

Scotch Bonnet Mountain Avalanche Fatality

2 snowmobilers caught, buried and killed

Cooke City, MT

Custer-Gallatin National Forest – December 27, 2021

SYNOPSIS

On December 27, two snowmobilers were caught and killed in an avalanche on Scotch Bonnet Mountain, north of Cooke City. A group of 8 snowmobilers from Minnesota were on their second day of riding when 2 of their machines got stuck on the SE face of Scotch Bonnet Mountain. Two members of their group rode up to help them dig out and the avalanche was triggered soon after. It broke 4-5 feet deep, ran 300 feet wide and 500 feet vertical and killed 2 riders, burying them under 4-5 feet of debris. Everyone had rescue equipment and they were recovered by their party. Park County Sheriff Search and Rescue brought the victims to town. The avalanche broke on a layer of facets 1.5 feet off the ground underneath a thick slab of wind drifted snow. The avalanche is classified SS-AMu-R2-D2.5-O.

GPS coordinates and elevation:

Crown: N 45.07147, W -109.94407; 10,040'

Toe: N 45.07052, W -109.94084; elev 9,600'

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

Pictures: pages 7-10

AVALANCHE

On the morning of December 27th, a group of 8 snowmobilers visiting from Minnesota (all males, ages 41-65) rode to Scotch Bonnet Mountain, north Cooke City. Some members of the group had snowmobiled in the Cooke City area more than 10 times, for others it was their first trip. One member of the group had attended two one-hour avalanche awareness lectures. The rest of the group had no avalanche training. None had read the avalanche forecast that morning. The group stopped at a beacon checker but did not notice the adjacent sign advertising CONSIDERABLE avalanche danger in the area. The group, on the second day of their Cooke City visit, had spent the previous day riding low angle treed areas and flat meadows.

When the group reached Scotch Bonnet Mountain they began to ride up onto the SE face, the first steep slope of their trip. Two riders rode onto the slope and got their snowmobiles stuck at the same time, about 300' apart from one another. Two additional members of the party rode up to assist the riders extricating the stuck snowmobiles. The riders had been working to free the snowmobiles (two riders at each of the stuck machines) for more than 10 minutes when the avalanche was triggered. One rider heard a "whumph" and yelled "look out" as the avalanche released. An initial wave of snow hit the two riders in the path of the avalanche. Both riders were still standing after this first wave of snow, but

disappeared beneath a second wave of snow that immediately followed. The other two riders on the slope were 2-3 feet to the side of the avalanche's path and narrowly escaped being caught.

RESCUE

The avalanche occurred at approximately 12:00 p.m. Neither buried rider had an avalanche airbag. The other 6 members of the party began searching. All party members had avalanche beacons, shovels and probes. Some spot probed while others searched the debris with their avalanche beacons. The group dug a couple false holes before locating the first victim. He was dug up about 30 minutes after the avalanche. CPR was initiated, but unsuccessful. After this they began looking for the second victim and located him with an avalanche beacon. They dug him up (head lower than feet) and tried CPR but got no response. This took an additional 30 minutes. Two local snowmobilers came upon the scene after both victims were out of the snow. One stayed at the scene and one rode to town to alert Park County Sheriff Search and Rescue. SAR arrived and transported the victims to the Cooke City EMS building.

WEATHER

Snowfall and precipitation data are from the Fisher Creek SNOTEL site at 9,100', 0.6 miles SSW of the accident. Wind data is from the Lulu Pass weather station at 10,020', 0.7 miles WNW of the accident on the opposite side of Scotch Bonnet Mtn. From December 6 through 20 the Fisher Creek SNOTEL received 4-5 feet of snow equal to 5.1" of snow water equivalent (SWE). From December 21 to 27 the area received 3-4 feet of snow equal to 3.8" SWE, for a total of 7-9 feet of snow equal to 8.9" SWE from December 6 through 27 (Figure 1).

From December 19 through 27 (and most of December) wind at Lulu Pass was out of the south-southwest averaging 10-25 mph with gusts regularly over 40 mph. Gusts hit 70 mph on December 23 and 25 (Figure 2 and 3). Temperature at Lulu Pass at the time of the accident was 0F (Figure 4).

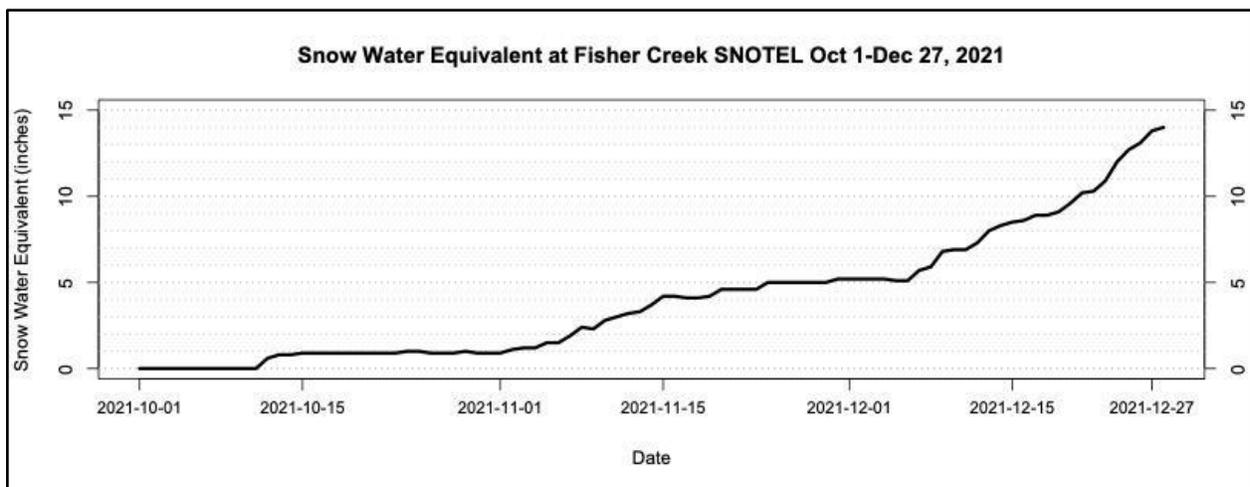


Figure 1. Snow water equivalent (daily values at midnight) at Fisher Creek SNOTEL site from October 1 to Dec 27, 2021. Located at 9,100', 0.6 miles SSW of the accident.

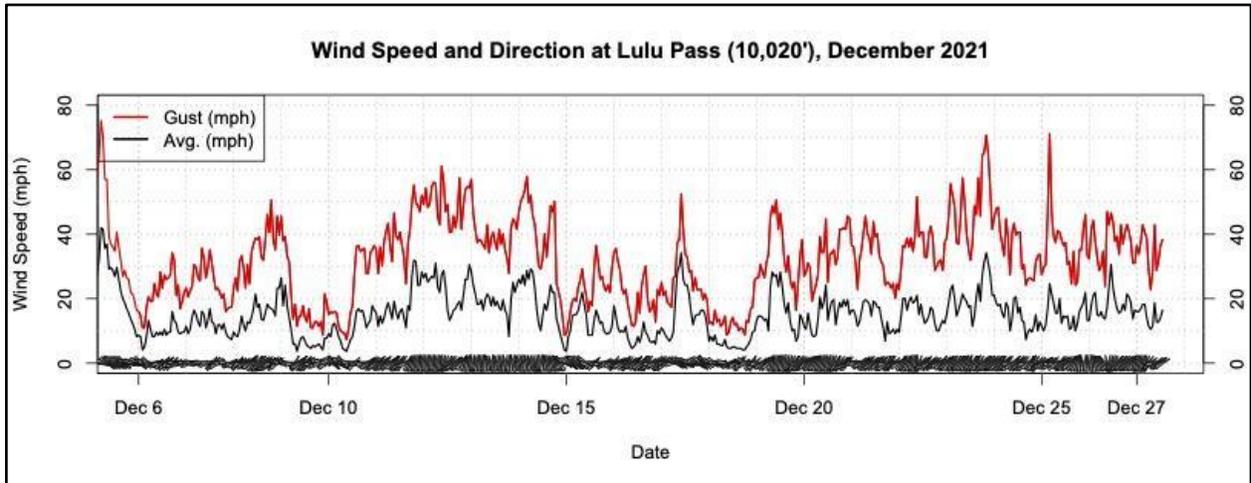


Figure 2. Wind speed and direction (hourly) from Lulu Pass from December 6 to the time of the accident on December 27, 2021. Wind direction is displayed as arrows along the bottom of the graph, and shows a generally south-southwest wind direction for 20 days prior to the accident.

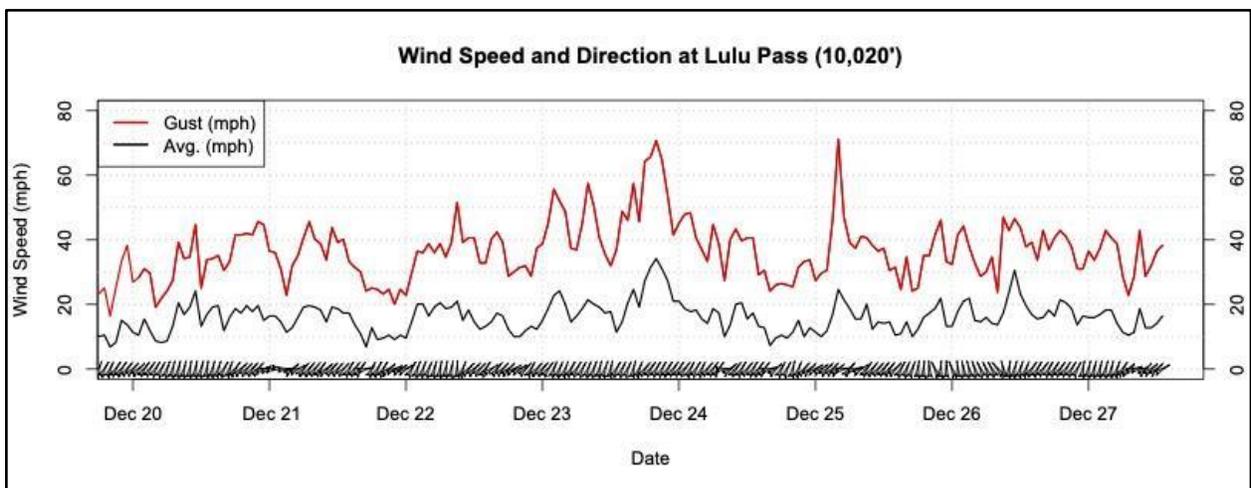


Figure 3. Wind speed and direction (hourly) at Lulu Pass from December 20 to the time of the accident on December 27, 2021. Wind direction is displayed as arrows along the bottom of the graph, and shows a generally south-southwest wind direction for the week prior to the accident.

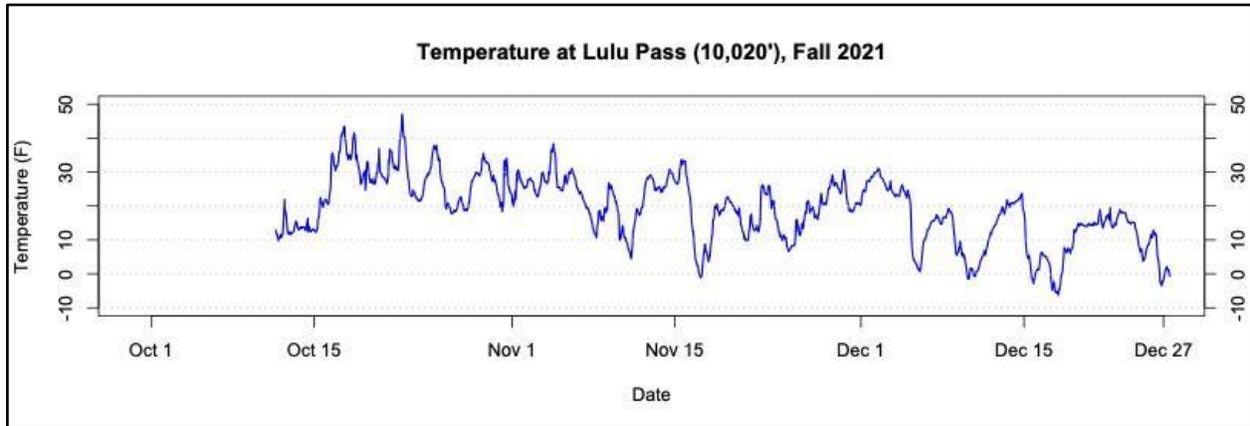


Figure 4. Temperature at Lulu Pass (10,020') from October 11 through the time of the accident on December 27, 2021. (Data collection began on October 11 at this station for the season).

SNOWPACK

The avalanche occurred at 10,000' elevation on a southeast aspect (130 degrees) of Scotch Bonnet Mountain located north of Cooke City, MT. The slope angle was measured 33 degrees at the crown and 36-38 degrees in the starting zone with steeper gullies in the path. The avalanche broke 4-5' deep, ran 500' vertical and was estimated to be 300' wide. The runout angle (toe of debris to crown) was measured to be 25 degrees. The avalanche is classified SS-AMu-R2-D2.5-O.

The avalanche broke on a weak layer of "4-finger minus" hardness facets (2-4 mm size) 16" above the ground. The slab was 4-5' deep and consisted of new and windblown snow (1F to P- hardness). The snowpit was dug the morning after the avalanche (Figure 5).

Fall of 2021 was warm and dry in the mountains near Cooke City which caused a far below average snowpack through the beginning of December (Figure 1 and 4). The 1-2 feet of snow that persisted in the mountains during October and November was layered with melt-freeze crusts and weak faceted snow. In mid-November, brief snowfall led to a few avalanches breaking on these weak facets at the bottom of the snowpack ([photo and event details](#)), and we saw an unstable snow structure in the mountains near Cooke City. During the second half of November, warm weather and lack of snow let these instabilities and the snowpack subside.

Snow returned on December 6, and on December 10 we began daily avalanche forecasts with a MODERATE danger for the mountains near Cooke City. Regular, modest sized storms kept danger MODERATE with the possibility of triggering avalanches of new or wind-drifted snow. There was also lingering concern for avalanches breaking deeper in the snowpack, but we saw minimal signs of instability on deeper weak layers. On December 20 avalanche danger near Cooke City rose to CONSIDERABLE on wind-loaded slopes and MODERATE on other slopes.

After continued steady snowfall, danger rose to CONSIDERABLE on all slopes near Cooke City from December 24 to 26. On December 27th the avalanche danger for the mountains near Cooke City was

rated CONSIDERABLE on wind-loaded slopes and MODERATE on all other slopes, and the avalanche forecast stated:

Consistent snowfall for the last five days brings our storm total to 31-37" equal to... 3.5" of [snow water equivalent](#) (SWE) in the mountains around West Yellowstone and Cooke City. The combination of recent snow and moderate winds from the southwest creates dangerous avalanche conditions. While the wind will ease off today, recently formed 1-4' deep drifts will remain unstable. Avalanches failing on weaker layers of snow in the mid and lower snowpack are a possibility and would be large and dangerous.... steer clear of wind-loaded slopes and carefully assess the snowpack and terrain features in non-wind-loaded areas prior to entering any avalanche terrain.

With the significant caveat that visibility is limited, we have not seen or received reports of widespread avalanche activity during this storm. However, we have good indicators of instability such as large "whumphs" triggered by skiers near Bacon Rind on Friday ([details](#)) and unstable snowpack tests throughout the area failing and propagating within new snow layers and on weak layers near the ground....

The avalanche danger is rated CONSIDERABLE on wind-loaded slopes where human-triggered avalanches are likely and MODERATE on non-wind-loaded slopes where avalanches are possible.

GNFAC Avalanche Advisory for December 27th, 2021:

[GNFAC Avalanche Forecast for Mon Dec 27, 2021](#)

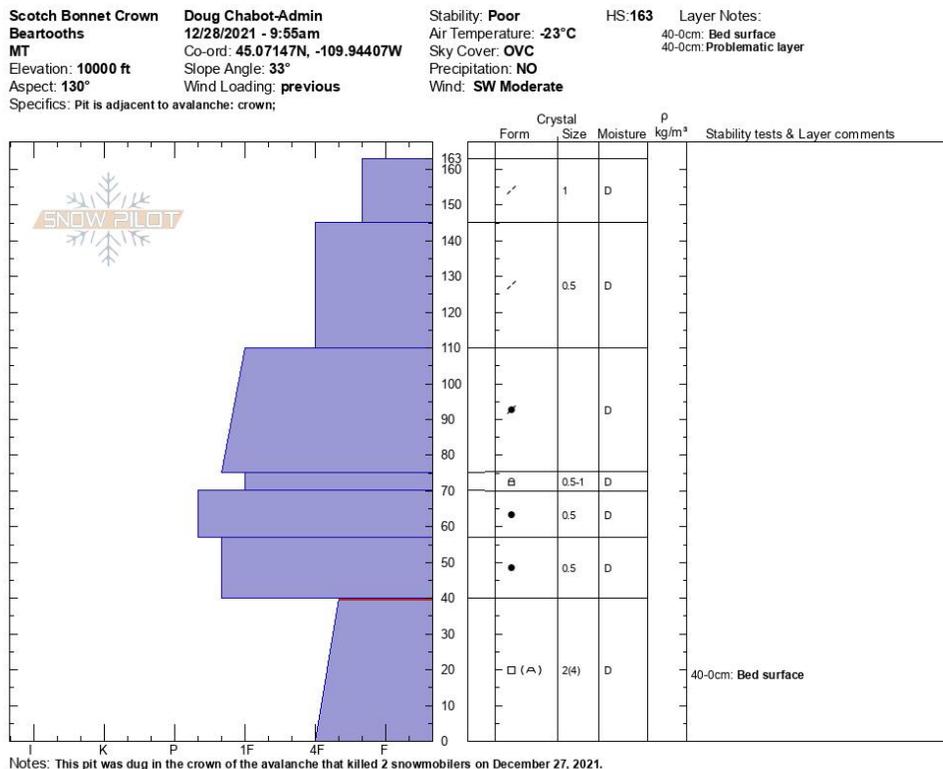


Figure 5. Snowpit profile from the crown of the avalanche. Observed by GNFAC forecasters on 12/28/21.

INVESTIGATION

GNFAC forecasters obtained details of the avalanche on December 27, 2021 when Ian Hoyer and Doug Chabot interviewed the party along with Bill Whittle, member of Park County Sheriff Search and Rescue. The next day Ian and Doug visited the site to gather slope and snowpack data. They also helped the 6 members of the party recover the two snowmobiles left behind the day before.

Any questions should be directed to:

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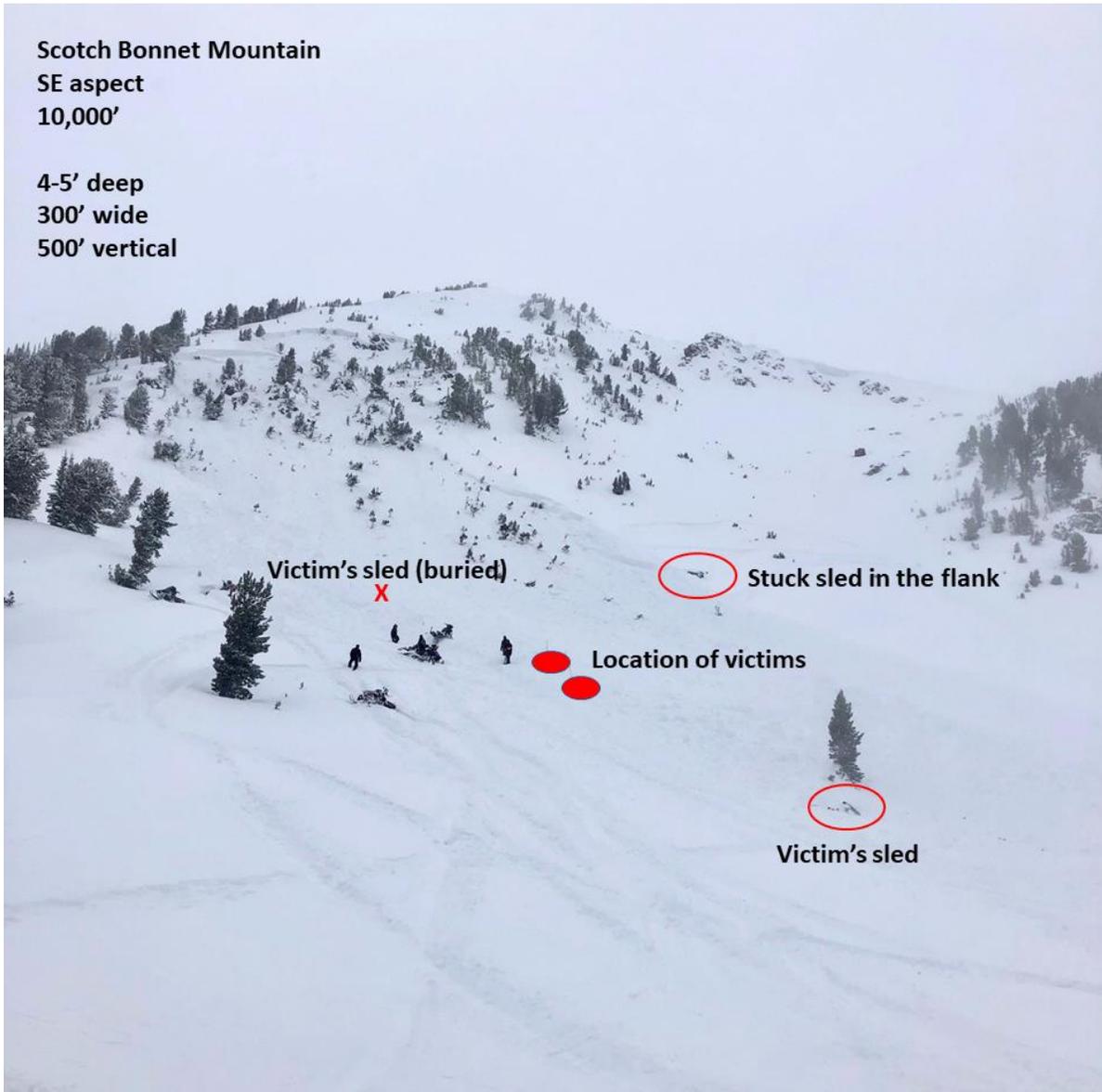
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Avalanche Overview



Avalanche Crown and Path



Standing in the crown



Location of stuck snowmobiles



Beacon Checker with CONSIDERABLE danger sign

