

Caving with Your Pocket PC

Rugged Pocket PC handhelds offer cave explorers more efficient and precise mapping

By Jim Moore

A case study from Tripod Data Systems, a Trimble company

For those among us who possess the explorer's mentality, the quest to be first to walk on untouched ground continues unabated-it's just gotten a little harder. That's because the remaining unexplored areas on earth are usually found in the most challenging environments. Hey, if it were easy, someone would have already been there.

The challenge only increases when you consider that you have to bring back proof that you've been somewhere that's truly new. In this day and age, a couple of photos won't cut it. Luckily, the heightened challenge of exploring uncharted spots-and charting them-is being matched by new technology that makes the process easier.

Finding and mapping uncharted territory

The actual number of unexplored spots left is dwindling rapidly. Want to bag a new peak? Better head to Antarctica or maybe the Brooks Range in Alaska-and have fun getting to either of those places. Only a small percentage of the bottom of the ocean has been explored, but what's it cost to rent a bathyscaphe? Maybe the wide-open desert is more your style. But it all looks the same, and how would you really know for sure that no one had been there before?

Perhaps the answer lies beneath your feet. Some of the most avid explorers on earth spend their time beneath its surface. Intrepid cavers are on a continual quest to find new caves-and when they find one, they map it. Mapping has a dual purpose. First, it provides a "trail map" for others, letting them know how much rope they'll need and what equipment to bring with them. And, on a more personal level, it delivers the satisfaction and notoriety of being the first to sketch the contours and features of a new cave.

It's a lot of fun, too. Just ask Mark Passerby, a dedicated caver who caught the bug as a teenager in West Virginia. Mark started by going into known caves, but moved on to cave exploring-looking for new holes in the ground. "I wanted to explore new places, and to promote caving to others," he says. On the promotion end he started a Web site (<http://www.caves.com>) that's devoted to sharing information with other cavers around the world.



Mark Passerby mapping a West Virginia cave with his rugged Pocket PC

Of course, finding new caves meant creating maps instead of following them. So Mark and his fellow cave explorers honed their mapping skills, initially using the time-worn methods. For years, cave mapping had been done entirely on paper. Explorers took measurements based on rudimentary surveying techniques and wrote them down, also hand-drawing contours and features of the cave. Once they were back above ground, they transferred the measurements and drawings to map paper and refined them.

The old way, the new way, and the search for a better way

The advent of computer software that could translate data into maps was helpful. Cavers could write measurements down on paper in the cave, and then later enter the measurements into a spreadsheet and transfer that data to a program that processed it and produced a cave map. But one elemental problem remained: ensuring accuracy in the data transfer. Because the data was taken in humid, muddy, and poorly lit environments, the error rate between data taken and data entered was tremendously high. Wet, muddy paper resulted in smeared ink, and handwriting done under those conditions often looked worse than a doctor's prescription. As he continued to explore new caves, Mark experienced the common thought that has motivated innovations for centuries: There has to be a better way.

So he began experimenting with entering the data onto small handheld computers while in the caves. But his early efforts were not fruitful-the computers available were not built rugged enough to withstand the environment inside the caves.

A cave's temperature holds steady at the average year-round temperature of the land above it-in the Lewisburg, West Virginia area, 52°F. In the caves Mark hangs out in, the humidity is 100 percent, all the time. In addition, most of the caves he explores are "living" caves-those with consistent water supplies-and very muddy. When exploring large caves, Mark and his colleagues are often underground from eight hours to three days at a time, and the equipment has to go wherever the caver goes-including tiny, muddy crawlways. It's no wonder he had had trouble finding a handheld that could hold up.

Then someone sent him a note through his Web site about the TDS Recon, a handheld computer being used by professional surveyors-and built rugged enough to withstand just about any conditions. After a little investigation into the product, Mark contacted the manufacturer, Tripod Data Systems (<http://www.tdsway.com>), asking for a Recon demo to use and review on his Web site. Mark explored and mapped three caves near Lewisburg using the Recon: "Bobcat Blowhole," "Deels Hole," and "Middle Earth." In the case of Bobcat and Deels, he was the first person to explore the caves.



TDS Recon, a ruggedized Pocket PC, being used in the rain

He discovered Bobcat after coming across a volleyball-sized blowhole in the ground that looked promising. (Many undiscovered caves "breathe" through small blowholes such as these; when cavers find an opening in the ground that has air moving out of it, their own breathing tends to speed up.) He and his partners-Bob Kirk, Aaron Bird and Rachel Bosch-

blasted out enough rock around the blowhole to squeeze in 10 feet, where they found that the hole opened up into a drop down to an underground creek. After mining out the creek and crawling through more tight passages, they found a larger crawlway-1,200 feet long-that ended with what Mark calls a "muddy, wet, and nasty" 35-foot drop into a 200-foot-by-150-foot room, 75 feet high. The cave was theirs to name, map, and spread the word about.

Surveying, cave man style

The process of mapping a cave using a handheld involves two explorers. Positioning themselves at a distance apart but within sight of each other, Mark and his partner determine points and take measurements using handheld surveying compasses. Then Mark enters data directly into a spreadsheet on the Pocket PC, including azimuths, inclinations and distances. Once back above ground, Mark uploads the data directly to a desktop computer equipped with mapping software. The result is an exponentially lower error rate in data transfer-and therefore much more precise and accurate cave maps.

After testing the Recon in three caves, Mark was pleased with the results he got from the advances in rugged handheld technology. "I'd have eight hours of data compiled, and in between entering it I'd be dragging the Handheld through a 1,200-foot crawlway," he says. "Sometimes I'd have to throw my pack in front of me, and it would roll down a drop, hit a rock-things got knocked around pretty good. The Recon would take a beating for hours, and when I'd turn it on, it would work great. I didn't have to go out of my way to protect it from water and mud, which also made it different than the other handhelds I'd tried." In addition, the device was good for 15 hours of operating time on a single battery charge-a real plus on multi-day exploration trips.

Perhaps the most impressive benefit of using a rugged handheld computer to map caves was the net time savings. According to Mark, the double-entry data process he previously used-once in the cave, again to the main computer-would typically take eight hours in the cave and eight hours in the office. Entering data directly to the Recon and then cutting and pasting it to the main computer? Eight hours gathering, 10 minutes transferring.

And the challenges just keep on coming

New tools like the Recon have improved the process of cave exploration tremendously from a technological aspect. But conditions in caves and the quest to find uncharted territory remain as daunting as ever. Next year Mark and the Caves.com Expedition Team are off to Georgia (the one in Russia) to assist a Russian team in exploring deep caves there, including one named Voronja that is believed to be the world's deepest cave. A previous expedition into Voronja ended when the team ran out of rope and was forced to turn back after descending well more than a mile below the earth's surface. At -1,710 meters, they could hear running water below them-a good sign that the cave goes deeper. This time they'll bring more rope. And when they're more than a vertical mile beneath the earth's surface, several days into a trip spent in humidity, mud and temperatures in the high 30s, you can bet they'll be thankful to have a rugged Pocket PC to help them bring back information about a place no one's ever seen before.

About Tripod Data Systems

Tripod Data Systems(TDS) designs and manufactures mobile computing systems for extreme outdoor and industrial environments. The rugged TDS Recon™ and Ranger™ handheld computers help users collect accurate field data and work more productively in public safety, field service, utilities, military and other outdoor or service-related applications. Both TDS handhelds meet military specifications for drops, vibration,

immersion and temperature extremes, and with an IP67 rating, they are impervious to water and dust.

TDS is a wholly owned subsidiary of Trimble. TDS is headquartered in Corvallis, Ore., and was founded in 1987. For more information about TDS, visit www.tdsway.com, e-mail handhelds@tdsway.com or call 541-752-9000.

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