

Cedar Basin Avalanche Fatality

1 skier caught, partially buried and killed

Northern Madison Range, MT

Custer Gallatin National Forest – January 19, 2016

SYNOPSIS

On Tuesday, January 19th, two on-duty Yellowstone Club (YC) Ski Patrollers were helping two MSU (Montana State University) graduate students collect snow science research data. They were on private land within Yellowstone Club, in an uncontrolled backcountry setting when, skiing back in-bounds to the YC ski area, one of the patrollers triggered an avalanche by jumping off a cornice onto a steep (39-42°) wind-loaded slope which released on his second turn. The slide broke 2-4 feet deep, 300 feet wide and carried him through a terrain trap of thick trees. He was partially buried 300 vertical feet below in the toe of the debris. His partners reached him within three minutes, but the trauma was fatal. The avalanche is classified SS-ASu-R2-D2.5-O with a runout angle of 32°.

GPS coordinates and elevation:

Toe of debris/victim location: 45°13'56.30"N 111°29'26.18"W (9,159')

Crown: 45°13'56.28"N 111°29'32.73"W (9,459')

Photos:

<http://www.mtavalanche.com/images/16/cedar-basin-avalanchemarked>

<http://www.mtavalanche.com/images/16/cornice-above-slope>

<http://www.mtavalanche.com/images/16/avalanche-dimensions>

<http://www.mtavalanche.com/images/16/avalanche-debris-trees>

<http://www.mtavalanche.com/images/16/location-partially-buried-skier>

<http://www.mtavalanche.com/images/16/looking-down-slope-crown>

<http://www.mtavalanche.com/images/16/snowpit-crown-avalanche-cornice-above>

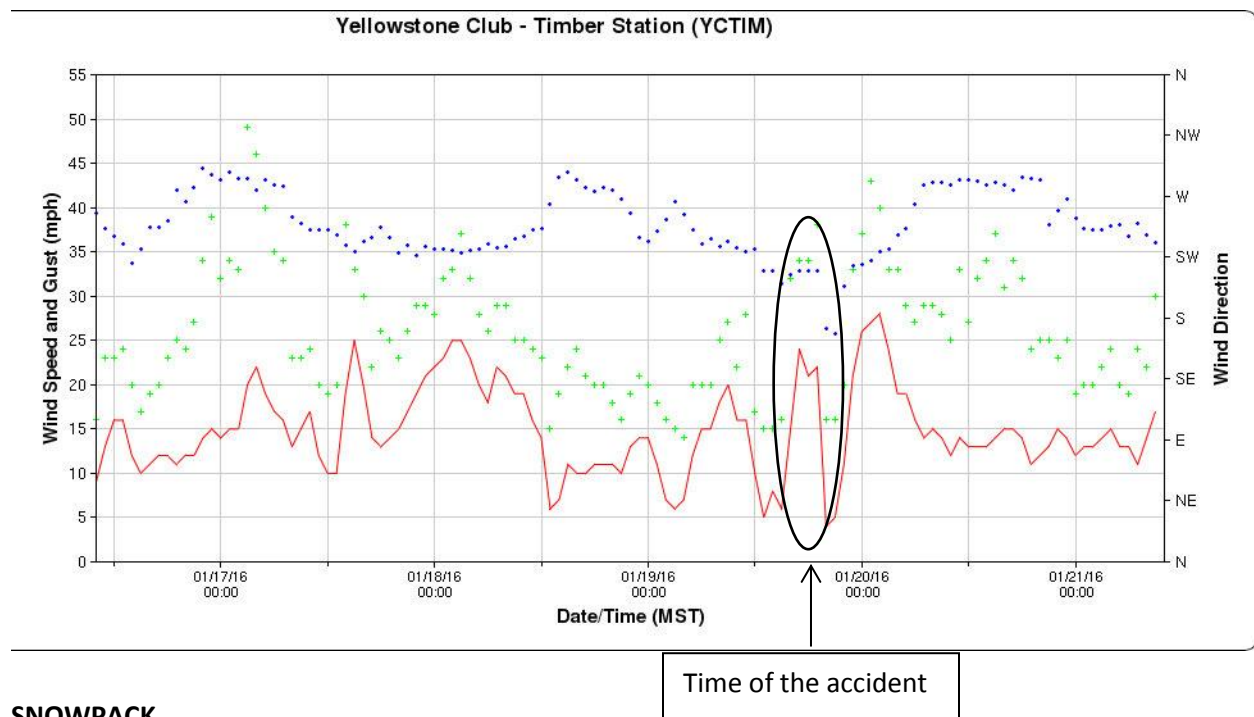
Video: <https://youtu.be/d9cAl5mjckY>

WEATHER

Weather data was collected from Timber Study Plot located at 9,400 ft. at the Yellowstone Club ski area. The site provides measurements for air temp, relative humidity, snow accumulation and snow water content. Wind speed and direction are measured at the top of Pioneer Ridge at 9,800 ft. The Study Plot is located approximately 1.5 miles northeast of the accident site.

Timber Study Plot recorded thirteen inches of snow between January 17th and the morning of January 19th totaling .8 inches of SWE. Winds were consistently from the west-southwest leading up to the accident. Wind gusts of 50 mph were recorded on Pioneer Ridge on the 17th and gusts of 35 mph were

recorded on the 18th. The day of the accident wind gusts reached over 30 mph. The temperature during the time of the accident was 20° F.



SNOWPACK

The avalanche occurred at 9,400 feet in Cedar Basin outside of the Yellowstone Club ski area. The crown was 300 feet wide (measured with a range-finder) and 2-4 feet deep. The slide ran a total of 300 vertical feet. The slope ranged between 39-42° steepness (measured) and had an east aspect (84°). The snowpack consisted of dense, wind-blown snow sitting over depth hoar.

The avalanche released near the ground on a depth hoar layer that formed during a cold and dry period during the last two weeks of November. This layer was capped by a dense slab that formed during heavy snow the last two weeks of December. High pressure set in the first two weeks of January, and it started snowing again on the 14th. During the five days leading up to the accident, Timber Study Plot recorded over a foot of snow totaling more than 1 inch of SWE. This slope was additionally loaded by wind deposited snow, which attributed to unstable conditions. The avalanche danger on January 19th was rated CONSIDERABLE on wind-loaded slopes and slopes steeper than 35 degrees.

Avalanche advisory: <http://www.mtavalanche.com/advisory/16/01/19>

Crown profile: http://www.mtavalanche.com/images/16/cedar-basin-snowpit-profile?size=_original

AVALANCHE

At 0900 four experienced backcountry skiers exited the backcountry gate at the bottom of the *Namaste* ski run at the Yellowstone Club: MSU1 (35), a MSU graduate student who was conducting research on

variable slab properties for a MS; MSU2 (30), a MSU graduate student assisting MSU1 in his data collection; SP1 (21), first year ski patroller at the YC; SP2 (34), a six-year YC ski patroller. They all carried a beacon, shovel, probe, MSU1 had an Avalung pack, and no one was wearing a helmet. MSU2 checked everyone's beacon before departing the ski area. The gate delineated the ski area boundary and they skinned on private YC land for 30 minutes to MSU1's study plot where they conducted 23 stability tests (15 PSTs, 3 ECTs and 5 CTs) to study how slabs of snow were reacting to the underlying depth hoar. All four spent the next 3 ½ to 4 hours recording slab propagation on the depth hoar, a sign of instability. This instability was in addition to the recent natural avalanche they saw on their approach and on the same aspect as the study plot.

At 1430 they departed the study plot. They headed to a ridge that MSU1 and MSU2 had skied underneath two weeks prior. The ridge was corniced and the slope below it wind-loaded. They all talked about descending the safe, lower-angled shoulder at the end of the ridge. Furthermore, they discussed that they would not ski on shaded slopes (east) because of the instability they found. The aspect of the wind-loaded slope below the ridge was the same as their study plot (east).

MSU1 skied the shoulder first and yelled from the flats for the next skier to come down. They were in view of each other. SP2 was next, but instead of following MSU1's route down the shoulder he jumped off the cornice. He impacted the 39-42° slope after 5-7 feet of air and the slope fractured on his second turn. The avalanche broke 300 feet wide and 2-4 feet deep. All three spectators yelled "Avalanche!" SP2 was swept through a terrain trap of thick trees and disappeared from sight. He was carried 300 vertical feet to the bottom of the slope.

RESCUE

All times are from the log at YC Dispatch.

SP1 and MSU2 immediately descended the bed surface to SP2's last seen point with their beacons on "receive". SP1 picked up a signal at 40m and shouted to MSU2. SP2 was visually located a few seconds later on the other side of the trees with his ski tips poking out of the snow. His face was covered by only a few inches of debris, though his legs and arm were slightly deeper. Shovels were not needed to unbury him. He was face up, head slightly downhill and unresponsive, having suffered severe trauma. MSU2 cleared his airway and then she and SP1 unburied him and positioned him flat on his back. SP1 wrote, "MSU2 assessed his respiration after he made agonal gasps and found he was not moving air. She went on to assess his pulse and said she was not picking one up and that it had dwindled as she first checked from the carotid. We then exposed his chest and began chest compressions and MSU2 checked and cleared his airway of some snow, inserting an OPA (oropharyngeal airway) and began rescue breaths." MSU1 put on his climbing skins and ascended to the site. SP1 informed YC dispatch of the accident at 1452 and CPR was initiated at 1455. YC dispatch notified Summit Air Ambulance, based in Bozeman, at 1454 and they launched soon after.

A YC lift mechanic riding a mountain sled arrived on scene at 1505, 13 minutes after the initial radio call, with a trauma pack, rescue sled and AED defibrillator. The AED displayed "no shock advised" and they

tried three more times at 5-minute intervals, but the AED displayed the same message since SP2 did not have a shockable rhythm. Other YC ski patrollers soon arrived by sled to assist in the evacuation. First dragging a sled, then towing by snowmobile, the patrollers brought SP2 to the bottom of Lake Lift at 1537 where Summit Air Ambulance landed at 1545. SP2 was unresponsive and medical authorities determined CPR should be stopped. He was transported by YC Fire to Big Sky Medical Center.

INVESTIGATION

The onsite avalanche investigation occurred on January 20. It was conducted by Doug Chabot (author), Dr. Jordy Hendrikx (MSU Assistant Professor of Geography, Director of Snow and Avalanche Laboratory), Doug McCabe (assistant YC ski patrol director) and Dewey Neighbor (YC ski patroller).

Doug Chabot interviewed the three other members of the party over January 19, 20 and 21.

Please contact Doug Chabot if you have questions.

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