REPORTER 47

The Magazine of Leica Geosystems

Leica Geosystems

Welcome to the vendor with the fullest choice of geomatics solutions

You are now holding the largest-ever "Reporter" in its 47-issue history. It is a statement of Leica Geosystems' extended competence in advanced geomatic solutions. Over the previous year, our company has developed into the most comprehensive vendor of solutions for recording, visualising and modelling spatial data. Continuing the trend of earlier years, the first business year since "going public" has brought a 19 per cent increase in sales to 642 million Swiss francs – above the industry average, and a figure that is set to be trumped once again as the 2001/02 financial year draws to a close at the end of March. This success story reflects opinion in professional circles, where we are perceived as progressing from strength to strength in meeting real-world requirements. Such impressions are frequently the result of wide-ranging comparative tests, of the kind conducted by the British Ordnance Survey as part of their procurement process for GPS equipment. We are proud to have won this largest-ever order in the history of GPS surveying, and of being able to continue our geomatics development programme in a strategic partnership with this internationally renowned institution.

For the first time since going public, Leica Geosystems invited its 6000-plus shareholders to the company's general meeting.

As you can see from the stories in this issue, the latest additions to Leica Geosystems' competence potential are Cyra Technologies, ERDAS, LH Systems and Laser Alignment. Their leading products for 3-D laser scanning, remote acquisition, photogrammetry, machine guidance and construction surveying now join our existing product lines in six user-oriented divisions within Leica Geosystems. In addition, we have strategic partnerships with AED Graphics, NovaLIS, Geocom Informatic and Lantmäteriet for land registry and land information systems (LIS). Our geomatics customers thus benefit from a closer-knit, extended value chain in the world of geographic information systems (GIS). I wish you happy reading of this Reporter issue, with its fascinating insights into the new world of Leica Geosystems.

Our products are developed, manufactured and marketed in an environmentally-friendly manner. Our environmental report shows major reductions in pollutants.

Hans Hess
CEO Leica Geosystems

You can find Leica Geosystems at numerous exhibitions, congresses and road show presentations in your region. In addition, you can find information on our national websites or on www.leica-geosystems.com, www.cyra.com, www.disto.com, www.gis.leica-geosystems.com, and www.laseralignment.com. Please visit us.

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CEO: Hans Hess

Editorial office: Leica Geosystems AG, CH-9435 Heerbrugg, Switzerland, Fax: +41 71 727 46 89
E-Mail: Fritz.Staudacher@leica-geosystems.com

Editor: Fritz Staudacher; Editorial assistant: Teresa Belcher (Bt); Layout and production: Niklaus Frei

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Ordnance Survey with Leica GPS500

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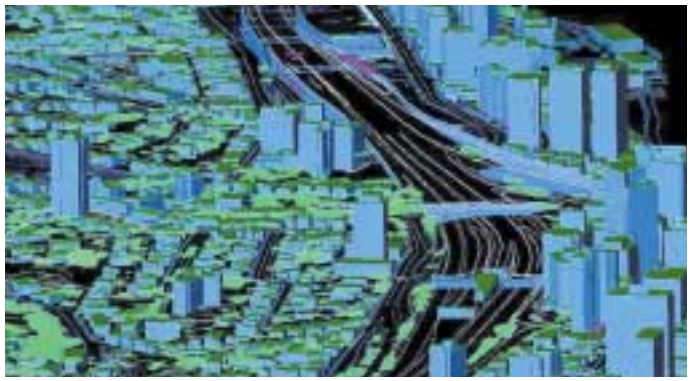
The highly sophisticated GIS of North Sydney



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Pin-point measuring over long distances: the unequalled Leica Geosystems principle of phase measurement with the new reflectorless Leica total stations

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Ordnance Survey builds bright future with Leica GPS

Above: Phil Harris (left), the OS Surveyor responsible for London and Ian Wilson from OS Head office in Southampton, use GPS to survey the whole of Great Britain, and in all weather conditions.

Above: Tim Hall, from Ordnance Survey measures at the Eden Project – an immense green-house landscape under geo-metrical domes. He uses a Leica GPS with RTK corrections delivered by GSM phone link from his Truro office some 27 kilometres away to revise 1:2500 mapping.

Following the start of the new millennium, Leica Geosystems was able to announce in March 2001, a multimillion pound GPS contract, combined with a partnership agreement with Ordnance Survey (OS) – one of the most internationally-renowned surveying and mapping authorities. With first-class technological performance and the evidence of many advantages in reliability and accuracy following demanding testing procedures in harsh environments, the Leica GPS Systems 500 ranked first amongst the tested GPS products available on the market. Using state-of-the-art Global Positioning System (GPS) equipment, Ordnance Survey will revolutionise map making.

Vanessa Lawrence, General Director of Ordnance Survey and Hans Hess, CEO of Leica Geosystems with a Leica GPS500 in the Royal Astronomic Observatory, Greenwich.

”This is one of the most important strategic agreements that has been signed in the long tradition of British surveying and mapping,” said Mark Concannon, Marketing Manager Europe within Leica Geosystems’ Surveying and Engineering Division. An appropriate place to sign the agreement proved to be the historic Royal Observatory, Greenwich. Ian Wilson, OS-GPS Manager said: ”This is a perfect venue to bring together a history of astronomy with the latest space satellite technology.” The Observatory is also the home of the 0° Greenwich Meridian, where the basis of all modern navigation and positioning was first calculated. ”Initial testing of the equipment has been successful in nine offices within four trial areas – Droitwich, Harlow, Rotherham and Perth,” said Vanessa Lawrence, Ordnance Survey’s Director General and Chief Executive. Following initial equipment testing and trials, the project was due to roll out to all of Ordnance Survey’s seventy field offices, from Inverness to Truro, from the Summer of 2001. Now hundreds of GPS Systems 500 are in use by Ordnance Survey all over the British Isles for the survey of map detail and several projects have been initiated to introduce GPS into the map revision process.

The pioneering team of Ordnance Survey and Leica Geosystems will compile solutions of the future by means of this partnership.

With the completion of the second Severn crossing, Wales now has a second gateway to the national road system. To complete this task, Senior Surveyor Stewart Voyle from the Cardiff Office, used the latest GPS equipment from Leica.

'The Armadillo' is the name given to the Sir Norman Foster-designed Scottish Exhibition Centre in Glasgow. With such an important addition to the banks of the River Clyde, OS-Surveyor Mike Hunter sets about updating 1:1250 mapping with the Leica GPS500.

Work in numerous locations has proved that the very best is required to be able to cope with every situation in the field and that Leica Geosystems has the experience to provide a consistent range of GPS products and convincing solutions in all situations and environment conditions. This is true not only for all aspects of accuracy, reliability, ease-of-use, compatibility, and cutting-edge technology but also for customer support and fast technical service.

Before deciding on Leica Geosystems, OS surveyors examined the manufacturing plants of their potential partners, here with Leica Geosystems in Heerbrugg.

Winner of a demanding international tender

"The decision to partner Leica Geosystems follows a rigorous assessment procedure, including the extensive testing of equipment by Ordnance Survey along with fact-finding visits to various production sites in Europe and the United States," said Vanessa Lawrence, Ordnance Survey's Director General and Chief Executive.

Hans Hess, CEO Leica Geosystems, said: "This collaboration confirms our ability to provide not just the best equipment, but also the ability to provide the best solutions. We have moved away from a purely customer-supplier relationship and now have a partnership."

Vanessa Lawrence complemented: "The agreement means we can improve efficiency and accuracy, increase the speed at which we can update our database, and produce enhanced data for all our customers. Our data is so vital to both the public and private sectors that a recent independent study calculated that around £100 billion worth of economic activity in Britain is dependent on it. It is essential that our information is of the highest quality and as a foundation for this we need to use the most accurate techniques available. GPS equipment and computerised mapping techniques allow us to do this."

Representatives of the international press, science, and Survey professionals discuss the future of GPS and GIS.

In order to measure the "London Eye" – the 130 metres high ferris wheel – OS-Surveyor Ian Baldwin from the Harlow Office, uses a Leica GPS500 with RTK-Technology with a Fujitsu pen computer.

Wind force as the future's pollution-free energy! Here, Tim Hall makes checks with a Leica GPS500 on Bears Down Wind Farm in Cornwall. The 16 wind turbines can generate enough energy to supply 7500 local homes.

Most modern national topographic database
All GPS information collected is added to the National Topographic Database (NTD). This is held on computer at Ordnance Survey's Southampton head office, featuring details as fine as pavements and the exact location of public telephone boxes. The result is a vast electronic map covering the whole of Britain, replacing around 230,000 of its most detailed maps. The whole project is establishing a new seamless information base and will offer definitive, consistent and maintained referencing of around 400 million man-made and natural landscape features in Britain. They include everything from forests, roads and rivers down to individual houses, garden plots, and even phone-cells. Data, Ordnance Survey already used by a wide range of public bodies and users in the private sector, from controlling the flow of urban traffic to managing property portfolios.

They know the British Isles in detail and keep the NTD map for their customers current around the clock with GPS: regionally responsible Chief Surveyors Steve Eyre, Ian Hughes and Bob Scott.

High productivity gains with Leica GPS
The system implemented is allowing all surveyors of Ordnance Survey to use GPS to update maps on the spot. The equipment delivered by Leica Geosystems proves to be highly productive. One person alone is able to measure all points and to check the data directly on the hand-held computer. Remote, inaccessible points close to the GPS are defined reflector-less with a DISTO™ or a Leica Reflectorless Total Station (TCR). "By using Leica Geosystems' GPS equipment we will be able to update our national digital topographic database more efficiently, more accurately and faster and will be in a position to offer our customers better products," said Vanessa Lawrence. The twenty-first century has just begun!

Finland and Ordnance Survey Ireland also define Leica GPS500 as "their" preferred systems.

Within the last few months, both Finnish and the Irish surveying and mapping authorities have made the decision in favour of Leica GPS500. In addition, OSi will manage its database with Leica Geosystems' GeoVault Data Manager. It provides an automated, cost-efficient and secure management and documentation system of digital image data and geospatial information.

Cyrax 2500 provides directly detailed pipe plan

With the help of the Cyrax™ 2500 laser scanner and Cyclone™ software, Chevron Corporation, one of the world's largest petroleum companies, was able to save considerable time and money in their recent GOMBU Eugene Island 252 Revamp Project.

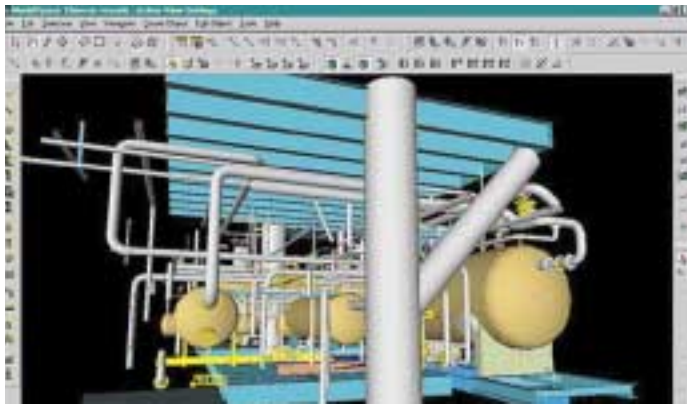
The upgrade involved the replacement of the process vessels on an offshore project in the Gulf of Mexico.

Cyrax combines a laser scanner with PC analysis and modelling software. In just a few minutes, the system was able to acquire and present, in three dimensions, the physical structures of the platform. Data was converted directly into a 3D AutoCAD model and an accurate CAD database and from this, mechanical drawings to support structural and mechanical engineering design were produced.

The project required a shut down in order to connect the associated piping and valve tie-ins to the process pipings. The Cyrax 3-dimensional data could be immediately incorporated into spool drawings, allowing more accurate piping connections and fewer field welds. The total shutdown was estimated to be 72 hours, but was finished in 40 hours, due largely to the highly accurate data provided by Cyrax. This time saving translated to an increased revenue of approximately $500,000.

In the next stage, the two new larger and higher capacity process vessels were installed while the platform was under normal operating conditions. The Cyrax data uncovered interferences and conflicts that would have been missed until the vessel's field installation, therefore saving field re-work time. All the piping connected right, the first time and there were no interferences or field errors.

Shrinkwrap from Cyrax Scan



Finished model is ready to be exported to AutoCAD or Microstation

Major Software Announcement Looks to Slash Office Costs & Make Topo Surveys Easier

Cyra has announced a major software upgrade plus a new software product for processing large point clouds directly within AutoCAD and MicroStation (and many applications that run on these platforms). Nine new data sheets describe these products and their advantages. View the datasheets in the products section of www.cyra.com.

Introducing Cyclone 3.1 & CloudWorx

The STAR organisation of Leica Geosystems – customer-orientated competence in six divisions

Surveying & Engineering

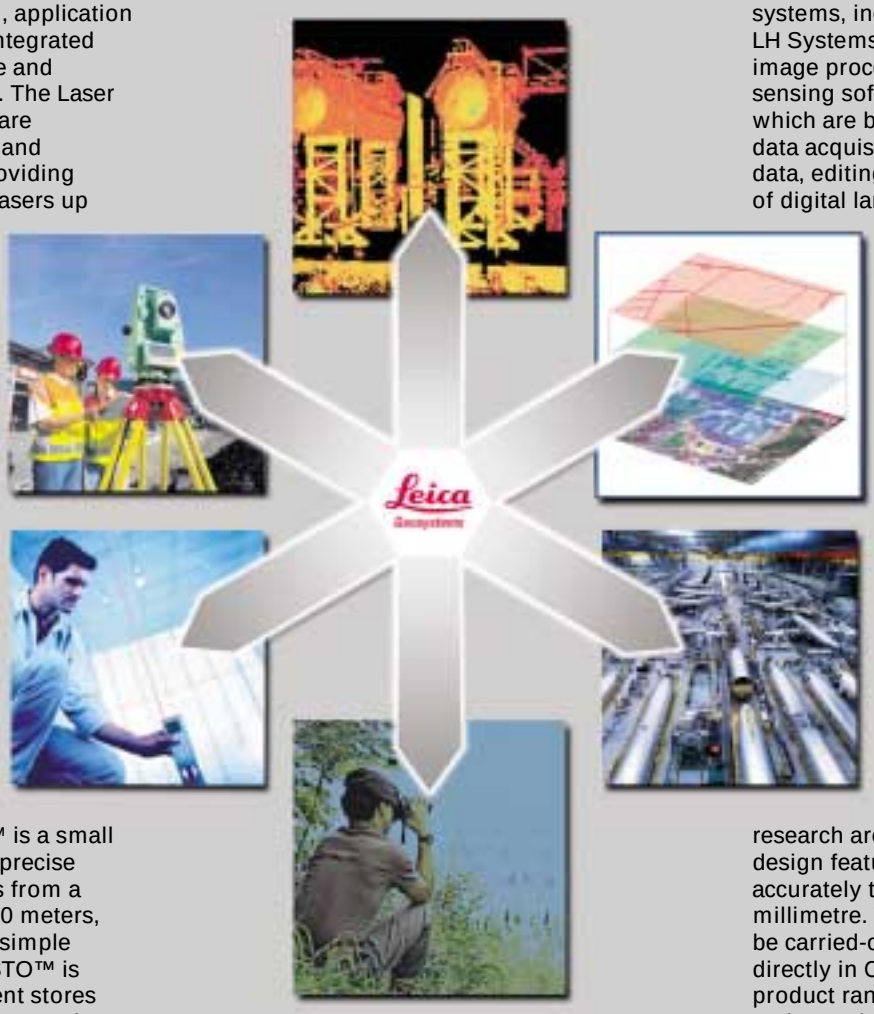
The Surveying and Engineering division is the largest of the new Leica Geosystems divisions, offering a variety of Terrestrial Positioning Systems (Theodolites, Surveying Total Stations, Electronic Distance Measurement, levelling instruments including numerous measurement accessories), which are complimentd by GPS systems for surveying with the different models of the Leica GPS500 series. In addition, application software is designed for integrated solutions for infrastructure and land-surveillance systems. The Laser Alignment laser products are designed for construction and building professionals, providing diverse types of building lasers up to machine control systems. The President of the Surveying and Engineering Division is Clement Woon, Heerbrugg (Switzerland).

New Business (Cyrax™)

This division focuses on newly emerging markets in the area of spatial information and 3D data. Top products include the laser scanner Cyrax 2500 and Cyclone, the 3D software of Cyra Technologies. The President of this Division is Erwin Frei, Oakland (USA).

GIS & Mapping

This Division concentrates on the rapidly-growing markets of geographical information systems (GIS) and cadastral solutions. Leica Geosystems can offer GPS/GIS data collection as well as the know-how and expertise from strategic LIS partnerships. The division can supply digital airborne data acquisition systems, including Lidar of LH Systems as well as the image processing and remote sensing software of ERDAS which are based on aerial data acquisition and satellite data, editing and visualisation of digital land models. Bob Morris, Atlanta (USA), leads this division.



Consumer Products (DISTO™)

This division focuses on customers in the building and construction industries, who want to use the DISTO™ measuring technology in their work. The DISTO™ is a small laser meter, which allows precise measurement of distances from a few millimetres to over 100 meters, in a few seconds with the simple touch of a button. The DISTO™ is available also in department stores and via specialised hardware outlets. The President of the Consumer Products Division is Klaus Brammertz, Heerbrugg (Switzerland).

Special Products

This division comprises defence technology and component manufacture. The Special Products segment, led by Linus Zoller, offers customers innovative solutions in observation, orientation and range-finding.

Industrial Measurement

The Industrial Measurement division enables metrology in the aircraft, vehicle and ship building industries and research areas to measure large design features and components accurately to one hundredth of a millimetre. This information can be carried-over and processed directly in CAD systems. Its product range includes Laser- and Laser/Radar trackers, digital industrial measurement systems and high precision total stations. In addition, comes a modern suite of software, which is compatible on an open platform with many CAD products. This division is led by Walter Mittelholzer, Unterentfelden (Switzerland).

Today, Leica Geosystems provides the largest spectrum of solutions for the capturing, visualisation and modelling of spatial data via the customer-orientated STAR organisation. Each of the six Divisions is oriented to the value chain of customers and their tasks to create and to provide fully integrated solutions.

The GIS partnerships of Leica Geosystems – Internet-capable cadastral solutions with high flexibility

Through active participation in AED Graphics AG, Leica Geosystems has expanded access to the rapidly-growing markets that create and administer cadastres via geographic information systems (GIS).

AED Graphics AG, Bonn is one of the first certified companies in Germany that is authorised to create national digital land register solutions. Emphasis is on the development of standard software solutions for real estate ownership, planning and surveying, environmental planning, topical cartography as well as for utilities.

The aim of the strategic alliance includes the further simplification and design of array data entry, creation of cadastral information as well as ensuring that all local cadastral solutions have flexibility. The combination of AED Graphics software and Leica Geosystems' modern survey systems already enables customers to undertake cadastral and GIS projects in an easy dialog field-office-field. The object is a rapid advancement into the next generation of the official German real estate property cadastral information systems (ALKIS*).

Within the area of geographic informational systems (GIS), the Swiss Company Geocom Informatik is working strategically with Leica Geosystems to create new constant field-office-field solutions for line network information (utilities), land registers, as well as GIS and surveying functions. These solutions have particular relevance to the Swiss market.

The company Geocom Informatik AG is the Swiss cadastral and GIS market expert with several years of experience and know-how in the structure, administration and the management of space-related data in accordance with Swiss standards. The Geocom partnership actively involves the development of new Leica Geosystems measurement and GIS solutions as well as new products for network information. The creation of a value chain of the new systems allows automated measurement in the field or from air, and covers all customer needs – from public authorities to the individual citizen. Markus Wuethrich, Manager of the Geocom Informatik AG, said: "Together it will be possible to break through past technological boundaries."

"I am convinced that we set new yardsticks that allow flexibility but at the same time constancy. Owing to our use of the most modern technologies, our customers will profit greatly and will be able to generate a considerable increase in value.

The modern software solutions of the Geocom Informatik enable land register and GIS creation as well as data exchange over the Internet.

LANTMÄTERIET

In 2001, Lantmäteriet, the National Land Survey of Sweden, signed an exclusive contract with Leica Geosystems to create the application software ArcCadastre.

ArcCadastre will offer new economic possibilities for the documentation and administration of real estate property and line networks.

Joakim Ollén, General Manager of Lantmaeteriet, said: "This partnership with Leica Goesystems is ideal. It brings together a combination of experiences – from component technology development to real estate register creation and land register responsibility. I am sure that other cadastral-responsible people in numerous other countries will profit from this partnership in the future."

In the last year, Leica Geosystems increased its shareholding in the Canadian software enterprise NovaLIS up to 42%. The aim of this collaboration is the creation of future-oriented land register and land information solutions (LIS) for the North American market. NovaLIS was created 1992 and partly-acquired in December 2001 with Halifax-based TerraSoft, who brings in computer-assisted mass data management technologies.

NovaLIS has just presented its Land development Office 8.1 – a perfectly integrated GIS solution. In the last few months, tasks have been to supply the GIS and management system for York County (South Carolina) and to the city administration of New Port Richey. In January, Molpus Timberlands management decided to acquire a combination of NovaLIS products to technically and commercially optimise the GIS administration and economic use of large forest stands.

The dynamics of the GIS markets and national land information systems standards find solu-tions in Leica Geosystems' partnership programs. Based on a long strategic partnership with the Environmental Systems Research Institute Inc. (ESRI), Leica Geosystems and its partners offer advanced solutions adapted to individual national standards and specific application requirements.

Reflectorless measurements with pinpoint accuracy... and up to 12 km using Leica Geosystems' phase shift measurement technology

Take reflectorless measurements up to 200 m with the X-Range total stations from the TPS1100 Professional Series. The visible coaxial laser beam, high accuracy and small footprint are the distinguishing features of this unique technology.

Reflectorless or with a reflector
In addition to the standard infrared EDM, the new X-Range total stations with their extended reflectorless range option are equipped with a reflectorless, coaxial, visible red laser EDM. The user can switch conveniently between the two methods.

The reflectorless distance measurement system can operate up to a distance of 200 m, depending on the reflectivity of the surface.

Narrow laser bundle
Reflectorless measurement is based on phase shift technology. Using this technique, an extremely narrow visible laser bundle is emitted, which precisely acquires the target and guarantees very accurate distance measurement. The technical advantages include the small laser footprint. At a range of 20 m the spot is roughly elliptical and only 0.7 x 1.4 cm. The small dot enables accurate distance measurements to corners and edges. There is no need to run a special program. Just point and measure – and it's done!

Visible spot
The red visible spot confirms the measuring position even under poor light conditions, e.g. inside buildings under construction or building interior surveys. Quick accurate measurements can be taken without having to look through the telescope. These advantages save you precious time and money.

Indicator light for reflectorless surveying
A yellow indicator light can be seen beside the telescope. When a reflectorless distance measurement is being taken, the indicator light remains illuminated until the measurement has been achieved.
The indicator light also shines when the visible beam is switched on so it can be used as a targeting aid or with prisms. It can also be used for distance measurement using prisms.

Distances up to 12 km
Using the X-Range Option with red laser distancer, it is possible to measure to targets over 7500 m away for single prisms or 12000 m for triple prisms. Of course you can also target reflector tapes.

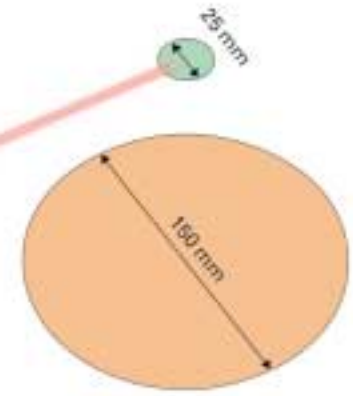
All the usual flexibility
When using TCRA instruments you can switch out of reflectorless measurement into the (ATR/LOCK) mode, which has automatic target recognition and tracking.
In this mode the instrument follows the prism automatically. There is also the lightweight wireless RCS1100 remote control unit with which you can carry out measurements just as easily as at the instrument itself.
And that's not all: for measurements with a prism in the infrared EDM mode, the instrument achieves an accuracy of 2 mm + 2 ppm over the whole measurement range of 0 to 3000 m.

Many advantages
The new X-Range option offers the surveying world a TPS1100 Professional Series total station, which, in addition to a longer range, will be welcomed for its proven simplicity of use, quick measurement times, great selection of applications, and its mobility.

Georg Lorse

Footprint of the reflectorless laser beam (X-Range)

At 20 m	0.7 x 1.4 cm
At 100 m	1.5 x 3.0 cm
At 200 m	3.0 x 6.0 cm



Laser bundles at 100 m distance

Green: Leica TPS X-Range
Orange: Typical measurement cone for a pulsed laser instrument

Unique advantages of Leica Geosystems' phase shift measurement

There are good reasons for Leica Geosystems to use the principle of phase shift in its current total stations for both reflectorless measurement and measurement with reflectors.

The laser bundle
is considerably smaller for phase shift instruments than for pulsed laser devices. This means the phase shift instrument is intrinsically more suitable for picking up discrete objects or details.

The accuracy
of phase shift technology is generally superior to that of the pulsed laser.

A visible beam
can be used for phase shift due to the wavelength. This can be useful for visible targeting.

Extremely long distances
can be achieved with infrared distance measurement to reflectors. It is possible to measure up to 12 km using a triple prism. This is something else that is beyond the scope of pulsed laser instruments. Leica Geosystems has matched the characteristic advantages of pulse laser instruments by optimising phase shift technology for a range of reflectorless surveying total stations.

TPS performance just keeps increasing thanks to Leica Geosystems' modular concept

Leica TPS700auto – now with ATR Automatic Target Recognition

ATR – Automatic Target Recognition – does away with manual fine sighting. Simply aim the telescope roughly at the target prism and press the button to start measurement. The instrument takes care of fine alignment and stores the measurement data all by itself. No active prisms are needed; existing prisms can be used. ATR is not only faster, it also delivers constant precision under all measurement conditions – even with failing light. Motorisation has other advantages, too: TCauto/TCRauto models bring pushbutton ease to changing orientation and positioning the instrument as required, e.g. for stakeout.

As well as a conventional infrared rangefinder, the TCR/TCRauto also incorporates a reflectorless rangefinder using a visible red laser. Thanks to the beam's minimal divergence (approx. 2cm/80m), the laser is ideal for precise measurements on very fine structures or elements. With the rapid coding feature, a single key-press initiates measurement and codes the measured point.

TPS700 Performance series total stations are available in three accuracy classes (2", 3", 5"), with an optional reflectorless measurement function (TCRauto). Accessories are fully compatible with the TPS100/300/ 1100 series, and the GPS500 system.

Leica total station models at a glance

TPS upgradeability keeps your instrument state-of-the-art
Most Leica Geosystems total stations are readily upgradeable for enhanced functionality, or to a higher-performance model. Your present-day investment in a total station is thus sure to meet future requirements.

Angle accuracy		10"	7"	5"	3"	2"	1,5"	1"	0,5"
TPS1000/2000 Precision	TCA							TCA1800	TCA2003
	TC							TC1800	TC2003
	TM				TM1100			TM1800	
	T				T1100			T1800	
TPS1100 Professional	TCRAplus X-Range			TCRA1105plus	TCRA1103plus	TCRA1102plus	TCRA1101plus		
	TCRAplus			TCRA1105plus	TCRA1103plus	TCRA1102plus	TCRA1101plus		
	TCAplus			TCA1105plus	TCA1103plus	TCA1102plus	TCA1101plus		
	TCRMplus X-Range			TCRM1105plus	TCRM1103plus	TCRM1102plus	TCRM1101plus		
	TCRMplus			TCRM1105plus	TCRM1103plus	TCRM1102plus	TCRM1101plus		
	TCR X-Range			TCR1105	TCR1103	TCR1102	TCR1101		
	TCR			TCR1105	TCR1103	TCR1102	TCR1101		
	TCMplus			TCM1105plus	TCM1103plus	TCM1102plus	TCM1101plus		
	TC			TC1105	TC1103	TC1102	TC1101		
TPS700 Performance	TCRauto			TCR705auto	TCR703auto	TCR702auto			
	TCR			TCR705	TCR703	TCR702			
	TCauto			TC705auto	TC703auto	TC702auto			
	TC			TC705	TC703	TC702			
TPS300 Basic	TCR		TCR307	TCR305	TCR303				
	TC		TC307	TC305	TC303				
TPS100	TCR	TCR110							
	TC	TC110							
	T	T110		T105					

Leica Instrument types:

T	Electr. theodolite
TM	Motorised electr. theodolite
TC	Totalstation
TCM	Motorised total station
Tcauto	Motorised total station with automatic fine sighting (ATR)
TCR	Reflectorless total station
TCRM	Motorised reflectorless total station
TCRauto	Reflectorless, motorised total station with automatic fine sighting (ATR)
TCA	Motorised total station with automatic fine sighting and tracking (ATR & LOCK)
TCRA	Reflectorless, motorised total station with automatic fine sighting and tracking (ATR & LOCK)

Leica TPS300 Basic with new software version 3.5

Version 3.5 brings further enhancements to TPS300 Basic series construction and civil engineering total stations, designed to ease work in the field.

Instruments that are currently in service can be upgraded. The latest software features a new Reference Line application for straightforward stakeout and checking of building lines and road sections, a radial method for tie distance, and the use of stored points in area calculations. Other enhancements include a target eccentricity function (length, width and/or height offset) and an extended codelist that can accommodate 200 codes.

TPS300 Basic series total stations are available in three accuracy classes (3", 5", 7"), with an optional reflectorless measurement function (TCR).

Leica Geosystems sets international innovations standards

Peter Frank, responsible for the Leica Geoystems Innovation Process, Eugen Voit, Chief Technology Officer, and Leica Geosystems' CEO Hans Hess, are proud of the TECTEM award for "successful practice".

The success of our economy and companies is based upon the ability to develop original ideas and to turn them quickly and efficiently into successful products. But why are some companies more successful than others in doing so? This question has been the topic of a benchmark study by the Benchmarking Center (TECTEM) at the University St. Gallen (Switzerland), who were investigating innovation controlling and management. Out of 150 companies invited to participate, half of them took part. Six companies from five countries, among them Leica Geosystems, Heerbrugg, were awarded a prize for the "Successful Practice" in Innovation Controlling.

The internationally formed group of members from Science and Industry was impressed by the Leica Innovation Process (LIP), with which a continuous stream of new products has been generated. This is a central source of success for the company, which today generates eighty percent of its turnover from surveying systems that have only come onto the market during the course of the last two years.
Leica Geosystems' CEO Hans Hess: "Together with my colleagues, I am very proud of this TECTEM award for successful practice. It shows that we are leading innovators not only within our industry and in Switzerland, but also compared to other worldwide leading enterprises in diverse fields."

Hans-Jürgen Euler, Ryan Keenan and Benedikt Zebhauser awarded in the US

The strong market position of Leica Geosystems within the area of GPS is continuously developing. For their presentation of the trail-blazing concept for the standardisation and improvement of data communication in GPS reference station networks, co-workers Hans-Jürgen Euler, Ryan Keenan and Benedikt Zebhauser were honoured at the ION GPS2001 conference in Utah, USA. The group co-wrote the paper "Study of a simplified approach to utilising information for Permanent Reference Station arrays" with Gerhard Wübbena from Geo++ GmbH, Germany.

Alain Würsch receives Nortel-Preis

Leica Geosystems' employee, Alain Würsch was distinguished with the Nortel Network Prize 2001 from the Swiss Society for Optics and Microscopy (SSOM) in 2001. Together with Marco Scussat and the laboratory of Leica Geosystems, he developed a procedure that makes it possible to coat and align miniaturised optic and optronic components to one thousandth of a millimetre accuracy. This procedure is highly suitable for industry mass productions and consequently Leica Geosystems and MTA Automation have registered a patent. Leica Geosystems has supported the TRIMO project for many years, and this project is a good example of the cooperation between university and industry in the discipline of optics and robotics. Products will soon be brought onto the market using this TRIMO procedure for minaturised surface-mounted optic and optronic components, e.g. for even more exact laser range finding. Complicated optics components can be smaller thereby than two millimetres.

Two honorary doctoral degrees for Marco Leupin

Independently, but practically at the same in Autumn 2001, the two Universities of "Yerevan State University" in Yerevan, Armenia, and the "Technical State University" in Tibilisi, Georgia, have awarded an honorary doctoral degree (Dr. h. c.) to Marco Leupin. Professor Marco Leupin acts as an advisor to Leica Geosystems for projects and business development. Both universities wanted to honour the professional contribution of Professor Leupin during his career as university professor, as Surveyor General of Switzerland and as CEO of private companies as well as for his dedication in both countries towards the economic development and promotion of geosciences.

Five thousand years in the 'field of vision'

Every summer for the last 15 years, archaeologists from the American University of Beirut Museum have been toiling away in the barren landscape of Tell Kazel, a site on the Syrian coast. Until this year, the job was pretty basic. Ancient walls were measured manually stone by stone and architects had to climb up and down pits three meters deep to record the ancient architecture, pulling the tape tight against the wind. Not only was the method very slow, it was only as accurate as the human hand and eye: until the arrival of the Leica Geosystems' Total Station TCR703.

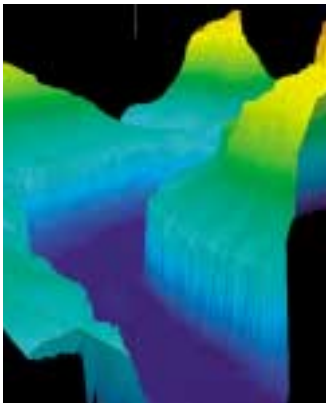
Usually found on major construction sites and modern projects, it revolutionised work at the archaeological site of Tell Kayel. Manned by a single architect at ground level, the instrument measured and recorded the ancient walls and structures in seconds. Results were then immediately slipped into the site's computer for exact and speedy mapping.

The American University of Beirut archaeological team is delighted by the new technology. "It's like going from the second Millennium BC to the third Millennium AD in a single leap," said the team's leader Dr Leila Badre.

Dr Badre thanked Mr Ghassan Ghattas, Head of Survey Department of Alpha-Tech, Beirut, for his support with the use of this modern technology.

The name of the millennia-old site being recorded by the Leica TCR703 is probably ancient Simyra, an Amorite and Phoenician city. At its height in the 14th Century BC, Simyra is referred to in the Bible as well as in the Tell Amarna Letters of Egypt.

Leica ALS40 and ADS40 systems dominate LIDAR



Grand Canyon, USA, captured by Leica ALS40 (right).

Leica Geosystems' impressive range of airborne data acquisition solutions consists of the industry-leading systems from the Leica Geosystems subsidiary, LH Systems. Integrated into the Leica Geosystems GIS & Mapping Division along with other LH Systems' products for the acquisition, processing and maintenance of imagery and geospatial data, are the

cutting-edge ALS40 airborne laser scanner and ADS40 airborne digital sensor.

The ALS40 LIDAR system is the next generation of the high-performance AeroScan system, formerly offered by Azimuth Corporation. The business of Azimuth was acquired by Leica Geosystems in 2001. Enhanced as the ALS40, this robust LIDAR system is an excellent addition to the Leica family of airborne sensors.

"There is a technical overlap between airborne sensors and LIDAR systems, both of which use flight planning, GPS, inertial, hardware, software and storage systems," said Bob Morris, President, Leica Geosystems GIS & Mapping Division. "Our expertise in these areas, familiarity with the challenges of installing and operating airborne sensors and the potential of our existing digital photogrammetry products to strengthen the ground processing phase of LIDAR work allow us to offer exceedingly attractive LIDAR and support solutions to our customers."

The LIDAR – LIght Detection And Ranging – scanning system measures the topography of the earth's surface. It works by emitting a series of rapid laser pulses towards the ground as the aircraft flies across the project area. These pulses are reflected by the ground or objects that they hit. An elapsed time is recorded between the emitted and returning signals, enabling a slant distance to be computed. At the same time the position and attitude of the aircraft are measured using airborne GPS and inertial measurement unit (IMU) sub-systems, and a GPS ground reference station is also deployed. This data is then combined with the slant distance, together with information on atmospheric conditions, hardware characteristics and other relevant parameters, to generate an XYZ coordinate triplet of a point on the ground. As the mission progresses, millions of such points are captured, providing a dense digital terrain model (DTM).

The ALS40 Airborne Laser Scanner is a LIDAR system based on a diode-pumped solid-state laser. It is capable of operating at altitudes from 500 to 6100 metres and can record up to five return pulses with a maximum pulse rate of 25 kHz. The data can be used to develop

Leica GS5+ plug and play

A novel GPS concept from Leica Geosystems for GIS and cartography

GS5+ incorporates the latest GPS technology from Leica and IBM, to address the special needs of GIS applications even better than before. The result: a very low-cost, compact, lightweight GPS solution for GIS work.

The Leica GS5+ offers very good reception characteristics, making it an economical data capture tool. The GS5+ sends WGS84 coordinates to NMEA-capable GIS acquisition software like FieldLink (Leica) or ArcPad (ESRI). The system ships pre-configured, only requiring connection with an appropriate PC or PDA. The complete GS5+ package includes a backpack, rechargeable batteries, and all interconnecting cables. The GPS antenna is fitted with a beacon correction receiver. Even without DGPS correction, the GS5 achieves positional accuracy of 3 - 5 m.

Michael Mudra

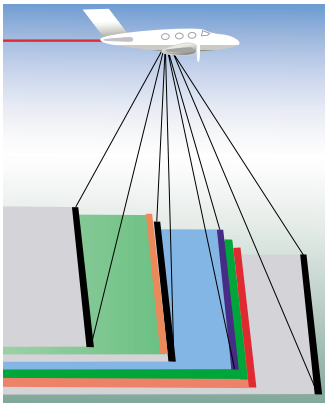
and digital airborne data acquisition

digital terrain models, contours, intensity images and various other representations of elevation.

The Leica ALS40 system will be supplied on its own or in joint configurations with the RC30 aerial film camera or ADS40 Airborne Digital Sensor.

Introduced last year, the ADS40 is the first digital aerial photography system, capable of delivering photogrammetric accuracy and coverage as well as multispectral data. Users can work digitally from flight planning through image acquisition, and return from the flight mission with digital data ready to enter the ground processing and archiving stages of the day's workflow. During flight, data is stored on a mass memory system, which is then removed from the aircraft's computer and connected to a PC workstation for ground processing.

The ADS40 is very different from the familiar Leica RC30. Not only is the imaging principle digital rather than analogue, but the fundamental construction is conceptually different from that behind the frame film camera. Three pairs of panchromatic CCD lines capturing panchromatic information in views forward, nadir and backward from the aircraft for photogrammetric restitution are supplemented by four multispectral lines, resulting in the simultaneous capture of seven bands of information. The raw ADS40 data is rectified using position and attitude data supplied by a Position and Orientation System from Applanix Corporation.



Parma, Italy, captured in seve bands of information with Leica ADS40 (above).

The ALS40 and ADS40 systems are supported and distributed through Leica Geosystems' GIS & Mapping Divisions' global network of sales offices, subsidiaries and exclusive third party distributors. "We are excited about the benefits of these advanced and flexible airborne data acquisition systems for our customers," commented Morris. "Our goal is to expand our rich selection of quality GIS & Mapping solutions to keep up with the changing and diverse needs of the market."

For more information about Leica Geosystems GIS & Mapping Division or its products and services, contact: +1 404 248 9000, or visit www.gis.leica-geosystems.com. ***Bt***

Online connectivity between laser rangefinders and Leica GPS receivers

Laser Locator

How can coordinates at inaccessible points be recorded using GPS survey techniques? All Leica Geosystems GPS sensors (System 500) support online connections to an external laser rangefinder. Both the Laser Locator and LaserAce® 300 can transmit distance, horizontal (Hz) and vertical (V) angles to the GPS receiver, where they are converted to geocoded coordinates. This makes it unnecessary to visit every measurement point, resulting in considerable time-savings using the technique. The choice of laser rangefinder depends on the measurement distance and precision required. A user-definable ASCII input supports online connectivity not just with rangefinders, but indeed any external device (environmental sensors, digital cameras, sonic depth finders, etc.).

Michael Mudra

Leica DISTO:		
Distance	Measuring range:	0,3-100 m
	Precision:	±3 mm
LaserAce® 300:		
D, Hz, V	Measuring range:	bis 300 m
	Precision:	±10 cm
Leica Laser Locator:		
D, Hz, V	Measuring range:	10-1500 m
	Precision:	±1 m

North Sydney sets the world stage for 3-D urban modelling

A digital urban model created for North Sydney Council has projected the future of urban management into reality. Leica Geosystems, with its combined strengths in GIS systems development, offers such solutions supporting state-of-the-art city development. Their comprehensive program of terrestrial and global positioning systems, together with the advantages of the photogrammetric aerial camera and software of LH Systems, has made it possible for Australian company, PSN Survey, to capture 1.2 million points and to create from this data a 3D model of North Sydney.

Peter Noble, Partner and Chief Surveyor, PSN Survey: "In essence, North Sydney Council have a dynamic, online and immediately accessible computer model of their entire region with a complete three dimensional model and detailed photo mapping of every single physical structure in their area."

What if a city developer wanted to build a 50-storey skyscraper in the middle of a Central Business District? In the past this proposal would have been a painful undertaking – plans would need to be drawn manually, shadow and wind tunnel analysis calculated and large textual reports produced for administrators to consider and assess.

Luckily, the future of urban planning is upon us. 3-D computer models of entire city areas with details down to the cracks in the pavements are now a reality. Town planners, architects, engineers, and designers now have a wealth of information at their fingertips – able to visualise conceptual and engineering projects and locate physical structures throughout the entire municipality down to a couple of centimetres.

North Sydney Council's newly-completed digital Urban Information Model, developed by Sydney-based PSN Survey, has defined a new benchmark in local government development control and asset management it is one of the largest accurate and detailed information databases of its type in the world.

The model, which involved accuracies between 1:250 and 1:500, was honoured at a recent international conference, when it was selected from entries from forty countries to be awarded for its engineering and technological excellence.

PSN exclusively employed Leica Geosystems' equipment for a combination of detailed ground survey techniques, aerial survey, and photogrammetry. Analysis and processing of photogrammetric work

High resolution ortho-photographs show every detail of the area.

was carried out using LH Systems' SOCET SET™ digital photogrammetry software.

One of the most detailed models in the world

The Urban Information Model provides North Sydney Council with a complete three-dimensional model and data link of every physical structure including buildings, complex roof structures, roads, sign posts, parking bays and kerb crossings.

> *"Customers are always into seeing a real picture rather than lines."*
> *Stephen Gaynor*

More than 20,000 buildings made up of an array of contemporary high rise office blocks, residential dwellings and historic terrace villages have been measured, 100 kilometres of roads have been accurately mapped and every utility located to within two or three centimetres over the entire municipality. Every manhole, gas valve, telecom pit and hydrant has been precisely mapped and linked to North Sydney Councils Geographic Information System and land visualisation systems supported by high resolution photography.

Several cities around the world are now developing advanced models of their cities, but North Sydney's model is so detailed and accurate that even cracks in the pavement have been measured and pram crossings can be modelled and visualised in three-dimensions to better than a few centimetres.

New model allows for detailed accuracy checking

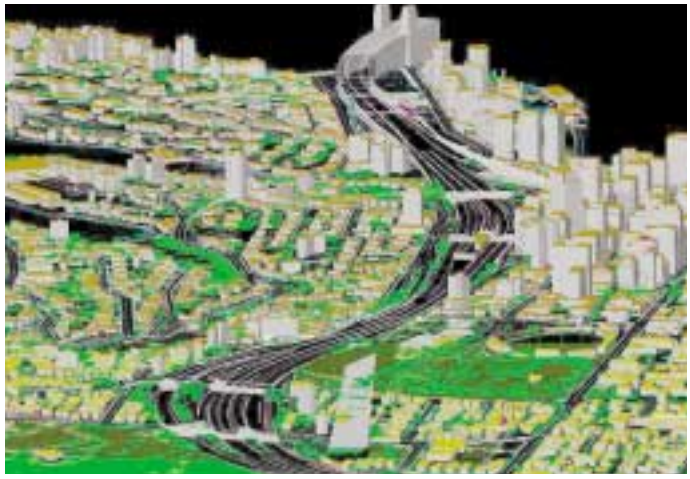
Until now North Sydney Council had been reliant upon a series of hard copy plans to manage their spatially-based management and information systems. "We decided that the Council needed a detailed and accurate large-scale database and three-dimensional model defining the topography, buildings and utilities," Mayor of North Sydney Council, Genia McCaffery said. "Prior to this, the systems we used did not allow us to check for accuracy."

This spatial database required transfer into the Council's existing Geographic Information System (GIS) and modelling systems with full verification of all layer components to enable access and three-dimensional visualisation throughout the modelled city and suburbs.

PSN has been able to provide a model which not only defines the physical structure to great accuracy but also locates all the utilities, road structures and provides asset maintenance monitors such as pavement deterioration and vegetation growth.

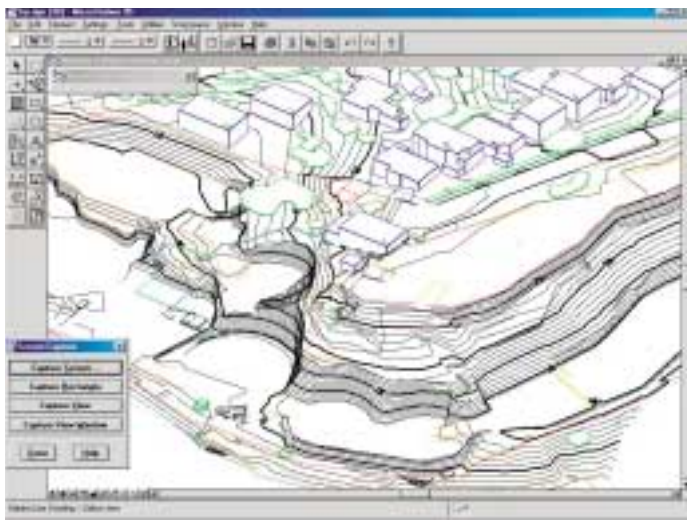
High accuracy terrain model and contour formation were carried out in conjunction with equally high accuracy orthophoto production to support the Council's GIS. Whilst normal orthophotos are corrected for terrain, plane and camera parameters, the entire area was corrected for building lean of over twenty thousand buildings as well as over 100 kilometres of roads and 250 kilometres of pathways.

"In essence, North Sydney Council has a dynamic,



North Sydney is the first big city to be documented in a GIS is such detail.

The height profile of the whole of North Sydney has been defined with equipment from Leica Geosystems.



The North Sydney GIS includes the following survey elements

2nd order control – traverse and GPS
1st order control – GPS
Detailed ground survey
Metrology
Digital photogrammetry
Topographic modelling
Control Adjustment
Digital Cadastre adjustment
Photographic mosaicing
Orthorectification (including building lean)
GIS creation
GIS polygon verification
Project design and implementation
Digital information management
Engineering analysis
Regional slope analysis
Solar analysis – full Keplerian mathematical analysis

Genia McCaffery, North Sydney Mayor: "We decided that the Council needed a detailed and accurate large-scale database and three-dimensional model defining the topography, buildings and utilities. Prior to this, the systems we used did not allow us to check for accuracy."

Stephen Fisher, Information Services Manager North Sydney Council: "This is going to give everybody the most accurate data available."

online and immediately accessible computer model of their entire region with a complete three dimensional model and detailed photo mapping of every single physical structure in their area," Peter Noble, Chief Surveyor of PSN said.
"Council staff can manage, view, take cross sections of, or visualise all of their roads, sign posts, parking bays, drainage, trees, assets and facilities within a matter of minutes without going out the door."

Wide-ranging benefits to all involved

Direct benefits of the model are diverse. The Council can now undertake very detailed asset management, the time of the development application process is greatly reduced, and the conceptual and engineering design considerations can be rapidly resolved. The effects of developments as major as under city tunnels or as localised as awnings and sign posting can be analysed accurately and immediately. Environmental, shadow, aesthetics or engineering considerations via computer or photography and complex three-dimensional image draping over the buildings is also possible.

"This is going to give everybody the most accurate data available – something the Council hasn't had before," Stephen Fisher, Information Systems Manager of North Sydney Council said. "The internal staff require this product as part of their business. It will reduce manual methods, reduce errors and provide the whole solution in one place, in a complete corporate database."

Several projects are already underway. Council assets are being accurately registered, the effect of individual trees adjoining footpaths is being investigated and a structure is in place for a full drainage analysis using high accuracy contours. 'What if' scenarios for development, road realignment and shadow effects can be reliably evaluated for shadow or view corridors as well as visual amenity and context in a tenth of the time normally required.

Whilst in-house benefits to Council are evident, a wealth of information is also available to residents and potential developers who can seek access to the information for their development proposals regarding utilities, adjoining property information, large scale photography or survey information. This has resulted in a dramatically improved customer relationship due to the ability to communicate with customers to evaluate proposals, resolve conflicts and discuss broader planning issues using either models or photographs.

> *"That's the beauty about the model – it can always be updated."*
> *Joshua Crowley*

Marc Forestieri, Managing Director of Architects' Quantum Leap, views the Urban Information Model as a huge benefit to his work. "This is a great management tool. We can tie our demographic information with the model, and present our clients with graphic information about the terrain and the buildings that would have normally been presented in a report format," he said.
"This is the key of what we want to do – putting this kind of information into the hands of people who need to make decisions, people

who often aren't mapping or database experts."

Technologies from entire surveying spectrum

The North Sydney Project took eighteen months to complete and employed a broad array of measurement, computing and presentation technologies spanning the entire surveying spectrum. The project relied upon three significant stages: data collection, model and map formation and image visualisation. All three stages relied almost exclusively upon Leica state-of-the-art surveying, measurement, photogrammetric technology, and software and data transfer to analyse services.
The data collection phase encompassed control measurement using electronic theodolites, first- and second-order GPS positioning and adjustments. Several hundred second-order control stations were placed through the area tied into the State network for ground and air control and over a million points were measured to structure the model. Continual development and implementation of methodologies for high-speed data collection by ground and air was necessary with careful and consistent monitoring of the individual positional accuracys.

Due to the diversity of features collected and measurement systems used, over fifteen major software packages were extensively required for development of the computer model. Once completed the models required verification and transferral to North Sydney Council's software. To satisfy interlinking of the software, it was often necessary to develop proprietary software in-house as a means of smoothing the transitions. Information was structured to tie in directly with Council's existing GenaMap and MapInfo (with full polygon verification), and layers were established for their future three-dimensional modelling software.

Leica Geosystems' equipment is stable, predictable and reliable

"PSN has always found Leica equipment to be stable, predictable and reliable," Peter Noble said. "It provided an ease of use and a continuous line of technical support and technical credibility that was fundamental

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Stephen Gaynor, from LH Systems and Joshua Crowley from PSN Survey view stereo images on the screen. The analysis and processing of photogrammetric work carried out using LH Systems' SOCET SET digital photogrammetry software.

Marc Forestieri, Managing Director of Architects' Quantum Leap: "This is the key of what we want to do – putting this kind of information into the hands of people who need to make decisions, people who often aren't mapping or database experts."

to the integrity of the Urban Information Model."

"What made the collection of the data so effective was that we could go from the camera system and the scanning to the film measurements and the industrial measurements, link them all together and have a continuous level of accuracy right throughout the model. In fact we are able to confidently report that there was not a single error found in the verification process of the Urban Information Model."

Up-to-date data is critical, and as such a rigorous maintenance program is being developed to support the initial information. "As a dynamic model, the Urban Information Model is always going to require updating and maintenance," Peter Noble said. "This can be done using a variety of methods – Leica has a facility within the SOCET SET™ system to provide regional updating and measurement of change. Ground survey, aerial survey and industrial measurement techniques will still be used to not only maintain the level of integrity that is placed in the model right now, but also to extend that level of information."

Innovation is the key

As technology improves, the model will also be developed for rapid photographic visualisation and more detailed analysis programs such as vegetation and environmental alteration.

Whilst the project was initially seen as a traditional aerial survey project, it was PSN's innovative approach to North Sydney Council's requirements that won them the contract. "PSN actually won the project through tender by virtue of introducing

> *"PSN has always found Leica equipment to be stable, predictable and reliable."*
>
> *Peter Noble*

what is called a new economy technology," Peter Noble said. "Traditionally, photogrammetric surveys have been carried out using aerial photogrammetric systems only – PSN offered a complete solution whereby all the information traditionally covered by trees and building shadow were also included in the project."

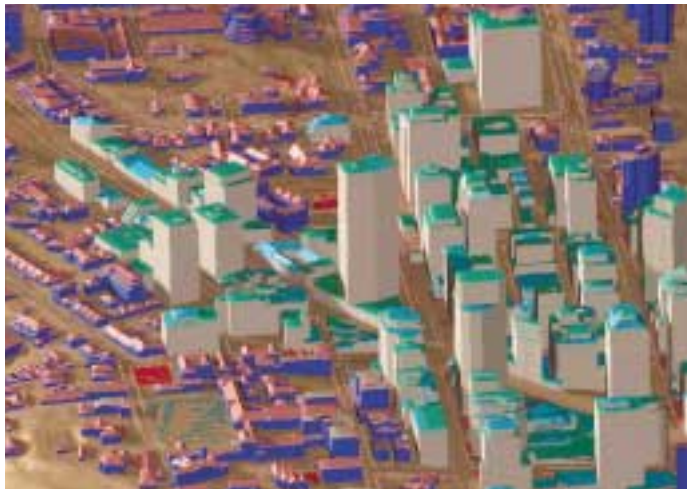
"The main challenge of the North Sydney Project was that it hadn't been done before. No one has collected information to the level of

detail that we have and many new technologies were employed in the development of the project," said Stephen Fisher.

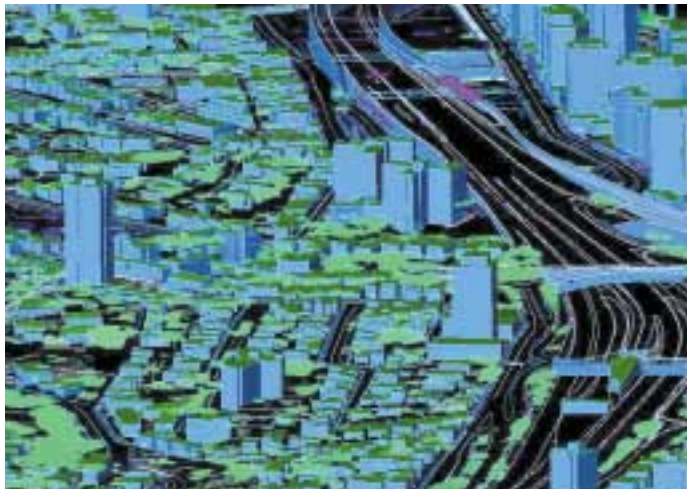
North Sydney's management area comprises several major foreshore parklands and heritage listed parks and significant structures. Minimal environmental impact occurred during the project, in fact most people were unaware that work had been undertaken. Actual effect was limited to establishment of new and more precise control marks for future surveys.

As a result of the project, North Sydney Council has been projected to the forefront of modern local government management. The project has been on exhibition at international exhibitions including the US Surveying and Remote Sensing Congress and the Bentley User Conference, and received international focus when the digital photography was displayed alongside NASA projects.

"The application of the Urban Information Model of North Sydney is repeatable around the entire globe," Peter Noble said. "Any city that has a sizeable population, that has physical structures, requires a detailed understanding of its assets and its elements within for effective management."
With the new capacity of Leica Geosystems, this task has become easier. PSN has done an excellent job demonstrating the capabilities of modern GIS data collection to every user.
A video of this project is available from Leica Geosystems representatives upon request to show how the future can be transformed into reality today. ***Bt***



North Sydney is the first big city to be documented in a GIS is such detail, allowing also shadow analysis.



Below: Survey technology has recently undertaken quantum leaps. Cyrax is able to measure complex structures in very little time as a test on the Sydney Harbour Bridge shows.
The system delivers accurate, "as built" 3D models to scale that can be viewed from any perspective.

Quick resolution of ambiguities required!

RTK positioning of ships using Leica GPS500

Above: Bridge and lock buildings caused GPS shadows. However, this did not prove a hindrance to the Leica GPS500. Below: Reference station and computer base. Right: Even with all the various ships and different mountings involved, it took less than 5 minutes to fit the two Leica GPS sensors and radio transmission equipment to the bow and stern.

Could the turbines in a new hydro-electricity generating station cause ships to drift within their shipping lanes? Following the construction of a new hydro-electricity generating station on the bend in the River Danube at the lower Bavarian town of Bad Abbach (Germany), it was feared that the operating turbines might have just such an effect. The turbine inlet zone opens out directly into the shipping lane just before a lock, which requires ships to pass this position only at reduced speed. Model tests carried out in advance of the construction did not detect any effect. It was essential that the results of the model tests were verified in practice by measuring the courses of a representative sample of passing ships. Therefore, the Geodetic Institute at the Technical University of Munich was commissioned to determine and analyse the tracks of the ships in position and height to an accuracy of ±5 cm in real time.

Working in real time, mobile, flexible and reliable

The demands on the measurement system were challenging. In order to keep the number of monitored ship passages as few as possible, and hence minimise the associated time and costs, the system was required to be able to produce initial analyses from the real time measurements immediately on site. Furthermore, the installed system had to be unaffected by the weather and able to determine the position of the bow and the stern simultaneously at a frequency of 1 Hz. As the monitoring was to be carried out on ordinary ships belonging to any Danube ship company, it was necessary to have sensors that would be mobile, and above all, flexible and quick to attach. The length of the test course was approximately 800 m, with good visibility and free of shadows – that is, except for the lock buildings at the start and a bridge at the end. In spite of these GPS shadows would it still be possible to use real time kinematic differential GPS here?

It had to be shown in advance that re-initialisation of the ambiguities in the on-the-fly process due to the loss of signal when ships passed under the bridge would only take a

GPS 530 at full speed

GPS rover at the stern

Mobile backpack solution

maximum of one minute. Any longer and it might not be possible to determine any drift accurately because the speed of the ship would have taken it too far into the test course. One test with the Leica GPS System 530 soon cleared things up: both rovers were mounted on the roof of a VW bus and several journeys were made along an industrial road beside the Danube at simulated ship's speed. At high and low speeds and with different satellite constellations, the ambiguities at both frequencies were able to be resolved within the specified time period.

A measurement concept using Leica components
During Summer 2000, a total of three SR 530 GPS receivers were used for the monitored journeys. The reference station was in the middle of the test course on an embankment over a shadow-free hectometre stone of known coordinates. The two rovers were each used with a backpack system with a plumbing pole and an AT 502 GPS antenna as well as a Leica TCPS26 radio data modem. The modem transmited the determined 3-D positions to a base station on the bank in the test bus, which housed a computer. The received data in NMEA format was recorded on a laptop, saved and then analysed immediately after the ship had passed with the Geodetic Institute's shiPos software and LISCAD Plus from Leica Geosystems.

GPS surveying on board ...
The river navigation authority's officer informed the captains of the passing freighters about the monitoring exercise over the radio just before they reached the test course and asked them for permission to attach the GPS rover antennas. As boarding the ships was only possible whilst they were in the locks at Kehlheim and Bad Abbach and any disruption to shipping movements on the river was to be avoided, in most cases the time available for attaching the GPS sensors was only 5 minutes. The GPS plumbing poles were attached in suitable positions at the bow and stern with the help of cable ties and referenced to the ship's side with a measuring tape. After the receiver was switched on, the ambiguities resolved and a test of the transmission back to the computer, the measurement of the monitored journey could begin. A total of six monitored journeys were undertaken per day. The resolution of ambiguities after the bridge was generally completed within 45 seconds and always provided reliable results.

Quick results!
The NMEA data records received on the bank were analysed immediately after each monitored journey. In addition to the height and speed plots, the main interest was the course of the ship. The trajectory was superimposed on the digital navigation charts and the plan of the power station by the LISCAD Plus graphical software. This plot could be manipulated to provide the required information and printed in colour to any scale – all on site.

Our measurement concept proved itself successful. In spite of the shadows, the GPS-System 500 from Leica Geosystems worked very reliably and provided the required accuracy and measurement frequency. The data radio transmission solution was also impressive. None of the monitored journeys was subject to an equipment failure. A big advantage was the quasi-real time analysis. The results were available on site a very short time after every monitored journey. This meant that the number of monitored journeys could be kept to a minimum.

Jens Czaja

GPS rover with TCPS26 modem

GPS rover at the bow

Leica GPS Construction machinery guidance system for the Airbus-Project

The production of the huge Airbus 380 in Hamburg requires a host of different construction projects at Mühlenberger Loch.

One of the construction firms, Josef Möbius Baugesellschaft mbH, opted to use the Leica GPS System 530 for the control of construction plant and staking out on the featureless 150 hectare site. A first order of 39 GPS sensors are now to be used at the Elbe estuary site. Considerably more accuracy and laser control will be in operation later in the fabrication shops. Control of tools, components and assembly work on the new wide-bodied jet will be carried out to submillimetre accuracy throughout the whole production process using Leica LTD500 laser trackers.

Below: The gigantic construction site at Mühlenberger Loch, Hamburg. Construction machinery guided by Leica GPS530 systems grade the fill to the profiles shown in the drawings and simplify the construction of the infrastructure works.

Final steps to finish for the largest “Emmentaler” Tunnel

In the lower Emmental, this 1.6 kilometre-long tunnel is being built below the River Emme. It is part of the Bahn2000 new construction section that will allow travel from Bern to Zurich. Using automated steering with a 3D-Machine Guidance System of Leica Geosystems, shoulders have now been laid in the biggest “Emmentaler Hole”.

The Swiss countryside is riddled with newly-created traffic routes. They break through not only the massive alpine mountains like the Gotthard, but also travel under riverbeds, such as the River Emme in central Switzerland. At the end of 2001, a new stage of the Bahn2000 project was completed – the “Emmen-tunnel” break-through – advancing further with the building of the “Matt-stetten-Rothrist” section, using the newest techno-logy to build the concrete side flanks. This tunnel is one of nine on the 41.5 kilo-metre stretch.

The last two years has seen the creation of 1.6 kilo-metres of tunnelling under the river, followed by the track section in December 2001. The shoulders have been built in concrete, using new technology with milli-metre-exact precision to create a perfect three-dimen-sional profile.

A world first in tunnel construction: shoulders with three-dimensional controlled slipformer

This is the first project in the world, where a tunnel has been concreted with the complex shoulders 3D-controlled sliding form. The concrete slipformer, owned by the building company Walo Bertschinger, auto-matically followed milli-metre-exact data calculated by Project Engineers Schaellibaum using the Leica Geosystems’ 3D-Machine Guidance Systems in a closed work-process. The finished concrete was supplied to the front of the slipformer from trucks to allow for exactly the correct dimension and position for the shoulders to be layed.

25% time savings

Within the specially-formed concreted shoulders, numerous wirings for com-munication and pipes for supply and disposal are to be integrated. This tunnel will connect in 2004 the Swiss capital Bern and the economic metropolis of Zurich in less than one hour train journey. The support of the unique construction of the track and tunnel, will allow the train to effortlessly glide through the country-side, even at 200 kilometres per hour. “Apart from the high precision, a consider-able time saving of 25 per cent is also achieved using this laser-steered slip-forming machine – comple-tely without time-consuming mark posts and obstructing strings!” said Walo Bertschinger construction specialist Heinrich Läuppi.

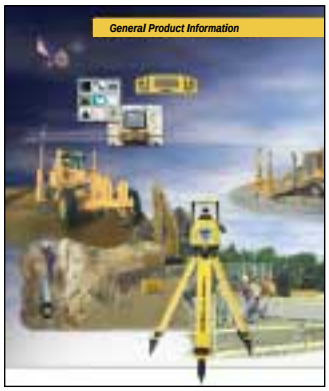
No mobile phone signal dead spots thanks to ERDAS remote sensing and image processing software

Geodata, and in particular remote sensing, play a significant role in the accurate positioning of antenna locations and the modelling of signal reception in mobile phone service planning. Using practically all the geodata available for Switzerland, MFB-Geo-Consulting on behalf of Micatel worked out the principles for the positioning of the antenna locations and modelled the signal reception. The work was carried out with Leica-Geosystems' Erdas image processing software. Erdas™ is the world's leading product in the field of digital image processing and has modules for processing digital raster data (especially satellite data) into 3-D visualisations (3D-GIS), for digital photogrammetry and stereoscopy.

Digital satellite data from SPOT and Landsat-TM was used as the basis for this work. The satellite data was geo- and ortho-rectified using Erdas-Imagine and took into account the DHM25 digital terrain model from the Swiss topography authority. In addition, the panchromatic data from SPOT and the multi-spectral data from Landsat-TM were brought together using image processing techniques (RGB/HIS transformation) to form a 10 metre grid data set. Finally a land use map was created out of the satellite data. Statistical classification processes and automatic pattern recognition were used for extracting the required information. In addition, the information from the pixel maps, the Vector25 national topography data records and the Swiss national statistical office's Geostat records was processed. The land use classifications are user-specific and are intended to achieve improved modelling of signal reception. Take the classification "Woodland" as an example: Woodland absorbs a great deal of energy from the antenna transmissions, which has a detrimental effect on reception.

It was possible to visualise the data with Erdas-VGIS (3D-GIS) and thus successfully optimise antenna positioning. Erdas proved to be an efficient, powerful and user-friendly tool for processing the large quantity of data (approx. 600 Gbytes), for importing and converting data from various sources, and its visualisation. In future, this system is also to be used in micro-cell planning with high resolution satellite data (e.g. from Ikonos and QuickBird at grid sizes of 1 m and 60 cm respectively). This data is obtainable with stereoscopic overlapping and allows 3-D urban models to be generated. ***Michael Baumgartner***

Above: Visualisation of satellite data and DHM25. Centre: Visualisation of land use, satellite data and DHM25. Below: Visualisation of antenna location and effective range, land use, satellite data and DHM25.



Laser Alignment accelerates construction

With the acquisition of Laser Alignment Inc., Grand Rapids/Michigan, Leica Geosystems extended its competence in the accurate 3-D control of machines on construction sites, in mines and agriculture. Laser Alignment is one of the original and leading manufacturers of red and green construction lasers for general construction, measurement and positioning in structural and civil engineering, and is one of the pioneering companies in this area. The extensive range of Laser Alignment laser based systems offers a variety of positioning solutions for heighting, alignment and machine control.

Sensational decathlon world rec

Roman Sebrle was the first person to exceed the magical 9000 points mark. The program for the determination of the height of the pole vault crossbar is also stored in the Leica total station.

Below: The high jump and discus had already been measured using Leica total stations in the previous year at Götzis using reflectorless techniques.

At the world-class international decathlon meeting in Götzis (Austria), the organisers took distance measurements with Leica TCRA1103plus total stations. For the first time in this event a competitor exceeded the magical 9000 point mark. Czech athlete Roman Sebrle scored 9026 points. The previous world record was held by Tomas Dvorak with 8994 points, who, like the whole of the world's elite and Erki Nool, the gold medal winner in Sydney, was there at the start. This first-time breaking of the 9000 point barrier will go into sporting history, together with the Leica distance measurement instruments.

Werner Christes from Leica Geosystems Heerbrugg assisted the Feldkirch geomatics engineer Günter Lackner in taking the measurements. He worked in his own office (and still does) with another manufacturer's instruments. However, he has now made an offer to buy one following his positive experiences with a TCRA1103plus whilst measuring the world record performances at the Götzis stadium. According to surveying engineer Lackner: "The 200 metres reflectorless range of the Leica TCRA1103plus is most persuasive! And here on site, the speed of the measurements is impressive. What gives me further confidence

The 9026 point decathlon record at Götzis

	New world record	*Previous world record*
World record holder	**Roman Sebrle**	Tomas Dvorak
Venue	**26/27.5.01 Götzis**	03/04.07.99 Prague
Points score	**9026**	8994
Discipline:		
100 metres:	**10.64 seconds**	10.54 seconds
Long jump:	**8.11 metres***	7.90 metres
Shot put:	**15.33 metres***	16.78 metres
High jump:	**2.12 metres***	2.04 metres
400 metres:	**47.79 seconds**	48.08 seconds
110 metres hurdles:	**13.92 seconds**	13.73 seconds
Discus:	**47.92 metres***	48.33 metres
Pole vault:	**4.80 metres***	4.90 metres
Javelin:	**70.16 metres***	72.32 metres
1500 metres:	**4:21:98 minutes**	4:37:20 minutes

** Measured using Leica TCRA1103plus*

Beijing Universiade uses Leica TCR700 measurements

The largest international student games, the "Universiade", took place in August 2001 in Beijing. Leica systems were used for recording all distance measurements. The measurements were taken with five instruments from the 700 Series total stations and a TC305. Already in the previous year, those working in the centre of the arena at the national championships in Shanghai had learned to appreciate the Leica Geosystems equipment – especially in the time saved in measuring and transferring the results on to the big screen.

ord ...

to change my system is the comprehensive range of accessories available from Leica Geosystems. We have to be as versatile as possible in our work – and for that a good accessory portfolio is very important."

Below: Roman Sebrle and Tomas Dvorak are trained by Vana Zdenec. The technical trainer won a DISTO last year for being the most successful decathlon trainer. Vana Zdenek: "Tomas Dvorak built his house using the DISTO. It is an first class instrument. Even when I am training and wish to know exactly how high the bar is. It is just the job!".

DISTO™ – in four versions

The DISTO™ is an easy to operate handheld laser meter with many functions (e.g. area and volume calculations) and is suitable for all building and tradesmen's activities. Depending on the version, it can also be programmed. With the DISTO™ lite, the 4th generation of the DISTO™ handheld laser meter-family now comprises four models.

The **DISTO™ classic⁴** with its multi-functional end piece has additional functions and can store values and constants. With the **DISTO™ memo⁴**, all measured lengths can be stored and downloaded over a conventional interface on to a computer. All handheld laser meters have a typical accuracy of ±3 mm. The **DISTO™ pro⁴** has an accuracy of ±1.5 mm.

America's highest peak now measures 6962 metres!

At 6,962 Metres on Aconcagua in January 2001: Climber Gianpetro Verza has just mounted the terrestrial reflector signal to enable the classical terrestrial survey with tacheometres from the valley, and he has fixed on the top the Leica GPS 530 antenna. This configuration allowed at the same time measurement in both technologies with high accuracy. Verza has put the Leica GPS530 terminal, the same equipment as used on Kilimanjaro, before him on the summit.

The highest mountain of the Americas is only 38.17 meters short of seven thousand. The indications on maps of the precise elevation of America's highest peak, Mt Aconcagua, will have to be corrected and increased by two metres. This is the result of an Italian-Argentinian Scientific Expedition led by Geologist Giorgio Poretti. Previously mapped at a height of 6959.75 metres this highest mountain of the southern hemisphere has been re-measured using the most modern global positioning (Leica GPS530) and terrestrial surveying methods and results reveal that it is 6961.83 metres above sea level.

The 7242 kilometre-long Andes are the longest mountain chain in the world. The Swiss Matthias Zurbriggen was the first man to conquer Aconcagua on 14 January 1897. In 2001 it was with the most modern GPS measurement technology from Switzerland, that the exact mountain height was re-determined.

Scientists of Poretti's expedition team have been very keenly awaiting the new results to find out if they reveal the "shrinking" trend of the previously re-surveyed peaks in Asia and Africa. This, however, was not the case, but the results still do not indicate that the Andes are growing at a greater rate than the Himalyas. The new results give no indication whether the earlier Aconcagua measurements were inaccurate, nor whether the mountains are "growing" or "shrinking". From now on, however, with technology and systems providing a reproducible accuracy of a few millimetres, it will be possible to precisely measure the summits and record their vertical and horizontal movements.

After Mt Everest and Mt Kilimanjaro now also Aconcagua

In the past, highly precise measurements of the world's summits were not possible due to technological limitations. However, with the emergence in the past decade of extremely accurate GPS surveying equipment, there has been a drive to re-survey and confirm the exact heights of the tallest peaks in each of the continents. Asia's Mt Everest and Africa's Mt Kilimanjaro have been re-surveyed using the same GPS equipment from Leica Geosystems.

On Mt Everest, re-measured in 1992 by an Italian-Chinese-Nepalese team also led by Professor Giorgio Poretti, the elevation of the highest peak of our globe reached 8846 metres, which was actually two metres lower than previously mapped. The same happened with Mt Kilimanjaro in 1999, where a German-Tanzanian team, led by Eberhard Messmer, came to the conclusion that this volcano was in fact 5893 metres above sea level, two metres less than before.

The highest mountains on the continents

Continent	*Highest Mountain*	*Height above sea level*
Asia	Mt Everest	8846 metres*
America (south)	Mt Aconcagua	6962 metres*
(north)	Mt McKinley	6194 metres**
Africa	Mt Kilimanjara	5892 metres*
Antarctica	Mt Vinson	5140 metres**
Europe (Caucasus)	Mt Elbrus	5642 metres**
(Alps)	Mont Blanc	4810 metres**
Australiasia/Oceania	Carstensz Pyramid	4884 metres**
Australia	Mt Kosciusko	2230 metres**

* Already re-measured with Leica GPS 300/500
** Measured with Leica theodolites during the 20th century

The results of the Aconcagua measurement are extremely accurate. Similar to the Mt Everest campaign, the experienced Poretti team of geologists, glaciologists, surveyors and climbers used the most precise terrestrial instruments available today (Leica T2002/DI3000 Tacheometres) and the most advanced systems for GPS surveying (Leica GPS530).

Mt.Blanc measured with Leica GPS

Three metres higher than currently stated in maps, is the elevation of the highest peak of the Alps, Mont Blanc. Its height above mean sea level was defined on 8 September 2001 with a Leica GPS500 as a result of a survey campaign carried out by the National French Surveying Authority (IGN).

The measurement revealed a result of 4810.4 metres. The Surveying Certificate is signed by Pierre Bibollet, President Savoy Geomètre Association, Michel Kasser, Director Geodesy IGN, and Michel Gouinguené, Survey Expert and Director Leica Geosystems France.

Bavarian Surveying Authority celebrates its 200 anniversary

A rare event indeed – a customer turns 200! Leica Geosystems was able to congratulate one of its most important customers – the Bavarian Surveying Authority, Munich, Germany – on its recent Jubilee. Leica GPS and TPS stations are standard in the free state of Bavaria.

The Bavarian Surveying Authority was derived from the Topographical Bureau, which was founded on 19 June 1801 by King Max IV Joseph. The Topographical Bureau's task was to survey and map the Kingdom of Bavaria. Based on a highly accurate database, the Bavarian Surveying Authority today provides a comprehensive spectrum of maps ranging from local plans to digital selections via the Internet. A book with the subtitle "There is a size/ unity/measure in all things!" has been published and can be found at http://www.bayern.de/ vermessung.

From the times of the Royal Topographic Bureau 1801: measurement of the base line between Munich-Erding. The poles were made from the wood of the fir tree – today it's a laser array.

Radio link closes gap between field TCA1103 station and office

In the last thirty years, there have been enormous advances in performing topographic survey. The Surveyor's field work has evolved from being totally manual – setting up baselines, running direct levels and pulling tapes, and plotting locations by hand – to the introduction of compact electronic total stations and computers.

However, these advances have not been without their problems. Traditionally, there has been a communications gap from having field crews perform the field locations and survey technicians perform the office computations. These are mostly associated with the amount and location of the data collected in the field and are not necessarily recognised until the data is processed and the office technician attempts to put the project together. Return trips to the field to correct errors in data or to gather more data can be very costly to the project budget and can affect both the quality of the map and the project schedule.

As experienced engineering and surveying professionals, Concord Engineering & Surveying Inc. (CESI) in North Carolina, have a wide expertise and knowledge-base and always strive to be at the forefront of using new technology, actively looking for ways to improve accuracy and efficiency of their engineering and surveying work.

CESI decided that one significant improvement to surveying work would be to devise a way to allow surveyors to see what they are locating at the same time as they perform the fieldwork. Although laptop computers are now being used in the field, the computer must be connected directly to the instrument, meaning that the Crew Chief who is keeping the field book and running the rod cannot see the locations as he or she completes them.

CSEI approached Tommy Dudley of Earl Dudley & Associates, regional Leica representatives. Dudley, along with representatives of Carlson Software, worked together to provide a solution. After much planning and trials, the team established a radio link between a Leica TCA 1103 Robotic instrument and a mobile laptop operating Carlson Software.

This innovation allowed CESI's Crew Chief, Cecil Porter, to walk freely around the site and control the instrument via a laptop mounted on the pole or strapped to the waist. He was able to determine the features to locate and immediately see the results displayed on the laptop.

"It won't be long before I can perform various types of surveys without the help of anyone or anything except this equipment and computer," Porter said.

So far, one of the most successful projects in utilising this system has been a topographic survey for facility improvements to the intersection of NC 73 and International Drive in Concord, North Carolina. This is a congested and heavily travelled corridor, linking two booming communities in Cabarrus and Mecklenburg counties as well as the expanding International Business Park at Concord.

The client, the City of Concord, required CESI to collect accurate and complete data within a short allotted time schedule and avoiding interference with traffic. The project involved many different items for field crews to locate and survey, including the creation of a digital terrain model of the existing pavement and of the areas to be widened, the making of property ties, and the location of gravity and non-gravity utilities.

"We were able to load the limits of the survey on the laptop so the Crew Chief could see when the targeted area was covered," James Craddock, Project Manager of CESI said. "As the pavement was located, it was also drawn and displayed on the laptop in real time. Breaklines, utilities, ground shots and physical features were all located and appeared so that positioning and accuracy of data could be checked."

When the Crew Chief had finished with locations, he was able to use Carlson Survey to process the T-net and check the contours to see if they appeared correct or if he needed to obtain more

locations to define a more detailed area. Using this technique, the fieldwork went smoothly and quickly.

Although the fieldwork took about the same amount of time to complete, the difference was that the crew was able to actually "see" what they were surveying in real time as they located features in the field. The most significant timesavings were realised in the office, as the data came in from field essentially already "processed". This meant greatly-reduced computation time and the elimination of costly return trips to collect data.

"The only task left to complete the project was to import the drawing and finalise the digital terrain model," Craddock said. "In using this new system to survey a site, the office computations time was cut in half, thus offering both time and money saving to the client." ***Bt***

A dynamic team: Chuck Brewster, Marion Saudlin, Alex Raukin, Jim Craddock, Glen Gamble, and Jim Davis.

Leica Geosystems' DataPro to be integrated with CAiCE's Visual Survey Software

Leica Geosystems has entered into a Cooperative Software Development Agreement with CAiCE Software Corporation to integrate Leica's TPS DataPro data collection system with CAiCE's Visual Survey Software. This integration will enable direct output from Leica TPS1100 Total Stations, GPS System 500 as well as TPS700 and 300 instruments to CAiCE via the Survey Data Management System (SDMS) data format. This direct output to CAiCE will eliminate the client's need for additional cost and data translations.

TPS DataPro is a software running onboard TPS1100 to simplify the data collection process for surveyors, and to write data directly to the formats required by the major packages in the US and Canada.

CAiCE has added to their software some functionality that reads the so-called SDMS data format, which can be produced using TPS DataPro on TPS1100, and by using the flexible output format functionality from GPS System 500 and TPS700 and 300.

The objective of the development agreement is to provide Leica and CAiCE users a streamlined methodology for data collection import, processing, and subsequent export for staking purposes. By minimising the number of steps in these processes, both ease of use and survey data integrity are greatly increased.

Martin Nix, VP Business Development Leica Geosystems, (right) hands the NA2002 over to Eric Kraehenbuehl, Manager Survey Services NJDOT .

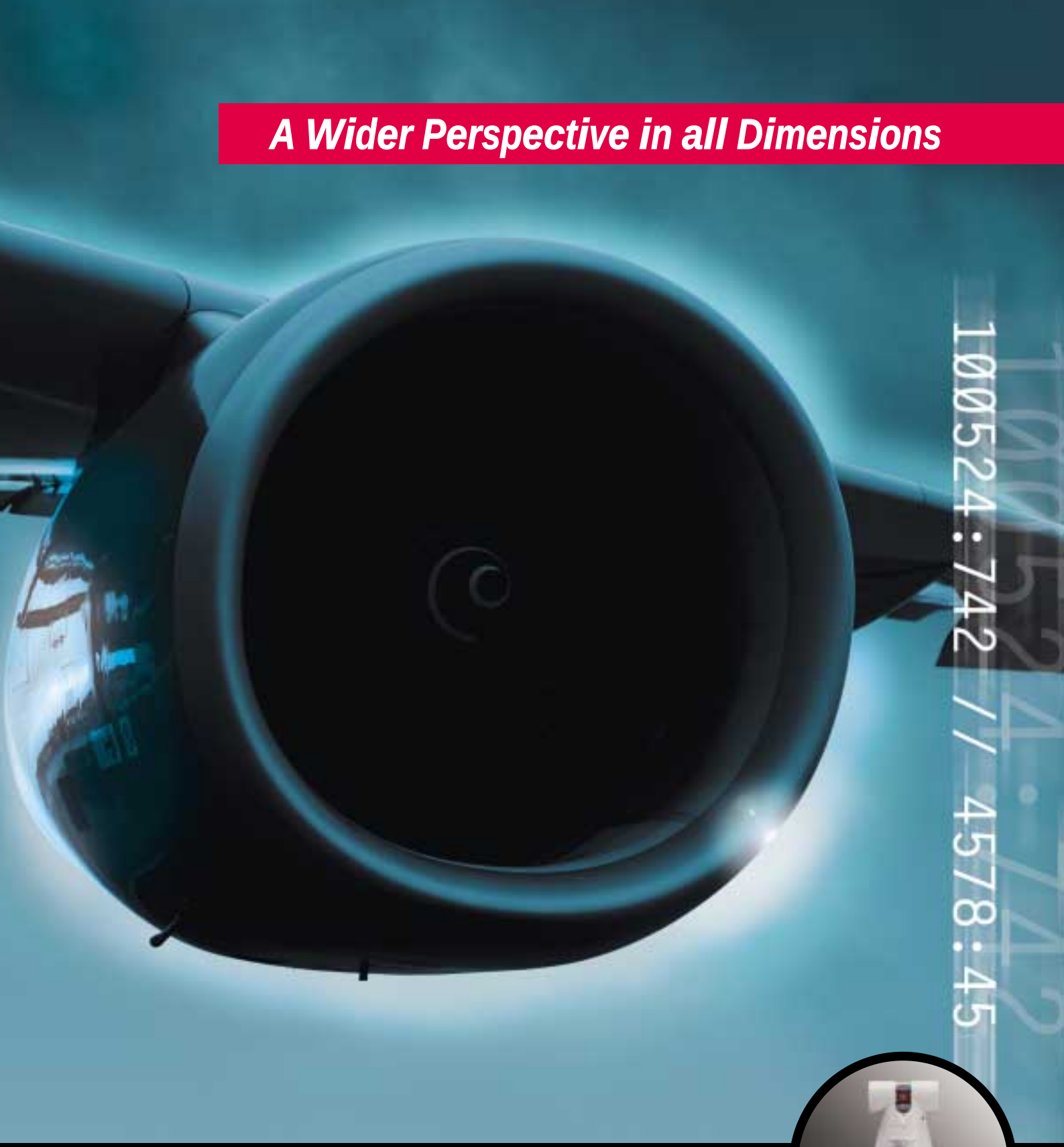
10,000TH Leica NA2002 Digital Level

Leica Geosystems and New Jersey Department of Transportation (NJDOT) officials recognised the 10,000th Leica NA2002 Digital Level at NJDOT in Trenton, New Jersey.

The NA2002 unit bearing serial number 10,000 was part of a purchase of 18 Leica digital levels that will be used for checking and bench runs on projects alongside New Jersey highways and interstates. The Leica NA2002 Digital Level uses digital electronic image processing for determining heights and distances and records the results automatically in a REC module that can be downloaded to a computer. The accuracy and speed in use are better than a traditional level because it eliminates human error in the reading and the processing of the gathered data. The level can be used for all aspects of highway surveying, for second to fourth order levelling, and topographic and construction surveying.

"The NA2002 Digital Level achieves time savings of up to 50% over conventional equipment. All of the main steps in the operation of the level, such as reading the staff, recording the data and computing the results, are completely automated, eliminating errors in reading and recording of the data," said J. Eric Kraehenbuehl, NJDOT.

A Wider Perspective in all Dimensions



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Leica Geosystems AG Mönchmattweg 5 CH-5035 Unterentfelden Switzerland Phone +41 62 737 67 67 Fax +41 62 723 07 34 www.leica-geosystems.com