customer stories

GPS database key to improving avalanche predictions

Customer
Avalanche Mapping, Colorado and Alaska

Project
Using GIS data to build avalanche maps for backcountry trekkers

Project Date
2005

PROJECT HIGHLIGHTS

- GIS of spatially accurate snow observations helps predict avalanches and protect backcountry enthusiasts
- Database contains recent and historical snow observation information dating back to the late 1800s
- Trimble's GeoXT rugged GPS handheld receiver is perfect for mapping snow conditions in cold, snow-packed backcountry terrain

For ski, snowboard, snowmobile and winter sports enthusiasts worldwide, a foot of fresh snow is like a dream come true. But that dream can quickly turn into a nightmare if conditions are right for an avalanche.

At those times when factors such as snow pack, slope steepness and orientation, temperature, wind direction, and terrain are just right, an avalanche can carry more than 300,000 cubic yards of snow—the equivalent of 20 football fields filled 10 feet high with snow—barreling down the side of a mountain, destroying everything in its path. Even a small avalanche can be extremely dangerous. According to the National Snow and Ice Data Center, avalanches kill more than 150 people worldwide each year, most of which are experienced backcountry enthusiasts.

Doug Scott is an experienced backcountry trekker who is working to help winter sports enthusiasts avoid avalanches. In 2000, Scott created Avalanche Mapping, an organization that uses Geographic Information System (GIS) data to build avalanche maps for backcountry trekkers, with the hope of reducing the number of avalanche accidents each year.

"Avalanches tend to occur in the same places over and over again," Scott said. "Typically, there is a trend in the type of terrain that is particularly susceptible to avalanches, but until recently, historical observations about avalanches were written in a book, put on a shelf, and rarely looked at again."

In addition to being difficult to share, manual records are impractical for monitoring conditions such as snow pack and temperature, which often change from hour to hour. Recording avalanche data manually also creates challenges for avalanche rescue teams. Until recently, avalanche observations were not standardized or recorded with spatial accuracy, and there were often several different names for the same backcountry location. Ensuing inconsistencies caused delays and miscommunication among rescue personnel.

With the help of technology from Trimble and ESRI, Scott's organization is building a spatially accurate database of historic and recent avalanche observations, mainly in Colorado and Alaska. Data includes observations about weather, snow, characteristics, terrain, slope, type, size, and destructive force of avalanches.

Much of the information about current snow conditions is obtained by digging snow pits, or holes, in various locations in the snow. By smoothing the uphill wall of the pit until it is vertical, experts can examine the different layers in the snow for moisture, strength, density and other factors indicative of snow pack stability.

Scott began this project by creating a geodatabase model based upon widely accepted avalanche observation guidelines from the National Avalanche Center and the American Avalanche Association. He then created a data dictionary using ESRI ArcPad software, and loaded it onto a Trimble® GeoXT™ handheld, a rugged computer and GPS receiver in one, which is used to record observations in the field.

Back at the office, Scott downloads the data into a GIS where it can be analyzed and mapped, with ArcGIS software from ESRI. Real-time data about rapidly changing factors such as temperature and snow pack is a valuable tool in avalanche forecasting.

In addition to recording new observations, Scott is digitizing historical avalanche data provided by various state parks, ski areas, the U.S. Department of Transportation and other organizations. Some of the information dates back to the late 1800s.

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Having access to historical data makes it possible to cross-reference data from the past and match it with current observations, resulting in more accurate avalanche predictions.

Not only does an accurate database help predict when and where avalanches are likely to occur, it can also be used to produce digital and paper maps for use by backcountry enthusiasts, government officials and educational institutions. Adventurers heading into the backcountry can visit Avalanche Mapping's website, or retail locations in various mountain resort towns to purchase maps with up-to-date detailed observations about avalanche conditions in specific areas.

"Maps with details about avalanche patterns were not readily available for most popular backcountry destinations. People would draw their observations on topography maps or write them in books that were generally inaccessible to the public," Scott said. "Now, people with basic avalanche knowledge and intermediate computer skills can download GIS avalanche and snow pit data, and print avalanche maps from their home computer. People can even download the maps directly to their Portable Digital Assistant (PDA) so they don't have to take paper maps into the backcountry."

Scott is optimistic that the benefits of GIS and GPS technology will be widely recognized within the avalanche and snow science communities, and hopes to expand Avalanche Mapping to include a wider geographic area as spatially accurate avalanche maps become more popular with consumers.

"My hope is that during the next few years, snow science professionals will begin to collect GPS coordinates as part of their control work in avalanche-prone areas. This could eventually lead to a database where we could easily view and cross-reference real-time and historical data to more accurately predict avalanches, shorten response times and, ultimately, save lives," Scott said.

AVALANCHEMAPPING.ORG

The equipment used on this project includes:

- GeoXT handheld
- Trimble Recon™ handheld
- ESRI ArcPad software
- ESRI ArcGIS software

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