

# AVALANCHE PREPARATIONS FOR THE 2002 OLYMPIC GAMES

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**ABSTRACT:** The 2002 Olympic Games in Salt Lake City, UT, U.S.A. will take place among large avalanche-prone mountains that receive large, amounts of new snow. Combine this with a million and a half residents and an equal number of expected visitors, and there exists a high probability for human-avalanche interactions. In anticipation of this potential problem, a number of preparations are taking place at venues, highways and in the backcountry. At Snowbasin, the site of the downhill and super-G, the ski area has doubled in size and expanded into very dangerous avalanche terrain. In response, they have initiated a number of improvements and changes in their avalanche program. On the highway through Provo Canyon, an expanded program of avalanche forecasting and control is being planned but not yet implemented. In the backcountry, the Utah Avalanche Center is expanding services that provide avalanche information to the public including web site development, installing additional software, developing avalanche education programs and media packets. Avalanche search and rescue is being reorganized and expanded. Law enforcement and security personnel are being trained to handle the avalanche hazards they will experience patrolling the venue perimeters and buffer zones. Finally the Swiss nearest neighbors model and the Swiss snowpack evolution model will be run for both the Forest Service Utah Avalanche Center and for Snowbasin.

**KEYWORDS:** Olympics, 2002, Avalanche preparations

## 1. INTRODUCTION

The 2002 Olympic Games will take place in Salt Lake City, Utah February 8-24 and the Paralympics Games March 7-16. The mountains surrounding Salt Lake City is also spectacular avalanche terrain with a vertical rise from the valley floor of over 2200 meters and annual snowfall amounts which average as much as 12.7 meters. In addition to the million and a half denizens of Salt Lake City, Olympic visitors and media will double the population of Salt Lake during the Olympic Games. With so many people combined with such high avalanche hazards, there exists a correspondingly high potential for avalanche incidents. Finally, an estimated 10,000 media and an estimated 3-5 billion people watching on television will nearly guarantee that any avalanche incidents will be high profile. There is obviously an intense pressure to keep human avalanche interactions to a minimum during the Olympic Games. Therefore, the Utah avalanche community is undertaking the following avalanche preparations: \_\_\_\_\_

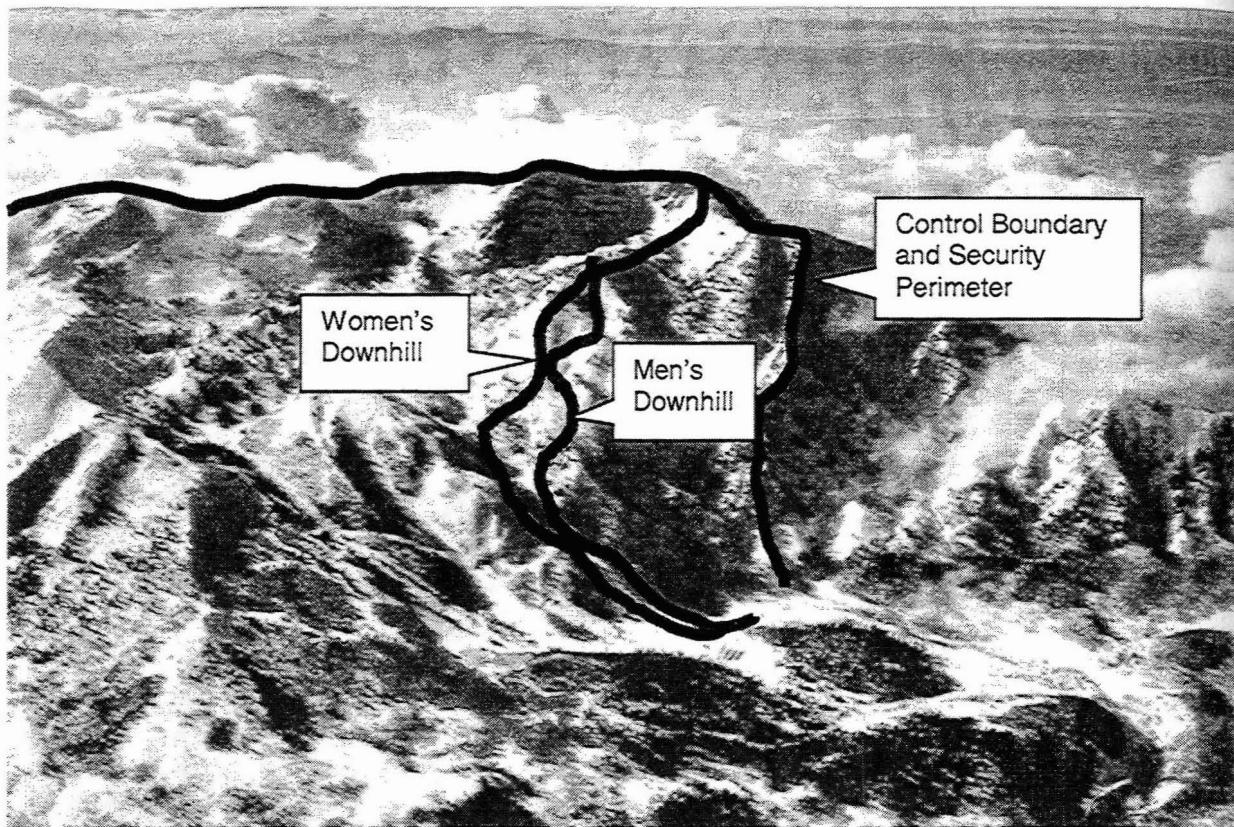
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## 2. PREPARATIONS AT SNOWBASIN

Snowbasin Ski Area was chosen for the downhill, the signature event of the Winter Olympic, because it has very steep, technical downhill terrain and it meets the requirements of: 1) two access roads (which eliminated consideration of Snowbird, which has larger and steeper terrain) and 2) the access roads are not threatened by avalanches, as they are for Snowbird. Bernard Russi, the famous Swiss downhiller, designed the Snowbasin downhill. It is fast, steep, very technical, and is considered to be one of the top five downhill courses in the world.

Steep terrain, however, also means avalanche hazards. Snowbasin has not only expanded their avalanche control boundary to the north to include the new downhill, but they have also expanded their southern boundary, which has doubled the amount of terrain controlled for avalanches. Snowbasin has undertaken many avalanche preparations including:

- 1) They have installed three GAZEX exploders—the first ones used at any ski area in North America,
- 2) They have dramatically expanded the number of ski patrol personnel,
- 3) Six new automated weather stations have been added by Snowbasin, the National



Weather Service and by the Salt Lake Olympic Organizing Committee.

4) Snowbasin, along with the Forest Service National Avalanche Center have installed the Swiss nearest neighbors model, (Gassner, M., Russi, T., Birkeland, K., Leonard, T., 2000) and the Swiss snowpack evolution model, (Bartelt, P., Lehning, M., Brown, R., Stöckli, V and Phillips, M., 2000).

5) Snowbasin has installed six new avalaunchers.

6) Snowbasin has installed a Doppelmayr explosive tram.

### 3. UTAH DEPARTMENT OF TRANSPORTATION

Four major access roads will be used to cross the Wasatch Range and travel between Salt Lake City and the "Wasatch Back" (the east side of the Wasatch Range), where all of the skiing and jumping events will take place. Three of these roads do not have significant avalanche potential, however, Provo Canyon, passes beneath very spectacular avalanche terrain. Provo Canyon has several avalanche paths on both sides of the highway with vertical falls up to 1,626 meters.

Provo Canyon is closed for avalanche control operations several times per season and an avalanche hits the road about three times per season.

Because of both political and land issues, only the north side of Provo Canyon has historically been controlled for avalanches. This creates an obvious problem since the avalanche paths on the south side are equally large and dangerous, Griffith (1996). As far as control on the north side of the highway, helicopter-thrown explosives control most of the terrain, which can only occur during times of good visibility.

The Utah Avalanche Center and the Utah Department of Transportation have installed an automated weather station near the upper elevation starting zones on the south side of Provo Canyon. Other than this, as of this writing, no progress has occurred on solving the political, land ownership and logistical problems associated with the avalanche hazard in Provo Canyon.

### 4. LAW ENFORCEMENT AND SECURITY

Unfortunately, we live in a world where terrorism is a constant threat at large public events and especially so at the Olympic Games. Law

enforcement and security issues will require hundreds of highly trained personnel from a number of local, state and federal agencies.

Each venue must have a controlled perimeter and in addition, many of the venues have a controlled buffer zone around the perimeter. In the case of the outdoor venues, these perimeters and buffer zones often lie in avalanche terrain. Snowbasin represents, by far, the largest concern as nearly the entire proposed perimeter and buffer zone lies in very dangerous avalanche terrain. Law enforcement personnel must patrol these areas, yet most lack the avalanche skills to accomplish this safely. Because of this, electronic perimeters will likely be used, for instance, video, infrared sensors, magnetic sensors and other as yet undisclosed technology is planned to monitor the perimeter and buffer zones. Still the personnel who set up these systems will require someone with avalanche expertise to accompany them during installation and maintenance of these systems.

Also, the Utah Avalanche Center, the National Ski Patrol and perhaps other entities will conduct a number of avalanche training classes, training videos and interactive multi-media computer modules to train law enforcement and security personnel as well as others who may need avalanche training such as course workers and rescue personnel.

Ski area, highway and helicopter skiing avalanche control operations will also be under intense scrutiny. Most likely, law enforcement personnel will remain on-site to monitor the use, storage and accounting of hand charges, avalanchers and especially military weapons at each avalanche control entity in northern Utah. Automated sensing technologies will monitor explosives caches such as magnetic sensors, infrared sensors, seismic sensors, video monitors and other technology. On-site personnel who monitor security and those who set up and maintain the technology must be familiar with avalanche control operations or they should be trained. All ski area, highway and helicopter skiing personnel who perform avalanche control will most likely need to pass background security checks.

## 5. UTAH AVALANCHE CENTER

The Forest Service Utah Avalanche Center is the interface between avalanches and the public. We issue twice-daily public avalanche advisories, mountain weather forecasts and avalanche warnings during times of extreme

hazard. In addition, we regularly teach avalanche awareness classes for the public.

We expect that many of the million and a half visitors during the Olympic Games will also want to recreate in the backcountry on the days when they do not attend one of the Olympic events. They may go snowmobiling, backcountry skiing, snowshoeing, track skiing, hiking and camping. In addition, we expect that many of the visitors may know very little about avalanches and may need special attention. In response, we have initiated a number of programs.

1) We have completely redesigned and updated our web site and will make additional changes and refinements for 2002. The web site will feature simpler interfaces such as icon-based displays of avalanche danger by aspect, elevation, steepness, wind exposure and other terrain and snowpack variables. We will also present the avalanche information in shorter, more easily digested packets for people who want only an overview of the avalanche conditions or for people who may not understand the more technical aspects of avalanche phenomenon. We will do this while maintaining our detailed avalanche information that the more hard-core local users have come to expect.

2) We are developing an Internet-based geographic information system (GIS) to display critical information on 3-D maps, such as snowpit profiles, snow surface conditions, accident information, avalanche terrain information, data from automated weather stations and recent digital photographs of the area. (Felix and Brown, 2000)

3) We have also installed software to display critical avalanche and weather information to the forecasters. One program was written by Randy Trover from Snowbird to display data from automated weather stations and also display manual weather data from ski resorts and highway operations, (Howlett and Trover, 1998). In addition, we will install the Swiss nearest neighbors model, (Gassner, M., Russi, T., Birkeland, K., Leonard, T. 2000) and the Swiss snowpack evolution model, (Bartelt, P., Lehning, M., Brown, R., Stöckli, V and Phillips, M., 2000)

4) We will convert all of our avalanche education programs from slide talks to Powerpoint. In this way, we can more easily organize and share images, annotate them, include video clips and create CD Rom versions and post on the Internet for wider distribution.

5) The Forest Service National Avalanche Center, the National Ski Patrol and students under the direction of Mike Jenkins at Utah State University are designing interactive Internet

avalanche training modules for both the public and for Olympic workers. After passing an online final exam, a certificate of completion will be issued from the National Ski Patrol.

6) We have doubled the size of our regular staff and we will bring in additional detailers for the 2002 Olympic Games.

7) We are installing signs and updating existing trailhead displays to provide basic avalanche information for the public accessing the backcountry.

8) Finally, for the past several years, the media has had an intense interest in avalanches and with an estimated 10,000 media personnel in Salt Lake City for the Olympics, we expect the trend to increase exponentially. We are developing both written and video media packets so that the media can more easily and accurately develop avalanche stories and not overly tax the valuable time of Utah avalanche professionals.

## 6. AVALANCHE SEARCH AND RESCUE

The area affected by the Olympic Games includes seven counties in northern Utah. (In the U.S., existing government jurisdictions ranging from large to small include: federal, state, county then finally city.) Presently, each county is in charge of all the search and rescue operations within its county. Each county maintains a volunteer search and rescue unit under the command of the County Sheriff. During the Olympic Games, we expect a dramatic increase in backcountry search and rescue missions, and this means that the various counties will need to cooperate closely and share resources. One plan is to combine all the search and rescue operations under one command, but in the latest plan, it appears that they will remain under their separate counties. In either case, all the counties search and rescue units will need to work out the logistics and politics concerning avalanche dogs, avalanche control, helicopters, outside resources and chains of command. These are all difficult issues on their own and tackling them all at once is extremely difficult.

## 7. MOUNTAIN WEATHER FORECASTING

Each outdoor venue at the Olympic Games requires a very detailed weather forecast in 3 hour time increments, 24 hours per day. In past Olympics in the U.S., the National Weather Service supplied these detailed venue forecasts along with their normal forecasts for the public.

For the 2002 Olympic Games, however, a private weather provider based in Salt Lake City will supply all detailed weather forecasts for specific venues, and they will be co-located with the National Weather Service during the Olympic Games.

Currently, the National Weather Service and the Forest Service Utah Avalanche Center jointly issue mountain weather forecasts for the public, ski resorts, UDOT and helicopter skiing operations. Unfortunately, as of this writing, no additional funding exists for intensified mountain weather forecasting, nor is any anticipated.

The University of Utah Department of Meteorology, however, has been developing a number of products that will aid not only in the display of current conditions but in forecasting weather. For instance, the University of Utah has developed the "Mesowest", an ambitious project, which collects and displays all of the available automated weather data from the Intermountain West. In addition, the University of Utah is developing and refining several high resolution weather forecasting computer models. (<http://www.met.utah.edu>)

## 8. LIAISON WITH AVALANCHE WORKERS AND AGENCIES

In a large event like the Olympic Games, many different entities that usually do not work together suddenly must work very closely together as a seamless unit to accomplish a common goal. These political, financial and organizational problems are usually much more difficult than the technological problems. Although the avalanche community has worked closely together for years, working with other agencies and organizations presents special challenges.

First, there is little top-down organization—a central command that controls all aspects of the Olympics. For instance, The Salt Lake Olympic Organizing Committee (SLOC) is the local arm of the International Olympic Committee, and as such, SLOC organizes the Olympic events. SLOC is mostly concerned with what occurs "inside the fence" or within the venues or closely associated with Olympic events.

Most of the public safety concerns, however, exist "outside the fence" where no central command has ever existed. To fill this role, the Utah Olympic Public Safety Command (UOPSC) was created by the Utah Legislature to fill the role of central planning and control. In addition, federal law stipulates that the Secret Service can act as the central public safety agency

in charge of all planning for large events. Although Secret Service presently operates as part of UOPSC, if necessary, they can exercise their federally mandated role. Also by federal law, the FBI will take over the command of public safety in unlikely case of a crisis such as terrorism or use of weapons of mass destruction. Then, after such an event, FEMA has the role of consequence management—dealing with the aftermath and cleanup.

In other words, instead of a central command for all Olympic-related issues, there are a number of parallel organizations and the liaison between all of these entities is a time consuming and difficult process. It requires an endless series of meetings, and complex lines of communication. We hope that these new relationships will leave a legacy of improved organization that lingers long after the Olympics.

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