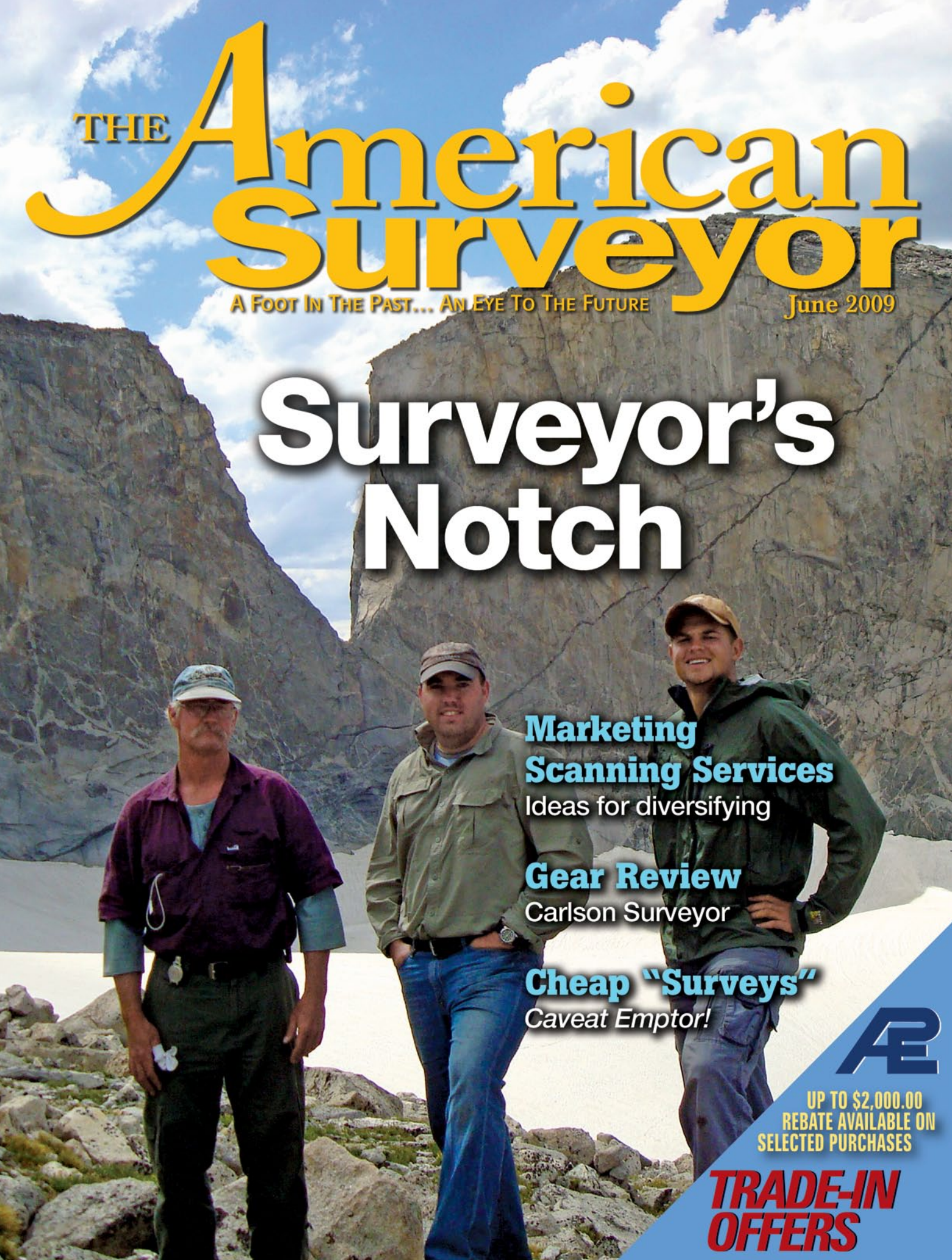
THE American Surveyor
A Foot In The Past... An Eye To The Future
June 2009

Surveyor's Notch



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Speed, accuracy and safety are creating new business for innovative survey firms like Optech customer Teccon bvba in Belgium. Shown here is Teccon's LYNX Mobile Mapper-equipped road vehicle.

MOBILE SCANNING IS GOOD BUSINESS

>> Lieca N. Hohner

Killer bees, 108-degree heat and minus 45-degree cold: these are conditions under which Clay Wygant has worked, and they're all too familiar to many surveyors. But what excites the senior surveyor and his team today is mobile scanning technology.

Since implementing an Optech LYNX Mobile Mapper System in June 2008, Wygant and his team at WHPacific, the first U.S. users of the LYNX system, have executed at least a dozen projects. With each one, they're continually stunned at the system's accuracy compared to static scanning and aerial mapping methods. Wygant noted at SPAR 2009 that after their first job at a municipal airport in New Mexico (where the company had performed previous static work), his team was first amazed at the speed of acquisition (a mere 30 minutes on 8,700 feet including base station setup and scanning of two runways, two taxiways, part of the hangar buildings and a main building), and then the accuracy achieved of six-hundredths of a foot vertically compared to original spirit level, RTK and static scan measurements and control. "Since it was the first project, we figured we had done something wrong for it to be that right," he said.

With 2-centimeter average accuracy, coupled with the time and cost savings over traditional surveying, aerial mapping and static scanning, the Native American/Native Alaskan A-E firm is taking on projects it wouldn't have been able to manage before. It was an uncertain start for them to be sure, but it's been worth it. Wygant explains: "We got it up and running and took it out on a great big western U.S. tour of our 17 offices. And while we were out on that tour the stock market started crashing … and we're trying to sell a million dollars worth of equipment and services…. It's been a tricky year, but all in all, we've completed some unique projects. We have a backlog of projects right now."

Other survey businesses across the globe have similar success stories using the LYNX Mobile Mapper. Sineco S.p.A. (Italy) and Infoterra (U.K.) were two early development partners that provided vital feedback during the design process. Essentially, the road (both conceptual and real) to establishing the LYNX system began north of the U.S. border in Ontario, Canada, and east of the Atlantic in Europe.

If speed, accuracy, high-quality data and automation weren't enough, the LYNX also offers the benefit of safety, both for survey personnel and the public.

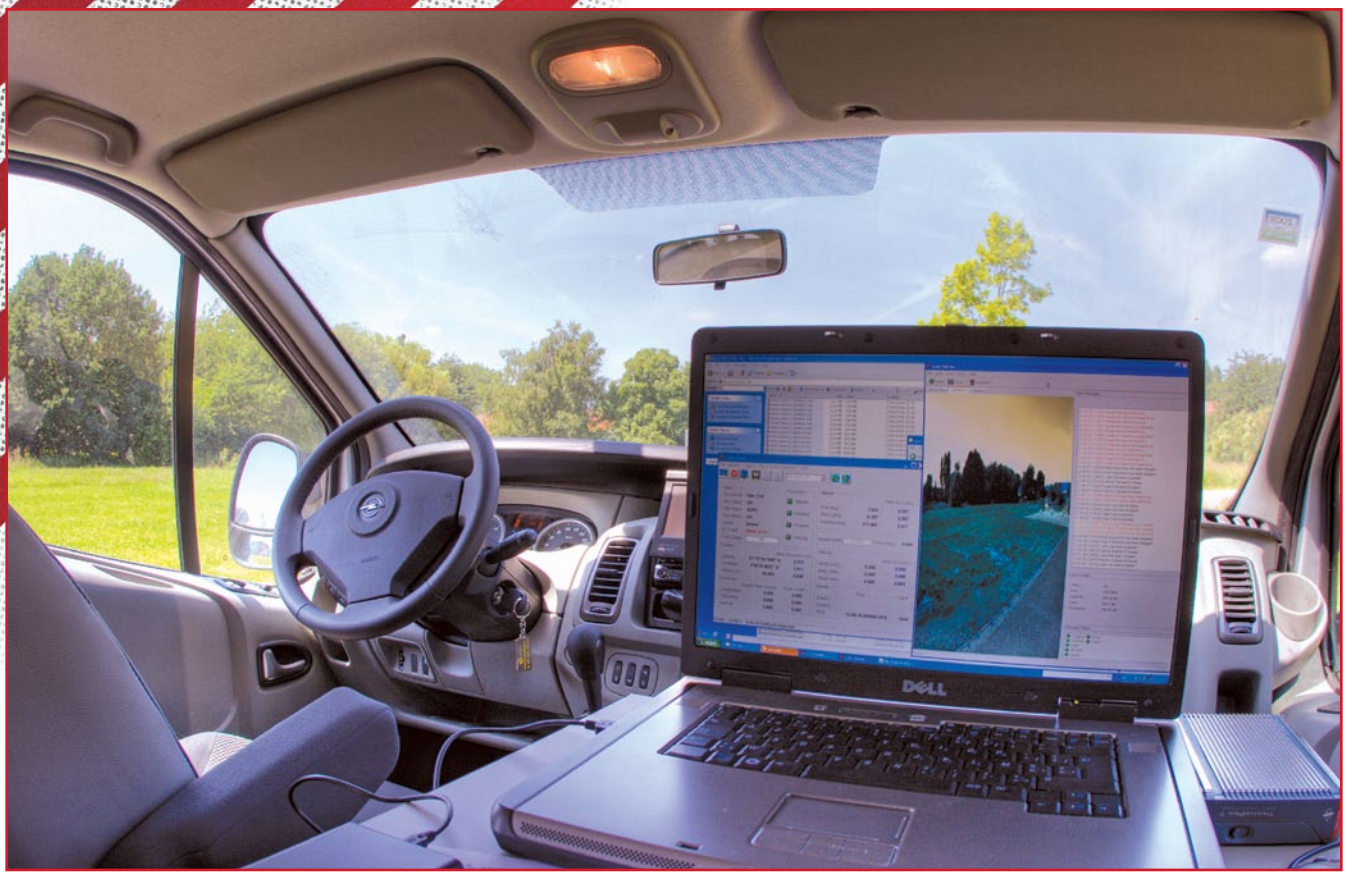
The LYNX Creation: The Links of the LYNX

In 2004, forward-thinking Optech Incorporated had begun developing sensors for an innovative mobile scanning solution. Static market systems housed sensors with limited fields of view around 40 x 40 degrees. Optech saw the importance of upgrading to a rotating sensor that would capture data at 360 degrees from a mobile platform. "The first prototype was an ILRIS-based system for proof of concept," explains Daina Morgan, product manager, Mobile Survey at Optech. "It highlighted the needs for very high measurement rates and the need for two 360-degree sensors. The impact of laser shadows on information extraction was flagged based on the very first prototype tests."

With interest, support and collaboration from Sineco, an engineering company that is part of the ASTM group, Optech also focused on integrating GPS and INS measurements for accurate georegistration and establishing a mounting platform to house the various components to maintain alignment of the sensors and navigation equipment. Up to four LiDAR sensor heads are managed by Optech's iFLEX technology, which "captures the design of laser timing and receiver electronics, and high-speed data communication," explains Morgan. "To maximize accuracy, LiDAR sensors depend on state-of-the-art timing and receiver electronics, high-quality optics and a cohesive design that facilitates the internal calibration of sensor subsystems. In iFLEX, we fuse the highest possible time-of-flight LiDAR precision with next-generation achievements such as eye-safe lasers, high measurement speeds [more than 100,000 measurements per second], wide field of view and rapid scanner speed, all in a compact sensor and control package."

Integrated with the Trimble/Applanix POS LV position and orientation solution, reliable data is continuously supplied by the precision IMU, and GPS antennae and a Distance Measurement Unit (DMI) enable automatic georeferencing of points and control drift errors during GPS outages. At speeds up to 100 kph (~62 mph), users can achieve accuracy better than 5 centimeters and a resolution of up to 1 centimeter.

By March 2007, the first LYNX prototype was ready for testing. Sineco and Optech collectively assessed the system in terms of accuracy, point density capabilities, GPS link outages, georeferencing of point clouds and other detailed specifications.



By performing surveys in-vehicle while compressing schedules and personnel requirements, Teccon bvba is able to work quickly, efficiently, cost-effectively and safely.

LYNX Goes to Market

Through frequent exchanges to improve the system, the LYNX Mobile Mapper was ready for market in September 2007. Taking delivery of the LYNX system in January 2008, a Sineco team applied the mobile solution on 120 kilometers of highway connecting Korinthos to Athens in Greece to collect 3D data of its pavement, structures, curbs and slopes and road signs. In just three hours at 80 kph (~50 mph), more than 120 gigabytes of raw data were collected. "LYNX is really powerful. You scan huge areas in a very fast time," says Federica Zampa, who is responsible for research and innovation at Sineco. She adds that the same area had been scanned statically a year before and took three months to complete.

The LYNX system also avoids the required security and permissions to close down highway lanes, which saves tremendous time for a scan team. What's more, the point density is "almost the same as [static] survey," says Zampa. "You just go with one pass and you have the entire construction of the environment while with a static scanner you have to start and stop." And, she says, even with aerial experience which is comparable in many ways, users need to understand that the results are different. "When you fly, the point density is the same [throughout the project]. [With] a mobile mapper, the point density is different according to the range. If the objects are really close, you have a high density like one point every three or four centimeters. While at high distances, the density is lowered." Zampa also touts the automatic georeferencing of point clouds as being a huge time saver.

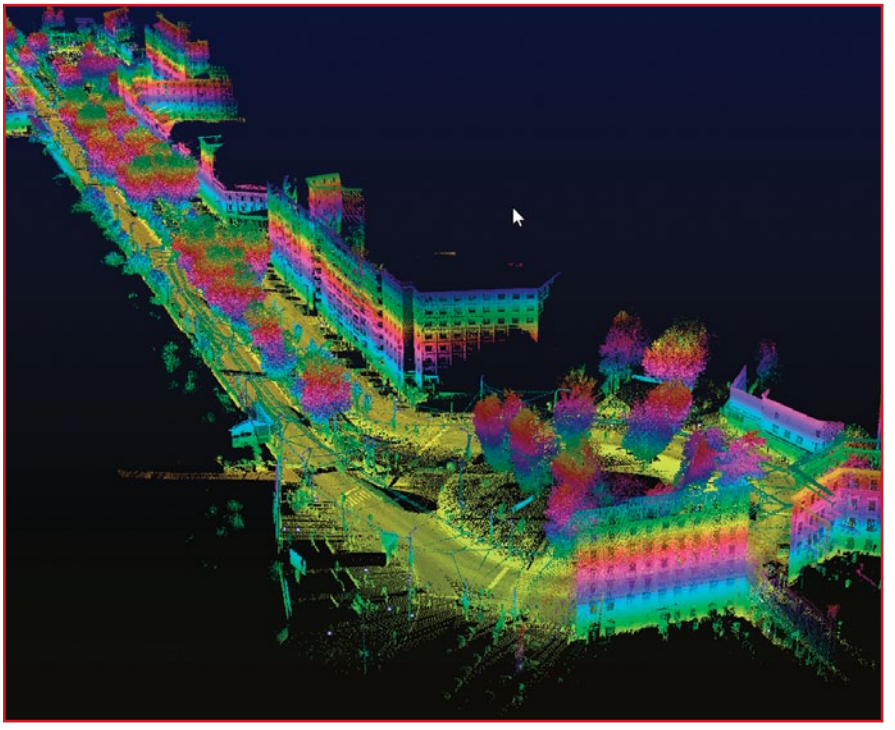
Like WHPacific's Wygant, Zampa has been impressed with the accuracy of the system. She says the Greece highway project had an average spot spacing of 11 centimeters average and within 1 centimeter compared to some ground control points. Elevation accuracy is reported as being between 1-2 centimeters and positional accuracy between 2-3 centimeters.

Compared to static scanning, the LYNX doesn't require overlaps, and it receives less noise from passing traffic (fewer shadows). In addition to speed, the LYNX has been found to produce better alignment, georeferencing and noise cleaning, as well as automatic feature extraction.

A Signature of Safety... and Market Opportunities

If speed, accuracy, high-quality data and automation weren't enough, the LYNX also offers the benefit of safety, both for survey personnel and the public. "We're always thinking safety first," Wygant says. "I give these presentations and put the safety slide up, and I tell people I could just turn off the lights and go home right now–that's really where it is." He adds: "X amount of dollars spent on people on any project ends up with accident." But compressing schedules and personnel requirements so exponentially speaks to a real advantage of mobile scanning.

An exchangeable platform holding all of the LYNX system's components allows WHPacific the versatility to conduct a four-mile cross country waterline design survey.



The LYNX system has expanded the company's service business through corridor survey capabilities.

Wouter De Maegt, co-owner of Teccon bvba in Belgium, another LYNX owner, concurs: "Before we had our mobile system, the safety precautions (like crash-absorbers) were a bigger cost than the survey, and a survey caused traffic congestions for several days," he says. "Some years ago, we did a survey of the highway around Brussels. [There were] several days of traffic jam warnings on Belgium's major radio stations. With this system, we have scanned a highway of 85 kilometers four times in one day all without causing traffic problems and [had] some time left to scan some other projects. If it happens that we are not allowed to close down a highway to do a survey, the mobile technique is the only option."

Andy Potts, survey business line manager at WHPacific, says the same-that the mapping aspects of projects that used to be flown are now being done in-house with the LYNX mobile solution. "You cannot produce the same product that the aerial group is producing–it doesn't replace them," he says. "But there are times or instances where there's a way to create a specific model that's needed that you wouldn't have gotten any other way [than with mobile]."

Capabilities like these offered by the LYNX system are expanding businesses. Some say mobile wasn't built around a market; others are building their company's market territories. The technology has helped Sineco achieve its goal of growing its service business with corridor surveying capabilities. "Before, we were not into the LiDAR survey

MORE ON MOBILE

The first Optech Innovative Lidar Solutions Conference will be held June 24-26, 2009 in Toronto, Ontario, Canada. Attendees will take in:

- Keynote and plenary sessions
- Breakout sessions on airborne, mobile and ground-based solutions
- Exhibitor fair
- Welcome reception
- Gala dinner

Register at http://secure.inorbital.com/Optech/default.asp today!

WHPacific carries out a LYNX-based riparian test study in conjunction with Idaho Power on Snake River, Glenns Ferry, Idaho.

field," Zampa says. "We were doing construction, road maintenance, asphalt tests .... Now we've done the city center in town, roads, mines, airports. Survey work has improved a lot."

Configuring an exchangeable platform holding all the system's components, WHPacific has mobilized on pavement via terrestrial vehicle, gravel via ATV and water via boat. "I think that speaks well of the Optech approach to building this lightweight equipment," Wygant says. "It's not some giant box and a whole bank of computers in a truck. It's just a few components and it is easy to move it onto a different platform."

Similarly, Teccon's Bruno Van Bastelaere notes prospects for establishing a modular system to adapt the sensors to the needs of any given project. This would include adding ground radar, thermal cameras, and a combination of different types of LiDAR sensors and cameras, and for the solutions to be used on boats, planes, helicopters and trains. Even to date, Teccon's use of the LYNX has enhanced business. It's literally helping to put Flanders, Belgium on the map.

Since 1999, the Flemish government has been overseeing the objectives of its Agency of Geographic Information of Flanders (AGIV), which was established, in part, to create and publish georeferenced house numbers for 2.3 million residents; to publish an array of digital maps; and to establish large-scale geographic reference databases of its 308 municipalities in the 13,521 km^2 area (about half the area of the New York Metropolitan Area). Teccon has completed work in six municipalities to date. And although the total area may be small in comparison to other international projects, the territories and objects to be mapped, as well as their associated work flows, are quite complex. Flanders is home to highways, rural areas with and without houses, urban centers, city centers, residential lot areas and industrial sections. Techniques for collecting the data include photogrammetry, total station and RTK GPS technology, and mobile LiDAR scanning. In some cases, such as lotting, urban centers and main roads, mobile scanning is the only option to collect data efficiently, accurately (at least comparable to total station data) and safely.

De Maegt says he expects mobile mapping to become more cost-effective then GPS surveys as experience grows and that new features will become available in the software solutions like automatic feature recognition and coloring of points from the cameras.

Next-generation LYNX

The first users of the LYNX give the mobile solution high marks. But the next generation, the V200 announced March 26, 2009, offers even more advancements. Aerial Data Services Inc. (ADS), of Tulsa, Okla., will take delivery of the first system. Eric Andelin, VP for ADS, says, "We're looking at working with DOTs and rail authorities on stimulus projects, all of them shovel-ready or that need to be done rapidly. Using this mobile LiDAR technology, we can do it two to ten times faster than with traditional methods-and, in some instances, at a reduced cost." He adds that mobile LiDAR keeps highway workers safer by removing them from the road. The V200 provides increased LiDAR measurement rates of 200 kHz programmable, increased resolution, longer ranging capabilities to 200 meters and versatile options that allow for customized surveys. These advancements give LYNX users even more opportunity to grow with the mobile scanning technology. That's good business.

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