

PATROLLER DOWN: RESCUE, DOCUMENTATION AND RESULTING OPERATIONAL CHANGES

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**ABSTRACT:** By the start of February 2007, the snowpack at Mt. Rose in the Sierras was atypically shallow and weak. After the first significant storm cycle of the season, on February 12th, a veteran patroller was caught in an avalanche while doing control work in The Chutes terrain that had yet to open for the season. A rescue was carried out and the partially buried worker was transported to the local trauma center by helicopter with significant life-threatening injuries. The patroller would have a long road to recovery. Having occurred on USFS lands, the accident required prompt notification to the Forest Service and a thorough investigation. This investigation included filling out the USFS National Avalanche Center's Long Form Avalanche Incident Form and developing operational alternatives to deal with atypical snow conditions. Similarly, the rescue itself was reviewed resulting in changes to the rescue plan. The result of the investigation and review of the rescue was the implementation of changes to make it safer for workers performing control work in the mid-slope starting zones of The Chutes.

## 1. INTRODUCTION

At all ski areas with inbounds avalanche issues, avalanche rescue plans and avalanche rescue training are important components that need to be considered. At Mt. Rose, these plans and trainings had been conducted annually with the focus on guest incidents. The focus of companion rescue training at Mt. Rose had primarily been on transceiver training and probing and shoveling techniques.

On February 12<sup>th</sup>, 2007, when a veteran patroller was caught in an avalanche while doing control or hazard reduction work it became obvious that an organized rescue of a fellow worker is a unique situation that has different logistics and circumstances than a guest rescue due to the time of day and personal emotional issues involved. Fortunately, in this instance, the rescue was initiated, the patroller was found and evacuated and recovered to return to work the following season.

Many lessons were learned and operational changes were made to both our control and rescue plans as a result of this accident. The following paper will be about the accident, the investigation of the accident and the changes that were made as a result of the accident.

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## 2. BACKGROUND

This avalanche accident occurred in the Yellow Jacket chute of the Mt. Rose Ski-Tahoe Chutes area. The Chutes are a 200 acre avalanche prone area located on the north face of Slide Mountain, Nevada between what was historically the Mt. Rose ski area to the west and the Slide Mountain ski area to the east. They are located in the Carson Range near the north end of Lake Tahoe. The Chutes consist of a series of spines, gullies and narrow paths separated by rocks and trees that historically are frequent producers of avalanches. The elevation range of The Chutes is from 9,280' at the top of the starting zone to 7,950' near the bottom of the run-out.

In the Tahoe area, Mt. Rose is considered a "high" elevation resort. The area tends to get shadowed out to some degree during all but the largest traditional storm fronts and usually receives 60-70 percent of the precipitation that the Sierra Crest receives at a similar elevation. Mt. Rose's snowpack can often exhibit more intermountain tendencies and continental snow-packs are not out of the questions especially early season or in drought years. Based on patrol records and a Snotel site at 8,850' within the ski area boundary, an average winter means just less than 45 inches of snow water equivalent on the ground at the peak of the precipitation season and around 32" of annual snowfall. However, it is not unusual to have a shallow snow-pack develop in October and November in The Chutes due to their aspect and elevation when there is little or no snow elsewhere. This situation often results in

naturally occurring climax avalanches the first time The Chutes are loaded.

There have been three avalanche fatalities in The Chutes and numerous close calls over the years. On January 29<sup>th</sup>, 1972 seven young men were in The Chutes in an area now called Cutthroat which was designated as a closed area at that time. All seven were caught in a slab avalanche resulting in the deaths of Steve Brown, 16, and Richard Lyon, 15. Close to a hundred people assisted in the rescue and recovery. A full account of this accident is documented as No. 72-7 in Snowy Torrents. On December 15, 2002, three snowboarders ducked under a closure into the Hornet's Nest area of The Chutes and all three were caught resulting in the death of Clint Sappenfield, 26. Seven paid and volunteer patrollers and two rescue dogs search in the dark for close to four hours before locating the victim lower on the path than expected.

In the winter of 2004-05, The Chutes were opened for the first as part of the developed ski area, although chairlift access had been to the top of Slide Mountain since the 1950's. Control work had been performed in The Chutes for road protection to some degree since the 1960's. In the mid-nineties a pivotal moment occurred in the history of The Chutes when ownership began to consider the possibility of trying to open the area as part of the developed ski area.

After trying a number of methods to either purchase or do a land swap for the 131 acres of The Chutes owned by the USFS, Mt. Rose submitted a Master Development Plan to the USFS in January of 2001 that was put through NEPA process. This plan was approved in January of 2003 and the mountain did what was necessary to open by the winter of 04-05. This included building a chairlift, installing eight access gates, installing an avalauncher and developing a more in depth control plan that was reviewed and approved by the Forest Service. In addition, patrol spent the three seasons prior to opening getting to know the terrain and developing mid-slope control routes.

The Chutes were officially opened on December 10<sup>th</sup>, 2004. The first operational season The Chutes were open for 128 days. Control work was conducted 27 times resulting in over 300 avalanches the majority being Class II. We received 340" of snowfall of snowfall and had 50" of SWE on the ground at the end of the season. The benefits of skier compaction to hazard reduction were obvious.

The season of 05-06 was about as perfect as it can be as far as favorable snow layering. We

received over 20" of water and 123" of snowfall in December and by the first of the year there was a strong Sierra snow-pack in The Chutes. We were open 115 days, had 415" of snowfall and 65" of SWE on the ground by closing. Control work was conducted 39 times with over 400 resulting avalanches. For the most part control work was done all from the ground due to an issue in getting avalauncher rounds. For an above average year, things had gone very smoothly considering it was only our second year in operation.

## 2. EVENTS LEADING UP TO THE ACCIDENT

The winter of 06/07 started slow and never really got going. When control work was first performed on January 5<sup>th</sup> numerous avalanches released low in the starting zones below the shot holes, foreshadowing what would occur the rest of the winter. By the beginning of February 2007 there was less than 8" of SWE on the ground. Depth hoar had formed and there was an ice crust mid-pack. The Chutes had not opened. Snow-pit data revealed we had an upside down snow-pack with significant faceting.

The first sizeable storm of the season concluded on the night of February 10<sup>th</sup>. On the day of the 11<sup>th</sup> the two Chute ridge top routes were controlled with a Class III occurring on the western ridge of the Chutes in an area that is predominantly north facing. The eastern ridge was controlled a little later in the day by me and the long-time patroller who would be caught the next day. The chutes off this ridge have a predominantly northwest aspect. We produced minimal results with a few Class D1's. The plan was to control a little lower on the slope the next morning. The grooming crew went in to the bottom of the area and tried to build the outrun to the lift in anticipation of potentially opening part of the area snow and weather permitting.

## 3. THE ACCIDENT

On the morning of the 12<sup>th</sup> a crew of five was brought in to do control work below the ridge-top work done the day before. The goal was to try and remove or stabilize the hazard that we felt existed lower on the slope along the eastern ridge of The Chutes in the area we call Red route. Along parts of this route the slope changes from 30-35° to 45° a couple hundred vertical feet of the top of the ridge. Some of the area can be shot with our avalauncher but do to our experiences of the previous seasons and the explosive supply issue; it was not used on this morning.

We divided into a team of three and a team of two with the group patrollers coming to work after us as our back-up. I teamed up with a long time patroller who had worked for many more years than me who I consider a mentor. I had spent lots of time in the area we were trying to mitigate over the previous four seasons but my partner had not other than from the ridge-top for twenty plus years. When we headed out with 11 shots after the briefing and transceiver check, he commented to me that I would have to show him the way as he did not know the route that well.

The route we were doing is a lateral across the slope above an area where the slope steepens above the throats of three chutes called Fuse, Detonator and Charge. The route would end up in a mid-slope area of Yellow Jacket that has close to a 35° slope angle. The top of Yellow Jacket above where we would enter is closer to 50°. Yellow-jacket also has a more easterly aspect than the area we would cross to reach it. We had done our protection shots above us the day before and there had been very little change in temperature and no additional loading since that time.

To start the route we through two additional protection shots into Fuse and one into what is called Saddle. These shots had no results and no obvious signs of failure. I descended down a spine between Fuse and Saddle to above the steep area of Fuse and threw one charges from a tree island. My partner stayed near the ridge-top with a good view of me. The charge released a Class D2.5 avalanche with a 30" crown just below the steep rollover. My partner moved down to me and I proceeded to move laterally to an island of safety on a spine between Fuse and Detonator. My partner then moved to me.

We threw two shots in Detonator and released another Class D2.5 just below us with a 36" crown that propagated from Detonator across Charge. The slide released close enough to us that my partner, who did not have as good of view as me, grabbed a hold of me because he thought I might be pulled downhill. The bed surface of the avalanche was a knife hard ice crust with uneven odd contours to it. My partner then said, "S—T we are going to have to hike out of here!" He said this because the avalanche had rendered what was below us free of avalanche hazard but un-skiable.

We discussed the situation and decided to continue with our lateral movement. There was some hang-fire above where we had to cross Charge. I proceeded out on the across the bed surface and through two shots into the hang-fire above and then returned to my partner at the

island of safety. These shots cleaned out the pockets we were concerned about. We then proceeded one at a time across the bed surface to an island of safety on the spine between Charge and Yellow Jacket.

Yellow Jacket is the most open area that we would be trying to control that day. There was evidence of the Class 1 we had triggered from the top the day before and we could see the debris field was localized in the center of the area and extended to just below us. We had four charges left so we threw two directly in front of us. These shots were holes with no evidence of failure. We decided to throw the last two lower on the slope. The last two shots had negative results and no indications of failure. We discussed what we should do and it was decided I would ski cut across the slope, proximate to our first two shots holes, to a safe location on the ridge between Yellow Jacket and Beehive. Beehive is the next run over and is more of a 30° tree run than a chute. I made my cut and stopped. My partner and I then discussed whether he should stay in my track or go ten or so feet below it. We decided he would go below it and he did and came safely across to below me. We discussed what to do next and decided I would ski cut back towards Charge and then turn and ski cut back to below our current location. I did this safely with no indication of any impending slope failure or fracture.

After another brief discussion, my partner off set my tracks again and cut across the slope. He made it safely across and turned and started returning to me. I glanced away and at the same time heard the crack of a large avalanche. I looked back at my partner and could see he was on a large slab that released over 100' above him just below our first ski cuts. His trajectory brought him towards me and then down the middle of the chute. We made eye contact and he was yelling, "Keep your eyes on me!" I continued to hear him yell that until the slab started to break up as it hit an island of trees at the bottom and I could no longer see him. The next thing I saw were his skis shooting 100' into the air to the right and left. My initial thought was that the avalanche was not survivable.

#### 4. THE RESCUE

While the avalanche was still in motion I made a radio call letting everyone know that my partner had been caught, I was starting a transceiver search and I would need some help. I then jumped on the bed surface and headed down to

start my transceiver search. The bed surface was very firm with lots of irregularities and was difficult skiing. When I reached the top of the debris I turned my transceiver to receive and visually surveyed the scene. The first thing I noticed was my partner's helmet sitting on the surface of the snow at the top of the tree island below the top of the run-out.

Based on where it appeared the slide had flowed, I elected to go down the left side of the tree island. I received two analog beeps on my three antennae transceiver and a distance of 68 meters. I paused and moved into the center of the path but I received no more signals. I proceeded down the middle of the debris to the area of deepest deposition. At that point I felt I was in a position that my transceivers range was such that it should have covered the entire debris field but I still did not have a signal. My next thought was that there was an issue with either his transceiver or mine. I then listened to what was going on the radio and when there was a pause I made another call saying I was going to need some help and my transceiver search was unsuccessful.

At this time I received a radio call from the team of two that was coming from above asking which way was the safe way to get to the accident site. I directed them to come in from Beehive due to a considerable amount of snow remaining above the crown. About the same time the other team doing control work was able to traverse to the bottom of the run-out and began packing out a landing zone in the event we needed a helicopter. In addition, I was able to hear a snow-cat coming across the bottom that was transporting a patroller and a rescue dog to the scene and was going to build a landing zone. The opening of the ski area was put on hold.

As the team of two came down the bed surface I had started to hike back up the hill. They reach the debris and one of them began a transceiver search. As they reached the top of the island of trees that was just below the top of the run-out, I thought I had seen a flash of red in the tree island. As I focused up the hill I could make out a patch of red up under some pine trees that appeared to be moving. I frantically directed the team to what I saw and after some confusion on lefts and rights they visually located my partially buried partner from 30 feet below him. Due to the topography at the tree island and the low lying branches he was under, he could not be seen from above and from below you had to be at just the right angle. The next rescuer down actually went right by the accident scene with the victim and the two rescuers due to the lack of visibility. The two

rescuers hiked up to my partner and pulled him out of the snow and downhill into an open area so they could assess and stabilize him. He was A and O x 1 with a large laceration on his head. Another team of two arrived at the crown location with a rescue sled and began the descent to the victim and rescuers. At this time I verified a Care Flight helicopter was inbound. When the sled arrived at the scene, I elected to leave the scene and head back to our base area to begin the process of notifications.

At the accident site, the patient was placed on oxygen, back boarded and transported to the helicopter that was waiting at the bottom of the run-out. The helicopter transported him to Renown hospital which is the regional trauma center. The patrollers on scene were then transported back to the base area. The ski area was then opened for the day.

## 5. THE INVESTIGATION

The accident had occurred on USFS lands. The first calls were made to our local permit officer and the district ranger's office. In addition, the USFS National Avalanche Center and CAIC were contacted to ensure the proper steps were taken to document the accident. In addition, a couple qualified off-duty patrollers were contacted to see if one of them could come in and investigate and document the accident. Fortunately, Tim Farrar, who has an AIARE Level 3 certificate, was available to come in the early afternoon. I was contacted by Bob Moore from the Truckee Ranger District to let me know he and our permit officer Ed De Carlo would be over in the afternoon to visit the scene and outline to us what they would expect as far as documenting the accident.

By early afternoon, Tim and my assistant Paulette Schneider returned to the scene and took photos and did a crown profile. While they were doing this, Bob Moore and Ed DeCarlo from the USFS arrived and we had a brief meeting at the base area and then headed to the scene. Bob took some pictures of his own including of Tim and Paulette doing the crown profile. We worked our way down the bed surface to my partner's point of rest. In addition to discussing the accident, we discussed possible alternative means of controlling the area in the future. It was refreshing to have someone looking towards solution instead of focusing on blame. We had downloaded the Long Form Accident Report from the CAIC and Bob Moore outlined for us what else we should include in our accident report.

This included the following:

- The USFS Avalanche Incident Report: Long Form
- Pertinent weather data
- Topographical diagram of the accident
- Snow-pit records
- Sierra Avalanche Center forecast for the day of the accident and a few days before
- The Patrol Incident Report Form
- The Dispatcher Log
- Control route records
- Any pertinent photographs

In addition to the above we were able to prepare a diagram of the accident scene on a picture that included the approximate location of explosive charges, the path we took when ski cutting, the location where the slide was triggered and the point of rest. I try and take photos while working and I had taken some during our route and then I took some of the whole scene after my partner had been located and I knew he was alive. A few days after the incident a report was sent to the CAIC and the NAC with all the information we had gathered. The slide was a SS-AS-R4-D2-O with a crown that averaged around 30" and was close to 100' across. The vertical drop to my partners' point of rest was around 600'.

## 6. THE AFTERMATH

The impact of this accident hit hard at all levels of the patrol, their families, the mountain family, the injured and his family. When someone you now's life hangs in the balance, all the what if's? run through your head. What if it had been me maybe I could have skied of it? What if we had hiked out? What if we had not ski cut after the first cut and skied down Beehive and opened the terrain? What if he does not make it? The reality was all the questions did not matter the accident had happened and while my partner was in the ICU life would go on.

One of the questions that we could answer was what happened to the transceiver. The afternoon of the accident I tested my transceiver and it worked flawlessly. The next day we were able to get his transceiver back up to the mountain. I turned it on and it appeared to work fine. I gave it a shake and it turned off. When we took the battery terminal cover off it became obvious one of the terminals was not fixed and the glue or adhesive that was used to keep it in line had cracked allowing the battery to come in and out of contact with the terminal. There was evidence of

a direct hit to the transceiver that likely caused the malfunction although there is a possibility it existed prior. During the rescue, when I got my beeps and my transceiver said 68 meters I was actually within 20 meters of my partner.

On the patrol side, the mountain would continue to open everyday and we had opened most of the mountain besides The Chutes with the storm the resulted in the accident. We had everyone from all departments that had anything to do with the rescue write a narrative detailing their part in the rescue. There was lots of discussion in the patrol shack about how it happened and how the rescue went. About a week after the accident, a shift occurred in the thought process of the patrol from what if to what now? With the assistance of some of our local fire personnel, we conducted Critical Stress Incident Debriefing. The focus was on what could be done to prevent an accident of this type in the future and how the rescue played out.

We received what would be the largest storm of the season the last few days of February. When control work was conducted on the 27<sup>th</sup> and 28<sup>th</sup> a number of scary mid-slope avalanches were triggered. On the 27<sup>th</sup> a Class D4 avalanche was released burying a portion of the state highway that is at the bottom. These slides served further notice that we needed alternative methods of controlling the mid-slope areas when facing this type of snow-pack. The Chutes were only open for 11 days during the winter of 06/07. It was amazing they were open at all. Mt. Rose received 190" of snow fall and had only 20" of SWE at its peak. Control work was conducted 13 times resulting in 82 avalanches.

The injured patroller would end up having a skull fracture, a broken leg and numerous other injuries. By the time he truly awakes his leg will be almost healed. He ended up having numerous complications while in the hospital. It was nine months before he recovered although he will most likely have lingering health issues for the rest of his life as a result of his traumatic brain injury. He returned to work the next season. After over thirty years at the resort he decided to make that his last year. His problem solving, professionalism and mentorship will be missed.

## 7. OPERATIONAL CHANGES

The accident and rescue where looked at from all angles. We considered the explosives and explosive delivery methods we were using, the rescue equipment we were using, our route procedures and our rescue plans. A

recommendation was made to management regarding personnel, rescue gear and avalanche mitigation gear. Operational changes were discussed within the patrol and with the other mountain operations departments. Proposed changes to the control program were presented to Doug Abromeit from the USFS NAC and Bob Moore with the USFS in March of 2007. They approved of the changes we were making to deal with similar situations in the future.

On the rescue side operational and equipment issues were addressed. Operationally a higher threshold was established for when mid-slope manual control work would be conducted. This threshold includes the need for an established snow vehicle access at the bottom for rescue purposes, the need for a minimum of two additional personnel standing by for rescue at the top, clear visibility when conducting routes prior to opening for the season and utilization of mechanical control methods in the presence of early season faceting. On the equipment end, a need to make all transceivers used by the patrol the same model was identified. 35 transceivers of the same brand were ordered for the next season. In addition, because transceivers can fail, RECCO reflectors that are able to be snapped on and off transceiver straps were obtained. These allow patrollers to have an alternative means of location on them but allows for easy removal in the event a search with a RECCO detector is being conducted.

On the personnel side, the need for a dedicated avalanche forecaster was identified. Due to a variety of reasons this position had been by committee although a need had been previously identified. The goal of the position was to coordinate forecasting activities and direct the efforts of all employees doing control work. Dallas Glass was hired the next season as the forecaster. Dallas is an avid backcountry skier with a Masters in Hydrology. We sent him to the AV-PRO course (and he got a scholarship) the next winter. He has developed his knowledge of The Chutes and has coordinated the efforts of the patrol in daily hazard evaluation and forecasting.

On the hazard mitigation side, the need to better utilize our avalauncher, the need to develop an additional mechanical method of controlling the mid-slope areas, and the need to consider varying the types of explosives we were using were all identified. We have increased the number of targets for our avalauncher and through the use of some of the newer "premium" rounds we increased our confidence with this tool. With the help of Dave Sly with Maple Leaf Powder Co. and

Larry Heywood with Outdoor Engineering we purchased an avalanche pipe system that included four bases and one head. With the approval of the USFS, three mounts with the bases were installed on the ridge-top of The Chutes and the fourth base was mounted on a snow-cat. This system will allow us to put the 4kg avalanche guard rounds into the mid-slope areas. We plan on using it early in the season, when we have large storm cycles that we are unable to stay open through, when faceted layers exist deep in the snow-pack, and when we have a high degree of uncertainty after using our other control methods. We have expanded the types of explosives we are using for hand charges to include different types with different detonating velocities. We had primarily been using emulsions for our hand charges that have a relatively slow detonating velocity. We have been mixing in some cast primers since then and have tried to hit slopes with explosives of different velocities.

## 8. CONCLUSION

Accidents happen but should be learned from to prevent similar accidents from happening again. Since the accident we have not dealt with a similar snow pack. The changes that were made to our avalanche control or hazard reduction program where done in an effort to make our resort safer for our workers and our guests. The inherent risk of avalanche can rarely be reduced to zero. The goal of our program is to minimize the residual risk of avalanche to which our workers and guest are exposed in The Chutes and the rest of the resort.

## 9. ACKNOWLEDGEMENTS

I would like to thank the members of the Mt. Rose Patrol that were involved with this rescue and who continued to work through the rest of the season. I want to thank the patroller that was caught in the avalanche for all he has taught me over the years and for the example he set for our employees and for having the perseverance to make it through a very difficult time.