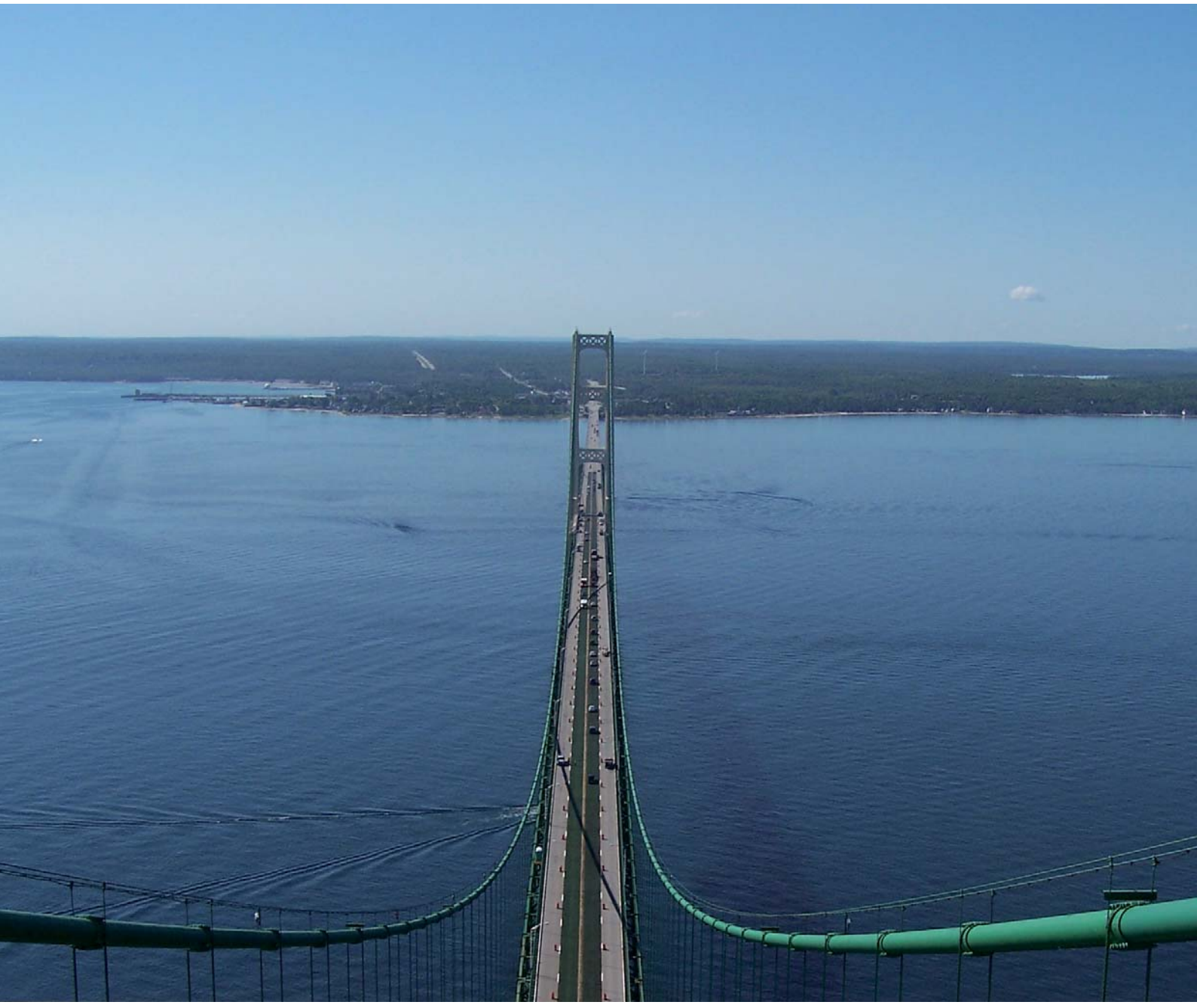
Reporter 58

The **Global Magazine** of Leica Geosystems



- when it has to be **right**

Leica Geosystems

Editorial

Dear Readers,

As always, it was a challenge to choose amongst all the exciting projects to be included in this Reporter. From the BMW Group Research and Technology putting their trust in Leica Geosystems GNSS technology to make the future of driving safer, to the Leica ScanStation 2 playing an important role in a new US crime scene TV series, or the scanning of a hundred year old church – I am sure we made the right choices.

The cover shows the Mackinac Bridge, opened in the late 1950s, connecting the Upper and Lower peninsulas of the State of Michigan/USA. It is one of the world's largest suspension bridges, and taking a look at the picture, you'll agree that it is an impressive monument to what mankind is able to do. Turn to the next page to read Matthew D. Mitchell's report on how the Michigan Spatial Reference Network, another impressive project, eases the life of the regional surveying community, and what the Mackinac Bridge has to do with it.

Bridges are fascinating constructions – long or short, broad or small, built of wood, stones, or concrete and steel. The technical aspect excites us, huge bridge projects capture our imagination, and are a source of inspiration to our fantasy. It is not by chance that people all around the world build bridges to reach each other – physically and figuratively. That is also what the Reporter is about, isn't it? Building a bridge between us – Leica Geosystems – and you, our valued partners and customers.

Enjoy reading!

Ola Rollén
CEO Hexagon and Leica Geosystems

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Premier Network

by Matthew D. Mitchell

The surveyors in the US-State of Michigan have a lot to be happy about these days. The Michigan Spatial Reference Network (MSRN) now consists of 85 high precision Continuously Operating Reference Stations (CORS) delivering, free of charge, high precision RTK corrections via the wireless web – making it Leica Geosystems' preeminent Reference Station in the world. In addition to providing single baseline solutions, the MSRN is equipped to provide full RTK network corrections (Max & i-Max), raw binary phase data and OPUS data resulting in also being the most robust Leica Geosystems' network.

When originally conceived in 1999 by the Michigan Department of Transportation (MDOT) Design Survey Section and Leica Geosystems, the concept of a continuously operating statewide reference station network was a ground breaking and novel idea. With experimental network management software, limited high speed internet connectivity, as well as a limited budget, 12 specially designed "Earlconic®" monuments were designed, positioned and became operational in 2000 for static data acquisition and OPUS operations. "It is amazing to me how much the MSRN has evolved since its conception in 1999", says Brian Dollman-Jersey, Supervising Surveyor for the MDOT Design Survey Section. "Since its conception we have added a total of 85 stations all now connected and operational 24/7/365. Although initially designed to support our Aerial Photogrammetry Operations, with the broadcast of Real-Time corrections in July of 2004 the system has now become the basis for all work done by the MDOT and our partners, in both the design phase and the construction phase of our numerous projects across the State. We have calculated that the cost savings experienced by MDOT with the fully implemented MSRN is on the magnitude of $1.32 million dollars per year for preliminary design survey projects. This does not include savings from MSRN application to construction stakeout and inspection or the future savings resulting from the

potential of Machine Control Grading applications. Certainly having all Michigan Department of Transportation projects across the entire State tied to one contiguous and repeatable coordinate system will herald massive money savings over the long run", continues Brian Dollman-Jersey.

With 85 stations currently in place (and 6 more to be installed by summer 2008), data needs to be monitored for integrity, analyzed, concatenated and transmitted to the wireless web, the Michigan Department of Transportation website (www.MDOTCORS.org) and the National Geodetic Survey. The daunting task of processing and distributing this huge amount of data is assigned to Leica Geosystems' state of the art SpiderNet Software. "Leica SpiderNet is some of the most remarkable and sophisticated software of its kind in the world today," says Andrew Semenchuk, MSRN Administrator. "Leica Geosystems' Reference Station team have worked diligently with MDOT to handle all of the issues related to the multifaceted situation that we have here in Michigan. The MSRN is now the framework for strategic as well as tactical geodetic surveying operations in the State of Michigan, and has proven to meet the needs of both the public and private surveying communities. Leica Geosystems has proven to be an excellent partner on this challenging project, seeing to the vital development of the hardware, software, firmware and the ever so critical support required by the MDOT to stay current with the constantly-evolving surveying technologies."

"In order for a reference station network to be world class, every component of the system needs to be of the highest quality", says Dr. Richard R. Sauve, Senior Technical Sales Representative at Leica Geosystems, Inc. Michigan. The MDOT realized this concept at the onset of the design of the MSRN. As a result of their foresight, they have established the benchmark reference station network for the United States. The MSRN monuments, referred to in Michigan as the "Earlconic®", consist of a Leica AT504 Choke Ring antenna surmounted on 17 feet of reinforced concrete, 24" in diameter. This highly engineered monument provides the stability required for the harsh freeze-thaw cycle experienced in Michigan. All stations are equipped with the extremely dependable Leica GRX1230 Pro GPS receivers and connected to high-speed Internet lines (T1, T3, Cable or DSL). With the highly developed and reliable Leica SpiderNet Software and the web interface tools developed by Leica Geosystems, it is easy to keep all the stations upgraded with the most current firmware remotely, thereby eliminating time consuming visits to all of the current 85 sites.

The great State of Michigan is as long in the North-South direction as it is in the East-West direction. This makes the travel time from the furthest site in the Southeast corner to the farthest site in the Northwest corner in excess of 14 hours. Having the ability to have full control of a reference station network remotely and reliably is critical to keeping all stations up and operational 24/7. Considering the

Spectacular Location

A "Premier Network" also needs spectacular locations. One of the earlier structural monitoring tests carried out after the completion of the MSRN took place at Michigan's Mackinac Bridge (see cover) in August of 2005. "We installed four GRX1230's on the bridge and two on land to monitor the movement of the receivers at a 1 second update rate for 8 days. Then we recovered them. Michigan's Mackinac Bridge was the worlds largest expansion bridge until the end of the 1990's. It's still on of the worlds largest", says Dr. Richard R. Sauve II from Leica Geosystems in Michigan.

total package of the MSRN – extremely dependable Leica GPS receivers and antennas, strong and proven monumentation, robust and steadfast network management software, and responsive dedicated technical support – there is a solid reason for its success.

"Utilizing the MSRN in the field is extremely simple" says Shawn Roy, Survey Automation Support Surveyor. "Of course the easiest part is the fact that you don't have to set up a local base, determine it's position and independently validate its accuracy, this in and of itself can save many hours of field time over the course of a project. In the event one of our surveyor's wishes to use network RTK we simply select the pre-defined configuration set in all of our Leica GRX1230 and Leica RX1250s for both the MAX and the i-Max operations. Full network RTK has proven to be extremely robust and does not require our field surveyors to manually select a given station. If however a surveyor wishes to use a single station we have developed configuration sets for each individual site using RTCM version 2.3. Either way the Leica GRX1230's and RX1250's operate excellently with the NTRIP protocol. As we still have in our fleet in excess of 50 SR530 GPS receivers, they easily connect to single stations or the i-Max solution using GPUID authentication."

"Although the MSRN was originally designed to support Michigan Department of Transportation projects, the benefit for private sector surveyors has been monumental," says Jeff Bartlett, President of Surveying Solutions, Inc., the biggest private user of GPS in the State of Michigan after the MDOT. "We currently field 28 Leica SR530 and Leica SmartRovers each and every day with our field crews. All of our receivers are linked to the MSRN via wireless web. If it were not for MSRN's RTK network abilities, I would currently have ½ of the capability of my GPS fleet as we would be a slave to the local Base / Rover technique. The MSRN provides excellent dependability and reliability and enables us to perform our surveying operations with precision and accuracy. Since all of our survey work is performed on a contiguous coordinate system, we are capable of easily databasing all of our work for future reference. With today's strict design and construction standards, tight schedules and tight budgets we have no time to worry about control issues. Repeatability is the most important tool a crew can have today. Being able to jump out of the truck, do a check shot, and start surveying is the only way to be competitive in today's market."

In conclusion, the Michigan Spatial Reference Network has exceeded the specifications for what a stellar reference station network should be: dependable, reliable, ever developing, and continually supported with the best technical support available in the world.

About the author:
Matthew D. Mitchell, B.S., is Technical Support Engineer at Leica Geosystems, Inc. (Michigan)

Laurent Gouin, president of the Conservatoire du Livre, measuring the south door of Notre Dame.

Measuring the Cathedral from every Angle

by Gwénola Le Gléhuir

For more than two years the Conservatoire du Livre in Paris has been carrying out an initiative intended to establish the exact dimensions of Notre Dame cathedral in Chartes with the help of Leica DISTO™. This is painstaking work, and involves a truly scientific approach.

The volunteers involved in this project are certainly not scared of a challenge, for their task, like the building itself, is colossal. This initiative will take them several years and its result will be equalled only by the precision of their work: nothing less than measuring Notre Dame cathedral in Chartres! Every week for over two years, members of the Conservatoire du Livre (CDL) – an association based in Paris – have been travelling to Chartres to examine the cathedral from every angle.

Scientific approach

They may well pass unnoticed, with their small Leica DISTO™ A8, in the midst of the onlookers and tourists taking souvenir photos of the cathedral. But

their approach is in no way connected with the mystical, spiritual or religious character often attributed to visitors to Notre Dame. The objective is a purely scientific one and this work has, until now, never been carried out.

"We first undertook research work, for a year, looking at all written material related to the building", explains Laurent Gouin, president of the CDL, standing at the foot of the south door as he prepares to measure the statues around it. "We realised, to our great surprise, that the information, once compared between authors and checked, is extremely unreliable. Much of it extrapolated on the architecture of the cathedral by referring to the famous golden ratio. We observed so many errors that we decided to redo the whole thing."

Examining everything in close detail

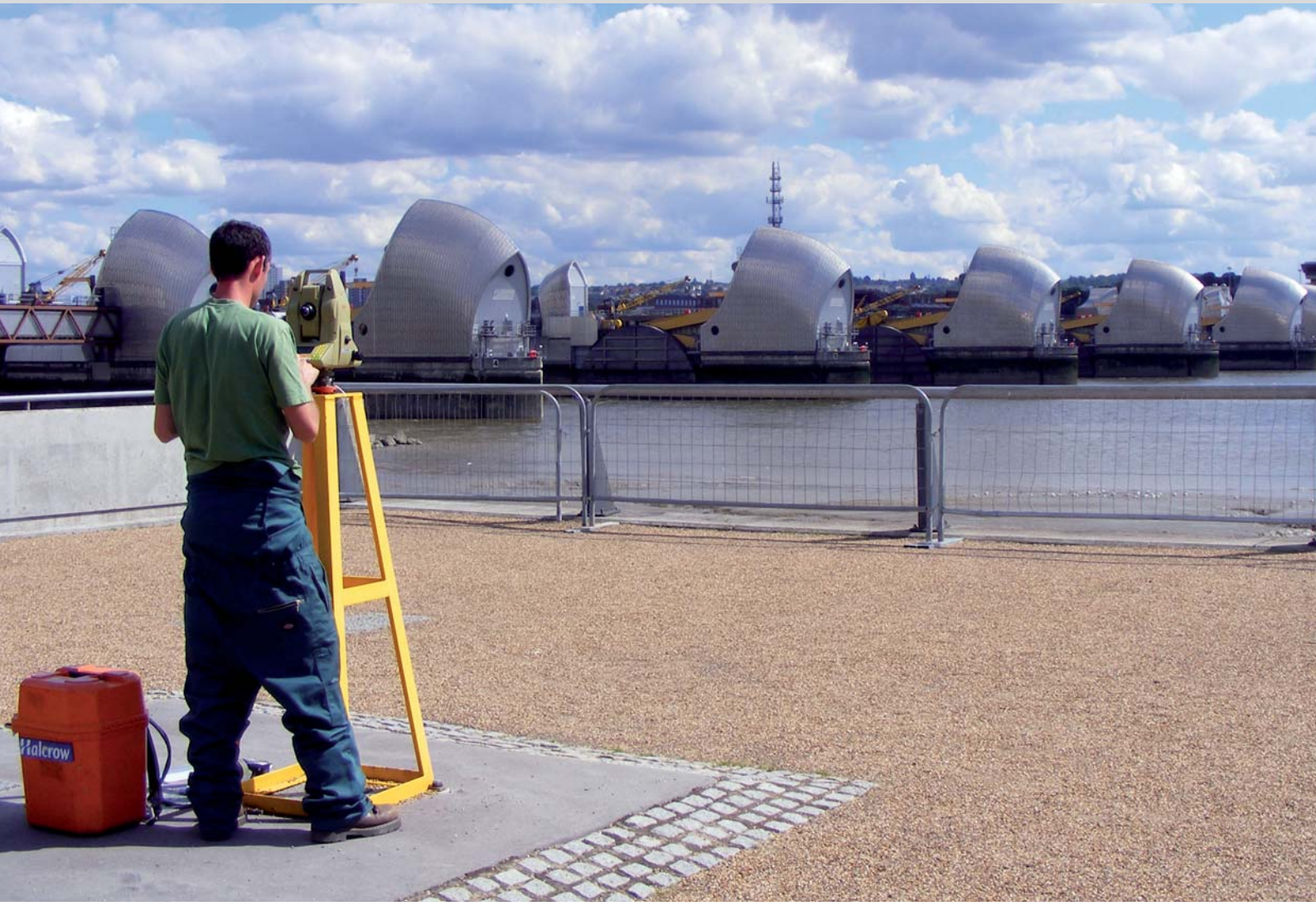
The project was therefore launched. The interior, exterior, architectural features, size of statues, of their bases, as well as a thousand and one other details: everything is examined in close detail using a Leica DISTO™ A8 laser distance meter and a Leica Geosystems theodolite, is photographed and listed in rigorous detail. "Data taken for the cathedral is systematically checked two or three times by different teams, in order to avoid errors and disputes in our final document."

And since Rome wasn't built in a day, the CDL is allowing itself the time required for successful completion of this painstaking work. "It's true that this is a long-term scientific and archaeological project. We want to put everything in its place. Precision requires time, and we're not required to proceed quickly", says Laurent Gouin, who hopes, through this approach, to "centralise all the data on the cathedral, once checked, to complement the existing base. Our work doesn't involve coming up with theories or hypotheses about the cathedral and its construction, but rather stating what is there."

In more concrete terms, at the end of its work the Conservatoire du Livre will publish a technical reference book, coupled with a photo catalogue, showing exactly how the building achieves its harmony right down to its smallest nooks and crannies, whether those who make a cult of the famous golden ratio like it or not. They have been warned...

Reprint courtesy of the journal "La République du Centre", 30th July 2007.

The CDL has been able to borrow professional equipment thanks to its partnerships with companies such as Leica Geosystems.



Precision for the Thames Barrier

by Chris Hall and Mark Burbridge

The overall demand for certificates confirming the measurement quality of new or used surveying equipment is growing, as an increasing number of surveying companies and contractors are applying for ISO 9001:2000 certification, as well as the growing number of 'public interest' projects that require certification (e.g. public health, public safety, sports events, and legal procedures) demonstrates. For one of its recent projects, Halcrow Groups' Geomatics division demanded sub millimeter accuracy calibration certificates from Leica Geosystems.

With over 220 staff worldwide, Halcrow Groups' Geomatics division is a leading consultancy specialising in a wide range of activities from topographical mapping and inshore hydrography, to Geographical Information Systems (GIS) analysis and software support. Cutting-edge engineering technology is at the heart of Halcrow's business from sub-millimeter precision total stations and terrestrial laser scanners to geotechnical tools such as tilt and verticality sensors.

The EDM Baseline

The EDM baseline pillars are located on the dam bed of the river Rhein near Heerbrugg, which consists of stone and rock. The pillar foundations are fixed with concrete into the dam, with the remaining concrete section above the ground being insulated by a plastic tube in order to protect it against heat caused by direct sunshine. Although the baseline has a long distance range of up to 3'000 m, the typical calibration range is 500 m, with a combination of 21 distance measurements. Longer range calibrations at 1'000, 2'000 and 3'000 m intervals can be made on request.

When the baseline was originally built, care was taken for the correct distribution of the distance intervals over the wavelengths of the EDM, in order to detect possible cyclic errors. This was needed for earlier EDM models, however, for later EDMs, such as in the Leica TCA1800, cyclic errors can be taken care of either by hardware and/or software.

One recent project to carry out deformation survey work at the Thames Barrier and associated gates required the highest accuracy, which is why Halcrow demanded full calibration certificates to verify the measurement precision and sub millimeter accuracy of the instruments.

Certificates for Surveying Products

Certification of equipment requires calibration in a national/international accredited EDM baseline laboratory. Leica Geosystems in Switzerland is one of the few international accredited calibration laboratories for the dimensions angle and distance. A number of certificates are available for new equipment at the initial purchase, including total stations, digital levels and GPS sensors, or for used equipment at Leica Geosystems authorised service centres.

Halcrow Instrument Calibration in Switzerland

To fully certify the Leica TCA1800 total station, Halcrow had to return it as well as all ancillary equipment (prisms and tribrachs) to Leica Geosystems UK head office in Milton Keynes. The instrument was then booked into the service centre and prepared for shipping to Switzerland. On arrival at the calibration laboratory in Switzerland the Leica TCA1800 underwent an initial check in preparation for the calibration process.

The Leica TCA1800 was then subjected to the following calibration tests:

1. Measurement determination of the linearity and the zero point correction of a distance measurement.
2. An EDM baseline test for the determination of the standard deviation of a distance measurement and for verification of the zero point correction.
3. A frequency measurement laboratory to determine the measuring frequency of the EDM at various temperatures.
4. An angle measurement laboratory for the determination of the standard deviation of an angle measurement (vertical and horizontal).

Leica Geosystems Certification

Calibration Certificates confirm that the product was inspected and explicitly state the traceability to national standards, the uncertainty of measurement for each measurand (measured value) and compliance of the measurement values with the published product specifications at the time of inspection. Calibration Certificates are not supplemented by detailed measurement reports, they are internationally acknowledged certificates that can only be issued by calibration laboratories with a national accreditation indicated by the registered accreditation mark and number on the certificate document.

Leica Geosystems offers certificates at four different levels.

- To issue the highest Certificate, the Calibration Certificate, a national accreditation of the calibration laboratory in accordance with ILAC (International Laboratory Accreditation Cooperation) and ISO/IEC17025 regulations is required. So the certificate is internationally acknowledged and the test results are directly traceable to national standards.
- Producer Inspection Certificate "M" is based on the manufacturer's defined standards and complies with the ISO 9001:2000 requirements of 'control

Scale Error

Any scale error on the Leica TCA1800 was determined by frequency calibration. In order to gain a picture of the long-term behavior of the baseline distances, we measure so called "nominal" distances using a mekometer unit as well as a Leica TC2003 total station. The precision of the results and the results itself of the two instruments are equal. The reason for this is that the mekometer has a longer measuring time within which the atmosphere can change, unlike the Leica TC2003 which has a short measuring time, minimising any atmosphere deviation, therefore the resulting distance on the Leica TC2003 is less affected by the atmosphere than the mekometer.

Atmospheric Corrections

One of the critical parts of the whole calibration process is the application of atmospheric corrections to the measurements of the Leica TCA1800. These parameters were measured at the instrument station and along the baseline for each measurement, and the atmospheric corrections were applied to each distance.

Angular Accuracy Determination

Determining the accuracy of angle measurement for a total station is not a trivial task, especially when the results should be free from atmospheric conditions and human skill. To overcome the deficiencies of manual methods of angular accuracy determination, Leica Geosystems invented the unique TPM machine (see picture on the right page), now in its second generation. The TPM-2 has a 1σ accuracy of 0.058″ for horizontal angles and 0.091″ for vertical angles. Only with such accuracy is it possible to provide Calibration Certificates for total stations with accuracies as low as 0.5″ and 1″ (e.g. instruments Leica TCA1800 and Leica TCA2003). Currently Leica Geosystems AG is the only manufacturer worldwide with an accredited Calibration Laboratory for both distances and angles.

Summary

Following completion of the calibration process the Leica TCA1800 was found to be operating to the required tolerance of 1″ angle accuracy and 1mm distance accuracy and a full Calibration Certificate was issued.

and monitoring of measuring devices'. The reported test results are traceable to national standards or recognised procedures.

- Producer Certificate "O" is based on the manufacturer's defined procedures and confirm that the individual product was inspected and published specifications were met at the time of inspection.
- Service Certificate is issued at Leica Geosystems authorised service centres in combination with repair or maintenance to confirm that the individual product was checked and the published specifications were met.

The certified instrument was then returned directly to Halcrow and was subsequently used in confidence on Halcrow's precise monitoring and engineering projects, including the Thames Barrier.

About the authors:
Chris Hall is Project Manager at Halcrow Geomatics, Mark Burbridge is GNSS Network & Technical Support Manager at Leica Geosystems.

Halcrow Group Ltd.
Ranked as one of the UK's leading consultancies, Halcrow Group (core sectors: transportation, water and power, maritime and property) employs over 7'000 people and generates a turnover in excess of £330 million. Halcrow has a well established presence around the world, and provides services from 26 UK offices and a further 59 international locations. The Spatial division works with its clients to provide bespoke geospatial solutions in the areas of data acquisition, management, analysis, integration and visualisation.
More information: www.halcrow.com

"The Leica TCA1800 is a very rugged total station, yet versatile enough to be able to carry out both setting out work and precision monitoring all in one day. Several of our framework clients insist on UKAS-traceable accreditation for the calibration, and this includes the need for a full baseline EDM calibration. This is especially important when observing long baselines over water (as at the Thames Barrier) and gives us the confidence in the repeatability and accuracy of the baselines we are measuring"

Chris Hall MRICS, Project Manager, Halcrow Group

BMW: GNSS makes Driving safer

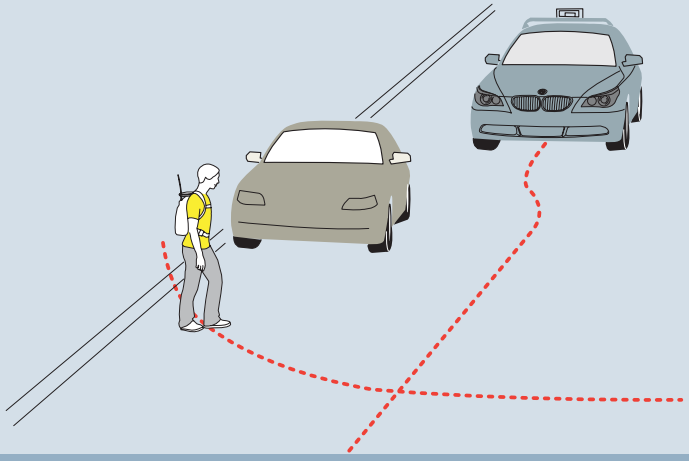
by Katrin Vogel and Carsten Wolter

BMW Group Research and Technology is working on the development of tomorrow's Advanced Driver Assistance Systems (ADAS) as part of its ConnectedDrive concept (www.connected-drive.com). Leica GPS1200 has proven to be a reliable reference sensor in this work.

Advanced Driver Assistance Systems support the driver, warn if necessary, or mitigate or avoid possible hazardous situations. Examples of Advanced Driver Assistance Systems on the market today include active cruise control with stop & go function, lane departure warning, BMW night vision, park distance control and adaptive headlights.

Advanced Driver Assistance Systems based on perception systems

These systems work using environment sensors integrated into the vehicle, such as radar or ultrasonic sensors, laser scanners or thermal imaging cameras. Objects in the vehicle's environment relevant to the various driver assistance functions are detected and tracked from the sensor data using complex algorithms. BMW Group Research and Technology is investigating innovative functions and assessing their feasibility. Depending on the envisaged function, the environmental perception system must fulfill specified minimum requirements for reliability, robustness and accuracy of positioning in detecting objects. The deviations of the object data calculated from the sensor data from "ground truth data", i.e. the refe-



Recognised method

The method of reference data acquisition used at BMW Group Research and Technology has already been successfully used a number of times, for example for evaluation in subprojects of PReVENT, the core project for active safety in the EU's 6th Framework Programme (www.prevent-ip.org) and in other research projects. Detailed information can be found in the paper "High-Accuracy Reference Data Acquisition for Evaluation of Active Safety Systems by Means of a RTK-GNSS Surveying System" published in the conference proceedings for "Intelligent Transport Systems and Services" Europe 2007.

rence data, are used to determine the achieved quality of object data. These reference data should be at least an order of magnitude more accurate than the data being evaluated, which means centimetre accuracy of positioning is required.

Reference data acquisition with Leica GPS1200

Three Leica GX1230 GG receivers are used at the moment to capture the reference tracks of pedestrians. This ensures the required RTK functionality and the fulfilment of the requirements for position computation. The system reconstructs specific traffic scenarios between vehicle and pedestrians. Pedestrians carry the systems in rucksacks or on GIS belts. Their positional data are displayed as auto points processed at a rate of 20 Hz. Vehicle reference position and orientation are calculated using a GPS/inertial system and stored with the data from the vehicle sensor system in the vehicle. The relative position of the pedestrian in relation to the vehicle coordinate system is calculated from the reference positions of the two objects "vehicle" and "pedestrian" and the reference orientation of the vehicle.

By using both the presently available GNSS systems (GPS and GLONASS), a large number of satellites are visible even in urban environments with many surrounding buildings. The use of Leica Geosystems' RTK-GNSS surveying systems allows reference data to be displayed at night and in adverse weather conditions, which means the sensors built into the vehicle can be tested efficiently under different environmental conditions. Reference positions are available for pedestrians even that are occluded from the view of the vehicle-based sensing system.

The Leica GPS1200 has an extensive range of possible uses which also supports other applications at BMW Group Forschung und Technik. These applications include centimetre accurate mapping of objects, the reproducible construction of particular scenarios and the on-site creation of local coordinate systems. The functions of the Leica GPS1200 help to considerably reduce the work involved in many positioning tasks in the development of assistance systems. ■

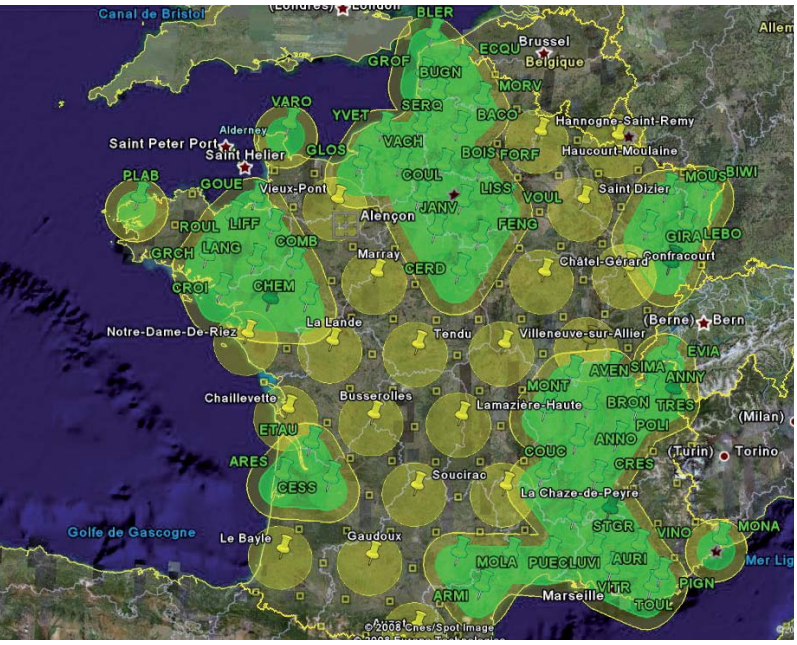
About the authors:
Katrin Vogel works for BMW Group Research and Technology; Carsten Wolter is employee of Leica Geosystems Vertriebs GmbH Germany.

Orphéon Network is Growing

by Hélène Leplomb

Géodata Diffusion extends its reference station networks and invests in 100 additional stations and 140 software licenses from Leica Geosystems.

In 2006, the French company Géodata Diffusion extended its Orphéon network of 10 reference stations by additional 50 permanent GNSS stations. The company chose Leica Geosystems for the recognised quality of both material and software but also for its experience in networks. Indeed, Leica Geosystems was the first manufacturer to develop MAC (Master Auxiliary Concept) technology that implements the MAX standard on GNSS network corrections. This standard, adopted by the international committee RTCM (Radio Technical Commission for Maritime services) in May 2006, clearly defines network processing routines: the regulations specify that calculation of the positioning solution is done on the GNSS mobile equipment. Géodata Diffusion is therefore more productive with this technology.



Map (source Google Maps) of deployment of the Orphéon network. In green, installed stations, in yellow the next 20 stations to be installed from now up to June 2008.

Stable, convivial solution guarantees 99% availability

By investing in 100 additional stations and 140 software licenses (target is 200 stations), Géodata Diffusion is now renewing its trust in Leica Geosystems. "With the software packages Leica SpiderNet, Leica GNSS QC and Leica SpiderWeb, coupled to the sensors Leica GRX1200 Pro GG, we benefit from a stable, convivial solution that is open to all mobile receivers thanks to the MAX regulation that is used to calculate our network corrections, and which functions equally well with GPS and GLONASS satellites. Furthermore, the quality of the support provided by the technological equipment of Leica Geosystems enables us to guarantee a service availability rate of over 99% and to develop our solution to always meet market expectations. All these factors put together are without a doubt the basis for the satisfaction that our customers receive from us daily", states Romain Legros, director of Géodata Diffusion.

Safe long-term investment

The durability of a network depends in particular on its GNSS compatibility, in other words the ability to process signals from American GPS satellites, Russian GLONASS satellites and future signals from the European "Galileo" and the Chinese "Compass" constellations without changing sensors or software. By choosing the Leica GNSS compatible GRX1200 Pro GG stations, Géodata Diffusion is making a safe, long-term technological investment.

Preventing the Risk on the Rhône

by Hélène Leplomb

In 1934, the Compagnie Nationale du Rhône (CNR) received a concession from the French state for operation on the Rhône river. Over 70 years later, it has become the only certified producer of "renewable energy" in France, operating 19 dams and hydroelectric facilities. Beyond its strictly commercial activities, CNR is also responsible for controlling the development of the riverbed and navigable channel. To do this, each year over 400 km of river are sounded and measured. The resulting analysis helps to determine displacements of the Rhône riverbed in order to locate possible areas of backfilling. To upgrade their equipment, CNR chose Leica GPS1200 for its expertise in surveying and its versatility.

Beyond its activities for production of renewable energy, CNR, as the guardian of the Rhône, ensures the safety of residents by means of a twofold mission: Ensuring that its developments do not increase flood flow and minimising their effects. Informing all departments affected by flood flow: the Flood Warning Service, the Department of Civil Protection and the Department of Navigation.

Versatility with Leica System 1200

To predict the accumulation of flood water, the CNR regularly monitors over 400 km of the Rhône riverbed and banks. Four regional directorates are deployed

Compagnie Nationale du Rhône (CNR) – Stakeholder and Guardian of the Rhône

In 1934, Compagnie Nationale du Rhône received from the French state the mission of developing and operating the Rhône for electricity production, navigation and agriculture. The company manages: 19 dams, 19 hydroelectric reactors and 14 locks between Switzerland and the Mediterranean Sea.

Since 2002, CNR productions have been certified by the label TÜV EE-02 (renewable energy) that guarantees that the energy is produced without resorting to pumping systems. It is the only French operator whose total production is certified as 100% renewable energy.

on the Rhône for this bathymetric (underwater) and topographical control. Each of these directorates is responsible for approximately 200 kilometres of Rhône riverbank.

In 2007, the company started to update its equipment basing its choice on a solution that was able to meet its topographical and bathymetric needs. Indeed, CNR is organised into "topography" and "bathymetry" teams. Using its future equipment in these two centres would enable a versatile use of the fleet and the possibility of strengthening the capacity of teams or agencies according to the intensity of their work.

Leica Geosystems – recognised for its expertise in topography – commercialises solutions that respond as well to topography as to bathymetry, particularly due to the reliability of its watertight instruments (IP67). It is for this reason that the Leica System 1200 including GNSS receivers (GPS1200) and total stations (TPS1200) was chosen for the renewal of the pool of the CNR agencies.

Monitoring of the river is carried out in 3 stages:

1. The topography equipment is used to survey the riverbanks to establish a plan view.
2. Next, the bathymetry equipment uses the topographical data as a basis to sound the river and carry out cross profiles.
3. Once the Rhône is mapped in this way, data collated on lengthwise and cross profiles is sent to corporate headquarters in Lyon. Simulations are carried out there that enable detecting areas at risk in order to carry out maintenance operations.

Topographic Surveying of Riverbanks

CNR regularly carries out topographic surveys of the Rhône riverbanks to establish or monitor their position and develop cross profiles (plan view) that define the models to follow when sounding the river. This reading is carried out with a pair of Leica GPS1200 and a Leica TPS1200 total station.

The advantage observed by CNR users is the fact that the GPS1200 and TPS1200 have the same user interface and data format. Therefore, a job initially carried out with GPS (open area, good visibility of satellites...) can be completed by working with the total station: it is sufficient to transfer the Compact Flash card that contains the GPS data to the total station. This leads to time savings that is appreciated both when training and during daily use.

Data on the localisation of riverbanks collected in this way is fed into the software developed by CNR for the creation or modification of the frame of reference in the field. This frame is then loaded into the computer on board the company launch boat.

Bathymetric Sounding of the River Bed

The bathymetry team then takes over on the river. Its aim: to carry out cross profiles, in other words sound the river across its width. The echosounder sends an ultrasound beam, which measures the water depth. Therefore, when the ship moves over the entire width of the river, the sounder sends back an exact image of river depths.

The echosounder enables obtaining a measurement of the water depth but does not locate the point in space. This is why one Leica GPS1200 is positioned on the roof of the ship and connected to the bathymetry software. A second GPS1200 remains on the riverbank as a reference. It communicates with the GPS1200 on the ship by radio. The two devices exchange corrections so that the position of the ship is given to the nearest centimetre.

In particularly covered areas, such as Gorges de Balme or Génissiat dam the GLONASS option makes the difference. Up to now, the instruments only received data from American satellites called GPS. Since 2006, Leica GPS1200 also receive data from the constellation of Russian satellites, GLONASS. The addition of these satellites enables using GPS and GLONASS – GNSS (Global Navigation Satellite System) – in rougher environments such as in the case mentioned above and therefore avoiding losses in reception.

Simulation to minimize risk

Receiving data from the echosounder and GPS1200, the CNR bathymetry software positions the ship in real-time on the plan view shown on the screen onboard the ship. The operator can then carry out localisation with respect to the markers from which they should begin sounding. The position of the ship given in real-time by GNSS enables the bargeman to follow the theoretical route of the transverse profile posted on the screen. The discrepancy between the ship's position and the theoretical position is displayed in real-time.

Topographical and bathymetric data collected in the software are transferred to the Lyon office where all the information on the river is grouped together. At headquarters, simulations are carried out on mathematical models in order to predict any risk of modification of waterlines.

Each year, CNR carries out maintenance operations in this way: maintenance dredging upstream of dams, dredging and taking away of materials. ■

About the author:
Hélène Leplomb is Marketing responsible for Leica Geosystems in France

Getting to the Bottom of Reservoirs

by Agnes Zeiner

In the reservoirs operated by the Austrian power company Illwerke vkw, the constant build up of sediment deposits is hampering the work of some of their divisions. Obtaining exact information on the amount and composition of sediment has therefore become very important. Using an echo-sounder, Leica GPS500 and Leica MobileMatriX, the survey crew is "getting to the bottom" of the problems in the reservoirs.

Illwerke vkw supplies power to approximately 180'000 customers, making it by far the largest power supplier in the western Austrian federal state of Vorarlberg. The company also owns about 15 reservoirs of various sizes; from ponds to large mountain lakes. "Sediment deposits in these reservoirs greatly limit power generation and endanger our economic viability", explains certified engineer Marco Ess, the supervising survey engineer.

Sediments reduce the volume available to store water: the more deposits in a reservoir, the less water it can hold, which results in less water available for power generation. Company specialists regularly excavate the sediments from the lakes, however it is crucial to reliably know the amount, extend and property of the sediments in advance.

For exact data gathering of the sediment deposits, an echo-sounding measuring system was acquired consisting of an echo-sounder Simrad EQ44, a Leica 500 GPS sensor and a Panasonic CF18 notebook on which the ArcGIS and Leica MobileMatriX software are installed. The reservoirs owned by Illwerke vkw

are measured at regular intervals – in each lake, tens of thousands of underwater points are measured, visualized and evaluated with ArcGIS, thereby calculating the volume of the sediments deposited. The locations of the sediment deposits are graphically displayed in an overview plan and a mass curve is calculated from which the useful water volume can be derived.

"The measured points are displayed in real-time in Leica MobileMatriX, thereby enabling an intelligent sequencing of the measurements and rendering costly new measurements unnecessary. This saves our crew much time and guarantees exact data gathering."

Certified Engineer Marco Ess,
Supervising Survey Engineer, Ilwerke vkw

Marco Ess explains the function of the equipment: "Through the constant synchronization between the Leica MobileMatriX software, the echo-sounder and the Leica GPS500, the depth measurements of the echo-sounder are linked to the positional coordinates of the GPS sensor and displayed in real time. In addition, the current time and location quality are saved. This not only enables intelligent sequencing of further measurements but it also saves our measuring crew a lot of time as re-measuring missing areas becomes unnecessary. The breaking edges of the original terrain or other areas important to the measurement can be displayed with MobileMatriX". ■

Live Sailing with Leica System 1200

by Matej Supej and Gregor Bilban

Matej Supej and Gregor Bilban installed a GNSS system for the live, interactive Internet braodcasting of a Match Race between two sailing yachts during the Portorož Cup in Slovenia. They describe the project for the "Reporter".

A regatta, and especially match racing, is an interesting sporting event. A real battle goes on between two opposing sailing yachts on a course. In the case of the RC 44 class – Russell Coutts 44 feet – full carbon sailing yachts make tide gybes one after another to gain centimetres that lead to winning the match race. The problem for spectators is that it is very hard to see the details from the shore or even from nearby boats. The solution of standard television broadcasting is relatively expensive to perform because cameras must be placed on the boats, on the shore, on helicopters for a bird's eye view, etc., and everything must be wirelessly connected to a studio for live broadcasting. Besides, even detailed camera shots have limitations in viewing and defining the winning position of a boat when two sailing boats are very close to each other.

Therefore, we have developed live, interactive Internet broadcasting of a match race event for the RC44 racing class – the Portorož Cup. We needed to use highly accurate and sophisticated hardware able to withstand salt water, vibrations and hard handling. Each boat and the reference station was equipped with a Leica GX1230 GG receiver. The receivers were attached to the hull of each boat to protect them against mechanical breakage. A GPS/GLONASS antenna was fixed under a plastic cover – practically the only part of the boat not made of carbon fibre that partially blocks GPS/GLONASS signals. This fixing of the antenna was also chosen so as not to disturb teams during races.

Even though such a fixation reduced the satellite signal, especially at high boat inclinations and when the full carbon sails were shielding the GPS signal, the measurements were still successful. To ensure maximum accuracy and consistency in these difficult working conditions all GNSS sensors received RTK corrections via Satelline radiomodems. A reference station was set directly on the roof of the Marina's reception in Portorož, using a Leica SmartRover.

There were also other sensors on board the sailing boats. A computer collected details of everything from wind speed and wind direction, boat inclination to course velocities. All of these were fed into a Leica GX1230 receiver via serial cable. All the data together with the position readings from our GNSS system were transmitted each second through a GSM modem to the central server as NMEA messages. Leica GS20 measured the buoys' positions on the sailing course. The positions were also sent to the central server in order to determine the "digital playfield".

The central server synchronised data from different boats and re-packed the position and other data from the sensors in a more compact and structured way. The data was then distributed over the Internet to all client applications installed on remote computers. The client application primarily checked the received data for possible errors and then showed them on a computer screen, so the spectator obtained a virtual interaction with the match race event. First, a 3D animation of the boats and the sailing course was plotted. Second, the top view with trajectories was plotted, the boat velocity and wind speed was written and a wind direction windmill was plotted.

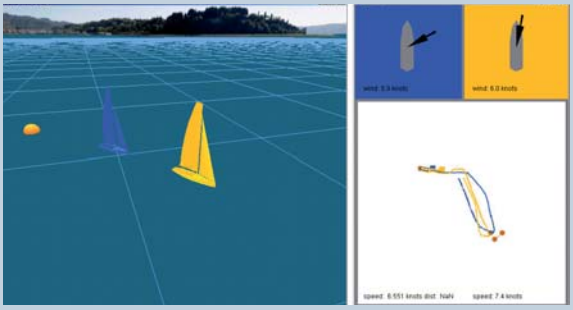
Perhaps the tracking of sailing boats does not require survey grade receivers, but it revealed that using high quality, precision hardware such as the Leica System 1200 GNSS pays off not only in functionality but also in terms of accuracy, in tracking performance in the worst possible conditions. The boats perform very fast and very tight gybes and the distances between them are often less than one metre. In such a case, inaccurate measurements would result in overlapping boat animation. The GX1230 GG was used as a central wheel that at the same time tracked satellites, received the RTK corrections, received data from other sensors and streamed all of these via a GSM to a server .

About the authors:
Ph.D. Matej Supej is an assistant professor at the University of Ljubljana, Faculty of Sport, Department of Biomechanics. His research is focused on the most precise mechanical and biological measurements and analysis in top-level sport.
Gregor Bilban is responsible for technical support for high-level instruments at Geoservis, d.o.o., a Leica Geosystems authorised distributor and certified service workshop for Slovenia.

Detailed 3D animation

At the Portorož Cup, spectators could interact with the live broadcast by being able to navigate the viewing angle, zoom in and out, etc. of the 3D animation of the race course and sailing boats. They were also able to monitor the boat speed, course, wind speed, wind direction and boat inclination in real time. This indisputably showed the spectators who had the advantage and who had a better momentary and/or overall position.

The difference between television and Internet broadcasting is that in the latter case the spectator sees the animation and several important measured parameters. Another advantage is that by active interaction with the broadcast, the spectator is able to choose between camera views, while also being able to navigate the camera angles and zoom in and out. It gives the spectator the possibility to visualize the tactics of the different teams.



Helping the Malaika Kids

by Enver Celik

The AIDS epidemic has ravaged Africa with disastrous consequences. One of the countries hit the hardest is Tanzania. So far, the epidemic has orphaned more than 2 million children. The Dutch Malaika Kids Foundation takes care of these orphans. Leica Geosystems helps.

Malaika Kids wants to yield hope and a future to as many Tanzanian orphans as possible. The Dutch relief organisation was founded by Ted Koch and his Tanzanian wife, Jamilla, three years ago. "My mother-in-law has helped orphans for more than 20 years by giving them food and offering the most vulnerable children shelter in her own house. In 2003, when two of her sisters and her brother died as a consequence of the AIDS epidemic, she took their children into her house, as a result of which there was no more room for other children. This was the turning point for us to start to dealing with the situation structurally", says Ted.

Ted and Jamilla founded the Malaika Kids Foundation in The Hague. In 2004, they rented a house that was equipped as an orphanage in Dar Es Salaam, the capital city of Tanzania with a population of 2.5 million. This offered shelter to 18 orphans. "The first step was successful, but we didn't want to leave it at that. So we have started a bigger and more ambitious plan, namely building a children's village for as many as 320 children."

Mkuranga, the Malaika Children's Village

Twenty hectares of land, south of Dar Es Salaam, were bought for only € 4'000 with much local help from the Tanzanian 'First Lady' and her organisation 'Equal Opportunities For All -Trust Fund (EOTF)' and the support of the local district commissioner. But before the development could begin, the land had to be mapped out accurately. Two surveyors came to Tanzania, sponsored by the Municipality of The Hague. They both quickly reached the conclusion that it would be almost impossible to map the whole area in the small amount of time available, due to the many trees and scrub on the terrain. The only solution: measuring from above. A platform of scaffolding was quickly erected upon which the Leica Geosystems measuring instruments could be placed. The land surveyors finally started work a little later than planned and the land was measured in detail within two weeks.

After modification of the existing design, a start could be made in preparing the site for construction. "In the first place we wanted to hire local contractors, but when they found out that the project was backed by European money they asked for absurd amounts of money", says Ted. The 'Malaika Kids' team quickly decided to deal with the project in an entirely different fashion. The design of the village was further simplified by standardising all the semi-finished products. These and all the other building supplies could now be built locally and much more cheaply. As soon as all the materials were available, a contractor was hired to start building the children's village.

Revolutionary

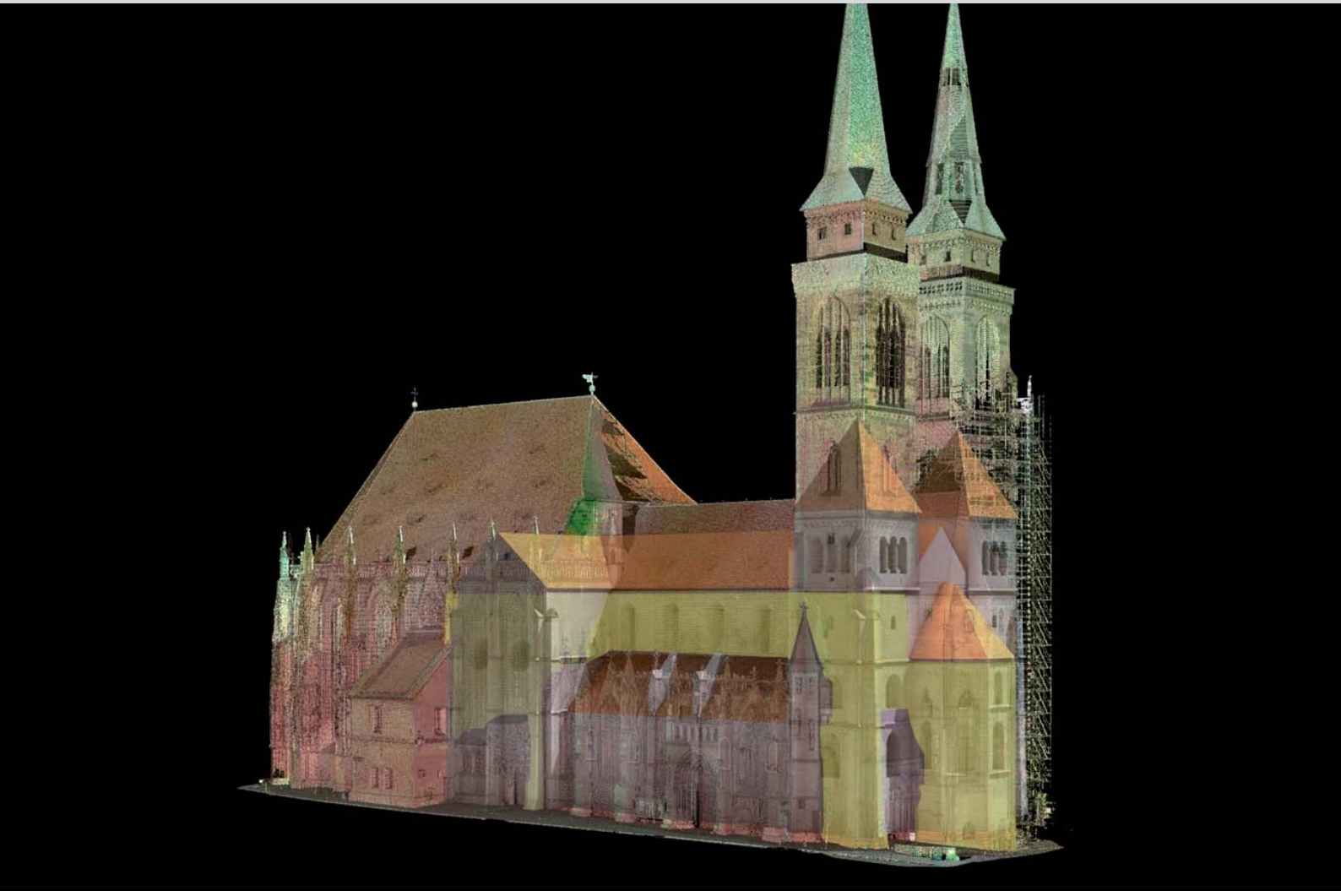
In the meantime the design of the children's village was completed and is considered 'revolutionary'. Especially the way rainwater is handled have clearly put the Malaika Children's Village on the map. The buildings will be positioned in such a fashion that the gutters of the various buildings join together to collect the rainwater, which then will be pumped to the water towers and – instead of the scarce drinking water – used for showers and washing. This design is a challenge. Ted: "Because the guttering on the various buildings has to connect, accurate alignment of the buildings is of crucial importance. We lacked good measuring equipment for this in Tanzania, so, on the explicit advice of the surveyors from The Hague, we approached Leica Geosystems and asked them to sponsor us by making a Total Station available." ■

More information: www.malaika-kids.com

Leica Geosystems & Malaika Kids

Leica Geosystems did not have to consider it for long and responded to the request from Ted Koch by supplying Malaika Kids with a high-quality Total Station. On 1 June 2007 a Leica TPS1100 Total Station (with accessories) was presented to Ted Koch by René E. Worms, Country Manager Benelux. René Worms is pleased about the collaboration between Leica Geosystems and Malaika Kids: "We are exceptionally proud to have contributed to this humanitarian project and wish Ted Koch and Malaika Kids much success with the construction of the Children's Village in Mkuranga".

As well as making a Total Station available, Leica Geosystems also financed the costs of training the land surveyors in the use of the instrument. The land surveyors from the Municipality of The Hague in turn trained local people who will then be contracted for future projects.



Memories Carved in Stone

by Agnes Zeiner

Nuremburg, the "City of the Nazi Party Rallies", was selected by the Allies as a particular target for wartime bombing missions. The Old Town quarter was destroyed in 1945 and the entire city suffered severe damages. St. Sebald's Church, which is the resting place of the bones of the founder of the city, was also affected. The church has finally been restored to its former splendour and can now be explored on-line in a 3D animation. The restoration is a testament to the commitment of the citizens of Nuremburg; the modelling owes much to Erwin Christofori, his engineering consultancy, and Leica Geosystems laser scanners.

The destruction of St. Sebald's Church at the end of the war was also a significant spiritual loss to the citizens of Nuremburg because it was the last resting place of the bones of the founder of the city, St. Sebald, who died sometime before 1070. "Town churches tell the history of their citizens. They underpin a city's identity and represent its memories, carved in stone. This applies to St. Sebald's Church, too", explains Father Gerhard Schorr.

Animated history

From the exhibition brochure "St. Sebald's Church – 50 Years of Reconstruction".

St Sebald's Church was built in the second quarter of the 13th century as a late Romantic style pillar basilica with two chancels. It had a west chancel, a three-aisle nave, a single-aisle transept and an east choir with three apses.

In the 14th century the side aisles were extended and a large hall chancel added in the east. The present layout of the church was completed with the last raising of the towers in the 15th century. The following centuries saw many extensions, changes and repairs, the most extensive being the major reconstruction between 1888 and 1906.

The Second World War soon spelled the end for St Sebald's Church. A ruin was all that was left of the once-proud building. But much of the church's artwork was already in storage before its destruction. The church took twelve years to rebuild.

Today this house of God, with its artistic treasures collected over many centuries, is an authentic architectural ensemble in which the traces of its history can be clearly read.

Complex animation

The citizens of Nuremburg have produced a further record of St. Sebald's Church; this time not in stone, but in bits and bytes. The state of the church from 1225 to 2007 is depicted in a nine-minute video animation. The complex animation was made possible by the team of consulting engineers Christofori & Partner, who are based in Rosstal near Nuremburg. "We were asked last year by the St. Sebald Church Council to carry out a 3D laser survey of the external facade of the church. The Bavarian Office for the Preservation of Historical Monuments then created the animation based on our data", explains Erwin Christofori.

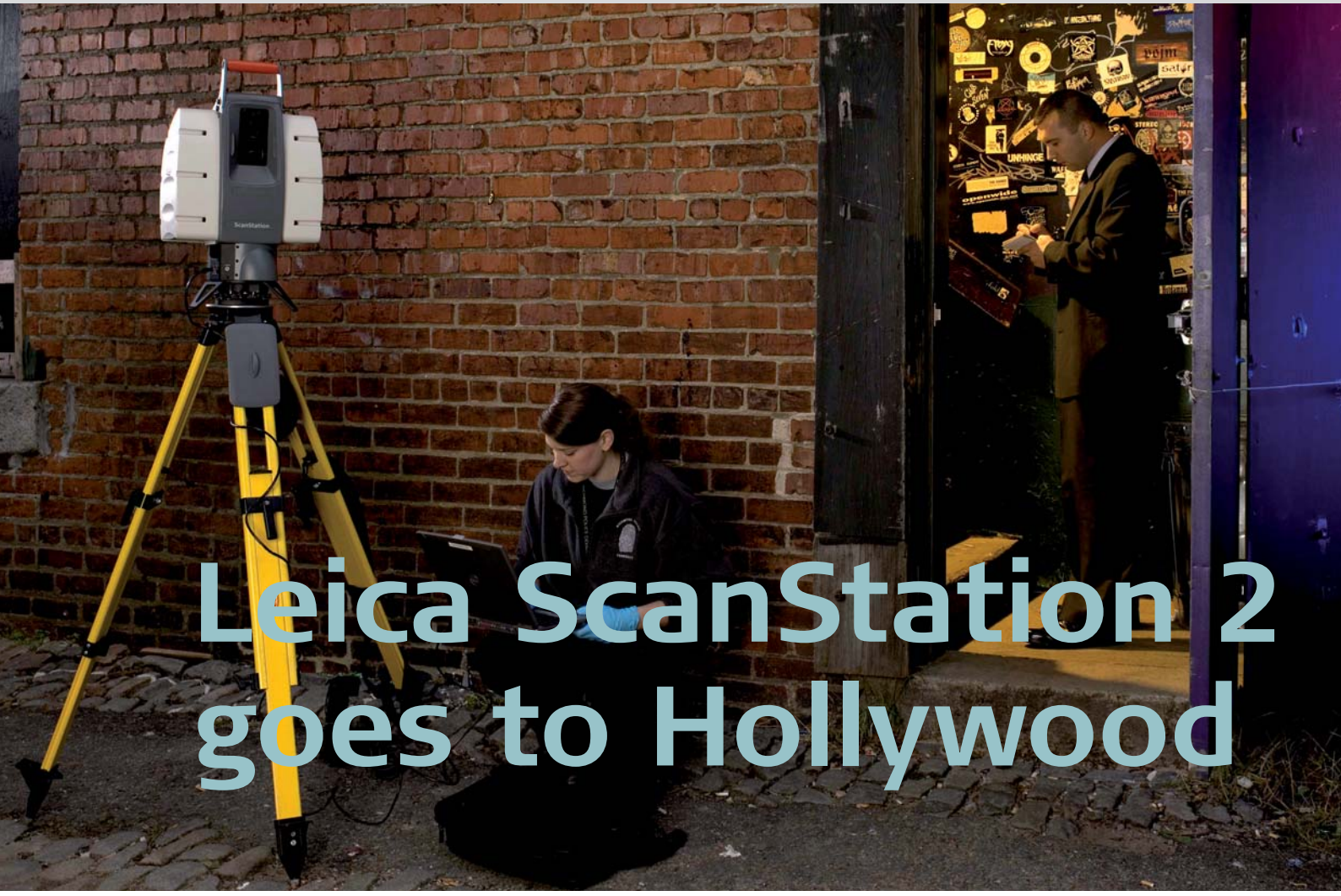
"The whole of the external facade was recorded using a Leica HDS3000 laser scanner from 20 different positions. The resulting measurements were brought together into a point cloud and formed the basis for the virtual reconstruction, which was then worked up by Robert Frank from the Bavarian Office for the Preservation of Historical Monuments with the assistance of building researchers and historians.

The reconstruction video shows the changes to the building from 1225 to today using a combination of point cloud and reconstruction model", says Christofori. The animation was revealed to the citizens of Nuremburg as part of the exhibition, "St. Sebald's Church – 50 Years of Reconstruction", in autumn of 2007.

Basis for an updated construction drawing

In a second phase – after the end of the exhibition – the whole of the interior of the church was captured and fully recorded using a Leica HDS6000 laser scanner and an external camera system. Erwin Christofori: "The results of the survey are to be used over the longer term to produce a drawing of the actual existing state of the church, fully correct in terms of shape and masonry detail."

The results of the work – the video animation and photographs produced during the survey – were used in the Heritage Network "CyArk" project. They can be seen on the project website at *www.cyark.org*.



Leica ScanStation 2 goes to Hollywood

by Andre Ribeiro, Picture courtesy of AETN

The new Leica ScanStation 2, a state-of-the-art forensic 3D laser scanner which enables investigators to remotely measure, model and diagram crime scenes with amazing detail, is prominently featured in the A&E Real-Life TV series, "Crime 360" in the USA.

"Crime 360," airing weekly on Thursdays at 10 PM on A&E, takes viewers inside actual investigations as they unfold using advanced cutting edge forensic technology including the Leica ScanStation 2.

The Leica ScanStation 2 makes millions of 3D measurements in just minutes, and by doing so preserves the crime scene exactly the way in which the first responder found it, forever. Long after the scene has been forensically examined and released, investigators can return to the scene of the crime virtually to make additional measurements or to verify what witnesses could have seen based upon the accurately mapped physical environment. The data can also be used to create compelling jury exhibits and animations, which enable jurors to easily understand the layout of a crime scene. The technology has been adopted by leading law enforcement agencies such as the California Highway Patrol, the Albuquerque Police Department and the Los Angeles County Sheriff's Department.

"Through 'Crime 360' a much broader audience will come to understand the value of Leica Geosystems 3D laser scanning as an investigative tool for homicides, officer involved shootings, crash investigations and even the prevention and protection against terrorism" said Tony Grissim, Forensic Account Manager for Leica Geosystems. "Leica Geosystems recently launched its forensic and public safety web site and the response from the law enforcement community has been tremendous."

More information about the use of 3D laser scanning in forensic analysis: www.leica-geosystems.us/forensic

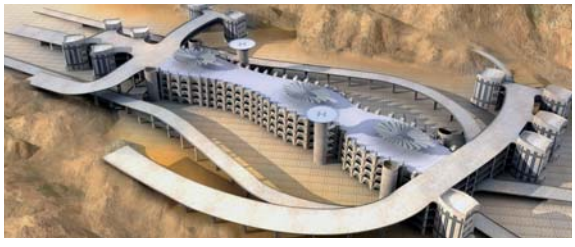
News »

Highest appreciation: GNSS Network, Bahrain

His Excellency Sheik Salman Bin Abdullah Bin Hamad Al Khalifa, Head of the Survey and Land Registration Bureau in the Kingdom of Bahrain, met Mr. Boguslaw Swiatkiewicz, Leica Geosystems Sales Manager for the Middle East. Leica Geosystems recently delivered and installed a Permanent Reference Station Network (PRN) in the Kingdom of Bahrain (see Reporter 57). His Excellency emphasized the importance of this project for the improvement of the surveying and mapping infrastructure in Bahrain. The meeting was also attended by Mr. Naji Sabt, Director-General of Survey, and Mr. Waheed Hadi, Director of Topographic Survey Directorate.

Jamarat Bridge at Mekkah to be built with Leica Geosystems Technology

The Saudi Binladen Group, the major building-construction group in the Middle East, which has been using Leica Geosystems instruments for many years, is now engaged in building the multi-tier Jamarat Bridge at Mekkah Al Mukarrema in the Kingdom of Saudi Arabia. They are using Leica Geosystems' latest and highly advanced Total Stations, Leica TCR1201 and Leica TCRA1201. The pedestrian bridge plays an important role in the Muslim religion and is used by up to a million pilgrims per month.



Virtual Wrench™ wins FinOvation Award

The agriculture industry's first remote service support and diagnostic tool, Leica Geosystems' Virtual Wrench™, won a FinOvation Award from Farm Industry News magazine. The FinOvation Award recognizes the most innovative new products published in Farm Industry News during the past year. Leica Geosystems launched the award-winning mojoRTK and Virtual Wrench™ service last September in North America revolutionizing RTK technology for the agriculture market.

More information: www.mojoRTK.com.

finOvation!
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Geomatics Center of Excellence in Houston, Texas

The Leica Geosystems "Geomatics Center of Excellence" opened to much excitement and high expectations from the local surveying and engineering community at the end of 2007. This 4'000 square foot, modern high-tech facility located in Houston, Texas, offers sales, support, and service for all Leica Geosystems surveying and High-Definition Surveying (HDS) products as well as for reference station network infrastructure. Bill Beam, Plant Sales Executive for the Western U.S. for Leica Geosystems, says, "Through the Center, we have a unique opportunity to work hand in hand with surveyors and engineers in Texas and surrounding states."

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