

Onion Basin Avalanche Fatality

1 snowmobiler caught, fully buried and killed

1 snowmobiler caught and partially buried

Gallatin National Forest - 1 January 2014

Synopsis

Three snowmobilers were riding in [Onion Basin](#) just south of Eaglehead Mountain in the northern Gallatin Range on January 1, 2014. They accessed the area by the Portal Creek drainage. One snowmobiler became stuck and separated from the other two while in Onion Basin. These two traveled under a steep slope where they triggered and were caught in an avalanche that released from above. One was partially buried. The other was fully buried for 30 minutes or more and did not survive. The avalanche danger was rated HIGH on all slopes and an Avalanche Warning had been issued for January 1, 2014.

The crown was approximately 400 feet wide and 2 feet deep. The avalanche ran 1100 feet slope distance and 500 feet vertical on a north facing slope at 9200 feet. Debris ranged from 5-8 feet deep. Average slope angle in the starting zone was 38 degrees. The alpha angle was 22 degrees. U.S. Classification of the avalanche is SS-AM-D2.5-R3.5.

GPS Coordinates:

Crown: [N 45.19274 W 111.11318](#); Toe of debris: [N 45.19565 W 111.11462](#)

Victim Location: [N 45.19557 W 111.11444](#); Partial Burial Location: [N 45.19478 W 111.11416](#)

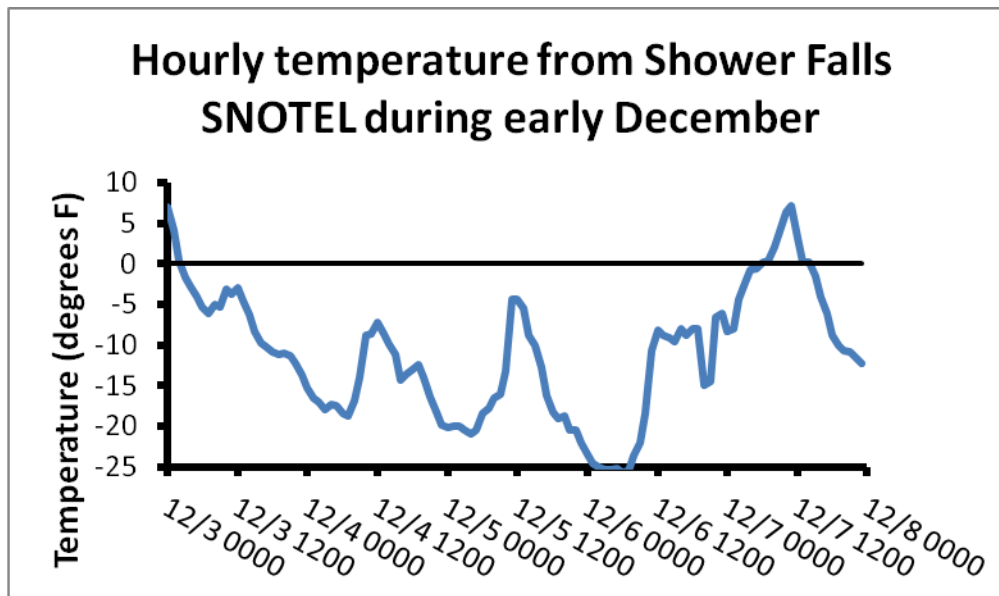
View all of these locations on a Google Map here:

<http://maps.google.com/maps/ms?msid=205958239390954080279.0004ef12f94ea22740204&msa=0>

Weather

Weather data for this location come from three sites: [Shower Falls SNOTEL](#) (16 miles NE), Yellowstone Club Timberline (16 miles W), and Flanders Mountain (19 miles NE). The defining weather event that set the stage for avalanche activity throughout the region including this fatal avalanche was a period of extreme cold weather in early December. Temperatures remained well below zero degrees F for five days. During that time snowpack depth at both Shower Falls and Timberline was about 30 inches. These cold temperatures created a weak layer of facets in the thin snowpack that became unstable under the weight of subsequent snowfall.

From December 8th to the time of the avalanche, Shower Falls gained 4.5 inches of [snow water equivalent \(SWE\)](#) and snow depth increased from 30 inches to 50 inches. There were two notable storms. One occurred in the three days before Christmas when 1.2 inches of SWE fell. Another occurred New Year's Eve when another 1.0 inches of SWE fell during a 24 hour period. Snowfall ended about 4 hours prior to the avalanche. Strong westerly winds averaging 20-30 mph gusting to 60 mph were recorded at Flanders Mountain. Winds of 20 mph gusting to 40 mph were recorded at Timberline. However, the slope in question was mostly unaffected by these winds.



Snowpack

GNFAC Avalanche Specialist Eric Knoff investigated the crown the day after the accident. The snowpack layering and structure in the crown was similar to the snowpack in many parts of the advisory area. The crown averaged 2 feet deep but ranged from 1-3 feet deep. It rested on a weak layer of faceted snow crystals found approximately a foot above the ground. This layer formed during the cold weather in early December.

Snowfall during the last three weeks of December formed a cohesive slab on top of these facets. A storm just before Christmas overloaded this weak layer, and an Avalanche Warning was issued for the northern Gallatin Range when many avalanches occurred. Some were over 1000 feet wide. Avalanche activity continued during the rest of December. Some avalanches occurred on slopes not much steeper than 30 degrees. This avalanche activity demonstrated the widespread and very fragile nature of this weak layer.

On the morning of the avalanche, another Avalanche Warning was issued for the northern Gallatin Range following a storm on New Year's Eve. The snowpack was overloaded and very dangerous avalanche conditions were expected. Many slopes in Onion Basin had produced natural avalanches. The Avalanche Warning and New Year's Day Advisory are linked at the end of this report for reference.

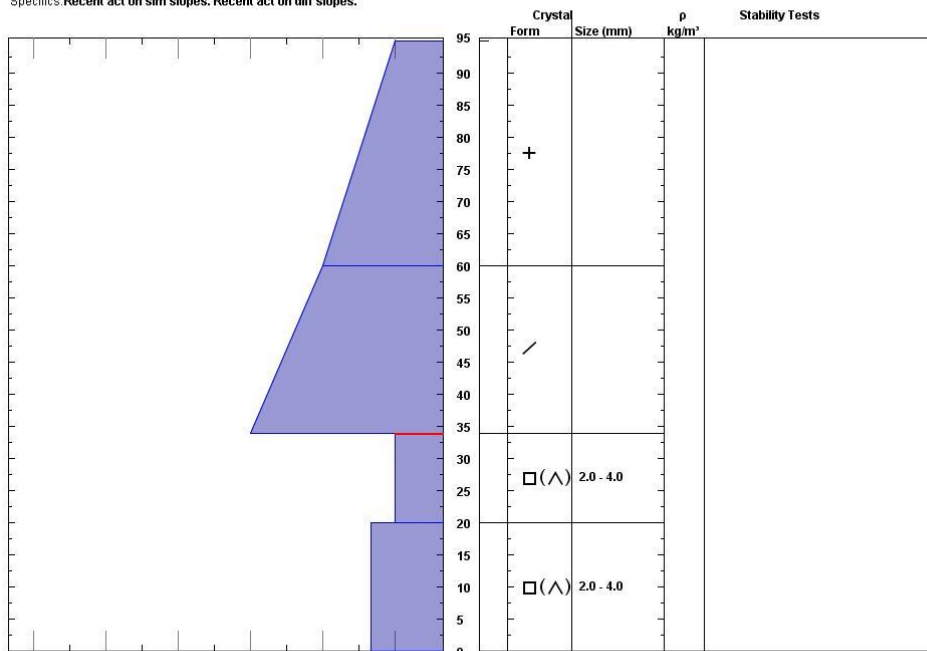
The avalanche was triggered when the two snowmobilers caught in that slide crossed a low-angled slope under steeper terrain. Before this event this slope had not produced any avalanches. They initiated a localized collapse (or fracture) in the weak layer that propagated uphill into the starting zone of the avalanche. In unstable conditions it only takes the weight of one person to initiate a collapse in a weak layer and trigger an avalanche.

While we can't say for sure they triggered the slide, all evidence indicates they did. Without active wind loading or cornices that could break and fall, the odds of it being a naturally triggered avalanche are very low. The widespread and fragile nature of the weak layer makes the odds of it being a human triggered avalanche very likely.



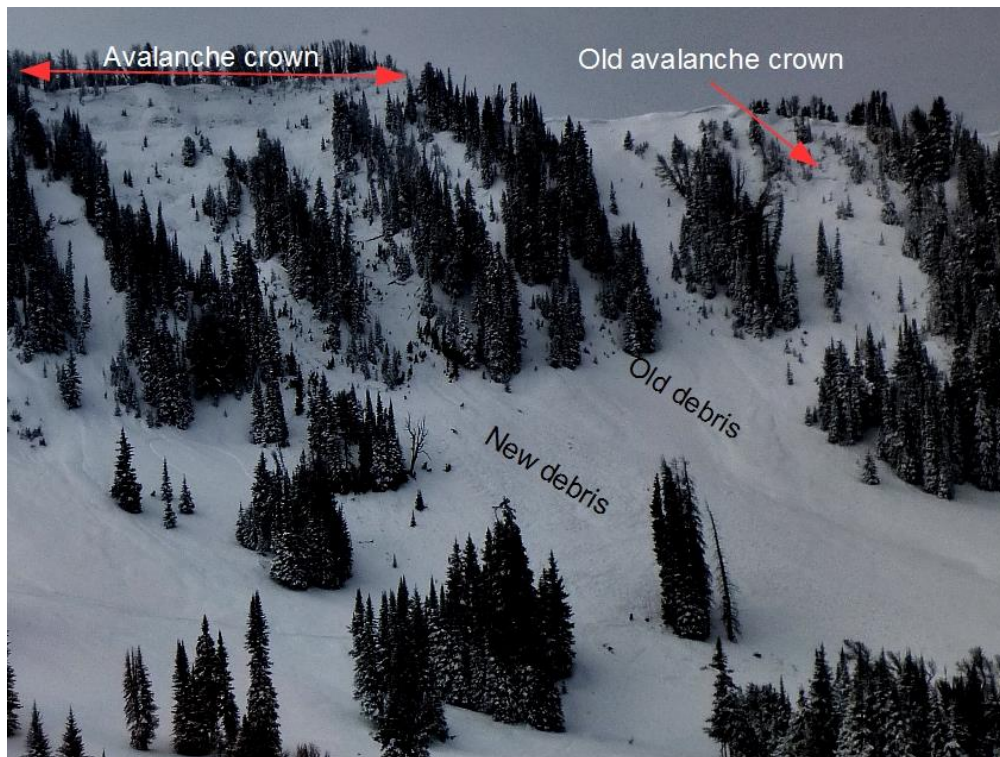
Photo of the avalanche crown looking west. Note the lack of cornices, pillows, or other signs of wind loading. For orientation, Cedar Mountain near Big Sky can be seen in the distance.

Snow Pit Profile Observer: Eric Knoff Stability on similar slopes: **Very Poor** HS95 Layer notes:
 Onion Basin Thu Jan 02 11:13:00 MST 2014 Air Temperature: C Stability Test Notes: 20-34: Problematic Layer
 Northern Gallatin Rang Co-ord: 45.19274 N 111.11318 W Sky Cover: sky 4/8 to 8/8 covered
 Elevation (ft): 9240 Slope: 38 Precipitation: None
 Aspect: 10 Wind loading: previous Wind: W Light Breeze
 Specifics: Recent act on sim slopes. Recent act on diff slopes.



Notes: This pit was dug in the crown of an avalanche that resulted in a fatality. A heavy load of new snow sitting on facets caused the unstable conditions. The slope did not appear to be heavily wind loaded, but the crown did vary from 1-3 feet in depth.

Crown profile showing very weak facets at 35 cm (about 1ft) above the ground and a 60 cm slab (2 ft).



The avalanche crown and debris from this accident are labelled "Avalanche crown" and "New debris". The slope immediately to the west had earlier produced an avalanche making it safe for SAR personnel to enter the scene.

Avalanche

There were three snowmobilers involved in this avalanche referred to as Riders 1, 2, & 3. Rider 2 was 46 years old and a very experienced snowmobiler. He knew many local riding areas and was well aware of avalanche hazards. Riders 1 and 3 were 19 years old and much less experienced. Rider 1 reported being aware of the High Danger and Avalanche Warning issued for this area. He had not taken an avalanche class but reads the Avalanche Advisory occasionally. All three riders noticed crown lines from older slides but never discussed the avalanche danger. All three had beacons, probes, and shovels. Riders 2 and 3 both had air bag backpacks.

Immediately prior to the avalanche, Rider 3 had become stuck some distance behind the other two. Rider 1 and Rider 2 entered relatively low angle terrain beneath a steeper slope when they triggered the avalanche.

Rider 1 saw the avalanche out of the corner of his eye just before it hit and carried him into a small island of trees. He was partially buried facing downhill. His arm was free but his head was covered. He initially used his hands to dig himself out of the debris until he could reach the shovel in his pack. He estimated that digging himself out of the debris took 30 minutes but this time is very subjective. His snowmobile was destroyed and buried next to a

large tree. Once out of the debris, Rider 1 tried to call 911 but was unsuccessful. The time on his phone was 14:10.

Rider 2 was about 100 feet behind Rider 1 and slightly downhill. Based on the burial location and tracks of Rider 2, Rider 1 believes (and we concur) that Rider 2 probably passed below Rider 1 in an attempt to snowmobile away from the avalanche. Rider 2 was wearing an air bag backpack but did not deploy it. Rider 2 was caught in the avalanche and fully buried.



Tracks show where Rider 1 and Rider 2 entered the area. They triggered the avalanche somewhere in front of the point where their tracks enter the debris.

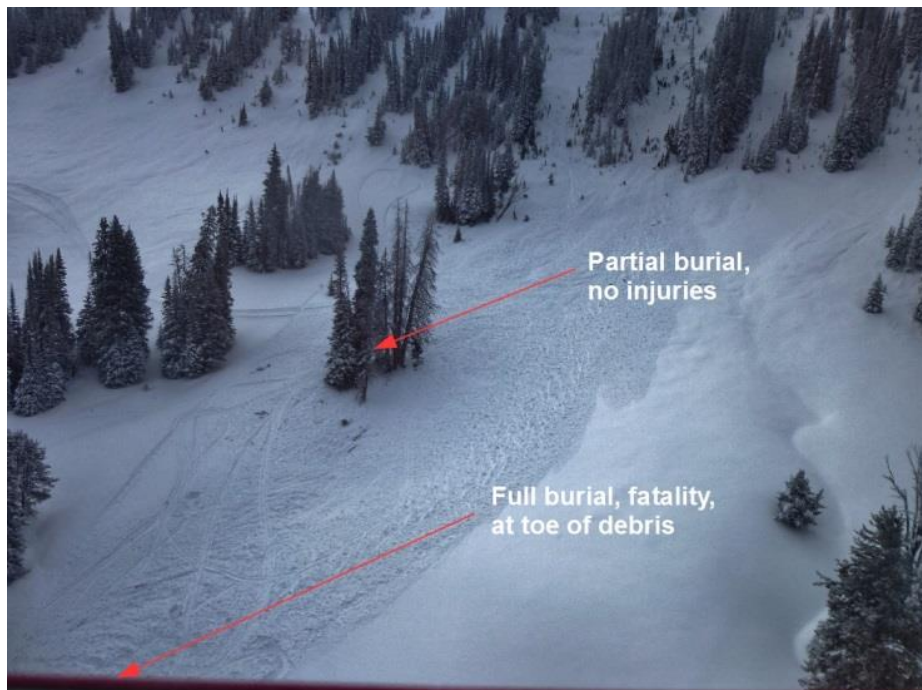
Search and Rescue

With Riders 1 and 2 caught in the slide and Rider 3 stuck out of voice and sight distance, no one was available to perform an immediate rescue. Rider 1 was partially buried and bruised but otherwise uninjured. Once he extricated himself, Rider 1 quickly used his beacon and probe to locate Rider 2. He struck Rider 2's boot with his probe and dug him out. He was buried on his side with his head 3-4 feet deep. There were no obvious signs of trauma and Rider 1 began CPR. While he was performing CPR, Rider 3 entered the scene and assisted with CPR which continued for another 40 minutes.



Rider 1 was partially buried in these trees. A ski from his damaged snowmobile can be seen.

CPR was unsuccessful and they determined Rider 2 was deceased. At that time, Rider 1 and 3 determined they needed to leave. One snowmobile was badly damaged. Another snowmobile was buried too deeply for them to recover it before darkness. They rode the third snowmobile back out Portal Creek and called 911 at 18:30. The following day Gallatin County Search and Rescue used a helicopter to retrieve the body and the GNFAAC investigated the scene.



Aerial view of avalanche debris and burial locations. The toe of debris is just out of view and stopped at a line of large trees.

Video at the debris: <http://www.youtube.com/watch?v=wdjcz9hlixU>

Video from the crown: <http://www.youtube.com/watch?v=42ekKnB-CCE>

Crown profile: http://www.mtavalanche.com/images/14/onion-basin-avalanche-fatality-crown-profile?size=_original

Avalanche Advisory and Avalanche Warning from 1-1-14:

<http://www.mtavalanche.com/advisory/14/01/01>

Photos:

<http://www.mtavalanche.com/images/14/overview-onion-basin-avalanche>

<http://www.mtavalanche.com/images/14/onion-basin-avalanche-debris-and-burial-locations>

<http://www.mtavalanche.com/images/14/avalanche-starting-zone-onion-basin-fatality>

<http://www.mtavalanche.com/images/14/avalanche-crown-onion-basin-fatality>

<http://www.mtavalanche.com/images/14/tracks-leading-scene>

<http://www.mtavalanche.com/images/14/partial-burial>

Information in this report was gathered by Mark Staples and Eric Knoff who visited the site on January 2, 2012. Doug Chabot conducted a phone interview with Rider 1 the same day.

Please direct any questions regarding this report to mstaples@fs.fed.us or 406-587-6984

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