

# Snoqualmie Mt—“Phantom” Avalanche Accident

Wednesday, April 6, 2011

**Date/Time:** 2011-04-06 / 0930 PDT

**Submitted by:** Marcus Engley—TAY Moderator, other party members; and Mark Moore—NWAC

**Place:** Phantom path, Snoqualmie Mt, central WA Cascades

**Slope specifics:** 5,800 feet elevation, southwest aspect, 30-35 degree slope angle; SS-AS-R4D2

**Activity:** BC ski

**State:** WA

**Country:** USA

**Fatalities / Injuries:** 0 fatalities / 2 seriously injured and expected to recover

**Summary:** Party of five BC skiers triggered 1.5-2 ft x 75 ft soft slab (40-62 cm x 25 m) that caught three of the group and swept them through trees, seriously injuring two and giving minor injuries to one. All victims found on the snow surface.

## Accident Narrative

The accident narratives below were graciously provided by members of the group. The first narrative that follows was prepared by Marcus and includes the sections entitled *The Climb*, *The Slide*, *The Rescue* and *The Mistakes*. The remaining witness statements have been provided by four other party members, Dan, Drew, Doug and Roger. Marcus’s description of the account and the account itself are presented first:

*This first portion will be primarily a description of the climb. I'll follow with the slide and the ensuing self-rescue and organized SAR response, from my perspective. A more thorough analysis of the decisions and mistakes will follow. I deliberately went with a "trip report" style format in this part, to try to capture the mood of our trip up so that I could better understand where my decision making failed.*

*To be clear, I am writing this as much for me and my friends and family as I am for anyone else. The lessons I take from this will be more deeply ingrained because of this process. If others can learn from it, so much the better—Marcus.*

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## The Climb

I’ve said for years that if I ever had to use my avalanche transceiver, I’ve screwed up big time. But here I am, having just hacked a wad of snow the size of a tangerine out of my throat, switching to receive and hoping to hear a sound. I’ve screwed up big time.

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Roger, Doug, Dan, Drew and I met at the Mercer Island Park & Ride a little after 5 a.m. on

Wednesday, aiming to get in a dawn patrol at Snoqualmie Pass and be back in town by 10:30. We piled into Doug & Dan's cars and headed up to Alpental, excited for fresh snow and new company. Roger and I had already discussed the telemetry, expecting upward of two feet of snow on the upper slopes and knowing that any notions we'd had of skiing the Slot or the Snot were not going to happen. The plan was to head up and see what we found – beyond that we didn't discuss it much.

We arrived at the maintenance lot and hit the trail by 6:15. Trailbreaking was arduous, Roger plowing ahead through 12-18" of light dry snow, with pockets up to waist deep. We knew this wasn't going to be a one-hour blast to the top and switched trailbreakers from time to time as we climbed through the trees to the left of the Phantom. We could feel the layers in the top few feet of the snowpack, with the obvious mushy rain soaked snow about a pole length down.

Progress through the trees eased as we got farther up, the SW slopes of Snoqualmie rolling back below the steeper upper pitches above the entrance to the Snot couloir. The snow remained excellent and, while we could get the new snow to break in soft slabs on the steeper kick turns, we continued up, spreading out as we began to encounter steeper sections. Roger was breaking trail again, doing a good job of picking a line with minimal exposure to the Snot entrance.

It was now 9:00, the first 2600 feet having taken almost three hours. We had a brief discussion about timing, as Doug and I both had to be back in town before the others. We talked about continuing up another couple hundred feet to the Slot entrance, just to look, then returning back down. I felt I had enough time to make it work, so we pressed on.

We traversed back to the right, climbing away from the ridge. The trail breaking was easier near the ridge, maybe 6-12", and the wind had picked up. I put on my thicker gloves and gave Roger some space. He pointed out a couple of features to avoid on the trip down – places he'd seen slide activity in his past trips.

As we wrapped a little farther away from the ridge, we came into deeper pockets of snow, particularly in the many small gully/concavity features on the upper slopes. The snow seemed a bit more reactive on the kickturns, the soft slabs a little more cohesive. No whumphing or shooting cracks, but the exposed upper slopes were definitely showing some new signs.

Roger cut out across the bottom of a steeper section, perhaps 60 feet wide. I waited in a pocket of trees for him to clear it then, when he put in a kickturn below a few thick trees, I zipped over to him quickly, so that I could watch him climb back across in the other direction. I checked behind me and saw that Dan had followed me across the slope and was with me at the turn. Too late now, I thought, and then I looked back to Roger and the crack rips out above him and he is falling and I am falling and we have screwed up big time.

This part is way more stream of consciousness and I apologize if it's harder to read. Just getting it out of my head.

## ***The Slide***

The crack is silent and none of us make a sound as the slab's blocks dissolve into powder. I slide on the surface, still in the light, trying to pound the head of my whippet into the bed surface. I'm already

moving too fast.

I've forgotten my aqualung!

Grab it, shove it into my mouth. And then I'm under, tumbling in the stiff liquid foam, like rolling around in a mixing bowl of well-whipped meringue.

Anastasia is going to be so pissed at me if I die here.

What else? Fight! Swim for the surface, make an air pocket, stick your hand up! It's all coming back, but when will this slide end?

SMACK! I've hit my head on something. I'm still conscious, no pain – I'm okay. Fight more, make an air pocket, stick your hand up! I've lost my aqualung. There's snow in my mouth. I can't breathe I can't breathe I can't breathe.

Stick your hand up!

And I've stopped. I can't see but it's light. I sit up, covered only in a thin coating of fine powder. I'm up against a big tree and I can't breathe. Stand up, have to cough! Harder! GASP! Huge volumes, lungfuls, barrelfuls of air, a wad of snow like a tangerine, discolored from being in my throat, lying on the ground.

I can finally look around. I see Roger. He's uphill about 250 feet, on the surface. I take out my beacon and switch to receive – nothing. Not a peep. I'm too far even from Roger and I've yet to grasp how far down I've come from the crown. Dan must be above me somewhere.

I try to shout to Roger, but my voice is hoarse from the snow. He sees me.

"Do you have Dan?" He can't hear me. I try to ask him to switch his beacon, but then I see Drew way up above and he's yelling to Roger too, so I wait. Drew has Dan. Thank god, okay. Roger starts scooting down to me on his butt, unable to stand – I start climbing up to meet him. Crap, I can barely lift my right leg! I can stand no problem, but man is it tender. I must have banged it on a tree and not felt it – okay, we'll have the hands help too. My head feels all right. No loss of consciousness, no pain, no vision trouble.

I find one of my poles and it's then that I realize that everything else is gone. Both skis and my whippet have checked out – thank god the skis came off my feet.

Roger and I finally come together. He looks good. Good airway, no obvious trauma. I try to switch into EMT mode as my brain is firing 1000 miles an hour. His knees hurt – okay, we expose them and they look okay. Tender and some bruising already, but no obvious deformity and no open injuries. No other complaints.

Drew's here too and he helps make Roger comfortable. He tells me that Dan's probably got a broken leg. I ask him about first aid background and tell them both I'm an EMT and ski patroller, just so we all know where everyone is. Drew offers me his skis if I think I can make it up to Dan. I click in (Dynafit fittings on the NTN boots, thankfully) and make my way up. Drew yells up that he's calling 911 – good, get them moving. It'll take a while and we'll need at least two litters, assuming I can walk

out, which I'm quite determined to do.

Both my legs are cramping and my right leg is on fire. Skinning on these fat, long skis on the avalanche's bed surface is a challenge. I finally see Dan and yell up to get his condition. He's pretty sure he's broken his right femur and thinks he may have broken the tibia too. Crap. I try to motor, but I have only one speed.

Dan is a tough guy. My initial exam reveals no real pain in the lower leg and, though he complains of pain in the thigh I have a hard time believing he's broken his femur. This is the injury that's supposed to be the closest a man can come to the pain of childbirth – he's barely grimacing. But sure enough, tightly bound muscles and an obvious deformity up high prove him right. I call the Operations Leader for the Ski Patrol Rescue Team and give him the details. He's just received the word from King County SAR and is working on spinning up the mission.

Dan is managing his pain well, so Doug and I try to make him a bit more comfortable and get him ready for the long wait. Extra jackets, balaclava, space blankets, garbage bag, Ibuprofen – he gets most of what we have, which isn't much. I empty my pack, trying to figure out what we need to make a traction splint. A stout ski pole. Leg loops cut off of the climbing harness he had with him. A 12" sewn runner. Three Voile straps. The aluminum harness buckle. That will do.

With the traction applied, we button up Dan and he seems fairly comfortable. I take some pictures and climb up toward the crown to see the starting zone. Dan's tree is about 250 feet downslope from the crown. Roger is another 250 feet further still, and I was a couple hundred feet below him. I realize that we'd all been filtered out by the trees and that I had no idea how far down the slide continued.

I check in on Dan as Doug returns from visiting Roger and viewing the slide path. He's found one of my skis and tells me that the slide ran another 800-1000 feet below where I stopped, over steeper slopes and a 50' cliff band, before hitting the lower angle fan and coming to a stop more than 1000 vertical feet from the crown. He also reports that Roger is in a lot of pain, so I bundle up what little I have left and head down to give him a more thorough assessment. Dan's break seems stable and he's in excellent spirits, with Doug to keep him company.

When I get down to Roger I offer him my last few Ibuprofen. I have some Immodium if things get ugly, but he turns it down. It's clear to me at this point that we've got an incredibly solid group of people. Roger and Dan are absolute troopers and fortunate to have stable, non-life-threatening injuries. Drew and Doug are unflappable, reflexively getting the rescue started and immediately caring for the most critical concern – imminent hypothermia. We are going to come out of this okay, despite our mistakes.

We hunker down and wait for Search And Rescue to arrive.

## ***The Rescue***

The first team on scene was actually a private party, close friends of Roger's, who'd been scrambled by Daveb after a text message from Roger alerted him of the situation. They dropped what they were doing and sprinted uphill just ahead of the formal SAR response. They must have connected with the SAR coordinators at the trailhead, because they brought up the first Cascade litter and some extra

supplies.

The next teams were only a few minutes behind them with the additional gear necessary to begin the extraction. Multiple EMTs in the first couple of teams and, to my delight, a paramedic that I work with in Snohomish County.

Everyone should have the privilege of seeing smiling, familiar faces arrive on scene when you're hip-deep in trouble of your own making. It was an enormous relief and, for me, the moment I really began to spin-down and start to relax. SMR, SPART, EMRU, ESAR and all the other units did a great job getting us packaged up and moving out. The whole thing felt more like a happy reunion than an unfortunate accident -- which, I guess, it kind of was.

Once we got moving I fully transitioned over to "subject" -- I briefly offered to help, but there were plenty of people and I didn't want to become a liability, so I hooked up with a friend from SPART and just tried to keep plodding downhill on my loaner snowshoes. Everyone was in good spirits and Roger was taking advantage of the deep powder to collect his last face shots of the season from the comfort of his litter. Drew skied out with Dan's skis, my single ski and managed to scrape up one of Roger's as well -- he looked like some kind of bizarre antenna array.

I arrived at the trailhead at 5:45. Roger got out about an hour later and Dan just after sunset. The debrief in the command vehicle was fairly straightforward, moreso because I'd been on the phone with several of them a couple of times over the course of the day. I almost lost it when Anastasia showed up at the trailhead -- she and Andy had tried to deploy into the field, but had gotten caught in the four hour pass closure and arrived at six instead of one thirty. I wasn't sure whether she was going to punch me or hug me -- thankfully the hug won out.

I know I speak for all our crew when I give enormous thanks to the efforts of everyone who came out to help, as well as those at the other end of the pager who may not have made it out this time, but routinely put forth such effort to help our fellow hikers, climbers and skiers when they're unable to get themselves back to the trailhead. It was an honor to be on that side of the experience and to see the skills and empathy of everyone involved.

## ***The Mistakes***

This is lengthy, so I hope it's coherent. Apologies if not.

As much as I can, I'll describe the things that we did wrong (or I did wrong) that got us into this situation. Much of this I've chatted about with others in the group (at particular length with Roger) and I think there's a fair bit of agreement among us, but I want to make it clear that I'm really only speaking for myself. Dan's already chimed in with his thoughts, which largely echo my own. I expect some of the others will do the same.

### ***Communication***

Far and away the biggest problem was heading out on a High hazard day with an unfamiliar group. I spend probably 95% of my time skiing with the same half a dozen people. Having skied so much, for so long, with such a small group, I take for granted how natural and predictable our communication has become. Chats about objectives, expectations, stopping points, red-flags... all that stuff is just par

for the course and typically happens without any prompting.

This is, of course, no reflection on our group -- a great bunch of guys. There wasn't any "rah rah let's go CHARGE!" vibe at all, it's just that we set no baseline for what the plan was and didn't have a quick group chat at any point about the day. No "let's discuss again when we get out of the trees" or anything like that -- had we established those open lines of communication and set some expectations, I think we would have been more diligent in our decision making and likely turned around to harvest the goods at the Snot entrance, if not below it in the trees.

Establishing that communication is tough. To that end, for me, I think I'm going to have to put much more thought into whether I go out with an unfamiliar crew in conditions that require frequent, open discussion among all members. I think we could have quickly and easily set that up with our group, but we failed to.

In a way, everything else just sort of follows off of that. I don't feel that there were signs that I was missing, but for whatever reason I had parked my decision-making brain in a much less active place than it typically would be. Roger and I were chatting at the switchbacks about what we were seeing, talking about the snowpack, but none of that chatting every bumped up to a quick group huddle to talk things over.

### ***New Behavior, Missing Data***

Another new element, for me, was the time pressure. I don't dawn patrol very often and I knew that I had to be back in town by 11. We were trying to crank our way through the trailbreaking to get a nice run and it was clear that it was going to take a while. I was making all my usual observations, taking in the snowpack, pole tests, hand pits, switchback cutting, noting the wind, etc etc etc. This is obviously a great way to get a lot of small points of data as you climb.

The other data which I almost always collect is a few quick pits. Quick compression and shear tests, then on we go. But I didn't, and neither did Roger -- he told me yesterday that he typically digs for the same reasons, especially when he's been away from the region for a bit.

Now, I won't pretend that we would've gotten the shear or compression results that Andy posted above (STE, CT10, both Q1), though I will say that any of those results would have kept me down in the trees, no question. I think the results themselves aren't as important to my point, which is that I was trying to make my usual risk assessment decisions with only, say, 80% of the info I usually have.

Another way to look at it is this: I was trying to make a good choice using a risk assessment model I was not as familiar with -- not as good at. For the sake of expedience, mostly. The silly part here is that the trailbreaking was so deep that I could have easily stepped out, dug a quick pit, stepped back in and been back with the group in a few minutes... but I was already sucking wind trying to keep up. It just didn't occur to me to stop.

The last, and probably most important, side effect of digging a pit? I'm betting everyone would have gathered up in a safe spot, waited to see what was found, and we would have had a quick pow-wow to discuss the results.

Would they have swayed the decision to continue? It's impossible to say. But the lines of communication would have been open and I think that would have made a big difference. At the very

least, it would have given all of us a feel for how the others balanced their risk and choices, which is the most important piece of info we were lacking.

## **Comments from other party members**

### **Comments and Statement from Dan**

Hello everyone, I'm Dan with the broken femur. I read the whole thread, and feel compelled to add my \$.02, so I just now registered on TAY for the first time. I'll try not to make this too verbose (though I'm sure I'll fail at that) and I don't want to repeat too much of what others have said.

My first goal is mostly to add to the usefulness of our experience in reducing the likelihood or severity of future avalanche incidents. I acknowledge and appreciate those who have stated that they don't "expect" a report from us, but at the same time I know how much I enjoy reading the AAC's Accidents in N. American Mountaineering each year, hoping I can glean some tidbit from someone else's experience that might save lives for me or my friends in the future. My secondary goal is to get my own memories down before they fade from my head.

My point of view comes as someone who is probably less experienced with explicit backcountry skiing than any of the other members of the team, but nonetheless my experience is pretty deep. I have lift-skied at Crystal all my life, and my experiences with avalanches began when I was 10 or so, being swept away in a slide in the Crystal slackcountry, saving myself from a likely very early grave by grabbing an opportune tree as I went by it and letting the snow slide under me. I generally have gotten about 5 to 10 true backcountry days a season for the past 15 years or so. In recent years, the Slot Couloir has been my most common objective, and I had done it most recently in late February, so I was quite familiar with the terrain.

Roger, on the other hand, a friend of mine for many years, has probably been up that side of Snoqualmie Mt. over 100 times – I'm guessing not many people know it better than he does. I didn't know Marcus, Drew, or Doug well before our trip, but based on our conversations on the drive & approach it seems all of them make backcountry skiing their primary recreational activity in the winter. I felt I had the least experience, and I had at least a slight feeling of deferring to my teammates' expertise and judgment on this trip.

Although we didn't discuss it much specifically, I'm sure we all knew the NWAC report for the day. We did discuss the obvious slow trailbreaking due to deep snow, and we swapped leads rather than letting Roger punch it the whole way like he usually does. The increasing risk of avalanche danger was certainly on my mind, but in the trees lower down the layers did seem fairly well bonded in most places; even on the steep slopes around the cliff bands our switchbacks did not cause significant sluffs. As we got higher up into the sparser trees, we started spreading ourselves out and paying close attention to not skiing underneath each other. There were signs that the snowpack was becoming more unstable up higher, but there were still no whumphing or shooting cracks. Our switchbacks did not slip out from under us.

We did not dig a pit. We limited our assessment to examining layers exposed by steep switchbacking in a few spots and just the general feel of the snow & terrain. I'm not aware that

this was a conscious decision to not do a more rigorous assessment. Roger noted aloud at one point that our main concern would be the new snow that had fallen since the weekend. There was a slightly crusty layer about 12"-18" down representing the surface from the weekend. I did notice (I think we all did) that the wind was blowing pretty hard up at the ridge as soon as it came into view, and certainly the possibility of wind loading there entered my mind at least for a moment.

We converged at the entrance to the snot couloir to check it out. By this time I think we were all on the same page that skiing anything on the N side of the mountain would be a bad idea, from both a time and a danger perspective. Nonetheless, we continued up to take a look at the slot in this order: Roger, Marcus, Dan, Drew, Doug. We weren't talking a lot at this point, but Roger pointed out areas to avoid on our descent because of their propensity to slide, as Marcus noted. Roger pushed a track up and climber's right, around a convex minor ridge where there was a small group of trees.

This is where we came upon the feature that eventually slid, a slightly horizontally concave and more open slope about 60 ft. wide. There is a minor rock buttress that comes down from the summit ridge on the far side of the open slope; all skin tracks up to the entrance of the slot must stay to climber's left of this buttress. There are a few trees around the base of the rock buttress, I believe that's what Marcus referred to as the "few thick trees".

He continued past the trees (Marcus's "pocket of trees") into the open slope. I watched Marcus wait at the small group of trees before the slope as I approached him. When Roger reached the other side of the slope, near the base of the rock buttress, he made a switchback. Marcus took this opportunity to punch across the slope and joined Roger at the switchback as I took my turn waiting at the trees. I remember being aware that this was probably the most dangerous terrain we'd been on thus far, but I don't remember being really worried. When Marcus got to the switchback, Roger began pushing the next leg climber's left, and I had a decision to make... wait for him to continue and eventually be breaking trail directly above me (above the trees), or punch it myself and get to the switchback before Roger got too far from it. I deliberately chose the latter option, thinking that the switchback was close enough to the rock and trees to be safe. And I made it. The 3 of us were bunched up pretty close to the switchback, me on the downhill side, Marcus right above me on the uphill side, and Roger breaking trail about 20 feet up and left of us. At that point, apparently Roger was on some wind-loaded snow that was much less stable, and it seems his weight caused a fracture about 5 -15 feet above him. I did not see the fracture myself, just heard about it later from Marcus and Roger. My first indication of a problem was the collapse of the upper part of the skin track at the switchback, that triangle wedge of snow that Marcus was on top of, onto the lower part, right where I was. I dove up toward Marcus, toward what I thought was the top edge of the avalanche in hopes it would fall out below me (as I have successfully done on a couple other occasions), but the real fracture line was up a little higher, out of reach.

As this is the end of the portion of our day where we could have prevented being involved in an avalanche, I'll pause here for a little reflection on our mistakes:

1. There will be some people who would say we had already made our worst decision by skinning up that side of Snoqualmie Mt. that morning at all. Obviously if we'd bailed that early, it wouldn't have happened. I'm not in that camp though. I feel strongly that the avalanche conditions on most of that side of the mountain at that time were not severe enough

for me to feel like I made the wrong decision to continue. Even after my experience, I would make that same choice again in identical conditions.

2. Once we made the decision that we weren't going to ski the N side of the mountain, we should have focused only on the quality and safety of our run back down to the parking lot. There was no real reason to continue up to the slot entrance, just our curiosity of how it was looking.
3. I think we were aware that the danger was increasing, but we didn't alter our behavior significantly. We continued breaking trail along the normal path, relying mainly on our intentional spacing and the routefinding decisions of the leader. That is not intended to put negative judgment on Roger for his routefinding decisions, but rather to claim responsibility for them myself because of my mental state. Speaking for myself, I was not opening my mind and being mentally proactive about assessing the whole situation. My self-image of being slightly less experienced than the others was a factor here. If I had been leading others who were less experienced than me, I would have been thinking much more actively.
4. We should have been more rigorous about our snowpack assessment as it changed higher up. Digging a pit would have alerted us more to the wind loading, and it also would have given us time to stop, think and discuss our decisions as a group.
5. Personally, I made an incorrect assumption that the far side of the slope by the trees & rock was safe from a fracture line from above. I suspect Marcus made the same assumption. If Marcus and I had not made this misinterpretation, we would have waited at the small group of trees until Roger was either completely back in safe territory, or, more likely, watched him succumb alone to the slide. Still not great for Roger, but definitely a better outcome for the team as a whole.

Back to the story. It seemed I was separated from Marcus fairly quickly; I knew I was going for a ride, but wasn't aware that Roger or Marcus had been caught yet. I got my avalung in my mouth and stayed mostly near the surface for quite a while. Then it sped up and I got turned under, but felt I still had enough control to influence my position within the slide a little. I was actually thinking I was getting the hang of riding it out, just wondering how long I'd have to maintain, knowing the important thing would be my position when things came to a halt. But then, with a surprisingly violent blow, I came to a halt even though the avalanche didn't. I remember a quick chain of thoughts that crossed my mind in the next few seconds. First, OW! Second, annoyance at the sudden disruption of my perceived avalanche flow management. Third, profound relief that my ride in the avalanche was actually over and even though I knew I was at the very least badly bruised, everything would be fine for me. I had hit the tree with my right quadricep only. As I was soon to discover, I had instantly broken my femur, but then the continuing avalanche pinned my leg against the very large tree, which supported it and kept it from moving around more. My upper body was hanging around the left side of the tree, which created a large airhole in the lee of the tree. All I had to do was hang out and wait for everything to stop. When it did, I was mostly exposed. Drew came by first, with his beacon in search mode, and he was saying to turn off other beacons, and I assumed he meant me, so it wouldn't interfere with his searching. I said "I can do that..." and started struggling to get to my beacon, but it was buried under several layers of clothing and I gave up trying to do that pretty quickly. I did yell that I very well could have broken my leg, but at that time I wasn't sure; it was only based on how hard I had hit. Drew kept going by to look for Marcus and

Roger.

Soon, I got my left leg around underneath me to support my weight. It was then that I realized my still-pinned right leg was not rotating the way it should when I twisted my hip around, and the muscles felt weird. Not much pain, but then I knew for sure it was broken, and I better not move around much because there were probably sharp pieces of bone sticking around in there ready to tear things apart. Doug came by shortly thereafter, and I told him I needed my leg dug out and I asked if everyone was accounted for. Drew yelled up that he had seen that Roger and Marcus were on the surface. Doug then proceeded to dig my leg out, and carefully set me down next to the tree. I could go into more detail about the following events, but I think Marcus covered most of that well enough.

When I go into the mountains, I always go with the expectation that I and my team are completely responsible for ourselves. Many places I have gone, that is totally true – if something had gone wrong, we never would have been rescued. On that note, I'm truly grateful for the expertise of our own team. Marcus in particular was invaluable, with his ability to set up my traction splint and many other things. Drew and Doug used their experience to our advantage also – Doug hung out with me the longest, and his amazing attitude and quick thinking kept me going. I can think of very little we could have done better as a team after the slide occurred.

Here is where I express my eternal gratitude to the parties involved in our rescue. I am very aware that when we subjected ourselves to our avalanche, we were risking not only our lives, but the lives of our rescuers. Nonetheless, the response was without hesitation and massive. Seattle and Everett Mt. Rescue, King County, Bellevue Fire Dept., and others meshed their services seamlessly from my perspective. It's an incredible network we have here in the PNW. Thanks guys so so very much! I would love to name everyone I met by name, but there were so many and I'd be afraid of missing someone important I'm not great with names anyway!

However, when we can have an accident like this one and be rescued as quickly and professionally as we were, it makes it more difficult to maintain the correct attitude. I would like to urge everyone to strive to keep it clear in your minds whenever you go out that you are on your own, it's your responsibility to make smart decisions, and only when everything breaks down, you can hope (not expect) that you can be lucky enough to get a rescue like ours.

Things are going well for me; got my titanium rod installed, and now I'm home sitting on my couch – all indications are that I'll have a speedy recovery, for which I'm very thankful. Roger will have a rougher go at it, he'll probably be in a wheelchair for a couple months at least. We're all here for you, Roger! I'm sure next year you'll be breaking trail for us up to the slot again!

I welcome any constructive comments. Please avoid flames. They do no one any good.

Dan

### **Comments and statement from Drew :**

Hey TAY'ers -

I'm Drew from Marcus' story. Don't have internet at home or I would've posted here earlier.

Analysis of what led up to the slide can go on and on. Once the slab broke out and three friends disappeared downslope with it, that all becomes instantly irrelevant. Despite mistakes, we also did a great deal right. Despite what we did right, we also were blessed with great luck and fortune.

Many people involved in accidents in the backcountry are not fortunate enough to look over immediately after the accident and see an EMT in their S&R uniform setting a femur break in a traction splint and administering medical aid to both victims. Thanks Markus! And Doug too for being calm and collected throughout - from when the slide broke to the evac to the hospital on to today. And Roj and Don for their courage, not losing their cool once while sitting through convulsions of shock in the pounding snow that fell all afternoon.

Thanks also to the greater NW backcountry community. The enthusiasm, concern, and knowledge out there is incredible. I suggest you all go skiing to reward yourselves for being great people.

### **Comments and statement from Doug:**

I am the Doug in the party and I've held off posting until now because I wanted Marcus to complete his incredible recounting of the events [and because the damn administrator of this site wasn't sure he wanted to approve my new account registration, with good reasons that will be obvious soon!]. Marcus and Dan really covered all the details and I can't add much to their accurate and thoughtful assessments – but will still take up the next pages 7 through 12 of this thread...

The part of the story that cannot be overstated enough is how incredible the rescuers were and smoothly the rescue went. The slide, what slid and decisions that were made/not made is probably what people on this board are most interested in, but my gratitude for the help of the rescuers is where my thoughts keep returning, so that is where I want to start. After hanging out for six hours with two injured friends during a stormy day (it dumped all day - and snow continued to accumulate at our elevation until around 1400 despite what the lower telemetry data displayed) and then looking down to see a large posse of heroes charging up the slope led by friends Dave Burdick, Zac, Fitz followed by so many incredibly strong, smart and caring mountain people was one of the most amazing things I have ever witnessed. From a distance, I have always been amazed and humbled by the selflessness of those who drop everything, leave their families and take precious vacation time for no compensation to go put them in harm's way to help strangers. Seeing the rescue close up made me very aware how much time the rescuers had to put in previously to become so efficient at first response and at technical rescue.

During haz mat and spill response incidents that I have been a part of (with police and fire professionals), I have witnessed things often getting started awkwardly as chain of command is

established and a top alpha dog or dogs emerges, typically in a necessary but weird power struggle. In this rescue, I saw flawless and quick communication between (mostly) strangers who got Dan's leg in a new traction split (replacing Marcus's improvised but as-good-as-gets split with a "real" traction split - the only difference was probably the comfort to Dan's leg to not have a ski pole lashed to it) and then quickly secured in the litter. (Dan is so stoic, I think he may have attempted a one legged ski down, but we hid his skis and pretended they were both buried.)

After both Roger and Dan were secured, a double rope system was used (one primary lower rope and a belay backup) to lower each litter off tree anchors. The ropes were each 300' long and the anchored lower/belay setup were used for about 1500 vertical feet, so the first part was tedious but went smoothly due to competency of the team and the (mostly) fall line path used. After entering the old growth below, the lowering was mostly accomplished by having about ten people braking/steering the litters using body weight and ropes (I will never, ever say anything negative about snow shoes again!).

By this point, Drew and I (accompanied by Andy Hill) knew the best thing we could do was get out of the way, let the rescuers do their thing as we slowly skied down through the trees. Since we were in no hurry (we wanted to be down with Roger but we were having no problem keeping up with him for a change!), we chatted with groups of rescuers (most of whom had no idea we were in the party that got caught) and again and again I was struck by how positive everyone was, how much they were enjoying themselves and how not the slightest criticism was uttered. After we reached the parking lot, and got a chance to thank (far too few) of folks staffing the base area - I got to hear from several beaming Search and Rescue leaders how they had the best team anywhere - which was not hyperbole from what I witnessed. I apologize I do not have actual names, but I am eternally grateful for all that participated in the amazing effort!

Although I have never posted on TAY before, I think I have already used my annual allotment of space. I cannot add much to Marcus'/Dan's recount so I will try to hit a few things not covered thus my thoughts will appear both random and include some info of lesser importance than what has already been said.

1) The Familiarity Factor – It is not surprisingly that this is the first heuristic trap listed in the paper linked to by pdelmi (thanks for posting that Peter D.) earlier in this thread. I would put familiarity as the main reason why we were more comfortable making riskier decisions on that day. Almost 100 times up the same slope by one of the team equates to a lot of the familiarity. I once skinned up this same slope three times in one day (with rescuer Dave B). Familiarity with this terrain had my mind thinking about how/if we should venture out into the Phantom Slide proper on the ski down since there is always avy debris there, but I have never seen debris in the particular area that slid so I was not thinking as much about our ascent path.

2) The Communication Issue. It would be nice to come across a problem in life that can't be traced back to poor or lacking communication, but the older I get, the less this seems likely. However, the importance of communication (or lack thereof) in this accident is anyone's guess. I have toured a lot with Roger so fast movement, rapid assessment and limited communication is the norm (we actually talk and laugh the whole way, similar to this day just maybe not about our immediate environment). The decision to not ski our objective was probably made collectively in silence and there was universal agreement to this decision when it was verbalized. If the group consisted of ALL strangers, I assume the communication would

actually have been greater but the level of familiarity between some of us made the amount of communication seem normal (to me at least). I would suggest an equal factor to limited communication (as our lack of previous time together) was related to the strength of the party. When I tour with my girlfriend (good skier but more risk adverse) or newer skiers - the communication is basically non-stop to the point of maximum safety but also inefficiency.

When I ski or climb with my closest and strongest partners, communication drops behind a collective trust in our collective abilities. Obviously, unstable snow could care less how experienced we are, how well we ski or how many days we have had so far, so the relative strength and skill of party is something I will try to weight a lot less in the future. Regarding Marcus's thoughts about the value of digging a pit to increase the chance to talk more, I can only speculate here but I think that action would not have changed the outcome much. If we dug a pit (probably in a much less loaded area than slid) I would guess it would not have added to our knowledge much and would have just affirmed our decision to turn around, but going to the top of the Slot would likely have been proposed as a relatively conservative compromise. I hate to admit this, but digging a pit may just have afforded me (or someone) the chance to say something regrettable about not being that concerned about dry snow sluffs. I don't think I will use "harmless" and "sluff" in the same sentence in the future as I have uttered occasionally in the past.

3) Gear notes. None of the skiers in the party were skinning with pole straps on which may have prevented deeper burials or upper body injuries. I do a lot of Nordic skiing so I can't bring myself to cut my straps off like lots of avy pros do, but I have thought more about areas where I need to not be strapped in the last few years. I have used an Avalung for about three years now but have always wondered if I was caught in a slide if I would think to put the mouthpiece in while I am swimming and trying to get my feet below me. All skiers in the slide did. I have only thought of a Lung as extending that precious 15 minute period if you are buried, but Marcus hacking up a mouthful of snow after his Lung was ripped out made me aware how getting the mouthpiece in can block the snow from choking you. Lastly, the binding release question really got a pretty good test in the slide. Dan's Fritschi's were sheared off at the pivot point (amounting to the only good Fritschi field breakage I have witnessed of many). Marcus's NTN's released quickly likely sparing him from leg injuries. Roj's O1s - coupled with his big Megawatts - may have played a factor in his injuries. Although I have always favored the most active/powerful tele bindings (currently on Axls), my main concern with all "non-releasable" tele bindings has always been premature ejection not being retained in the binding. Although they don't ski exactly the way I like, this incident will have me giving NTN another look.

4) Safety gear. I think the natural progression, especially among alpinists, is to go lighter and lighter. Interestingly, I keep on adding to my ski repair kit while my first aid kit has been getting anemic (I have stopped bringing it all together on these "low-commitment" trips - familiarity trap once again). Marcus had a lot of safety supplies and was extremely competent in their use - the rest of us probably could only watch and learn. Marcus spoke about how the limited time factor contributed to some of our mistakes. Well, the Slot dawn patrol has basically become, in my mind, an extended slackcountry trip - so much so - that I often wonder why I really need to take my "real" backcountry back (compared to my so light, so cool, so streamlined slackcountry pack) and anything more than a liter of water, a bar and gloves/goggles on a Slot lap. With that said, I did have lots of extra warm layers with me that day and they all got used. It is hard to imagine how much clothing an injured and completely sedentary person needs to stay relatively comfortable waiting six hours on a snowing, mid-twenty degree day. I had the luxury of being able to move around to generate heat but wasn't

wearing much after loaning some layers, or eating anything since I couldn't bring myself to move Dan's femur to get at the food in my pack which was supporting his leg; so I got a little cold. Being anywhere else would have probably meant spending a cold night out. I have since purchased a few extra emergency bags/blankets which I hope will enjoy an uneventful life in the bottom of my pack for years to come.

5) Skin track spacing. Even the most novice skier learns the importance of spacing out on suspect slopes. Being one of the most impatient people alive, I typically seem to follow a repeatable pattern on tours: keep a good distance across the first few suspect slopes, less space on the next, and when the top is near, say 'the heck with it' and get right behind the leader in the skier's version of summit fever. I owe Drew boatloads of gratitude for his very safe spacing distance and the luck of being behind him in the rotation as we neared the top. Drew gave more distance than any skier than I have seen, so much so I started to get really cold and used the waiting time at the switchbacks to transition into my downhill action suit. Drew's example is something I will really follow in the future. Thank you, Drew.

6) Tremper confidence vs time graph. Several people mentioned that graph in this post, and I was speaking about it all day as we waited because I have been thinking about it a lot this year. Truthfully, my confidence has slowly been declining over this whole year not due to a specific event but because the more time you spend out there, especially during an unstable last 8 weeks like we have seen, the more you realize how weak our avy forecasting ability is. This event caused a steeper drop in my declining chart. Now I need to align lower confidence with more caution which were not tracking evenly so far this year.

If anyone is still awake and reading this, I wanted to end by passing along a little love from Roger. He has been overwhelmed by the outpouring of support from this great community. The good vibes experienced around his hospital bed and his house as friends and family came from all over to help has been an incredibly moving experience. Roj will have a long recovery ahead but he has been truly moved by the love sent his way. Keep it coming and book a lunch date with the man if your schedule allows.

Be strong and heal quickly Amigo – playing in the hills just aint the same without you!

### **Comments and statement from Roger:**

Howdy folks, sorry it took a bit, but I'd like to start by thanking everyone on this post/thread/site for a better than expected positive response to our roadside Dawn Patrol epic; a culmination of many factors that the 5 of us will be processing on different levels for time to come. HUGE thanks to my 4 amigos, Marcus, Dan, Doug and Drew that made a potential nightmare a very manageable rescue scenario. (I wish I could say self rescue as my mantra is that it's the responsibility of myself and my partners to get our asses out of any predicament that we put ) EXTRA HUGE thanks to all rescue workers involved. Your9ourselves in efforts were beyond superb. Your communication and respect for each other when having to negotiate and problem solve was impeccable. When I get your names, I will contact each of you with our gratitude. Fitz Cahall, Zac West and Dave Burdick, when you first to arrive on scene, it brought me to tears amigos that you dropped everything to run up there and drag my sorry ass off of one of our favorite DP 'laps'.

I can't agree more with Marcus, Drew, Dan and Doug's deep and thoughtful TR's as they were inspiring and led me to write this; part catharsis as well as food for thought for anyone interested. I won't spend any time on being redundant with the well stated details, snow science, logistics, and terrain assessment, as we feel we know quite well what we were getting into upon clicking in at the trail-head, the signs that lead to me triggering the slide, and most everything in between. I think that we all agree that if one of us pushed for pulling the skins a little earlier, it would have been a different scenario. Also keep in mind that believe that no matter how much experience, training and success one has in the mountains (or life for that matter) there are no guarantees and if there were, it would seem a bit anti-climactic, almost disappointing and take away the random magic keeps life vibrant.

For those who don't know me well or at all, this is the first post that I've made on any site/forum/blog as a result of not being impressed by the tendency for most interactive sites becoming a downward spiral, or the 'black plague' of regional, national or global climbing forums. On the contrary, I've always appreciated TAY's mostly positive chat, gear, and trip reports without much bottom feeding. I mostly use TAY and NWAC combined with UW's global weather models for my winter climbing/skiing bible, using it from the moment I awake until a quick check before bed.

Those that do know me, probably agree that I'm ridiculously obsessed with the mountains and feel that they are a gift to all of us not to be taken for granted; thanks to my parents for taking me into them at the age of two...I hope to always go to them in search of adventure balanced with humility. Although rock, ice, mixed and alpine climbing has been and still the main passion driver since my late teens, backcountry skiing has been a close 2nd for at least as long. For me touring complements and gives a different, almost relaxing perspective relative to the sometimes all out battle of a committing alpine route or big wall. Could this be one of the reasons why my risk assessment and commitment level may be different than some? And part of why I feel a bit more responsible for not pulling the skins earlier on the upper Phantom?

Marcus's summary of mistakes, communication, new behavior and missing data is spot on. Thank you Andy Hill for professional and easy to read scene investigation plus your honest and sobering thoughts, I would share the same feelings if I was in your position.

A few bullets of reflection;

- Out of the 100+ trips of climbing/skiing on Mt. Snoqualmie, I've gladly pulled the plug or completely bailed at the parking lot at least a dozen times in similar conditions or of lesser avi concern; Why was Wednesday different?
- I'm super passionate about tele (and wish everyone would at least give it a chance!:-)) and love skiing/touring on fat skis, ridiculously stiff bindings and boots...could this be part of my why both my knees are destroyed? Maybe. Will I continue to ski with the same system? Absolutely.
- Why didn't I stick with pulling the plug at the top of the Snot Couloir (aka New York Gulley)? At that point we had slowed down for more precautionary travel and spread out enough between safety zones, then lured into 'peeking' down the Slot entrance. Curiosity ultimately ended in supporting the rest of our mistakes.
- I'm of the school that enjoys the up nearly as much as the down, as it gives the cardio that I crave and allows me to get new perspectives and learn from even the most

familiar terrain. How ironic that my “home Dawn Patrol” nearly wacked me and 4 wonderful friends...a fact that will eat at me (in a productive way) for the rest of my years.

- I feel incredible fortunate that the outcome wasn't worse or one or more of us being killed. I've lost too many friends to the mountains and the Bering Sea (I was a Crab Fisherman for nearly 21 years), I shutter to think of trying to make sense or justify each case and how we could have joined those statistics.
- As a new father of a beautiful 21 month old girl, I promised my amazing wife Merridy that I would quit soloing completely, and take a 2 year sabbatical from hard alpine climbing expeditions. Recently fulfilling that commitment, two close friends and I received large support to attempt a new route on the monstrous NE Face of Mt. Dickey (Ruth Gorge, AK) in a couple weeks... obviously now out of the question for me...will my desire and level of commitment for remote alpine big walls change? This will remain TBD as some of the most deeply intrinsic times in the mountains have been with incredible partners, exploring the biggest challenges on new terrain...even when the route hadn't been completed or 'successful' (success in my opinion is everything that makes the journey, whether you reach the top or not, and coming home alive)

Please feel free to reply on this thread or me directly; rogmahaj@hotmail.com, 206-276-5954...as I don't pay much attention or give much validity to pseudo names...How can anyone have an opinion when no one knows who you are!!?? I want to know who you are so when we see each other in the hills, we have more to share

Thanks all for listening...be safe, follow your heart and take time to appreciate our incredible community, family and friends just a bit more.

Everlasting thanks to all loved ones with the incredible support you have unselfishly given us at every level. It's all of you and the time that I'm blessed to share with you that make life such wonderful ride...

Cheers,  
Roj

## ***Accident Photos***

Photos of the accident location (all taken by Andy Hill - SPART and Alpentel/Cascade Backcountry Ski Patrol).



The crown and area immediately above Dan's tree:



The climber's right flank:

Closer picture of the crown -- if memory serves, Dan and Marcus were standing right below the cluster of trees on the far right of the frame. The crown broke maybe a foot or two above my skis:



The crown at its thickest -- estimated 62 cm according to Andy:

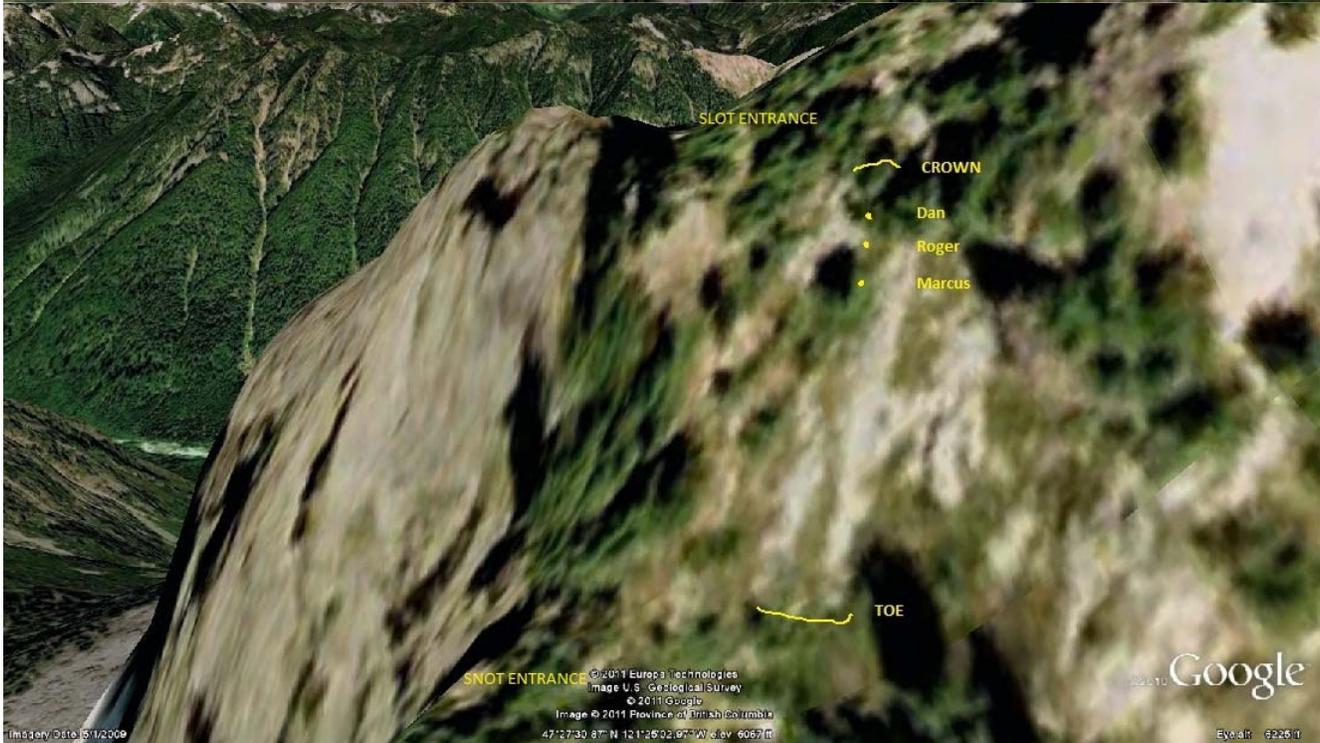
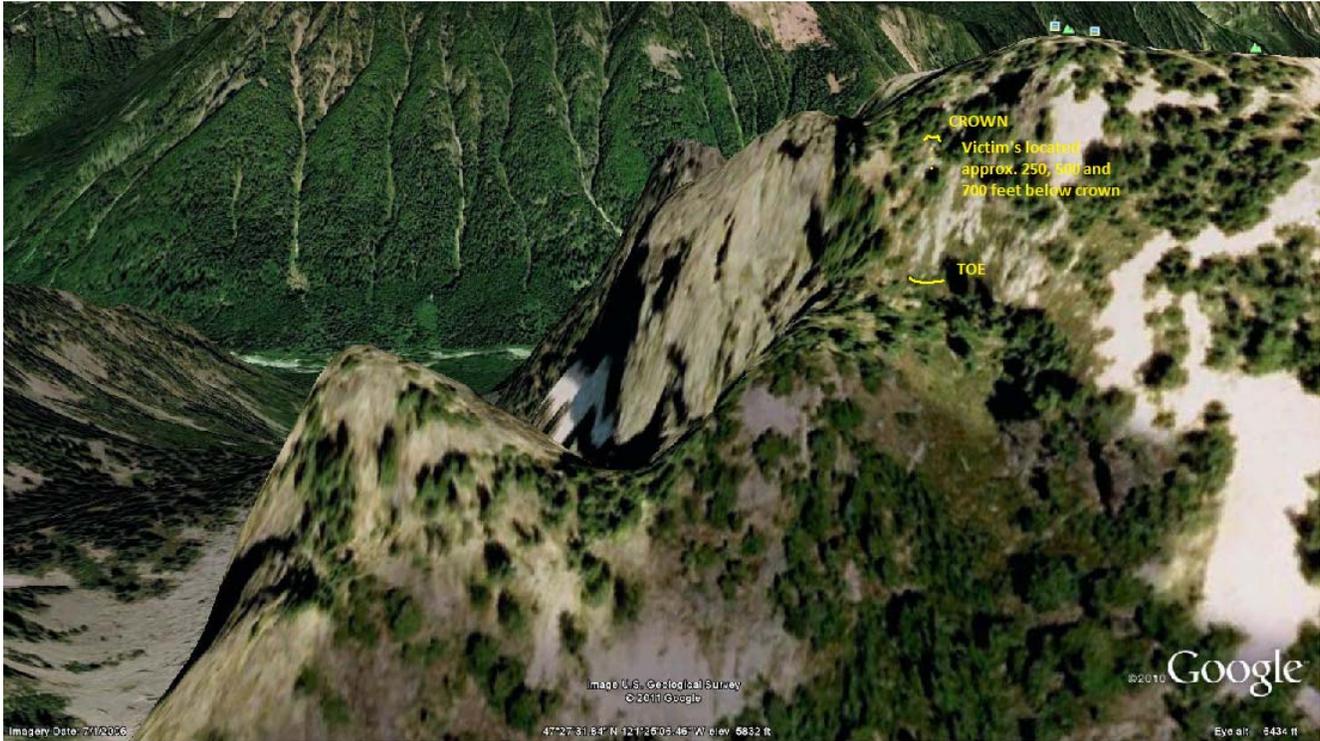
Looking downslope from the crown:



The large tree on which Dan broke his femur. I (Marcus) can only assume that, since I was right next to Dan, I threaded the needle on either the left or the right side of this tree:

## More Location Information:

(provided by Marcus):



## ***Fracture Line Profile Results***

Gary, these are Andy Hill's pit results, which he shared with me Thursday morning:

### **Avalanche Observation:**

4/6/11 – estimated occurrence at 09:30, observation at 16:00

Mt Snoqualmie - Upper Phantom

5,800 feet elevation, South Aspect, 30-35 degree slope angle

Soft Slab Avalanche,

Artificial Skier Triggered (unintentional),

D2 force (bury/injure person),

R4 Path Size (Large relative to how far it could have gone),

I Bed Surface (release within new/old snow interface)

Dry Snow Slab

### **Avalanche Dimensions:**

40 – 62cm crown height

50-75 ft crown width

1,000+ ft vertical fall

1,000+ ft path length

### **Snow properties (at Crown)**

Density of Slab (40-62 cm): Fist (dry)

Density of bed surface: Finger/Pencil (wet)

Shear Test: STE (fails with min pressure)

Shear Quality: Q1 (unusually clean, smooth, and fast)

Compression Test CT10 (easy)

Propagation Saw Test: End (on weak layer cut, slab slides to end)

## Ancillary Weather and Avalanche Information

### Weather Data:

Thanks to Amar Andalkar for the historical timeline shown below leading up to the avalanche accident:

For reference, here is the Alpentel telemetry for the days preceding the avalanche, extending back to the 8" of precip which fell in 65 hours at the end of March:

Northwest Weather and Avalanche Center  
Alpentel Ski Area, Washington

Wind sensors unheated and may rime

MM/DD	Hour PST	Temp F 5400'	Temp F 4300'	Temp F 3120'	RH % 3120'	RH % 5400'	Wind Avg 5530'	Wind Max 5530'	Wind Dir. 5530'	Hour Prec.	Total Prec. 3120'	24Hr Snow 3120'	Total Snow 3120'
3 28	2200	26	30	33	98	98	11	16	195	0	.03	0	98
3 28	2300	26	30	33	99	98	9	16	190	.01	.04	0	98
3 29	0	26	30	33	99	99	8	15	140	.02	.06	0	98
3 29	100	25	30	33	99	98	10	14	155	.04	.1	0	97
3 29	200	25	30	32	100	99	11	20	175	.04	.14	0	98
3 29	300	26	29	33	100	99	12	31	193	.05	.19	0	99
3 29	400		29	32	100					.04	.23	2	99
3 29	500	26	29	32	100	98	16	33	206	.06	.06	2	100
3 29	600	27	29	32	100	98	18	34	233	.05	.11	2	100
3 29	700	28	29	33	100	98	17	36	232	.06	.17	3	100
3 29	800	29	30	34	97	99	18	37	239	.07	.24	3	101
3 29	900	31	32	34	95	97	18	32	244	.03	.27	3	101
3 29	1000	31	32	36	92	96	14	42	226	.04	.31	3	101
3 29	1100	30	33	38	91	94	14	34	221	.03	.34	3	100
3 29	1200	32	33	38	95	93	16	43	221	.03	.37	2	100
3 29	1300	29	32	37	95	97	2	16	221	.05	.42	2	100
3 29	1400	31	32	38	97	95	0	0	221	.04	.46	2	99
3 29	1500	29	33	38	95	98	0	0	222	.04	.5	2	99
3 29	1600	30	32	38	96	94	0	0	222	.03	.53	2	99
3 29	1700	30	32	35	96	96	0	0	221	.05	.58	2	99
3 29	1800	28	32	33	98	98	0	0	221	.04	.62	2	99
3 29	1900	28	32	33	99	100	0	0	222	.05	.67	1	99
3 29	2000	28	32	33	100	100	0	0	221	.06	.73	2	100
3 29	2100	28	32	33	100	100	0	0	222	.07	.8	2	99
3 29	2200	29	32	33	100	100	0	0	221	.09	.89	2	100
3 29	2300	30	33	33	100	100	0	0	222	.09	.98	2	100
3 30	0	31	33	34	100	100	0	0	222	.11	1.09	2	100
3 30	100	31	33	34	100	100	0	0	221	.19	1.28	2	100
3 30	200		33	33	100					.29	1.57	2	100
3 30	300		33	33	100					.36	1.93	2	100
3 30	400		34	33	100					.14	2.07	2	99
3 30	500		35	34	100					.31	.31	2	100
3 30	600		35	34	100					.24	.55	2	100

3 30	700		35	35	100					.4	.95	2	99
3 30	800		34	34	100					.33	1.28	0	99
3 30	900		33	34	99					.26	1.54	0	100
3 30	1000		33	35	100					.18	1.72	0	99
3 30	1100	31	33	35	99	100	0	0	220	.14	1.86	0	99
3 30	1200	31	33	36	99	100	0	0	222	.15	2.01	0	99
3 30	1300	31	33	36	98	100	0	0	222	.14	2.15	0	99
3 30	1400	31	33	36	99	100	0	0	220	.14	2.29	0	99
3 30	1500	31	33	36	99	100	0	0	221	.14	2.43	0	99
3 30	1600	31	33	35	99	100	0	0	221	.12	2.55	0	99
3 30	1700	31	33	35	99	100	0	0	220	.17	2.72	0	99
3 30	1800	31	34	35	100	100	0	0	222	.09	2.81	0	99
3 30	1900	32	35	36	100	100	0	0	221	.11	2.92	-0	99
3 30	2000	32	36	37	100	100	0	0	223	.13	3.05	0	99
3 30	2100	32	36	36	100	100	16	36	249	.22	3.27	0	99
3 30	2200	34	37	36	100	100	26	48	232	.05	3.32	0	99
3 30	2300	35	36	37	100	100	33	63	235	.06	3.38	-0	99
3 31	0	36	39	38	100	100	35	56	239	.07	3.45	0	99
3 31	100	36	40	40	100	100	35	69	239	.07	3.52	-0	99
3 31	200	37	40	43	100	100	39	77	242	.13	3.65	0	99
3 31	300	36	39	43	96	100	49	89	243	.1	3.75	-0	98
3 31	400	36	39	42	97	100	40	75	243	.24	3.99	-0	98

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3 31	500	35	38	41	98	100	41	80	247	.23	.23	-0	99
3 31	600	33	37	39	99	100	32	59	241	.32	.55	-0	98
3 31	700	32	35	37	99	100	34	63	243	.31	.86	-0	98
3 31	800	32	35	35	99	100	25	50	236	.19	1.05	-0	98
3 31	900	32	34	34	100	100	3	29	234	.24	1.29	-0	97
3 31	1000	31	34	34	99	100	0	0	235	.26	1.55	0	98
3 31	1100	32	34	35	100	100	13	55	236	.13	1.68	0	98
3 31	1200	32	35	37	99	100	23	47	239	.03	1.71	0	98
3 31	1300	32	35	38	99	100	24	44	238	.06	1.77	0	98
3 31	1400	31	35	39	98	100	29	53	249	.02	1.79	-0	98
3 31	1500	32	35	39	99	100	31	60	248	.03	1.82	-0	98

storm total: 8.1" in 65 hours

3 31	1600	32	35	39	98	100	26	49	241	0	1.82	-0	98
3 31	1700	31	35	39	94	100	26	45	243	0	1.82	-0	98
3 31	1800	31	35	38	96	100	27	41	257	0	1.82	-0	98
3 31	1900	30	34	37	98	100	24	37	255	.01	1.83	-0	98
3 31	2000	30	34	38	94	100	25	44	241	0	1.83	-0	97
3 31	2100	30	34	36	99	100	22	36	260	0	1.83	-0	97
3 31	2200	30	33	35	100	100	20	30	268	0	1.83	-0	98
3 31	2300	28	33	35	100	99	19	33	291	0	1.83	-0	98
4 1	0	28	33	33	100	100	15	21	292	0	1.83	0	98
4 1	100	27	32	32	99	100	13	24	291	0	1.83	0	98
4 1	200	27	32	33	100	97	16	21	292	0	1.83	0	98
4 1	300	27	33	34	100	93	16	27	292	0	1.83	0	98
4 1	400	28	33	34	99	96	17	26	292	0	1.83	0	97

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4 1	500	27	32	34	100	100	19	28	292	0	0	0	98
4 1	600	28	32	34	100	99	12	20	291	0	0	0	98
4 1	700	29	33	35	99	97	15	28	292	0	0	0	97
4 1	800	30	32	35	98	99	15	26	292	.01	.01	0	97
4 1	900	31	32	36	98	99	16	28	275	.02	.03	0	97
4 1	1000	31	32	36	99	98	19	32	226	.06	.09	-0	97
4 1	1100	33	33	37	99	98	20	31	220	.07	.16	-0	97
4 1	1200	34	33	38	98	99	22	36	224	.06	.22	-0	97

4 1	1300	36	37	38	98	99	26	50	225	.02	.24	-0	97
4 1	1400	36	37	38	99	98	26	56	233	.07	.31	0	97
4 1	1500	36	39	39	99	99	25	50	231	.07	.38	-0	97
4 1	1600	36	38	41	100	99	24	45	226	.03	.41	-0	96
4 1	1700	35	38	40	100	99	24	52	236	.15	.56	-0	96
4 1	1800	32	36	38	100	100	22	43	247	.12	.68	-0	96
4 1	1900	31	34	36	100	100	14	38	268	.14	.82	-0	96
4 1	2000	31	33	35	100	99	0	0	272	.13	.95	0	96
4 1	2100	29	32	34	99	99	0	1	272	.1	1.05	0	96
4 1	2200	29	32	33	99	100	0	1	272	.07	1.12	0	96
4 1	2300	28	31	33	100	100	0	1	273	.04	1.16	-0	97
4 2	0	26	31	32	100	99	0	0	272	.04	1.2	0	97
4 2	100	24	30	32	100	98	0	0	271	.02	1.22	0	94
4 2	200	24	29	31	100	98	0	0	272	.02	1.24	0	97
4 2	300	23	29	31	100	97	0	0	272	.02	1.26	2	98
4 2	400	23	28	32	99	97	0	0	272	.01	1.27	2	98

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4 2	500	23	27	30	99	97	0	0	271	.09	.09	4	100
4 2	600	22	28	30	99	98	0	0	271	.08	.17	0	102
4 2	700	23	27	31	99	98	0	0	273	.03	.2	1	102
4 2	800	24	27	31	98	98	3	28	267	.03	.23	0	101
4 2	900	23	27	32	96	97	21	36	238	.09	.32	2	102
4 2	1000	24	27	32	94	96	20	33	237	.07	.39	3	104
4 2	1100	28	28	34	91	97	21	41	236	.04	.43	5	105
4 2	1200	27	28	34	94	98	21	42	242	.01	.44	4	104
4 2	1300	26	29	34	93	97	22	34	248	.03	.47	5	104
4 2	1400	28	28	33	95	99	16	30	250	.07	.54	5	-4
4 2	1500	24	28	32	98	98	20	44	247	.13	.67	6	106
4 2	1600	24	28	33	97	98	22	44	270	.15	.82	8	108
4 2	1700	23	28	32	97	98	17	29	285	.13	.95	9	108
4 2	1800	23	28	31	98	98	22	37	257	.06	1.01	10	109
4 2	1900	22	28	31	99	98	18	33	276	.01	1.02	10	110

storm total: 2.3" in 36 hours

4 2	2000	22	28	31	97	97	15	31	290	0	1.02	10	110
4 2	2100	22	28	31	99	97	19	31	283	0	1.02	10	110
4 2	2200	22	27	30	99	98	20	34	261	0	1.02	10	110
4 2	2300	22	27	30	99	98	21	31	252	0	1.02	10	109
4 3	0	22	27	30	99	98	13	26	277	0	1.02	10	109
4 3	100	22	27	30	99	97	10	22	308	0	1.02	9	110
4 3	200	21	27	30	99	97	12	23	298	0	1.02	10	110
4 3	300	21	27	30	99	98	11	21	312	0	1.02	9	109
4 3	400	21	27	30	99	97	11	28	288	0	1.02	9	109

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4 3	500	22	27	30	99	97	8	16	252	0	0	0	109
4 3	600	22	27	30	99	98	8	13	263	0	0	0	109
4 3	700	24	27	31	96	97	7	14	289	0	0	0	108
4 3	800	25	26	32	94	98	6	12	284	0	0	-0	108
4 3	900	27	28	35	88	97	4	9	254	0	0	-0	106
4 3	1000	30	28	36	84	98	3	6	240	0	0	-0	105
4 3	1100	33	29	37	84	98	2	6	245	0	0	-0	105
4 3	1200	32	30	37	86	98	3	12	224	0	0	-0	105
4 3	1300	34	30	37	86	93	6	13	240	0	0	-0	105
4 3	1400	34	30	37	87	93	6	14	240	.01	.01	-0	105
4 3	1500	33	30	36	92	95	7	13	237	.01	.02	-0	104
4 3	1600	32	30	35	91	95	10	18	238	.01	.03	-0	104
4 3	1700	27	29	34	97	96	12	18	234	0	.03	-0	104
4 3	1800	25	29	33	97	96	12	22	232	0	.03	-0	104

4 3	1900	24	29	33	98	97	10	16	228	0	.03	0	104
4 3	2000	24	28	32	99	97	8	18	223	0	.03	-0	104
4 3	2100	23	27	32	99	96	7	13	229	.01	.04	0	104
4 3	2200	23	27	32	98	97	12	26	235	0	.04	0	103
4 3	2300	23	27	32	98	97	16	28	244	0	.04	0	104
4 4	0	23	28	31	98	97	17	30	241	0	.04	0	103
4 4	100	23	28	32	98	98	18	39	238	.01	.05	0	104
4 4	200	24	28	32	99	97	19	31	229	.03	.08	0	105
4 4	300	24	28	32	99	97	18	28	231	.04	.12	0	105
4 4	400	24	28	32	99	97	18	27	233	.04	.16	1	105
-----													
4 4	500	24	28	32	99	97	20	36	234	.04	.04	1	105
4 4	600	25	29	32	100	98	24	37	234	.06	.1	2	106
4 4	700	27	29	32	99	97	21	34	237	.1	.2	2	106
4 4	800	28	30	33	98	97	20	33	234	.09	.29	3	107
4 4	900	28	31	34	96	97	19	33	238	.07	.36	-0	109
4 4	1000	29	31	35	92	96	15	27	238	.06	.42	0	109
4 4	1100	30	31	35	91	97	16	29	239	.06	.48	1	109
4 4	1200	31	31	36	90	96	14	30	229	.04	.52	1	109
4 4	1300	30	31	36	91	96	15	29	226	.05	.57	1	109
4 4	1400	29	31	35	94	97	19	38	226	.05	.62	1	109
4 4	1500	29	31	34	97	96	22	40	230	.03	.65	1	109
4 4	1600	29	31	34	97	97	18	40	227	.05	.7	1	109
4 4	1700	28	30	33	98	97	15	32	230	.05	.75	1	109
4 4	1800	27	29	33	100	98	20	37	220	.04	.79	1	108
4 4	1900	26	29	33	99	98	25	45	228	.04	.83	1	108
4 4	2000	26	29	32	100	98	27	42	239	.07	.9	1	108
4 4	2100	27	29	32	100	98	25	48	239	.06	.96	2	109
4 4	2200	26	29	32	100	98	25	44	241	.07	1.03	3	109
4 4	2300	25	29	33	100	97	30	58	251	.06	1.09	3	109
4 5	0	23	28	32	98	98	30	54	251	.02	1.11	3	109
4 5	100	23	27	32	96	97	23	45	254	0	1.11	3	109
4 5	200	23	26	31	98	96	23	45	253	.04	1.15	4	110
4 5	300	22	26	31	99	97	25	48	251	.03	1.18	4	109
4 5	400	22	26	31	95	97	20	38	243	.01	1.19	4	110
-----													
4 5	500	21	26	30	98	96	21	38	250	.05	.05	5	110
4 5	600	20	25	30	92	97	21	40	247	.02	.07	5	110
4 5	700	20	24	29	91	96	19	35	243	.02	.09	5	110
4 5	800	21	24	30	94	96	15	26	237	.07	.16	0	111
4 5	900	22	25	31	92	95	17	31	242	.05	.21	-0	110
4 5	1000	23	26	31	93	96	19	36	248	.03	.24	1	111
4 5	1100	24	26	33	90	93	17	33	249	.02	.26	1	110
4 5	1200	25	27	34	90	93	19	36	252	.01	.27	1	111
4 5	1300	27	28	35	91	96	15	27	248	.03	.3	2	110
4 5	1400	26	28	34	94	95	17	31	247	.03	.33	2	110
4 5	1500	25	28	34	88	97	19	36	246	.01	.34	2	112
4 5	1600	25	27	32	97	96	17	35	240	.06	.4	3	112
4 5	1700	23	27	32	96	98	19	40	245	.05	.45	5	113
4 5	1800	22	27	31	95	97	17	36	246	.03	.48	5	112
4 5	1900	23	27	30	98	96	10	21	240	.08	.56	5	114
4 5	2000	23	26	30	99	97	9	21	231	.07	.63	6	114
4 5	2100	22	26	31	99	97	10	17	236	.04	.67	7	116
4 5	2200	23	26	31	99	96	11	20	235	.04	.71	8	117
4 5	2300	23	26	31	100	97	13	25	230	.08	.79	9	117
4 6	0	23	26	31	100	97	13	29	233	.1	.89	10	119
4 6	100	23	26	31	100	96	13	34	240	.04	.93	11	119
4 6	200	22	26	30	100	97	11	28	241	.07	1	12	121
4 6	300	22	26	30	99	97	16	28	241	.01	1.01	11	120

4	6	400	21	25	30	99	97	13	27	240	.07	1.08	12	121
-----														
4	6	500	20	25	29	99	96	16	31	242	.02	.02	12	120
4	6	600	19	24	29	95	95	16	34	235	.01	.03	12	121
4	6	700	18	23	28	94	94	11	27	253	.04	.07	0	122
storm total: 2.5" in 55 hours														
4	6	800	19	23	29	92	94	14	26	238	0	.07	0	122
season-to-date snowdepth maximum														
4	6	900	22	25	32	84	95	12	26	247	.02	.09	0	120
avalanche at 930 PDT (830 PST)														
4	6	1000	23	25	32	86	95	13	23	231	0	.09	0	119
4	6	1100	25	27	37	76	93	10	18	234	.01	.1	-0	119
4	6	1200	32	26	34	83	95	7	26	246	.02	.12	1	119
4	6	1300	25	25	31	92	93	12	28	243	.03	.15	1	119
4	6	1400	26	25	30	94	93	11	24	240	.06	.21	1	119
4	6	1500	31	26	34	83	94	10	23	230	.04	.25	3	120
rescue teams arrive														
4	6	1600	26	27	32	84	96	8	16	240	0	.25	3	119
4	6	1700	25	26	32	88	96	15	33	232	.01	.26	3	120
4	6	1800	21	26	29	88	96	9	19	230	0	.26	3	119
4	6	1900	19	25	28	94	96	11	21	244	.01	.27	3	119
4	6	2000	19	24	27	95	95	9	18	322	0	.27	3	118
patients reach trailhead														
4	6	2100	19	24	27	95	95	8	12	322	0	.27	2	118
4	6	2200	20	25	28	96	95	7	12	322	.02	.29	3	120
4	6	2300	19	24	28	97	95	8	18	322	.01	.3	3	119

(Note that times in the NWAC telemetry remain on PST year-round.)

## NWAC Avalanche Forecasts

The following forecast issued on the day before the accident indicates that an avalanche warning had been issued for most of the Washington Cascades and Olympics that began on the 5<sup>th</sup> and continued into the morning of the 6<sup>th</sup>. While these forecasts are indeed regional in nature, this forecast seemed to capture the basic snowpack ingredients (new unstable wind slabs) that contributed to the incident.

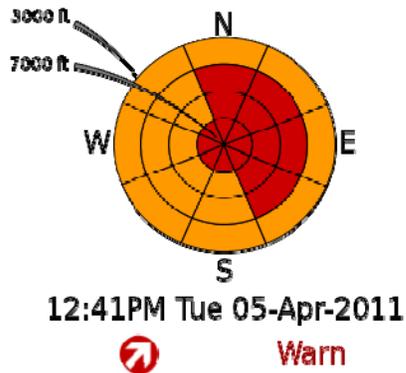
1241 PM PDT Tue Apr 05 2011

This forecast applies to back country avalanche terrain below 7000 feet and does not apply to developed ski areas or highways.

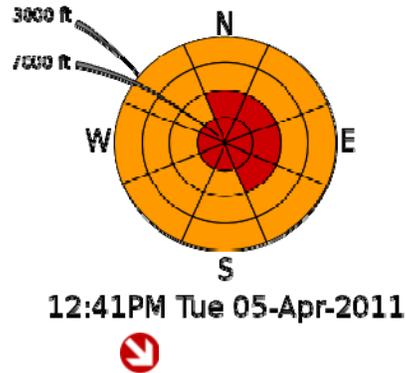
## Zone Avalanche Forecasts

### Snoqualmie Pass

Danger Rose for Tuesday



Danger Rose for Wednesday



Click [here](#) for complete definitions of the avalanche danger scale.

### Forecast

#### AVALANCHE WARNING TUESDAY TO WEDNESDAY MORNING

**Tuesday to Wednesday morning:** High avalanche danger above 4000 feet and considerable below. Danger increasing Tuesday night to Wednesday morning.

**Wednesday afternoon and night:** Decreasing high danger above 6000 feet and considerable below.

### Snowpack Analysis

A strong storm began Monday morning, depositing some 10 to 25 inches of new snow in most areas. Strong winds near ridge top caused widespread unstable layers to form on most lee slopes, especially higher terrain. Heavy snowfall and daytime warming produced some natural avalanches Monday, however many of these paths have already reloaded with new unstable layers.

Unstable conditions were reported at the Mt Baker and Stevens ski area by field professionals early Tuesday where ski triggered and explosive releases had extensive propagation and were sensitive, despite significant new snow settlement rates. In general, most slides were involving storm snow layers up to 1.5 ft deep, but with good propagation and running long distances.

There remains a threat for some slides releasing in new snow layers to penetrate a wet snow layer of some 1 to 2 feet thick that may be buried 1 to 3 feet below the surface. Any slides involving these layers would be big and very dangerous, possibly destructive in nature, however predicting which slope would or could slide to these deeper layers is difficult.

Therefore we are not recommending travel in avalanche terrain until these unstable wet snow layers strengthen and new unstable layers stabilize.

## **Detailed Forecasts**

### **Tuesday to Wednesday morning**

Moderate orographic snow showers and moderate to strong westerly crest level winds should maintain or build further unstable wind slab layers on lee slopes, especially northwest to southeast facing slopes. Another frontal system is expected later Tuesday afternoon through early Wednesday. This should cause increasing and strong winds with moderate to heavy snowfall at low freezing levels. This weather will build new unstable layers on similar aspects, mainly northeast to southeast. Natural or human triggered avalanches should remain likely through early Wednesday, especially on steep open lee slopes. Avalanche releases may step down to or entrain underlying wet snow layers making some isolated large slides possible. Travel in avalanche terrain is not recommended Tuesday through Wednesday morning.

### **Wednesday afternoon and night**

Gradually decreasing showers are expected later Wednesday and Wednesday night. This should allow for a slow decrease in danger as previous unstable layers slowly consolidate and settle. However, any sun breaks being received later Wednesday may quickly make recent snow unstable and cause wet snow avalanches on steep exposed slopes. Some of these may be quite large in areas that have received significant recent storm snow amounts. Also, large cornice formations may become weak and fail during the warmest part of the day. These conditions will make careful route-finding essential later Wednesday.