UVM researcher helps warn of avalanches

UVM engineer Christian Skalka has developed electronic sensors that measure snow depth and is working on an app that will be used to predict avalanches. / EMILY McMANAMY, Free Press

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Christian Skalka knows better than to think that he, or anybody else, can foretell with precision when and where an avalanche will occur.

Such a prediction is beyond the capacity of avalanche experts and might be likened to forecasting the stock market.

But Skalka has an idea for how to make avalanche risks clear to those who want to venture into the high terrain: backcountry skiers, ice climbers, snowmobilers and others. He has developed a smart-phone application that crunches relevant data and spits out a number from 1 to 5, in ascending order of hazard.

Not that the app — which he has named “the Stabilitron” — will be the last word in protecting anybody, but it could be a useful tool in assessing how safe it is to proceed.

Skalka always has liked to ski, so his invention represents a fusion of his personal and professional interests. He’s an associate professor of computer science at the University of Vermont whose research, for the past three years, has been taking the measure of snow in various ways.

Another of his creations, co-developed with Jeff Frolik, an associate professor of engineering, is a remote sensor that measures snowpack height and water content, known as “snow water equivalent.” This is a lightweight, low-cost computerized device that Skalka sees as a significant technological improvement over the ponderous equipment that has been deployed in Western mountains to take these measurements since the 1980s.

A network of these sensors — which Frolik and Skalka call Snowcloud — can provide data that pertain to water supplies (most public water in California comes from the Sierra snowmass). Skalka spent his sabbatical last year in Truckee, Calif., near the famous Donner Pass, where he tested the system.

While Snowcloud is most useful to scientists and technicians, the Stabilitron will be for laypeople. It’s in the demo phase, with a patent pending, and Skalka is weighing how it might best be developed and made available.

What prompted him to develop this device was his own experience — including a scary incident on New Hampshire’s Mount Washington a few years ago when he watched an avalanche sweep a friend down the mountain and out of sight. And that was on a day when the avalanche risk — as charted by the Mount Washington Avalanche Center — was low, in the 1 to 2 range.

“That experience definitely inspired me to work on tools for safer travel in avalanche terrain,” he said.

The Stabilitron uses a program that combines data from the regional avalanche center (the one on Mount Washington, in New England’s case) with three kinds of on-the-spot observations — in effect, precursor signs — that the phone-user can punch in:

• A “whumphing” sound — the sound that one snow layer makes when it settles on another, forcing out air.

• Cracks in the snowpack.

• Signs of a recent avalanche, either in the form of debris below or a crown — a vertical wall in the snow — above.

The optimal slope angle for an avalanche, Skalka said, is 37 degrees. On steeper slopes, especially more than 42 degrees, he said, “the snow never gets a chance to bond and has already sloughed off.”

It also happens that “37 degrees is the perfect pitch for intermediate expert” level skiers, he said.

There’s much more to a snowpack than meets the eye.

“Snow is not continuous,” Skalka said. “From the ground the surface, it’s like phyllo dough, in layers.”

Many variables are in play with a snowpack, not all of them known (as in the case of the stock market.) Some snow layers are weaker by virtue of hoarfrost — large ice crystals that form on the surface only to be covered by another layer by the next snowfall.

Stability can be affected by the variation in temperature from the ground to the surface, depending on the snowpack’s thickness, as can the snow water equivalent.

Wetter snow binds better, and thus tends to be more stable. Light powder, while celebrated by skiers, doesn’t bond as well — which explains partly why Utah experiences a lot of avalanches.

“The only place worse than Utah is Switzerland,” where hoar layers abound in the snowpack, Skalka said.

In the West, avalanches intermittently block major thoroughfares, such as U.S. 80 through the Donner Pass. But there’s danger in the Eastern mountains, too. Six years ago, an avalanche at Smugglers Notch swept extreme skier Alec Stall off a cliff, to his death.

On Mount Washington, Skalka’s friend survived unscathed, having been swept down hundreds of feet. He later published an article about his experience in The Avalanche Review titled “Springtime Avalanches Don’t Happen Here: A Nearly Deadly Avalanche in New Hampshire’s Presidential Range.”

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