

Sheep Mountain Avalanche Fatality

3 snowmobilers caught: 1 partially buried, 2 fully buried, 1 killed

Beartooth Mountains, Cooke City, MT

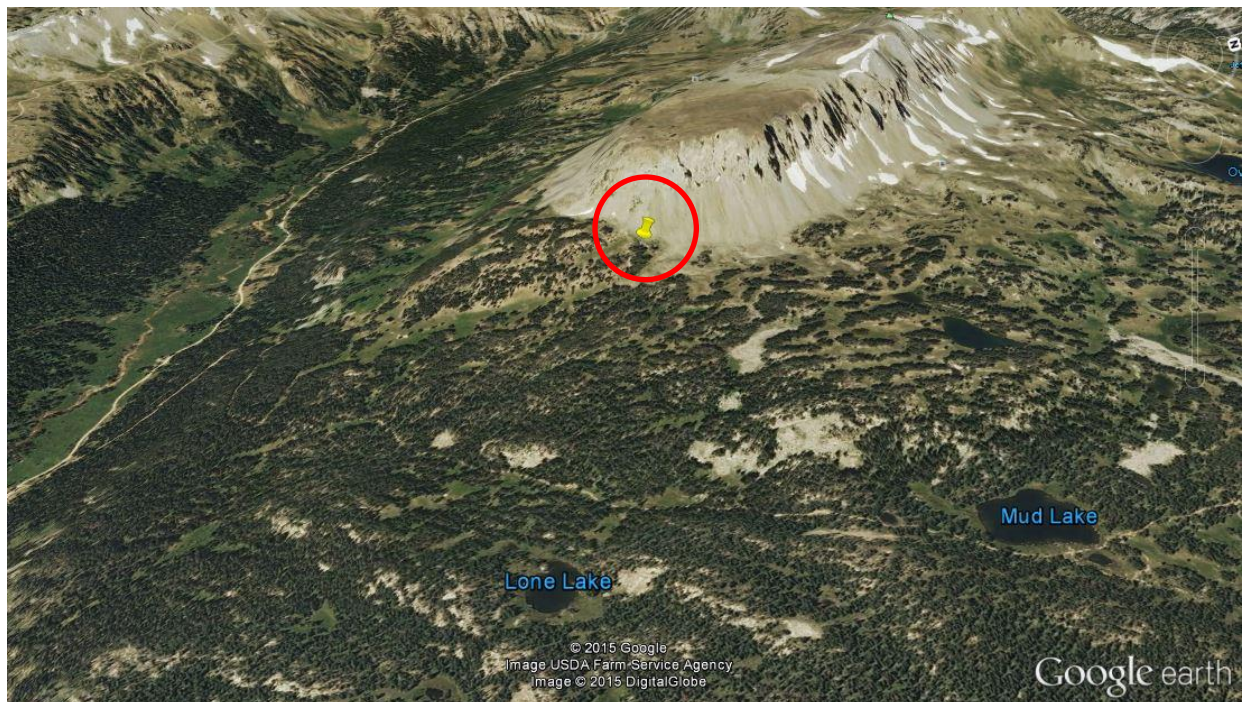
Custer Gallatin National Forest – 19 December 2015

SYNOPSIS

On December 19, 2015 at approximately 1 p.m. snowmobilers triggered an avalanche on the SE face of Sheep Mountain outside Cooke City from low on the slope. The avalanche caught three people, partially burying one and fully burying the other two resulting in one death. The avalanche was estimated to be 100 feet wide, 400 feet vertical and 3-4 feet deep with a measured runout angle of 28°. The slope angle at the crown was assessed to be steeper than 40°. The victim's head was buried six feet deep and CPR was administered, but he never regained vital signs. The classification of the avalanche is SS-AM-O-R2.5-D2.5 (a soft slab avalanche triggered by a snowmobiler in old snow that was small to medium-sized relative to the path, yet big enough to kill a person or damage a car). The avalanche danger was rated HIGH on all slopes and an Avalanche Warning was issued the morning of the 19th.

GPS Coordinates from Google Earth at toe of debris:

45°03'47.82"N, 109°55'08.26W; elevation 9,600' (yellow thumbtack on picture)



Photos:

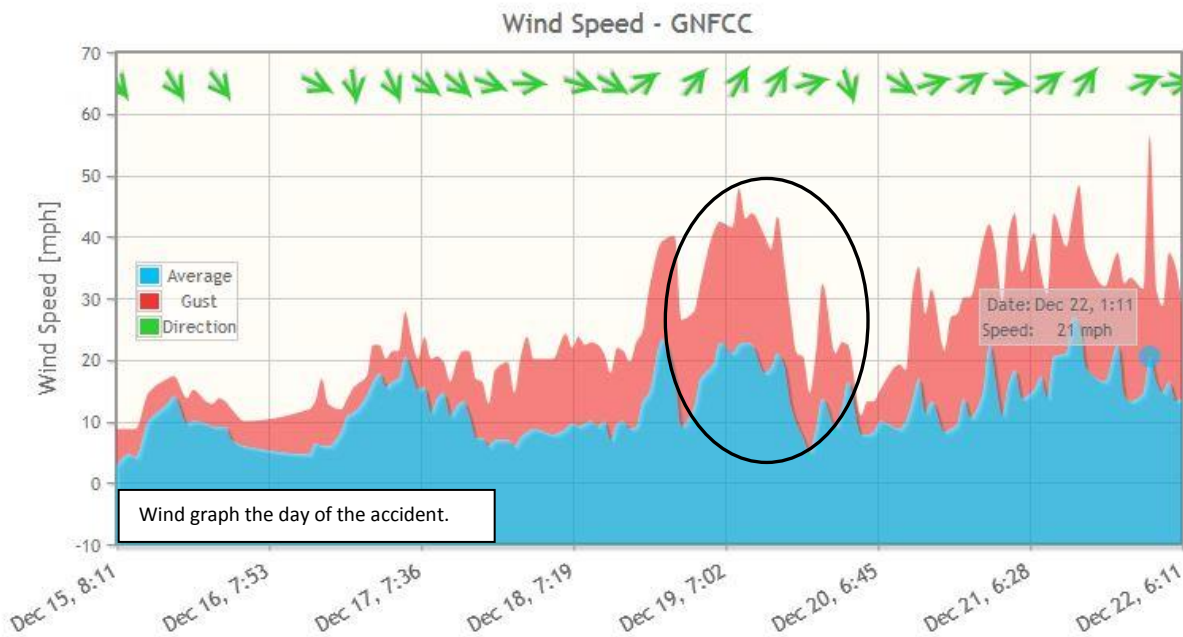
<http://www.mtavalanche.com/images/15/cooke-city-sheep-mountain-avalanche-crown>

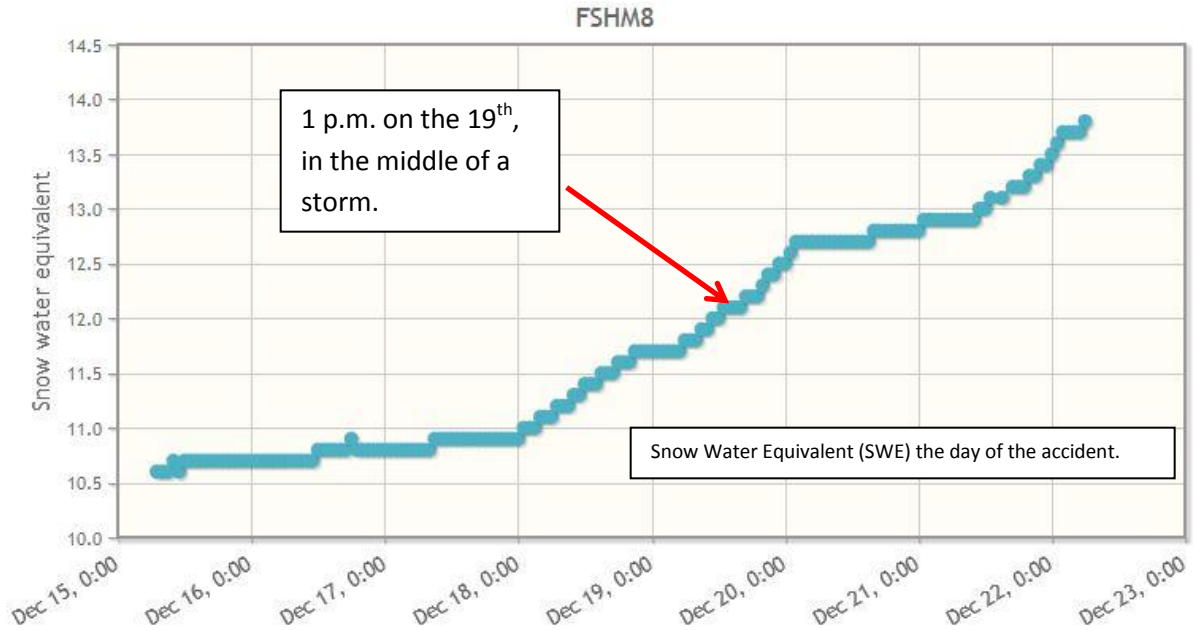
<http://www.mtavalanche.com/images/15/cooke-city-sheep-mountain-avalanche-path>

Video: <https://youtu.be/xp6MqrJVSPg>

WEATHER

Saturday, December 19th was stormy around Cooke City. Snow accumulated throughout the day and winds averaged 20 mph out of west-southwest with consistent gusts over 40 mph. Temperatures were in the mid-20s F at the time of the accident. During the three days prior to the accident this area received over a foot of snow totaling 1.4 inches of snow water equivalency (SWE). The two-week total prior to the accident was 5 inches of SWE, close to four feet of snowfall. Winds on the 18th were blowing 20 mph out of the west-southwest with gust near 40 mph. Snowfall data was collected from Fisher Creek SNOTEL site (9,100') less than two miles away and wind data was collected from a weather station near Lulu Pass (9,984'). On the day of the accident winds were blowing and it was snowing as the graphs below illustrate.





SNOWPACK

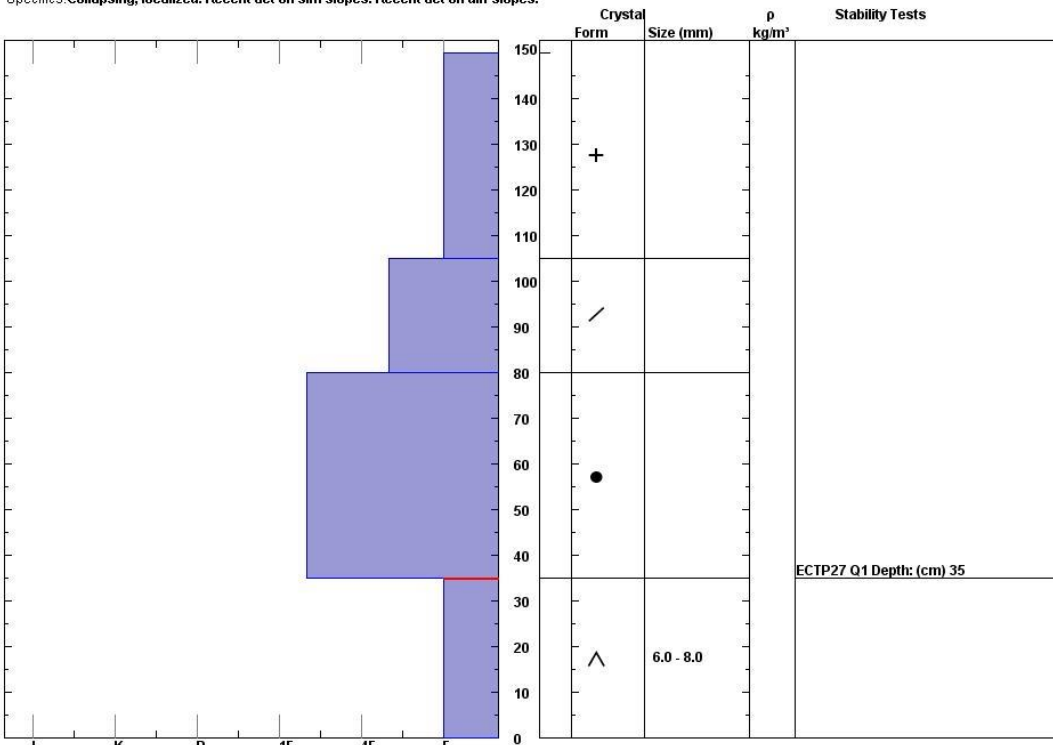
The avalanche occurred at 10,000' on the SE face of Sheep Mountain outside Cooke City. The crown was approximately 100 feet wide and 3-4 feet deep breaking on the ground. The slide ran a total of 400 vertical feet. The snowpack consisted of dense, wind-blown snow sitting over depth hoar, a persistent weak layer, which allowed the slide to be triggered low on the slope.

The avalanche released on a depth hoar layer that formed during a cold and dry period during the last two weeks of November. High temperatures during this time barely rose above 0° F and low temps were -15 to -25° F. From December 6th to December 19th Fisher Creek SNOTEL Site (9,100') recorded 5 inches of SWE. This capped the depth hoar with a dense slab of snow creating instability. As a result of this poor snowpack structure, on December 15th six avalanches were triggered by snowmobilers in nearby Miller Creek resulting in two being caught but not buried.

On December 18th a strong wind with steady snowfall loaded this slope further, adding more weight and stress to the buried weak layer. On the morning of the 19th we issued an Avalanche Warning since the avalanche danger was rated HIGH on all slopes, meaning human-triggered slides were very likely. The avalanche advisory can be found here: <http://www.mtavalanche.com/advisory/15/12/19>

The snowpit profile (below) is from Daisy Pass the day after the slide and shows the poor snowpack structure found in the mountains around Cooke City. The layer that fractured was the bottom 35 cm of depth hoar. Here is a video of the snowpit and our findings: <https://youtu.be/QSKAk3SHzBY>

Snow Pit Profile Observer: **Eric Knoff** Stability on similar slopes: **Poor** Stability Test Notes: Layer notes:
Daisy Pass **Sun Dec 20 01:35:00 MST 2015** Air Temperature: **C** **0-35: Problematic Layer**
Cooke City, MT Co-ord: **45.05511 N 105.95667 W** Sky Cover: **sky 8/8 covered**
Elevation (ft) **9760** Slope: Precipitation: **Snow < 0.5 cm/hr**
Aspect: **345** Wind loading: **yes** Wind: **SW Moderate**
Specifics: **Collapsing, localized. Recent act on sim slopes. Recent act on diff slopes.**



Notes: This pit was dug near Daisy Pass. The snowpack in this area has a very similar structure to slope that casued the avalanche Fatality on Sheep Mountain.

AVALANCHE

All times and quotes are from G's GoPro camera which filmed part of the event.

A group of five experienced snowmobilers from North Dakota were on their last day of riding. G (46, dad) has been snowmobiling regularly in Cooke City since 1999 with upwards of ten trips a year. He and his group had all the latest rescue gear: beacons (Tracker 2), shovels, probes, airbags (BCA Float 22) and had avalanche awareness training. Three were expert riders and two were advanced. They knew the avalanche danger that day was rated HIGH and A (19, nephew) got an Avalanche Warning alert on his phone from the National Weather Service that morning.

At approximately 1 p.m. the group was at the southeast end (aspect 130°) of Sheep Mountain. T (22, son) was sitting still on his machine at the base of the slope on a small ridge between two gullies. G rode up the southern gully, got stuck near the top and told W (39, cousin) through their helmet radios that it "...was not a good place to be!" in reference to avalanches. W was already riding uphill and cut above G. J (33, friend) followed ten seconds behind. With four of the five people either on the slope or in the runout zone, it is impossible to know who triggered the slide. We do know the slide was triggered low on the slope on terrain estimated to be 20° steep.

G was off his machine when the avalanche struck. After a few missed attempts to grab the handle of his airbag he finally succeeded and deployed it as he was carried down the hill. He was buried to his chest and unhurt, five feet from the edge of the debris. A was safely below and rode up the hill to help. G crawled on his hands and knees over the debris to T's last seen point and saw his airbag sticking out of the snow. This took seven minutes. All three began digging with their hands and a shovel blade and had him extricated in five more minutes. T was facedown, head downhill, turning purple and fading out of consciousness. After getting him out of the snow they began searching for J who was located approximately 20 feet away. He was buried next to his sled, still tethered to it, with his head six feet deep and pointed downhill. Given his deep burial it is estimated that it took at least 30 minutes after the avalanche to reach him. Upon extrication they began CPR but resuscitation was unsuccessful.

NOTE:

J had not deployed his airbag, which is not unusual. He was facing uphill when the avalanche hit, likely holding the handlebars trying to turn and outrun it. The fact that he was still tethered to his machine leads me to believe he was flipped and buried abruptly and not carried downhill very far. He likely did not have time to release the airbag.

RESCUE

G rode to a nearby group of riders who then rode to town to alert Search and Rescue. Cooke City SAR was notified at 1:48 p.m. and dispatched rescuers to the scene but they were unable to revive him. They brought the victim down and left J's sled along with T's missing sled at the scene. Both were recovered the next day.

This avalanche accident was investigated by Doug Chabot and Alex Marienthal. They interviewed the four survivors on the evening of December 19th and rode into the accident site on the 20th.

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