The Fin Avalanche Accident

3 skiers caught and partially buried, 1 seriously injured
Cooke City, MT
Custer-Gallatin National Forest – January 8th, 2021

SYNOPSIS

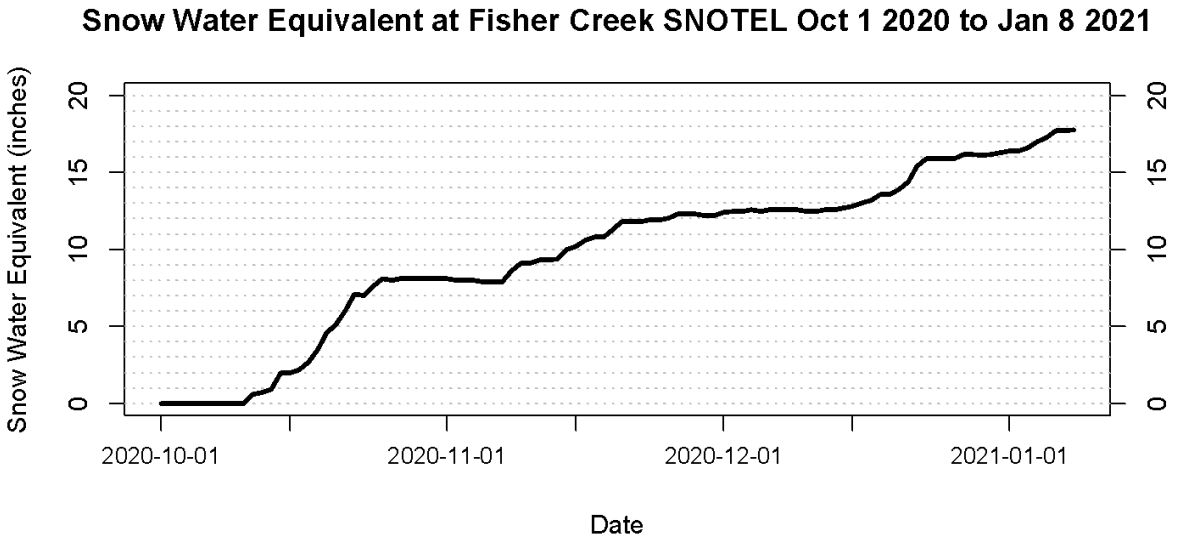
On January 8, 2021 a group of six skiers triggered an avalanche on The Fin on Republic Mountain outside of Cooke City. They were skinning up the slope when they felt the slope collapse and watched cracks propagate 250' upslope. Three were caught and partially buried. Skier 1 deployed his airbag, was partially buried and able to get himself free. He freed himself from the debris and began a beacon search which led him to see skier 2 who was buried head down with his airway obstructed. He was uncovered by skier 1, not breathing and unconscious. He sustained injuries, but later made it out under his own power. Skier 3 was partially buried higher in the path, sustained serious injuries to his ribs and lungs and was evacuated by helicopter. The avalanche broke 1.5'- 2' deep, 200' wide and ran 700' vertical. The average slope angle was 37 degrees. Slope angle at the crown was 33 degrees on an east aspect at 9,700' elevation. The avalanche is classified SS-ASu-R2-D2.5-O.

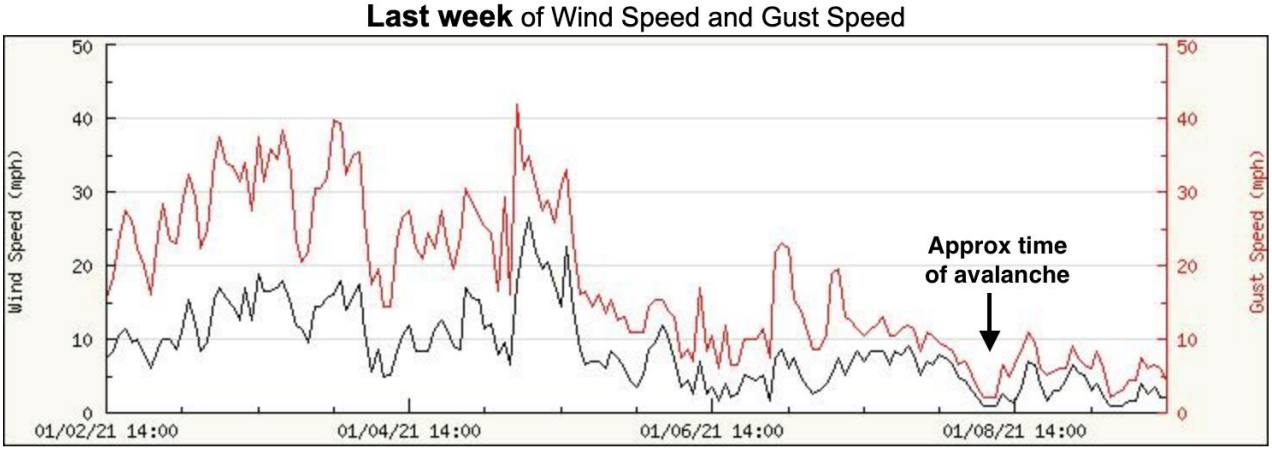
GPS coordinates and elevation:
Crown: N45.00608, W109.95671; 9775'
Toe: N45.00662, W109.95232; 9070'

Video: https://youtu.be/0x5E-7XHwG8
Pictures: pages 6-9

WEATHER

Snowfall and precipitation data are from the Fisher Creek SNOTEL site at 9,100', 4 miles NNE from the accident. Wind data is from the Lulu Pass weather station at 10,000', 4.5 miles NNE of the accident. On January 7th the Fisher Creek SNOTEL received 0.1" of snow water equivalent (SWE) equal to 1" of snow. Ski guides in Cooke City reported 6" of new snow equal to 0.3" SWE. Between January 2nd and 5th. The Fisher Creek SNOTEL recorded 1.3" of SWE and 14" of snow (figure 1). From January 2nd to January 5th wind at Lulu Pass was westerly at 15-20 mph with gusts of 30-40 mph. From January 6th to 8th wind was northwest-north at 5-10 mph with a few gusts to 20 mph (figure 2). The day of the avalanche temperatures at Lulu Pass were in the teens F.





SNOWPACK

The avalanche occurred at 9,700' elevation on an east aspect (82 degrees) of Republic Mountain outside Cooke City. The slope angle was mostly uniform at 37 degrees, and 33 degrees at the crown. The slide broke 1.5' to 2' deep, ran 700' vertical and 200' wide (measured at the site with rangefinder). The avalanche is classified SS-ASu-R2-D2.5-O.

The mountains near Cooke City received heavy snow in October and November which formed a dense, 2-4 foot deep snowpack on many slopes. In late November to December, minimal snowfall and cold temperatures lead to the formation of weak layers of sugary facets on some slopes, especially where the snowpack was relatively shallow. These layers were buried by subsequent heavy snowfall in late December, followed by small storms through the first week of January.

The avalanche broke on a weak layer of "Fist+" hardness sugary facets (2mm) 1.5' above the ground. The slab was 1.5 to 2' deep and consisted of layers of precipitation particles and mixed formed rounds.

The presence of a thin snowpack consisting of weak snow in the lower half is not typical for Cooke City. The skiers dug a 6' deep snowpit when they broke out of trees, close to where the avalanche was triggered. They found good snow structure and good stability in their pit which Dave and Doug confirmed when they dug in the same spot. Approximately 100' away with a slight change in aspect the snowpack thinned from 6 feet deep to 2 to 3' deep. This thin area is where they initiated a fracture in the faceted grains which propagated 250' uphill.

On January 8th the avalanche danger for the mountains near Cooke City was rated MODERATE. The avalanche forecast for Cooke City stated:

> *Over the last three days, skiers triggered an avalanche on Henderson Mountain, got collapses/whumpfs while skinning, and saw several avalanches north of town. Yesterday, skiers south of town got very unstable test results on a weak layer buried 2 ft deep. While weak layers are not as widespread as in other regions, they are out there and need to be checked for before riding steep slopes. Digging in the snow is your best defense against these sporadically distributed weaknesses. Today, the avalanche danger is rated MODERATE.*

GNFAC Avalanche Advisory for January 8th, 2021:
https://www.mtavalanche.com/forecast/21/01/08

AVALANCHE

On the morning of January 8, 2021 two groups of skiers (Group A and Group B) met in Cooke City to ski together for the day. There were three skiers in each group, 1 female and 5 males. Group A (Skier 5, 2, 1) arrived two days prior and skied nearby in Republic Creek on January 7th. Group B (Skier 3, 4, 6) had been in the area skiing and snowmobiling for a few days prior. All members of both groups carried an avalanche transceiver, shovel and probe, and Group A were wearing helmets. Two carried avalanche airbag packs. All have at least some level of avalanche education and are advanced skiers. They all read the local avalanche forecast regularly and had read it the day before, but not the day of the avalanche. The danger had not changed.

They decided to ski The Fin on Republic Mountain, a locally known run visible from town. They had discussed skiing this objective earlier in the week, but made no firm plans until that morning. None of them had been to this particular slope or mountain before. On their ascent visibility was poor and they could not see the entire slope or the ridgeline they intended to use for safe travel. One of the skiers wrote:

> *"…six skiers approached from Republic Basin through east facing trees on the far right horizon line. When we got out of those trees we dug two pits and performed a column test and an extended column test. Though we identified potential weak layers at 60 cm and a deeper one…, we got minimal failure and no propagation. What we saw in the pits was a nice right side up snowpack. However, we knew if we skinned along the ridge to the south west, the snowpack would change due to wind exposure. We discussed mitigating this by skinning close to the ridge and skiing back down our skin track if we saw warning signs. However, when those in the skin*

track crossed over a wind lip into a slightly more southerly aspect, a crown broke above them and propagated along the face..."

Three of the skiers were caught (Skiers 1, 2 and 3), one was at the edge of the slides and able to hold on (Skier 4), and the other two (Skier 5 and 6) were further back in the skin track.

"[Skier 1 and 2] were carried almost full course of the avalanche... [Skier 1] had an airbag, and was able to wiggle his way out, then search and begin recovering [Skier 2] who was partially buried [with his head completely under the snow]. [Skier 3] was carried about half of the way down and ended up partially buried with an exposed airway on the northern edge of the slide path. This individual sustained significant injuries. We are incredibly grateful to the rescuers who helped everyone get home safely. The day would have ended much differently without their diligent, thoughtful help."

RESCUE

Skier 1 deployed his airbag, was partially buried and able to get himself free. He freed himself from the debris and began a transceiver search. His transceiver read 56 meters. He started uphill and the numbers on his transceiver got bigger, so he turned around and saw skier 2's ski. Skier 2 was buried head down with his airway obstructed. Skier 1 uncovered skier 2, whose head was over 2 feet deep, had snow packed in his mouth, was not breathing and unconscious. Skier 1 cleared skier 2's airway, and skier 2 began breathing and regained consciousness. Skier 2 sustained injuries to his leg, but later made it out under his own power. Skier 3 was partially buried 300' higher in the path and sustained serious injuries to his ribs and lungs. Skiers 4, 5 and 6 were not caught and quickly skied down to help. Skier 4 went to skier 3 who was breathing, but seriously injured. They stayed together while skiers 5 and 6 went to find the others.

The three skiers in group B had BCA two-way radios and called for help on multiple channels. There is no cell service in this region. They were able to contact someone else with a radio in the town of Cooke City, who went to the gas station and reported it to Park County Search and Rescue. While the skiers waited for rescuers, they used their radios to communicate between the two burial locations. Because skier 3 could not move, eventually skiers 1, 2, 5, and 6 climbed back up to skiers 3 and 4 where they made a fire and waited for rescuers.

Park County Search and Rescue initiated a response at 1230 hrs. Two professional guides from Beartooth Powder Guides (members of SAR) snowmobiled and skied to the scene. They carried equipment to stay overnight if a helicopter evacuation was not possible. They ascended on skis 1,200' to a ridge and then descended 400' to the other side to the accident site. Due to this very complex terrain a helicopter was essential to evacuate the seriously injured skier. At approximately 1600 hrs a helicopter from Teton County Search and rescue (Jackson, WY) long-lined the injured skier to a waiting Life Flight for transport to a hospital. Skiers 1, 2, 4, 5 and 6 were able to get out under their own power with the help of the two rescuers.

INVESTIGATION

GNFAC forecasters obtained details of the avalanche on January 9, 2021 through a visit to the site and interviews with skiers in Group A.

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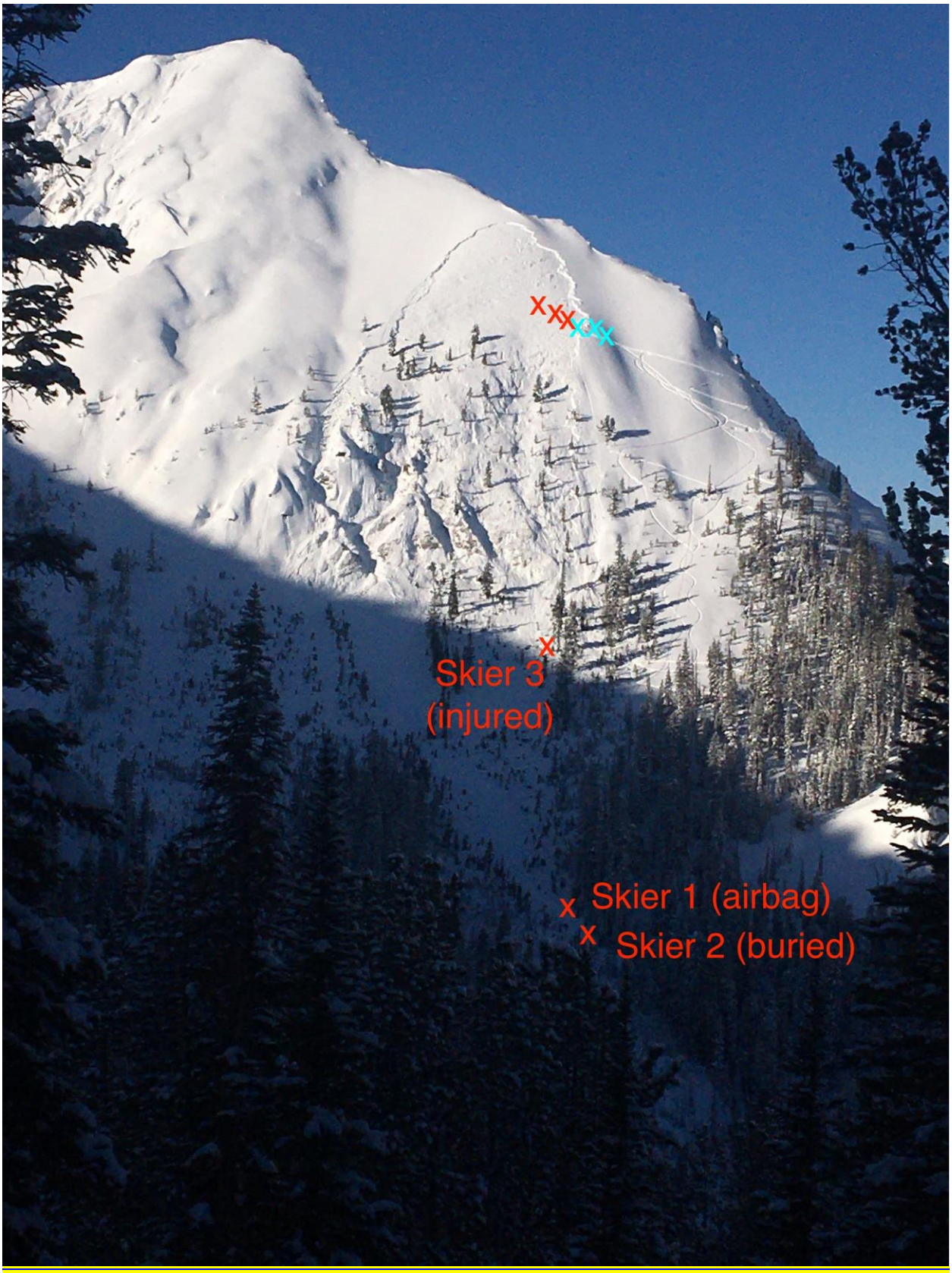
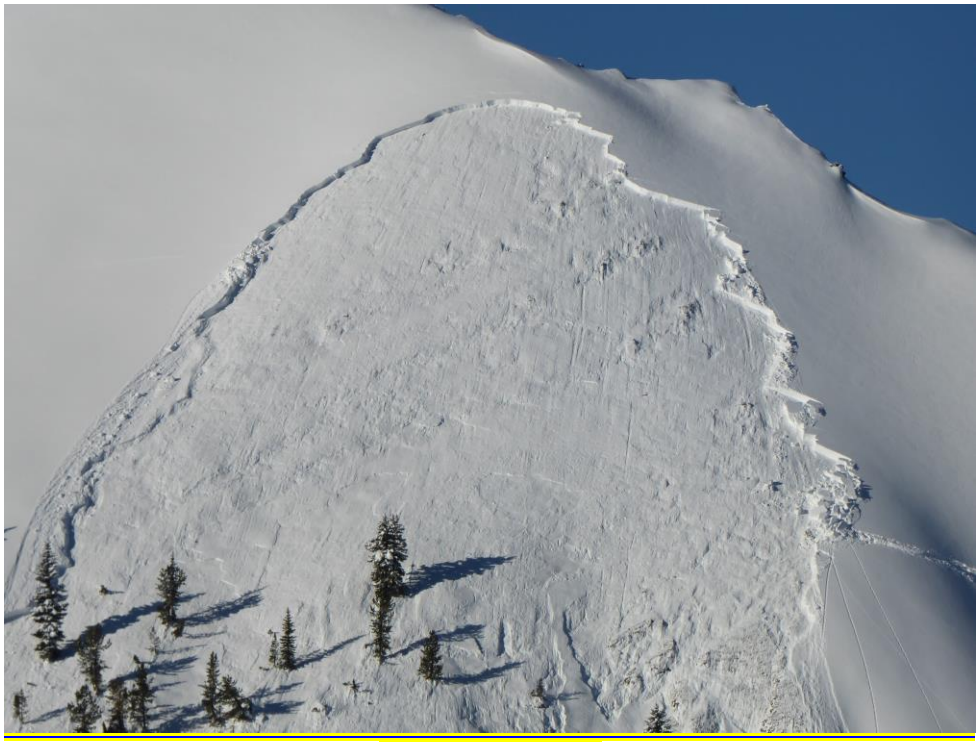
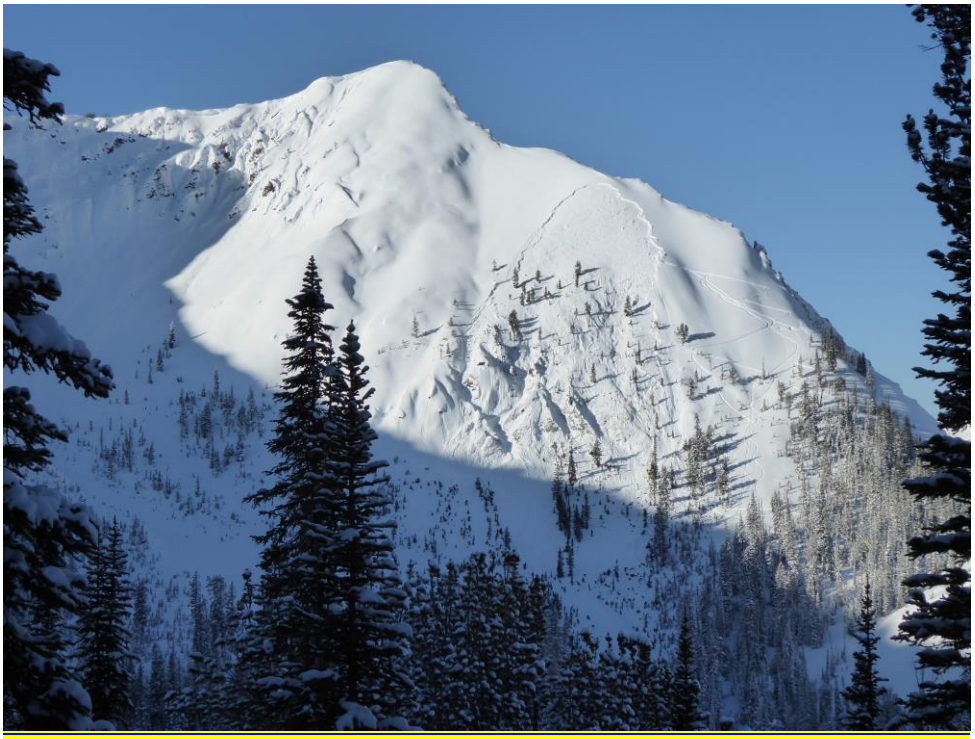

Skier 3
(injured)
Skier 1 (airbag)
Skier 2 (buried)

Photo: B. Fredlund



Upper Bed Surface



Avalanche viewed from a distance

Debris at the toe of the avalanche

At the crown line

The Fin Avalanche
Absaroka Range
MT
Elevation: **9775 ft**
Aspect: **82°**

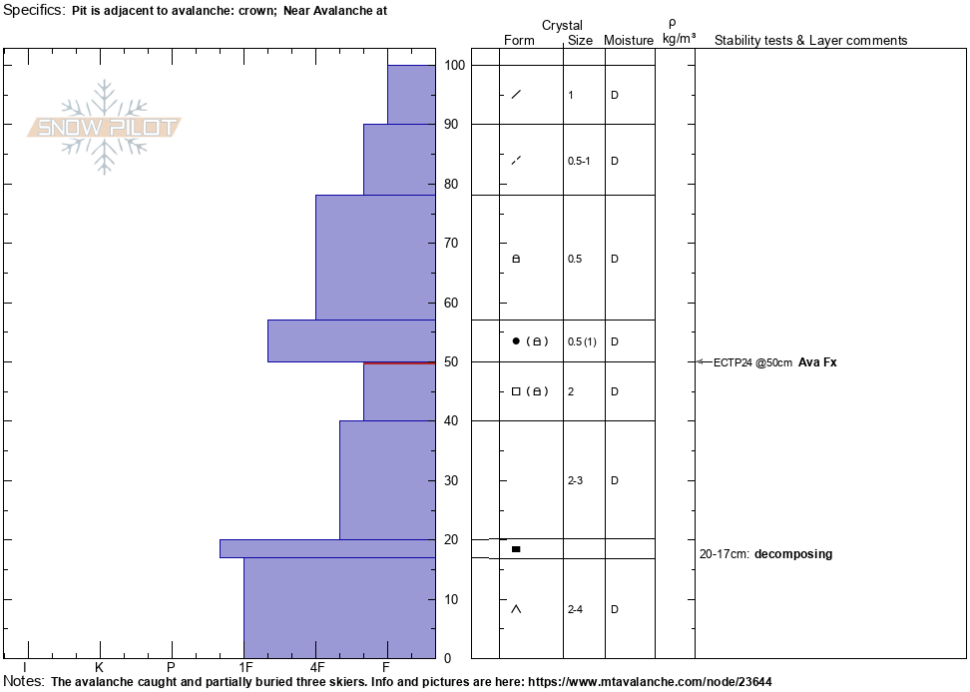
Doug Chabot-Admin
01/09/2021 - 1:00pm
Co-ord: **45.00608N, -109.95671W**
Slope Angle: **33°**
Wind Loading: **no**

Stability:
Air Temperature: **-7°C**
Sky Cover: **CLR**
Precipitation: **NO**
Wind: **Calm**

HS: **100**

Layer Notes:
50-40cm: **Problematic layer**
20-17cm: **decomposing**

Specifics: **Pit is adjacent to avalanche: crown; Near Avalanche at**



Notes: **The avalanche caught and partially buried three skiers. Info and pictures are here: https://www.mtavalanche.com/node/23644**

Snowpit