Altoona Lakes Avalanche Accident
March 10, 2014
Flint Creek Range
Beaverhead – Deerlodge National Forest
Summary: 1 caught, 1 buried, 1 fatality
Classification: HS-ASu-D4-R4-O

Prepared by Dudley Improta, Avalanche Specialist, West Central Montana Avalanche Center

Synopsis
On March 10, 2014 at approximately 1415 hours, Peter Maxwell, from Missoula, Montana, triggered a hard slab avalanche on a westerly (260 deg.) slope above Altoona Lakes, in the Flint Creek Range of western Montana. The overall elevation of the crown was 8512 feet and the approximate slope angle of the crown was 35 degrees plus. The toe of the avalanche was estimated at 7780 feet. The alpha angle of the entire slide path is 34 degrees. The avalanche ran 1324 feet on the ground. The estimated horizontal length of the crown was 2100 feet.

Peter was caught and carried the full length of the avalanche and succumbed to injuries sustained during the avalanche and/or asphyxiation from burial.

Peter was skiing with a group of friends from Missoula. The group had spent the previous day and evening at Altoona Ridge Lodge, a backcountry cabin rental near Maxville, Montana. There were five split-boarders and two skiers. They arrived at the lodge on the morning of March 9 and elected to delay skiing until Monday due to inclement weather. Each individual in the group carried a transceiver, an avalanche probe and a shovel. There was at least one smart phone and a SPOT with the group. Five of the seven had avalanche training; three of them had Level 1 training.

Mitch Strang, one of the group members posted this information on the internet March 12.

"March 10 at 9am we left Altoona ridge lodge with the plan to ski some low-angle terrain. It had snowed 6 inches the night before and we were all excited…. We began our skin up to the ridge directly above the lodge. Visibility was low…, and we had talked about that. The plan was to skin the ridge and locate some safe steep terrain, and if that was not an option we were going to do a low angle tree run back to the lodge. Once we reached the ridge we skinned 2 miles to a face we had spotted during a break in the weather. There were seven of us and we knew that was a big group for the backcountry. We reached a spot where we decided it was safe to dig a pit and make a call…. We split into two groups; one to dig a pit and the other to wait above for the go-ahead. Two pit tests were conducted and both clearly showed a very deep weak layer right on the rocks. During the tests the top group had moved skiers left to see another aspect. At this point we deemed the slope unsafe and were ready to exit. Peter had spotted another potential pit site on another close aspect, which was shadowed by old growth trees. He spotted a tree that he felt safe to ski to, when he descended towards the tree he gained a considerable amount of speed, and passed the tree…. He only went 10 feet further and that is all it took.
We heard the slope break; only two of us were in position to see him go down. Immediately we were mobilized, we had dangerous snow above us. But we decided to get down the slope as fast as possible. The fracture was huge and ripped all the way down to the rock. The slide carried him 1,500 vertical feet over a series of very large cliffs. The chance of him surviving that initial trauma was extremely low.

We bounded down a 1,500 foot sheer rock face in less than 10 minutes. Our beacons brought us right on top of him. On our third probe we had a strike, and began digging trying to save our best friend. In less than two minutes we had his face and chest unburied. We began doing some chest compressions but decided we needed his entire body clear from the snow. After getting him free we resumed chest compressions and mouth to mouth. A spot device was activated as soon as the body was found. We worked on Peter for an hour taking turns trying to save his live."

Search and Rescue

The group was able to reach Peter quickly through steep and complex terrain. The SPOT was activated at 1437 hours. EMS, through a 911 call from a smart phone, was initiated as the group began compressions and breaths. Another member of the group, Jacob Hensley, with permission of the Granite County Sheriff, and assistance from Granite County Search and Rescue, was able to recover Peter's body that evening.

Weather and Snowpack

Dry, cold weather, during early winter, and a shallow snowpack had created a very weak faceted layer near the ground (depth hoar). This layer was 25cm (10 inches) in depth in a snowpit dug adjacent to the crown on March 11.

The Missoula Weather Service had predicted heavy snows for the Georgetown Lake area on March 9 and 10. Forest Service personnel in the area estimated 5 inches of snow fell in the Flint Creeks between 1500 and 1700 on March 10.

Peterson Meadows Snotel (elevation 7200' near Discovery Ski Area) recorded .7 inches of new snow water equivalent from the storm beginning on March 9 until the accident. During the same period, Black Pine Snotel (elevation 7210' west side of Flint Creek) recorded 1 inch of new snow water prior to the accident and an additional 1.4 inches of snow water after the accident. Both snotels are 1500 feet lower than the avalanche crown.

The two snotels recorded unseasonably warm temperatures on March 8; reaching into the 40's F. Mountain temperatures dropped into the low to mid 20's F with the arrival of the system beginning March 9.

Conclusion

This was an avalanche on a deep instability (depth hoar) that ran to the ground. Avalanche specialists, from the West Central Montana Avalanche Center, initiated a collapse and a large crack on a convexity above the crown while digging a snowpit on March 11.

The cliff and tree hazards on the slope were covered by snow until the avalanche ran. The terrain hazards were not immediately obvious before the slope failed.

The Flint Creek Range and the Philipsburg area have a drier climate than the west central Montana region. The combination of elevation, colder temperatures and relatively shallow snowpack in the early season, often builds weak faceted snow associated with continental snowpacks. The transition from an intermountain snowpack to a continental snowpack in a two-hour drive is an important consideration when assessing avalanche danger in the Flint Creeks.

This was a strong group with Peter; they responded quickly in hazardous, steep and complex terrain. At the time of the incident they were assessing the snowpack before committing; and they were moving one at a time.

Unfortunately, Peter, while skiing to a new pit location, probably broke through to the weakness in the snowpack near some rocks and initiated the propagation and failure of the avalanche.

Tim Laroche and I visited the avalanche site on March 11, the day after the incident. Bruce Tremper, Director of the Utah Avalanche Center and author of *Staying Alive in Avalanche Terrain*, visited the site on March 16 with members of the family and some of the group members. Here are Bruce's notes and observations:

"Bruce Maxwell has been a livelong, close friend since grade school when we first started ski racing together in Missoula and I knew his wife Ann since 1st grade and even introduced them to each other in high school. And I have watched their boys grow up. So I when Bruce called to tell me that his son Peter had been killed in an avalanche, I immediately made plans to return to Montana and spend several days with him and his family, especially to return to the accident site with Bruce and his son Tyler to try to explain to them what happened and why. I've found, through the years, that this process greatly helps everyone to find closure in the face of incredibly tragic events like these. Plus, I needed to see it for myself.

We went in with four of the original seven party members as well and we used snowmobiles to access the basin and skins and skis to get to the avalanche deposition area. I had reviewed Dudley Improta's photos before I went in, so I knew it was a large, climax avalanche in unforgiving terrain but I found the avalanche much larger and less forgiving than I imagined. It was about 1/3rd of a mile wide, it fractured 5 feet deep on a very weak layer of depth hoar near the ground. It descended 1300 vertical feet, ripping out some mature timber in the process and the debris ran well into the forest at the bottom of the run out zone, so I'm guessing that this was a very rare avalanche with at least a 10 year return period.

The terrain where the accident occurred is what I sometimes refer to "zero tolerance for error" terrain because there are so many obstacles to hit on the way down including many trees and very steep, protruding pinnacles of rock and cliffs. Its danger was not apparent from the top because the section near the ridge was gentler terrain (perhaps 34 degrees) with thicker trees, but as you move down, the slope rolls over to the steepness of prime avalanche terrain around 38 degrees with sparse trees. Then, at mid slope, it rolls over yet again into extremely steep, 50-60 degree, rocky, cliffy terrain that terminates on a gentle apron at the bottom. Standing at the top, they would not have been able to see any of this because it was hidden beneath the rollovers. In terrain like this, it's easy to be lured in.

Then there was the snowpack. Of the many different types of avalanches, the kind that Peter triggered was what avalanche forecasters call a "deep slab avalanche" which is by far the most dangerous and unpredictable kind. They break very deeply on a weak layer near the ground and the entire season's snowpack slides at once. They are very unpredictable and most common snow stability tests, even explosives, are often unreliable indicators. They are the classic low probability – high consequence avalanche. In other words, they are often difficult to trigger but if you do find the trigger point (often in a shallow rocky area) you collapse the culprit weak layer by the ground and it can propagate extremely wide and large. It's the kind of avalanche that can easily fool avalanche professionals. There is no way to manage this kind of avalanche problem except to avoid the slopes where you suspect they may occur.

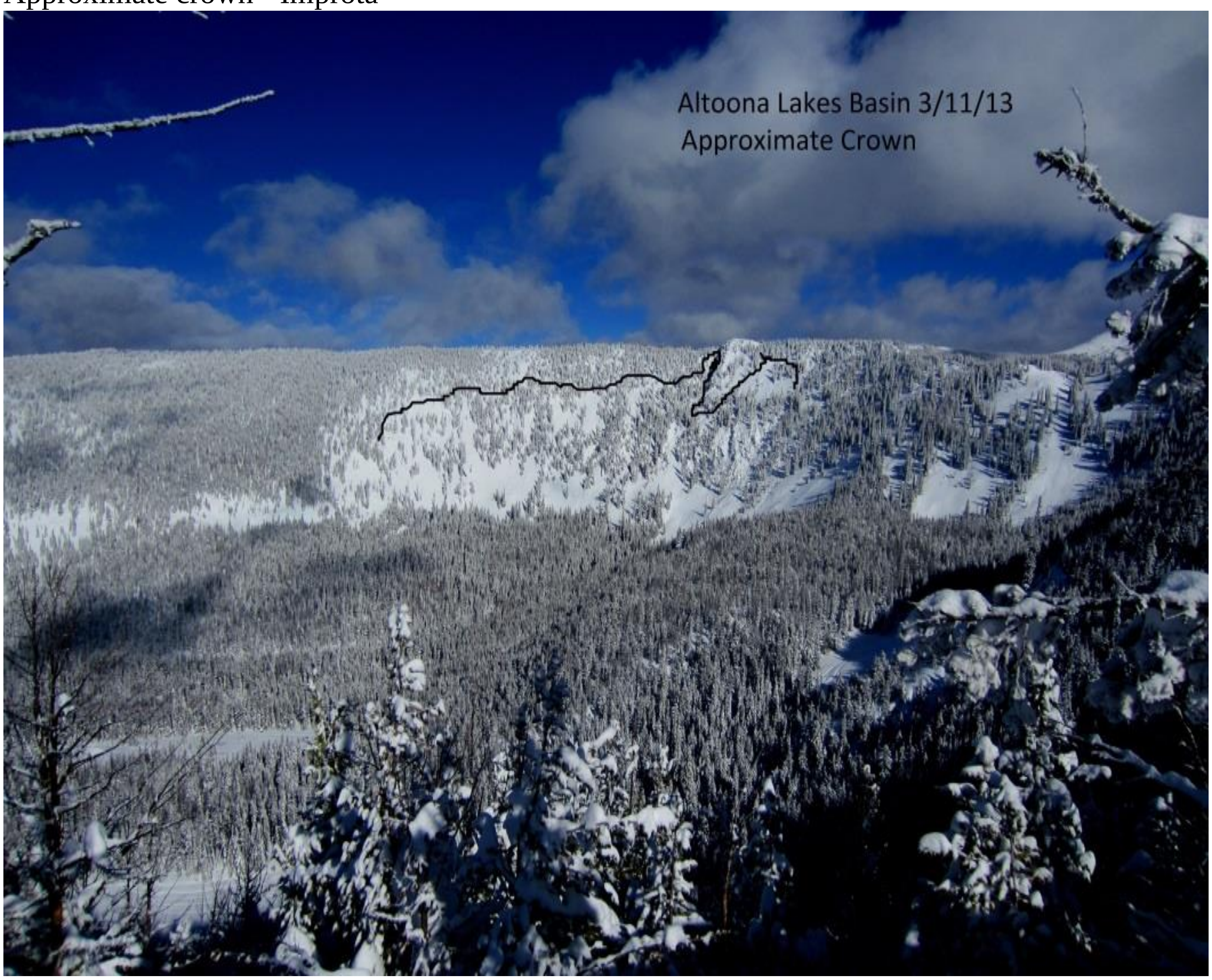
I dug a snow profile on the downside of a small knoll in the run out of the avalanche that was spared from the blast of the avalanche above. It was almost identical to the profile dug by Tim Laroche and Improta included in this report. The layer of depth hoar near the ground was extremely weak and angular without a hint of rounding (which indicates sintering and bonding). I tried to isolate columns of snow and they would just collapse before I could cut them out, sometimes before even reaching the depth hoar. In other words, it was a very unstable snowpack. I normally expect to see a snowpack like this in the early to mid-season but never so late in the season, especially in mid-March, when the snowpack is typically thick and stable.

In addition, normally a deeply-buried weak layer with a strong bridge above it like this snowpack will require a significant load of snow to make it unstable. But in this case, only .7 inches of water weight fell before they triggered the avalanche, which was only a 5% increase in total snow water equivalent. The party members reported 6 inches of fairly low density snow from the previous 24 hours to the accident. Normally, I would expect a snowpack like this to need more water weight to become active. So this speaks to the unusually unstable condition of the snowpack.

The party members all seemed to have at least Level 1 avalanche knowledge, intelligent and prepared with proper rescue gear. Despite the difficulties of descending the steep, rocky terrain, they performed a textbook rescue and first aid. But this accident was a combination of an extremely dangerous and unpredictable snowpack with extremely dangerous terrain that was difficult to judge from above. They were dealing with something far more dangerous, unpredictable and rare than they had seen before, indeed, more than many avalanche professionals have seen before.

As a final observation, fracture lines of large avalanches like these not only have very random zigs and zags, but it's also common for them to break right to the ridge tops. This particular avalanche could easily have claimed more victims."

Approximate crown - Improta



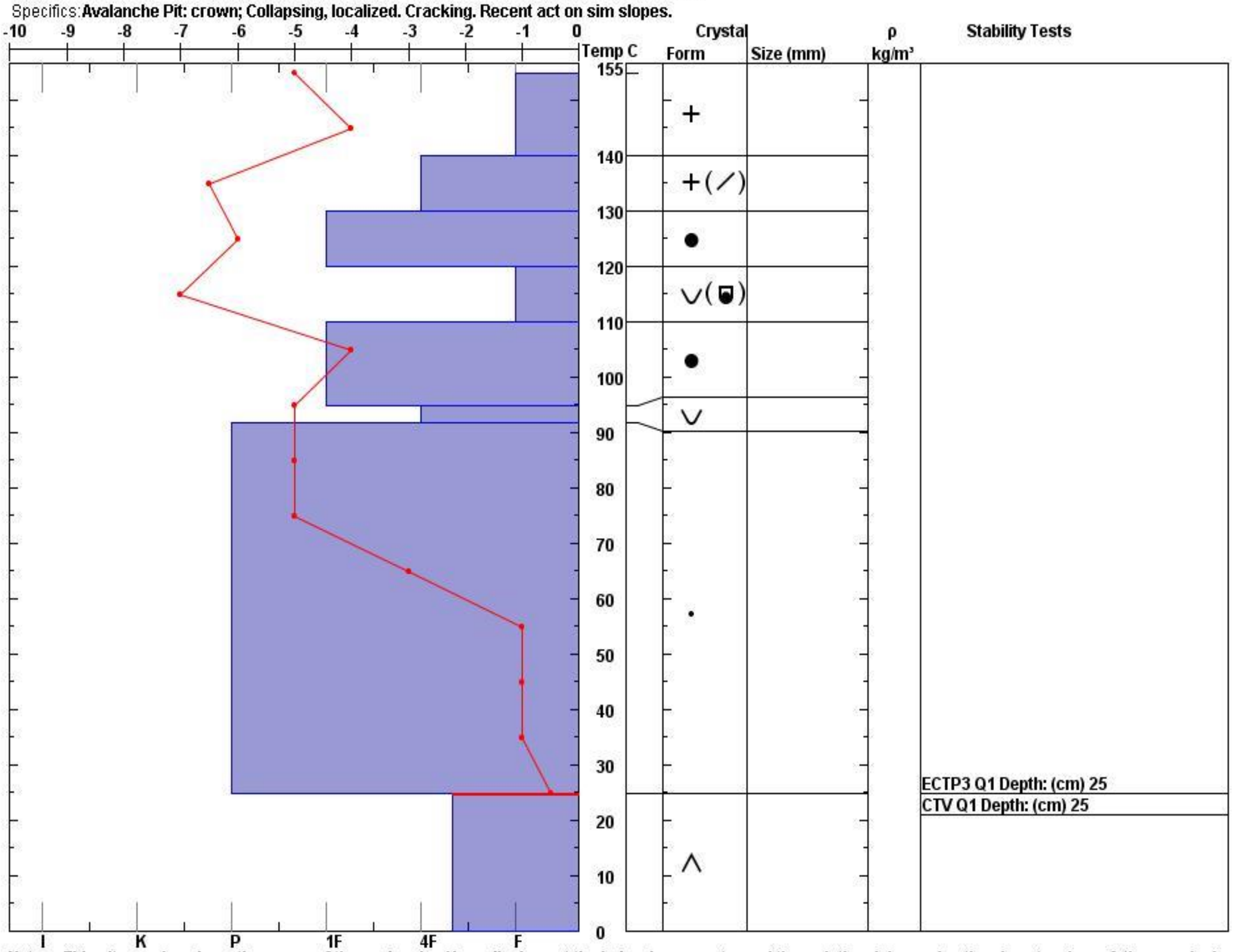
Entire slide path - Improta

Approximate Trigger Point - Improta

Burial site looking up slide path - Tremper

Snow Pit Profile	Observer: **Tim Laroche**	Stability on similar slopes: **Poor**	**PS25 HS155**	Layer notes:
Deerlodge Basin	**Tue Mar 11 02:30:00 MDT 2014**	Air Temperature: **-5 C**	Stability Test Notes:	**0-25: Problematic Layer**
Flint Creek, MT	Co-ord: **46.23701 N 113.04914 W**	Sky Cover: **sky 4/8 to 8/8 covered**		
Elevation (ft) **8538**	Slope: **33**	Precipitation: **Snow < 0.5 cm/hr**		
Aspect: **260**	Wind loading: **yes**	Wind: **W Light Breeze**		

Specifics: **Avalanche Pit: crown; Collapsing, localized. Cracking. Recent act on sim slopes.**



Notes: This pit was dug above the crown of the avalanche. Upon digging out the hole, observer stepped through the slab causing the slope to whumpf, thus producing a fracture across the slope 30 feet downhill of his location on a rollover.

Peterson Meadows Snotel – accumulated SWE 24 hours preceeding accident