

**UTAH AVALANCHE FORECAST CENTER
ANNUAL REPORT
1990-91**



U.S.D.A. FOREST SERVICE WASATCH-CACHE NATIONAL FOREST

N.O.A.A. NATIONAL WEATHER SERVICE

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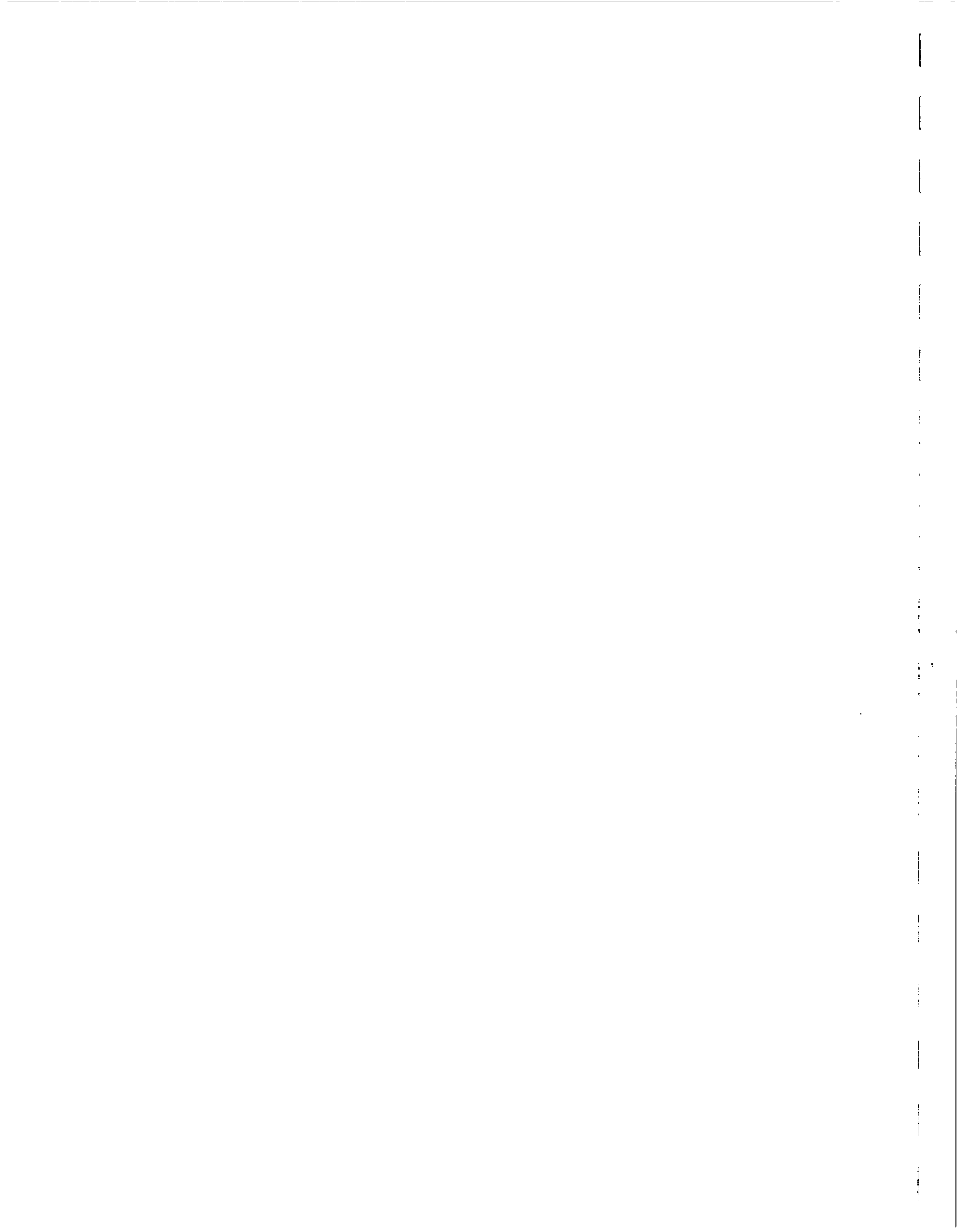
The Utah Avalanche Forecast Center is a cooperative effort between the USDA Forest Service, Wasatch-Cache National Forest, and the NOAA National Weather Service. Copies of this report can be obtained by writing or calling:

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The Utah Avalanche Forecast Center

The Utah Avalanche Forecast Center is a cooperative effort between the Wasatch-Cache National Forest and the National Weather Service. It is under the administration of the Salt Lake District of the Wasatch-Cache National Forest with offices located at the National Weather Service at the Executive Terminal Building at the Salt Lake Airport. The UAFC has three charters:

- Issue backcountry avalanche advisories to the public via a network of avalanche hotlines.
- Issue mountain weather forecasts for both the public and the cooperators in the UAFC information network, which includes the ski areas, the Utah Department of Transportation, and any other agencies in need of an accurate mountain weather advisories.
- Provide avalanche education to the public, through avalanche awareness multimedia lectures and short field courses. The UAFC also provides avalanche information to any interested party, which includes numerous requests from both the local and national media.

Backcountry avalanche forecasting in Utah is functionally separated into two entities--the Wasatch Mountains of northern Utah and the La Sal Mountains of southeastern Utah.

In northern Utah, the forecast covers primarily the northern Wasatch Mountains from the Utah-Idaho border near Logan to about Spanish Fork canyon south of Provo. Although very little use--and thus very little information--comes from outside this area, we also advise the public upon request for areas such as the Oquirrh Mountains, the Stansbury Mountains, the Uinta Mountains and Mt. Nebo area. The staff for this northern area includes director, Bruce Tremper, Brad Meiklejohn, Tom Kimbrough, and Al Soucie.

The second backcountry avalanche forecast area is the La Sal Mountains near Moab. In its second year of existence, Mark Yates operates this center which is funded by the Manti-La Sal National Forest. This season report includes a season summary from both of these centers, although it concentrates on the Wasatch section because it receives a vastly higher amount of use.

The public accesses these forecasts via recorded telephone messages in the following locations:

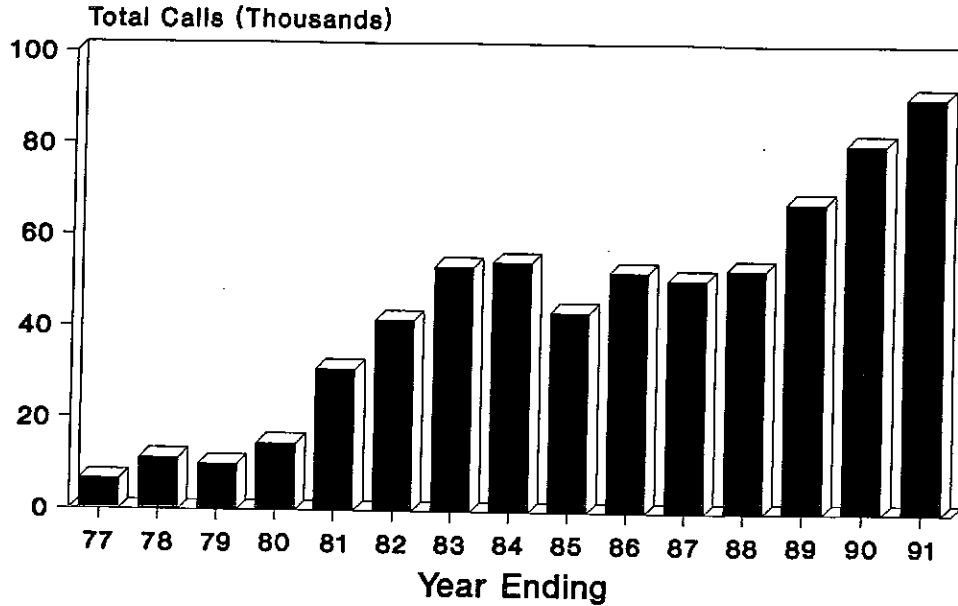
Salt Lake City 2 1/2 minute forecast (7 lines)	364-1581
Salt Lake City 5 minute forecast (2 lines)	364-1591
Park City (one line)	649-2250
Logan (one line)	752-4146
Ogden (one line)	621-2362
Provo (one line)	374-9770
Moab (one line)	258-7669

Season Highlights

The winter of 1990-91 was the eleventh season of operation for the Utah Avalanche Forecast Center (UAFC). Some of the highlights were:

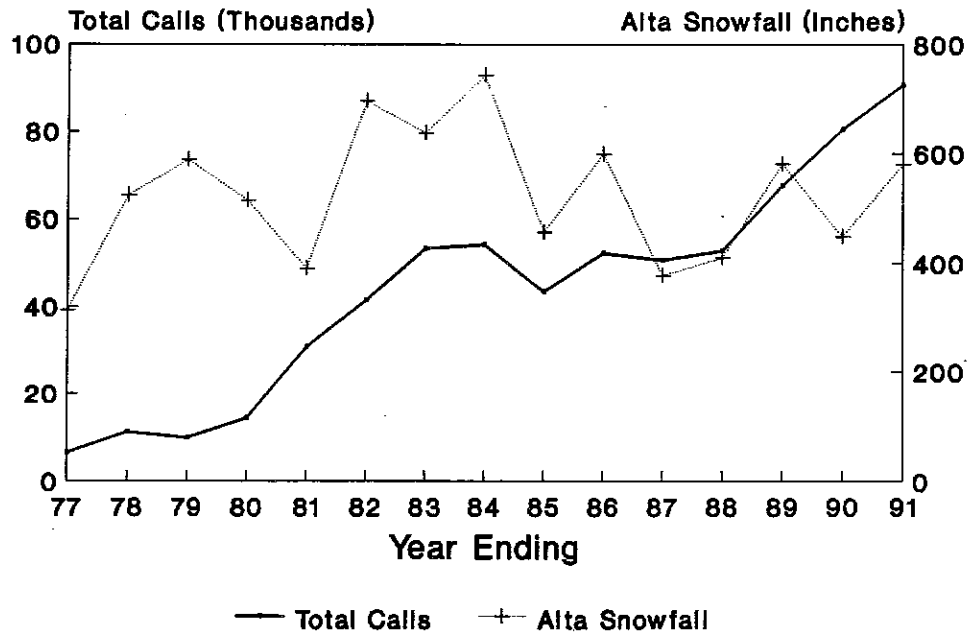
- * Once again, no avalanche fatalities occurred in Utah's mountains during the 1990-91 winter season. Only one avalanche-related fatality has occurred in Utah in the past four seasons. This is rather remarkable considering that the ten year average is 1.4 fatalities per winter.
 - * The call rate for recorded avalanche and mountain weather information continued to rise, reaching record numbers once again. 90,785 calls were received for the entire network, with 72,974 calls on the Salt Lake City recording line alone. Overall, there was an 10% increase in the call rate over the 1989-90 call season.
 - * UAFC education efforts reached 1,607 people directly through avalanche slide shows, workshops, seminars, and conferences, and several million through national media contacts.
 - * The avalanche accident rate was down this season, with 41 avalanche accidents and incidents, in which 18 people were caught, 6 people were partly buried, and one person was totally buried.
 - * Fund raising efforts continued to be successful. The non-profit group The Friends of the Utah Avalanche Forecast Center was formalized. This group raised \$4000 for the UAFC through a ski swap and a fundraiser dance, and another \$3000 was donated by individuals.
 - * We improved our network of mountain weather stations, adding one new station on top of Mt. Ogden, and contributing equipment to new and existing sites at Alta and Snowbird.
 - * The UAFC continued to make effective use of our Observer Network, receiving 200 reports from 8 individuals, at a total cost of only \$2400.
-

Total Calls to UAFC Recording 1977-1991



The total call rate for the UAFC continues to rise. This season's calls totaled over 80,000

Calls versus Alta Snowfall



Call rate versus annual snowfall at Alta. The call rate continues to rise at a rate independent of the amount of snowfall.

Introduction

The greatest puzzle that we face as avalanche forecasters is why more people do not die in avalanches in Utah. Several hundred thousand backcountry recreationists enter the Wasatch each winter, while up to 10,000 avalanches happen all around them. This season alone, 46 people triggered avalanches in the backcountry, 19 people were caught by these avalanches, 7 were partially buried, and one was totally buried. The odds suggest that we are teetering on the brink of a disaster. Yet another winter has passed and everyone came home alive.

Our next door neighbors in Colorado seldom see a winter pass without at least 5 people dying in avalanches. Much as we at the Utah Avalanche Forecast Center would like to claim credit for the low avalanche fatality rate, most of the reason lies in the geographic difference. Colorado suffers from a continental snowpack, meaning that cold temperatures and shallow snow depth create thick layers of persistently weak depth hoar. With depth hoar as the foundation, and hard, stiff slabs created by persistently high winds as the overburden, instabilities linger for weeks, sometimes months. Plus, Colorado's mountains are numerous and large, and the avalanche paths are the stuff of movies"-steep, long, and unapproachable.

In contrast, we in Utah forecast for one linear mountain range that bristles with instruments, and contains more avalanche professionals per square mile than any other place in the world. Scarcely a snowflake slips by without being reported. In short, we have an ideal situation for a regional avalanche forecast program. The public has also come to depend on this with their lives. They have come to expect very detailed avalanche advisories which tell them exactly what conditions to expect, where to find them, and useful clues on how to avoid the hazards.

We offer both a 3 minute and a more detailed 5 minute recorded advisory, which as far as we know, are the most detailed and accurate avalanche and mountain weather advisories available anywhere in the world. We aim to take the mystery out of avalanches, to give the public useful information, which they can use to make their life and death decisions. The continuing trend of an almost negligible avalanche fatality rate in Utah proves that this philosophy works and works well. As far as we know, no one who has called our avalanche advisory before going out has ever been killed. And more and more people keep calling.

The numbers continue to rise"-increases of five or ten percent per year. On a busy sunny weekend upwards of a thousand people call our avalanche hotlines and venture forth with the best, and really the only, tool for staying alive in avalanche terrain"-knowledge.

Our philosophy is to make the advisories not only accurate and detailed, but also entertaining. Instead of sounding like a bureaucratic recording couched in cover-your-rear jargon, we tell it like it is, and we do so with humor and professional delivery. Often we feel more like radio personalities than avalanche forecasters, but the "spoon full of sugar" approach works well, as the numbers seem to prove.

Changes this Season

Video Project

With a \$9,000 challenge cost share grant from the Forest Service Regional Office, combined with \$5,000 in private donations, we completed most of the filming for an avalanche education video. UAFC director Bruce Tremper has taken the lead on this project, serving as the writer, producer and remote cameraman. Video specialist Kelly Rigby was also contracted for camera and editing work. The video concentrates on the specifics of exactly how do you stay alive in avalanche terrain. It covers four aspects of avalanche safety: safe travel techniques, stability analysis, rescue, and the human factor of perception and group dynamics.

We interviewed a dozen avalanche experts from both North America and Europe, and their testimony will narrate the video as much as possible. Most of the cut-away shots were filmed in Utah, but we have also aquired avalanche footage from all over the country. We will do a rough-cut edit this summer and film some additional footage to fill in holes this following season. The video will be produced under the banner of the Wasatch Interpretive Association.

Mt. Ogden Weather Station

This season, we culminated a long-time dream of installing a wind direction and wind speed sensor on Mt. Ogden. This site, which is equipped with Taylor heated anemometer and wind vane, as well as a temperature sensor, has worked incredibly well. Now we have confirmed our suspicions that Mt. Ogden is one of the windiest locations in the Wasatch, and that it experiences very heavy riming. Winds up to 100 mph were recorded on several occasions, and the heating units kept the equipment free of rime. However, on one occasion, several feet of rime built out away from the tower and blocked the wind, although the anemometer itself was free of ice. Far and away this site is our best telemetered weather station.

The instrumentation which we cooperatively purchased with Alta and Snowbird during the 1989-90 season was installed at four locations this winter, and all four sites have functioned satisfactorily. There has been some problem deciphering the data from the Collins weather station at Alta, because Daniel Howlett, the "mad scientist of Alta" kept "improving" the micrologger program.

With respect to weather stations, one of our best sites, Logan Peak, fell off our most-trusted list when its wind data became suspect. It appears that the direction vane needs to be realigned, which may be a summer program for Campbell Scientific.

Doug Abromeit Oversees UAFC Program

In our second year with under the supervision of the Salt Lake Ranger District, the UAFC was placed under the direction of Doug Abromeit, Winter Sports Specialist. Doug has been with the Salt Lake Ranger District since 1985 as a Snow Ranger, recently succeeding John Hoagland as the coordinator for USFS winter recreation programs on the Salt Lake District. Doug is very familiar with the UAFC program, is supportive of it, and eager to take an active role in UAFC operations. Doug was recently named the Director of the Center of Excellence for Avalanches, a USFS program which we hope will yield future possibilities for the UAFC.

Al Soucie Returns

After a two year experiment on the East Coast, Al Soucie returned to the West and to the UAFC. In a formal arrangement with the Salt Lake Ranger District, Al worked two days in the UAFC office and one day in the Tri-Canyon backcountry. Al stepped with grace and ease back into the system that he had left in 1988, and he lost no time coming up to speed with new program operations. It was great to have Al's wealth of knowledge and experience back, and we are glad to know he will be staying for good this time.

Network Computer System

The National Weather Service installed a NOVELL intra-office computer network that ties together all the computers within the building, including the AFOS and DATACOL systems, making file transfers much faster and simpler.

Bruce Tremper worked very hard to take the network a step further by connecting the ski resorts and other cooperators into this system. Now many of the avalanche control workers can quickly access not only UAFC and National Weather Service forecast products but satellite images and weather maps as well. This pilot system is the only one of its kind operating in the country. It has been a quantum leap forward not only for our office but for the ski areas to acquire and exchange information.

Bruce also completed work on a scheduler which runs on our old IBM PC and accesses all 12 of the mountain weather stations once every hour. This data is now updated on the network every hour, making quick, easy access of mountain data not only by us, and the ski area avalanche control teams, but the National Weather Service, and the Rivers Forecast Center.

Season History - Northern Wasatch Mountains

Early Season

Every year in late Summer the first hints of Winter arrive in the high country. Those of us who make our living attempting to stay one jump ahead of the avalanches, feel the frosty air and wonder what surprises the coming season holds. This year at Big Fork, Montana, site of the 1990 International Snow Science Workshop, several days of rain had many snow watchers wondering if this could be a big Winter coming up. But it wasn't. At least for Utah, it was an average winter which played out like a fireworks display; there was a steady fusillade of heartwarming showers and it ended with a grand finale--a record-setting snowy spring.

The avalanche season began along with the deer season, as an Alta ski patroller hunting in the high country, almost found himself bagged by an avalanche. Carrying a rifle rather than a transceiver, he was lucky not to have gone down with the slide he triggered in a steep gully.

Despite floods in the Northwest and cactus sprouting at the California ski areas, November was kind to the Wasatch. While far from providing plentiful powder, four storms moved through. As usual, just as ski area managements began to worry about loosing the Thanksgiving holiday, a last minute storm blasted in, and got most everyone open. Then the weather cleared for the huge crowds. They came from all over the country, and not only through Thanksgiving but through the Christmas holidays as well. The Wasatch had the best conditions in the nation through this period and the flakes of Winter, especially those from California, were plentiful in the Wasatch. To the benefit of Utah, the California drought continued until nearly March.

December

December weather can be summarized by the word COLD! As in November, the principle storm arrived in mid month, with slides running in the new snow, once again with Avalanche Warnings. The cold temperatures that followed broke records all across the West. All-time low minimums and maximums were recorded for several days at the Salt Lake airport. A few slides were triggered by skiers but only one person was caught. Because of the cold, backcountry skiing conditions remained excellent for long periods, as long as people dressed warmly.

January

The Avalanche Dragons didn't seem to really come awake until January. On Saturday, January 11, a rare, light rain fell on the Wasatch, even up to 11,000 feet. An egg shell crust formed over the new snow within minutes. On Sunday night more snow began to fall and by morning the avalanches were on the move. Heavy snow continued into Tuesday as we issued another avalanche warning. By mid day Tuesday, the most active avalanche cycle Big

Cottonwood Canyon had seen in years was in full bloom. The UDOT forecasters had closed the road and were sweeping it when a huge slide came out of Stairs Gulch and buried over a hundred feet of road with 20-or-more feet of glacier-like debris. Fortunately it didn't hit any cars but a smaller slide farther up the road did slam into a vehicle, blowing out the rear window and cutting a passenger with flying glass. At the same time search teams were working on the road in Little Cottonwood where a smaller human triggered slide covered several hundred feet of highway with no injuries. Clear skies on Wednesday revealed a high percentage of the steep terrain in the Wasatch had avalanched during the storm, almost all releasing on the fragile egg shell crust.

This same crust was the bed surface for the closest shave of the Winter on the following weekend. An off-duty ski patroller was out skiing with a snowboarder within the Summit Park subdivision when they triggered a slide on a steep slope. The patroller was able to grab a tree but the snowboarder was taken down to the bottom of the slide and completely buried"-only 40 feet from a house. The snowboarder was able to get a hand out and partially extricate himself before the patroller arrived and helped him out the rest of the way. The snowboarder had to wriggle out of his Sorrell boots to free himself from the buried snowboard. The snowboard itself was broken in several places. Neither of them were carrying beacons or shovels.

February

After the January storm, Spring arrived in the Wasatch. By February, we had to begin our early morning corn skiing report and some of us were wondering if we could start our Summer vacations a bit early. But the pattern of the winter continued, with one storm around the middle of the month. And again, the avalanche activity, while widespread, was limited to the upper layers, with the big slides breaking in faceted snow formed on the surface during the last clear spell.

March

The end of February broke the mold. A huge storm marched into drought-stricken California and continued on to Utah. The Southern storm track became active and remained so for the entire month. Storm after storm hammered California, with Utah getting the leftovers. One hundred MPH winds accompanied the first storm, building thick, rock-hard slabs, too strong to be easily human triggered. Even bombs were only occasionally triggering avalanches, but when they did, they were huge. The largest slide ever witnessed in the Devil's Castle area at Alta occurred during this time. The old faceted snow deposited early in the season was at last becoming overloaded.

Despite several unpleasant rides and near misses, no one was killed or injured by these tricky and very dangerous hard slabs. Sometimes only a seemingly trivial additional loading would be enough to tip the balance. A careful watch on slope steepness was the best technique to avoid disturbing the deep dragons. As March continued, a total of six storms, tracking mostly through the Southern half of the state, replaced Spring with Winter, which proved to be a portent of things to come.

The Spring Onslot of Snow

Several very warm days in early April aroused both people and avalanches alike with the warm and wet variety, and so much so that two avalanche warnings were required until dropping temperatures sealed them off below a 6 inch refrozen crust.

Alta ski area, which usually stays open until late April, decided to close early this season, and that should have been the first clue. The dropping thermometer signaled a real return to Winter. A low pressure center parked over the Rockies for almost a week, and dumped a fresh load of powder each day. With little wind and the newly formed crust underneath, the avalanches were quiet. Skiing was exceptional and total snow depths reached seasonal maximums. The skiers, willing to trash knees and skis on rocks in November, couldn't be dragged off their bikes and golf courses for several feet of perfect April powder. Snowbird was the only resort still open, and was jammed with smiling faces.

And the snow just wouldn't stop. The last week of April dumped a storm total of 63 inches of new snow at the Alta Guard Station, and over 70 inches at the Collins station. The 50 year

old record for April snowfall fell on the last day of the month...with more storms on the horizon. Both Brad and Tom were off on summer vacations already, leaving poor Bruce scrambling back and forth between the mountains and the office, checking out the conditions and issuing forecasts. He even had to enlist his girlfriend to record a forecast on one of the days, which she handled like an old pro. Despite the greatly reduced traffic in the mountains, several people survived close encounters, all occurring at the closed Alta Ski Area. Most accidents involved hard-core Alta locals who jumped into their favorite radical chute only to get a lesson in life without avalanche control.

The first half of May seemed to be a transition period. The several storms were less intense with longer breaks in between. But there was enough snow to keep the corn skiing from developing. Fortunately we had already enjoyed Spring way back in February. Another small snow storm arrived May 10th as Bruce departed for Hawaii on his spring vacation. Tom had just returned from vacation and took over. Abruptly with the end of the third week of May Winter ran of gas. Suddenly sultry Summer, and the greenest Utah has looked in years.

Alta Guard Station ended up with 580.2 inches of snow through the end of April, which was 119 percent of the 487 inch average. Including the additional 23 inches of snow that fell in May, it brought the season total to 602.9. Alta Lifts ended up with 103 percent of average and Snowbird 108 percent. Not bad when most all of the western U.S. considered themselves to be drought stricken.

Season History - La Sal Mountains

by Mark Yates

The La Sal Avalanche Forecast Center has completed its third season of operation. The call rate to the recorded avalanche advisory rose by 40 percent over last season, totaling 2811 calls. The advisory is updated each evening and gives detailed information not only on avalanche conditions but mountain weather, and on snow and road conditions. The advisory began this season on November 15th and ended on March 31st.

One of the most exciting changes this season was a dramatic increase in not only the use of the avalanche advisory, but an increase in the use of the Geyser Pass Trailhead. A total of 2330 people signed in--an increase of nearly four times over last season. Backcountry skiing accounts for 75 percent of the use, and almost as many people from out of the area recreated at Geyser Pass than locals. Other new services include 5 miles of skate-groomed trails, several signed and rated trails, an outhouse at the trailhead, and plowed access to three more trailheads. Also, this season, our winter recreation guide was published and distributed to local shops and trailheads.

Avalanche education efforts included an airing of the video Avalanche Awareness, a Question of Balance, as well as periodic avalanche information on the local TV station. An avalanche course is usually taught through Canyonlands Field Institute, using Utah Avalanche Forecast Center personnel.

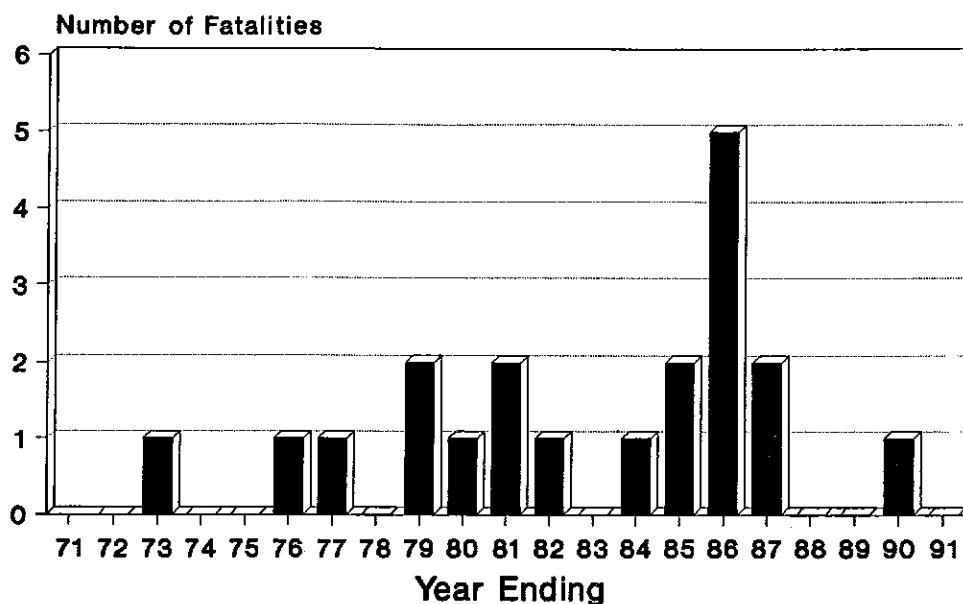
New developments for next season include: 1) the development of a winter hasty team to aid the County Sheriff winter search and rescue; 2) next season there may be a full hut system circling the central La Sal massif; and 3) the Forest Service district should complete a Winter Recreation Plan.

Weather wise, we had a slow start with, again, a below normal snowpack through most of the winter. By January, the snowpack was almost completely shallow, weak, faceted crystals and when it was loaded it brought widespread failure to the ground. Another dry spell from

mid January to mid February kept the entire snowpack faceted--quite a thing to see so late in the season. The snowpack was only three feet deep at this time. But March really kicked in dropping enough snow to get us up to an average snowpack, peaking at 90 inches at Geyser Pass. The winds in March blew almost constantly with several heavy loading events on leeward north and east aspects. Not surprisingly, some large avalanches occurred during this period.

Avalanche Incidents and Accidents

Avalanche Fatalities UTAH 1971-1991



There has been only one avalanche fatality in the past four seasons, and that one is unconfirmed. In past years, Utah had a fatality rate of 2 per season. But with the recent downward trend, the rate is 1.4 per season. We hope the trend continues.

We love it when we can call a season "average" if there were no fatalities. Over the past 10 years, the average is 1.4 fatalities per season, but over the last four seasons, there was only one fatality, and even that fatality wasn't certain. It occurred last season in the Logan Area near Tony Grove Lake. Since the body didn't melt out until late spring, the report wasn't included in last season's report, so we will include a brief description here.

The body of 24 year old Mark Miller, a backcountry skier on alpine gear who had been missing since November 25th 1989, was finally found by two springtime backcountry skiers. He had been skiing alone, so there was no one to confirm how he died. We only know that the body was found mid slope in an obvious avalanche path, and buried very close to the ground.

Bruce Tremper examined the site a day after the body was found and extricated and he found that it was certainly not a clear-cut example of an avalanche fatality. The body was found laying on it's side, with a hat and sunglasses still on, ski poles directly below him on the slope, and skis directly above him. Both skis were facing the same direction and the heel piece on the uphill ski was released. On first inspection, it appeared that he had simply fallen over in place and, for whatever reasons, could not get up again. However, the medical examiner's report came back indicating no obvious cause of death, so by default, the Sheriff and the Coroner called it death by asphyxiation in an avalanche, and we will call it that as well.

He was first reported missing as the first major snowstorm of the season was beginning. Since it was so early in the storm, most of the searchers assumed that he did not die in an avalanche. Some leading theories of how he died include: 1) He triggered a very small avalanche early in the storm which simply pushed him over in place and prevented him from getting up. 2) He spent the night out in the storm, and upon returning the next day, the snow was deep enough to produce an avalanche large enough to bury him. 3) He had some unidentified medical reason (exhaustion, heart failure, hypothermia, etc.) which caused him to fall over and not be able to get up. We will never know the real answer. But we are assuming--in the absence of other data--that he is an avalanche fatality.

This season, however, everyone managed to escape the jaws of the dragon. The closest call came when an off duty Park City ski patroller and a snowboarder friend were skiing between two switchback roads in the Summit Park subdivision. They triggered a soft slab avalanche about a foot deep on a 40 degree northwest facing slope in a small clearing. The skier was able to grab trees to keep from sliding down, but the snowboarder was carried about 200 feet to the bottom and was completely buried only about 40 feet from a house. He was able to get an arm out of the snow and had partially dug himself out of the fairly soft debris when the skier arrived and helped him out the rest of the way. He had to wriggle out of his Sorrel boots, which were locked in the bindings of the buried snowboard. Although his snowboard was broken in several places, he escaped with only bruises and cold feet.

Much of the Summit Park subdivision lies on steep north-facing treed slopes, and snow usually accumulates to about four or more feet deep. Many of the local teenagers and adults alike ski and snowboard on these slopes in several fine, sparsely-treed glades among the subdivision houses. The local game involves shuttling the participants up the slope with a car via the switchback roads. As often happens, good ski slopes are also good avalanche starting zones, as this one was. The mountain above Summit Park also offers excellent skiing and sees heavy backcountry ski traffic as well. Local teenagers have even built a primitive cabin near the summit replete with stereo and hot tub--all with materials they hauled up on their backs. No doubt, we have not seen the last of avalanche accidents in Summit Park.

In other areas, we saw the usual number of close calls--people triggering avalanches and occasional taking rides in them. One person was carried into trees in Cardiff Fork. Another was buried to his neck on Kestler Peak. But some of the most frightening avalanches occurred during and immediately after the largest snowstorm of the year after Alta closed for the season. The problem comes when a place controlled for avalanches by state-of-the-art technology suddenly becomes "backcountry" when the ski patrol packs their cars and goes on summer vacation. Some of the locals were jumping into all kinds of ridiculous places. One notorious local establishment owner triggered two large and very scary avalanches in two days--one on the Baldy Chutes, perhaps the most radical slope in a canyon full of radical slopes. This one came close to hitting other backcountry skiers on the more reasonable slopes below. Our own Bruce Tremper watched the spectacle from a safe place and wished he had brought his video camera. It would have made a nice addition to the video he is working on.

Utah Avalanche Accidents, 1990-91

Date	Location	Details
10/20	Mineral Basin	1st human-triggered slide, by a hunter.
11/22	Peak 10,420	10-18" fracture at breakover.
12/15	McConkies Bowl	Skier-triggered avalanche.
12/31	Cinder Chutes, P.W.	Small skier-triggered avalanche.
1/9	Maybird	1 person caught, carried, partly buried.
1/10	Little Superior	6-18" soft slab, one skier caught.
1/11	No Name Bowl, P.C.	Skier-triggered avalanche.
1/12	Day's Fork	Skier-triggered avalanche.
1/13	Highway to Heaven	1 Interconnect skier caught, carried.
1/14	Daly Bowl	1 skier caught on low-angled slope.
1/16	Cinder Chutes	Skier-triggered avalanche.
1/19	Summit Park	1 skier and 1 snowboarder caught; snowboarder buried with hand out, skier partly buried.
1/19	Steam Mill Pk	Skier-triggered avalanche. (Logan)
1/25	Shingle Mill	1 helicopter skier buried to waist. (Sessions Mtns)
1/26	Primrose Cirque	2' fracture triggered by ice climber. Timpanogos
1/26	Mineral Fork	Small skier-triggered avalanche.
1/27	Catherine's Pass	Small skier-triggered avalanche.
1/27	Maybird	1 skier took short ride.
2/1	Porter Fork	Large wet slide triggered.
2/2	Maybird	Small skier-triggered avalanche.
2/7	West Monitor	Skier caught in point release.
2/13	Pioneer Ridge	1 skier caught, skied out of slide.
2/14	Red Pine, L.C.	Small sluffs kicked off by tourers.
2/15	Little Superior	1 person caught.
2/20	No Name Bowl	Ski released from top.
2/20	Mineral Fork	Large slide ski-released 20 turns into slope.
2/20	Maybird	Skier-released slide from collapse.
2/25	Mill B South	5 people climbed up, 4 skied down, slide released before 5th person started down.
3/2	Powder Mtn.	One skier caught, buried to waist.
3/2	Flagstaff Face	Slab released by snowboarders.
3/3	Sound of Music	Skier-triggered slide.
3/3	Pink Pine	1 person caught, carried, partly buried.
3/9	Bonanza Flat	1 skier caught, carried, held on to trees.
3/9	Maybird	1 skier caught and carried.
3/9	Kessler Peak	1 skier caught, carried, buried to neck, lost pole and ski, and was banged up.
3/9	Willow Heights	1 skier caught.
3/20	North Bowl, P.W.	Skier-triggered, hung onto bed surface.
3/22	Wellesville Mtns	Skier-triggered slide.
3/23	Maybird	Skier-triggered slide.
4/10	Tri-County Peak	Ski released, with 2nd sympathetic.
4/12	Days Fork	Skier-released slab.

4/12	Cardiff Fork	Skier caught, carried into trees.
4/14	Cardiff Fork	Skier-triggered slide, skied out of it.
4/27	Alta Wildcat	Skier triggered slide.
4/28	Alta, Lone Pine	Skier triggered slide.
5/3	Alta, Ballroom	Skier caught and went for 100' ride.
5/3	Alta, High Rustler	Skier triggered large avalanche.
5/4	Alta, Baldy Chutes	Skier triggered large avalanche.

Backcountry Observer Program

Unfortunately, the Observer Program, which had functioned effectively for the previous four seasons, ran afoul of bureaucracy and became seriously crippled. In past seasons, the observers were paid \$10 per observation and handled through a simple volunteer stipend program. But the powers that be ruled that they should be considered regular contractors, which requires a complex bidding process and invoicing by the observers. The byzantine paperwork required for an otherwise simple program proved too much of an impediment for all but the most dedicated observers. The final nail in the coffin came when as of the end of March, none of the observers had even been paid. As a result, many simply stopped calling in observations and our program was badly hurt because of this. We are unsure about how to proceed in the future.

On the brighter side, Bob Athey and Greg Dollhausen, our two most dedicated observers, were invaluable to the UAFC this winter. Bob Athey spends more time in the mountainous backcountry than any other individual and as a result has an excellent understanding of the snowpack. For the past several years, Greg Dollhausen has done an excellent job observing the avalanche conditions for the UAFC on the Park City side of the range. Both of these individuals are tremendous assets and play an important role in the UAFC. The Friends of the Utah Avalanche Forecast Center (a private non-profit group) gave Bob Athey and Greg Dollhausen \$200 cash awards for the work they performed this season.

Observer	Nov	Dec	Jan	Feb	Mar	Total
<u>Logan</u>						
Kevin Kobe	2	4	4	4	5	19
Ron Stagg	3	2	5			10
Brian Dixon		3				3
<u>Ogden</u>						
Brian Smith		2	4	3	1	11
Brad Bodily	1	1	1	4	1	9
<u>Salt Lake / Park City</u>						
Greg Dollhausen	9	14	12	4	3	42
Rip Griffith	2	3	9	5	6	27
Bob Athey	7	17	14	17	19	8
Total	22	46	49	37	34	203

Avalanche Education

Avalanche education is one of the primary missions of the Utah Avalanche Forecast Center, and we accomplish it any way we can. Our daily forecast themselves are the cheapest form of avalanche education around, offering something for all levels of knowledge and interest. Each year we are asked to speak to a wide variety of groups throughout the Wasatch Front area, and this year the appearances ranged from Boy Scout slide shows up to university level lectures. Several of the UAFC forecasters presented papers at national and international symposia, and for the first time the UAFC held it own 3-day avalanche workshop, sponsored by the Friends of the UAFC. The response for this course was excellent, and we are likely to make it an annual event.

In addition to public appearances, the UAFC staff attempt to spread their knowledge and information to the public through the printed media. Bruce Tremper, UAFC director, published a short article on avalanches in *The Weather Channel Calendar* along with a photograph of an avalanche in motion. Bruce is also the editor of *The Avalanche Review*, the official publication of the American Association of Avalanche Professionals. Over the years Bruce, and Brad Meiklejohn have had a number of articles in *The Avalanche Review* on topics such as avalanche forecasting, stability evaluation, avalanche injuries, avalanche control, as well as others. This year, both Bruce and Brad had articles printed in the local publication the *Sports Guide*, and Bruce had an article in the *Catalyst*, that were intended to improve the knowledge of the local community about avalanches and the Avalanche Forecast Center.

Date	Forecaster	Location	Topic	No. People
7/10-12	Tremper	Weather Channel Calendar	Avi Awareness	
10/9	Meiklejohn	ISSW, Montana	Safe Skiing	300
11/9-10	Meiklejohn	Alberta	Safe Skiing	150
11/13	UAFC Staff	USFS	UAFC Operation	40
11/15	Tremper	Blaster's Clinic	Recent Research	80
11/15	Meiklejohn	NWS Staff	UAFC Operation	30
11/21	Meiklejohn	Boy Scouts	Avalanches	80
11/27	Tremper/ Meiklejohn	REI	Avalanches	150
12/7	Meiklejohn	U. of Utah Dept. of Meteorology	Avalanche Weather	40
12/8	Meiklejohn	UAFC Supporters Ogden	Safe Skiing	30
1/15	Tremper	U. of Utah	Snow Physics	40
1/18	Soucie	Rocky Mtn. Rescue Dogs	Avalanches	12
1/19	Kimbrough	Sierra Club	Avalanches	150
1/22	Tremper/ Meiklejohn	REI	Avalanches	100
1/23	Meiklejohn	Park City Snowmobilers	Avalanches	20
1/25-27	UAFC Staff	Brighton Lodge Avalanche Workshop	Avalanches	25

2/12	Soucie	Park City Ski Patrol	Avalanche weather	50
2/13	Kimbrough	Kaysville Snowmobilers	Safe Snowmobiling	30
3/4	Tremper	Wilderness Medical Conference Snowbird	Avalanche injuries	80
3/7	Soucie/ Meiklejohn	Alta Library History	Alta Avalanche	80
4/15-17	Meiklejohn	Governer's Conference on Tourism, St. George		140
4/19	Tremper	Wilderness Medicine Conference, Park City	Avalanche Injuries	200
7\12	Tremper	Utah Capitol State Officials	Avalanches vs Man	100
<hr/>				
TOTAL		22 Talks	228 Hours	1927 People

Media Contacts

As usual, most of our media contacts occurred on days when we had issued avalanche warnings. Since the warnings automatically broadcast throughout the nation over the Weather Wire, we often receive calls from the press concerning warnings. This makes our job doubly interesting; just when we are the most busy"-during times of extreme avalanche activity"-we must also find time to talk with the press, and do so in a professional manner. Often, the phone rings and the person says, "Hello this is _____ from National Public Radio and we would like to ask you a few questions." Then they turn on the tape recorder.

Each season, the UAFC staff fields dozens of interviews such as this with both local and national media. This helps keep the Forest Service in the public eye for all the right reasons. This season, we had less national media contacts than in past years, but we did talk with the Associated Press on occasion, and Bruce Tremper was also featured on the Channel 2 evening news (an NBC affiliate).

Date	Forecaster	Agency	Topic
12/7	Kimbrough	Kall Radio	Avalanche Awareness
12/16	Tremper	Daily Utah Chronicle	Avalanche Awareness
1/14	Meiklejohn	S.L. Tribune	Avalanche Warning
1/15	Kimbrough	S.L. Tribune	Avalanche Warning
1/15	Kimbrough	Deseret News	Avalanche Warning
1/15	Kimbrough	KSL Radio	Avalanche Warning
1/16	Kimbrough	Salt Lake Tribune	Avalanche Warning
1/16	Kimbrough	Associated Press	Avalanche Warning
1/16	Kimbrough	Deseret News	Avalanche Warning
2/17	Meiklejohn	Salt Lake Tribune	Avalanche Warning
3/2	Tremper	KSL Radio	Avalanche Warning

3/3	Meiklejohn	Salt Lake Tribune	Avalanche Warning
3/4	Meiklejohn	Salt Lake Tribune	Avalanche Warning
3/4	Meiklejohn	Utah Standard Examiner	Avalanche Warning
3/5	Kimbrough	Salt Lake Tribune	Avalanche Warning
3/19	Kimbrough	Salt Lake Tribune	Avalanche Warning
3/23	Tremper	Channel 2 Television News	Laser Probe
4/29	Tremper	KSL Radio	End of Season

Budget

Budget Cutbacks

We could hardly believe it ourselves, but at the beginning of the season we were asked to further trim our already bare-bones budget, "just keep the doors open," as it was explained. The only trouble is that for the past several years, with our budget was already stripped to a bare minimum, just keeping the doors open usually ran us into the red. Yet we our budget was still decreased by \$6,000 from the previous season. Clearly, something had to give. At the level of the allocated budget, we would either have to lay off one of our employees and simply not forecast one or two days per week, or to simply stop forecasting at the end of February.

We partially solved the problem when Bruce Tremper, the program director, went to part-time. He worked the other half of the time on an avalanche video and was paid out of a challenge cost share grant. However, this still left the UAFC half a person down and the quality of the forecasts noticeably decreased this season because of it.

The UAFC has operated at a crisis level for several years. Even though we receive more than double the calls to our avalanche hotline than any other avalanche advisory center in North America, we operate at half the budget of either the Colorado Center, and the Northwest Avalanche Center. Since, so far, the Forest Service has not been willing to contribute more funds, we have sought support from the State of Utah. Since we have understandably found no State agency willing to give up funds for our program, it seems the legislature must allocate additional funds. Lobbying legislators, of course, requires prodigious amounts of work--all done on our spare time. It's easy to see why little progress has been made. We will, however, continue to contact legislators and attempt to find a sponsor to introduce an appropriation in the next session.

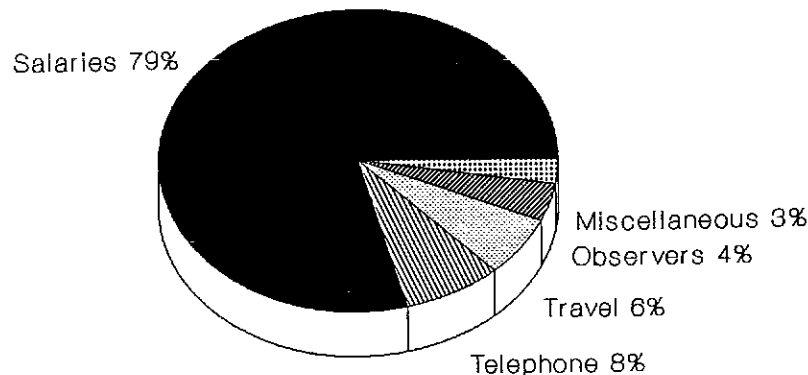
Private Fundraising

We have been somewhat successful in raising private money. The Friends of the Utah Avalanche Forecast Center became a legal reality this year, achieving its tax-exempt status. This non-profit corporation was established to facilitate fundraising for the UAFC.

During the 1990-91 season the Friends sponsored two fund-raising events, both of which were successful. On December 8th at REI \$3000 was raised through a backcountry/cross-country ski swap which drew heavy attendance. On March 9th, the First Annual Dirt Bag Ball was held at the Greek Orthodox church, with potluck supper and dance music by Zion Tribe. \$1000 was raised with this event. Many thanks to Wendy Ziegler, Dana Appling, Rob White, Dr. Howie Garber, Brad Barber, and others who have voluntarily contributed many hours of work.

Private contributions ranging from \$5 to \$500 were received made to the UAFC, totalling approximately \$3004, were accompanied by heart-warming letters of appreciation, which continue to be the best form of compliment and the best part of the job. As of this writing, over \$5,000 is in the bank account. The Friends of the UAFC use the money primarily to purchase necessary equipment which is either too difficult or time consuming to purchase through the normal Forest Service purchasing procedures. It has been a tremendous time and headache saver. It also sponsors avalanche workshops and invests in future fundraising schemes.

Utah Avalanche Forecast Center Budget Breakdown 90-91



Total Budget \$62,406

Over 80 percent of the UAFC budget goes to salaries of forecasters and observers.

Future Directions

The UAFC has finished its 11th season of operation, and appears to be in good health. The avalanche fatality rate is down, the call rate is up, the services provided are appreciated by the public; in short, the program is working. However, the UAFC has operated on a very tight budget throughout much of its history, occasionally slipping over the allocated budget simply to perform the functions of the program. The following is a list of the areas where attention needs to be paid in the future:

Multi-Line Announcer

Without question, the single greatest need of the UAFC is for a new multi-line announcing machine. The existing AEC machines which we shuffle through have been stellar workhorses, fielding upward of half a million calls over their lifespans. However, the perpetual game of musical answering machines that we have had to play to keep our recorded messages going needs to stop. The timeliness and quality of our service has definitely suffered. We need to buy a new machine. The research we have done says that we need to spend \$5-7000 for a 10 line, 2 message machine that is non-barge in (the message starts at the start for each caller) and has digitized voice.

**More
Instrumentation**

With the successful installation and operation of our Mt. Ogden weather station we have gained the confidence we need to expand our weather network. We still have some significant gaps in our network, most notably in the Provo region and in the Logan region. A wind and precipitation site in the Provo mountains, preferable in the Cascade Ridge area, and a precip. site in the Logan mountains, would be important links. Planning for expansion of our mountain weather network should be part the future direction of the UAFC, and the cost of acquisition and installment of mountain weather equipment should certainly be made a part of the annual UAFC budget.

**Take Back
the
Mountain**

Burnout has finally caught up with us. For the past several seasons, both Bruce Tremper and especially Brad Meiklejohn have worked countless unpaid hours, skiing in the backcountry on days off just to do what needed to be done. Both have done this because it was their passion; it has always been more than just a job. But the inevitable crash came this season. Days off became real days off. Also, Bruce Tremper was working part time on the avalanche video project which often took him away from needed backcountry observations. As a result, the decrease in field time resulted in a lack of understanding of the snow and avalanche conditions on several occasions. Although this information gap may not have been apparent to the public, it was noticeable in our inability to anticipate avalanche problems, to actually forecast them in advance. Our shortage of field time was also noticeable for how little time was spent in the outlying areas. For instance, not one single trip was made to the Logan mountains by UAFC staff in the 1990-91 season.

A thorough knowledge of snow and avalanche conditions throughout the Wasatch Mtns. is part of what has made the UAFC credible and successful. This knowledge has come at great personal expense of the dedicated UAFC employees. The UAFC must find a way to address this problem, and we feel it should come from increased staffing.

Perhaps the best way is to increase the pay and status of what has been volunteer, or near volunteer, observers. Without dedicated observers, such as Bob Athey the UAFC program would be in trouble. For the future, it would be worth considering having contract observers who are paid significant wages. Also, the bureaucratic snafus concerning observer payment this past season (addressed previously) pushed the lack of information to a dangerous level, one which should not be duplicated in the future.

Liability

Finally, the problem of program liability presents some unique challenges for the UAFC in the future. Avalanche forecasting, by its very nature, is an inductive process that is highly reliant on the empirical experience of individual forecasters. While dealing extensively with numbers and facts, the process of avalanche forecasting is integrated through the interpretation of available information. Each individual will assign relative importance to different pieces of data. The avalanche forecasting at the UAFC is not structured, and does not follow a commonly known process but rather an unstated, understood process. At the UAFC, the beauty of the program lies in the individual styles of the forecasters.

However, this lack of structure may pose a liability problem in the future. It has happened in the past that particular pieces of data are overlooked, or are not given sufficient weight in the overall evaluation, with the result that the information given to the public is, if not incorrect, then at least incomplete. Several attempts have been made to introduce some structure into the forecasting process through aids such as the "Hazard Evaluation Worksheet", but have met with limited acceptance, mostly because of tight time constraints. Perhaps we should fully adopt such a system into our program to show that we did go through a process to arrive at our decisions. An outside investigation at this time might view the subjective nature of the forecasting process as more random than it actually is.

Appendix

MONTHLY CALL RATE - SALT LAKE SHORT RECORDING

	NOV	DEC	JAN	FEB	MAR	APR
1979-80	714	1,514	4,274	2,967	3,389	1,313
1980-81	2,200	4,800	6,257	7,277	6,887	3,135
1981-82	1,761	6,879	8,522	5,485	6,361	3,416
1982-83	2,741	6,804	7,614	7,731	9,911	5,339
1983-84	3,216	10,708	7,073	7,032	5,983	4,396
1984-85	2,827	5,704	5,260	8,399	7,122	3,021
1985-86	4,119	4,703	6,298	10,628	6,225	3,706
1986-87	3,903	3,911	10,022	8,201	8,364	3,406
1987-88	2,390	6,534	10,201	7,297	9,208	3,780
1988-89	6,200	11,484	8,603	9,678	9,050	3,472
1989-90	3,854	7,626	14,126	12,528	10,831	3,933
1990-91	5,800	11,813	12,789	8,864	13,087	5,964

YEARLY CALL TOTALS

	SLC 3 MIN	SLC 5 MIN	LOGAN	OGDEN	PROVO	PARK CITY	MOAB	TOTAL
1976-77	6,522							6,522
1977-78	11,258							11,258
1978-79	9,924							9,924
1979-80	14,469							14,469
1980-81	30,736							30,736
1981-82	33,099							41,610
1982-83	40,355		4,357	1,890	3,671	3,042		53,315
1983-84	39,647		5,300	2,725	4,076	2,577		54,325
1984-85	32,476		4,652	1,706	2,278	2,386		43,498
1985-86	36,535		5,469	5,464	2,292	2,562		52,322
1986-87	38,841		4,693	2,587	2,518	2,121		50,760
1987-88	39,614	4,020	2,500	2,500	2,500	2,500		53,000
1988-89	48,488	8,033	2,500	2,500	2,500	2,500	1,100	67,621
1989-90	52,898	10,947	5,000	2,500	2,500	5,000	1,693	80,297
1990-91	62,814	10,160	5,000	2,500	2,500	5,000	2,811	90,785

	CALLS	ALTA SNOW (IN.)
1976-77	6,522	314.5
1977-78	11,258	524.5
1978-79	9,924	588.0
1979-80	14,469	514.0
1980-81	30,736	391.0
1981-82	41,610	696.0
1982-83	53,315	637.0
1983-84	54,325	743.5
1984-85	43,498	457.0
1985-86	52,322	599.0
1986-87	50,760	378.0
1987-88	53,000	410.3
1988-89	67,621	581.5
1989-90	80,297	448.0
1990-91	90,785	580.2

BACKCOUNTRY AVALANCHE INCIDENTS

YEAR	TRIGGERED	CAUGHT	AT LEAST PARTLY BURIED	TOTALLY BURIED	KILLED
90-91	46	19	7	1	0
89-90	65	34	14	2	0
88-89	64	9	1	0	0
87-88	39	6	(1)	(1)	0
86-87	50	18	6	3	2
85-86	66	27	12	5	5
84-85	79	39	15	6	2
83-84	M	24	M	M	1
82-83	M	M	15	M	0
81-82	M	M	M	M	1
80-81	M	M	M	M	2
79-80	M	M	M	M	1
78-79	M	M	M	M	2
77-78	M	M	M	M	0
76-77	M	M	M	M	1
75-76	M	M	M	M	1
74-75	M	M	M	M	0
73-74	M	M	M	M	0
72-73	M	M	M	M	1
71-72	M	M	M	M	0

1990-91 Avalanche Incidents by Hazard Category

HAZARD	TRIGGERED	CAUGHT	AT LEAST PARTLY BURIED	BURIED	KILLED
Low	11	4	0	0	0
Moderate	15	8	3	0	0
High	15	6	4	1	0
Extreme	0	0	0	0	0
Warning	6	3	2	0	0
TOTALS	41	8	7	1	0

Incidents by Hazard Category

	LOW	MODERATE	HIGH	EXTREME
8 YEAR AVG (1984-91)	6	25	17	2
1988-89	16	37	11	0
1889-90	4	25	35	1
1990-91	11	15	15	0

Summary of Forecast Hazard Ratings

YEAR	LOW	MODERATE	HIGH	EXTREME	WARNING DAYS	TOTAL DAYS
80-81	49 28%	73 42%	47 27%	6 3%	32	178
81-82	92 48%	67 35%	31 16%	3 2%	34	195
82-83	61 36%	81 48%	22 13%	4 2%	25	168
83-84	69 39%	83 48%	20 12%	1 1%	16	173
84-85	52 30%	90 52%	30 17%	2 1%	17	174
85-86	44 28%	82 53%	25 16%	4 3%	19	155
86-87	33 19%	81 47%	55 32%	3 2%	14	172
87-88	73 44%	54 33%	37 23%	0 0%	8	164
88-89	67 41%	54 33%	41 25%	0 0%	9	162
89-90	60 34%	61 34%	53 30%	3 2%	14	177
1990-91	63 37%	66 38%	43 25%	0 0%	16	172
11 YEAR AVERAGE	60 35%	72 43%	37 21%	2 1%	18	170

Number of Days Each Hazard Category was Used

	LOW	MODERATE	HIGH	EXTREME	WARNING	DAYS W/ AVAL.	NO. AVAL.
OCTOBER	0	0	0	0	0	1	1
NOVEMBER	15	10	5	0	2	7	80
DECEMBER	13	9	9	0	2	16	155
JANUARY	13	7	11	0	4	18	780
FEBRUARY	8	13	7	0	2	16	470
MARCH	6	16	9	0	4	20	940
APRIL	8	11	2	0	2	11	120
TOTAL	63	66	43	0	16	89	2546

Example of Avalanche Advisory

ZCZC SLCWRKSNW SLR
TTAAOO KSLC DDHHMM

GOOD MORNING, THIS IS BRUCE TREMPER WITH BACKCOUNTRY AVALANCHE AND MOUNTAIN WEATHER INFORMATION ON SATURDAY, MARCH 2, AT 7:30 AM. THE UTAH AVALANCHE FORECAST CENTER IS A COOPERATIVE EFFORT BETWEEN THE WASATCH-CACHE NATIONAL FOREST AND THE NATIONAL WEATHER SERVICE. (WHITE PINE TOURING CENTER--PARK CITY < THURSDAYS AND SATURDAY >)

IT APPEARS THAT PARK CITY GOT THE MOST SNOW OVERNIGHT WITH ABOUT 12 INCHES IN TOWN AND THE CAT DRIVERS ON THE MOUNTAIN ESTIMATE ABOUT 17 INCHES OF NEW OVERNIGHT. SOLITUDE REPORTED 12 NEW OVERNIGHT WITH STORM TOTALS OF 22 INCHES AT THE BASE AND ABOUT 30 INCHES ON THE UPPER MOUNTAIN. AT ALTA, 10-12 INCHES AT THE BASE WITH A STORM TOTAL OF 18 INCHES. DENSITIES ARE BETWEEN 8-10 PERCENT. WINDS OVERNIGHT WERE UP TO 54 MPH FOR HOURLY AVERAGES FROM THE WEST AND NORTHWEST.

AS YOU MAY HAVE GUESSED, WE HAVE ISSUED AN AVALANCHE WARNING THIS MORNING FOR THE BACKCOUNTRY OF THE NORTHERN WASATCH MOUNTAINS AND THIS WOULD BE AN EXCELLENT DAY TO GO TO A SKI AREA. YESTERDAY, I WAS RUNNING THE VIDEO CAMERA AND MY PARTNER WAS JUMPING ON CORNICES AND TRIGGERING AT LEAST 5 AVALANCHES WITH A COUPLE OF THEM SIZABLE. LIKEWISE, MY PARTNER BRAD WAS FEELING MORE COLLAPSING OF THE SNOWPACK YESTERDAY THAN HE HAS FELT ALL YEAR. HE SAID IT SOUNDED LIKE ROLLING THUNDER AND HE WAS ABLE TO TRIGGER SYMPATHETIC SLIDES 100 YARDS AWAY FROM HIM BY COLLAPSING THE SNOW WHERE HE STOOD. AND WE'VE GOTTEN AT LEAST A FOOT MORE OF SNOW SINCE THEN. YES, THINGS ARE VERY UNSTABLE OUT THERE. THERE'S A HIGH HAZARD OF BOTH HUMAN TRIGGERED AND NATURAL AVALANCHES ON NORTH AND EAST FACING SLOPES STEEPER THAN ABOUT 30 DEG AND ON SOUTH AND WEST FACING SLOPES STEEPER THAN ABOUT 35 DEGREES. THERE'S A MODERATE HAZARD ELSEWHERE. REMEMBER THAT 30 DEGREES IS ABOUT AS STEEP AS AN INTERMEDIATE TO ADVANCED RUN AT A SKI AREA. THE MOST DANGEROUS SLOPES ARE UPPER ELEVATION NORTHERLY AND EASTERLY FACING SLOPES WITH RECENT DEPOSITS OF WIND DRIFTED SNOW. THE SAFEST SLOPES ARE SOUTH FACING ONES AT LOWER ELEVATIONS IN THE TREES. BE SURE TO WATCH YOUR SLOPE ANGLES CAREFULLY. WITH THIS DEEP SNOW, IF YOU'RE ON A SLOPE STEEP ENOUGH TO MAKE TURNS IT'S PROBABLY STEEP ENOUGH TO AVALANCHE.

MOUNTAIN WEATHER:

WE SHOULD CONTINUE TO HAVE MORE SNOW THIS MORNING WITH POSSIBLY 8 MORE INCHES OF ACCUMULATION BEFORE IT BACKS OFF BY AFTERNOON. WE SHOULD HAVE MOSTLY CLOUDY SKIES ALL DAY WITH THE POSSIBILITY OF

SOME BREAKS THIS AFTERNOON AND TONIGHT. WE SHOULD HAVE YET ANOTHER WEAK PULSE OF PRECIPITATION ON SUNDAY AFTERNOON. RIDGETOP WINDS SHOULD BLOW 15-25 FROM THE WEST. TEMPERATURES ON THE RIDGETOPS NEAR 20 TODAY AND 17 OVERNIGHT. 8,000' TEMPS NEAR 28 TODAY AND NEAR 25 TONIGHT. FOR THE EXTENDED FORECAST: ANOTHER STORM ON ABOUT WEDNESDAY.

FOR MORE DETAILED AVALANCHE INFORMATION, CALL 364-1591.

YOU CAN REACH US IN OUR OFFICE AT 524-5304. (1-800-662-4140)

I WILL UPDATE THIS FORECAST BY 5:00 THIS AFTERNOON.

THANKS FOR CALLING

TREMPER

NNNN

Example of a Mountain Weather Forecast

ZCZC SLCWRKMTN SLR
TTAA00 KSLC DDHHMM

UTAH AVALANCHE CENTER MOUNTAIN WEATHER ADVISORY

MONDAY, MARCH 4, 1991
0630 HRS.

THE WINDS TO CONTINUE...

STRONG WINDS CONTINUED OVERNIGHT, WITH A PEAK GUST OF 95 MPH RECORDED AT MT OGDEN. AS OF 5 AM ONLY A TRACE OF SNOW HAD FALLEN, BUT SNOW WAS JUST BEGINNING TO FALL AT THAT TIME.

SO FAR THE STRONG, MOIST SOUTHWEST FLOW HAS NOT GIVEN US MUCH IN THE WAY OF PRECIP IN THE LAST SEVERAL DAYS. THE IMPULSES HAVE LOOKED IMPRESSIVE COMING TOWARDS US, BUT SEEM TO DISSIPATE AS THEY REACH US. IT MAY BE THAT OUR POSITION JUST NORTH OF HIGH PRESSURE IS GIVING US SOME NEGATIVE VERTICAL ADVECTION, WHICH TENDS TO SQUELCH WEATHER. BY SHEAR OROGRAPHIC LIFTING ALONE, THOUGH, YOU WOULD THINK WE WOULD BE GETTING SOME SNOW. THE SNOWFALL MODELS THAT WE HAVE TO WORK WITH ARE GIVING OUT NUMBERS OF 20" FOR THE NEXT 24 HOURS AND 10" FOR THE NEXT 12 HOURS. SO FAR THEY HAVE BEEN OVER FORECASTING FOR THE SOUTHWEST FLOW. THE NEXT 36 HOURS LOOK MORE MOIST THAN THE LAST, AND WE SHOULD SEE PERIODS OF SNOW THROUGH TUESDAY.

THE SCENARIO IS AS FOLLOWS: WE ARE STILL IN THE STRONG, MOIST SOUTHWEST FLOW THAT IS FEEDING A LARGE COMMA HEAD SYSTEM THAT PASSED TO THE NORTH AND EAST OF US. TO OUR NORTH AND WEST IS AN UPPER TROUGH THAT WILL BE SETTLING DOWN INTO THE WESTERN GREAT BASIN OVER THE NEXT 36 HOURS. THIS TROUGH IS BRINGING WITH IT COLDER

AIR, AND SHOULD BE RESPONSIBLE FOR GIVING US SOME GOOD SNOW TONIGHT AND TUESDAY. THE IDEA IS THAT THE FLOW OVER THE WASATCH WILL BECOME MORE WESTERLY AND COLDER AS THE TROUGH SETTLES IN TO THE WEST OF US. THERE IS A COLD FRONT THAT IS EXPECTED TO REACH AROUND MIDDAY ON TUESDAY.

IN MY MIND I SEE SEVERAL PROBLEMS: THIS IS FAR FROM A CLASSIC SCENARIO, WITH LITTLE IN THE WAY OF A NORTHWEST FLOW. AS A MATTER OF FACT, THE FLOW IS LARGELY OUT OF THE WEST-SOUTHWEST THROUGH THE PERIOD, AND BECOMES SPLIT ON WEDNESDAY. THE FLOW ALSO BEGINS TO DRY OUT ON WEDNESDAY. I STILL THINK THAT OUR BEST CHANCE FOR SIGNIFICANT SNOW WILL COME ON THURSDAY AS A FAST MOVING SHORT WAVE TROUGH WILL ENTER THE WEAKNESS LEFT BY THE FIRST TROUGH AND GIVE US A CLASSIC NORTHWEST SHOT. UNTIL THEN, AREAS FAVORED FOR A SOUTHWEST TO WEST FLOW WILL DO WELL TODAY, TONIGHT, AND TUESDAY.

I AM UNCERTAIN ON HOW THE NEXT 36 HOURS WILL DEVELOP, AND MY OVERALL CONFIDENCE LEVEL IS RUNNING RATHER LOW.

	5AM-5PM TODAY	5PM-5AM TONITE	5AM-5PM TOMORROW	5PM-5AM TOMORROW NITE
FREE AIR (10,000')				
WIND DIRECTION	SW	WSW	WSW	
WIND SPEED(MPH)	30-50	30-50	20-40	
	(WINDS UP TO 100 MPH MAY BE POSSIBLE			DURING THIS PERIOD.)
TEMPERATURE(10000')	30-35	20	20	
TEMPERATURE(8000')	35-40	25	25	
WEATHER	S-,S	S,S-	S	
CLOUD COVER	OVC,BKN	OVC	OVC	
CLOUD ELEVATION	12K	10K	10K	
SNOW LEVEL	8000'	7000'	6500'	
SNOW DENSITY	10-15%	10-15%	10%	
LIGHTNING	GOOD CHANCE OF LIGHTNING			

QUANTITATIVE PRECIPITATION FORECAST (INCHES OF SNOW):

	TODAY 5AM-5PM	TONIGHT 5PM-5AM	TOMORROW 5AM-5PM	TOM NIGHT 5PM-5AM
POW MTN/SNOWBASIN	2-5	3-6	4-8	
PARK WEST	2-4	2-5	3-6	
PARK CITY/DEER VALLEY	3-6	3-6	4-8	
BRIGHTON/SOLITUDE	3-6	3-6	4-8	
ALTA/SNOWBIRD	2-4	2-5	3-6	
SUNDANCE	2-5	2-5	3-6	

MEIKLEJOHN
NNNN

Example of an Avalanche Warning

ZCZC SLCSABSLC CSW
TTAA00 KSLC DDHHMM

UTAH AVALANCHE FORECAST CENTER
NATIONAL WEATHER SERVICE, SALT LAKE CITY, UTAH

0600 HRS, TUESDAY, JANUARY 15, 1991

AVALANCHE WARNING

AN AVALANCHE WARNING IS IN EFFECT FOR THE MOUNTAINS ABOVE SALT LAKE CITY AND PARK CITY.

TWO FEET OF HEAVY SNOW HAS FALLEN IN THE MOUNTAINS. DANGEROUS AVALANCHE CONDITIONS HAVE DEVELOPED ON MOST MOUNTAIN SLOPES. WIDESPREAD AVALANCHING OCCURRED MONDAY AND WILL CONTINUE TODAY.

THE HAZARD OF HUMAN-TRIGGERED AVALANCHES IS EXTREME ALL SLOPES STEEPER THAN 30 DEGREES ABOVE 7000'. SPONTANEOUS AVALANCHES ARE LIKELY. ADDITIONAL SNOW WITH STRONG WINDS ARE EXPECTED, AND WILL CAUSE THE AVALANCHE CONDITIONS TO WORSEN.

MOUNTAIN TRAVELERS SHOULD AVOID AVALANCHE TERRAIN AND RUN OUT AREAS TODAY.

THIS ADVISORY DOES NOT APPLY TO DEVELOPED HIGHWAYS OR SKI AREAS WHERE CONTROL WORK IS NORMALLY DONE.

FOR MORE DETAILS, CALL YOUR LOCAL NUMBER TO RECEIVE RECORDED AVALANCHE INFORMATION.

IN THE SALT LAKE AREA, 364-1581.....IN PARK CITY, 649-2250....IN LOGAN, 752-4146....IN OGDEN, 621-2362....IN PROVO, 374-9770. TO CONTACT OUR OFFICE....524-5304.

UTAH AVALANCHE FORECAST CENTER (USDA FOREST SERVICE/NATIONAL WEATHER SERVICE)
KIMBROUGH
NNNN

Letters of Support

10 N. Wood Avenue, Apt 424
Linden, New Jersey 07036
March 6, 1991

Utah Avalanche Forecast Center
337 North 2370 West
Salt Lake City, Utah 84116

Enclosed is our check for \$150.00 payable to the Friends of the Utah Avalanche Forecast Center.

Your reports give us exactly what we need to plan our skiing: where it might be good, where it might be deadly, and what the weather might be. While we're in Utah, we dial your number at least once a day. We think the reports are perfect for content, length, and humor. The only change we can suggest is that you be given more resources to do your work.

We always mention the Avalanche Forecast Center as one of the most important reasons for travelling to Utah for backcountry ski touring. We have gone touring in other places - the Tetons, the Sierra, the Cascades, and the Alps - and none of them comes close to providing the kind of detailed, helpful information that we need for planning our tours.

So now we just keep coming back to Utah, and tell others to do the same. Last year we took some friends from New Hampshire on a tour from the Millicent lift to Wolverine, Twin Lakes pass, and out Silver Fork. This year they were back on their own.

And the word is spreading. Last Sunday we were going up the quad at Park City with a couple from France. They also had earlier made the trek into Puma bowl and managed to avoid getting blown off the ridge. They asked us if they could use alpine touring gear in the Wasatch like they have done around Val d'Isere. We said, "Yes, the terrain is perfect for ski mountaineering: steep slopes, no long flat approaches. And what makes touring in the Wasatch better than Val d'Isere is access to detailed, reliable avalanche information from the Avalanche Forecast Center." Their reply: "Oh yes, we know about them."

Sharon Marsh Roberts

Sharon Marsh Roberts

Kenneth Roberts

Kenneth S. Roberts

Al,
Good work,
I filed this
- Abro



Jan 26, 1991

Dear Al,

Thanks for the great presentation you gave to us on Jan. 4th. We appreciated seeing the slides and going over route finding and snow pit information. We are lucky to have the avalanche forecasting center in our area and appreciate being able to take advantage of your expertise.

We look forward to getting together with you in the future.

Sincerely,

Margaret Gregory


Rocky Mountain Rescue Dogs Inc.
Management Committee

Mr. Micheal Sieg
 District Ranger
 Wasatch-Cache National Forest
 Salt Lake Ranger District
 6944 South 3000 East
 Salt Lake City, Utah 84121

Dear Mr. Sieg,

I received your letter concerning the idea of charging for call on the backcountry avalanche number. I understand your need for cash to support the Forecast Center, but the idea of charging for each phone call is an inappropriate way to raise money. First of all it will reduce the number of callers; myself included. For the simple fact that I call almost daily, even if I don't ski, just to keep up on backcountry conditions. It also goes against why myself and many of people I ski with backcountry ski... we can't afford to go to a resort! If I was charged every time I called and I called once a day or every other day I'd still pay (if I understand your information concerning costs of calls) from \$15.00 to as high as \$60.00 a month. For this simple fact you will effectively reduce the number of informed backcountry users.

It also upsets me that the phone company apparently makes more money on the calls than you do (again if I understand your math in the charges and monies your receive vs the money the phone company receives). I must admit when you look at the cost of these calls as a rider to an insurance policy it's pretty cheap information to save your bacon. But I feel it is not the appropriate way to raise your needed cash. I wish I had good suggestions for you, but at the moment I don't. It appears that as usual the U.S.F.S. has its priorities in timber quotas as opposed to the interests of all forest users; ie your back is against the wall as far as inside funding. If you need volunteers for fund raisers I am available, please keep me informed as to the status of funding.

Thank you for your letter,

 William E. Mulvey

RECEIVED	
SALT LAKE RANGER DISTRICT	
OCT 3 1990	
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SSS	
Resource Clerk	
Receipt/Clerk	
RESOURCE STAFF	
Fire	
HRP	<input checked="" type="checkbox"/>
SUMMER REC STAFF	
Maintenance	
Protection	
Trails	
WINTER REC STAFF	
Winter Tech	<input checked="" type="checkbox"/>
OTHER AGENCIES	

Media Articles

USERS • GUIDE

to the
UTAH AVALANCHE FORECAST CENTER

by Brad Meiklejohn

Moderate drinker. Moderately expensive. Moderating influence. Moderate avalanche hazard. All this mumbo-jumbo about slabs and depth whores is bad enough, but these guys can't even keep their verbs and nouns straight. Do they mean the avalanches are moderately dangerous, or are the conditions moderating? It doesn't look too bad to me, I say we ski it — wanna go first?

The tape at the Utah Avalanche Forecast Center spins around 80,000 times every winter, dropping hints and tips to callers about how to get the most skiing for the least terror. Eighty thousand times a year speed dialers and fast fingers find out how good a day they are missing if they go to work. And 80,000 times a year, we avalanche forecasters cringe a little, hoping all those ears hear the words the same way — which doesn't seem likely.

For instance, last year I was climbing the ridge to Mt. Superior when I caught up with a group of tourers headed for Mineral Fork. We chatted, swapped leads breaking trail, and made the summit together. Not knowing I worked for the center, they said the avalanche forecast was calling for a low hazard, so they felt good about skiing anything. I almost fell over backward.

First, these folks were wrong — the forecast did say there was a low hazard in some areas, but not in places like Mineral Fork. Second, because these folks were basing their decisions completely on the forecast.

Misunderstandings plague our lives; sometimes you lose your girlfriend because of them; with avalanches, you might lose your life. The Utah Avalanche Forecast Center gives out more specific information about snow, avalanches and mountain weather than the general skiing public can get anywhere else in the world. This information can help you find the best and safest skiing, but if you don't listen carefully, you're wasting your time and we're wasting our breath.

So, to help you get the most out of the avalanche forecasts, we've put together this User's Guide. We hope you find it moderately useful.



PHOTO: COURTESY U.S. FOREST SERVICE

Call Every Day.

The morning advisories are the cheapest form of avalanche education you'll find anywhere. We update the forecast every day (even holidays) by 7:30 AM, and on most days we'll update it again at four in the afternoon. If you call every morning, whether you're going skiing or not, you'll get more than the equivalent of the best avalanche courses around. By calling every day, you can follow the history of the snowpack, which will help you make your own stability evaluations. Besides, what better way is there to start your day than with an off-beat mix of facts and humor?

The "H" Words

We bury them, we whisper them, we don't say them at all, and still they are the only words most callers want to hear. After listening for 2.5 min-

utes, the condensed version you tell your ski partner the "avalanche danger" is (pick one) low, moderate, high, or extreme. We hate these words; they stick in our throats. But we have to use them.

The "h" words are the hazard categories, and they came in to use when public avalanche programs began back in the Pleistocene. Some of you might remember the days when all you got was a bland government voice intoning that "there is a moderate avalanche hazard on all steep open slopes and gullies...zzz". The hazard categories were meant to summarize in one word the avalanche conditions on every slope in Wasatch. Kind of like calling Utah "pretty, great".

The trouble with the "h" words is that they force too much information into too little meaning. What's more, there is no avalanche hazard until a person gets in the way of an avalanche (or triggers one). Avalanche hazard really is a personal matter, and depends on the route you choose. We can tell you about the snow, but how can we forecast how smart or stupid you will be? But, like it or not, our legal advice says we have to use the low-to-extreme scale.

While the top and bottom of the scale seem obvious, it is the middle, or moderate, part that gives us trouble. Far more avalanche accidents happen on moderate hazard days than during any other time. The reason? More people are out skiing on "moderate" days than "high" days, and the snow

is more unstable than on "low" days. In the same way, most avalanches happen during storms, but most avalanche accidents happen on sunny days.

Each of the hazard categories tries to describe the degree of instability of the snow, the distribution pattern of instability, and the size of the avalanches that might occur. A moderate hazard might mean there are a few big avalanches you could trigger if you fell a lot, or it might mean there are lots of small slides that you could ski cut, or maybe a moderate number of medium-sized avalanches that could release while you were skiing.

Although I hate them, here are the accepted definitions for the hazard categories:

LOW: Mostly stable snow exists, except in isolated pockets. Human-triggered avalanches, except small slides, are unlikely. Explosives or large falling cornices may release slides.

MODERATE: Localized areas of unstable snow exist. Human-triggered avalanches are possible and may be dangerous.

HIGH: Widespread areas of unstable snow exist. Human-triggered avalanches are likely, and natural or spontaneous avalanches are possible.

EXTREME: Widespread areas of unstable snow exist. Human-triggered avalanches are certain and large, destructive natural avalanches are possible.

(Continued on next page)





The Skiers' Source

REI has everything you need for winter fun. Shop our huge selection of gear and clothing for downhill and cross-country skiing. Our expert ski shops provide a full range of services. Check out our selection of rental skis too. And REI always offers friendly, knowledgeable service.

What's in store:

REI RE-GRAND OPENING
 Friday, January 25 - Sunday, January 27
 &
WINTER WRAP-UP SALE
 Friday, January 25 - Sunday, February 3



Quality Outdoor Gear and Clothing Since 1938
 Salt Lake City: 1122 East Brickyard Rd. (Brickyard Plaza)
 (801) 486-2100



PHOTO: BRUCE TREMPER

Avalanches (continued)

Over the past 10 years, roughly 35 percent of the days in a winter season are low hazard days, 40 percent are moderate, 20 percent are high, and 1 percent of the days are extreme. We usually issue 10-20 avalanche warnings in a season.

On any given day, we may have a low hazard in one area, moderate in another, and a high hazard in a few spots. If you want to get the most out of the forecast and out of the Wasatch, stop waiting for the "h" words and listen to the details of what the forecast is saying. We'll tell you where, when and how to find the best, worst, safest, and scariest snow.

Just the Facts

It snows more in Little Cottonwood Canyon than it does in Park City. The sun shines more on south facing slopes than north. The wind blows harder on the peaks than in the valleys.

These are facts, things that we know. What you may not know is that these facts, and a multitude of other factors affect the snowpack and determine where we will have avalanches. Each region, each canyon, each slope will have different conditions, some safe, others deadly.

We try to pinpoint the areas of highest hazard by region (Salt Lake, Provo, Park City, etc), by location within that region (Big Cottonwood canyon, South Fork of the Provo, etc.), and for specific kinds of slopes in each location (east facing, open bowls, steeper than 35 degrees, above

10,000', etc.). Obviously we can't look at each slope in the Wasatch, so we have to generalize a bit. We use the factors of slope angle, elevation, and slope aspect, to outline the patterns of stable and unstable snow.

Slope Angle

If you have only one avalanche skill, it should be in evaluating slope angles. The primary question you should ask yourself at the top of any slope is "Is it steep enough to slide?" Unfortunately, the slope angles that make for enjoyable skiing make for unenjoyable avalanches. Slab avalanches can run on slopes from 25 to 50 degrees, and here in the Wasatch, slabs are most common on slopes of 35 to 45 degrees.

So how steep is 35 degrees? 35 degrees is about as steep as most expert runs at the ski resorts, and the entry into High Rustler at Alta is about 40 degrees. Few avalanches start on slopes less than 30 degrees, and there is lots of good skiing on these lower angled slopes. Slopes over 40 degrees should be avoided on any but the most bombproof days.

Fortunately most people over-estimate slope angle, so that they think a 35 degree slope looks like a 45 degree slope. You can find cheap slope meters in the hardware store for less than \$5.

Elevation

Everything about the weather changes as you go up in elevation; temperature, wind, precipitation. Since weather is the architect of the snowpack, the snowpack is going to change as you change elevation. Here in the Wasatch, the avalanche conditions often worsen with elevation because more snow and wind occur the higher you go. Avalanches can occur in the foothills, but here in the Wasatch, most avalanches occur above 9000', reaching a maximum around 10,000'.

It would help if you figured out the elevations of some of your favorite tours. For instance, the base of Snowbird is about 8,000 feet, Dog Lake is nearly 9000 feet, and the top of Twin Lakes Pass is about 10,000 feet. There are no peaks above 10,000' north of Millcreek Canyon, although peaks in the Ogden and Logan mountains are just short of that level.

Aspect

Aspect is a fancy way of saying which way the slope faces. The influence of wind and sun vary depending on the aspect of the slope. For instance, a north facing slope gets less sun than a south facing one, and west winds scour snow off west aspects while loading east aspects. The snowpack through the early and mid-winter is often weakest on north facing slopes, while in the spring-time, slopes that face the sun will see more wet avalanches than shady slopes. The best skiing is usually on north facing slopes, but the majority of avalanches, as well as avalanche accidents, also happen on these same slopes.

In case you can't keep it straight, east is where the sun rises in the morning, west is where it sets. South is where you go to ride your mountain bike, north there are only sheep and savages.

If you understand the way we use these variables, "a high hazard on north facing slopes above

10,000' and steeper than 35 degrees" will sound like more than just "high hazard."

Know the Wasatch

Our forecast area is the Wasatch Mountains from the Utah-Idaho border in the north to Spanish Fork Canyon in the south. We break the Wasatch into five areas (Logan, Ogden, Salt Lake, Provo, and Park City), and put out separate recordings to fit the conditions in each of the areas. For instance, the avalanche conditions on the east side of the range are often different from those in the Cottonwood canyons, so a call to the Park City recording might help if you intend to drop in to Dutch Draw.

Logan Mountains: 752-4146

Includes the Bear River and Wellesville ranges. Extends from the Utah-Idaho border in the north to Sardine canyon in the south.

Ogden Mountains: 621-2362

Includes the Wasatch Front from Sardine canyon in the north to City Creek Canyon in the south, as well as James Peak and Durst Mountain to the east.

Salt Lake Mountains: 364-1581

The meat-and-potatoes section. Primarily the Tri-Canyons (Millcreek, Big and Little Cottonwoods), but includes City Creek in the north to Box Elder peak in the south, and the Park City/-Big Cottonwood ridgeline in the east. Occasional information from the Stansbury mountains.

Provo Mountains: 374-9770

The Wasatch Front from Box Elder in the north to Mt Nebo in the south, and east to Daniel's canyon.


Park City Mountains: 649-2250

The eastern side of the Wasatch from Lamb's canyon in the north to the Snake Creek/Ant Knolls region. Occasional information from the Uintas.

Don't Take Our Word for it

We are doing the best that we can, but there are only three and a half of us. We cover a large area, with a wide variety of conditions, and we sometimes make mistakes. Frankly, the amount of faith people place in us is out of proportion, and this scares us. Every time someone is caught in a slide, we feel a personal responsibility — even if our forecasts were accurate.

Please take the time to learn about avalanches for yourself so you can see when we've blown it before you get blown away. Take an avalanche course; there are some good ones, including ones that the Utah Avalanche Forecast Center staff teach. Read books. Dig snowpits; the snow may look white at first, but there is a lot going on down there. You wouldn't cross the highway with blinders on, would you?

Finally, if you are already up to your neck in the steep and deep, learn how to practice "Safe Skiing", which I will cover in the next issue. 

(Author and backcountry forecaster Brad Meiklejohn has even been known to take his own advice.)

The Salt Lake Tribune State/Local

Wednesday Morning—January 16, 1991
Section B Page 1

2 Avalanches Pour Across Canyon Roadway

Massive Slide, Smaller Slip Trap Vehicles Between

By Stephen Hunt
Tribune Staff Writer

BIG COTTONWOOD CANYON — Tons of wet, heavy snow roared down the steep slopes of Big Cottonwood Canyon Tuesday afternoon, blocking the road in two places and trapping two cars and a UTA bus between the slides.

Up to 200 people were stranded in the canyon until workers using equipment cut a path through the hill of snow Tuesday night.

Four people whose car was pushed off the road by the avalanche suffered minor cuts and scratches from flying glass when the car windows exploded from the force of the snow, said Salt Lake County Fire Lt. Dennis Steadman.

The four victims escaped the car and kept warm inside the UTA bus until Salt Lake County Sheriff's search and rescue teams reached them. The four injured were taken to LDS Hospital, where they were expected to be treated and released.

The slides were reported about 2:30 p.m. The largest slide occurred 1½ miles from the mouth of the canyon in the Storm Mountain Slide Area and was estimated to be 25 feet deep and 200 feet long.

A smaller slide occurred about one mile above the Storm Mountain slide, and just below the "S" curve, said Sheriff's Sgt. Larry Sistrucos. That slide was only about 4 feet deep.

Jim A. Eberling, Utah Department



Heavy equipment is used to cut a path through an avalanche in Big Cottonwood Canyon. The slide blocked about

200 people from leaving. Shortly after 8 p.m., workers shoveled a path through the slide, allowing buses through.

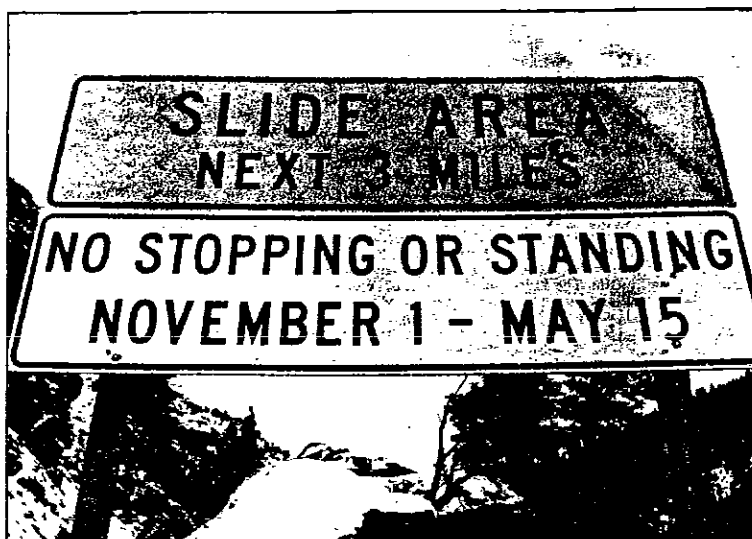
of Transportation highway operations supervisor, described the lower slide as a wall of snow. He said minor snow "slugs" block the road, "every other year" so, but an avalanche of this size was unusual.

The four injured were taken from the slide area at about 7 p.m. in a sheriff's snow-transport machine. Waiting in the bus with them were about 20 UTA passengers and six other stranded motorists, Lt. Steadman said.

Rescuers rushed to the scene and used avalanche probes and rescue dogs to determine if any cars were trapped beneath the snow, but rescuers were confident no one was buried, Lt. Steadman said.

Meanwhile, heavy equipment dug at the massive pile of snow. Shortly after 8 p.m., workers had shoveled a path through the slide and four UTA buses were being sent up to carry those stranded back to the valley, said Lt. Steadman. Earlier estimates of 500 skiers trapped by the slide were later revised to 300 or fewer after a first bus drove up the canyon and counted the people. Lt. Steadman said keeping the alders at the ski resorts overnight was not considered because electrical power was not at Brighton.

As night was falling and a new storm began laying down more wet snow, the American Red Cross was on the way to the scene with hot drinks and doughnuts for rescue workers.



A large snowfall in a short time is one way that snow can become too "loaded," making it prone to break away from the mountain and become a slab avalanche, the worst kind for skiers and other outdoorsman.

Curtain of snow can kill

By LINNEA LUNDGREN
Chronicle Feature Writer

The Wasatch Mountains are known for the greatest snow on earth. Every winter thousands of people flock to the hills to enjoy the wonderful powder. While most will never stray from the beaten path, those who do must face the realities of avalanches. These natural disasters have always plagued the slopes of the Wasatch. However it wasn't until the mining era in the 1800s that these natural disasters began taking lives. Each winter as many as 10,000 avalanches occur in the Wasatch—ranging from harmless rolling snowballs to thundering slides that bury cars, cabins and people.

There are two main types of avalanches—loose snow or point avalanches and slab avalanches. Loose snow avalanches start at a point and spread out into an inverted V-shape as they descend the slope. Loose snow avalanches usually involve only a small amount of snow.

Slab avalanches, on the other hand, start with a large amount of snow. A slab avalanche can be thought of (in simple terms) as a plate sliding off a table top. Slab avalanches occur when a strong layer of snow breaks away from the weak layer. There is a well-defined fracture line where the moving snow has broken from the underlying snow.

"A slab avalanche is a good chunk of snow. The average slab avalanche is about half the size of a football field and is about two to four feet deep," Bruce Tremper, director of the Utah Avalanche Forecast Center said.

While there are many conditions that increase the risk of slab avalanches, one of the major factors is rapid loading. Over time snow is able to adjust to new loads of snow. However, the trouble occurs when the loading comes too rapidly.

Wind can load snow faster than anything else. Wind can transport an enormous amount of snow from the upwind side of ridges and deposit it on the downwind side of ridges in a matter of hours.

Another rapid loading factor is new snowfall. "The more rapidly the snow is loaded, the more

dangerous it is. The mountains can have 10 feet of snow over 10 days and it is usually safe (because the snow is able to adjust to the load). However, if the slopes receive 10 feet of snow in one day the potential for avalanches is very high," Tremper said.

Slab avalanches account for most avalanche accidents. Contrary to popular belief, avalanches do not come down from above and bury people. "It's not like getting hit by lightning," Tremper said. Ninety-five percent of people caught in avalanches are caught in them. Their weight on the pressed snow is enough to break the fragile bonds that hold it to the slope.

Tremper said most avalanche accidents occur in the backcountry—outside ski boundaries—where no avalanche

people these crucial seconds needed to get off the slope are wasted due to being knocked down, and/or disoriented.

When the avalanche begins moving, the victim will begin tumbling. "It feels like someone put you in a dryer and shoveled snow in there. Snow goes in your mouth,

nose, ears and under your clothing. It forms a plug in your mouth and nose so you can't breathe. Avalanches will pull every article of clothing off of you that is not nailed down."

The most dangerous situation is when an avalanche travels through trees. Avalanches travel (on average) between 40-80 m.p.h. and being caught in one is like going through a gigantic bread slicer in high gear.

"One-third of all people killed in avalanches die due to trauma—by hitting trees and rocks and going over cliffs. They don't even get a chance to suffocate, because they are already dead," Tremper said.

When the avalanche comes to a stop, it sets up just like concrete. "The snow starts light and fluffy at the top, but as it tumbles it gets ground up, heated up and becomes very dense. It is like being buried in sand." Thus, the possibility of being able to dig yourself out of an avalanche is very unlikely.

If a victim is trapped underneath the snow it is very difficult to breathe. While the snow may have been 20 percent air to begin with, it may be less than 50 percent air by the time the avalanche has stopped. If that isn't bad enough, the pressure of the snow on the victim may be so great that he is unable to expand his chest to draw a breath.

Rescue beacons are devices used by skiers to help locate a buried victim. An avalanche victim wearing a beacon can be found by his partner who also wears a beacon. The beacon acts like a metal detector and "beeps" faster as the rescuer approaches the area where the person is buried.

While the beacon's main purpose is to assist people in locating avalanche victims, some skiers use them instead as a "passport" to go beyond the safety zone. In other words, skiers think that since they are wearing a beacon they are entitled to take greater risks.

"It feels like someone put you in a dryer and shoveled snow in there. Snow goes in your mouth, nose, ears and underneath your clothing. It forms a plug in your mouth and nose so you can't breathe. Avalanches will pull every article of clothing off of you that is not nailed down," said Bruce Tremper, director of the Utah Avalanche Forecast Center.

controls exist. The typical victim of an avalanche is an experienced skier or snowboarder, male and between the ages of 18 and 30, Tremper said. "These people are experienced at their sport—skiing, snowboarding—but they aren't experienced in detecting (the possibility of) avalanches."

"When a person triggers an avalanche the first sound they will hear is a loud crack. Then it feels like someone pulled the rug out from underneath them," Tremper said.

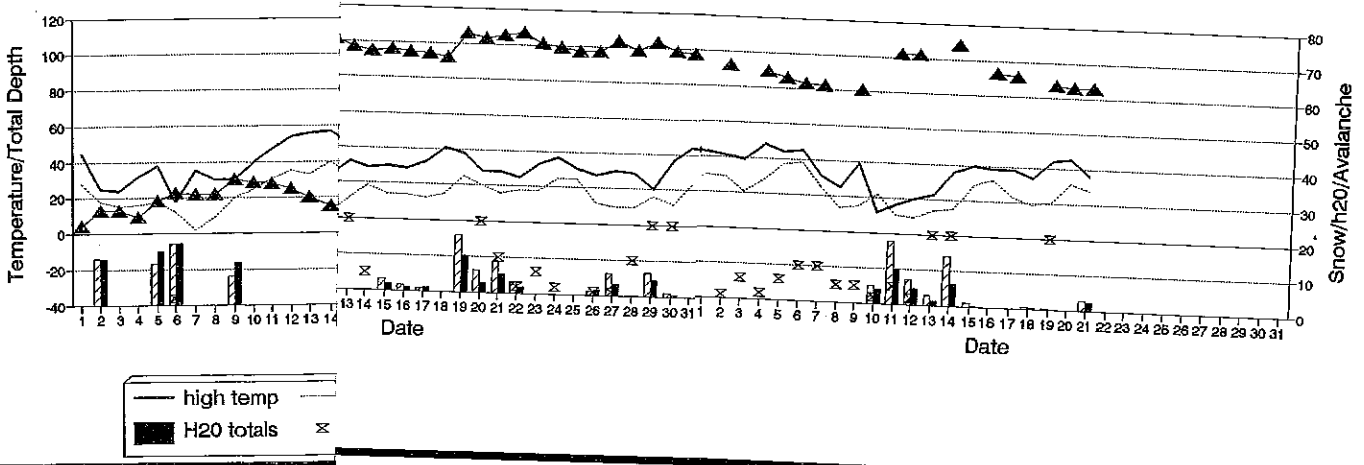
The victim will most likely fall down and become disoriented. "It usually takes a few seconds for someone to realize what just happened," Tremper explained.

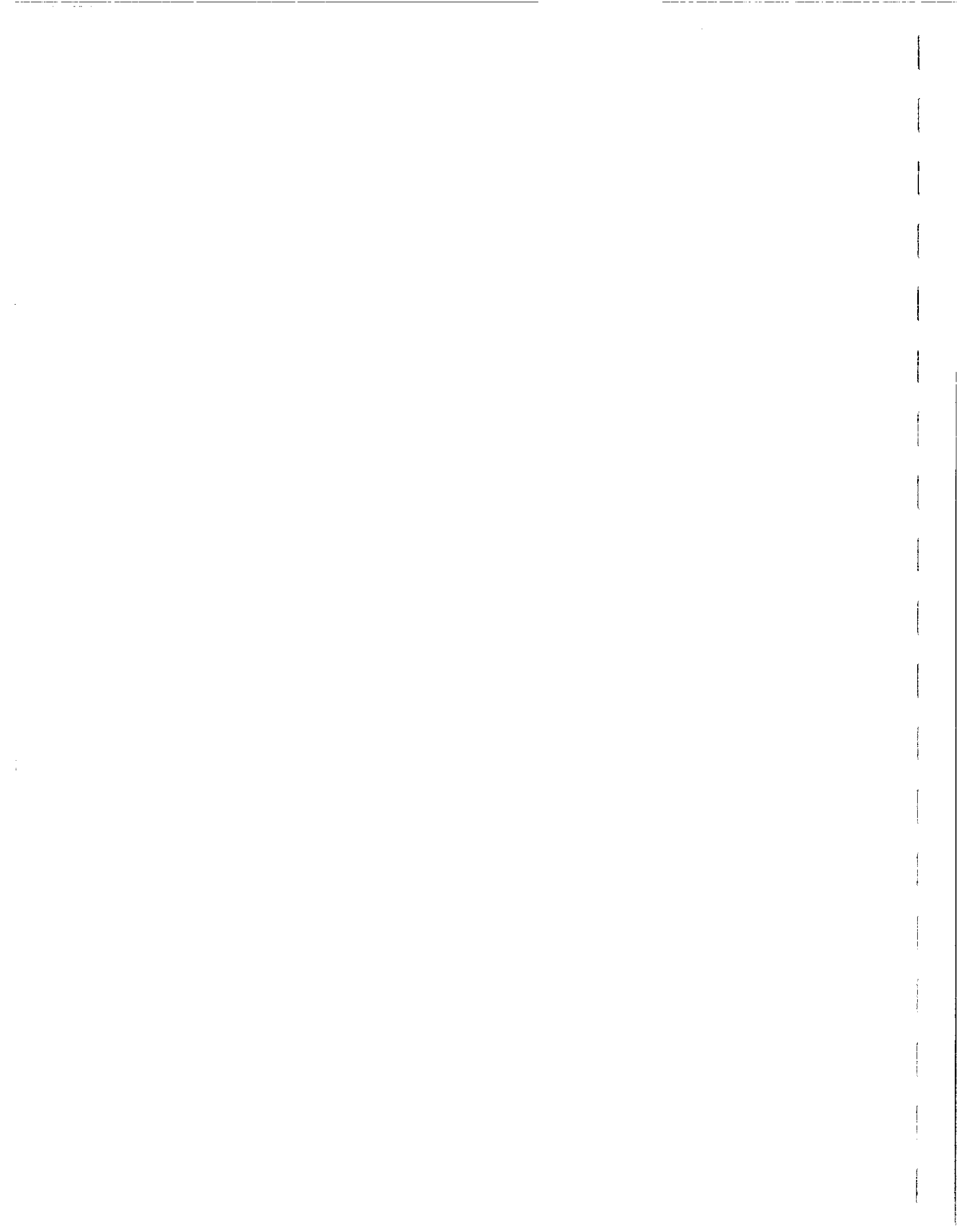
The first job one needs to do if caught on a moving slab is to vacate the area. The best way to do so, recommended Tremper, is to turn your skis 45 degrees down the hill and head for the nearest non-moving snow. However, for many

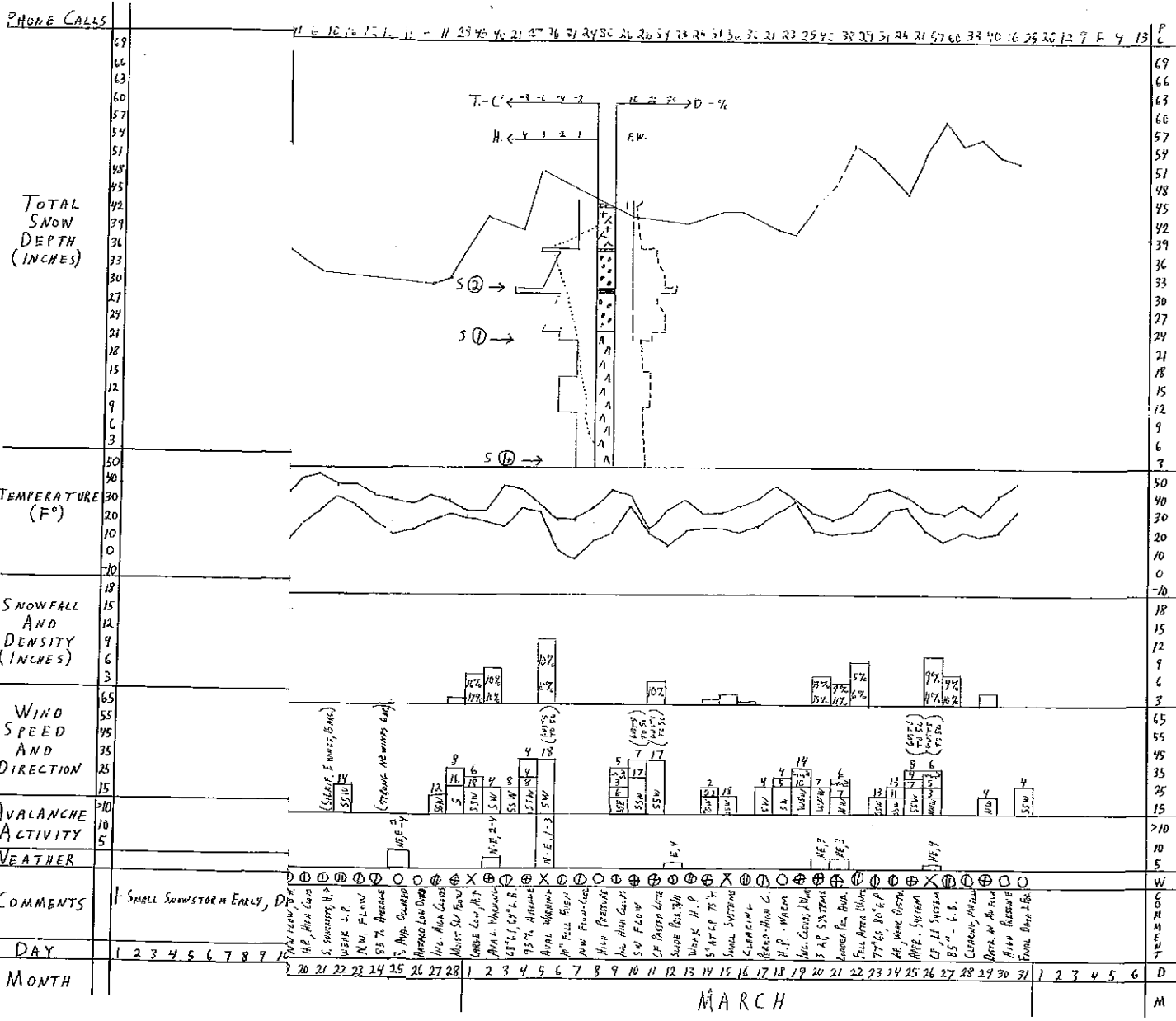
see "Avalanche" on page eight

NOVEMBER
Temps/Snow/H2O/Avis

April
Temps/Snow/H2O/Avis







MARCH

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