THE Avalanche REVIEW

A Publication of the American Avalanche Association®

VOLUME 30, NO. 1 • OCTOBER 2011

www.AmericanAvalancheAssociation.org

Season Roundup 2010/11

February 27, 2011
Snowbird Ski and Summer Resort
Wasatch-Cache National Forest in
Little Cottonwood Canyon, Utah
Photo by Matt Boynton

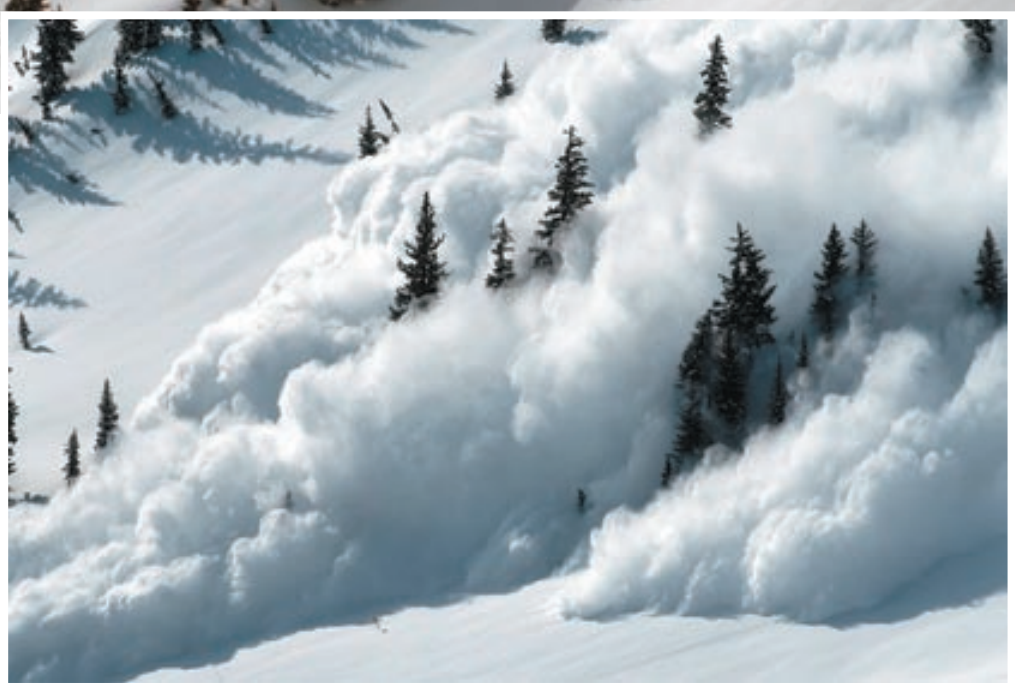
About the Avalanche

from Dean Cardinale, snow safety at Snowbird—

February 25-27, 2011, we picked up 28.6" snow with 1.68" of water at the Snowbird tram base study plot. More snow fell at higher elevations and in Mineral Basin. After the weather cleared on February 27 we went helicopter bombing throughout the Snowbird resort. This slide was triggered with four pounds of explosives thrown from the Wasatch Powder Guides helicopter during our bombing mission; it was triggered above the ski traverse on an un-compacted slope.

From Matt Boynton, the photographer—

I wasn't in the heli; I went up Hidden Peak on foot before the mountain opened to specifically shoot this and just posted up with my long lens, focal length was 320mm. These photos were shot on a Nikon d300 and 80-200 @ 1/1000 and f/5.6.



Matt Boynton has been skiing and shooting photos in and around Utah since 1999, when he relocated from New York to enjoy the outdoors and phenomenal snow that this area offers. Aside from shooting winter sports, he enjoys landscape and long-exposure photography. He wants to offer special thanks to the Snowbird ski patrol and Jared Ishkanian for the opportunity to shoot on this particular morning.

For more information about avalanche conditions in the 2010/11 season, see the NAC summaries beginning on page 16 ➡

The Avalanche Review
P.O. Box 2831
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in this issue

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OCTOBER 2011 • VOL. 30 • NUMBER 1

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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

On our 25th Anniversary, AAA Reviews Last 10 Years

The fall of 2011 marks the 25th anniversary of AAA. The idea of a professional organization aptly named the American Association of Avalanche Professionals was presented to the community on the deck outside of the Squaw Valley Theater during ISSW 1986. Many of the folks present on the deck that afternoon became members (including myself), and a lot of those folks are still members and still serving the avalanche community. The founders of AAA/AAAP should be very proud of what they created.

MEMBERSHIP: In the last 10 years the number of Professional Members and Affiliate Members has each increased by about 60% with 502 Pros and 120 Affiliates currently. This doesn't count a number of lapsed members who we hope to connect and reunite with. The number of membership applicants has significantly increased especially in the last several years (more than 80 for the spring review). Membership Chair Stuart Thompson, Secretary Mike Bartholow, and the Section Reps have done a fine job with the increased workload. The electronic application process has increased efficiency in the review process.

Interestingly, the number of *The Avalanche Review* subscribers has remained virtually unchanged in the last 10 years (229 then and 235 now).

FINANCES: Our income has jumped significantly during the last five years by about 50% and our expenses have increased as well. See the charts on the next page for a breakdown of both income and expenses. Membership dues remain our main source of income, and we put the majority of those funds back into our flagship product, *The Avalanche Review*. This is money very well spent, and we owe a tremendous round of thanks to the TAR editor Lynne Wolfe and our TAR designer Karen Russell of Fall Line Design. We are fortunate to have such talented and dedicated folks.

Through a generous annual donation from the explosives supplier C-I-L/Orion we have been able to make a commitment to provide funding to regional professional development workshops. We were able to co-sponsor seven events last winter and have already committed to co-sponsoring four for the upcoming winter. Those interested in organizing a regional workshop can find information about grant opportunities on the AAA Web site.

The funding of both academic and practitioner research grants remains a priority, and last spring the board voted to increase the amount of funds available to practitioners to match that available to academic awards, now $1500 annually for each. Again, grant information can be found at the AAA Web site.

OPERATIONS: As AAA has grown we have had to mature as a business. This means utilizing legal, accounting, and IT resources as necessary and then bear the accompanying costs. These expenses can be significant, but necessary to a professional organization.

For the coming winter the governing board looks to consolidate our recent efforts (the acquisition of Avalanche.org, maintaining and increasing membership benefits, and dealing with increased administration responsibilities) to make sure that they can be sustained at the high level the membership has come to expect. This may sound easier than it really is. Although a few positions are paid – the TAR production folks, our AVPRO coordinator, our IT person, and myself – many of the efforts of AAA are accomplished by dedicated volunteer members.

This summer and fall we are looking to institute an online membership management system. This will streamline the AAA membership database management (an ever-increasing and time-consuming effort). Members will be able to renew online and manage their contact information. An up-to-date membership directory will be available to members in good standing. The one thing we need from the membership (along with some patience) is an accurate and usable email address in order to facilitate this effort. Be guaranteed that we will not share your contact information and that information will be safeguarded in a secure site. It may take some time to choose and develop the best system, but it is a necessary step for AAA to take into the 21st Century.

Finally, this fall marks my 10th anniversary as your Executive Director. Thank you for your continued support. The challenges over the years have been many, but I have been very fortunate to meet and work with a number of exceptional individuals in AAA. It is an honor and a privilege to work for and represent the American Avalanche Association

—Mark Mueller, AAA executive director

from the editor

From a birthday party on the summit of the Grand Teton, July 2011. *Photo by Rachel Stam*

See you at "SAW"

It's absolutely clear and blue out my window right now, hard to believe that winter is truly on its way. But within two weeks of writing this, our first issue of volume 30 will emerge from the printer and fill your mailbox. This is the fattest issue ever, yet even with 36 pages we still had to squeeze to make room for all the fabulous photos and stories that came with last year's season summaries and bump several articles to December.

Volume 30, you may say, 30 years of *The Avalanche Review*? Yes, and you'll see a retrospective on our anniversary and our progress in the December issue, thanks to a distinguished line of previous editors and ongoing support from the AAA Governing Board. If you have any thoughts or comments on TAR's evolution and influence over the years, please contact me ASAP.

Autumn also brings the "SAW" season, when several regional Snow and Avalanche Workshops jump-start our thinking about snow and avalanches with one-day awareness and education events. This year I will be able to attend the new NRSAW, in the northern Rockies town of Whitefish, Montana, plus the perennially popular and high-quality CSAW and USAW events. These events are organized and presented by local forecast centers and teams of volunteers, and supported in part with product and cash by local and national gear companies. Your organization, the AAA, also contributes grants funded by your dues and the monies from a percentage of sales from C-I-L/Orion.

In my SAW travels I look forward to seeing old friends, connecting faces with names on our subscriber lists, and hearing what you are puzzling over from last year and working on for this year. If you've got an idea for an article for TAR, you can discuss it with me at any of these workshops. Or just send me your musings; I welcome submissions.

Over the summer, I found that TAR 29/4, with its focus on decision-making and the human factor, succeeded in its mission to generate open-ended conversations about personal decisions and consequences, and about how we acquire and then change our beliefs and practices. My favorite quote from a summer's worth of discussion comes from Ron Johnson, who told me that he hardly ever goes into the mountains with a goal. "I go poke around, see what's in shape and what the problems are; if you do that long enough with a look-and-see attitude, you'll get to the top, find some good skiing, and make it back home in one piece." *—Lynne Wolfe*

SUBMISSION DEADLINES

Vol. 30, Issue 3 ..... 12/01/11
Vol. 30, Issue 4 ..... 02/01/12
Vol. 31, Issue 1 ..... 08/01/12

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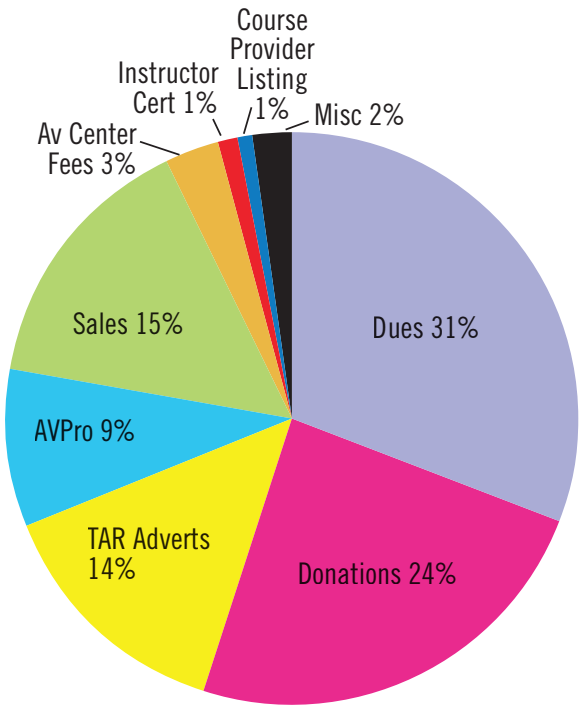
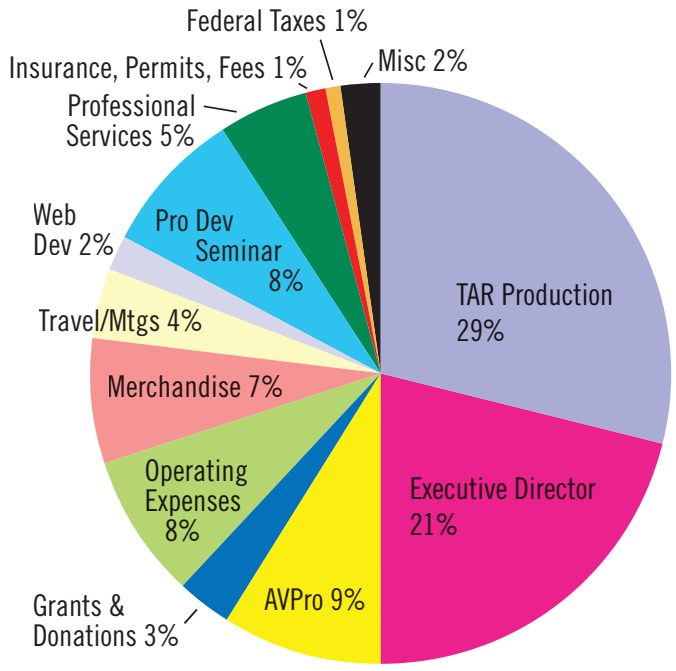
aaa news

AAA INCOME • WINTER 2010/11



ITEM	INCOME	%
Dues	$34,822	31
Donations	25,527	24
TAR Advertising	15,285	14
AVPRO	9,900	9
Sales	16,002	15
Avalanche Center Fees	3,000	3
Instructor Certification	794	1
Course Provider Listing	975	1
Miscellaneous	1,775	2
Pro Dev Seminar	0	0
TOTAL	$108,080	

AAA EXPENSES • WINTER 2010/11



ITEM	INCOME	%
TAR Production	$28,225	29
Executive Director	21,600	21
AVPRO	9,634	9
Grants & Donations	3,422	3
Operating Expenses	8,303	8
Merchandise	7,050	7
Travel/Meetings	4,272	4
Web Development	1,845	2
Pro Dev Seminar	8,400	8
Professional Services	4,815	5
Insurance, Permits, Fees	1,099	1
Federal Taxes	1,200	1
Miscellaneous	2,000	2
Instructor Certification	0	0
TOTAL	$101,865	

IMPORTANT!

AAA Transitions to Electronic Membership Communications: UPDATE YOUR EMAIL

This summer the American Avalanche Association will begin communicating with its members and subscribers using Constant Contact, the online email-marketing provider. We first used this last spring to notify members and subscribers to renew with modest success: about 60% of the recipients opened the email. This past summer we sent emails to those members and subscribers who need to renew and to all AAA members with the notice of our annual membership meeting in Leadville, Colorado, on October 14.

As we transition to electronic communications exclusively, it is important that we have a current usable email address for you. In the future as we continue transitioning to more complete online membership management, you will manage all your own contact information online.

What if you didn't receive an email this summer? Then the email address we have for you is incorrect, you didn't provide an email address when you signed up, or our email to you got spammed (set your spam filter to allow emails from aaa@avalanche.org).

The transition to electronic communications may take a little getting used to. We'll apply a one-issue grace period to everyone for their subscriptions to *The Avalanche Review* to allow enough time for everyone to get on board with our new program. Finally, thanks in advance for helping make this new program a success.

AAA Annual Membership Meeting Set for October 14 in Leadville

The American Avalanche Association Annual Membership Meeting will be held Friday, October 14, 2011, from about 6 to 8 pm at the National Mining Hall of Fame & Museum Conference Center in Leadville, Colorado. The meeting will be held after the Colorado Snow and Avalanche Workshop. The entrance to the Conference Center is located on West 10th Street in Leadville.

Several continuing education and professional development opportunities co-sponsored by AAA are scheduled for this fall and winter *(see box at right)*. Check www.americanavalancheassociation.org for an up-to-date listing as more workshops are scheduled.

Northern Rockies Avalanche Safety Workshop
Saturday, October 1
Whitefish, Montana

Colorado Snow and Avalanche Workshop
Friday, October 14
Leadville, Colorado

Utah Snow and Avalanche Workshop
Saturday, November 5
Salt Lake City, Utah

Gallatin National Forest Avalanche Center Workshop
March 2012

Left: During the Telluride AvPro course in spring 2010, Sterbie gave a tour of avalanche-mitigation routes. This shot was taken near "Sterbie's gun," one of the area's new Howitzers.

Photo by Sarah Carpenter

AvPro Scholarship Deadline Nears

Calling all AvPro scholarship applicants for the 2012 AvPro course:

AVPRO 2012 February 25- March 4: Telluride, Colorado

Scholarship applications due October 31, 2011. AvPro course description, scholarship description, and application on AAA Web site. www.americanavalancheassociation.org/edu_courses.php

AAA Awards & Memorial List Committee Seeks Input

The American Avalanche Association Awards and Memorial List Committee is chaired by Halsted Morris. This year there has been only one petition for an award. This award is a posthumous award of the Bernie Kingery Award to Leif Eric Borgeson of the A-Basin ski patrol. This award will be presented to his family and the A-Basin ski patrol at the Colorado Snow Avalanche Workshop (CSAW) in October. Leif had made many presentations at CSAW, and it seems fitting to do the presentation at CSAW.

There are currently 52 persons – all avalanche-related workers killed while on the job – listed on the American Avalanche Association's memorial list. The last person added to the list was Scott Kay, the Wolf Creek ski patrol director killed during avalanche control work on November 22, 2010.

Halsted Morris has been tabulating names of folks related to the greater snow/avalanche community who have died since the 2010 ISSW for the remembrance page in the ISSW proceedings. If you think of anyone who might be eligible for listing on either list, please contact Halsted at HM1Hacksaw@aol.com.

AAA Outlines Principals of Conduct

Item C of AAA's Statement of Purposes states, "To contribute toward high standards of professional competence and ethics for persons engaged in avalanche related activities." To this end AAA created a Code of Ethical Conduct many years ago. AAA members are in a position of trust and our Code of Ethical Conduct is meant to reflect that responsibility. The intention of the code is to state general principals of conduct to be observed by each member so that they may best serve the interests of their employers, the public, their fellow members, and the avalanche community.

American Avalanche Association Code of Ethical Conduct

A. Hold above all the public trust and reputation of their profession, perform services only in the areas of their competence, and strive to enhance their qualifications through continuing educational, professional, and technical development;
B. Issue public statements only in an objective and truthful manner and endeavor to extend public knowledge to promote understanding of the achievement of avalanche science;
C. Act in a professional manner for each client or employer as a faithful agent or trustee and avoid conflicts of interest;
D. Build their professional reputations on merit of their services and not compete unfairly with others and;
E. Conduct their practices in accordance with this code and bring to the attention of the association unethical practices of any member.

metamorphism

Congratulations and thanks to our new AAA members:

Certified Instructors
John Stimberis, Ellensburg, WA
Tom Thorn, Big Sky, MT
Eric Geisler, Anchorage, AK
Blase Reardon, Ketchum, ID

Pro Members
Arni Jonsson, Gan, Norway
Philip Edmonds, Driggs, ID
Jonathan Hare, Dillon, CO
Gabe Monroe, Pocatello, ID
Sean Janes, Juneau, AK
Erin Smart, Seattle, WA
Ulrik Domass, Skjetten, Norway
John Kascenska, Lyndonville, VT
Dr. Christian Jaedicke, Oslo, Norway
Hans Hjelde, Ogden, UT
Devon Haire, Dillon, CO
Jim Donovan, Silverton, CO
Zeb Blais, Truckee, CA
Steinter Bakkehoi, Oslo, Norway
Robert Lee, Santa Fe, NM
Roger Yim, Nelson, BC Canada
Jake Urban, Wilson, WY
Aaron Parmet, Dillon, CO
Brandon Woolley, Westminster, CO
Andrew Slaughter, Bozeman, MT
Ryan McPartland, Zephyr Cove, NV
Rebecca Parkinson, Tetonia, ID
William Blair, Silverthorne, CO
Stephen Szoradi, Aspen, CO
Jeff Taipale, Seattle, WA
Chris Catlin, Bothell, WA
Tyler Reid, Port Townsend, WA
Daniel Bechtel, Durango, CO
Alexander Alexiades, Reno, NV
Kurt Hicks, Leavenworth, WA
Colin Mitchell, Black Hawk, CO
Jordy Hendrikx, Bozeman, MT
Dieter Issler, Oslo, NORWAY
Jason Konigsberg, Park City, UT
Steve Kunnen, Seattle, WA
Kjetil Brattlein, Oslo, Norway
Kalle Kronholm, Aal, Norway
Frode Sandersen, Oslo, Norway
Kevin Hammonds, Salt Lake City, UT
Jonathan Tukman, Telluride, CO
David Sutherland, Fairplay, CO
Ben Mitchell, Truckee, CA
Jim Giglinto, Keene, NY

Affiliate Members
Pedro Rodriguez, Berkeley CA
Robert Yerex, Sandy OR
Benjamin Gardner, Durango CO
Jim Delzer, Leavenworth WA
Scott Havens, Boise ID
Thomas Lewis, Seattle WA
Brett Crandall, Bend OR
Travis Catanzaro, Victor ID
Amber Moran, Dillon CO
Nick D'Alessio Girdwood, AK
Ian Nicholson, Seattle, WA
Geoffrey Williams, Durango, CO
Jeff Fowlds, Pagosa Springs, CO
Joe Tobias, Boise, ID
Tucker Cunningham, Truckee, CA
Eric Balog, Wilson, WY
Dustin Byrne, Bellingham, WA
Andrew Morris, Silverton, CO
Shay Bright, Ft. Collins, CO
Bryan Biggs, Boise, ID
Peter Flynn, Auke Bay, AK
Chris Groves, Littleton, CO
Georg Kirschner, Kingfield, ME
Dr Hedda Breien, Oslo, Norway
Ryan Woods, Englewood, CO
James Sampey, Golden, CO
Lucas Mouttet, Fort Collins, CO
Casey Henley, Plattsburgh, NY
Matthew Lynch, Bellevue, WA
Chuck MacLaren, Kenmore, WA

Craig Wilbour Retires from WSDOT

Story by John Stimberis

Craig Wilbour, the avalanche control supervisor for the Washington State Department of Transportation on Snoqualmie Pass, is retiring after 36 years with WSDOT.

Craig began skiing at Holden Village above Lake Chelan when he was 4. He skied at Squilchuck while attending Wenatchee Valley College as well as the first season at the newly opened Mission Ridge ski area. Craig moved on to Alpental in 1969 and soon joined the pro patrol where he became more involved with avalanche work. By 1975 Craig had joined the WSDOT avalanche program in a seasonal capacity and eventually moved to the supervisor spot in 1978. He has held that position ever since. During his tenure at the WSDOT Craig helped develop the highway control program on Chinook Pass.

photos of Craig Wilbour then and now, courtesy Craig Wilbour collection

During his career Craig has attended or presented at nearly every ISSW, missing only Banff in 1976 and Aspen in 1984. He has also co-authored numerous reports and papers related to snow and explosives. Although he has experienced all of the joy and misery of winters in a maritime climate, the one thing that has always kept him happy is skiing at Alpental.

Upon retiring Craig plans to "break as many toys as possible," and he has a lot of them. Craig's legacy will live long with his crew, both past and present.

"Mountain Man" Dick Reuter Dies

Dick Reuter died in the arms of Jeanne, his wife of 51 years, at his beloved mountain home in Kirkwood on July 4, 2011.

Dick was born December 9, 1922, in Hamlin, KS, and spent his early years on a farm in Nebraska. He was a Boy Scout and participated in Future Farmers of America. Dick got his AA degree at Yuba College, continuing his successes in sports, and meant to go on to UC Davis to study forestry. Instead, he joined the US Army Corps of Engineers in May 1943 and participated in the invasions of Normandy and Omaha beaches. He was a skillful machine operator building air strips, and an expert M1 rifle marksman. While away in the service, Dick sent home his pay to buy his parents a home in Chico. He was awarded a number of ribbons and medals and the rank of staff sergeant, honorably discharged in December 1945.

Dick came home and worked a short time on heavy equipment before heading for the mountains with his trusted husky, King. He settled in the Mineral and Mill Creek area outside Lassen Park, ranch caretaking, trapping martens, logging for Collins Pine, building hand-split rail fencing, fishing and hunting – sometimes with his father but usually alone. He was mentored by "mountain men" of the region who forever shaped his lifestyle. Later, he skied across the Sierras doing snow surveys for PG&E.

Dick was lured to Squaw Valley in 1955 or 1956 when winter stopped the logging, and he joined the ski patrol in time to help Squaw Valley prepare for the 1960 Winter Olympics.

In June of 1960, Dick married Jeanne Kessey, a school teacher in Truckee. They raised four children – Eric, Carolyn, Ernie, Sheila – while Dick worked winters on patrol and summers cutting ski trails for Squaw Valley and Alpine Meadows. He assumed

Continued on next page ➡

Nick DiGiacomo, Skier, Surfer, and Scientist, Passes Away

This story first appeared in the Telluride Daily Planet in March, 2011.

Nick DiGiacomo passed away on March 9, 2011, from complications of ALS (Lou Gehrig's disease). DiGiacomo will be remembered as a skier and climber, a surfer and scientist, a coach, mentor, and friend. He will be sorely missed by his family and many friends all over the world.

Before settling in Telluride in 2001, DiGiacomo's intellect, curiosity, and thirst for life led him on a wide-ranging scientific and business career from Boulder to Los Alamos, NM, to Switzerland, France, Washington DC, San Diego and San Francisco. DiGiacomo was born in Philadelphia, PA, to Nicolo and Marie DiGiacomo. He attended Monsignor Bonner High School in Upper Darby, PA, and graduated from Siena College in New York with a bachelor of science in physics. He went on to earn his master's and PhD in physics from the University of Colorado.

DiGiacomo's specialty was the physics of antimatter, and he published more than 60 peer-reviewed scientific papers. DiGiacomo worked in nuclear physics at the Los Alamos National Laboratory, the United States supercollider program, the CERN laboratory outside Geneva and the European Organization for Nuclear Research (on the early developmental stages what became the Large Haldron Collider). Later, he worked as a senior associate of George A Keyworth, science advisor to President Reagan and Director of the White House Office of Science and Technology Policy.

DiGiacomo embarked on a successful business career, working as a senior executive for Lockheed Martin, Science Applications International (SAIC), Scient, Sawyer Media Systems, and Vanno.com. During these years, he led various projects, including the development of the first e-commerce security standards and the development of SDMI digital music standards.

DiGiacomo retired in 2001 and spent nearly 10 years fully enjoying his passions – surfing, climbing and skiing with his wife, Susan Curtis, and Ruby, their Siberian husky.

With close friends in Telluride and around the world, DiGiacomo explored the San Juan backcountry in both winter and summer. He quickly became a part of the backcountry skiing, climbing, and avalanche community, applying his scientist's curiosity to avalanche phenomena. He was a presenter at the 2006 International Snow Science Workshop in Telluride, always carefully photographing, observing, and analyzing local avalanche events.

Editor's Note: Nick DiGiacomo contributed the cover story for TAR 25-3, "The Role of Belief in Avalanche Decision-making." His insight and empathy were wonderful to work with.

DICK REUTER

continued from previous page

the mountain manager position, built the Squaw Valley tram, and loved sharing the adventures of those early experiences to the delight of listeners. Dick was featured in books about snow safety and the ski industry, including *The Avalanche Hunters*, by Monty Atwater and *Mountain Dreamers*, by Robert Frohlich. During that period he saw avalanche control evolve from roped-up patrollers jumping onto slopes with hazardous snow to the introduction of explosives and cannons for specific stabilization.

Bud Klein, the founder of a new ski area named Kirkwood under development near Carson Pass, was searching for just such an individual to head up the mountain expansion. In July of 1972, Dick was asked to be mountain manager by Janek Kunczynski, who was building the chair lifts. He was kept busy clearing more and more ski trails and adding more chair lifts, one of which was named "The Reut" after Dick. He was an honorary member of the American Avalanche Association and will always be remembered for his pioneering efforts in snow safety. His meticulous records and keen sixth sense in laying out the Kirkwood avalanche plan have greatly contributed to their no-loss record. Dick's tenacity, perseverance, and insurmountable work ethic always carried him forward and gained him respect from all. He inspired the next generations of avalanche professions. He touched many lives through his tireless dedication to the ski industry, and he has been recognized with awards from the US Army, US Forest Service, CA Ski Industry Association, Kirkwood Resort, KMPUD, and the American Association of Avalanche Professionals.

A memorial gathering was held on August 6 with full military honors in Kirkwood, where attendees remembered Dick Reuter's dress code.

In lieu of flowers, the family suggests donations in his name to the American Avalanche Association, PO Box 2831, Pagosa Spring, CO 81147 or to the Northern CA/NV Alzheimer's Association Memory Walk 2011, "Reuter's Rooters" team.

See more photos of Dick Reuter at right along with a note from his son Eric.

Jim Kanzler Touched Many Lives

Story by Bob Comey

Renowned climber and avalanche forecaster Jim Kanzler (also known as "Rathole" for its similarity to "Reinhold," as in Messner) passed away outside his home near Wilson, WY, on April 18, 2011. Jim was 62. He was born in Spokane, WA, and grew up in Columbia Falls and Butte, MT.

Jim's climbing accomplishments are legendary with many difficult first ascents in Glacier National Park, the Beartooth Mountains, and the Canadian Rockies. He made expeditions to Alaska and China and guided for Exum Mountain Guides from 1977-1999. Some of his lesser-know climbing escapades included the scaling all of the higher buildings in Butte during high school and the first winter ascent of Lone Mountain, the future location of the Big Sky Resort.

Jim's younger brother and four of his closest climbing companions died in a massive avalanche on the North Face of Mt Cleveland in Glacier National Park on December 29, 1969. After this event Jim dedicated his life to educating others about the hazards of avalanches. He attended Montana State University and was also self educated and versed in multiple subjects.

Jim joined the Bridger Bowl ski patrol in 1968 and was the first director of the Big Sky ski patrol (1972-1978). He began his career as a ski patroller at Jackson Hole Mountain Resort in 1978. In 1985 he became the lead avalanche forecaster for the resort and the Bridger-Teton National Forest Avalanche Center. Jim finished his career as an essential member of the resort's Information Systems Department (1999-2011).

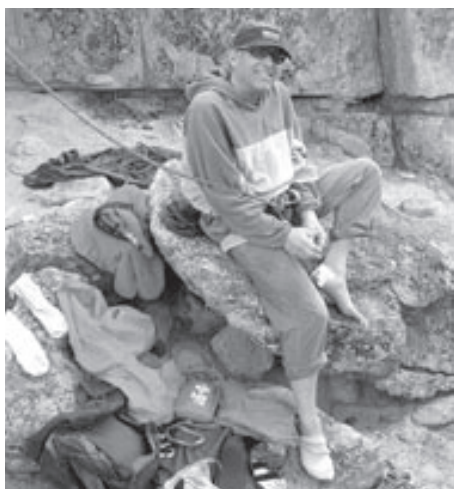
Jim touched the lives of people everywhere he went. He was loved and made a difference to everyone around him. When I meet people from Montana and they find out that I live in Jackson Hole, they always ask me if I knew Jim Kanzler. When I explain that I worked with him, they often reply that they never met him. The thought of his wry sense of humor will continue to make me laugh as long as I live.

As an avalanche forecaster, Jim was the ultimate practitioner and a great mentor. His contributions were cutting edge, practical, and eternal. In October of 1990 his presentation at the ISSW in Big Fork, MT, on the use of large explosive charges for avalanche hazard reduction was immediately challenged by many credentialed avalanche experts, but has since been globally applied.

Jim and his colleague, Larry Livingood, were among the first to post a daily backcountry avalanche hazard forecast on something called the World Wide Web. Concurrently they developed a nearest neighbors program to search past avalanche events on an early MacIntosh computer. At the time, this tool provided great insight into the management of the avalanche hazard at Jackson Hole Mountain Resort and the neighboring backcountry during extended avalanche cycles when large and destructive avalanches were likely.

One of Jim's mantras was to collect the same data at the same locations in the same manner every day. Jim's greatest contribution may be rooted in this mantra. He methodically collected daily weather and avalanche data as he was taught by his mentor, USFS Snow Ranger Gary Poulson, and then passed the care of this mission onto others who followed in his footsteps. As a result of these efforts a database consisting of 37 seasons of meticulously collected weather and avalanche information exists and will continue to grow.

Although Jim no longer walks on the planet his insight and knowledge were diligently recorded and preserved. The handwritten texts of Jim's daily backcountry avalanche hazard bulletins issued during the 1980s and 1990s are archived in the laboratory at the Bridger-Teton National Forest Avalanche Center. A sophisticated nearest neighbors program developed by Chris McCollister can be used to search the historic database for days in the record that are most similar to the present day. Once the old handwritten advisories have been converted to electronic records the center will be able to see what Jim's written advisory was on those similar days. It is anticipated that his knowledge may continue to benefit future forecasters and the people who view their forecast.



Rathole with his characteristic grin, doctoring his feet cragside.
Photo by Margo Krisjansons

As a practitioner Jim had several sayings such as "Watch out for the first bluebird day after a storm", "the avalanche doesn't know you are an expert" ,"avalanches will occur when it begins to snow after an extended dry period.", "If you are trying to find an avalanche expert look under the avalanche debris."

Jim was preceded in death by his father Hal and his brother Jerry, and is survived by his mother, Jean, his son Jamie, and grandchildren James Dylan and Jacqueline. Memorial services were held in Bozeman, Montana, in April, at the Climbers Ranch in Grand Teton National Park in July and at the Jackson Hole Mountain Resort in September.

Bob Comey is director of the Bridger-Teton Avalanche Center. Jim Kanzler was his mentor from 1982-1997 and was only just down the hall for insight on a question after that.

Hi Lynne,

Thank you and the pictures are attached. I included our favorite picture which is my dad climbing Mt Lassen in the '50s with his skis and skins over his shoulder. I used that image for his memorial program since he appears to be climbing into the sky.

The photo that has received the most notoriety is the one of him standing on the gun platform at Kirkwood because it represents so much of who my dad was and metaphorically, his love for and "battle" with the elements. I remember him getting up at 3:00 am every morning there was a big snowstorm and heading out to "shoot," clear the lifts with a cat, and then get to work as mountain manager. As we'd be eating breakfast before trekking to school, we'd hear the gun and shots being thrown up on the mountain. *The Avalanche Hunters* by Monty Atwater has some great quotes about my dad.

My dad was an amazing man physically and professionally who positively influenced and mentored many lives. But the one attribute about my dad that hasn't been written about is that he was a great father and set a great example for us kids by the way the lived his life and the values and lessons he taught us by example. I have never met anyone with his true integrity, work ethic, and principles – and I doubt I ever will. He truly was one of a kind. I loved him very much and I miss him every day.

Warm Regards, Eric Reuter

what's new

CSAW Set for October 14 in Leadville

The Tenth Annual Colorado Snow and Avalanche Workshop will be in Leadville at the National Mining Museum & Hall of Fame on October 14. For more information or to register, visit www.colorado.gov/avalanche

USAW to be Held November 5 in SLC

Utah Avalanche Center & Brooks-Range Mountaineering Equipment will present the 2011 Utah Snow & Avalanche Workshop on Saturday, November 5. The workshop will be held at The Depot, located at the Gateway (400 W. South Temple) in downtown Salt Lake City, Utah. For more information, visit the Events tab at Utahavalanchecenter.org

The Eski Prize Offers Tuition Contest for 22nd National Avalanche School

On March 3, 2009, Squaw Valley ski patroller and High Angle Construction Gazex installer Andrew "Eskimo" Entin was swept by an avalanche into some trees while performing a snow safety route on the Headwall at Squaw. Although he was only partially buried, he did not survive his injuries. The Eski Prize scholarship has been named in his honor.

To apply, send a resumé of your life experience and career goals along with why you think you deserve this scholarship to the address listed below. To be eligible, you must meet all the eligibility requirements necessary to attend the NAS. Please include a cover page with your name and address, e-mail, and phone. All entries must be postmarked or received by October 1, 2011.

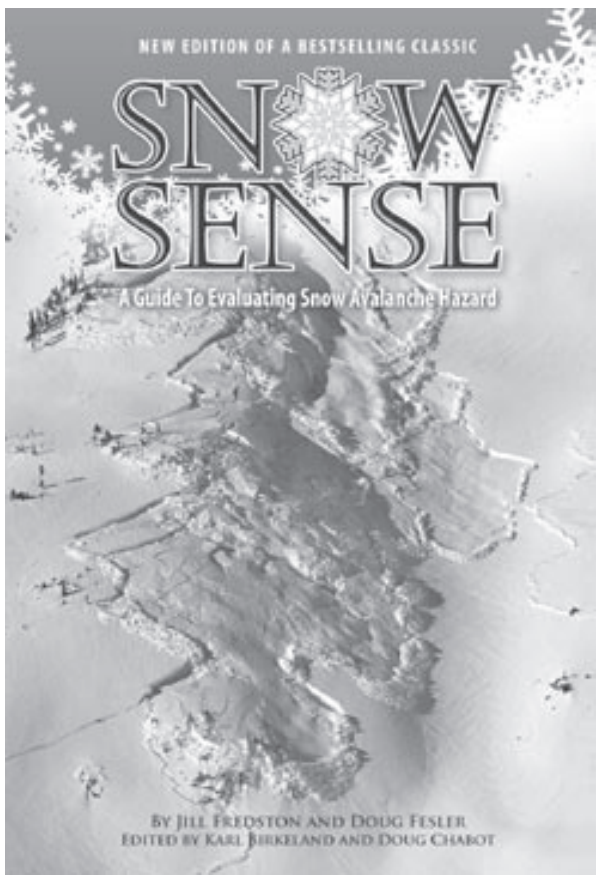
Send essays to High Angle Construction, Inc., 11200 Donner Pass Rd #126, Truckee, CA 96161 Email: highangle@charter.net

Mammut Purchases SnowPulse

It appears the partnership first seen last January at the Outdoor Retailer Show as a Mammut-branded airbag pack with SnowPulse technology has become a full-fledged acquisition.

According to Mammut, SnowPulse represents a valuable addition to Mammut's portfolio, giving them access to leading technology in the avalanche airbag market. Besides being the first company to seriously compete with ABS, the original avalanche airbag pack company, SnowPulse has developed RAS technology which allows the entire airbag and inflation bottle to be removed and used in another compatible pack, or simply removed altogether to maximize pack volume.

The founders of SnowPulse, Yan Berchten and Pierre Yves Guernier, will continue their involvement in the world of airbags as employees of the Mammut Sports Group. Based in Snowpulse's current premises in Martigny, they will work on product development, quality control, production, sales, and marketing of airbag products. Mammut will continue to market the proven Lifebag models and the SnowPulse RAS models under the SnowPulse brand.



5th Edition of *Snow Sense* Just Released

From Jill Fredston and Doug Fesler:

We have been working on a new edition of *Snow Sense* for quite a while. With help from Karl Birkeland and Doug Chabot, we are just about done and it should be rolling off the presses by the end of September. We are excited about this 5th edition – it is fully updated and has quite a few new photos but we tried to keep the same no-BS approach.

NGI Avalanche Group Accepted as AAA Professional Members

Story by Krister Kristensen

NGI head out during annual safety training in the Stryn Mountains January 2011 with the new avalanche research station Fonnbu in the background. l-r: Krister Kristensen, Arni Jónsson, Hedda Breien, Ulrik Domaas, Carl Harbitz, Frode Sandersen, Steinar Bakkehøi, Peter Gauer, Dieter Issler. *Photo by Christian Jaedicke*

Avalanches play an important part of the life in Norway. Approximately 30% of the total land area is covered by mountains. Slopes over 30-degree steepness cover 6.7% of the country. A significant number of buildings and many kilometers of roads and railways are exposed to avalanche hazard. Therefore, the avalanche group at the Norwegian Geotechnical Institute (NGI) was founded in 1973.

The aim was to establish a center of competence based on research and consulting relating to avalanches. It started with the establishment of the avalanche research station Fonnbu in the Stryn mountains in western Norway. Here, the first avalanche warnings were issued. Studies on snow avalanche runout lengths and snow creep met the demands of the Norwegian society asking for dimensioning criteria for structures and power lines in the hydro power development.

In the 1980s the full-scale test site Ryggfonn, close to Fonnbu, was instrumented to study the dynamics of avalanches and the effect of a catching dam. Through the following years NGI assisted in numerous avalanche situations, issued hundreds of avalanche warnings, and participated actively in the international avalanche community. Large parts of Norway were mapped and many mitigation projects planned and installed. Within these activities, the famous alpha-beta model for avalanche runout length was developed. After some tragic events, a special focus was set on slush flows, their occurrence, triggers, and dynamics.

Today NGI is a private foundation employing over 200 experts who conduct research and advisory services in the geosciences on assignment from federal institutions, private industry, and society at large. NGI is a vital part of the Natural Hazard Division and consists of 11 experts and three seniors with a wide spectrum of experience and backgrounds. Theoretical member qualifications include physical geography, geology, geotechnics, snow physics, GIS, fluid dynamics, and meteorology. Additionally, some are experts on mountain search and rescue. Together the group accumulates roughly 400 years of experience. It is always fascinating when the seniors share their experience with the next generation of experts.

The research station Fonnbu burned down in a devastating fire in 2004. NGI decided to rebuild the station in a completely new design. The experiences from the last 30 years were applied to build the perfect research station with doors at three levels to access the building regardless of the surrounding snow accumulation. Fonnbu is now used as a basis for the Ryggfonn experiments, local avalanche warning for Highway 15, courses, and training sessions.

Over the years, through active participation in almost all ISSWs, NGI has developed a close and fruitful contact with the AAA. Ideas and methods are constantly discussed with American and European colleagues, and NGI has been an active member of the European Avalanche Warning Services (EAWS, www.lawinen.org) since its start in the 1980s. NGI has adopted SWAG and is currently working on a revised version of the Norwegian observations guidelines.

On the background of this close contact to the AAA and the wish for a formal acknowledgement of our qualifications, NGI applied for professional member status at the ISSW 2010 in Lake Tahoe. By spring 2011 all members of the group were admitted to the association as professional members. We will honor our new status to support and spread the work of the AAA here in Norway, and we look forward to a long-lasting and successful partnership between our countries.

NGI members include Arni Jónsson, *avalanche expert, mitigation measures, rescue*; Carl Harbitz, *avalanche expert, dynamics, risk analysis*; Christian Jaedicke, *discipline leader, meteorology, forecasting, snow physics*; Dieter Issler, *avalanche expert, dynamics, modeling*; Erik Hestnes, *senior, slush flows, hazard mapping*; Frode Sandersen, *avalanche expert, hazard mapping, risk*; Hedda Breien, *avalanche expert, dynamics, forecasting, hazard mapping*; Kalle Kronholm, *avalanche expert, forecasting, education, spatial variability*; Karstein Lied, *senior, hazard mapping, modeling*; Kjetil Brattlien, *avalanche expert, mitigation measures, forecasting, accidents*; Krister Kristensen, *research station host, risk analysis, education, rescue*; Peter Gauer, *avalanche expert, dynamics, modeling*; Steinar Bakkehøi, *senior, meteorology, forecasting*; Ulrik Domaas, *avalanche expert, hazard mapping, forecasting*.

Krister Kristensen is the European section representative to the AAA board. He welcomes your questions and thoughts on the role of the European section and can be reached at Krister.Kristensen@ngi.no

SLF Celebrates 75 Years of Snow and Avalanche Research

Measuring snow hardness with a rammsonde, 1937. *Photo courtesy SLF archives*

In 2011, the WSL Institute for Snow and Avalanche Research (SLF) looks back on 75 years of snow and avalanche research. SLF celebrates this anniversary with its parent organization, the Swiss Federal Research Institute (WSL), which passed the 125-year mark last year. The two institutes are celebrating their anniversaries by staging a series of public events in various regions of Switzerland.

Schneeschmöcker, "snow snoopers," was the familiar name for the young researchers who, on the Weissfluhjoch above Davos in 1936, became the first to study snow stratigraphy and measure snow properties. Since snow and avalanche research was still in its infancy worldwide, the ambitious scholars largely had to develop their own investigation methods and instruments. In particular, they were eager to explore the nature of the snowpack and understand how avalanches are formed. Their interest was prompted by the steady development of the alpine region and the boom in ski tourism, which raised the importance of avalanche safety. Soon after, in 1945, responsibility for the national avalanche warning passed from the armed forces to SLF.

SLF's development was driven by events such as the extreme avalanche activity in the winters of 1951 and 1999, and by public demand for products such as hazard maps, rapidly available snow and avalanche data, or energy-efficient snowmaking equipment. Today, SLF is a research and service center at the hub of an international network. It employs 130 people from 15 different nations. Snow is now regarded not only as a threat, but as a threatened resource, and remains the centre of attention at SLF. In addition to avalanches, SLF scientists now investigate other alpine natural hazards, as well as permafrost, mountain ecological systems, and the interaction between snow and the atmosphere. Since 1989, SLF has been part of WSL and thus belongs to the ETH Domain.

The anniversary Web site www.wslf.ch features news, an event calendar, historical items, an online competition, and an anniversary blog.

Congratulations to our friends at SLF and WSL on the occasion of their anniversary. Look for articles on the history of SLF in future issues of The Avalanche Review.

Updates from Winter in South America

From Jerry Roberts:
Some powder shots from Portillo. They are in a drought for the second year in a row. Have less than 100 cm, but it's beginning to snow a bit.

From Tim Lane:
Not a whole lot of snow, about same as last year: 50% below average. Yes that is Aconcagua, and yes that's me with the gunners and a new Brennen pistola at La Cumbre, 60 km from the Pimenton Mine *(left)*. Here's a shot of Winnie the avalanche dog (named for Jerry Roberts' dad) with her Chilean flag coat.

Photos by Tim Lane

history

Avalanche Acronym Soup: AAA, NSP, AIARE

Story by Rick Grubin

The avalanche community in the United States – researchers, ski patrollers, forecasters, guides, educators, snow rangers, highway technicians, and recreationists – has a wealth of knowledge and experience from which to draw. Available resources include conferences and seminars, schools, outdoor education programs, ski patrols, and guide companies supporting research, education, training, and information exchange. Among these entities, the American Avalanche Association (AAA), the National Ski Patrol (NSP), and the American Institute for Avalanche Research and Education (AIARE) are perhaps the best known. Despite sharing much common ground and goals, confusion sometimes arises as to what each of these organizations does, both separately and together. A short tour through the history of avalanche research and education in the US may help to better understand from whence we came to arrive at where we stand today.

The Beginning

Avalanche research and education in the US began at Alta, Utah in the late 1940s with USFS Snow Ranger and 10th Mountain Division member Monty Atwater. In the early 1950s, Ed LaChapelle arrived at Alta, lending a scientific background to complement Atwater's mostly self-taught and hard-won experience. This pairing, along with snow rangers from avalanche centers at Berthoud Pass, Colorado, and Stevens Pass, Washington, would produce publications on avalanche research, a manual for snow rangers, and what were likely the first snow safety education opportunities in the US.

Among those benefiting from these snow safety courses were members of the NSP, who were trained in this program. NSP patrollers soon outpaced the capacity of the USFS to provide sufficient courses, and in 1957 the NSP developed its own avalanche education course, modeled after the USFS course – the avalanche "Patch" course. A shorter, "Basic" (Circle A) course was also created to accommodate patrollers in areas where avalanche hazard was low. In practice, completion of the Circle A course was required prior to taking the Patch course. These courses remained at the core of NSP avalanche education until 1990.

Throughout the 1960s, the study of avalanche problems continued in many other locations in the western US. Folks such as Ron Perla, M. Martinelli, and Norm Wilson, among others, cut their teeth working at universities, regional USFS forecast centers, and ski areas. The Westwide Avalanche Network (WWAN) was started at USFS offices in Colorado. The use of explosives to control avalanches, pioneered by Atwater, became more prevalent. The Silverton Avalanche School began in 1962, and in the mid-1960s a three-phase National Avalanche School (NAS) was developed. The NAS principal instructors came from the USFS snow rangers and researchers and senior NSP instructors.

Avalanche Forecast Centers

Thanks to Art Judson and Knox Williams, the 1970s saw the first forecast center in the US created in Colorado as an outgrowth of the WWAN. The USFS moved forward by establishing regional avalanche centers throughout the West, in order to provide daily public forecasts of backcountry avalanche conditions on USFS lands. A demand for education regarding avalanche awareness and hazard evaluation was met by course providers such as the American Avalanche Institute, founded by Rod Newcomb. Innovative avalanche-control programs at Jackson Hole, Squaw Valley, and other ski areas arose to complement what was already ongoing at Alta.

As the 1980s dawned, the USFS had provided nearly 40 years of research, operational forecasting and control, and leadership in the avalanche field. It was also making a concerted effort to move away from such business, and some forecast centers came under state control, with ironic support from the USFS. As much winter recreation use occurs on federal lands, USFS support was justified. Folks from across the avalanche community were also coming together to form an organization where information exchange and common interests could be pursued. The first International Snow Science Workshop (ISSW) was convened in 1982, and Sue Ferguson first published *The Avalanche Review* that same year. The American Association of Avalanche Professionals, now the AAA, was founded by Ferguson, Betsy Armstrong, and Dick Penniman at the 1986 ISSW at Squaw Valley, California. Principal membership consisted of professional ski patrollers and forecasters at various avalanche centers and was rounded out by academic researchers.

Avalanche Education

In the 1990s, avalanche incident prevention, in the form of various avalanche education courses for backcountry recreationists, had begun to grow much more rapidly. Generally, each avalanche course tended to display an individual approach that reflected the experience of its instructors: a "top of the mountain down" approach from ski patrols, a snow profile-centric approach from scientists and researchers, and a rescue-based approach from SAR groups.

The NSP, under the guidance of Rob Faisant and Bill Hotckhiss, was focused on education for ski patrollers, primarily from a rescue perspective. The NSP was the largest avalanche education provider in the US, and had developed an avalanche instructor's handbook, complete with course guidelines and lesson outcomes, centered on its Basic and Advanced course offerings. By 1995 this would become the *NSP Avalanche Instructor Manual* (AIM), its creation overseen by Lin Ballard. Shep Snow would update the NSP AIM in 2001 to conform more closely to subsequent work by the AAA.

Around the same time, Swiss IFMGA guide Jean Pavillard was assisting the AMGA in becoming accepted into the IFMGA, along with Karl Klassen and Colin Zacharias from Canada. During this process, instructors and guides alike recognized that avalanche knowledge was uneven and little common terminology was in use. Despite a variety of excellent avalanche course providers in the US at that time, there was little continuity between them. Guide candidates displayed excellent intuitive understanding of avalanche phenomena and risk management, but struggled – despite the existence of international standards for observing and recording weather and avalanches – to document and explain their decision-making. By the mid-1990s, Pavillard, Klassen, Zacharias, and Tom Murphy set about to construct a framework for avalanche instruction to address these issues, with input from guide services, outdoor education programs, and ski patrols from across the US. These efforts would be the foundation of AIARE.

The AAA had not yet published course guidelines and progressions, but had been actively working on such an approach, using the NSP AIM as a historical basis. In 1999, the AAA did publish its recommendations for course classifications and standards. Each classification listed curriculum topics and skills to be covered, and minimum course durations necessary to adequately cover all suggested material. The recommended Level I and Level II course classifications addressed classroom and fieldwork time breakdowns for perhaps the first time.

In 2003, the AAA revised its course guidelines and progression to further develop the requisite knowledge and skills needed to significantly reduce the avalanche death rate and to meet the needs of an ever-expanding population of backcountry snow enthusiasts. The AAA again reviewed and revised its national avalanche education guidelines in 2007, in a collaborative process with individuals from the broader avalanche community, including the NSP and AIARE. The guidelines provided for new classifications and designations for courses, including Awareness and Introductory level course categories, new standards for both classroom and fieldwork time, and overall instruction time in Level I and Level II courses. Virtually all avalanche education providers now follow the AAA education guidelines and course progression, aligning their curricula with these standards.

SWAG

The decade of the 2000s also saw the development of *Snow, Weather and Avalanches: Observation Guidelines for Avalanche Programs in the United States* (SWAG), under the project leadership of Ethan Greene. The first edition, published in 2004, was supported by the AAA and the USFS, and completed with input from individuals spanning the entire spectrum of the avalanche community. SWAG is the professional reference that establishes common methods, nomenclature, and language for observational standards. SWAG is a critical tool for professional avalanche operations as well as being important for education programs, and it was revised as a second edition in 2009.

Current Roles of AAA, NSP, and AIARE

Today the AAA functions as the organization of and for US avalanche professionals, with a clear mission *(in part)* to: provide information about snow and avalanches, represent the interests of the US avalanche community, exchange information amongst persons engaged in avalanche activities, and provide direction, promotion, and support for avalanche education, and research and development in avalanche safety. With respect to avalanche education, the AAA strives to promote both quality and consistency through consensus and collaboration amongst all interested parties.

The NSP, as an avalanche education course provider, supports the endeavors of the AAA. As well, the NSP recognizes and depends on other organizations like the AAA to provide the essential knowledge base that is the foundation for curriculum content. It continues to be an active participant in the process of evolving such education, as it did beginning in the 1950s, as it does with the NAS, and with its current course offerings that use the AAA standards and guidelines for its avalanche curricula. The NSP's high standards for curriculum and instructor development and program delivery help carry out its mandate to provide education for patrollers and recreationists alike.

AIARE develops avalanche course curricula, with the mission: Save lives through avalanche education. AIARE does this by focusing on increasing the public awareness of avalanches and avalanche safety. That is accomplished by providing educators and course providers with the curricula, training, and tools to provide quality avalanche education in support of awareness and safety. Lastly, it's accomplished by providing professional development for instruction and education, and by funding projects that support these objectives. AIARE continues to develop curricula that follow existing national standards developed by the AAA for a complete program of avalanche courses that meets the needs of students at all levels.

All three organizations strive to be inclusive and work together as dedicated professionals to develop avalanche education and research, exchange information, and promote avalanche safety as part of a greater good. As a member of all three organizations, I can personally attest to this, and hope this article makes clear the advantages and benefits we all enjoy because of this collaboration and cooperation.

The author is the AAA Member Affiliate representative, an AIARE qualified instructor, a NSP avalanche instructor, and a ski patroller at Loveland Ski Area in Colorado. He'd like to thank the many folks who helped provide background and information for this article, including but not limited to Dale Atkins, Don Bachman, Lin Ballard, Janet Kellam, Mike Laney, Mark Moore, Tom Murphy, and Lynne Wolfe.

snow science

Having Problems in Multiple Burial Searches? SIGNAL OVERLAP EXPLAINED

Story by Steve Christie

Does your beacon not work as advertised? Do you have trouble in multiple burial practices and don't know why? This article addresses why you may encounter these issues.

Last May I was able to attend the Canadian Avalanche Association's (CAA) annual general meeting. This five-day event takes place every spring in Penticton, BC. Attendees include Canada's top guides – both mechanized and ski touring – Canada's top avalanche educators, and several prominent Canadian snow scientists. It's the real deal, like a smaller version of the International Snow Science Workshop, except it's sponsored by Kokanee beer and coincides nicely with the Stanley Cup playoffs. The purpose is to share ideas and continuing research and to recap the season as a whole. And it's all about avalanche safety.

After reading an article last spring written by Canadian Mountain Holidays (CMH) guide Rob Whelan, entitled *Today's Transceivers: user expectations, performance limitations and marketing messages*, (Avalanche.ca Journal) I was excited to see that Rob was on the agenda to speak at the meeting. Rob's been a helicopter ski guide and avalanche educator for 21 years and is well respected when it comes to beacon knowledge and training. Points raised in the introduction included:

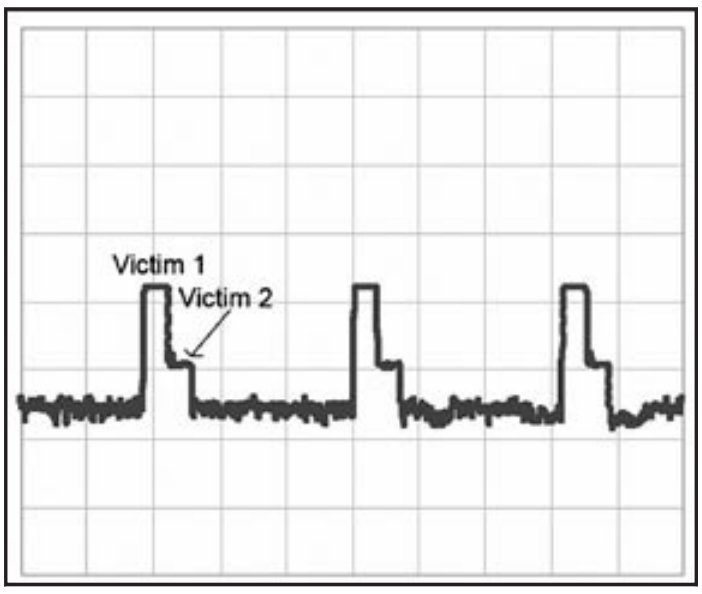
- Why do people still struggle with avalanche beacons?
- Most modern users own a newer beacon and have several modern electronic devices. Why do they struggle?
- Some teachers have a difficult time keeping up with technology.

Rob went on to discuss how easy digital beacons are to use compared to the old days when the only choice was analog beacons. Digital beacons have made it easy to teach anyone how to do beacon searches, but one of the main concerns in the Canadian guiding community is a single searcher solving a multiple burial, a scenario that is more likely to occur in a guided setting than in a recreational setting. In multiple burials, all beacons have their limitations, and this is where Rob pointed out a major issue in multiple burial searching: signal overlap.

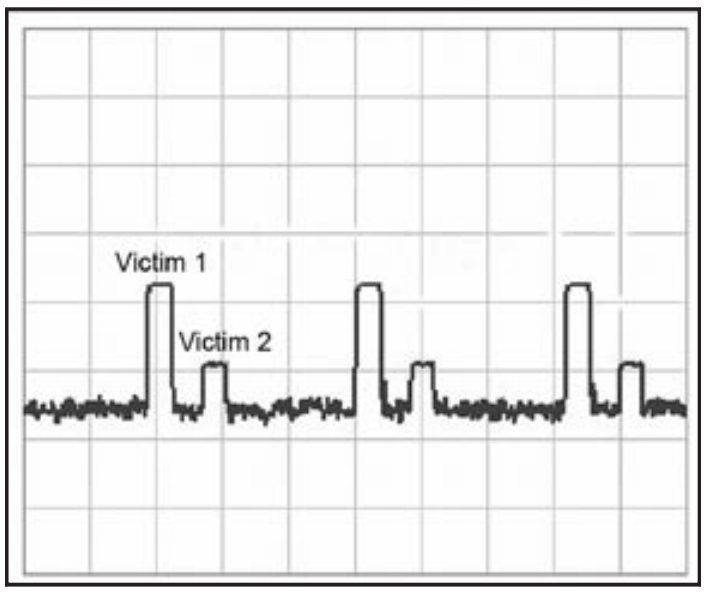
Identifying the problem

This past winter there was a report from a CAA Operations Level One avalanche course that raised concerns about several students failing the beacon exam in which two beacons have to be found in five minutes or less. This sounded slightly odd since several of us at Backcountry Access (BCA) have taken this course and are familiar with the exam procedure. Interestingly enough, one of the transmitting beacons was a Tracker2 and the students who failed were using a "marking" function on their beacon to solve the multiple burial. It was believed by some that an incompatibility had been discovered between a marking beacon and the Tracker2 signal. However, we know from our tests that the Tracker2 meets all the criteria for international beacon transmit standards. And we were certainly aware of signal overlap and the possibility of how it can affect the search mode of every beacon on the market. But we still tested this for many hours, making sure that we weren't missing anything.

Signal Overlap



Signal Separation



The result was quite productive and a first in the avalanche industry: after multiple field and laboratory tests by both sides, we issued a joint statement with the other beacon company explaining that there were no compatibility issues between the two beacons. The failure in the exam was more likely due to the students not understanding signal overlap and how to avoid it. Rob Whelan's conclusion was similar when he stated, "I suspect this was the issue we saw earlier in the winter."

What is signal overlap?

Signal overlap is simply two or more beacon pulses (signals) overlapping at some point to where it creates the illusion that there is only one signal, or fewer signals than there actually are.

In the diagram above left, two signals overlap one another.The diagram above right illustrates how when there is no signal overlap, the signals are separated.

An analogy I commonly use when teaching courses is this: imagine a car-racing track where there are four lanes and four race cars. One race car is traveling at 55mph, one is traveling at 65mph, one is traveling at 75mph, and one is traveling at 85mph. At some points during the race, the cars are going to be lined up in a row next to each other on the track for a certain amount of time. This could happen once or many times; it simply depends on the duration of the race. Are you following me? The race is your beacon search, the cars are the transmitting beacons under the snow, and their speed is the number of signals they put out per minute, with varying brands of beacons (or race cars).

A video that illustrates signal overlap in the BCA lab can be found at: www.vimeo.com/23539827

One of the questions Rob fielded during his talk was, "How many transmitting beacons does it take to get really bad signal overlap?" His answer was, "…generally when a fourth beacon is introduced to a scenario." We at BCA could not agree more. Over the past few years, the fourth beacon has always been the one that's caused problems among all beacon models and resulted in total meltdown of a multiple burial practice search in some scenarios. But the good news is that there are alternative search techniques available to get out of a meltdown and continue searching.

What can be done?

So what should a single searcher do if he or she encounters signal overlap? I'm going to break it down by beacon model in a few paragraphs, but let's assume that the search is for four transmitters, and your beacon is going to have some difficulties. First off, you need to know how your beacon is supposed to work in a multiple burial involving four or more transmitters without applying any special search techniques. If you don't, go back to the owner's manual and the practice field. Second, if you are not familiar with the special search techniques called "Micro Search Strip" or "Three Circle Method," read about them here: www.backcountryaccess.com/research. Following are quick summaries of these two techniques.

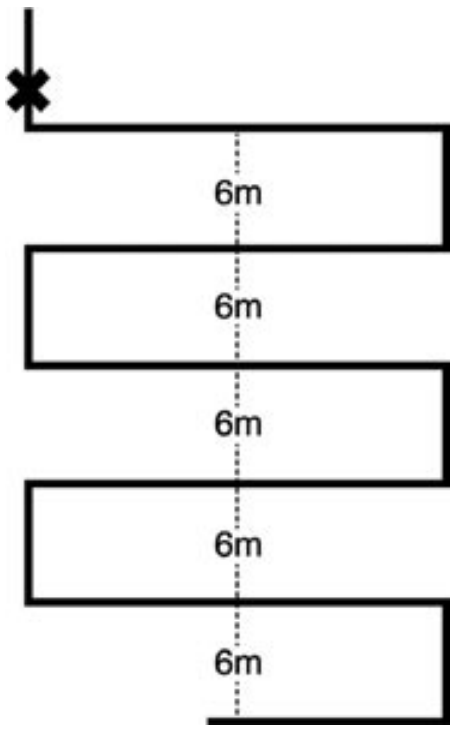
Micro Search Strip Technique

In a multiple burial search, narrow the "search strip" in your signal search (also called primary search) to 20m or less, instead of the usual 40m. If the beacons are suspected to be in close proximity to each other, you should reduce it even further. We commonly see professionals improvising the size of their micro strips (which is very smart since every scenario is different). As an example, imagine five buried transmitters in a small area. You will likely be on your knees sweeping your beacon on the snow surface, methodically looking for different signals. At right is an illustration a Micro Search Strip search path (the X represents the first signal that's already pinpointed).

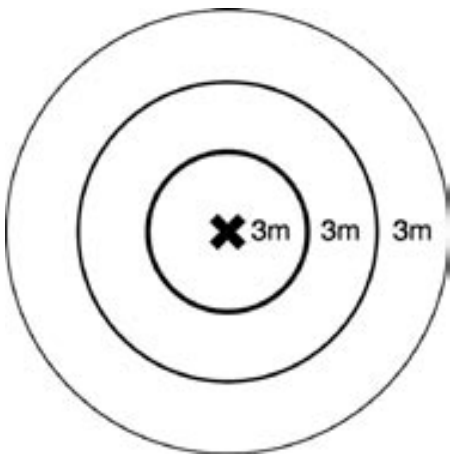
Three Circle Method

After you find your first beacon, back off three meters and walk a circle around it with a three-meter radius, letting your beacon find other signals. Repeat two more circles if necessary, three meters off of each other. Imagine the middle three circles on a target, and the first beacon you found is in the bulls-eye.

Micro Search Strip Technique



Three Circle Method



What do the Micro Search Strip Technique and Three Circle Method have in common? ***Getting away from the first signal you found.*** We feel that it's important to have a variety of multiple search techniques in your quiver, regardless of what beacon model you have.

So for me, this is what I use: Tracker2 in regular search mode, which always finds the strongest signal. It has a multiple burial light to let me know if there are other beacons in the scenario – and it flashes if they are in close proximity to each other (more than one within five meters of the searcher). If necessary, I'll use SP mode after finding the first transmitter, although I often have a general idea of where the other victims are. I'll use the Micro Search Strip or Three Circle Method when it's greater than three transmitting units,

Continued on next page ➡

SIGNAL OVERLAP

continued from previous page

especially if I suspect some of them are close together. (Tip: for passing guiding exams, see the *Advanced Users Manual* at www.backcountryaccess.com.)

Transceiver Model Recommendations

So now that you know what your beacon is "supposed" to do in a multiple-burial search and you're familiar with two alternative multiple burial search techniques, you have a quiver of methods to apply to your beacon. Here's what you do when that beacon doesn't work like it's supposed to–or as Rob Whelan noted in his talk, "when the marketing messages fail:"

- **Tracker DTS and Tracker2:** Manufacturer's recommended technique is SE mode for recreationists and SP mode for trained experts. SP mode helps you see other beacons in the scenario. It's easy to use for finding up to four transmitters, but takes practice and can be tricky. The multiple burial light on the T2 can help identify when there is more than one signal in the general search area and more than one in close proximity. At that point, apply Micro Search Strips or the Three Circle Method to find other beacons if not confident using SP mode.
- **Barryvox Pulse:** Manufacturer's recommended technique is marking. When the marking doesn't work it's important to know how to go into analog mode and reduce the signal sensitivity (volume) down to about five meters. It's also important for the searcher to know how to search in analog mode. At this point you can use Micro Search Strips or Three Circle Method. If you insist on using marking, you may get a "stand still" message in your display. In some cases the beacon will correct itself after you have stopped. Barryvox also has a description of the Micro Search Strip technique in their owner's manual.
- **Barryvox Opto 3000:** Manufacturer's recommended technique is analog mode for multiple burials with the assistance of an indicator light for when there's more than one transmitting signal. Analog mode for multiple burials requires the searcher being comfortable with analog searching and using Micro Search Strips or the Three Circle Method.
- **Ortovox S1:** Manufacturer's recommended technique is marking. Can display up to three buried victims on the screen. When the marking doesn't work it's important to know how to go into analog mode and reduce the signal sensitivity (volume) down to about five meters. It's also important for the searcher to know how to search in analog mode. At this point you can use Micro Search Strips or Three Circle Method. If you insist on using marking, you may get a "stop" message. In some cases the beacon will correct itself after you have stopped and remained still.
- **Ortovox 3+:** Manufacturer's recommended technique is marking. Multiple burial indicator for up to three signals. When marking doesn't work it's important to search methodically and try Micro Search Strips or the Three Circle Method. Ortovox also advises a method called "sector" searching which is kind of like attacking the scenario from different quadrants. Again, the common theme here is getting away from the first signal just like Micro Search Strips and the Three Circle Method.
- **Ortovox F1/M2:** Analog. User should be comfortable with Micro Search Strips or the Three Circle Method with the sensitivity set down to five meters.
- **Pieps DSP:** Manufacturer's recommended technique is marking. Multiple burial indicator for up to three signals. When marking doesn't work it's important to search methodically and try Micro Search Strips or the Three Circle Method.
- **Pieps Freeride:** Analog. User should be comfortable with Micro Search Strips or the Three Circle Method.

Bottom Line

There's no harm in mastering multiple beacon searches as long as the searcher has first mastered single searches with his or her beacon. Guides are often well practiced at multiple burial searching but may need to better understand how their modern beacons work and the signal overlap nuances they may encounter. If a guide is leading a real multiple burial search, the clients will take orders from the guide. Those orders may include helping search with a beacon or getting probes and shovels ready.

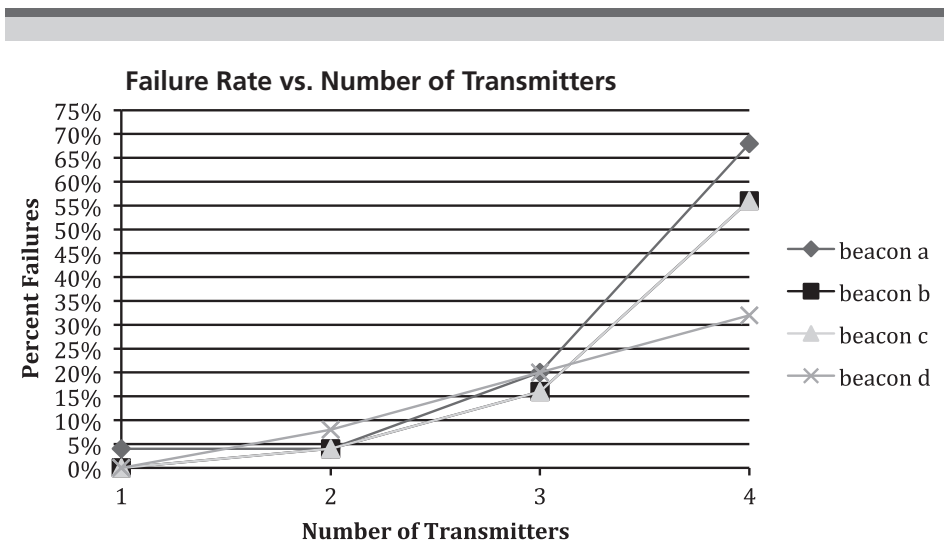
Recreationists can keep multiple burials simple and effective by appling more than one searcher when possible (also called "searching in parallel," see www.backcountryaccess.com/research). The more searchers there are, the less of a problem signal overlap will be, since the searchers are spread out on the search area and will likely end up each isolating different victims. In a best-case scenario, a recreational group involved in a multiple burial will designate a leader to take charge of the search, similar to a guide. In this situation, the leader needs the confidence to give orders and must be able to determine where to use extra manpower in the tasks where it's needed the most. We've seen an improvement in group organization skills over the last few years, and this is likely due to avalanche educators addressing the importance of the issue in their courses.

But the truth is that almost all real multiple burial avalanches kill when there's more than one completely buried victim. That's because there's almost always inadequate manpower for shoveling. To see how the numbers stack up in reported incidents, take a look at the accident databases of www.avalanche.org and www.avalanche.ca/cac.

The reality? Stick with basic avalanche protocol to avoid multiple burials: don't expose more than one person at a time on a slope, and get those route finding and terrain choice skills wired. If you make a mistake and do end up with a multiple burial, it then becomes all about group dynamics and excavation: leadership, communication, strategic shoveling, and available manpower are the factors that determine the outcome in a real multiple burial. Beacon searching is the easy part.

This article originally appeared in the Backcountry Access blog, which can be found on the BCA Web site at www.backcountryaccess.com/blog.

Steve Christie is the director of sales for Backcountry Access and loves traveling for his job, especially to the Tetons.



Signal Overlap Failures: Quantified at Last

Story by Sean Metzger, Matt Greenberg, and Bruce Edgerly

In July of 2011, Backcountry Access intern Sean Metzger ran a series of tests to quantify the effects of signal overlap on the latest avalanche beacons to hit the market. He used four different models to search for one, two, three, and four transmit beacons at a time. For each quantity of one to four transmitters, he and supervisor Matt Greenberg set up scenarios with five different models of transmit beacons. They searched each scenario five times using each of the four search beacon models, for a total of 400 searches. Transmitters were all approximately 10 meters apart and lightly concealed in a grassy field located in Boulder, Colorado.

The graph shows the results of the first round of tests. Failures were defined as instances when either a) the beacon lost its "mark" and led the searcher back to an already-marked transmitter, b) the distance and/or directional display did not change or led the searcher in the wrong direction for at least 25 seconds, or c) a transmit beacon was not detected despite not being intentionally "marked." The failure rate was approximately 5% in two-beacon scenarios, 15-20% in three-beacon scenarios, and ranged from 30-70% in four-beacon scenarios. Two of the models showed identical results. One recently introduced model experienced a distance/directional failure in one of the single-beacon scenarios – and a distinctly higher failure rate than the others in the four-beacon scenarios.

The objective was not to time the searches, but to determine the failure rates as the number of transmitters increased. Each transmit scenario was comprised of beacons of identical model, as might be found in professional fleets.

The next phase of testing will include scenarios involving mixed beacon models, which are more likely to be found in recreational scenarios.

Sean Metzger, Matt Greenberg, and Bruce Edgerly are dedicated staff and product testers for BCA, whether in grassy city parks or winter powder fields.

media

Gallatin Forecast User Survey Yields Valuable Insight

GNFAC Users Request More Maps, Raw Data, Beer Coupons

Story by Mark Staples, GNFAC forecaster

One in four users of the Gallatin National Forest Avalanche Center have been caught in an avalanche, and 17% had others caught in the same slide. 80% are male, and 20% are female. We recently gathered these and many other interesting statistics about our users through an online survey. It was inspired by a survey conducted by the West Central Montana Avalanche Center and the School of Business at the University of Montana *(see story on next page)*. Dudley Improta from WCMAC helped us craft a very similar survey specific to our area, and we posted it on SurveyMonkey this season.

The response was overwhelming. We shut it down once we had received almost 500 responses. The purpose of this survey was to learn a little about our users, how they use our site at www.mtavalanche.com and our advisory, and most importantly, how we can better serve them. There were many very interesting findings. Although one in four were caught in an avalanche, 60% of them did not report it. 5% were fully buried, 34% were partially buried, and 10% were injured.

To get our advisory, 80% access it via email. This was surprising since we put so much energy into our Web site. To address this need, we immediately started embedding photos into our emailed advisories. We also realized the importance of getting people on our email list at every opportunity. Southwest Montana sees extremely heavy snowmobile use, yet only 23% of our responses came from snowmobilers even though a large portion of our Web site traffic comes from the Midwest. Some in this user group either didn't respond to our survey or don't check our advisory. Probably a little of both, but we need to redouble our efforts to reach this group.

These statistics are helpful, but the real meat of the survey was found in the qualitative responses from open-ended questions. The good news is that people want our advisories. They want more of them, they want a larger advisory area, they want a longer season, etc. These responses are probably no surprise to everyone who has seen winter backcountry use rapidly expand in recent years.

Our photos and videos were easily the most popular feature of our advisory/Web site, and we plan to expand the use of this media. Some folks wanted raw data, and we will start posting every snowpit on a separate page to address this need.

We also learned that people need a little help keeping track of the different mountain ranges in our area. To help them we will probably add two maps: one with areas shaded by danger rating and another with key peaks and drainages labeled.

The survey offered extremely valuable insight allowing us to accurately fine tune our advisory and Web site. It also confirmed many things we thought we were doing well. It also provided a little humor with comments like provide beer coupons, share pro deals, and hire some cute women.

Mark Staples investigates an avalanche in Truman Gulch, the scene of a fatality in mid-February, 2011. This gully was cross loaded by 60 mph winds. The victim and his partner crossed the gully about 100' below the crown where they dug two snowpits. Their test results were CT12 under the wind slab. For more about this incident, see the GNFAC Season Summary on page 26. *Photo by Eric Knoff*

Mark Staples was introduced to snow in the wild Appalachian Mountains where he received a BS in civil engineering at the University of Virginia. He began teaching ski lessons, moved to Bozeman, eventually working for Big Sky in 2002 and starting as a professional ski patroller there in 2004. He returned to school and obtained a master's degree at MSU where he studied the energy balance of snow in mountainous terrain and its effect on weak layer formation. His work at the Avalanche Center began in 2006 as an instructor. The following year he was hired as an avalanche specialist. In summer months Mark has worked as a rock guide, NOLS instructor, construction consultant, and civil engineer. In August 2010 he took on the most difficult job so far when his son Ethan was born.

missoulaavalanche.org Survey Summary

Results compiled by Dr Shawn Clouse, University of Montana Business School
and Dudley Improta, West Central Montana Avalanche Center

Steve Karkanen, West Central Montana Avalanche Center director, and Dudley Improta, WCMAC forecaster, wanted to learn more about the users who came to missoulaavalanche.org for avalanche-related information. Karkanen had a professional writer review and critique advisories from the 2008/09 season; the idea to "profile" our readers, so to speak, came out of this review. The original questions were, "Who's reading our advisories?" and, "Can we improve our advisories by knowing the background of the readers?" The project also provided the opportunity to elicit comments and criticisms about WCMAC and the Web site. The West Central Montana Avalanche Foundation (the friends group for WCMAC) contracted with Dr Shawn Clouse from the University of Montana School of Business and the Management Information Student Association (MISA) from the UM Business School to run a survey of avalanche Web site users and analyze the data.

The survey asked users questions about the quality of the avalanche alerts on the Web site as well as demographic information to profile the survey participants and finally asked the participants a series of questions related to the usability of the site.

The primary goal of missoulaavalanche.org is to provide avalanche advisories for the west central Montana region. The organization also provides avalanche classes for professionals (EMTs, S & R, and LifeFlight crews) and the general public, including a public school program.

The areas of interest for the survey project were the demographics of users, opinions on avalanche advisory delivery, if users have been caught in an avalanche and if the avalanche was reported, what avalanche equipment users carry into the backcountry, what winter businesses participants work in, how they travel into the backcountry, satisfaction with the frequency of avalanche advisories, the different types of communication methods that could be used to deliver the advisories, some general information about the avalanche advisories, and information about the Web site usability and satisfaction.

The survey instrument was developed in the fall of 2009. The delivery method for the survey was online via SurveyMonkey from January 15 to March 9, 2010. Participants were solicited via email with a link to the survey, and there were multiple requests to participate written in several of the avalanche advisories. To encourage participation, t-shirts and an avalanche transceiver (donated by BCA) were offered as prizes. Participants were entered into the drawing after they completed the survey. The process included one online survey with all of the research questions and a second survey was used to gather names, phone numbers, and email addresses for the drawing. This ensured anonymity for submissions.

The following is the executive summary that identifies the main findings from the survey:

Demographics– The survey participants were highly educated (81% with college degrees), had an average age of 36 years, and 82% were male. The income level was a little below the 2006-2008 Montana median household income average of $44,043.

Web site Visitation– Participants come to the Web site frequently with 74.9% reporting one to two times per week and 82.1% reporting once per month or more.

Web site Additions– Participants wanted more videos, a discussion board, blog, and a web interface suitable for smart phones.

Backcountry Use– 67.4% recreate in the winter backcountry once per month or more.

Avalanche Experience– 26.3% or 85 participants reported direct experience with an avalanche, but only 41% reported it. 98.8% of those participants carry some type of avalanche rescue equipment like transceivers, shovels, probes, and cell phones.

Avalanche Advisories– Participants want more frequent advisory reports, but they also say that the two advisories per week are working well. They find the advisories very helpful with a 6.25 rating on a seven-point scale. Participants want more media and less text in the advisories.

YouTube– 85% of the participants have watched the YouTube videos and felt they were very valuable (6.02 rating on a seven-point scale). YouTube videos are an excellent choice for avalanche information delivery.

Avalanche Communication– Participants want text messages, Facebook/Twitter integration, and there was more than one suggestion (ironic because of the popularity of using technology) for roadside signs showing avalanche-danger warnings similar to fire-danger warning signs.

Avalanche Education Program in Schools– Almost 93% of the participants supported a standardized avalanche-education program in local schools.

Open-Ended Responses– Participants submitted about 30 pages of responses to open-ended questions. This information, which is not included (over 300 comments), will be consulted when making changes to the Web site or advisories. Open-ended responses always make for interesting reading and provide valuable information when trends in responses are noted.

Web Site Usability Models– There is low risk associated with using the Web site and participants have a high degree of trust in the information provided. Increasing usability and satisfaction leads to higher behavioral intentions or more users utilizing the information from the Web site for its intended purpose of informing winter backcountry users on avalanche conditions. For more information on Web site usability models contact Dr Shawn Clouse from the University Of Montana School Of Business, shawn.clouse@business.umt.edu.

The project gathered a lot of information from the aforementioned open-ended responses to detailed demographics such as how much money the users spent on winter backcountry gear annually to marital and family status. The tables and figures at right were selected as most relevant to the primary goal of understanding the activities and background of advisory readers.

Generally, the users of missoulaavalanche.org seem satisfied with the product. However, criticisms and suggestions were noted. Actions and changes will be considered from the survey results, and, no doubt, some will be implemented. Items listed below are a sampling of actions either taken or to be considered.

Two actions from the assessment have taken place:

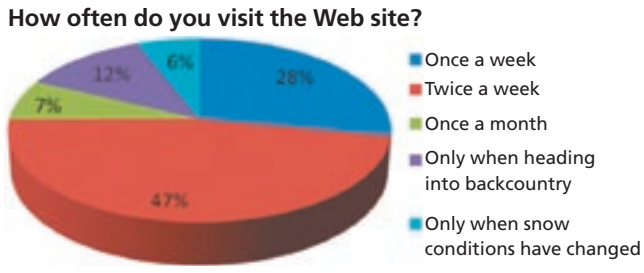
1. Comments from users about the major fund-raising event (Pray for Snow Party) were taken into account during the planning committee's first meeting.
2. Additional education events and Level I and II courses are being planned to meet increasing need in the area.

The following actions are to be considered:

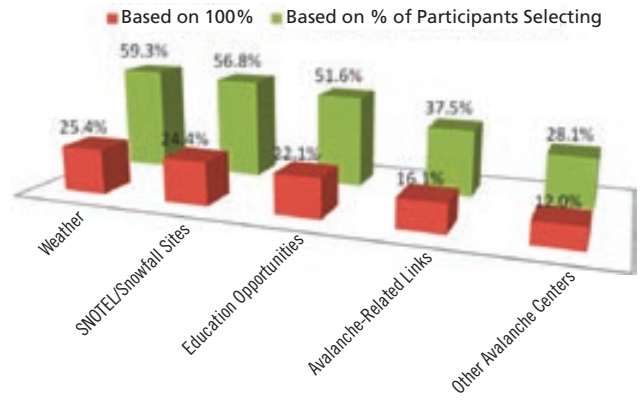
1. Use alternative communication methods (Twitter, NPR radio) to broadcast avalanche advisories.
2. Change the wording or format of the avalanche advisories to ensure the public understands data is collected from the entire region.
3. Change the presentation of the YouTube clips to ensure the public understands that the clip is not the advisory *(related to #2)*.
4. Have the main forecasters routinely visit diverse areas within the west central Montana region.
5. Many users asked for information that is already supplied, so brainstorm ways to make the information stand out on the Web pages.
6. Brainstorm for new funding sources.
7. Consider a third advisory day.

Any questions or comments regarding the survey may be sent to info@missoulaavalanche.org.

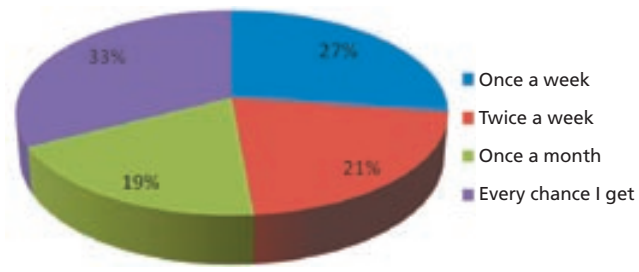
How often do you visit the Web site?



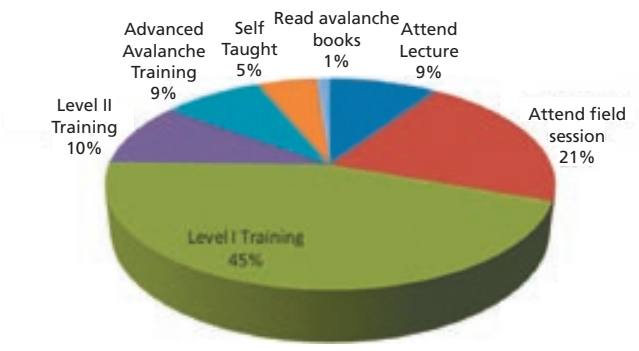
Other information accessed on the Web site:



How often participants recreate in the winter backcountry:



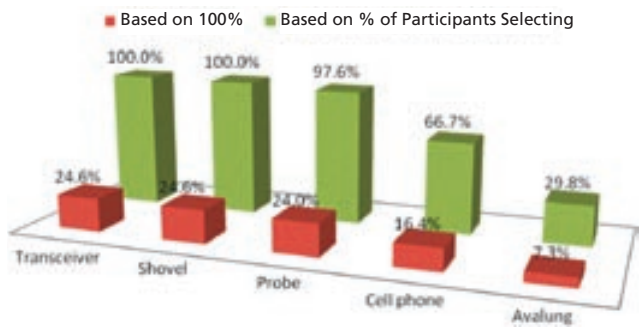
Participants avalanche-training level:



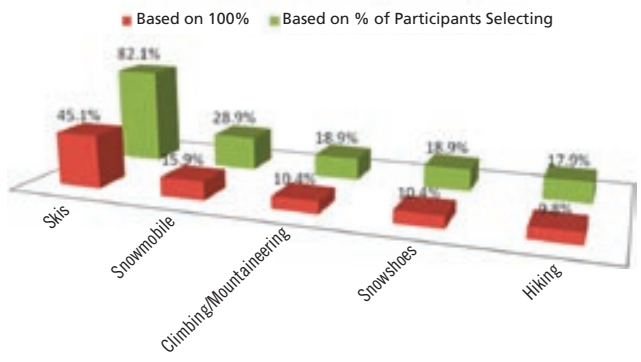
Participants caught in and reporting an avalanche:

Number	Question	Responses	N	Percent
Q4-1	Have you ever been caught in an avalanche or been a part of a group when someone was caught in an avalanche?			
		Yes	85	26.32%
		No	238	73.68%
		Total	323	100.00%
Q5-1	Was the avalanche reported (to ski patrol, sheriff's department, avalanche center, etc.)?			
		Yes	34	40.96%
		No	49	59.04%
		Total	83	100.00%

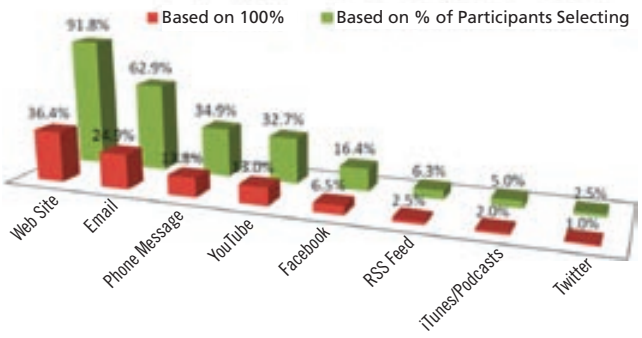
Avalanche equipment participants carry in backcountry:



Backcountry travel methods:



Preferred communication method to access avalanche info:



US Avalanche Centers Survey

Story by Garth Ferber and Doug Abromeit

In the fall of 2009 I became interested in how the US avalanche centers dealt with various issues such as scheduling and staffing. In the spring of 2010 I decided to survey the various centers regarding this and a few other topics, and Doug Abromeit offered to help out. At about that time I also learned of a similar survey compiled by Knox Williams *(1998)*. So I added some questions to our survey in order to update his work.

Survey categories included:

- Administration
- Mid-Winter Staff & Pay Grade
- Forecast Area Size & Elevations
- 2009/10 Budget
- Days & Hours of Winter Office Staffing
- Weather Stations
- Weather Forecasts
- Snow & Avalanche Data
- Avalanche Forecasts
- Dissemination
- Avalanche Control
- Avalanche Education
- Length of Seasonal Employment
- Volunteer Organization

Directors at all 19 US centers listed on avalanche.org responded to the survey. The results are based on the 2009/10 season.

I would like to emphasize that this survey was not undertaken in order to show any particular results. Rather the work was undertaken out of interest in similarities and differences between the various centers.

Partial results that could be presented in graphical form follow in this article. Be careful of comparisons especially since centers have evolved differently in response to local needs. A purpose of this article is to let interested persons know that complete or more exact results in tabular form can be obtained by contacting the first author.

There are currently 19 avalanche centers listed at avalanche.org for the US compared to seven indicated by Knox in 1998.Fourteen of the centers are administered by the USFS except Colorado (state), Cordova and Southeast Alaska (city), and Kachina Peaks and Wallowa (volunteer). Knox indicated six USFS-administered centers and one state-administered center (Colorado) in 1998.

Avalanche center funding in the US is about 1/3 USFS, 1/3 state, and 1/3 other especially City funds and Friends groups.

Budgets vary depending on services and facilities. Thirteen of the centers have budgets of about $100,000 or less. The other six centers have budgets in the $100,000 to $450,000 range. In-kind support is very important at many centers.

Most centers have USFS funding. State and Friends group funding is very important to several centers. Two centers are city funded (Cordova, Southeast Alaska). One center (Northwest) gathers NPS funds. Two centers (Colorado, Northwest) gather ski industry funds. One center (Sawtooth) gathers some BLM funds.

Staffing ranges from volunteers or a couple to a few paid staff, up to seven to 15 paid staff. Of the seven centers listed by Knox in 1998, four had an increase in staff (Colorado, Utah, Bridger-Teton, Sierra), two stayed the same (Sawtooth formerly known as Central Idaho), and one center had a decrease (Northwest).

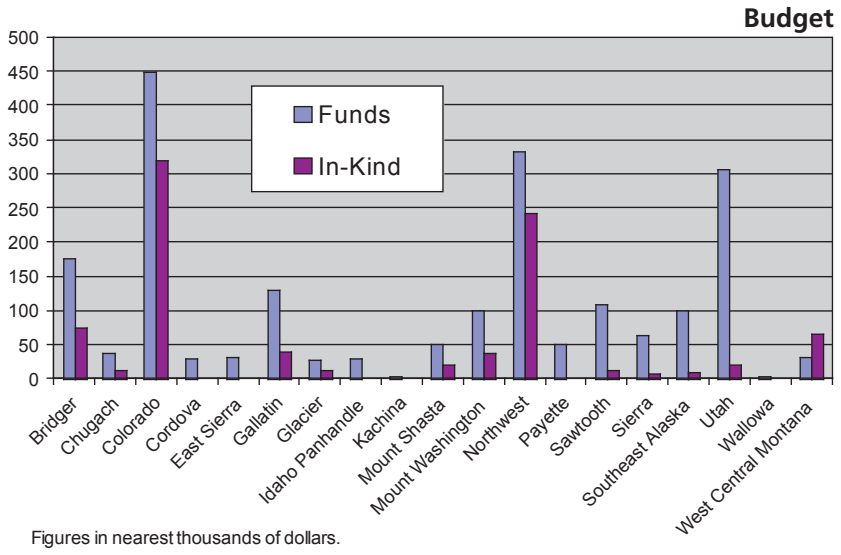
Forecast area sizes range widely from the 2 km2 at Mt Washington to the 120,000 km^2 in Colorado. Of the seven centers listed by Knox the only significant change in forecast area size occurred when the forecast area in Colorado doubled. The size of the area has consequences for the style of forecasting at each center. Centers with larger areas employ a regional style of forecasting and centers with smaller areas are more likely to employ local or even slope-by-slope forecasting.

REFERENCES

Williams, Knox, 1998. *An Overview of Avalanche Forecasting in North America*. ISSW 1998 Proceedings, 161-169.

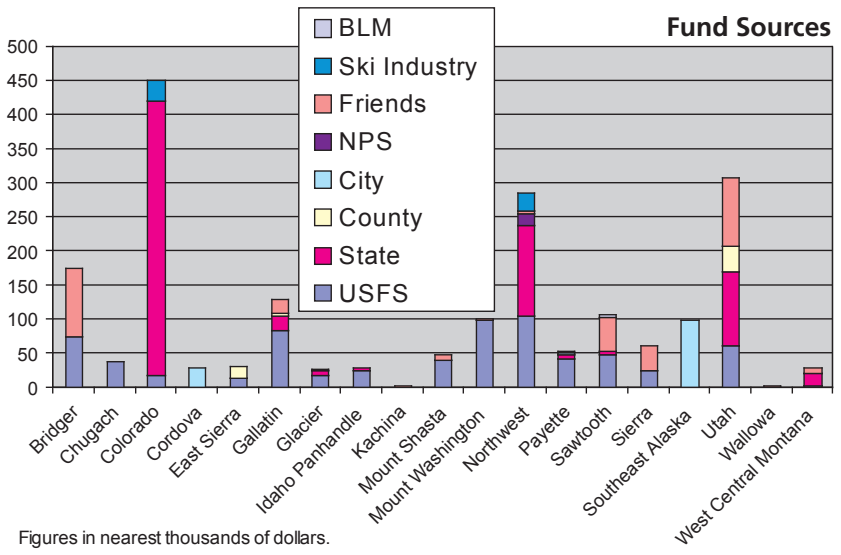
Garth Ferber is a forecaster at the Northwest Weather and Avalanche Center. Doug Abromeit is now the former director of the National Avalanche Center. For the complete text of the survey, contact Garth at garth.ferber@noaa.gov.

Budget



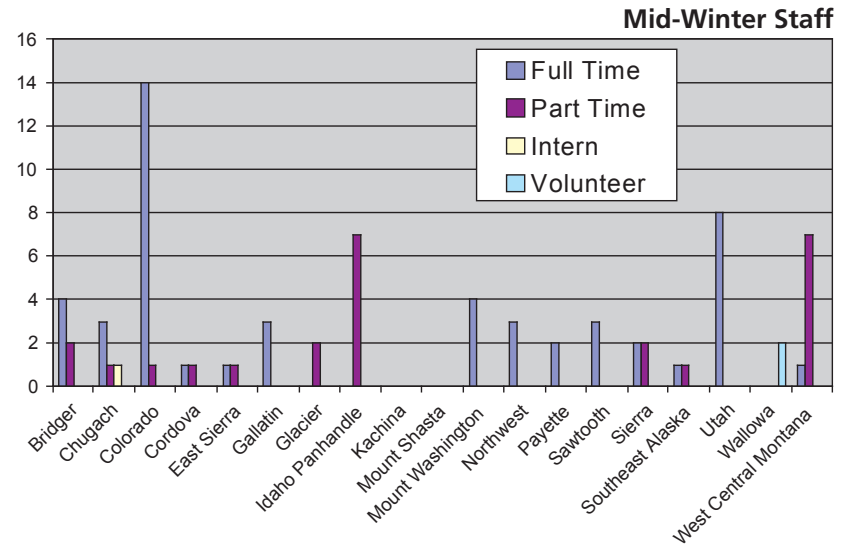
Figures in nearest thousands of dollars.

Fund Sources

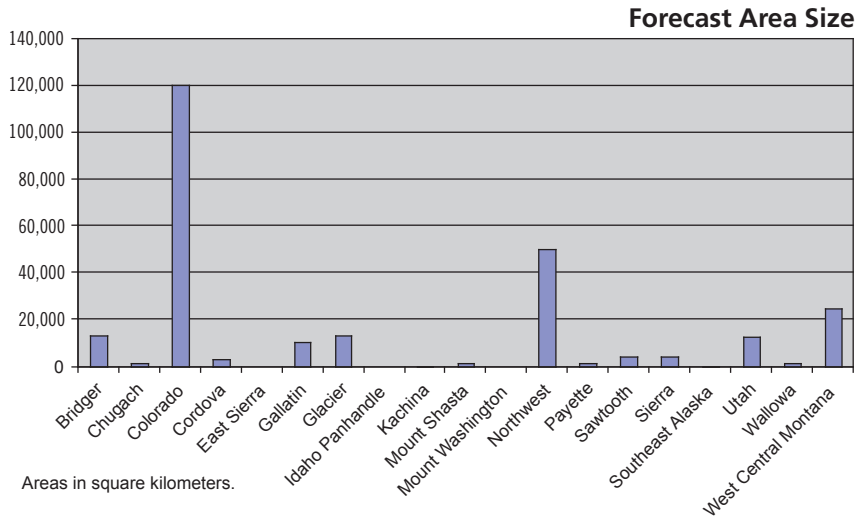


Figures in nearest thousands of dollars.

Mid-Winter Staff

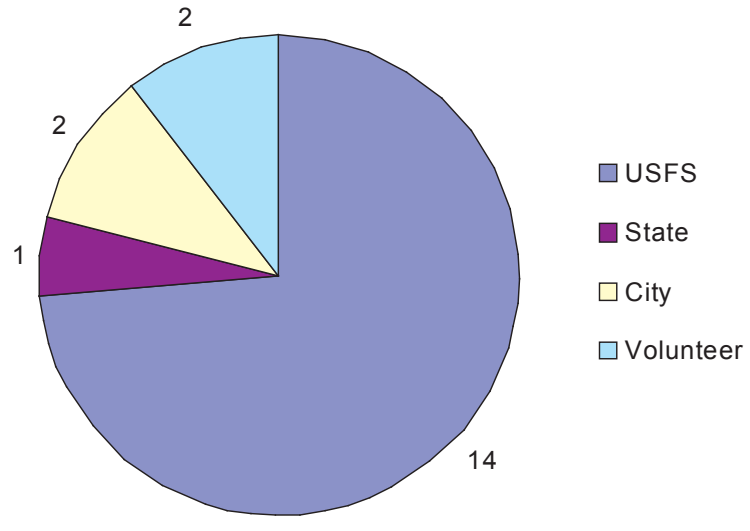


Forecast Area Size

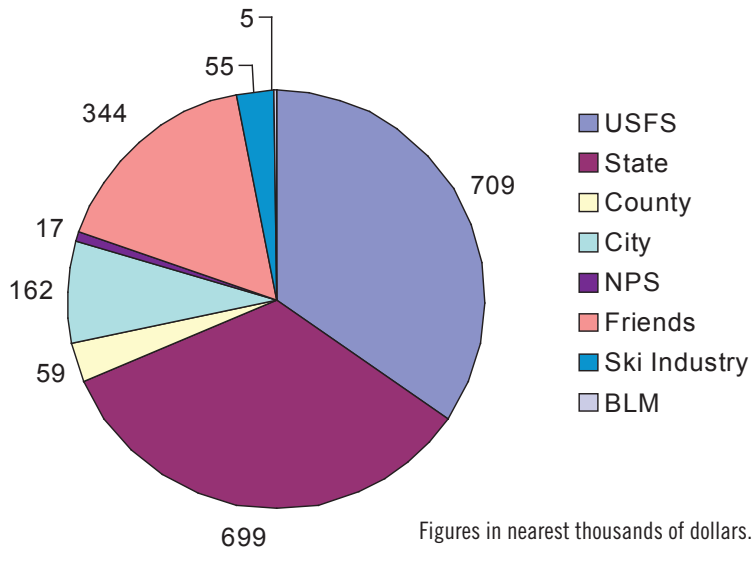


Areas in square kilometers.

Administration of Individual US Avalanche Centers



Total Funds of US Avalanche Center Budgets



Figures in nearest thousands of dollars.

2010/11 Season Summary: UNITED STATES

Forest Service National Avalanche Center

The Forest Service National Avalanche Center (NAC) congratulates the avalanche centers for another successful year of providing avalanche mitigation, forecasting, and education for the public. We kicked off the 2010/11 season with our annual avalanche centers meeting immediately prior to the Squaw Valley ISSW. The meeting covered a variety of topics, including implemention of the long-awaited update to the avalanche danger scale. Led by Grant Statham, the update effort was five years in the making and involved extensive cooperation with our Canadian colleagues. The new danger scale was well received by both avalanche professionals and the public this winter. It has been adopted by New Zealand, and there is talk of translating it into Spanish for use in South America.

The 2010/11 winter provided great snowfall throughout most of the western United State,s and it was still coming in the high country as of mid-June. Some places in the Sierra exceeded 30' of settled base depth and many locations reported record snowfall. The copious snowfall led to generally stable conditions when compared to recent unstable years; however, nine accidents in April and May left us with a total of 27 fatalities. This is well below last year's tally of 36 but too high for those of us working to keep the public safe from avalanche danger. Only three (14%) of the year's fatalities were snowmobilers, far fewer than previous years when snowmobilers have made up about half of all fatalities.

The next few years are likely to be challenging ones for the avalanche centers. State budgets are being drastically cut in many areas, threatening some of the vital state funding that comes in to many avalanche centers. The Colorado Avalanche Information Center is faced with the prospect that their state agency (the Colorado Geological Survey) may be eliminated, necessitating a move to a different state agency. Finally, the Forest Service budget will likely remain flat at best in light of the continuing federal budget difficulties.

These financial challenges are occurring as the demands for our services continue to skyrocket. Luckily for us, the strength of our programs is their broad public support and diverse funding sources. Avalanche center personnel, working with nonprofit Friends groups, have done an amazing job at keeping the avalanche centers going. Our hope is that the avalanche centers can maintain their federal funding while serving as models of a great private/public partnership. With public and employee safety becoming a primary focus of the Forest Service, we feel the avalanche centers are in a good position to compete for scarce dollars.

The NAC, with a great deal of help from Mark Staples, updated the snowmobile side of its Web site and added an interesting video on how avalanches benefit the ecosystem including improving fish, mammal, and bird habitat; check both additions out at fsavalanche.org.

This issue of *The Avalanche Review* highlights the good work of the avalanche centers. Thanks to Mark Staples for tracking down the antsy ready-to-go-to-the-desert avalanche center folks and hounding them for their season summaries. As you read through this issue we hope you will be as amazed as we are with how much this avalanche center network is able to accomplish given the available resources. Kudos to the avalanche centers, and to all the avalanche professionals in our community, for their hard work in the name of public safety!

—Doug Abromeit & Karl Birkeland

Ahh, choices. A moment to discuss decision-making during class with a group of 50-somethings from the Midwest. *Photo by Kevin Davis*

Idaho Panhandle Avalanche Center

This season felt like about three winters wrapped into one. It will be the winter remembered as one of extreme weather fluctuations. The flip-flopping of the weather began back in November as snow began to accumulate in earnest over a crust from a melted layer of October snow. In December the weather continued to fluctuate between bitter cold with prevailing weather out of the north, strong winds, temperatures dropping below zero and warm W/SW flow with mountain temperatures above freezing and heavy rain. This trend established itself and became as reliable as the buried faceted crusts that lingered in the pack for the rest of the winter.

The widely varying conditions led to consistent avalanche activity, ranging from wet to dry slab avalanche cycles. On several occasions IPAC warned the public of wet slab avalanche hazard at low elevations due to multiple feet of dry snow rapidly warming and receiving rain. Wind-loaded snow over crusts was a common hazard, and PWLs forming from facets over and under buried crusts also became a warning mantra. This weather/snowpack scenario was partly responsible for one avalanche fatality northwest of Avery, Idaho, involving a snowmobiler on December 29.

IPAC's newest collaboration this year is with the Spokane National Weather Service. This winter, during periods of high or extreme avalanche hazard, the Spokane office NOAA Web site displayed the blue Avalanche Hazard icon to more broadly alert winter travelers. This icon also linked to the IPAC avalanche advisory. We were informed by the director of the NWS-Spokane that public feedback was positive on the specific alert, and he was certain that the warning was reaching a broader audience. IPAC has also been working hard to make friends. I'm pleased to convey that we're establishing a Friends group. This winter we worked together on a mission statement, common goals, and bylaws. The Friends group is now incorporated, and we should be working together next year. This will be a great addition to the program, allowing us to extend our education efforts; create an independent, versatile, and more user-friendly Web site; and increase skills with more professional development training. To seal the deal, we sent Eric Morgan (forecaster) and Scott Rulander (friend) for three days in Blind Hollow yurt attending an AIARE Level II with Mike Jenkins.

Communication with local ski areas and guide operations, along with regular input from dependable observers, assisted our advisory as in the past. Our partnership with Idaho Parks and Recreation was renewed with two new Polaris 600 RMK snowmobiles this year. The sleds are on a four-year loan, and IDPR also assists IPAC with a yearly cash donation. Our end of the deal is fulfilled by providing the weekly

avalanche advisory and assisting with state sponsored snowmobile avalanche awareness courses and providing courses of our own. About 200 individuals attended the North Idaho snowmobile classes this year. IPAC assisted local certified avalanche instructor Shep Snow with teaching Level I avalanche classes. We're looking forward to working with Lisa Portune, who relocated this winter from the Chugach National Forest Avalanche Information Center. She is eager to get out in the hills and has already offered her assistance. Speaking of wayward souls…Abro will be returning to the homeland, so we expect to take advantage of his free time as well.

Education opportunities abounded and our classes and workshops were well-attended this winter with about 425 attendees. We offered regularly scheduled monthly classes to the general public with transceiver training, avalanche awareness, route-finding, and decision-making, but we also introduced something a little different. We analyzed the statistics from 10 years of fatal North Idaho avalanches and presented an evening workshop on our findings using Google Earth to visually travel from one location to the next. It's pretty amazing the amount of media you can throw into the flight plan. The audience was captivated by the visual and attentive to the message resulting from the statistics compiled from the accidents. What popped up as highly relevant for our region is that 70% of avalanche fatalities in North Idaho have occurred in February and March; 70% were snowmobilers; and 90% occurred on northerly and easterly slopes, which tend to be wind-loaded slopes.

There were some other standout statistics that made it easy to educate folks about common watch-out situations. Which segues into another small project we worked on this winter. Since many of our colleagues and forecasters are wildland firefighters we formed a committee tasked with developing a mnemonic (yes, I'm avoiding the "A word") for slope hazard evaluation. The committee came up with SLIDE (Slope steep enough to slide, Look at the consequences, Identify the hazard, Decide route based on information known, Escape route identified). We're still field testing, but it seems to work so far.

Education outreach in the Spokane area continued with classes for the Spokane Mountaineers and Saint George's outdoor education school, and we're optimistic about the prognosis for next year. At this writing the snow is still accumulating in the high country, and for the region we are 125% of average for snowpack.

—Kevin Davis, director

Eric Morgan and Kevin Davis checking snowpack stability in the Cabinet Mountains somewhere along the Idaho/Montana border. *Photo by Brenton White*

Eric Morgan, forecaster with the IPAC, checking the stability of the lower pack utilizing the snowmobile in the stuckblock method. *Photo by Kevin Davis*

Arizona Snowbowl is known for its rime events: this year's event at Christmas caused damage and took a lot of time and energy to clean up. *Photo by David Lovejoy*

Kachina Peaks Avalanche Center

Weather and Snowpack Summary: Judging from the snowfall total it was an average year, with 266" (676 cm) at 10,800', just one inch over the 30-year mean. We considered ourselves lucky since La Niña years tend to have highly variable snowfall, often on the lean side. This winter most of our variability came in the form of infrequent but dramatic storms characterized by substantial precipitation and wind, alternating with long dry spells. 53" (135 cm) of snow fell during a storm cycle ending on December 23, and all lifts were spinning at Arizona Snowbowl resort on the day after Christmas when there was a substantial clean up from wind and rime damage. The opening storms were characterized by fierce, moisture-rich winds and 80+ mph gusts resulting in dramatic riming and tree blow down between tree limit and mid-elevations. The blow down was sufficient to dramatically impact a lot of the local tree skiing at elevations between 9000-11,000', which left the windward starting zone nearly bare.

Then January was bone dry – in fact, it was the third-driest January on record with only 9" (23 cm) of super-low-density snow falling the entire month. The drought continued into February along with unseasonably warm temperatures. We wondered if winter had ended without even the prospect of sweet corn due to shallow snowpack. On February 27-28, a major right-side-up storm laid down more than a meter of "pow on slop," starting with 22% water content and ending nicely at 11%. Despite the long drought and a number of distinct crusts, few natural avalanches were reported. The exception was a skier-triggered slide in Telemark Couloir on March 1, reminding us of the frequency of action in this path site. As in the past, this seemed to have been a case of new wind slab on the old hard snow surface, and perhaps a little snowpack warming, as opposed to failure of a persistent weak layer. This is an assumption, since a fracture line profile was not done.

Surprisingly, March and April cooled, returning us to winter and producing some great skiing on light snow with 15" (38 cm) on March 7-8, 26" (66 cm) on March 22-24, and 28" (71 cm) on the closing weekend, April 8-10 – with an 8% water content.

Instrumentation: The notable event of the year was that we erected a weather station in cooperation with Flagstaff National Weather Service (NWS). When the anemometer is not crippled with rime, this station enables near-real-time weather data from the top shack at Arizona Snowbowl at 11,565' transmitted to NWS at Beaumont, Arizona, and posted on our Web site at www.kachinapeaks.org and other sites such as Meso-West. This has been a highly appreciated development, giving the recreational public good estimates of snow/thaw line and wind velocity and direction.

Avalanches and Rescue: Generally speaking the snowpack stability was nonreactive. Field reports of stability concerns (based on Web site postings) were rare. There were at least two skier-triggered avalanches during the winter, the most notable of which happened on March 1 in Telemark Couloir. All natural and human-triggered avalanches seemed to have resulted from wind loading, such as new slabs releasing on old, hard snow devoid of persistent weak layers. We had some crust/facet sandwiches low in the snowpack from early season rain and thaw, but these never proved to be reactive.

Winter Backcountry Permits: The Coconino National Forest continues to issue (free) winter backcountry permits. Although a source of some disgruntlement among longtime locals, KPAC supports it in order to provide a modicum of educational outreach concerning snow avalanches and other winter hazards. The permit system also provides a rough estimate of backcountry use and trends over time. Although difficult to substantiate statistically, it seems that backcountry rescues are reduced by the system which requires permit seekers to learn some basic prevention strategies. The educational effort also promotes KPAC's mission, Web site, and educational outreach. This season there were 830 permits issued. Only four backcountry rescue missions were launched. These were mostly lost out-of-bounds snowboarders or skiers.

Avalanche Education: KPAC co-sponsored four Level I courses: three with Prescott College and one with Arizona Snowbowl resort, with a total of 40 students participating. One early February Level I course was cancelled due to lack of snow cover, and one Level II course failed to reach sufficient enrollment. We also ran

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Photos this page: soft-slab avalanche on May 4, 2011.

From Erich Peitzsch:

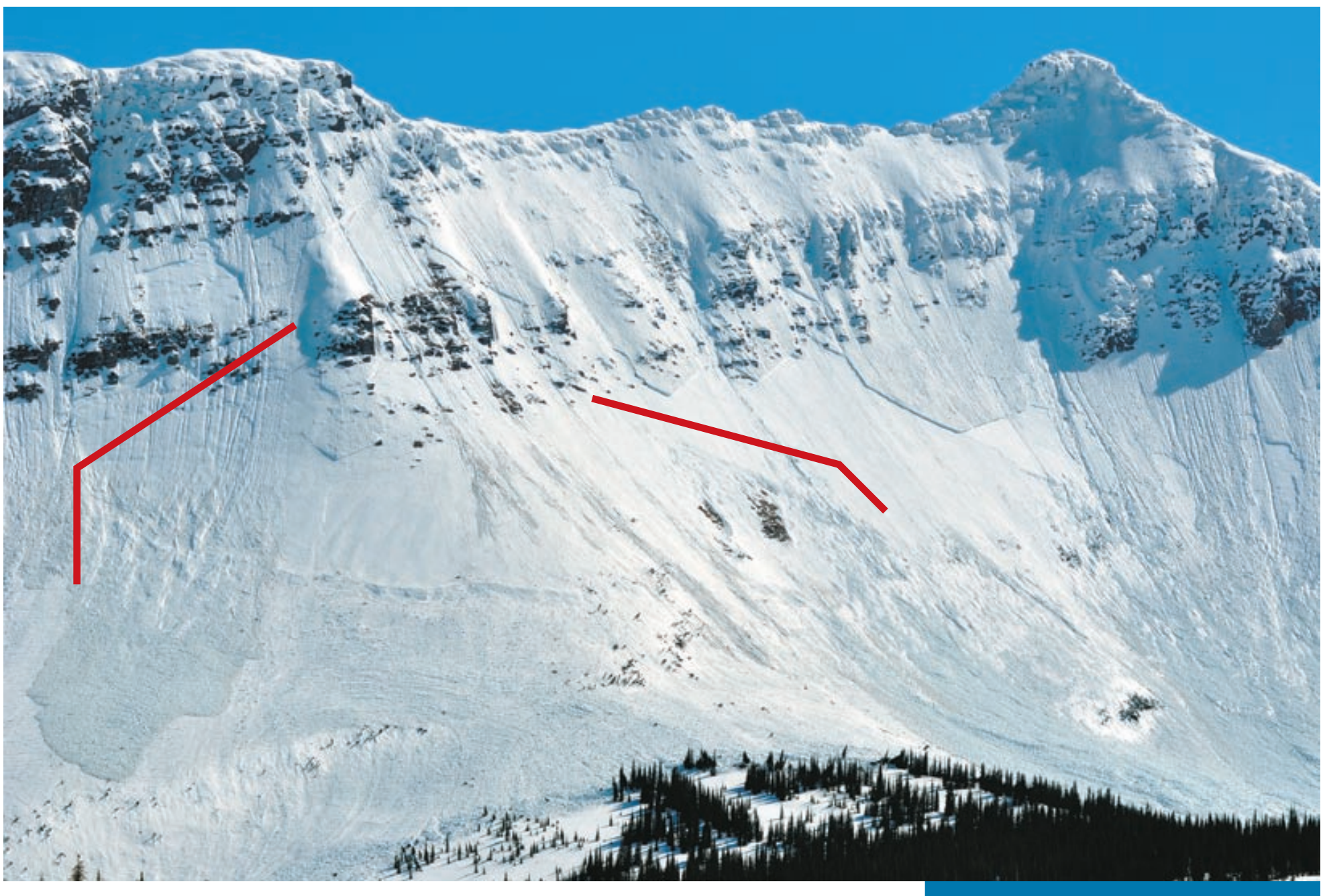
Here are a few photos from our spring season along the Going-to-the-Sun Road here in Glacier National Park. The first photo is a soft slab that occurred on May 4 (we were still contending with a predominately dry/winter snowpack at that point). The next one shows a wet slab that occurred in the same path about one week later on May 11. The existing crown from the previous week was still visible. This wet slab released in the hangfire from the avalanche the week prior and also released more of the bowl itself. The third and final image shows the same bowl with even more hangfire released as well as more of the bowl and a couple of small pockets on the far side (other aspects) of the bowl.

Pretty interesting sequence from dry snow avalanches to a wet-slab cycle in a relatively short period of time. Seeing the various wet slabs pull out A LOT of the hangfire from previous slides was interesting. Eric Knoff (who now works up here in the spring with me) and I definitely didn't trust that stuff, so unfortunately, we were unable to get to the crown of this one.

May in Glacier National Park:

Dry Slabs, Wet Slabs, and Hangfire

Wet-slab avalanche on same slope, May 11. Red line indicates original May 4 crown.



Third avalanche in same bowl.

Photos by Erich Peitzsch with help from Eric Knoff

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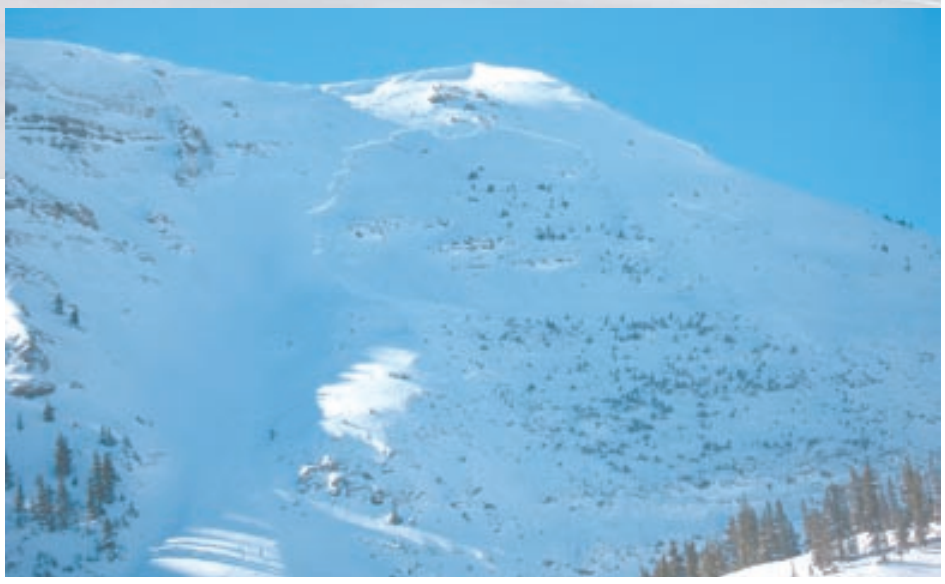
three free "Introduction to Avalanche" clinics for approximately 115 participants, including one ski area field session for anyone who attended the clinics. We continued our tradition of participating in the Science in the Park event as part of Flagstaff Festival of Science during October. Our slab-avalanche simulator is a crowd pleaser among local school kids, some of whom subsequently attend our "Introduction to Avalanche" sessions with their parents.

Website Activity (November 1, 2010 – April 27, 2011)
- Seasonal Site Visits: 41,542
- Absolute Unique Visitors: 19,941
- Page Views: 670,824
- Average Page View: 16.15 Page views/visits
- Average Time on Site: 4:15 minutes/seconds

Fund-raising: Two major fund-raising events were held during the season: the Teton Gravity Research film event, "Shredder Night," at The Green Room bar; and a Level I scholarship fund-raising dinner at Arizona Snowbowl resort in commemoration of Michael Linville, a local backcountry skier and Snowbowl lift attendant who tragically perished while skiing last spring. These events combined with modest revenue from private contributions and level I courses grossed KPAC approximately $7400.

Agency Relations: KPAC continues to have excellent relations with all agencies who are concerned with snow safety, including Arizona Snowbowl resort, Coconino National Forest, and Coconino County Search and Rescue. We have served as a communication catalyst and conduit for improved coordination and communication between all concerned groups and with the public. We are particularly proud of this element of our service for the greater good. *—David Lovejoy*



Some pictures from a very close call on December 2, 2010, on the north side of Scarp Ridge in the Elk Mountains, Colorado. The Shield slide caught and carried one skier who ended up on top of the debris with a broken ski boot. *Photo by Frank Konsella*

Crested Butte Avalanche Center

The Crested Butte Avalanche Center operated from November 16 through April 4 and produced 140 daily avalanche bulletins. We went to high danger a total of nine times this season. The core staff for the 2010/11 season consisted of four forecasters who also work locally as backcountry ski guides, ski patrollers, and avalanche educators. A board of six volunteers oversaw fund-raising and coordinated events in the local community.

Beginning in October and continuing through late April, La Niña mostly brought average to above-average snow to the town of Crested Butte and the surrounding mountains. January was the one month this winter with slightly below -average snow totals. Town is situated at 8,885' and has received 238" as of writing this article on April 26; the mountains north and west of town received over twice that amount with the CS Irwin snow study plot (at 10,200' and five air miles west of town) recording 732" for the season. These differences within the forecast area, along with the sheer quantity of snow, contributed to both an exciting and challenging winter season in our corner of the Elk Mountains.

The undisputed highlight of the season was the major winter storm that pounded the Elk Mountains December 18-22. Snow totals ranged across the forecast area from 5-6'; the Schofield Pass SNOTEL site recorded 9" of water. The first two feet of snow arrived cold and light – 5% water content – on December 18. December 19-20 brought another two feet of snow; this time it was warm and dense snow with 18% water content. The storm continued to rage for the next 48 hours bringing close to another two feet of dense snow and steady winds. As can be surmised, several large, natural avalanche cycles occurred during the storm. The combination of warm, wet, and heavy snow over very low-density snow created instabilities throughout the storm. Also, all snow fell on an early season snowpack, and a huge amount of mass was perched on a shallow and variable continental snowpack The CB Avalanche Center was at high danger December 19-23. Whether or not the CB Avalanche Center should have gone to extreme is a question worthy of future debate; widespread natural activity was unevenly distributed around the zone and the forecast staff will continue to discuss the semantics surrounding extreme danger.

Other weather and snowpack highlights from this season included a series of surface-hoar events from the end of December through mid-January. January's snowfall was 68% of the historical average; stretches of high pressure followed by intermittent snowfall led to the creation and preservation of three distinct buried surface hoar layers. These weak layers remained reactive through February and were responsible for several close calls in the Crested Butte backcountry. Snow began stacking up throughout February, and as temperatures began warming at the end of the month, we moved into another avalanche cycle with several natural and triggered size 3 avalanches occurring during the last week of February and early March. On March 21 strong pre-frontal winds out of the southwest brought a dust layer to the Elk Mountains. This layer was quickly buried and remains mostly buried as of late April. April has been cold with snowfall 110% of average. Wind slabs resting over buried wet grains has been a common theme this "spring." Rapid warming on April 24 led to a natural shedding cycle near and above treeline and a close call on Mt Axtell.

The two accidents where backcountry travelers were caught in significant avalanches occurred early in the season. Neither the one snowboarder nor the one skier was injured. The first near miss occurred on October 24 on Mt Baldy north of Crested Butte. A snowboarder was caught on a north-facing slope at 12,400'. The victim was fully submersed in the debris at one time but emerged on the surface uninjured. Nobody in his party had any avalanche rescue gear. The next near miss occurred on December 2 on steep, north-facing terrain off of Scarp Ridge at 12,200'. The CB Avalanche Center had issued a danger rating of moderate on December 2, stating, "Areas which received more wind deposited snow yesterday could release larger avalanches today." Strong winds and 4" of snow added another layer of shallow wind slabs to an already variable early season snowpack. The third skier down in a party of three veered slightly skier's left of the other tracks and triggered a SS-ASu-R3-D3-O. The skier was swept down over 1,500 vertical feet. He ended up on the surface of the debris; the only casualty was a broken boot.

The CB Avalanche Center is looking forward to another season of serving the Gunnison Valley's backcountry community. New for next season is the creation of a full-time forecaster who will have an administrative role in addition to forecasting three to four days per week. The CB Avalanche Center hopes that this position will lead to increased communication with other avalanche centers, a more detailed and thorough Web site, and a better product overall for our users.

—John MacKinnon, forecaster

On quite possibly the busiest non-weekend day ever experienced on Mt Washington, MWAC forecasters watched as thousands of skiers streamed into the bowl (Tuckerman Ravine). The April day began with a moderate danger rating, but with solar gain and skier compaction, conditions moved well into the realm of low by mid-afternoon. *Photo courtesy MWAC*

Mount Washington Avalanche Center

While many western avalanche centers were keeping tabs on heavy snowfalls, the Mount Washington Avalanche Center (MWAC) patiently endured another winter that fell short of what many locals would call a "good snow year." Though the 2010/11 season certainly won't be one for the record books, there were enough memorable events that it won't quickly be forgotten. Snow totals were below average most months, but consistent small snowfalls kept backcountry visitors on their toes throughout the winter. A rash of avalanche incidents in March offered plenty of learning opportunities for Northeastern avalanche junkies. Finally, our spring season was marked by a relatively cold April and a warm soggy May. In addition to snow-related business, the season marked the final winter for two experienced snow rangers: Justin Preisendorfer and Brian Johnston.

Living in New England, you take what you can get for snowfall, but this past November even the hardiest souls were scratching their heads wondering when the snow would arrive. That month, Mt Washington only recorded 17.7" (45 cm) of snow compared to the historical average of 40.8" (103 cm). Water equivalents were a mere 36% of the usual and customary. December fared better but not by much – snowfall and water equivalents were only about 85% of the average. January snowfall was 73% of average, but snow water equivalents were down to about 30% of the norm due to very light-density upslope snowfalls.

By the end of January there was a feeling of desperation around the mountain. While it wasn't looking good on paper, when you looked around the mountain the conditions didn't seem to reflect the dearth of snowfall. Gullies and snowfields were slowly filling in, runout paths were growing, and on occasion there were modest storms to lighten the mood. There was one redeeming quality to these months – the temperatures had stayed cold enough to preserve what snow had fallen.

The weather in February and March improved slightly. We received a few decent storms and temperatures colder than average, with temperatures on the Mt Washington summit only once rising above freezing. Wind throughout the season also didn't follow historical patterns. Aspects facing south fared well, but those with a more northerly component were left behind. Despite all this, somehow by the end of March coverage across the mountain was looking good for the upcoming spring ski season.

What we didn't have for large natural avalanches was made up for with a burst of human-triggered avalanche activity in March. The first of these was skier-triggered in the Gulf of Slides, just outside our forecast area. This ended with the skier going for a long ride but without burial or injury. A couple weeks later a pair of skiers triggered this same slide path and were also left uninjured. Fortunately, the event caused the pair to pack up their tent and head home, as later that same evening a different slide path naturally released and ran over the very spot where they had been camped! Had they not been involved in the initial incident, they likely would have been asleep in their tent when the avalanche hit them.

In our forecast areas – Tuckerman and Huntington Ravines – we had a few more close calls. One party was hit by the tail end of a natural avalanche (under high danger) and left unharmed. We only learned of the incident by a helmet-cam video posted on YouTube. Another incident involved four people unintentionally triggering three small pockets in about an hour, the third one being so predictable that two video cameras were used to capture the event.

The most significant avalanche accident of the season was an unroped ice climber in Pinnacle Gully who triggered a slab from the top of a grade 3 ice pitch. This carried him over the cliff and into a snow-covered talus field below that had been encapsulated in a thick rain crust. He sustained multiple broken bones, but was able to summon snow rangers by using his nose to dial 911 on his Blackberry. Avalanche danger that day was rated considerable due to fresh snow and active wind loading. All of these incidents over the course of a few weeks caused quite a stir around the Mt Washington community. If it weren't for technology – i.e., internet forums and helmet-cam YouTube videos – we may not have learned of some of these incidents. We'll be keeping one eye on the computer screen as we continue to build a culture where people are supportive of reporting avalanche incidents to us.

Having the lead agency responsibility for search and rescue on the eastern slopes of Mt Washington can add a hefty burden to the forecasting responsibilities. Once again, public outreach and education paid off with very few incidents taking place in the winter months. Rescues weren't a big part of the picture until the human-triggered avalanche events of March followed by the usual falling skier and hiker incidents that take place each spring. Every year the Mount Washington Volunteer Ski Patrol (MWVSP) earns our appreciation by dedicating countless hours to helping visitors through education, information, and of course, rescue assistance.

Outside of snow and rescue, MWAC has some changes underway. This season we ramped up our online presence, with a new Web site, Facebook page, Twitter account, and RSS feeds. These features were well received by our audience this year. Online traffic to the new Web site was heavy, with over a half million page views from almost 89,000 unique visitors.

We also launched a new scholarship program, the White Mountain Avalanche Education Fund. This fund is intended to help local youth become more educated about avalanches and can take the form of individual scholarships for classes, bringing an educator into a classroom, or developing educational materials. The program is a collaborative effort between MWAC, MWVSP, and the New Hampshire Outdoor Council. Donations to the fund will be possible through the avalanche center Web site.

In personnel news, two of the four snow rangers accepted promotions within the White Mountain National Forest. Brian Johnston is now the assistant ranger for recreation on the Saco Ranger District, while Justin Preisendorfer has become dispersed recreation manager for the Pemigewasset Ranger District. Chris and Jeff are excited for the prospect of bringing two new snow rangers onboard to fill their shoes, though the loss of two highly skilled and experienced teammates will certainly be felt in the upcoming season.

We're looking forward to new adventures and new challenges in 2011 and 2012. With any luck, we'll have that "good snow year" that so many of our community have been patiently waiting for, but we won't hold our breath. Instead, we'll be taking advantage of whatever weather comes our way. *—Jeff Lane, snow ranger*

Bridger-Teton National Forest Avalanche Center

During the 2010/11 season a strong La Niña coincided with record snow depths that lasted well into the summer. The season began late with the first real storm not arriving until the end of October. The season snowfall and settled snow depths hit record levels in late November. In December there were only four days without new snow. December snowfall and end-of-month snow depths were 140% of average.

January and February were drier with snowfall at 90% of normal and end-of-month snow depths at 110% of the 45-year average. Snowfall in March was over 200% of

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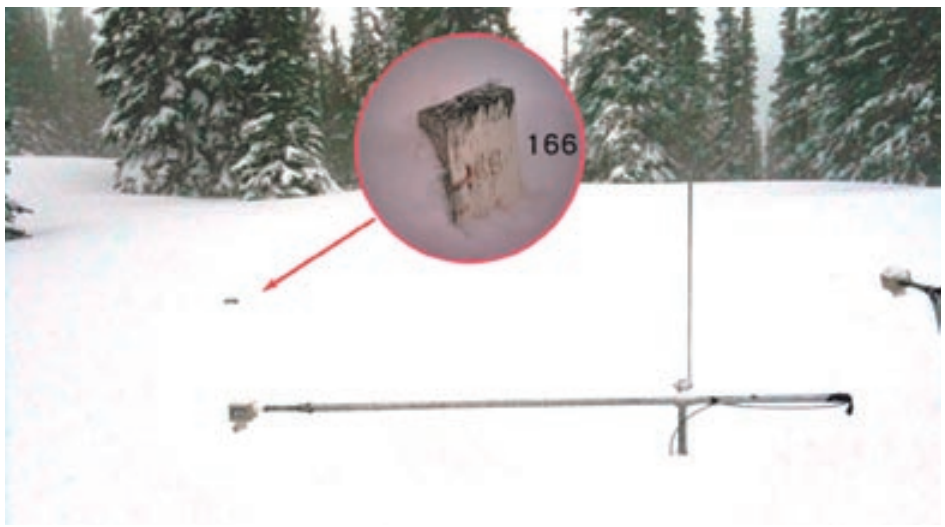


top: This photo of the snow stake at the Rendezvous Bowl snow study plot was taken on April 19, 2011. Several days later, it was completely buried for the first time in 45 years and remained buried until May 12. *Photo by Jim Springer*

above: On April 26, the automated weather station located on Blind Bull Summit in the Wyoming Range was nearly buried. Record snow depths buried many of the automated weather stations in the Teton Range for the first time in 45 years. Some of these stations were completed buried from mid-April to late May. *Photo by Bob Comey*

normal. Abundant snowfall occurred in April and May, and cool wet conditions continued into June. The season snowfall exceeded 700". Snow depths that greatly exceeded any previous records were experienced in April, May, June, and July.

The center issued weekly snowpack summaries beginning in September and continuing into late June. Daily morning and afternoon avalanche hazard bulletins were issued from late October into late April. At the request of the Teton County Search & Rescue, morning avalanche bulletins for the Teton area were reinstituted for an additional two-week period from Memorial Day Weekend until June 12.

Most of this season's avalanche activity occurred during storms. Poor visibility and high winds during the storms often obscured the observation of avalanche activity. Typically only faint lines of filled-in crowns and hard-to-discern humps of buried debris piles were visible when skies cleared. Numerous avalanches likely occurred and were not observed or recorded because the evidence of these events was obliterated during the storms.

Our center had knowledge of 24 people who were unintentionally caught and carried by avalanches. Of these, three were partially buried and three others were fully buried. One of the fully buried persons (a snowmobiler) was recovered without injury. Two skiers who were bivouacked in a wind moat around a large boulder in Garnet Canyon in the Teton Range were deeply buried in their tent on April 17, 2011 *(see story next page)*. The storm that created the avalanche that buried these people began after midnight and deposited 8" of new snow with an inch of moisture by morning. This storm was accompanied by strong winds and rain to an elevation of 10,500'. Strong winds and new snow obscured the evidence of the avalanche that buried and killed these men. Dangerous conditions and weather delayed their recovery.

Program improvements were implemented for the 2010/11 season. Our Google map display of avalanche activity was upgraded with the ability to display snowpit profiles, photographs of avalanche events, and weather station data. The program can post snowpits in any format. We also configured the administrative section of our Web site to allow our forecasters to upload avalanche events, photographs, and snowpits from any computer with internet access. The avalanche events mapping section of our Web site is very popular with our knowledgeable users.

This season's Web site also featured new snowfall graphs from 10 of our snow study plots and 24- and 48-hour graphical displays of temperature, humidity, and wind speed and direction data from five of our automated wind stations. The wind data display format was provided by the Geospatial Science and Engineering Team at the Idaho National Laboratory.

A new wind station located on the top of Fred's Mountain was added to our network of automated weather stations. This station was purchased and is maintained by the ski patrol at Grand Targhee Resort. The data from the station is collected and disseminated by the avalanche center in partnership with Grand Targhee Resort and Jackson Hole Mountain Resort.

Our new 11-minute avalanche awareness video, *More Than Meets the Eye*, was posted on our Web site and presented to the public at a number of educational functions. This film targets people who are familiar with our backcountry avalanche advisories and discusses the limitations of these bulletins. It includes some spectacular footage that was generously provided by Teton Gravity Research, KGB Films, and Wink Inc.

Air bags purchased at the end of the previous season were issued to each of our avalanche specialists at the start of this year.

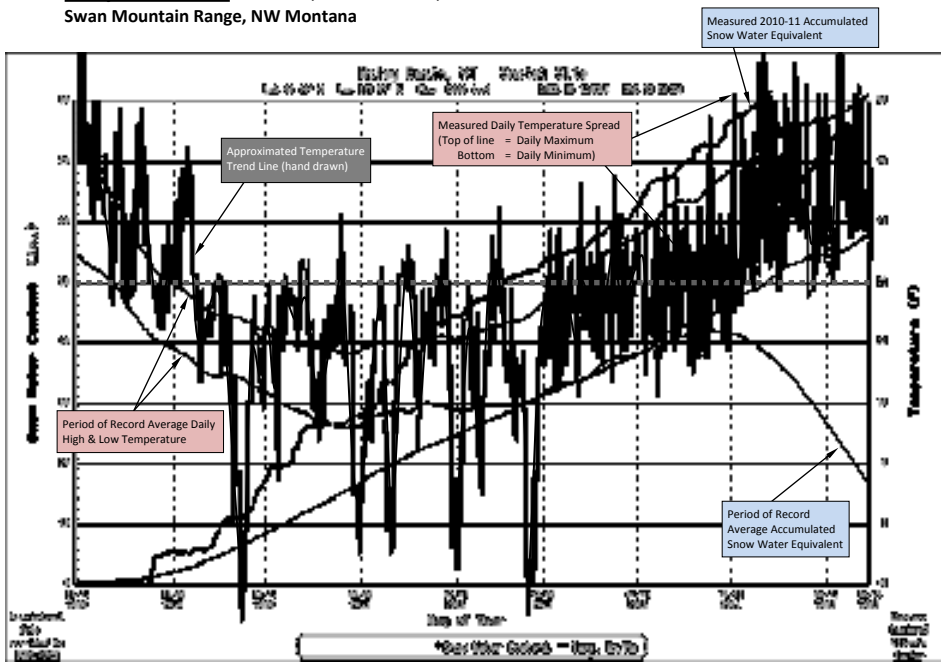
The center has been busy over the summer working on the development of the warning sign observation section of our Web site. New programming will enable users to post observations associated with unstable conditions. These observations will focus on areas that are experiencing shooting cracks, whumphing, and blowing snow and will supplement the existing avalanche occurrence observations. This program will also enable users to delineate the distribution of problem layers.

The visual presentation of avalanche events has been previously presented in a two-dimensional Google map format. The presentation of this information in the three-dimensional Google Earth format is in progress and will likely manifest itself in a Google Earth display of the locations of our remote automated weather stations and avalanche fatalities.

A recreational trails program grant was obtained in partnership with the Wyoming Trails Program. This grant is for the purchase of a new weather station on Commissary Ridge in the Salt River Range. This station will provide snowfall, temperature, and wind data from an area of complicated avalanche terrain that has easy access and is very popular with local, regional, and destination snowmobilers. This station is anticipated to be operational for 2011/12 season.

The center has a new friends group. Previously the Avalanche Forecast Support Organization acted as a local entity which received donations for the center and operated under the nonprofit umbrella of the American Avalanche Association. Our new organization, the Friends of the Bridger-Teton Avalanche Center, is its own 501(3)(c) nonprofit organization. This new friends group has talented people on its board with diverse backgrounds. With their support we anticipate many new improvements in the design of our Web site and dissemination of the center's products through social media. This group is also expected to establish a long-term sustainable funding program for the center. *—Bob Comey, director*

Noisy Basin Snotel October 1, 2010 – June 15, 2011
Swan Mountain Range, NW Montana



Glacier Country Avalanche Center - Northwest Montana

The winter of 2010/11 was a moist one for northwestern Montana. A La Niña weather pattern provided well-above-average snowfall to the region. Between mid-November and the first of March the area was subjected to a neck-popping roller coaster ride as the air temperature wildly and rapidly fluctuated. Readings at or below zero°F one day would soar into the mid-30s or low 40s only a few days later – then just as rapidly plunge back into the deep freeze. This produced a significant amount of "crust and dust" snowpack conditions.

By April and May the erratic fluctuations in air temperature settled and readings became more seasonable. Precipitation then dramatically increased. While snowfall accumulation in most of the region's mountain areas had been at or above average most of the season, from April onward the comparison readings were dizzying. Figures of 200-300% of average were common at many mountain locations. Season peaking snow-water-equivalent readings of 60-80" were widespread, compared to the typical 25-40". Higher elevation snow persisted well into summer, significantly delaying the opening and use of many roads and trails.

In early January, persistent weak snow above an ice layer caused the sole northwestern Montana avalanche fatality of the season. One snowmobiler was killed when he and a partner were overtaken by an avalanche in the northern Swan Range near Hungry Horse, Montana. On the same weekend several other snowmobiling parties were also involved in snow slides in this heavily used riding area. The following weekend another snowmobiler was almost totally buried in a triggered avalanche northeast of Troy, Montana.

The avalanche center was unable to secure partnership funding to maintain the seasonal employee position that in the previous three seasons provided various avalanche safety programs. National Forest recreational users were still able to attend three separate in-depth avalanche awareness classes offered by the Flathead and Kootenai Forests at no cost. While Kootenai's was a joint user program, the Flathead classes were again directed at two separate groups. The first session in early January was tailored to skiers, snowboarders, and mountaineers. The second session focused upon snowmobiling was presented in late January and early February.

Twice-weekly avalanche advisories were again posted on the Glacier Country Avalanche Center Web page and offered via email and phone voice message. The Web page also offered a forum for backcountry observation reports. The Forest

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Search and Recovery in the Tetons

Story by Nick Armitage

I write this account with the intent of learning from the experience. I provide the reflections with the utmost respect for the subjects, their families, and the rescuers who risked a lot for this recovery.

On the afternoon of Saturday, April 16, 2011, Greg Seftick and Walker Kuhl entered Garnet Canyon with the hopes of another successful summit on an increasingly impressive list of technical climbs and ski descents. The two men planned on skiing the Grand Teton. Because of the previous day's storm snow, wind, and the possibility of another storm that night, they had considered a more conservative plan of skiing the Teepee Glacier. What actually happened and how they were thinking, one can only speculate. Most likely, sometime during that first night, Seftick and Kuhl were struck by a large avalanche originating high on the north face of Nez Perce over 2000' above their camp. The slide buried them and all of their equipment. The weight of over 13' of snow killed them instantly or within a couple of hypoxic minutes.

When Walker Kuhl did not arrive at work the following Monday he was reported missing. With only a last-seen point at the entrance of Garnet Canyon at approximately 4:30pm on Saturday, a search for the missing skiers began. As snow and wind continued through Monday, rescuers and equipment – including a helicopter – were assembled. An afternoon aerial search revealed no signs or clues.

On Tuesday morning approximately 50 rescuers assembled from Grand Teton National Park: Teton County search and rescue, ski patrols, and local ski mountaineers. Due to continued bad weather and avalanche hazard, the searchers accessed lower Garnet Canyon by ground. That afternoon the skies briefly cleared, allowing the helicopter to conduct an aerial search, dog team transports, and avalanche hazard reduction in upper zones of Garnet Canyon. The first full day of searching in snow and wind ended without any clues, signals, or alerts.

With four previous days of unsettled weather clearing on Wednesday, search teams accessed the upper reaches of the canyons as well as several aerial sorties of the peaks and surrounding terrain. Due to a large search area, several days of storms, and unsettled spring weather, there was no shortage of debris piles. By Wednesday afternoon approximately 30 searchers re-converged on the Meadows area of Garnet Canyon for more thorough searching of a debris field extending from the Meadows to the Platforms (over 1 km long). Searchers again stayed in the field until dark with no results.

Thursday and Friday were a return to unstable weather allowing only a few aerial search sorties and hazard-reduction explosives operations to prepare for a larger effort on Saturday, April 23.

The weather cleared on Saturday as forecasted, and an operation with three RECCO units, four dog teams, and over 40 searchers focused on the five acres of debris in lower Garnet Canyon. After 10 hours of searching the entire debris there were still no clues, signals, or alerts. As darkness fell, searchers with blistered hands and raw paws began to fly back to the valley from the heli-spot at the lowest end of the debris.

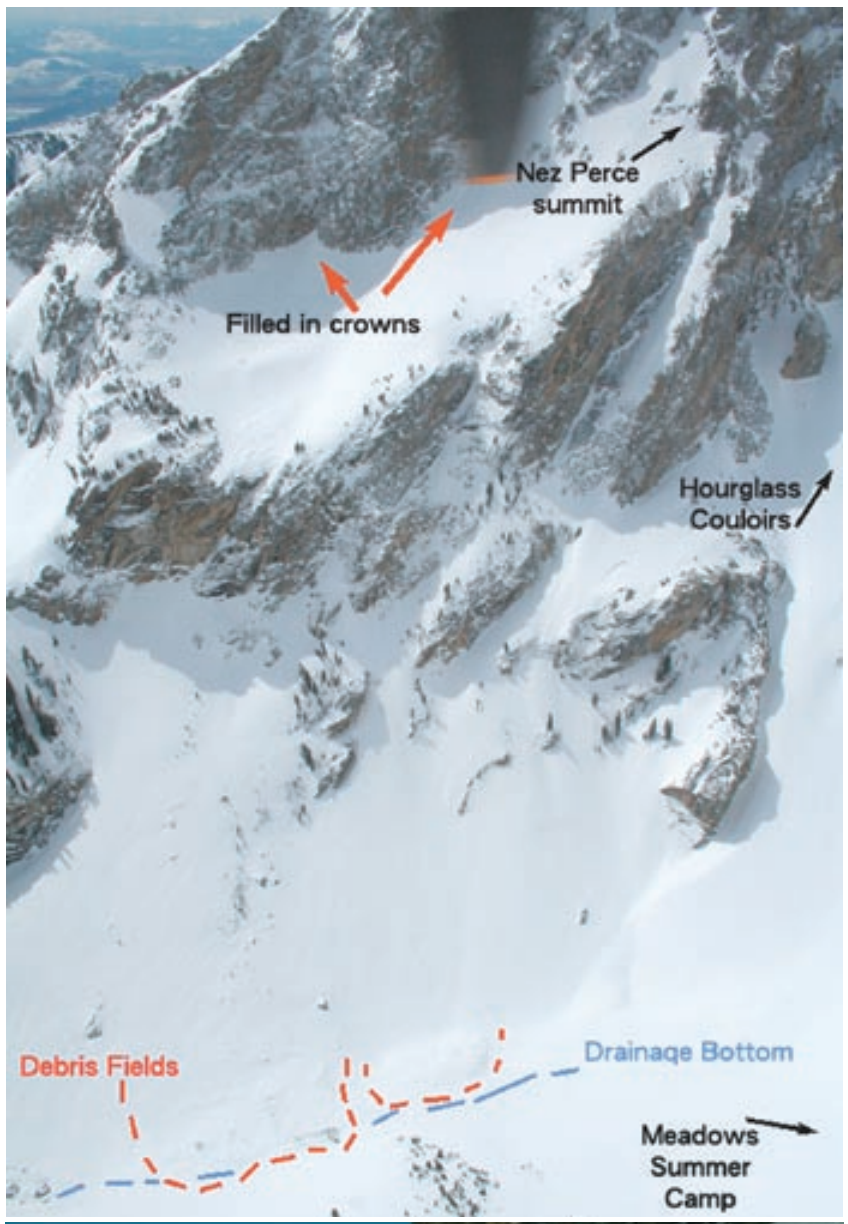
As the division supervisor, I was tasked with managing the ground search operations that day. I remained at the upper end of the debris while the crew shuttle continued below. Standing in the half light of the canyon, perplexed as to the location of Seftick and Kuhl, I searched the surrounding slopes and the corners of my mind for a clue. With the area quiet and clear of all search personnel, I decided to pull out my transceiver and give it one last sweep. About halfway down the debris I got a signal and pinpointed it to a strength of 7.5 meters on my Tracker 2. I radioed down to the group and was joined by five others. We probed the area twice, confirmed a second signal, and began to dig. After digging down four feet, we finally obtained a positive probe strike still over eight feet down. With nightfall upon us and many hours of digging to go, we decided to return with bigger shovels in the morning. Six of us returned the following morning and dug for over three hours. We finally excavated Greg and Walker buried in their tent 13.5' deep.

Why did I do that last search? It was all I could come up with for a solution. I have done this before on other searches with no results, and it seemed to give me closure and the feeling that we had done everything we could. But why hadn't that signal been picked up sooner? Had I missed an earlier opportunity when the field operation was transitioned to me?

Yes. When I arrived at the search area, I was told the area had been searched with transceivers at least three times previously; however, I did not see it happen. It was decided to focus the day's efforts on probing, RECCO, and dog teams. The debris was long and convoluted with some narrow spots, varying depths, and several lobes extending hundreds of feet up the north side of the canyon. Subsequent avalanches both natural and explosive-triggered had buried the debris. An additional 20" of snow with high winds had scoured and buried the area reshaping the snowscape. Confusion in stormy weather as to what was actual debris may have contributed to the delay in finding the subjects. Also, with the threat of avalanches to searchers, transceivers were switched from search to transmit many times on the previous days of stormy weather. The depth of the subjects and their weakening transceiver batteries could also have contributed to the difficult search conditions.

All of that being said, I feel that a lot of rescuers and backcountry users do not practice the hard skills enough. Even if you have been around for decades, transceiver and RECCO skills are very perishable and need to be practiced often and in a varied format. Creative weekly transceiver searches are the benchmark for good hard skills. Avalanche rescue work has evolved so much in the last 15 years that I think a much greater emphasis should have been placed on the technology and skills to use it correctly. Large probe lines are time consuming, painful, and expose very high numbers of rescuers to the hazards of mountainous terrain as well as the hazards involved with heli transport. I still consider well-organized, specific spot probing to be an effective tool. However, with regular practice all guess work can be taken out of searching with RECCOs and transceivers. The use of these devices along with spot probing and well-trained search dogs should all but eliminate the need for massive probe lines.

Nick Armitage works as a Jenny Lake climbing ranger during the summer, and he plans to return to Big Sky Resort this winter as avalanche forecaster. As The Avalanche Review *goes to press, Nick married his sweetheart, Allison, at Lupine Meadows in Grand Teton National Park.*



Photographs taken on April 22, 2011, of the location in Garnet Canyon where two skiers were buried in their tent on April 17. Evidence of the crown and debris associated with this fatal avalanche was covered by post-event wind and snow. The two skiers pitched their tent in a wind moat on the uphill side of one of the two large boulders in the lower left portion of this image. *Photos by Jim Springer*

Top: A probe line of 18 people is dwarfed by the size of terrain and debris in Garnet Canyon. *Above:* Thirteen feet of deposition calls for terraced strategic shoveling techniques. *Photos by Nick Armitage*

NAC ROUNDUP 2010/11

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April deep-slab avalanche activity: Blaine Mountain to Jenny Lake, North Swan Range, Flathead National Forest, Montana *Photo by Stan Bones*

Service again received a grant from the Montana Department of Fish, Wildlife & Parks Recreation Trails Program for avalanche education.

Plans for next season involve adding new partnerships, posting the avalanche advisory on the new Flathead National Forest Web site, implementing some changes suggested in the user survey conducted this past spring by the nonprofit Glacier Country Avalanche Center, Inc., and maintaining our avalanche safety training programs as much as possible. *—Tony Willits & Stan Bones, avalanche & snow specialists*

Mt Shasta Avalanche Center

The Mt Shasta Avalanche Center operates under the US Forest Service and is currently a Type III Regional Avalanche Center. We forecast three days a week, specifically for 1000 km^2 in the Mt Shasta, Castle Lake, and Mt Eddy backcountry. However, our information is accessed by many recreationists north and south of our area where avalanche advisories are not provided.

Our Friends of the Mt Shasta Avalanche Center group (FMSAC) is able to provide around 25% of our funding and continues to pay for our weather stations and Web page. A few highlights from the Friends:

- The **4th Annual Movie Night** in November brought record crowds to the Mt Shasta Brewing Company for the showing of *AZADI: Freedom*, featuring local skier Forrest Coots. FMSAC raised over $2,500 at the event, more than three times that of previous film events.
- The **9th Annual Snowball** held in late January was another record breaker hosting close to 300 people. Yogoman Burning Band played music and local pizza by the Dough Slingers provided some of the food. Over $10,000 dollars was raised for the Avalanche Center.
- The Friends group bought some new **avalanche interpretive signs** for the Old Ski Bowl slide site. The signs and mounts are built to last for decades and have been a focus of FMSAC fund-raising. Installation this spring will be the final step in a three-year process toward a new and upgraded Ski Bowl interpretive trail.
- The **2010/11 Avalanche Education Scholarship** was awarded to Dane Brinkley. Dane lives in Mt Shasta full time working as a Shasta Mountain Guide year round and at the Mt Shasta Ski Park in the winter. He attended an Avalanche Level II course in Utah to diversify his snow science education and will use the new skills he acquired directly as a guide to increase the safety of the backcountry community.

The 2010/11 winter featured a moderate La Niña that peaked in the three-month period from October to December. The Pacific Decadal Oscillation was also in its cold phase, which likely enhanced early and late season La Niña effects. La Niña conditions caused November/December to start off with a bang in terms of precipitation. La Niña conditions were then disrupted by an MJO in early to mid-January, bringing warmer-than-normal temperatures and virtually no precipitation from mid-January through mid-February as strong high pressure parked over the west coast of the US. More typical La Niña conditions returned during the latter part of February, and then March precipitation was record setting as La Niña rapidly weakened. *(Lutz, NWS)*

Precipitation in our area was 121% of normal this season and we finished the year with the snowpack depth at 166% of normal. March was record setting for Mt Shasta City when records for total snow fallen and total snow on the ground were shattered. Total snow fallen for the storm cycle was 89.9". Up until March 16, only 4" had fallen for the month, thus it was a stormy few weeks! 40" broke the record for total snow on the ground. During the March snowstorms, two of our weather station snow-depth sensors were maxed out and buried. The Old Ski Bowl snow-depth sensor topped out at 237" (19.75') plus a bit more! March finished at 258% of normal. Northwest winds were dominant and pounded the mountain for much of the winter with a max wind speed recorded at 120 mph.

We received a few avalanches throughout the season, though nobody was injured or caught. One notable large slide was released naturally near the mountain on Gray Butte, 8,000', had a crown of 3-5' deep, and was over a half mile wide. In late December, our good old "Southwest Snowmaker" storm track came through and dumped upwards of 5' of snow on the mountain with moderate southerly winds which led to this slide. Primary backcountry access roads closed during storm cycles, and it's likely any slides were covered up by the time the roads reopened.

Mt Shasta Avalanche Center has undergone some recent changes and staff developments. Long-time avalanche forecaster and wilderness climbing ranger Eric White accepted a meteorologist position with the National Weather Service in Hilo, Hawaii, starting on February 27. His knowledge and experience at Mt Shasta will be seriously missed, and we hope to fill in behind Eric as soon as possible. So, that put me (Nick Meyers) up to bat. I was hired into a permanent position with the USFS last August as a climbing ranger and avalanche forecaster. I have worked at Mt Shasta as a climbing ranger for 11 years and look forward to growing into Eric's shoes! Kai Allen, former USFS snow ranger and wilderness manager at Crested Butte, CO, and Mount Washington, NH, has accepted the recreation/wilderness staff position on the district.

Our outreach efforts included our regular services of local avalanche-awareness presentations. The MSAC gave six avalanche-awareness presentations to local snow enthusiasts as well as a couple school groups. Our outreach totaled 65 hours and touched the lives of 558 people! Additionally, in a partnership with the National Weather Service, we included a "Climate Outlook" section in our local presentations by meteorologist Brett Lutz. This helped attract bigger crowds to the presentations. We continue to offer free transceiver clinics, and these remain very popular. Finally, I added in a few extra avalanche-awareness talks and beacon clinics that were requested. These were with the Siskiyou County Search and Rescue Team and Southern Oregon University Outdoor Program.

We are anticipating a great season of climbing and spring skiing. With snow totals at the end of April still at 15' at 7500', good climbing and skiing should last well into July and maybe August! We've got a great crew of seasonal climbing rangers, and we're heading into the climbing season with climber safety and education at the top of our lists! *—Nick Meyers, lead climbing ranger/avalanche specialist*

Eastern Sierra Avalanche Center - Inyo National Forest

The winter of 2010/11 will be remembered as the winter of extremes: extreme snowfall, extreme dry spells, and an extremely long and cold spring. The eastern Sierra had a record three avalanche fatalities this year, and the unusual weather and snowpack conditions this spring caught many people by surprise.

As the winter season approached, dire predictions of an unusually dry winter for central and Southern California literally flooded the media. During La Niña episodes, the jetstream usually steers storms on a more northerly trajectory and Northern California and the Pacific Northwest receive the majority of snowfall, leaving the eastern Sierra and Southern California dry. All I could do was wait and see.

The first indication the winter was going to be unusual occurred near the end of October. A warm subtropical storm dropped 4-6" of rain in the mountains, and the Owens Valley picked up close to annual precipitation from the storm. An ice layer formed on Mammoth Mountain and isolated areas in the backcountry.

above: Examining the Gray Butte crown.
left: Wind transport in the Mt Shasta forecast area on April 21. *Both photos by Nick Meyers*

Many full-depth avalanches ran on the ice layer two months later during the huge December 19-22 storm. The ice layer in one frontcountry area was responsible for the death of two endangered bighorn sheep that slipped, slid, and died after hitting rocks at the bottom of the slope.

The next indication La Niña was affecting weather patterns in an unexpected way occurred before the Thanksgiving Day holiday. Mammoth Mountain was able to open on natural snow for the first time in many years, and frontcountry skiing in the Mammoth area was possible to the delight of everyone. The first fatality of the winter occurred in November when a climber descending a steep series of ledges off the North Fork of Lone Pine Creek was found days later with a skull injury, face down under a foot of snow.

By the middle of December, meteorologists at the National Weather Service office in Reno were buzzing with excitement as they showed me satellite images of a subtropical stream of moisture curving across the entire Pacific Ocean, heading to central California. Several days later, snow started falling, and the fire hose was aimed directly at Mono County.

Snow came in waves of intense precipitation and snowfall rates. December 19, 2010, stands out as the day when precipitation intensities averaged 0.3" an hour for 5-7 hours, and 24-hour SWE totals ranged from 3-5". Several days later, on December 22, occasional patches of blue sky were a welcome sign the storm was mostly over. It was time to assess impacts from the most powerful winter storm since February 1986.

The eastern Sierra received 10-16" of water and 110-120" of snow in five days. The high precipitation intensities and strong wind resulted in several avalanche cycles during the storm. The high precipitation intensities on December 19 probably resulted in the largest avalanches. Surface sluffing was widespread once skies cleared and the 10' deep snowpack was an early Christmas present for skiers and riders, provided they could shovel their way to the last seen point of their cars.

After such a huge powerful storm, it would take a while for high pressure to build back into the area. Post-frontal winds raged after a cold storm dropped another foot of snow over the higher elevations. The first reported near miss occurred during the wind event that brought sustained ridgetop winds of 40-60 mph. A well-known local skier was ascending a steep, wind-scoured slope when he reached a wind-loaded convexity and decided to turn around. He triggered a soft slab that carried him about 250 vertical feet and deposited him right above a stand of trees.

The first 10 days of January were cold, windy, and unsettled. A party of two local former ski patrollers and an out-of-area female expert skier changed their ski plans when snow plumes obscured the ridgetops and their skiing objective for the day. They selected what they believed to be a safer alternative: a steep, committing, north-facing line they believed would be sheltered from wind loading. The first skier down triggered a slab avalanche that broke above him, and he cartwheeled down 1500 vertical feet. Fortunately, he was shook up, bruised, and lost some gear but otherwise escaped injury.

Martin Luther King crust, Sierra-style. Several other forecast centers report a similar event during this time period. *Photo by Sue Burak*

After the excitement and drama of early January, the traditional January dry spell overextended its welcome and lasted for over a month until the middle of February. On the Martin Luther King holiday weekend, high dew points and above-average air temperatures resulted in surface melt, a 5-10 cm thick melt-freeze crust, and spring snow skiing on south aspects up to 13,000'.

Once more typical January temperatures returned, the widespread melt-freeze crust made for challenging skiing conditions. A similar crust formed in the Wasatch over the weekend. Once the next round of multi-day storms began a month later, a month of cold temperatures had transformed the crust into a coarse, faceted, and disintegrating layer – the most prominent feature in the Sierra snowpack.

The extreme dry spell ended with 5-6' of snow falling in a couple of days. Widespread whumpfing, planned and unplanned skier-triggered slides, and consistent fracture and propagation on the Martin Luther King crust were clear indications the snowpack was going to take a while to adjust to the new load. After a long dry spell, the lure of powder skiing drew many locals to leave the June Mountain ski area boundaries during the height of the storm when visibility was low due to strong winds and heavy snowfall. June Mountain's ski patrol director lectured several so-called experienced groups as they left the boundaries, because ski patrol is responsible for avalanche rescue in the sidecountry.

March came in gently with two storms in the first week that dropped 12-20" of dense snow over the eastern Sierra. By now, snowpacks were already above average for the winter. The next siege of winter storms hit the area the third week of March dropping another 3-5' over the region followed by another 2-4' the last week of March. This time around, March sun was stronger and elevations up to 7500-8000' melted out in a day or so. Once again, storms came in with sustained winds and wind loading that triggered a few rare class five avalanches in one drainage south of Mammoth. Though starting zones were 12,000' and higher and were primarily wind-loaded slabs, by the time the avalanches reached 7500' the debris was a wet dense mass of channels and runnels and covered several football fields' worth with 10-15' debris piles.

Unusual weather results in unusual snowpack conditions and avalanches. The cold, windy spring continued through April. Despite strong solar radiation, north-facing aspects above 10,000' remained cold due to a combination of high albedo, cold temperatures, and the ever-present wind that keeps snow surfaces firm with areas of windblown snow. Two fatalities occurred at the end of April when two skiers attempted a steep ski descent of Split Mountain's northeast couloir. Strong winds prior and during the ascent of the couloir created an unstable wind slab that the skiers probably triggered on their ascent. Winds were so strong helicopters were unable to retrieve the bodies for four days.

Pine Creek ran huge in a cycle post wind event in mid-March. *Photo by Sue Burak*

It's going to be a long spring skiing season here in the eastern Sierra. As of May 3, temperatures at the high elevations are just reaching the low 40s. It has been both the best and worst of winters – powerful storms, great skiing, an interesting snowpack, and an uncertain future for the avalanche center.

—Sue Burak, forecaster

La Sal Avalanche Center

The La Sal Avalanche Center (LSAC) based out of Moab, Utah, has been operating since 1988 providing avalanche and mountain weather bulletins for southeastern Utah. LSAC forecasts for the La Sal Mountains southeast of Moab and the Abajo Mountains near Monticello. The La Sal Mountains are the second highest mountain range in the state of Utah with more than 10 named peaks exceeding 12,000'. Both the Abajo and La Sal Mountains rise several thousand feet above the Colorado Plateau, forming "Island Ranges" that are exposed to severe weather.

Temperatures are cold during southeastern Utah winters with high winds and low relative humidity. These mountains are classic continental peaks. Strong temperature gradients typically lead to the development of a weak "Colorado snowpack." Large climax avalanches are the norm for at least one cycle each winter. The 2010/11 winter was no exception.

There has been no formal data collection to determine actual use in either range, but use appears to be steadily on the rise. The inclusion of Mt Tukunikuvatz (La Sals) in the book, *50 Classic Ski Descents of North America*, will likely enhance this trend. No skier or rider has been buried or injured in southeastern Utah since an accident in 1992 that took four lives. Since then, the mountains of southeastern Utah, especially the La Sals, have earned a reputation as an unforgiving range with an unstable snowpack and unfriendly slope profiles. This may be true, and it seems that backcountry users of all types in southeastern Utah refrain from making hasty decisions when traveling in backcountry terrain. There were no known unintentional skier or rider involvements this season.

This season LSAC was staffed by Dave Medara (lead) and Max Forgensi. Snow totals are from the La Sal SNOTEL site, but we added a better site that conforms to industry standards this year. Gold Basin is quoted several times in this report but monthly totals and seasonal averages come from the older site.

November - December: The center opened December 6 with 30" on the ground at the Gold Basin Study Plot at 10,000'. The month of November was generous with 83" of snow for a finish of 152% of normal water. Things were looking good for stability and overall ski conditions, but La Niña, it seems, had other plans. High pressure took over for the bulk of the month, and by mid-month snowfall totals had dropped to 100% of normal in the La Sals and a paltry 37% of normal in the Abajos with only 9" of snow at the Camp Jackson Study Plot. Development of faceted crystals in the shallow southeastern Utah snowpack continued on its typical yearly course.

The snowpack set up for a dramatic event, and Mother Nature delivered with a major storm that started on December 17. By December 24, 4+" of water had fallen in the La Sal mountains and 7+" of water equivalent had fallen in the Abajo Mountains in an unusually dense snowfall event. Avalanche warnings for both the La Sal and Abajo Mountains were issued. Snow totals reached 22" in the La Sals and 25" in the Abajos (with rain). The balance was tipped, and the snowpack produced some dramatic avalanches. A 17" storm just before New Years capped off a snowy month. We finished the month at 130% of in the La Sals with 35" of snow at the La Sal SNOTEL and 61" at the Gold Basin Study plot.

January: The Christmas and New Years storms produced dramatic slides and great ski conditions. Following those storms, something happened in southeastern Utah that is quite rare. The wind didn't blow. In a period lasting the first three weeks of January, calm winds ruled, skies were mostly clear, and ski conditions were exquisite. Small nonviolent storms freshened things up every now and then. A rare mid-winter run of stability and good conditions was enjoyed by locals and vistors alike, marred only by cold temperatures. Lows of -18ºF were measured during the second week of January. Our snowpack started to deteriorate and develop severe faceting over this period. Despite low snow totals for the month, cold temperatures and light winds contributed to make January memorable for good conditions. We measured 56" of

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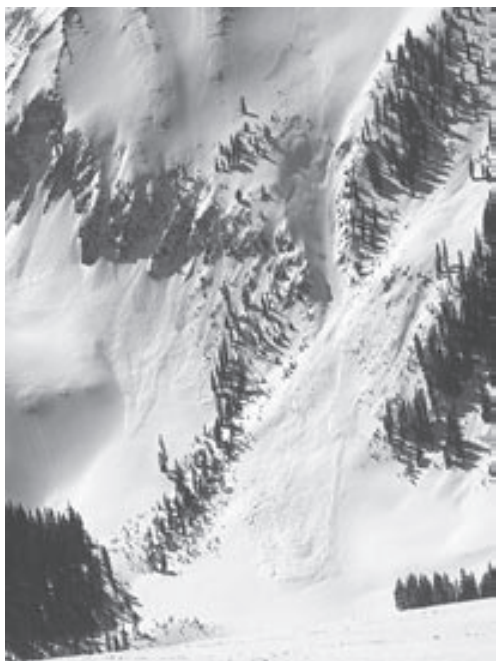

Moab Lanes bowl a strike. *Photo courtesy LSAC*

NAC 2010/11

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new snow at the La Sal SNOTEL in January. The month ended with 34" of snow at the La Sal SNOTEL and 55" at the Gold Basin study plot. Our percentage of normal dropped from 159% to 104%.

February: In stark opposition to the month of January, the winds of February were the highlight of the month. Temperature gradients continued their work on snow that had been laying around for a month or more, and the winds did major damage. Over February 3-4 there were 15 hours with gusts over 60 mph and 2 hours with gusts over 70 mph measured at Pre-Laurel Peak (11,700') in the Middle Group of the La Sals. There were 17 hours with average wind speeds over 40 mph over the period as well. Ski conditions did not fare well. This trend continued through the month.

On February 20, a strong storm affected the Abajo Mountains much more strongly than the La Sals, and an avalanche warning was issued for the Abajos as they received 12" of snow and 1.8" of water with high winds falling onto a highly layered and weak snowpack. Winds again returned after this storm combining with further small storms, just numerous enough to keep spring corn conditions out of reach. We finished the month measuring only 37" of new snow at the La Sal SNOTEL. Ending at 33", the La Sal SNOTEL total stake site actually lost an inch. The Gold Basin Study plot added 5" to finish at 160".

Dirt in the Utah snowpack from late February winds. *Photo by Karl Kelly*

March through April: When March arrived, the snowpack was a mess of facets, sun crusts, wind crusts, and surface hoar from two months of La Niña high pressure. Small storms kept spring conditions from arriving and good powder skiing was on tap for most of the month with spring conditions being limited to valley elevations. Accumulations were mostly light, although 16" of new snow was measured on March 8, ushering in a late-season period of high avalanche danger for a few days. Old-snow avalanches were noted during the ensuing avalanche cycle, highlighting lasting deep instabilities in southeastern Utah. High avalanche danger was again reached for the March 26 forecast with up to 10" of new snow and "belligerent" winds from the south. Only the very rare day of corn skiing was experienced before LSAC closed for operations on April 2. For the month of March, snow totals were 73" new snow, 35" on the total stake at the SNOTEL site, and 76" on the total stake at the Gold Basin Study Plot. Just before the close of the season, on March 29, the La Sal SNOTEL was reading exactly 100% of normal snow water equivalent, an excellent measurement for the 2010/11 season.

—Dave Medara & Max Forgensi, forecasters

Wallowa Avalanche Center

We completed our second full season of operation on April 7, 2011, after issuing 21 weekly summaries along with a few early season condition bulletins. Summaries provide backcountry travelers a synopsis of snowpack stability and conditions observed by our staff and a team of trained observers. A detailed snowpack analysis, potential concerns, and a weather discussion are included in the summary posted every Thursday afternoon all season. Web site traffic nearly doubled over last season, and we expanded into social media with a presence on Facebook. Sponsorship and donor dollars grew at a modest pace from a mix of individuals and corporate sponsors. Our education program included awareness events such as on-snow fundamentals and local certification courses. We received a grant that will enhance our educational offerings for next season with an all-new, flashy and engaging avalanche-awareness program with separate tracks targeting schools, search and rescue, and the general public.

This year brought a formal partnership with the Wallowa-Whitman National Forest, a brand-new Web site design, and a continuation of our close relationship with the National Weather Service office in Pendleton, Oregon. We received dissemination support from the NWS when we issued our first-ever avalanche warning in late March. They also developed a couple of new winter forecast products for WAC and the general public to use.

WAC installed our first-ever mountaintop weather station through a cooperative effort with a local scenic tramway operator and the county sheriff's department.

This wet slab released on the MLK crust sometime around February 12-13 when the Wallowa area experienced some real warmth, wind, and rain. This path runs all the time on a slick rock surface and usually slams high into the bank to the left in photo before turning down canyon. *Photo by Keith Stebbings*

First a drier slab released around March 10 to the right, out of frame, with a strong powder blast that took out two 12"+ trees. Later a wetter slab released and made quite a flow pattern to the left. This left-most flow was uniformly 6-10' deep. *Photo by Keith Stebbings*

Using the county communications tower saved us oodles of dollars and allowed us to purchase the full gamut of weather instrumentation. The data is transmitted to the valley via ham radio and is available free to the general public through a link on our Web site. We have been looking for representative mountaintop wind data, and this venue is just the ticket.

It seems like everyone was plagued by the MLK rain crust which began over the Martin Luther King holiday weekend of January 16-17, and we weren't spared. It haunted us the rest of the season. That rain event and subsequent warming periods produced many avalanches of the variety you see in the photos above. This year (different from last) we had a well-behaved layer of snow near the ground, and therefore depth hoar was absent from our minds. Nothing out of the ordinary concerned us for NSFs and buried surface hoar this winter season as they have in the past. Our season otherwise wasn't spectacular weather-wise, and we concluded our forecast season with slightly above-normal snowfall and about-normal temperatures.

This year was slightly more active in the skier-triggered-avalanche department with more reports coming in, perhaps because folks now know where to report this data. No injuries, but several took rides. One person released a D3 hard slab when bootpacking up a ridge and sat on it for about 50' before rolling off of it to the side. Whew!

Next season we'll incorporate new ideas and improvements as we learn each year to produce a better and more accurate product. *—Keith Stebbings, director*

Gallatin National Forest Avalanche Center

Unlike many seasons in southwestern Montana with early dustings of snow and cold weather by Halloween, early snow melted during a warm, extended fall. One big storm in late October was followed by nearly continuous snowfall lasting through the end of April, and I had many days riding powder in avalanche terrain.

Extreme, depth-hoar-forming, cold weather came only twice before the New Year, but the snowpack was deep and dense each time. Although extremely cold weather was fleeting, many days experienced temperatures in the single digits and teens F. Under these temperatures some faceting occurred, mostly in areas with relatively thin snow cover, and these areas required very large loads to create an avalanche. Steady loading from big storms finally provided the right load, and a short avalanche cycle occurred in the third week of January. Following even bigger loads and even bigger storms, a few large, cornice-triggered avalanches occurred at the end of March/beginning of April.

Steady intervals of snowfall and no extended periods of dry weather prevented any long-standing near-surface issues, and the primary avalanche issues were new snow and wind-blown snow, quite a treat for SW Montana. Numerous strong and extended wind events occurred, forming hard wind slabs throughout the advisory area. Unfortunately an avalanche fatality occurred in the Bridger Range after one of these wind events on February 14. This avalanche involved a wind slab in a cross-loaded gully, and the victim was carried 1,300' down the gully through trees. Sadly he and his partner discussed concerns about wind loading and planned to descend a broad ridge just south of the gully. *(see photo on page 13)*

Touring near Big Sky, Montana, following another strong wind event. *Photo by Mark Staples*

Strong wind events continued into March when the avalanche danger spiked with each storm and had a hard time dropping to LOW because snowfall wouldn't stop. By April most SNOTEL sites were reporting an above-average snowpack with snow still falling. By April 5, measureable precipitation had occurred on 72% of the days in the southern half of the advisory area and 65% of the days in the northern half. At least one area was rated low danger on certain terrain for 45% of the season. Considering that the low rating was never issued anywhere the previous winter, this season was one to remember.

On top of generally stable snow and plentiful powder, we had other notable highlights. Photos and videos continued to be an integral part of our advisories with 35 videos (29,627 views) this season and an ever-increasing number of photos. We continued using Twitter and Facebook, often posting links on Twitter to recently updated photos and videos. The Friends purchased a new weather station we placed in Hyalite Canyon, a hugely popular area south of Bozeman. This allowed us to keep better tabs on wind loading in an area seeing huge increases in ice climbers and skiers/boarders. The Friends purchased a new BCA beacon park which was installed at a city park in downtown Bozeman. Another was installed in West Yellowstone for the second year, and we plan on installing another in Cooke City for next season. More BCA beacon checkers were purchased. Some were installed at fixed locations while others were set up as mobile units. Both GNFAC and Gallatin Snow Rangers deployed these when parked at local trailheads, and the response was extremely positive. Our partnership with Yamaha continued as they loaned us two new MTX Nytro snowmobiles that had no problems chewing up this season's deep snow. We're incredibly fortunate to have this relationship and these sleds.

A big highlight for us was the online survey run by the Friends and modeled after one conducted by the WCMAC last season *(see story on page 13)*. With 485 responses, the most exciting result is that our users want more advisories, more days in our season, more coverage in our advisory area, and generally more of what we offer. Most users rated our photos and videos as the most valuable part of our Web site and advisories. The majority of our users access advisories by email, a surprising result that will affect how we move forward and deliver information. Answers to open-ended questions were by far the most useful information. We made some immediate changes and will make more for next season. These include: posting all our snowpits, reworking our weather page, embedding photos and videos in our emailed advisories, adding information and videos on stability tests, adding wind roses to our weather data, posting a map of common place names, posting a map shaded by danger, reaching out to more snowmobilers and young adults, and expanding our use of photos and videos.

We had another solid year in terms of fund-raising and education. Between the GNFAC and the Friends of the GNFAC, we gave 79 talks/classes to 4595 students. Of those classes, 31 were for 1127 snowmobilers. Instructors Jay Pape, Angela Patnode, Dale Gullett, Tim Campbell, Scott Savage, Ben Noble, Alex Marienthal, Scott Schmidt, TJ Krob, and Beau Fredlund were key in making this happen as well as Jay's work as education coordinator. When Jay got busy in Cooke City as a snow ranger, Scotty stepped in and helped us fulfill a surprising number of late-season requests for classes. We ran a one-day Professional Development Workshop on *Surprise Avalanches and Post-Control Releases* in March. Scotty once again was instrumental in organizing this event which was attended by 45 avalanche professionals. We filmed eight of the lectures and posted them on our Web site under "Resources/Other Info – Avalanche Lectures."

Doug, Eric, and I, along with Karl Birkeland of the National Avalanche Center and Jay Pape and Dale Gullett of the Friends of the Avalanche Center, won a national award from the Forest Service for Safety and Occupational Health. This award was in response to the great partnership between diverse groups to further avalanche education, especially among snowmobilers. Only one group a year (in the entire United States) receives this award and we were honored to be chosen. It's a team effort to run the Gallatin National Forest Avalanche Center, and we couldn't do it without help from the Friends, all the sponsors, and each of the local ski areas. *—Mark Staples, forecaster*

Alaska Avalanche Information Center

The Alaska Avalanche Information Center (AAIC) had another banner year producing public avalanche bulletins and/or snow observations for many of the major mountain regions in Alaska, and providing avalanche education to the backcountry travelers of this great state. We saw a huge increase in traffic on our regional snow observations forums, and we have received great feedback from the backcountry travelers in those regions of the state without established forecast centers regarding the benefit of having snow observations available for all to see. The AAIC Web site provides active regional observations pages for Hatcher's Pass, Haines, Seward, Fairbanks/Northern Alaska Range, and the Anchorage/Eagle River area. Professional bulletins for established forecast centers in Valdez, Cordova, Juneau, and CNFAIC (Turnagain Pass) continue to be linked to the Web site and have seen increased traffic and support across the state.

The avalanche education program saw phenomenal growth this season, with a tremendous increase in instructor interoperability and exchange. In total, AAIC provided avalanche education to 540 Alaskans in the 2010/11 season: from awareness outreach seminars for elementary school, high school, and college students, to AIARE Level I and II courses for backcountry users and professionals. Our snowmobile-specific avalanche education program continues to grow as we clear the hurdles of reaching this diverse and unique user group. AAIC will continue to offer AIARE awareness and Level I courses specific to snowmobilers in 2012, in accordance with the AAA guidelines for snowmobile education progression. The AAIC women's studies program has also seen great success, and AIARE Level I courses taught exclusively for female backcountry travelers were overbooked for every offering. We will be expanding this program in 2012 to offer AIARE Level I, AIARE Level II, and awareness seminars to address the specific communication and human factors women face when traveling in or leading trips in avalanche terrain.

The AAIC internship program saw continued success this season, with two full-time interns working in the field for a combined 150 days collecting and processing data,

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Another deep snow day near Cooke City when it's best to leave the skis at home. *Photo by Q Gidley*

This avalanche in Truman Gulch was the scene of a fatality in mid-February. The gully was cross loaded by 60 mph winds, and the victim and his parter crossed it about 100' below the crown where they dug two snowpits. Their test results were CT12 under the wind slab. *Photo by E. Knoff*

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generating snow profiles, and observing classes. While our internship program is currently primarily based at the AAIC Valdez Operations Center, we hope to expand this program to other forecast centers in 2012.

Unfortunately we lost three Alaskans to avalanches this season. One in Hatcher's Pass, one outside of Anchorage on Bird Ridge, and one still missing but presumed dead outside of Ketchikan. Accurate numbers pertaining to near-miss incidents are unobtainable at this time, although presumed to be high based on word-of-mouth accounts. We will be developing and improving our current near-miss reporting system for public use next season.

Following are brief seasonal summaries from the AAIC Valdez and Cordova forecast offices. Detailed information from each regional observation area and forecast office in Alaska can be found at www.alaskasnow.org.

—Sean D. Wisner, executive director

Wind drift on Thompson Pass, Alaska. *Photo by Pete Carter*

Alaska Avalanche Information Center - Valdez

Although 2010 was the fifth driest of the past 40, Thompson Pass received 427" of snowfall, close to the 500" average. Consistent with the La Niña climate, there was, however, no shortage of beautiful clear days with strong to extreme, bitterly cold, northerly outflow winds. The wind howled continuously for 23 days in December, 13 days in January, 14 days in February, and 17 days in March. During these 43 days it never blew less than 40 mph; many gusts exceeded 100 mph. There were two days in February with gusts over 120 mph and a jet streak recorded at 154 mph. The wind drifted snow on the highway was considerably deeper than 30'.

Other than the spring shed, there were 16 avalanche cycles with the major events corresponding with the extreme winds, an 80" snowfall the first week of November, and a 40" snowfall February 2. *—Pete Carter, director of forecasting*

Alaska Avalanche Information Center - Cordova

Another winter whizzed by all too quickly here in Cordova. Our winter was characterized by long dry periods with strong north winds and colder than normal temperatures. When storms did develop, temperatures would rise and many times brought rain to the top of our local peaks, ~3000'. Sea level was snow-free for the majority of the winter. It was a winter to break out the ice skates. Cordova offers world-class ice skating when conditions are right, and they were phenomenal this season!

Although precipitation amounts were normal for our maritime climate, our snowpack was shallower than normal at all elevations. The snowpack experienced a lot of rain during storm events and subsequent near-surface faceting during the long dry periods, yet no significant weak layers persisted throughout the winter. In the beginning of April a large storm brought winter conditions to sea level, and Cordovans had to find their forgotten snow shovels. We experienced a few large avalanche cycles throughout the winter occurring amid or immediately after storm events, though avalanches did not affect the highway, Cordova Electric facilities, or the backcountry user.

We posted approximately 50 highway avalanche hazard bulletins as well as pro bono backcountry forecasts on the City Web page and on the Alaska Avalanche Information Center's Web page. 17 snow profiles were also posted for the user to view. Over 60 avalanche hazard bulletins were provided for Cordova Electric facilities.

We taught an AAA Level I Avalanche Fundamentals class again this year. We had nine students and received very positive feedback. We also conducted awareness classes for Cordova Electric employees and high school students. North America Outdoor Institute came to town and offered an awareness class to the general public. *—Kirsti Jurica, director*

Sawtooth National Forest Avalanche Center

During the 2010/11 winter in Central Idaho, the bookends – early and late seasons marked by regular snowfall – were more interesting than the six interminable weeks of dry, windy conditions in between them. Six. Interminable. Weeks. Ugh. The mid-winter dry spell formed a persistent weak layer that, once it was finally buried, produced widespread and destructive avalanche cycles in mid-March.

The season started in mid-November, when a parade of small but windy storms marched through the area. An arctic front followed at Thanksgiving, and despite the cold temperatures, many holiday meals included a side dish of backcountry recreation. The SNFAC started advisories December 4, a full two weeks earlier than the previous year.

The steady accumulation prevented the formation of a widespread basal weak layer, created an uncharacteristically supportable early season snowpack, and had people raving about the best early season riding in years. December ended with an arctic front that brought bitter cold temperatures and a lingering but localized hard-slab hazard at most elevations.

What followed next was six more weeks of dry, windy conditions. During this period our weather station atop Bald Mountain recorded only 7.5" of snow and less than half an inch of SWE. The northern zones saw a little more snow – a whopping 27" of snow and 2.6" of SWE near Galena Summit. Much of that precipitation fell during an unseasonably warm mid-January storm that left a rain crust up to nearly 8000'. The snowpack dropped from 110% to 80% of average, and a persistent weak layer developed on shaded, wind-sheltered, mid-elevation slopes, in part due to faceting around the mid-January rain crust. After northwest winds and above-freezing temperatures ruined the snow on normally dependable northerly slopes, our advisories included more poems, song lyrics, and movie quotes than snow geek jargon.

A series of southerly storms eventually ended the dry spell, but the rapid loading created widespread instability, particularly in our southern zones. As the instability lingered, several close calls ensued. In the most serious, a party of two triggered a deep hard slab while climbing a steep ridge. The resulting slide ran 1700' down a path that averaged 40 degrees and ended in a deep gully, where some of the debris piled up about 20' deep. The rest climbed up the opposite side and launched off a ridge, coming to rest on the valley floor. It was an ugly slide and no exaggeration to say that the one person caught narrowly escaped with his life when he hung up on a small tree after tumbling several hundred feet.

The season's main event, however, was a widespread cycle of destructive natural avalanches provoked by two back-to-back storms in mid-March. These storms packed gusty winds and lots of snow – the second produced 24" of new snow on Bald Mountain in 24 hours – and prompted the SNFAC to issue two avalanche warnings for the Wood River Valley. Some larger avalanches ran to valley bottoms, while slides on mid-elevation slopes put nasty amounts of debris into gullies and other terrain traps. Despite the widespread hazard, we had no close calls.

A week-long warmup as March ended generated wet slides at lower elevations, but the stormy weather returned as we closed out the season. Though the storms weren't big, they added up, and gusty winds either accompanied the snowfall or marked the intervals between storms. Mid-elevation slopes started a predictable melt-freeze cycle, but upper-elevation slopes retained a winter snowpack. Several close calls occurred as people ventured into higher terrain, including one in which three people were swept 1200' down a couloir in the Pioneer Mountains after triggering a small wind slab near the top.

We ended all operations the third week in April with the snowpack at 110% of average and 175% of the same time the previous year. During the season we tallied

SNFAC Forecaster Simon Trautman investigating cracks on a slope of about 32 degrees steepness. The cracks occurred under loading from new snow without a human trigger. *Photo by Blase Reardon, February 21, 2011*

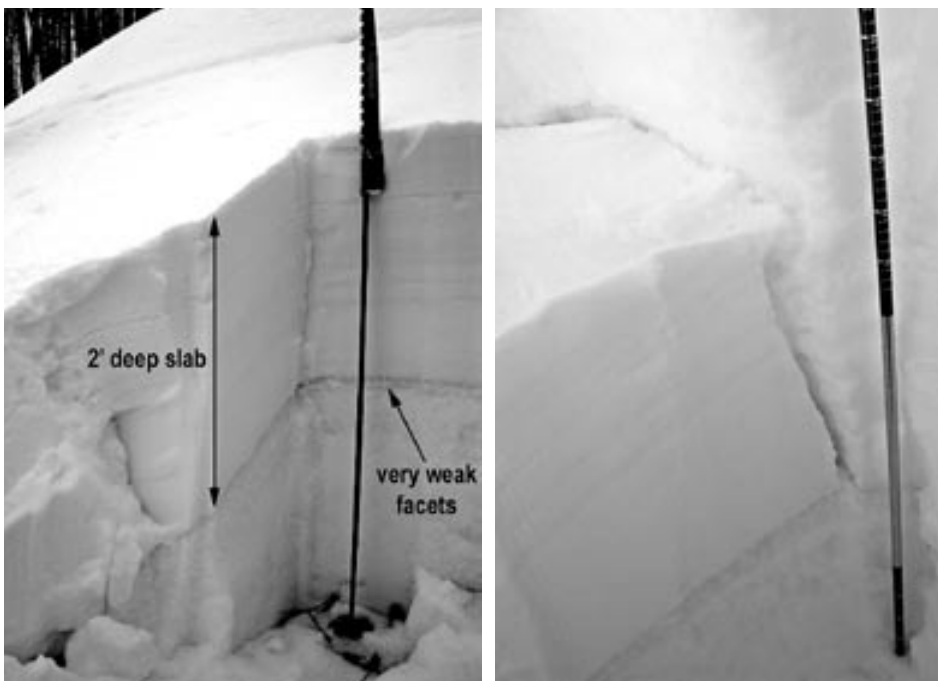
This dry-slab avalanche in mid-March plowed into rain-saturated snow at lower elevations and covered Warm Springs road with 30+ feet of debris. One other large avalanche occurred just downstream but didn't quite reach the road. *Photo by Simon Trautman*

numerous unintentionally triggered slides, and seven close calls – defined as someone partially or completely buried – but we suspect others occurred in the Bald Mountain sidecountry and went unreported. Despite the number of close calls, no fatalities occurred in our advisory area this season, the first time since the 2007/08 winter.

SNFAC operational highlights for the season:

- La Niña brought an early start to winter, and we began Daily Advisories on December 4.
- Due to public feedback and increased support, we offered Daily Advisories through April 10 – more than a week longer than in the past.
- We issued more advisories than ever before – 127 daily advisories and 11 pre- or post-season updates!
- Our Web site and the Web-based advisory received 15% more traffic than last winter. All told, our advisory received 131,000 views – a 30% increase over last season!
- We augmented our Web site with social media and local newspaper and radio media. We have over 960 Facebook "likes" and 55 Twitter followers, while our YouTube videos had 2236 views. The local newspaper published seven well-written articles and three online updates, and a local radio station played 89 one-minute avalanche summaries on weekday mornings at rush hour.
- Over 200 people responded to our online survey, providing invaluable information about advisory use demographics and feedback on our programs and services.
- We expanded our education programs this season, adding a professional development workshop for local avalanche pros as well as presentations for the Sun Valley ski patrol. Class participation was up from last winter – we taught nearly 700 skiers, snowboarders, snowmachiners, and snow professionals.
- In partnership with Sun Valley Company, we laid the groundwork for tackling the out-of-bounds avalanche problem on Baldy. Over 120 people attended an informal discussion hosted by the SNFAC and the Sun Valley ski patrol to discuss how to prevent a sidecountry accident.
- The Friends of the SNFAC hired a part-time executive director, recruited new board members, and are pursuing their own 501(c)(3) status, independent of the American Avalanche Association nonprofit umbrella.

We're looking forward to next winter and hoping it won't include such a long, dry book in the middle! *—Blase Reardon, forecaster*



left: The mid-March snowpack in the Bald Mountain sidecountry. Imagine what would happen if you loaded this snowpack with 24" of new snow in 24 hours – exactly what happened two days after this photo was taken. *Photo by Chris Lundy, March 18, 2011*

right: Profile dug into crown of D2.5 slide that occurred March 21st after a storm that dumped more than 24" of new snow in 24 hours. The crack extends below the bed surface to a layer of facets that developed around a mid-January rain crust. It appears the facets collapsed and shook off the storm snow and other older snow layers, but the pencil-hard slab immediately above the weak layer only slid a few centimeters. Similar cracks existed in some other slides during this cycle. *Photo by Blase Reardon, March 28, 2011*

Southeast Alaska Avalanche Center

We had a nice quite winter in southeastern Alaska. Avalanche programs in the City and Borough of Juneau and throughout the state continue to grow and prosper.

This year in the Juneau region we were fortunate to have Ron Simenhois in his second season running a great program for Coeur Alaska at the Kensington Gold Mine. In the fall of 2010 AEL&P internalized its avalanche program with the full-time hire of Mike Janes, formerly of Alaska Avalanche Specialists. AEL&P also invested in the long term of their program with the purchase of a new Daisy Bell. Bill Glude, owner of Alaska Avalanche Specialists, continues to support local and regional education with his course offerings as well as continuing his avalanche consulting work in the region and elsewhere. We are lucky to have had so many programs grow out of the seeds Bill had planted in southeastern Alaska and we are grateful for his efforts.

The City of Juneau Avalanche Forecast Program continues to gain strength by focusing on collaboration with its local, regional, and state partners. This year we were happy to have a new weather station at higher elevations up and online 24/7. It is available at http://forum.ci.juneau.ak.us/avalanche/.

The 2010/11 season started strong with our Second Annual Southeast Alaska Snow and Avalanche Workshop (SEASAW) held the first week in December. We were excited to bring in outside presenters this season and reached out to Scott Savage of Montana as well as the new vice-president of AAA and my old high school friend John Stimberis. We had to kick off the weekend of education by taking John straight from the airport to the heli-pad for our first Mt Juneau snow survey of the season. Presentations were given by Bill Glude of Alaska Avalanche Specialists, Ron Simenhois of Coeur Alaska, Mike Janes of AEL&P, Tom Ainsworth of the National Weather Service, Tom Mattice the SE AK Avalanche Center director and City avalanche forecaster, Scott Savage of Montana, and John Stimberis from WSDOT. Attendance and revenue was up this year over last year's event, and we are looking forward to maintaining this momentum into the 2011/12 season.

Avalanche-education programs continued to build strength in Juneau this past winter. The weekend after SEASAW we hosted a 16-hour free Avalanche Awareness workshop for the public. During the month of January the avalanche center sponsored a Companion Rescue Skills Workshop Series free to the public every Saturday afternoon during the month. Awareness programs were hosted for many school groups in Juneau, even though we have still not reached our target of hitting every student in town at least once. We are working with the National Weather Service to continue to promote these school awareness offerings as they already work with the schools on weather-related programs. Aside from all of the fine Level I and Level II courses that the Alaska Avalanche Specialists offer to the public this year, the avalanche center, in partnership with the National Ski Patrol provided a Level I course to the ski patrol, Juneau Mountain Rescue, and others. The avalanche center also helped the local heli-ski company, Alaska Powder Descents, with their spring guide-training programs. The focus of this training was how to better understand the tools available in the region and draw from them while building their daily forecasts.

This year the Southeast Alaska Avalanche Center was pleased to have the Juneau Snowmobile Club reach out to us in an effort to build a rapid response team for backcountry rescue situations. This team had prior first aid and avalanche training. We held a two-night, one-day course for the group to remind them of best practices for rescue. Then we reached out to the other search and rescue responder groups in the region to build an exercise to test the new team's capability and practice working with the other responders. By reaching out to the Coast Guard and the Alaska State Troopers who control search and rescue in the state of Alaska we got the ball rolling. We then worked with Juneau Mountain Rescue, SEADOGS Rescue Team, Eaglecrest ski patrol, Civil Air Patrol, Capital City Fire Rescue, the Juneau Police Department (our local 911 dispatch center), and Bartlett Regional Hospital. We created a two-day training plan leading up to the exercise with refreshers in beacon skills, RECCO locators, safe scene rapid-assessment techniques, helicopter safety, ground loading, basket and sling operations, snowmobile towing and safety, patient hypothermia treatment, as well as incident command and communications at all levels. Special thanks to Mike Janes and Ron Simenhois for donating their time to help instruct.

We then held a first annual Douglas Island Search and Rescue Training Weekend. The scenario was a heli-skiing group crashing into the side of a mountain, starting an avalanche, and burying a second group on scene. The event took place several miles into the backcountry with a live call-out to 911. Teams were quickly mobilized at the trailhead as we transported 40 people on 11 snowmobiles into the search area. This was a live action drill but only at about half speed to ensure safety at all times. Even though we kept the speed down for safety and spent extra time working on staging and communications, we were still able to account for all nine injured people after only one hour and forty minutes. All victims were buried a minimum of a meter deep. We were very pleased to see all the different responder groups practicing and working together, and we look forward to hosting the exercise again next season. The Alaska State Troopers and the Coast Guard said this was the largest SAR drill they had ever conducted and look forward to doing it in other locations around the state in the future with the avalanche center's support.

Throughout the course of the winter we had light to normal snowpacks. As is quite often the case in the high latitude maritime climate there were a number of great snow events, many of which finished with warming trends or light rains. Several times during the course of this winter we went through moderate avalanche cycles helping to build long-term stability in the snowpack by removing the near-surface weak layers in place. We had one DOT shoot on Thane Road this season with results coming down to the road. There were no notable natural events this winter.

I was however saddened to see that on a high avalanche danger day while the Eaglecrest ski area was blasting its West Bowl and getting 80-150 cm crowns on most every aspect with debris running full path, people simply ignored the quite-visible signs of avalanche activity, traversed over a half mile of avalanche

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crown and debris, and ducked the ropes to head out of bounds for additional powder turns. The day finished uneventfully but with reports of more than eight people taking rides in sidecountry avalanches. What does it take to educate a society? I am not sure we have figured it out yet. Amazing to see how powder clouds the otherwise rational mind. *—Tom Mattice*

Sierra Avalanche Center

The winter of 2010/11 once again exhibited the fund-raising and management strengths of the nonprofit Sierra Avalanche Center (SAC) in partnership with Tahoe National Forest. The proven business plan between these two organizations goes beyond typical Friends Group support with the SAC nonprofit providing over 50% of the avalanche center's total operating costs for the season. This ever-evolving relationship, executed through an annual operating plan and collection agreement, allows the SAC nonprofit to collaborate with the Forest Service in order to provide continued avalanche center operations while also collectively focusing on future development.

SAC's all-volunteer board of directors raised $119,166 through local donations, allotting $11,171 to forecaster salaries and additional funds for contracted field observers, snowmobile insurance, some field equipment, continuing education for the forecasters, and savings for future operation of the center. In addition, this season the Tahoe National Forest received a welcome increase in forecaster salary funding with $15,000 from Forest Service Region 5, $5500 from Forest Service Region 4, and $19,022 from Lake Tahoe Basin Management Unit. This brought the total Forest Service contribution for forecaster salaries up to an all-time high of $39,522. In past seasons, SAC contributions have accounted for up to 95% of the avalanche center's annual operating costs when less Forest Service money was contributed. This season the SAC nonprofit paid for 65% of the annual operating costs.

The board of directors worked closely with the backcountry-traveling public and many major sponsors to raise funds to support the avalanche forecasting program. The most significant sponsors for the 2010/11 season *(in alphabetical order)* were: Alpine Meadows ski area, Backcountry Access, Bear Valley Mountain Resort, Heavenly ski area, Kirkwood ski area, Mt Rose ski Aarea, Northstar at Tahoe ski Area, Polaris Industries, Porters Lake Tahoe, Resort Sports Network, SnowBomb.com, Squaw Valley USA, Sugar Bowl ski area, Thin Air Motor Sports, KTKE 101.5 Truckee & Tahoe Independent Radio, and Voilé-USA. Each of these sponsors provided cash, goods, or services in excess of $3000 with some in-kind contributions as high as $24,000.

This season the board organized a professional development workshop open to avalanche workers in the Sierra. Over 60 people attended from various disciplines including patrollers, highway control workers, National Weather Service forecasters, and snow researchers. The workshop focused on post-control releases, explosives' effect on snow, and some fracture mechanics. The particpants found the workshop useful and informative. Overall, this one-day event was a great success.

From an avalanche perspective, the winter of 2010/11 began with a bang with record rainfall in October followed by record snowfall in November and December. The January 1 snow survey for the Sierra Nevada came in at 198%. A six-week dry spell occurred January through mid-February followed by more record snowfall through March. The April 1 snow survey for the Sierra Nevada came in at 173%. For most portions of the forecast area this was the most snowfall on record since the winter of 1950/51. With record early season snowfall, the snowpack took on mid-winter characteristics by mid-December. Numerous avalanches cycles occurred with large avalanches occurring during both periods of rapid loading and rapid warming. Large avalanches occurred in avalanche paths that had not been active in many years.

From late November through late April, Tahoe National Forest Avalanche Forecasters Brandon Schwartz and Andy Anderson issued two early season conditions updates and 156 daily avalanche advisories. These products covered the Sierra Nevada Range of California and Nevada from Yuba Pass south through the Lake Tahoe Basin and Carson Pass down to Ebbetts Pass. This spanned areas of the Tahoe National Forest, Humbolt-Toiyabe National Forest, Lake Tahoe Basin Management Unit, El Dorado National Forest, and Stanislaus National Forest. Field observers Steve Reynaud and Travis Feist aided the forecasters greatly in providing coverage for the region.

16 separate backcountry avalanche incidents involving caught or buried persons were reported to the avalanche center. The numbers broke down as 16 backcountry recreationists, one car, and two trains caught; six partial burials; two full burials; two people with severe injuries; and no fatalities. All of these incidents occurred during periods of moderate, considerable or high avalanche danger.

Building on the success of the Sierra Avalanche Center Web site rebuild in 2009, SAC added a Facebook page, Twitter feed, RSS feeds, and an email subscription to the services provided. These additions allowed the avalanche center to allow users to get more information in more ways. The site provides a very easy interface for the public to view snowpack and avalanche observations collected by the forecasters, field observers, and general public. Our users love the embedded photos and videos of snowpack assessment and avalanche investigations. We received 100% positive feedback. Overall Web site traffic for this past season increased by 45% to over 500,000 page views for the season. A new single day record of 8615 page views was set on March 25, 2011. Unique visitors to the Web site numbered over 70,000 for this past winter.

Excellent continued growth on both operational and financial fronts contributed to another very successful year of this program. The relationship between the Sierra Avalanche Center and the Forest Service remains strong. These organizations' shared vision and complementary goals will continue to fuel the success of this program.

—Brandon Schwartz & Andy Anderson, forecasters

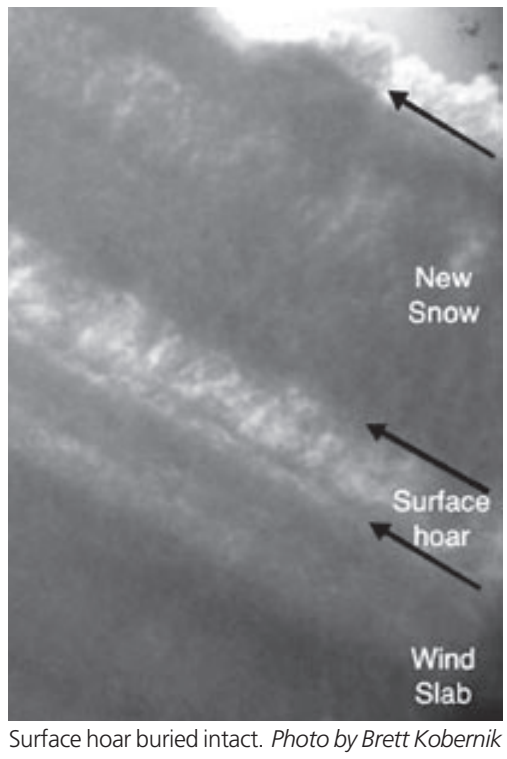
This snowmobile-triggered avalanche in the Sierras on February 21, 2011, left two people partially buried as they attempted to free a third stuck sled. *Photo by Brandon Schwartz*

Utah Avalanche Center - Wasatch

What more can you say about the 2010/11 winter aside from it snowed a lot? To summarize, nearly 800" of snow fell, the number of human-triggered avalanches was about half the amount of the previous year, and an unusual rain event occurred that left many people scratching their heads.

The season started out about normal with snow starting to layer up in late October. Thankfully, storms were fairly consistent through November, which didn't lend well to any persistent weak layer formation. There was a minor rime crust that formed with some faceting associated with it. This did produce a little avalanche activity, but it was a minor and short-lived event. Storms were again fairly consistent through December with a bountiful amount of Utah deep powder. For the most part, the early part of the season was known for avalanche activity during the storms; good stability otherwise. In the colder, drier, more continental western Uintas, however, we suffered our first fatality of the season near the end of the month. Two very experienced snowmobilers accessed the popular Windy Ridge area without any intention of riding in the steep terrain, so they left all their rescue gear back in the truck. Riding below an adjacent slope, one of the two looked back to see a large powdercloud that ripped a sled track out of the popular Cherry Hill. The crown was estimated to be 3-5' deep and 500' wide. Recent wind and snowfall and the weight of a snowmachine combined to overload an early season basal facet/crust combination, resulting in tragedy.

Snowfall tapered off after the New Year for a while, thus a layer of surface hoar formed and was subsequently buried intact. We do see surface hoar growth here in Utah, but it's not that common for it to get buried and remain a widespread persistent weak layer – although the previous season (2009/10) saw a similar pattern that caused a record number of human-triggered avalanches. We were all shaking our heads, "No, not again!"



Surface hoar buried intact. *Photo by Brett Kobernik*

There was no doubt that the newly formed and buried layer of surface hoar was widespread. We were finding it everywhere. It was textbook. Then something unexpected happened on January 16 – it rained, and it rained HARD! It percolated through the pack and affected snowpack temperatures all the way through our already 110" deep snowpack. Only the most seasoned avalanche workers can remember another rain event that came close to this one. This event would be known as the "MLK rain crust" for the rest of the season, named after the Martin Luther King Jr. holiday weekend of its creation.

UAC forecaster Drew Hardesty got out in the field the next day to look at the aftermath. In his travels that day he found a crust so thick that he claimed, with some exaggeration, you could drive a tank on it. He wrote that "perhaps except for snowmobiles in thinner crust areas or a 'step-down' from other slides [insert other fine-print, legal-ease disclaimers here]…we may have hit the reset button for the year." One part forecast, one part wish-cast. Only a dozen human-triggered avalanches stepped beneath the crust soon after the surface hoar was capped. By contrast, we had over 120 human-triggered slides on a buried pair of feathers from the year before. Perhaps the torrential rain event was a blessing in disguise after all.

The MLK crust was no doubt the focal point of conversation amongst avalanche workers for the rest of the season. At first, the conversations were about how the crust would react in the near future. We seemed still poised for a bad cycle. However, with each storm that would pass, not a whole lot happened; there were large avalanches but nothing like the previous year. It seemed that with each large storm there would be one large deep-slab release, then no activity until the next storm. These spotty large deep slabs were just enough to keep us nervous, even though no one seemed to be able to trigger any of these between storms. Speculation about the MLK crust continued, but the conversation was switching more to what might happen during the spring warm up. Would it become a player then?

Ian Havlick investigates a large natural March 16 in White Pine canyon of LCC (one canyon down valley from Snowbird). It was triggered by cornice from above, measuring 6-10' deep, failing on the SH beneath the MLK rain crust. I felt a little like Marlin Perkins from *Mutual of Omaha's Wild Kingdom* - sending the strong young buck up to wrestle the anaconda while taking soil and plant samples from a safe distance. I always wondered whatever happened to Jim, Marlin's sidekick? Was he well insured by Mutual of Omaha?
Photo by Drew Hardesty

Northwest Weather and Avalanche Center

November to Mid-January

After off-again-on-again snow that began in late October we started our forecasting season on November 24, the day before Turkey Day. It was to be a long season of early mornings that did not end until late April. The first avalanche fatality of the season occurred on December 4 when a solo climber was killed in a gully on Morning Star Peak in the central Cascades.

Mother Nature seemed to think that the Northwest needed a periodic Pineapple Express this winter. The first came on December 12-13 with most sites near and west of the Cascade crest getting 4-8" of precipitation as snow changed to rain. Coastal freezing levels rose to 9600-11,400', and many natural and human-triggered avalanches were reported.

Off-again-on-again snow generally continued until mid-January. A warm and wet few days culminated in the second Pineapple Express of the season seen on January 15-16. Most sites near and west of the crest received 4-8.5" of precipitation mostly as rain with Timberline the winner with over 10". Coastal freezing levels rose to 9000-10,400' with many natural and human-triggered avalanches again reported. This also resulted in a crust that became a benchmark for the winter – the Martin Luther King (MLK) crust.


Spatial variability: Hurricane Ridge, Olympic Mountains, December 31. *Photo by Greg Halberg*

March was snowy with many storms and the MLK pattern continued with one large deep-slab release with each storm. It was then at the end of the month off the high, windswept Manti-Skyline Plateau that Utah suffered its second fatality. This story will be remembered for years. A party of seven Salt Lake City expert skiers and riders, using a snowcat for access, settled upon what is known as Big Horseshoe – a steep alpine powder bowl near 11,000'. In a remarkable chain of events, one person along the ridgeline unintentionally triggered and went over with a very large piece of cornice, which in turn triggered a 4-8' deep and 350' wide hard slab on top of two skiers below assessing the structure and stability of the slope they intended to ski. The party remaining on the ridgeline conducted an excellent rescue, recovering the three victims. One that had been assessing the snowpack, however, responded to CPR but never recovered and unfortunately died a few days later in the hospital.

April was similar. It kept snowing in May as well, long after the Utah Avalanche Center was closed for the season. March, April, and May contributed to one of the wettest springs on record. The MLK crust/weakness started to slip into obscurity, but many still had it in the back of their minds as temperatures warmed.

In the end, the MLK crust never produced one significant cycle. It just made us all nervous for a long time. Compared to the previous year where we had a three-month period of human-triggered deep-slab releases, the MLK crust didn't produce activity as we thought it might. Yes, there was associated activity, and it did contribute to one fatality, but I don't think I'll look back at it years from now as a significant contributor to a widespread avalanche cycle. It certainly will remain in my head as a very unusual event.

So, I look back at the 2010/11 winter as a huge snow year with a potentially dangerous surface hoar layer and an unusual rain event that both turned out to be "non-players." Overall, the number of human-triggered avalanches was down as well as fatalities, which totaled only two. *—Brett "Cowboy" Kobernik & Drew "Hardslab" Hardesty, forecasters*


From Craig Gordon: February 9, 2011. 19 Turns: Upper Chalk Creek, Uintas – Ted and I went up to work on the Windy Peak weather station and spotted a portion of the slide from across the valley. It wasn't until we got closer to the site that we realized just how big this avalanche was. The terrain isn't extreme, slope angles average 35 degrees, though there is a 37-degree mid-slope breakover. The scary deal here is the slide pulled snow out along a low-angle ridge which only measured 22 degrees in slope angle. In addition to this large avalanche, you can see another pocket in the foreground which broke sympathetically. This is a perfect example of just how tricky surface hoar is once buried in our snowpack. *Photo by Craig Gordon/Ted Scroggin*

Mid-January to Mid-February

We had a drought during this period that made many of us doubt whether the hoped-for La Niña effects would ever materialize. The drought shows up in height of snow charts, especially at Crystal Mountain.

The second fatality of the season occurred on February 1. Well-known local skier Monika Johnson walked onto a cornice on top of Red Mountain at Snoqualmie Pass. The cornice failed, and Monika was killed in the resulting avalanche. The annual Alpental Randonee Ski Rally has been renamed in her honor.

Some spectacular wind speeds were seen on February 12 at the NWAC Camp Muir weather station at 10,100' on Mt Rainier *(speeds in mph, at right)*.

Mt Rainier Camp Muir Wind Speeds 2/12/11

Time	Min	Ave	Max
800	85	100	113
900	90	102	114
1000	91	103	114
1100	97	112	131
1200	96	114	135
1300	95	117	137
1400	105	128	152
1500	107	132	155
1600	83	120	141
1700	96	111	127
1800	97	112	124
1900	87	112	130
2000	59	83	102

By mid-February many were singing the lack-of-snow blues and wondering what had become of all the promised La Niña snow. At about this time I overheard a conversation at the local maritime watering hole:

Billy Snow Crystal: "You seen any of that La Niña snow yet?" Jack Palance: "Nope." Billy: "Seems like it ain't gonna happen." Jack: "Winter ain't over yet."

Late February through April

Well winter wasn't over yet because La Niña kicked into high gear in late winter and spring here in the maritime Northwest. The February 22 to mid-March period gave us 10-20' of snow near and west of the crest. On February 29 an off-duty patroller at Mt Hood Meadows escaped a close call due to a skilled partner. On

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NAC ROUNDUP 2010/11

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March 4 a snowboarder who was part of a film project was seriously injured near Mt Baker. After a heroic evacuation the crew later noted that all seven factors of ALPTRUTh were present.

The third fatality of the season was seen on March 5 at Mt Cashmere, which is east of the Cascade crest. A backcountry skier triggered a slab on a rollover where recent snow had accumulated on facets above the MLK crust. The accident report notes that the average height of snow in that area was 250 cm, but the height of snow at the trigger point was 45 cm.

D5, Mt Hood Meadows, March 10. *Photo by Ron Martin*

With all of the late February and early March snow accumulating on a weak facet/MLK crust combination, an enormous D5 avalanche was artificially triggered on March 10 at Mt Hood Meadows. Note the person in the lower right of the photo above.

The fourth fatality of the season occurred on the backside of Cowboy Mountain near Stevens Pass on March 27. The victim triggered a shallow wet -snow avalanche that entrained more wet snow and carried the victim into trees.

The third deluge of the season came on March 30 to April 1 with most NWAC sites getting 2-6" of rain and Snoqualmie topping out at 8.5". Another huge, natural D5 avalanche was reported on March 30 on Mt Hood, once again releasing on the facet/MLK crust combination. More examples of this deep instability were very large controlled avalanches on April 1 within the Crystal Mountain ski area. This was followed by injury accidents on April 3 and 6 at Stevens and Snoqualmie respectively.

Stevens Pass, March 31. *Photo by Mike Stanford*

The photo at left shows a snowplow that was caught in an avalanche on March 31 at Stevens Pass. Fortunately the driver was not seriously injured.

The strong La Niña conditions continued with a vengeance through April. NWAC sites near and west of the crest received another 6-12' of snowfall in April. Several sites continued to attain new height of snow maximums for the season at the end of April, well after the usual time of around April 1. Monthly average freezing levels at Quillayute, Washington, actually lowered from January (5300'), to February (3800'), to March (3550'), to April (3490').

May 1 Snow Heights & Percent of Normal

	Height	%
Hurricane Ridge	170"	187
Mt Baker Ski Area	241"	175
Stevens Pass	113"	140
Snoqualmie Pass	87"	147
Crystal Mountain	107"	149
Paradise, Mt Rainier	244"	153
White Pass	66"	228
Timberline, Mt Hood	211"	138
Mt Hood Meadows	156"	137

Roses and Twitters

We starting issuing avalanche danger roses with our avalanche forecasts this season. Our roses use elevation rings that range from 3000-7000' and divide the compass into eight parts. We also started Tweets (?), Twitters (?) Twittering (?) – at least until the next latest social media fad comes along – with about 100 twitters tweeted so far this season.

Friends of the Northwest Weather and Avalanche Center

The FOAC continues to be a great help and the recent SnowBall live and silent auction dinner netted $32,000 for their educational and other support efforts.

—Garth Ferber, forecaster

Colorado Avalanche Information Center

The 2010/11 season was a big winter for most of Colorado. La Niña made an impressive performance with over 500" of snow reported from several ski areas, and well-above-average snowfall for the northern and central portions of the state. The southern portion of the state, including the Sangre de Cristo Mountains, ended the season slightly below normal. Heavy snowfall, cool temperatures, and avalanche activity lingered well into the spring. Seven people in Colorado lost their lives in avalanches during the 2010/11 season, which makes two years in a row with above-average deaths (the 10-year average for Colorado is five people).

In most parts of the state there was significant snow on the ground by November 1. By mid-November the Colorado snowpack was well on its way toward the traditional Rocky Mountain horror show: hard slabs over depth hoar. In November there were six people caught in avalanches, with one person buried and killed. The first avalanche incident of the season occurred on October 24 when an ascending snowboarder was caught in a large slide on Mt Baldy near Crested Butte. The snowboarder escaped with minor bumps and bruises. The first fatal accident occurred when a hard-slab avalanche caught, buried, and killed Wolf Creek Ski Patrol Director Scott Kay on November 22 during a control mission.

By early December Colorado sat under favorable west to northwest flow that brought plenty of snow and wind to areas between Red Mountain Pass and the Wyoming border. This kept the avalanche danger at considerable or higher for the first half of the month. On December 5, two skiers in Dry Gulch just east of the Eisenhower Tunnel were buried in a deep, hard-slab avalanche that failed on an October snow layer. One skier was able to self-rescue, but the other was killed in the avalanche. By mid-December a "Pineapple Express" began pumping moisture into the western United States and produced over 8" of precipitation the week of December 17, resulting in a multitude of large, hard slabs around the state. Many of these were easily visible from major highways. Most of these large and deep slabs also failed on weak depth hoar that had formed from October's snow. One of the more prominent hard slabs ran naturally on Mt Trelease near the Eisenhower Tunnel off Interstate 70 *(see photo spread in TAR 29.4)*. It was a busy month for avalanche activity.

AAA President Dale Atkins at the crown of the Dry Gulch avalanche on 12/5/2010. *Photo by Scott Toepfer*

A snowboarder-triggered avalanche on Uneva Peak (1/29/11). The rider was the third person to descend the looker's-left gully. The avalanche broke into snow on both sides of the gully taking out tracks from the day before in the looker's-right gully. *Photo by Scott Toepfer*

Ethan Greene hikes up to the crown of the 1/29/11 snowboarder triggered avalanche on Uneva Peak near Vail Pass. *Photo by Scott Toepfer*

January brought a slight lull in the La Niña juggernaut resulting in below-average snowfall statewide. Most SNOTEL sites across the state showed a decrease in percent of average during the month compared to the end of December. With the decrease in precipitation the usual kinetic metamorphism kicked into full gear. Although there was below-average snowfall across the state, the month was not without storms. During a prolonged period of heavy snow mid-month, a snowboarder went missing near steep terrain on Berthoud Pass. The storm cycle closed Berthoud Pass late in the day on January 17, complicating search and rescue efforts. That evening the Stanley avalanche path ran naturally, burying the closed roadway of US 40 under 20' of debris. Search and rescue crews found the missing snowboarder with probe poles on January 19. On the 29th a snowboarder riding near Vail Pass was caught in a large hard slab. The snowboarder was the third member of the group to descend the slope. The fracture propagated into two neighboring paths which were easily visible from Interstate 70. Luckily, the snowboarder escaped with only minor ankle injuries. In January, eight people were caught in avalanches: two people were fully buried, and one person was killed.

An arctic outbreak surged into Colorado during the first week of February, bringing the coldest temperatures in over a decade. An automated station at Long Draw Reservoir, near Cameron Pass, recorded -46ºF on the morning of February 2. Temperatures on Berthoud Pass dropped to -32ºF, the coldest in 20 years. In the last 60 years, the temperature on Berthoud Pass dropped below -30ºF only 12 times. These very cold temperatures aided further development of weak, near-surface layers. Continued snowfall quickly buried the near-surface layers and set us up for the next round of avalanches.

On February 20 an avalanche buried and killed a snowmobiler while he tried to extricate his machine from a terrain trap in the Flat Top Mountains in northwest Colorado. His partner was unable to dig him out from under nearly 10' of debris. Two days later a skier was caught, buried, and killed in the backcountry of the Elk Mountains near Snowmass. The accident occurred in an area of complex avalanche terrain. Weather and avalanche conditions conspired to delay rescue attempts for several days. By the time rescuers reached the body it had been moved and reburied by a second avalanche. In February, 12 people were caught in avalanches with three people buried and two killed.

March is usually a busy month for avalanches in Colorado, and this season was on the quiet side for Colorado. There were only a handful of involvements, some close calls, but fortunately no fatal accidents. On March 8, two riders entered an avalanche path near Ophir. The first skied to dense pocket of trees on the right flank of the path. The second (a snowboarder) made a cut across the slope with no results. As he descended the slope he triggered a sluff that quickly triggered a 1-4' deep soft-slab avalanche. The slab pulled the skier from his "safe spot" and quickly stripped him of his skis and poles, then left him partially buried. The snowboarder was caught and carried in the debris and was eventually deeply buried near the toe of the slide. The skier was able to locate his partner and quickly determined this was a deep burial. Fortunately the buried victim was using an AvaLung and was able to survive 30 to 40 minutes of excavation.

On March 18 there was a close call on the north flank of Peak 1 near Frisco. A snowboarder triggered a large slide but rode to a flank and escaped the debris. Brad Sawtell (CAIC-Breckenridge) visited the site the day after the accident and estimated the debris to be over 20' deep. On March 21, a skier on Mines Peak near Berthoud Pass remotely triggered a large hard-slab avalanche. The fracture line ranged from 1-8' deep, propagating some 700' wide across the start zones of two avalanche paths (Mines 1 and Mines 2). The debris ran full track into a terrain trap leaving debris 20-30' deep in the gully.

April continued the now familiar pattern of a northern storm track favoring the northern and central zones. Consistent snowfall with strong spring winds continued to build new slabs in the mountains. On April 1 a snowboarder was caught and buried in an avalanche near US 6 across the road and down valley from the Arapahoe Basin Ski Area. Search and rescue crews working with nearby skiers were able to rescue the buried victim after about a half hour. His partner was also caught and later evacuated with a broken leg. On April 2 another skier was caught in a large avalanche on Green Mountain near Aspen. The riders had explored the area the previous day with no signs of instability. The next day they triggered a HS-AS-R3D3 that ran to the ground on faceted snow formed in October/November. The debris ran to the valley and crossed SH 82, which was closed for the season between Aspen and Twin Lakes (Independence Pass). It struck and damaged the group's parked snowmobile. On April 4 a skier was caught, buried, and killed in a soft-slab avalanche between the Maroon Bells and the Aspen Highlands ski area. In the early morning hours of April 30 a large natural avalanche (R4-D3.5) ran near the small mining town of Montezuma in Summit County. The slab uprooted and broke several acres of mature timber and destroyed a high voltage power line tower that was originally built between 1906 and 1908. The line was upgraded in 1977. A nearby SNOTEL site had recorded a snowpack at 231% of normal for the winter as of May 1. Rings on one of the broken trees showed it was over 150 years old. In April, five people were caught in avalanches with two people buried and one killed.

Winter returned with a vengeance across the state in May. Snow seemed to fall without a break for the month. The CAIC provided public Statewide Avalanche Statements three times per week through May 30, as well as a specialized weather and avalanche forecasts for CDOT to safely clear SH 82 over Independence Pass. During the month of May, five avalanche incidents were reported, with four on May 21-22. There was one fatality for the month, on May 21, when a snowboarder in a party of three entered a steep line near the summit of Torreys Peak in the Front Range. Near the ridgeline he triggered a small soft-slab avalanche in high consequence terrain. During the 1,000 vertical foot ride he was carried through several rocky areas before coming to rest on the surface of the debris. The rescue was complicated by a winter storm with poor visibility keeping a helicopter rescue out of the equation. While being evacuated by search and rescue personnel he died from injuries sustained during the avalanche.

Totals for the 2010/11 season, as of mid-July, came to 42 people caught in avalanches, 10 people buried, and seven killed. There were four avalanche warnings issued and 1659 avalanches reported. Damage from avalanches came to over $230,000. It was a long winter. Most mountain sites in the state received well above average snowfall. As the old saying goes, unusual weather creates unusual avalanches. The winter of 2010/11 certainly fit this rule of thumb. *—Scott Toepfer, forecaster*

Chugach National Forest Avalanche Information Center

The 2010/11 winter was a season of change for the CNFAIC. All three prior Girdwood forecasters moved on to new challenges. Carl Skustad took a promotion at Superior National Forest in Minnesota. Matt Murphy moved over to the Seward Highway avalanche program with the state Department of Transportation, and Lisa Portune moved with her husband to Sandpoint, Idaho. A completely new lineup of forecasters moved in to fill some big shoes. I joined the program from the snow safety department at nearby Alyeska Resort. Jon Gellings came on full time after his internship in 2009/10. Wendy Wagner flew up from Utah in mid-January, bringing a fresh scientific perspective. Alex Mclain continued to provide observations and advisories for the Summit region in the Seward District.

The changes brought some unique challenges, and some priorities were refined as we labored to keep safety and quality at a high standard. An intern was not selected this season due to so many leadership changes. As a result the Summit forecast was reduced to Saturdays only, down from a Friday/Saturday schedule the previous year. We hope to expand back to two+ days per week next season as we all get up to speed with the program.

Despite the huge staffing changes, business as usual continued with Turnagain Pass advisories seven days per week from November 12 to April 16. We maintained our established education outreach schedule with a series of Fireside Chats in early winter and used the staff as an educational resource for the community on request. The avalanche season was abnormal due to a thin snow year and snowpack structure that was anything but maritime in character. Snowfall in Turnagain Pass was 62% of average. They said it would be La Niña, and all our observations support the definitions.

All winter the lows in the North Pacific would bounce off the blocking high over Alaska and track farther south. Month after month we watched on the satellite images as our precipitation got diverted to the Cascades, Sierra, and the Rockies. The end result was a season of shallow snow, persistent weakness, and complicated discussions but no climactic storms to completely vindicate our preaching of a dangerous snowpack. It was an eventful year nonetheless, with

From Wendy Wagner: a pic of the most rememberable aspect of last winter.....!! this pic was taken by Joe Kurtak - Tincan anti-tracks ..... brutal!

plenty of interesting avalanches to keep us busy.

Our season kicked off with a sudden storm cycle at the end of October. Two inches of snow on October 28 blossomed to 58" total depth within two weeks time. A consequence of the abrupt heavy load was a historically significant glide crack/avalanche cycle. Starting around November 9 we entered a period of numerous glide avalanches region-wide. Investigation confirmed that the ground remained warm, moist, and lubricated as the snowpack was keeping it insulated from the colder air.

A statewide freezing rain happened on November 22, an event that we would come to know as the Thanksgiving rain crust. It produced a layer of ice from sea level to the ridge tops up to half an inch thick. The event coated our entire forecast area and well beyond. The National Weather Service reported above-freezing temperatures to 8000' over Anchorage and freezing rain north of Fairbanks. No avalanches were seen in November on the rain crust, but our fears of future problems were realized in January.

After the great start to the winter in November the moisture flow shut off almost completely through the end of the year. December was dominated by clear and cold weather and relatively stable conditions. Many local skiers were able to ski classic steep lines normally reserved for deeper, late-season conditions. Snowpack temperature gradients were high for a couple weeks as relatively shallow snow reacted to cold air temperatures creating a host of persistent weak layers on top and bottom of the snowpack.

By the end of December our confidence in the occurrence of future instabilities was high. The layering structure had deteriorated significantly, especially around the November 22 rain crust. Early January finally gave us the load that tipped the balance, overcame the weaknesses, and caused widespread avalanching.

January was the second snowiest month of the winter behind November. Quite a few avalanches ran on buried surface hoar and facets. As time went on the frequency of the avalanches dropped but it continued to react easily with remotely triggered slides several days after the storms ended.

The second half of January produced giant surface hoar in the valleys. Wide swaths of terrain cultivated fields of potato chip-size hoar feathers. Some individual crystals reached over 5" in length. Fortunately this growth was confined to the lower angle areas and didn't cause problems when buried on the 19th.

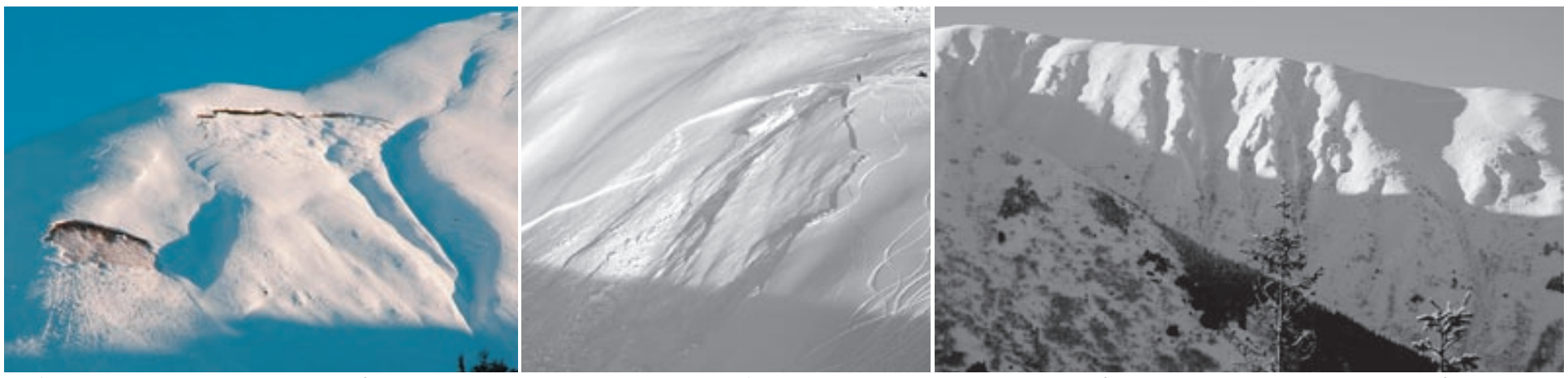
A significant avalanche rescue occurred on January 29 near Summit Lake when four skiers were swept off their ascent route. One skier was fully buried but found by a companion. Three were seriously injured and two dogs with the group were killed. The entire party was rescued by an extensive interagency effort culminating in a elicopter hoist extraction by an Air National Guard crew.

February and March were exceptionally dry, with only 31 and 20" of snowfall respectively. The snow that did fall was cold and the corresponding avalanches were large and propagated widely. March brought some of the worst surface conditions in recent memory with the drought and high wind. Scoured and raised tracks were visible for weeks. Recreational use dropped considerably even on sunny weekends due to the truly awful skiing and riding.

April continued to stay cold for the first couple weeks. Buried surface hoar caused a number of skier- and snowmachine-triggered avalanches. A ski guide was fully buried in an avalanche triggered during snow assessment work but rescued uninjured by his companions.

So far three avalanche fatalities have happened in the south-central Alaska region. All incidents happened outside our forecast zone and beyond the scope of any current avalanche advisory.

Overall it was a great season despite a lack of frequent powder. We maintain great support from the community and look forward to continue bringing quality forecasts to the public with a more seasoned crew next year. *—Kevin Wright, forecaster*



l-r: 1) Glide cracks and glide avalanches were found throughout the region in mid-November. 2) Skier- or snowmachine-triggered avalanche from around January 10 on Turnagain Pass failed on buried surface hoar – slope angle at crown was under 20 degrees. 3) Huge avalanche south of Turnagain Pass on February 3 failed on facets around an ice crust from November 27. *Photos by Kevin Wright*

2010/11 Season Summary: EUROPE

AAA European Section Summary

The AAA European section consists of about 22 members from ountries including Switzerland, Austria, Russia, Norway, Iceland, and Sweden. Many of the members maintain a longstanding connection with the American avalanche community, through work and/or friendships.

Apart from that, the EU section is not a very coherent group, so the activities last winter naturally have varied a great deal. Following is an overview of the winter and the avalanche incidents in France and Switzerland provided by David George. The total number of avalanche accidents and fatalities in all of the European countries are only available after the meeting in October of the Avalanche Commission of the International Commission of Alpine Rescue (ICAR) in Åre, Sweden.

Regarding the activities of the AAA EU members, most of us are involved in a wide spectrum of avalanche work: from engineering works, hazard zoning, education, and research. The long tradition of avalanche work in Europe is reflected by the fact that the legendary WSL Institute for Snow and Avalanche Research (SLF) in Davos, Switzerland, has been celebrating its 75th anniversary with a number of events this year.

l-r: Director Jakob Rhyner and Dr Juerg Schweizer at the reception in Davos on March 18. Dr Rhyner has now left the SLF for a position at the UN, and Juerg Schweizer has been appointed the new head of the SLF. *Photos courtesy SLF*

Less known to the Western avalanche community, at least up until the 1990s, is the Center for Avalanche Safety of "Apatit" JSC in Kirovsk on the Kola Peninsula in northern Russia. The center does avalanche research in cooperation with national and international organizations and serves the mining town of Kirovsk with avalanche forecasting and mitigation. This agency has also been operating for 75 years. Chief Engineer Pavel Chernous organized an international conference this September *(see cas.apatit.com)*. Kirovsk is certainly worth a trip, especially if you are interested in avalanche history in light of the shifting political situation in this part of the world.

A Nordic avalanche conference is to be held in Tromsø in Northern Norway on the November 4-6 *(go to www.skredkonferansen.no/)*. This is a biannual conference, rather like a small version of the ISSW, where a large share of the Nordic avalanche community comes together. The conference traditionally has invited guests from other avalanche communities such as American friends Dale Atkins and Bruce Tremper.

—Krister Kristensen, EU section representative

France

During the current 2010/11 season in France there have been 29 avalanche fatalities in 19 incidents. On the face of it this was a fairly typical season; however, the overall figures hide a concentration of fatal avalanches in the border region with Italy and in the months of December and March which saw 58% of fatal incidents. Ski-touring incidents as well as the seriousness of incidents both continued the recent positive trend.

Weather Conditions

Winter, if it can be said to have come at all, came early to the French mountains. It was possible to tour in the last week of October, and by the end of November there was normal snow cover above 1800 m. December saw weather systems bring both snow to low altitudes and rain to 2000 m on December 6 and 19. The snowfall was accompanied by strong winds. January and February saw dry, anticyclonic conditions over France so that by the end of February the snow conditions were among the worst for the last 50 years. On south-facing slopes there was little cover below 2200 m. However it was still possible to ski many routes in sheltered north-facing valleys down to 1200 m. Consulting the community ski-touring Web sites, a similar number of trips were logged for 2011 in the Savoie department as for the excellent 2010 season. Skiing conditions were generally spring-like.

March saw something of a return to winter with some weak weather systems bringing fresh snow, especially on the border with Italy and in the Southern Alps and Pyrenees. Winter sports were difficult in the Massif Central, Jura, and to a lesser extent the Vosges from January. Only the Southern Alps can be considered to have had a "normal season," and then in the areas on the border with Italy.

April was hot; temperatures were around 4ºC above average, so by the end of the month there was little snow cover below 2000 m. Due to the poor cover and warm temperatures the summer season arrived four to six weeks early.

Snowpack

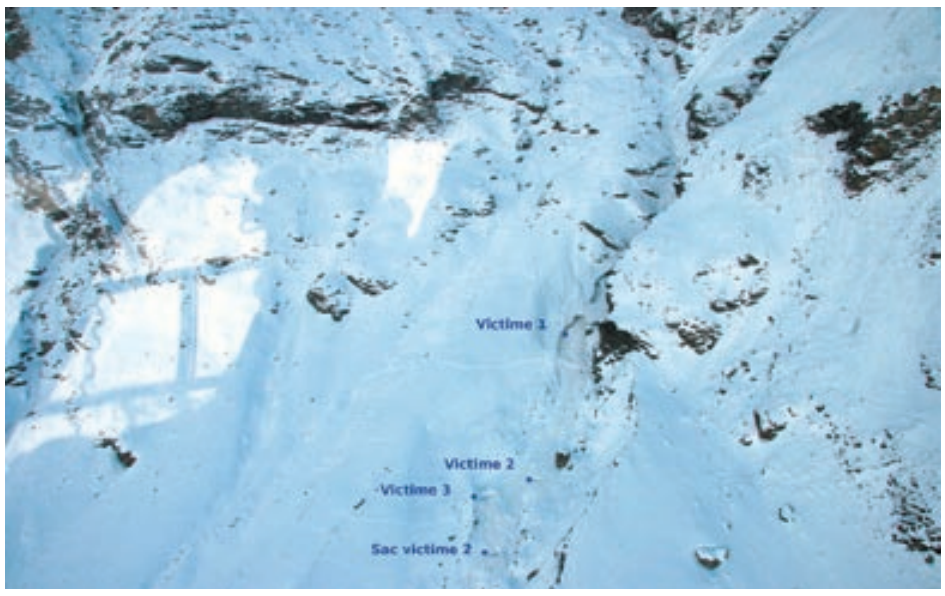
The good early season snow cover limited the formation of depth hoar except on the coldest north-facing slopes and at altitude. There were also a number of thaws with rain at altitude. As a consequence, most incidents occurred above 2400 m in the Alps. The high altitude resorts of Val d'Isere and Tignes were particularly affected from December to mid-January.

An anticyclone and strong temperature gradient transformed shaded slopes into faceted snow during January and February. South-facing slopes, where they had any snow, generally experienced spring skiing conditions. The weak layer established during January and February led to an explosive situation along the Italian border in March which saw the best of the fresh snow in the middle of the month.

Incidents

The early snows brought the first incidents including one of the most serious of the season. On November 1, three climbers from the same family, including a guide and avalanche expert, were ascending a couloir above the village of Bessans in the Savoie. At 3100 m, where the couloir reaches 38 degrees, they triggered a relatively dense soft slab some 40 cm deep. The slab broke on a layer of depth hoar. The group was taken 800 m and buried under 3 m of debris. The scale of the accident triggered a major search and recovery operation. This was followed on the November 11 by the death of a construction worker on the Iseran road pass which was closed for the winter. The crew had stopped their pickup due to the depth of snow when it was hit by the avalanche, killing the driver.

The rest of the month was calm with a thaw before a new storm cycle brought 50-80 cm in three falls over the final weekend. This was followed by cold and strong northerly winds. On December 3, Dominique Letang, director of the National Agency for the Study of Snow and Avalanches (ANENA) was concerned enough to issue the following warning: "Every winter there are three or four episodes which are particularly dangerous in the mountains. Our fear is that the good weather and fresh snow will encourage skiers to head into the high mountains while the risks of slab avalanches are really important."



Avalanche on November 1, 2010: aerial photos show the avalanche path and location of the victims. The snow profile (above) displays the weak layer that collapsed. *Photos by David George*

Saturday, December 4 was something of a bonanza for winter sports enthusiasts, but perhaps with Mr Letang's warning still fresh, many skiers opted for lower -lying ranges which were now covered in a meter of snow. They found blue skies, little wind, and half a meter of fresh powder on a good base. That evening the forums were buzzing with photos of the amazing early season conditions.

Things couldn't have been more different on Sunday morning for those skiers who had missed Saturday's powder fest; they woke to grey skies, intermittent

A shot of the very big crown associated with the avalanche that happened in the beginning of 2011, burying skiers equipped with airbags. *Photo by David George*

One of the avalanches that occurred on the France/ Italy border in the beginning of March. In this case, two skiers were caught but miraculously saved. *Photo by Alain Duclos, courtesy of www.data-avalanche.org*

rain at altitude, and a westerly that could blow the horns off a bull (as the locals say). Three ski tourers headed up to the Dome de Pravouta in the Chartreuse. This easily accessible 1700 m summit is a favorite in such conditions. However, the group left the normal route and started climbing the steep northeast slopes under the summit. A guidebook warns against these slopes when the conditions are suspect. The subsequent avalanche took the men into trees. Despite two of the group having airbags, the consequences proved fatal. The police found one of Saturday's Trip Reports in the pocket of one of the victims.

The accident came shortly after Don Sharaf highlighted the risks of being carried in the debris flow when using airbags in an article for *The Avalanche Review (see Avalanche Airbags and Industry Standards, TAR 29-1)*. It was the second fatal incident involving the use of airbags in France in 2010, and it would not be the last. On January 1, 2010, three skiers, including a local high-mountain guide, were killed by a massive avalanche in les Arcs. They had actuated their ABS but were buried under 6 - 10 m of snow. This season has seen airbag use move into the mainstream by both off-piste skiers and ski tourers, and these particular deaths should be balanced against a number of successful outcomes through the rest of the season.

Over the next month avalanche incidents were centered on the Val d'Isere/Tignes area. Close to the Italian border, these areas were picking up snow from depressions over the Mediterranean which had trouble moving further into France. In total, seven people would die in four incidents; three of the groups were instructor-led. In one incident a victim was wearing an airbag but was unable to actuate it before being buried. The most serious incident occurred on January 11 when a group of seven skiers was hit by a large avalanche, killing four. There had been light snow over the previous 24 hours, and the risk was given as 2 rising to 3 later in the day due to a thaw. There would be one further fatality in January: a member of the French Alpine Club on a tour in the Queyras region close to the Italian border. The avalanche risk was 2, but there had been considerable fresh snow and wind on the border with slab warnings issued.

Unusually there were just two incidents with fatalities in the whole of February. There was fresh snow in the Southern Alps and Pyrenees around February 17, a series of non-fatal incidents over the following weekend in those areas culminated in the disappearance of two snowshoers on a long traverse above the lac d'Oô in the Pyrenees on the 22nd. Their bodies were only found in April by relatives who had continued to search the area. Three teenage off-piste skiers were also hit by a slide at the ski resort of Corrençon in the Vercors. They were not equipped with beacons, and the delay in recovering one of the young men probably was fatal.

The anticyclone that had been sitting above France since the start of January and the clear skies had created a very strong temperature gradient in the snowpack; 10-20ºC over the 30-50 cm of snow depth at 2250 m. By the start of February the whole snowpack was comprised of facets on slope aspects from WNE through to NE. That there were no more fatalities during the February winter holiday period can be attributed to an almost complete absence of fresh snow, at least in the Northern Alps. The next major storm cycle came during the first half of March and yet again was largely confined to the Italian border region and the Pyrenees, a classic pattern with Mediterranean depressions. Some of the fresh snow was accompanied by strong winds from the southeast, forming new slabs close to summits and ridges. These slabs were then covered by further snowfall. The trap was in place.

With up to a meter of new snow, word of the great touring conditions in the Queyras was relayed across Interweb, and a number of skiers traveled to the area looking for that rare fix of 2011 powder. Conditions on some routes were described as "crowded.. In one notable instance a group of eight skiers, including an eyewitness of the Chartreuse avalanche in December, were avalanched on the Chapeau de Gendarme by another group of 25 skiers descending above them. Our eyewitness was able to ride out the slide after triggering his airbag and survived with just the loss of his new skis.

The period from March 18-20 saw the worst three-day period since February 20, 2006, when nine people were dead in seven incidents. Rescue services were stretched as they mounted back-to-back missions in a line from Val d'Isere in the north to the epicenter of events in the south, Queyras. The body of a Russian skier buried in the popular Mont du Vallons itinerary in Meribel was only recovered in June.

In the most serious incident a group of four skiers were caught on the northwest side of the Col de Beaubarnon in the Queyras. One of the group was able to free himself from the slide but was unable to save his friends. Later the same day, piste patrollers at the nearby ski resort of les Molines were caught by an avalanche on an off-piste route, killing one.

A rapid thaw followed with just two "out of season" incidents. One killed an avalanche instructor leading a club group in the Pyrenees on May 8, and the other occurred on June 4 when a German climber was killed on Mont Blanc. In both cases small slides took their victims over cliffs.

Summary

The 2010/11 season saw 29 fatalities in 19 incidents. The number of fatalities is slightly above the median figure of 28.5 (ave 31.3) but the number of incidents is lower than the median of 20 (ave 22).

On average there were 1.56 fatalities per incident, above the average of 1.46. There were four incidents with three or more victims. The last six seasons have seen a slight up-tick in the seriousness of incidents after a sustained decrease.

There may be a number of factors for the decrease in the seriousness of incidents that was observed up to 2006: better avalanche awareness and group management, improved self rescue and faster intervention by the rescue services with improved medical techniques especially for hypothermia.

So why a reversal in the trend? The last five years have also seen ski touring take over from off-piste skiing as the principal activity concerned with avalanche fatalities. 2010/11 was no exception with 10 incidents involving fatalities to ski-touring groups compared to six for off-piste skiing. A detailed analysis of French incidents by Fred Jarry of ANENA analyzed 440 accidents between October 1999 and September 2007. He concluded that climbing group – and therefore ski tourers as well as snowshoers and alpinists – were nearly twice as likely to be involved in multiple-burial scenarios. The increasing popularity of ski touring has also led to some routes getting overcrowded, especially in a poor snow year.

The number of fatal incidents by department is skewed toward the Northern and Hautes Alpes and then toward the border zone with Italy compared to the long-term average. Between 1980-2010 the Savoie, Haute-Savoie, Isere, and Hautes-Alpes departments saw 80% of fatal accidents. Last season the figure was 92%. This concentration reflects the poor conditions in the Massif Central, Jura, and Vosges as well as the Pyrenees except for the period from mid-February to the end of March.

The most deadly month was March with 37% of incidents compared to an average 17%. This was followed by December with 21%. January and February saw just 21% of incidents overall, when normally they would total 46.5%, probably due to the stable high pressure that established itself over France for much of the January-February period. February is the main winter holiday period for France with six weeks of staggered vacations and the busiest time for ski resorts and for off-piste skiing.

The overall poor season led to frustration for some ski tourers and maybe an increase in risk as they searched for good conditions. Talking of the Chapeau de Gendarme incident, Daniel Goetz, the avalanche forecaster for the Hautes-Alpes, including the Queyras remarked, "The group leader noted purges on similar aspects to their chosen route as well as a weak layer when probing the snowpack with his baton...this information should have incited them to either change their route or turn back. However the north-facing slopes were the only ones to offer good snow which tempted skiers to ski them especially as any slabs were hidden by a layer of fresh powder."

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Switzerland

In a press release issued in April 2011 the Swiss Snow and Avalanche Research Institute (SLF.ch) highlighted how a winter marked by above-average temperatures and a thin snowpack led to a very delicate situation following fresh snow in early March. The majority of fatal avalanches were recorded during this period. The number of deaths in Switzerland is already equivalent to the long-term annual average despite fewer risk 3 and 4 avalanche days.

A Winter of Exceptionally Poor Snow Cover

At the time of writing, the snow cover in the Swiss Alps is very poor. Above 2000 m the figure is 50% of the long-term average. Between 1000

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and 2000 m there is just 25% of the normal snow depth. A number of weather stations (for example Andermatt, Arosa, Grimsel, Hasliberg, Ulrichen, Weissfluhjoch) are either snow free for the first time at this period of the season or have never recorded so little snow. Records go back 60 years in some cases.

Winter 2010/11 started relatively early. Above 2000 m, mountains were already snow covered from the start of October. In particular the south of the Alps had considerable snow fall during October and November. In December it snowed frequently to low altitudes – much of Switzerland even woke up on the 25th to a "White Christmas." By the end of the month snow depths were either average or above average.

Fragile Snowpack at the End of Winter

By the New Year, the base was well stabilized in most areas. Generally snowfall was less than average in January and February. During this dry spell there was little avalanche risk over much of the Swiss mountains except for mid-January when it rained to 2000 m, leading to numerous wet-snow avalanches and creating spring-like snow conditions. Even at the start of February snow depths below 2000 m were exceptionally poor. During the long period of fine weather a strong temperature gradient transformed the snowpack into facets, and this constituted a weak layer for the fresh snow that fell at the end of February. The avalanche risk was significant right through to April for winter sports enthusiasts. *(see graph)*

The majority of avalanche accidents occurred at the end of winter, and the majority of fatal accidents were in the south of the Valais where the old snow layers were particularly fragile. Compared with previous years, there were more Low (1/5) and Medium (2/5) risk days, and consequently Considerable (3/5) and High (4/5) days were less frequent.

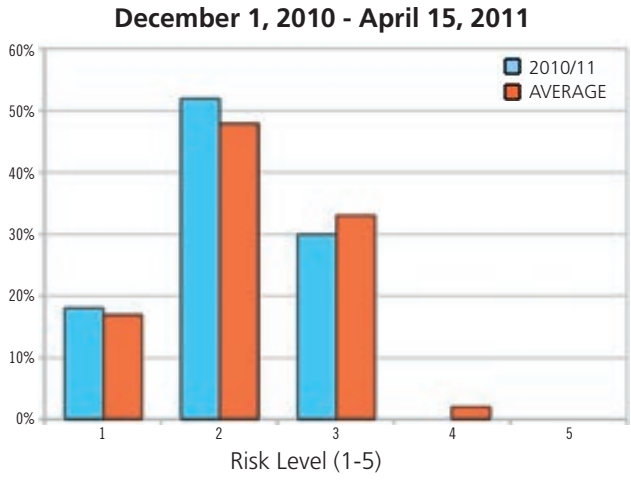
Avalanches in Switzerland, such as this one in the Simplon Pass on a north slope above 2500 m, were easily triggered by one or more backcountry travellers at the end of winter 2010/11. *Photo by C.Höhener, March 6, 2011*

A Number of Serious Avalanches at Winter's End

By mid-April, 110 avalanches involving 179 victims had been reported to the SLF. 25 people were killed in 15 incidents: 10 people died on risk 2 days, and 15 died on risk 3 days. One person is still missing; 41 other people were injured. Avalanche victims fall into the following categories: two off-piste skiers, 17 ski tourers (including snowshoeing), one climber, one heliskier, four unknown (ski tour/snowshoe).

The number of victims is equivalent to the long-term annual average. The most serious incident killed four people with one still missing at Valsorey close to Bourg-Saint-Pierre.

Avalanche Risk Level as Percentage of Total Days
December 1, 2010 - April 15, 2011



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