



The Hardware of the Future

New hardware will create a very different world for the surveyor of the future.

If there's one thing the major manufacturers agree on, it's that technology will play a critical role in shaping the future of surveying.

The next decade will bring major improvements in the cost/performance ratio of data collection equipment, says Magellan Professional product marketing director, Robert Snow.

Surveying and GIS data collection equipment will be increasingly integrated. 'Future systems will contain multiple wireless means of communication, such as Bluetooth, UHF, cell phone, WiFi, and WiMax.'

Snow also points to other integrations designed to improve performance in difficult tracking areas, such as miniature inertial systems and lasers.

'Lasers will be incorporated into GNSS data collectors, which will allow offset measurements to be made with the data collector itself,' he says.

Total stations will be mobile and remote-controlled, and combine several products rolled into one – GNSS, scanner and camera,' says 12d Field sales manager Graham Wirth. 'They will be capable of performing many of the tasks that currently require separate devices.'

Increased processing power will also allow surveyors to complete more work in the field, rather than in post-processing. 'Instruments will be co-ordinated using high-precision internal guidance, which will allow data to be collected in motion,' he says.

Furthermore, improved equipment will be capable of automatically generating better data. 'Onboard scanner hardware-software will produce intelligent data, rather than a cloud of random points,' says Wirth. 'Lip of curve and line marking strings, for example, will be produced automatically at scan time.'

High-speed wireless internet access will enable an automated system to pick up survey information with little human intervention. Instruments will

be increasingly integrated into site wireless networks.

Manufacturers predict that equipment will become cheaper in response to stronger demand. Increased battery performance and improved display technology will make fieldwork easier. Meanwhile, expensive items such as keyboards and displays are likely to become redundant as external computerised control becomes the norm. Equipment will continue to become more compact, yet more powerful.

'Survey products are going to get smaller, lighter and easier to handle,' says Position Partners survey specialist, Garry MacPhail.

The expansion in the number of satellites will have important impacts. New constellations are only a few years away, with Europe's Galileo system coming online in the next couple of years and China's Compass not far behind. These constellations, and Russia's Glonass system, will become increasingly dominant.

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Global market forces will also see a shift in where these users are located. 'With increased penetration of First World users, the instrument business will follow global economic trends. Large territories such as China, Russia and India will become the key markets in terms of GNSS units sold,' says Snow.

He also believes the GNSS instrument market will offer users more choice in the future.

'The availability of a new generation of hardware that tracks all signals means the range of GNSS products offered for survey or GIS – and the price range – will become much wider. Users will have more choice than ever before.'

All this – greater choice, increased usability and decreased prices – adds up to what Snow describes as the 'democratisation' of GNSS technology.

The new satellite constellations will allow surveyors to negotiate difficult signal environments with more robust positioning solutions. New signals will include the L5 for GPS; a new third frequency for Glonass; the L1, E6, E5a and E5b signals of Galileo; and the L1, L5 and E5b signals of Compass.

'More frequencies will allow quicker ambiguity fixing. It will also mean faster time to a centimetre-level solution over longer baselines,' says Snow.

Not only will there be more signals; they will be more powerful than existing GPS.

'The higher signal-to-noise ratio will mean stronger tracking and better performance in marginal environments,' he adds.

Snow believes that the steady increase in both public and private networks for signal corrections will eventually eliminate the need for users to have their own base stations.

'There will be more precise point positioning, where satellite orbit and atmospheric model information from the international GNSS service can be accessed online in advance of a job,' he says.

Other manufacturers believe that the use of augmenting technologies to improve level accuracy will increase, as will the use of pseudo-satellites to improve reception in poor areas. Such techniques will also eventually allow the use of GNSS in tunnels.

'GNSS will continue to replace target processing stations except for the highest levels of accuracy,' says Wirth.

Like total stations, GNSS will lose expensive items such as keyboards and displays as third party external computerised control becomes standard.

But while technological developments will bring significant advantages to surveyors, not all technologies will be greeted enthusiastically.

'One trend that the profession may have difficulty embracing is the increase in machine automation,' says Snow. 'Today it is possible to go directly from a digital design model to grade within 2 cm accuracy, eliminating many construction staking requirements. This trend is putting pressure on surveying

companies that once derived regular income from such work.'

Wirth believes the trend towards machine control will encourage providers to shift their focus.

'In the future, all manufacturers will provide APIs (application program interfaces) for their equipment. This will change machine control vendors from hardware and software providers to purely hardware.'

Out in the field, he says, the technology will also promote two-way information flows.

'Seamless conversion flows of design data to the control PC will enhance machine control and guidance. Conversely, machines will deliver information like as-trimmed or excavated levels or compaction details back to the surveyor.'

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'Machine control will be integrated directly into site wireless networks. In fact, as GPS improves – especially in levels, and with augmentation – the TPS side will disappear.'

Technology will also influence the way that data is created and managed in the future. The number of GIS users will grow as workers in non-traditional fields learn to incorporate the technology in their everyday tasks. More and more people in the field will collect and update data on larger territories.

In recent years, the industry has witnessed a blurring of the traditional surveying and GIS roles. 'The ability to "geo-enable" the mobile workforce has required more and more accuracy over the last few years. This is largely due to the increasing use of survey-grade data in GIS,' says Chris Gibson, vice-

president of Trimble's survey division.

The push for more data and greater detail is set to continue as technology allows greater design flexibility.

'The advent of CAD saw a monumental leap in surveying. The need to manage assets resulted in the development of GIS databases,' says Wirth. 'These technological leaps are just the first step in the evolution of survey data.'

According to Wirth, as information databases develop, survey-grade 3D data will be required, with more detailed attribute information to support GIS principles.

'New shortcomings will arise as the needs of surveyors, asset managers, government departments and designers grow. The cycle of detail, design, development and as-built requires a continuous flow of information that is not restricted or devalued through the cycle.'

Wirth predicts that within the civil infrastructure industry, paper plots and drawings will be phased out, as electronic 3D civil models become increasingly popular at all stages of surveying.

'Three-dimensional data will universally replace CAD as surveyors, engineers and site managers take design into the field via tablet computers,' he says. 'The cadastre will be adjusted to a 3D model via GNSS standards to simplify property definition.'

Government will set uniform specifications for 3D electronic data. This will ensure accuracy and standardised co-ordinate systems. 'Once standards are governed, more data will come from sources outside surveying,' says Wirth.

The growth of online services means that information captured in the field will be increasingly combined with data already available. For example, surveyors will be able to integrate

field data with information from their company's internal system or with other material sourced through the web.

'In some cases, the future is already here,' says MacPhail. 'Surveyors can already access information remotely at any time, and from virtually any place on Earth.'

The future will also see improvements in communication. As wireless bandwidth increases, surveyors in the field will be able to send increasingly larger amounts of data to the office. At the same time, other data – such as job orders, digital models and maps – will flow in the opposite direction.

'The ability to exchange data seamlessly between the office and the field in real time is becoming an expected norm among GIS professionals,' says Gibson. 'This trend will further unite the surveying and GIS communities. We will see increased integration of the IT systems and communications that manage geospatial infrastructure across the enterprise.'

'Standardised tools will become mainstream in the GIS community, allowing geospatial and asset data to be shared between surveyors and mobile GIS users in real time.'

Interestingly, all this integration actually means that surveyors will be able to work far more independently.

'Future surveyors will carry everything they need in a compact, powerful package. They will be constantly in touch with their colleagues and the online resources and information they need,' says MacPhail. 'A single device will allow surveyors to compare what they are looking at with what was there a day, a week, a year or even a decade ago,' he says.

'There will be considerable challenges to the old ways of working in the survey field,' says MacPhail, 'but there will also be enormous opportunities to develop new methods and new business models.'

'It's going to be a very exciting time.' ♦



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