

**Elk Mountain Avalanche Incident Report
Glacier National Park, MT**

Date of Avalanche: 8 January 2013

Date of Investigation: 9 January 2013

**Investigation Team: Erich Peitzsch (USGS), Tony Willits (Flathead Avalanche Center),
Jason Griswold (NPS) and a member of the party involved**

INCIDENT SYNOPSIS

On Tuesday, January 8, 2013, a party of two (one skier and one snowboarder/splitboarder) were traveling on Elk Mountain near Marias Pass in Glacier National Park, MT. Around 1530, one skier triggered and was caught and partially buried in an avalanche. This skier sustained substantial injuries including a broken lower left arm, six broken ribs, a head contusion, and a head laceration. The non-injured snowboarder was able to call 911 from the location of the partially buried skier. Glacier National Park dispatch received a call around 4:15 p.m. indicating there was an avalanche and one injured skier. We investigated the avalanche site on Wednesday, January 9, 2013, and were accompanied by a member of the party involved (Snowboarder, male, 35) and climbed a preexisting ski uptrack along the Fielding Trail in Glacier National Park. The avalanche occurred on a south-southeast facing slope on the south side of Elk Mountain in an area locally known as “The Backstrap” and funneled into a gully. Some of the avalanche path characteristics were derived from on-site images and a geographic information system (GIS) due to limited visibility and potentially unsafe conditions near the avalanche crown during the investigation. The average slope angle of the starting zone was approximately 35 degrees and the alpha angle was 32.5 degrees. Avalanche dimensions were also difficult to determine due to conditions, but the crown face depth appeared to range from 12 to 36 inches deep and the avalanche was approximately 145 feet wide and ran approximately 1400 vertical feet. The crown was located at approximately 7200 feet in elevation and the toe of the debris was around 5800 feet. The caught skier was carried approximately 800 vertical feet. US classification of the avalanche is SS-ASu-R4-D2-I (Greene et al., 2010).

WEATHER AND SNOWPACK

Weather data are from the USGS/BNSF/GNP Shed 7 automated weather station (48.3°N, 113.5°W; 6363 ft.) and Pike Creek SNOTEL site (48.3°N, 113.3°W; 5930 ft.). Total Snow Water Equivalence (SWE) for the Flathead River Basin was hovering around 92% of median, but nearby Pike Creek SNOTEL was around 36% of median. This SNOTEL site, however, is located lower in elevation than the incident site. Shed 7 automated weather station is located approximately 3.5 miles south of the incident site.

Beginning on January 2, 2013, a high pressure system entered the region causing a break in precipitation and producing occasional clear skies. Chris Gibson from the National Weather Service in Missoula, Montana stated:

"The holiday period of Christmas and New Years leading up to early 2013 was characterized by stable high pressure with relatively light winds and little snowfall. During the period of January 4 to 8, 2013 a series of weather disturbances moved from west to east across the northern Rocky Mountains and Glacier Park region. These disturbances brought strong westerly flow aloft to the area resulting in the periods of increased wind observed at Shed 7 on January 4th and again from late January 6 - lasting through the 8th. Temperatures were fairly steady and averaged in the 20s at shed seven through the period. Snowfall increased over the area beginning early on January 6. Snow pack depth increased 10 inches by early on the 8th."

Snowfall amounts at Shed 7 totaled over 12 inches (30 cm) with sustained average wind 15-20 mph and gusts to 56 mph (Figure 1). Pike Creek SNOTEL, located approximately 6 miles NE of the accident site, recorded 0.5 inches (1.3 cm) of SWE.

Surface snow throughout the region prior to the storm was comprised of a myriad of snow types including sun crust, freezing rain crust, surface hoar, and near surface facets. The BNSF avalanche safety team observed a sun crust on southern aspects above 5700 feet on January 3, 2013 near the Shed 11 area above the railway. Observations on the morning of January 8 in nearby Skiumah Creek showed intentional human triggered wind slab avalanche activity on wind loaded slopes with up to approximately 20 inches (50 cm) of new snow at upper elevations (~6500 feet). BNSF avalanche safety personnel reported strong winds, inverted new snow, and substantial new snow accumulation at all elevations in John F. Stevens Canyon that morning (1/8).

We completed a fracture line profile on a south-southeast aspect and found a slab sitting on a layer of mixed-form faceted crystals over a 0.8 inch (2 cm) thick ice crust (potentially a sun crust) (Figure 2). The bed surface of the avalanche was the ice crust (Figure 3). Above this crust was a cohesive wind slab ranging in depth from 12 inches (30 cm) to nearly 40 inches (101 cm). Due to poor visibility and safety concerns we were unable to fully investigate the avalanche triggered by the party. However, a member of the party (Skier, male, 34) reported seeing an avalanche occur as he was ascending the ridge (Avalanche 1). This avalanche was in an adjacent gully to the avalanche triggered by Skier later in the day (Avalanche 2). We were able to safely access the lower part of Avalanche 1 and complete stability tests and a full profile of the crown (Figure 2).

New snow and more wind loaded snow limited us from gaining a true perspective on snowpack conditions from the previous day. However, our stability test results show that a fracture propagated across the column right above an ice crust with small facets and rounding facets sitting on top of this crust (ECTP 14 and ECTP 23). We performed our second Extended Column Test further back in the crown which may have led to the higher score. Regardless, the avalanches that occurred on January 8 consisted of a wind slab sitting on top of this crust/facet combination. This area was heavily wind loaded and cross loaded from southwest winds with substantial cornices above the gullies in which the avalanches occurred. The day of the investigation we did not see any new avalanche activity aside from the avalanches investigated nor did we experience cracking or collapsing of the snowpack along our ascent or descent.

AVALANCHE

The Flathead Avalanche Center avalanche advisory for January 8 read:

“The general avalanche hazard will increase to **CONSIDERABLE** at mid and upper elevations in our region. New storm accumulations will be easily transported to form soft surface slabs on lee slopes and in chutes. The new snow should bond well with Monday’s storm snow but weak interfaces on or just below recent rain crusts will be the concern.”

The non-injured member, Snowboarder provided valuable information regarding the accident site and all of the events of the day of the incident. Snowboarder is from the local area while Skier is from the Missoula, Montana area. Both Snowboarder and Skier had traveled on Elk Mountain the previous day (January 7, 2013), and skied the middle and lower parts of the same slope that they skied the day of the avalanche (Figure 4). Before departing, neither Snowboarder nor Skier had checked the avalanche advisory from the Flathead Avalanche Center. Skier had thought that Snowboarder had checked the advisory, but was uncertain. They began at the Fielding Creek trailhead along the southern boundary of Glacier National Park. They first climbed the southeast ridge of Peak 6996 (Little Shields) to the summit and descended a northeast facing chute for approximately 2000 vertical feet that leads to Fielding Creek.

Then, they followed the Fielding Creek trail to a small creek drainage on the southwest side of Elk Mountain. They followed a sub-ridge on the ascent on this side of Elk Mountain (Figure 4 and 8). Snowboarder was about 10 minutes ahead of Skier and traveled to the summit of Elk Mountain (7835 ft.) and then descended approximately 300 vertical ft. back down near the uptrack to meet Skier as he was still ascending. Before descending Skier mentioned to Snowboarder that he saw an avalanche to his right as he was ascending. It is difficult to know whether this avalanche (Avalanche 1) was human triggered or naturally occurred. It may have been triggered remotely by either member of the party or it could have failed naturally.

Knowing this, Snowboarder, from this location at approximately 7500 ft., then descended a southwest aspect that changes slightly to southeast to about 6750 ft. where he stopped on a small treed sub-ridge. From this location he was unable to see Skier descend due to low clouds. Snowboarder then noticed avalanche debris to his skier’s right. He was able to see the crown. At this point he became concerned given the size of Avalanche 1. He then looked up in the direction that Skier was to descend and noticed a powder cloud moving rapidly downhill. He did not see Skier at any point. Snowboarder pushed off of a tree to descend and was immediately surrounded by moving snow. He was able to safely ride downhill and to the right out of the debris and up onto the ridge they ascended. He had not seen Skier since he first began his own descent at 7500 ft. Once the powder cloud settled and debris stopped moving, he began scanning the debris and heard yelling coming from downslope. He traveled downslope to find Skier buried up to his neck with his left arm and head out of the debris. It is worth noting that Skier was not wearing an avalanche transceiver. Snowboarder then began digging Skier out of the debris. Skier had a contusion on his forehead and complained of left arm pain and pain in his ribs. Skier was wearing a helmet but the helmet was broken into numerous pieces during Skier’s fall in the avalanche. He was carried through a stand of small trees and was deposited along the skier’s left side of the debris at approximately 6500 ft. It appears based on their recollection and our

investigation (with limited visibility) that Skier was transported about 800 vertical feet. Skier mentioned that he thought he was carried only “30 or 40 yards”.

Avalanche 1 and Avalanche 2 occurred on southeast to south aspects. These two avalanches occurred in two adjacent gullies separated by a small, shallow, and sparsely treed sub-ridge (the location that Snowboarder stopped after the initial descent before Avalanche 2). During our investigation these gullies were being heavily loaded with snow by west-southwest winds. These gullies are continually loaded and cross-loaded as evidenced by the large cornice on the party’s ascent ridge. The two began their initial descent on a more southwesterly facing slope and eventually entered wind loaded terrain on a slightly different aspect.

Snowboarder then placed a call to friends in nearby East Glacier under the assumption that they could reach the scene faster than an organized rescue. After this call, he then placed a call to 911 at 1616. Snowboarder was able to extract Skier. Skier’s skis and poles were missing. Despite the pain, Skier was ambulatory and the two then began their descent. Snowboarder placed his skis on his split board backward so that Skier could descend at a slow pace to accommodate the pain and his injuries. Snowboarder assisted Skier by providing support on Skier’s right side and proceeded to walk in deep snow while Skier traveled on the disassembled splitboard. Travel at this point was very slow going. From the point of partial burial at 6500 ft. the two traveled to their existing uptrack and followed that down to about 4900 ft. There they were met by a friend of Snowboarder’s (Friend) who brought skis for Snowboarder to utilize instead of walking in deep snow. The three continued back down to the Fielding trail where they were eventually met by rescue personnel on snow machines at around 1830. Skier was transported via snow machine to the trailhead where he was met by ground transport ambulance and taken to a medical facility in Browning. Snowboarder, Friend, and the remaining rescuers skied out to the trailhead.

The images below illustrate the aforementioned events and observations (Figures 4-8).

SEARCH AND RESCUE

Glacier National Park dispatch was notified of an avalanche around 1615 on Tuesday, January 8. National Park Service personnel were dispatched and used snow machines to access the site. They along with the BNSF avalanche safety team and local emergency personnel including Blackfeet Law Enforcement Services, Glacier County Sheriff’s Office, Flathead County Sheriff’s Office, Flathead County Search and Rescue, and North Valley Search and Rescue coordinated the rescue operations. At around 1830 rescue personnel met with Snowboarder, Skier, and Friend and transported injured Skier the remaining approximately 1.5 miles to the Fielding Creek trailhead. The Glacier County EMS Ambulance transported the injured skier to a medical facility in Browning and Snowboarder was released at the scene with no injuries.

This report was written to ensure accurate information is available and to assist others who may encounter themselves in similar situations in the future. This document will supplement an official report completed by Glacier National Park, and will become part of a database of avalanche accidents. We would like to thank the members of the involved party for sharing valuable information that aided in making this report accurate. We’d also like to thank the

National Weather Service in Missoula, BNSF avalanche safety personnel, and all rescue personnel involved for sharing information.

Direct any questions regarding this report to epeitzsch@usgs.gov or 406.888.7925

PHOTOS AND MAPS

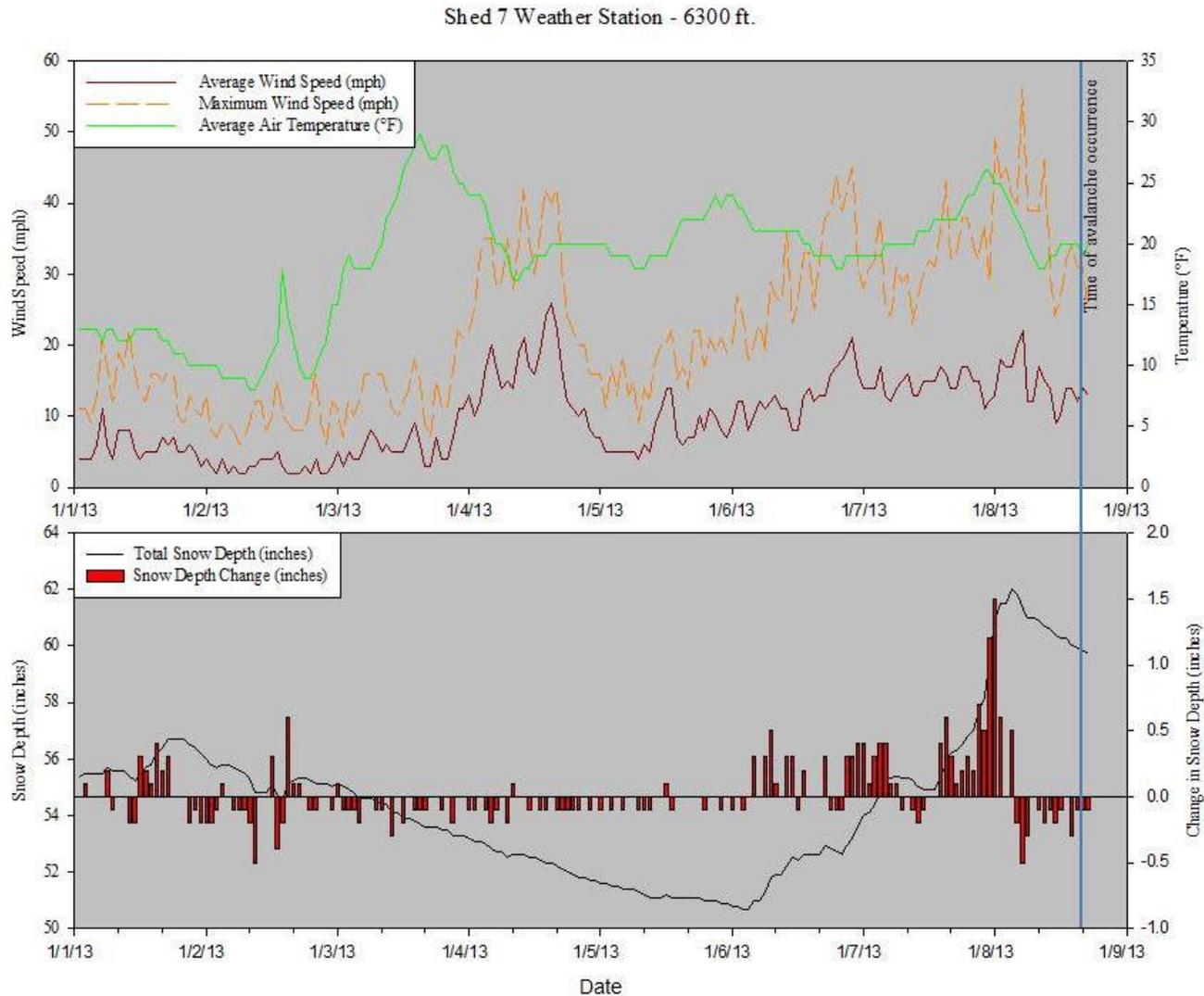
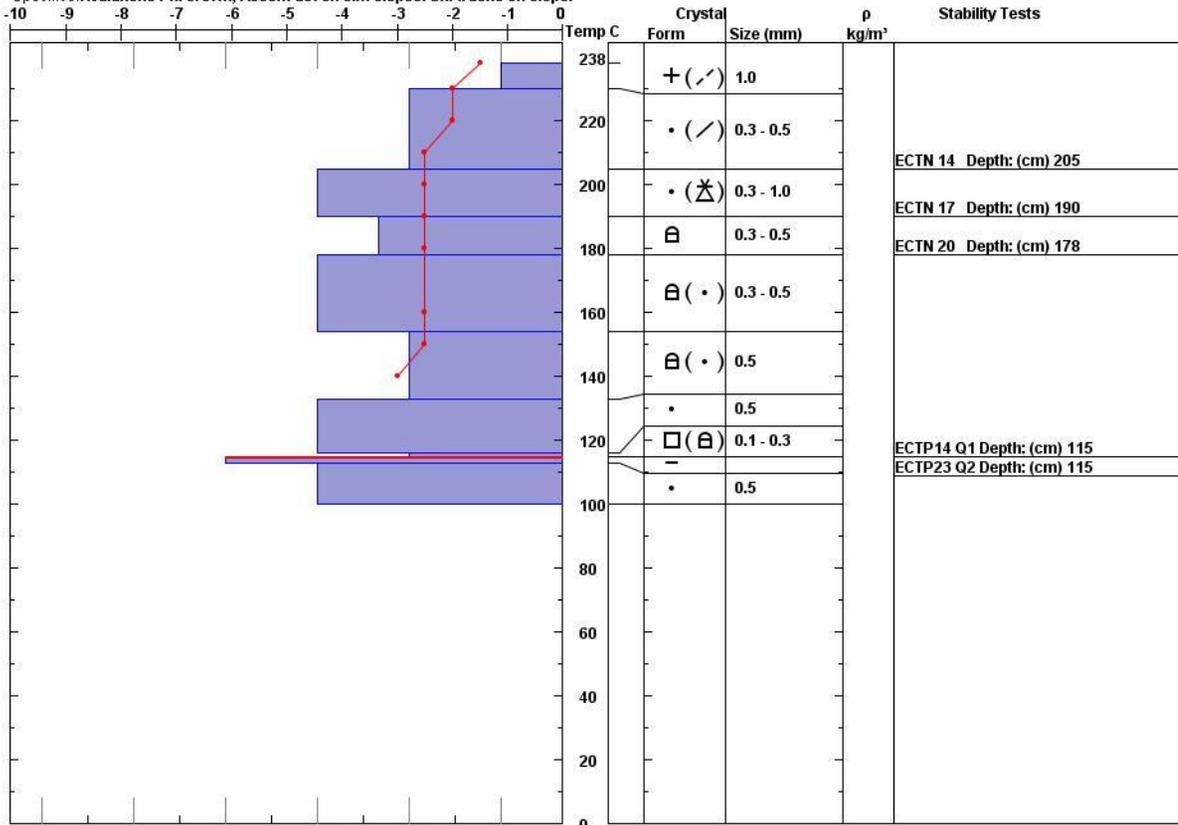


Figure 1: Air temperature, wind speed, and snow depth from Shed 7 weather station from January 1, 2013 0100 to January 8, 2013 at 1700 (about 1.5 hours after the accident). The time of the incident is labeled with a vertical blue line.

Snow Pit Profile Observer: **Erich Peitzsch** Stability on similar slopes: **PS25 HS238** Layer notes:
Elk Mountain **Wed Jan 09 11:00:00 MST 2013** Air Temperature: **-2 C** Stability Test Notes: **113-115: Problematic Layer**
Lewis Range, MT Co-ord: **43.30358 N 113.45139 W** Sky Cover: **sky 8/8 covered**
 Elevation (m) **2042** Slope: **38** Precipitation: **Snow - 2 cm/hr**
 Aspect: **114** Wind loading: **yes** Wind: **SW Moderate**
 Specifics: **Avalanche Pit: crown; Recent act on sim slopes. Ski tracks on slope.**



Notes: This profile was conducted on the lower part of the crown of an avalanche adjacent to a separate avalanche that caught and partially buried a skier. The skier sustained substantial injuries. See "Elk Mountain Avalanche Incident Report" on Flathead Avalanche Center website for more information.

Figure 2: Crown profile of the avalanche.



2cm ice (sun) crust with small facets and rounding facets sitting on top of it. Our stability tests resulted in propagation of a fracture on this layer with moderate force.

Figure 3: FAC avalanche specialist Tony Willits pointing to the 2cm ice (sun) crust that has small facets and rounding facets sitting on top of it.

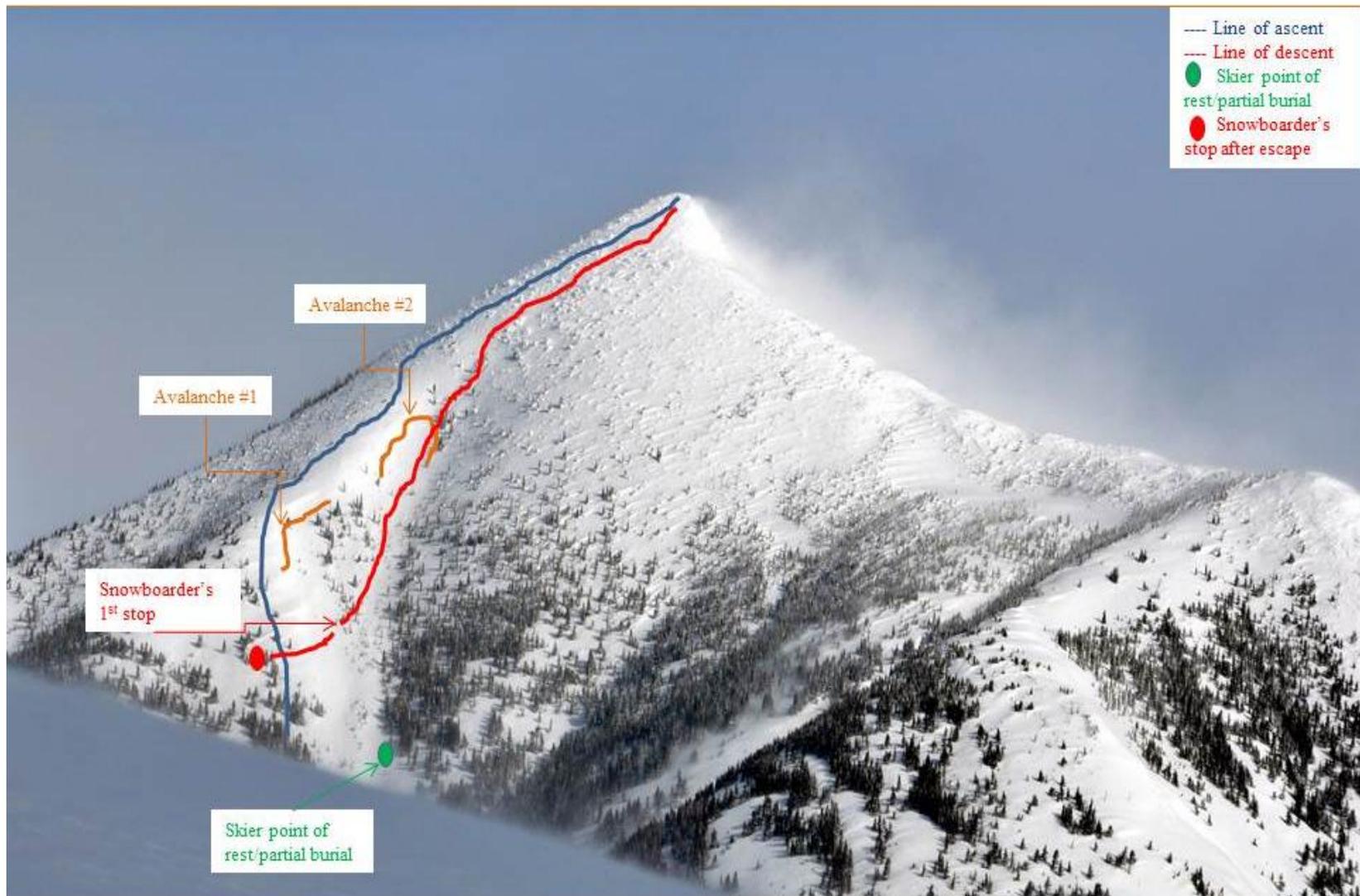


Figure 4: Overview of Elk Mountain with locations of ascent, descent, avalanche crowns, and individuals involved.



Figure 5: Looking up at the crown of Avalanche 2 (the avalanche that caught and partially buried Skier) from the location of the snow profile. We performed a snow profile on the lowest part of the crown of Avalanche 1.



Figure 6: Looking down the gully that both avalanches funnel into and where Skier was carried and partially buried. New snow (6-8 inches since the previous day) covers and masks much of the debris.



Figure 7: Looking up the avalanche path from the toe of the debris. The debris was already covered by 6-8 inches of new snow since the previous day.

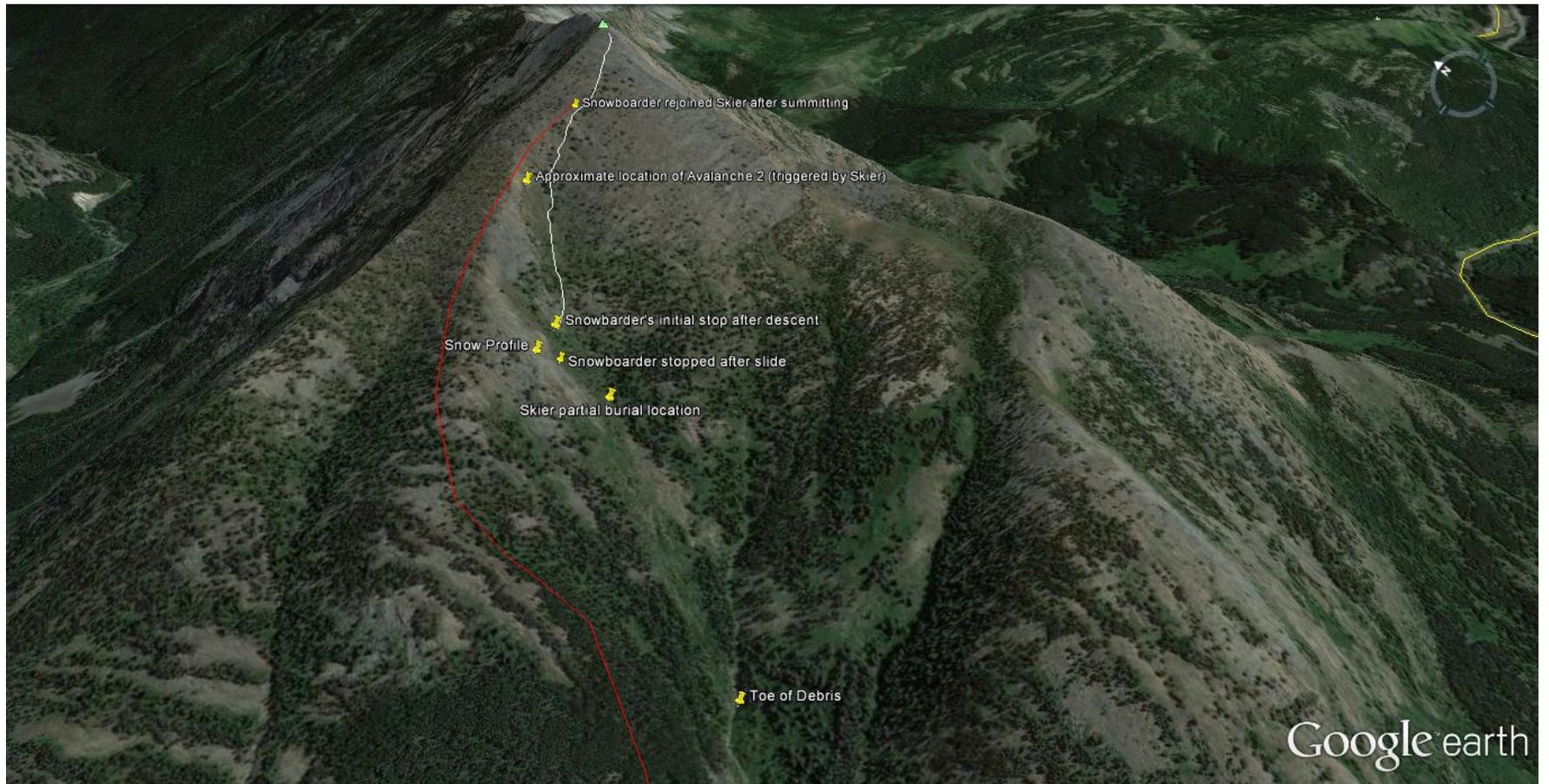


Figure 8: A Google Earth view of the entire avalanche incident site.

REFERENCES

Greene, Ethan M., D. Atkins, K. Birkeland, K. Elder, C. Landry, B. Lazar, I. McCammon, M. Moore, D. Sharaf, C. Sterbenz, B. Tremper, and K. Williams, 2010. Snow, Weather, and Avalanches: Observational Guidelines for Avalanche Programs in the United States. American Avalanche Association, Pagosa Springs, CO: Second Printing Fall 2010, 152 pp.