

Subzero learning environment enabling avalanche research

12 April 2015, by Nancy Owano



A recent article about avalanche research in *Popular Science* referred to the effort toward knowing more about the avalanche in its subhead as "snowslide science," and the article was about the interesting lab [work](#) going on at Montana State University (MSU). Lab work? Do they want to replicate an avalanche in a lab? That is what they are doing, in attempting to understand more about such disasters. Sarah Zhang in *Gizmodo* called the [lab](#) "a mountainside in miniature." The scientists go to the Subzero Science and Engineering Research Facility when they are ready to study the effects of the cold on projects across many scientific disciplines. The Subzero Lab occupies 2,700 square feet and includes eight room-sized cold laboratories; three low-temperature biological incubators; two additional environmental chambers; a temperature-controlled computed tomography (CT) scanner; and a refrigerated epifluorescence microscope. MSU scientists there are probing for avalanche answers.

A film to document their work is called "Avalanche Engineers." The film-maker, Abby Kent, traced [two](#) scientists as they went out in the field—They have been examining layers of snow on slopes—and

their return from the field and back the labs, where avalanche [simulations](#) are carried out. They are trying to understand how these snow layers cause avalanches.

An avalanche is definitely not the way you want to move the world or, more to the point, feel the world move beneath your feet. David Walters and Tony LeBaron, both PhD candidates in applied [mechanics](#), talked about their efforts and methods in the film. "We recreate avalanches to understand how and why they actually work." At the lab they simulate weather conditions. A room features a solar simulation source, a temperature controlled ceiling, to simulate a "cold sky" and humidity control.

In an interview in *Nautilus*, Walters said, "We recreate the conditions we see outside. We can control the amount of sunlight we have in the lab with a metal halide lamp, and recreate sky conditions by controlling the temperature of the lab ceiling and the air temperature." They take samples of snow and analyze microstructure with a micro CT scanner, which offers a 3-D picture of the snow's structure.

They proceed on with steps that simulate an avalanche. The significance of their work was discussed in the *Nautilus* article by Yvonne Bang. She wrote, "Avalanche [forecasting](#) relies on subjective interpretation, both of field data by rangers, and by skiers of the five risk categories that appear in American forecasts: low, moderate, considerable, high, and extreme. But new approaches to the science of snow are promising to dramatically increase forecasting accuracy."

The investigations in the [lab](#) can help with forecasting. Walters told Bang: "One of my colleagues, mechanical engineering graduate student Patricia Curley, is working on a very cool model that takes a digital terrain map, like Google

Earth, and weather conditions to model a snowpack. In this model, we can track the sun moving through the sky, see how shadows affect certain slopes, and know what the temperatures are, both on the surface of the snowpack as well as underneath the surface. Her model can map the locations where we get these critical temperatures, or [temperature](#) gradients that form weak layers. We can then start to forecast weak layers for specific mountains—not just guess at how weak those layers are, but be able to put a number on it. "

The WSL Institute for Snow and Avalanche Research SLF in Davos presents avalanche types as fundamentally different—loose snow avalanches and [slab](#) avalanches. The latter is characterized by the simultaneous release of a cohesive snow layer (slab). Loose snow avalanches are mostly harmless, but slab avalanches can be large and dangerous. Dry slab avalanches, in which a sliding motion predominates, reach speeds of 50-100 km/h. In very steep terrain, a dry slab avalanche can be transformed into a powder [avalanche](#) as it descends, reaching a velocity of 200-300 km/h.

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