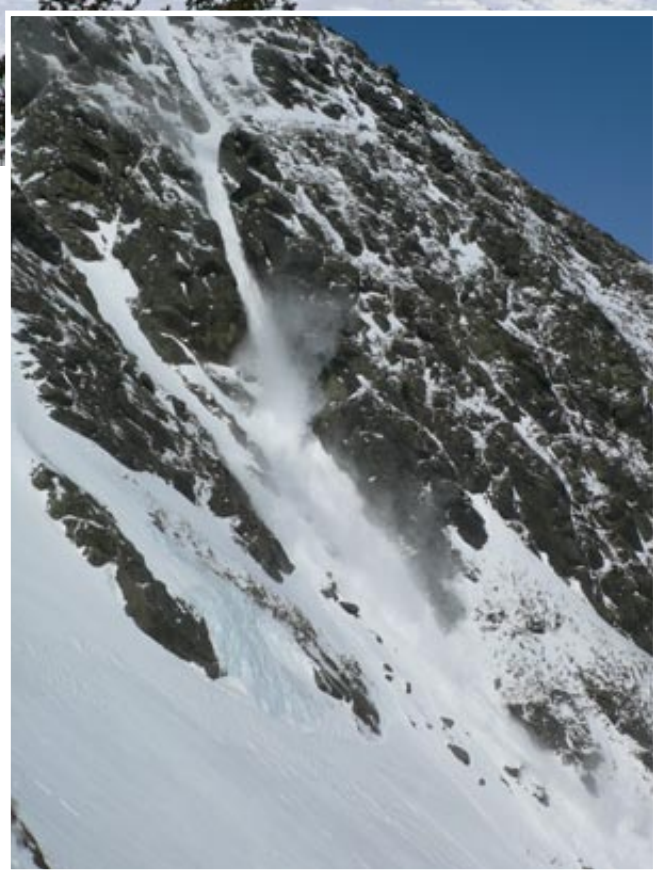
Hope this will help you out a bit, Mike. Ciao, Graham

Graham Predeger is a backcountry ranger for the Vail Pass Winter Recreation Area; Holy Cross Ranger District, Minturn, CO.

crown profiles

USFS Mt Washington Avalanche Center White Mountain National Forest 2007/08 Season Summary

TUCKERMAN BOWL This photo was taken during a cycle that pushed numerous paths farther than they'd run in 40 years. First aid caches were buried and 75-year-old trees were snapped like toothpicks.
Photo courtesy Mt Washington Avalanche Center



HUNTINGTON RAVINE'S NORTH GULLY ON MT WASHINGTON This soft-slab avalanche ran approximately 450m, triggered by two solo climbers who are out of view at the top of the photo. A roped party of two had just begun climbing the waterfall ice at the beginning of the gully, obscured in the moving snow. Miraculously no one was seriously injured. *Photo by Ron Birk*

Snow was king this year in New England and most area residents hailed its long-awaited return. Road salt was in short supply, snowblowers flew off the shelves, and slide paths exceeded their historic maximums providing impressive piles of tangled trees and dirty debris. Concord, NH, came within inches of having its all-time snowiest winter, a record that was set in the much-lauded winter of 1873/74. Despite the amazing snowfall recorded around New England, the Mt Washington Weather Observatory somehow ended up with snow totals well below the long-time average. As all snow professionals know, a single piece of data doesn't paint the whole picture, and regardless of the summit observations, the Mt Washington Avalanche Center had one of its most memorable seasons.

Forecasting began on November 17 and ended with the last avalanche advisory on May 26. During the course of the season, 182 advisories were issued in addition to two dozen Weekend Updates, a program initiated during the 2006/07 season. Visitor counts in the forecast area ranged from zero during the -30°C (-22°F) days of mid-January to a whopping 4000+ on a busy April Saturday. The latter was the busiest day on the snow that the mountain had seen in 30 years.

When broken down by the month, the season provided the typical ups and downs of a normal New England winter. December was a boon for snow lovers, and above-average snowfall was recorded on the Northeast's largest mountain. A dry January followed, and February clocked in with snow totals below average as well. By the end of the season we were witness to seven straight months of drier-than-average conditions. After repeatedly clearing small trace amounts from the 24-hour boards and doing the math, we gawked at the main snowstake and contemplated manufacturing an extension. Twenty cover-to-cover SWAG sessions couldn't provide an answer to why the depth of our snowpack was exceeding the average while the storms skirted around the mountain. Despite the modest snowfall, multiple paths pushed into old groves of trees and even buried one of our rescue caches that had been relocated to a "safe" location close to 40 years earlier! An abundance of storms from the south also created a deep snowpack that allowed skiers and riders to enjoy top-to-bottom runs on northern aspects through Memorial Day.

Paired with forecasting, the Snow Rangers at the Mt Washington Avalanche Center also have the unique responsibility of coordinating all search and rescue activities within our forecast area. Historically we respond to approximately 25 incidents per season, but the average over the last decade has dropped, and this season we responded to an even 20. The number of avalanche accidents and near misses was up again this season with traditional paths running more regularly and many unusual tracks becoming more active. We recorded approximately double our average number of avalanches, though it's likely many more occurred without being noticed as a result of our direct action regime. Climbers were the dominant human trigger this season with skiers taking second place.

Two avalanche incidents from this season are noteworthy. One solo climber perished from injuries received while caught in a slide during storm conditions under a high avalanche danger rating. He was found quickly the following morning on top of the debris pile approximately 60m (200') above the toe. Another avalanche incident involved a party of two climbers soloing the top of a 300m (1000') mixed snow and ice gully. The climbers managed to escape the avalanche (SS-AF-R3-D2-I), but unbeknownst to them, a second party of two was beginning an ascent of the same route when the slide occurred. The leader was swept over a pitch of waterfall ice while the unanchored belayer was yanked up into the first piece of protection. Despite two broken helmets and a sizeable leader fall, the two were able to walk away with no major injuries. A third party was able to capture pictures of the event from an adjacent climb *(see photo at left)*.

About 20 avalanche courses were offered over the course of the season by local providers and the avalanche center assisted with almost all. In addition the center conducted specialized avalanche rescue training sessions for local volunteer rescue teams as well as for the Elite Rescue Team from the New Hampshire Department of Fish and Game. A number of short educational programs were offered to the public, and we worked with the media from local papers to CBS and *National Geographic* to assist with dissemination of safety messages. Once again the avalanche center co-sponsored the 14th Annual Mt Washington Valley Ice Festival and staffed an informational booth during the weekend-long event.

The avalanche advisory continued to be our most accessed educational tool with Web site (tuckerman.org) visits climbing steadily. We're approaching the end of our season, and it looks like the Web site will have tallied close to 350,000 visits by the time the snow melts. Almost 90,000 of those visits came in the relatively snow-free month of April alone! Weekday visits consistently outnumbered those on the weekend throughout the season, leading us to conclude two important points:

1. Our traditional hard-copy avalanche advisories are still a key delivery method for the majority of our visitors.
2. Very few people visit our Web site in the morning hours but once lunch passes people lose their interest in being at work!

Our friends from the Mt Washington Volunteer Ski Patrol faithfully reported for duty every spring weekend and helped us provide safety messages to our throngs of mountain visitors. They tallied approximately 200 days of volunteer time when visitor numbers were highest and assisted with rescue efforts when needed. In May, Patrol Director John D Knieriem was honored for his long-term commitment to the volunteer ski patrol and given the President's Call to Service Award by Secretary of Agriculture Ed Schafer. John and the patrol's dutiful assistance has helped us ingrain avalanche awareness and mountain hazard recognition into the mentality of Eastern skiers, riders, and mountaineers.

Cutler, our yellow lab, continues to be the most popular member of the staff and has developed one heck of a following in his seven years (41 dog years). Visitors greet him like long-lost family and beg to have their picture taken at his side. Many a face dropped this season when we mentioned that we are on the hunt for a new puppy to eventually replace him. With a few good years of service left, we look forward to his role as mentor. *—Justin Preisendorfer, MWAC forecaster*

DIG DEEPER

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best serve their students, educators should emphasize the following:

1. **Organizing the rescue:** Allocating manpower, controlling the site, and calling for assistance when appropriate.
2. **Basic beacon searching:** Owning beacons, mastering single burials, and – in more advanced groups – double burials performed in series or in parallel. Instruction on "special case" close-proximity techniques should be limited to professional courses.
3. **Shoveling techniques:** Several recently published reports propose valuable techniques for efficiently excavating avalanche victims, including "strategic shoveling" and the "V-shaped conveyor" method. See *The Avalanche Review*, issues 25/2 and 26/3. These are already proving to be effective in saving lives (see "Shoveling Education at Work: A Case Study. Success Story on Mt. Proctor," in this issue).
4. **Probing:** Basic probing for life-sized targets, not Tupperware, using a spiral or concentric circle pattern.
5. **Reducing the depth of burial:** This can be accomplished through proactive escape strategies, releasable bindings, and avalanche airbag technology.

Most important, however, is preventing avalanche incidents in the first place—through on-snow education, terrain selection, proper routefinding, and effective communication. Ideally, educators shouldn't need to teach avalanche rescue in their courses at all. But this, of course, is more "ivory tower" thinking—and there's no place for that on the debris pile!

ACKNOWLEDGEMENTS

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The quotes that appear at the top of the preceding pages were gathered during Bruce Edgerly's interviews with avalanche survivors.

Bruce Edgerly is the marketing director for BCA. He is an avid backcountry skier with an interest in how people make decisions.

COURSE DEBRIEF

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Our job as instructors is to ensure that, by the time they leave the course, each student has a method to evaluate their personal levels of avalanche risk including awareness of their own process:

- Am I using a checklist to meter the decision-making process?
- Am I seeing what the experts see? (Are my terrain choices consistent with the danger rating?)
- Have I been in this situation before?
- Is this the same choice I would have made prior to the avalanche course?
- Do I have a simpler terrain option?
- What are the consequences if an avalanche occurs?

And finally,

- Do I wish I were with a more experienced person right now?

Wrapping each course up naturally involves suggesting future trips, future courses and an encouraging tone. Have fun and here is a list of helpful resources. The instructor knows the "nothing ventured, nothing gained" adage is the inevitable motivation that urges the student through their first 10 years of backcountry travel. The instructor also hopes that the student's "ghost in the machine" is haunted in some way by what's been learned from his avalanche-course instructor.

This article summarizes the topic presented by Colin Zacharias at the 2008 Pre-ISSW Educational Forum, hosted by the American Institute for Avalanche Research and Education (AIARE).

Colin Zacharias presently lives in Vancouver, BC, where he is a mountain guide and mountain safety consultant. He is an instructor/examiner for the ACMG and AMGA certification program and for the CAA Level 1 and 2 (ITP) professional level avalanche courses. He has worked in avalanche control programs since 1980 (ski areas, highways, industry) and worked on curriculum development for several programs including the ACMG, AMGA, CAA ITP Level 2, and the AIARE Level 3 Avalanche Certification. Colin also consults in the mechanized ski-guiding industry, including for Helicat Canada.