Reporter 70

The **Global Magazine** of Leica Geosystems

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Leica Geosystems

Editorial

Dear Readers,

Our growing population and our constant demand for mobility create needs that are challenging to sustain. The world is rapidly changing and placing increasing strains on our resources. We all have a responsibility to the future and need to minimise our impact on the environment by developing greener energy sources and yet still meet the growing needs of today's world. Resources need to be competently managed; information received instantly and decisions made faster and here, geodata plays an important role. Access to accurate geodata helps us to decide how to plan, implement and allocate our resources. It helps us to move forward, quickly and react to global change properly.

In this issue of the Reporter, you'll read about how our customers are actively contributing to manage change on our planet. By extending a transportation system to reduce CO_2 emissions and quickly responding to a growing city's need for mobility; by capturing and analysing the highest peak of Europe to understand its change; by recording the erosion of sandbanks to preserve Brazil's coastline and by efficiently setting up solar panels in France to capture the sun's renewable energy.

Hexagon, our parent company, now has the perfect opportunity for you to exchange your stories and geospatial challenges. On the back pages of this issue you can read about how to become a Thought Leader by sharing your ideas and proactively working towards positive solutions to our global changes.

I hope you enjoying reading this edition.

Juergen Dold
CEO Leica Geosystems

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JFK: New light on a tragedy

by Christine L. Grahl

The assassination of President John F. Kennedy on November 22, 1963, was a tragic event in American history. Many questions still linger about the young president's death, even though more than 50 years have passed. What really happened in Dealey Plaza in downtown Dallas, Texas that day? Did Lee Harvey Oswald fire the bullet from the sixth floor of the former Texas School Book Depository (TSBD) alone, or did a second gunman fire a shot from the "grassy knoll", a small sloping hill inside Dealey Plaza? For the first time ever, modern technology has been applied to investigate the Warren Commission's conclusion of where the fateful shot originated. The Leica ScanStation P20 plays a valuable role in a new, state-of-the-art shooting reconstruction and helps forensic specialists resolve some of the mystery.

Most people still believe conspiracy is behind the death of the president and are convinced it wasn't the work of just one man. Can modern ballistics and technology prove this wrong? What happened that day 50 years ago in Dealey Plaza? With the help of Leica Geosystems' ScanStation P20, ballistic experts Michael and Luke Haag set out to determine if the "single bullet theory" was possible in "Cold Case JFK", part of a special Nova series presented by PBS.

The former Texas School Book Depository, where the rifle was fired. In the foreground, the Leica ScanStation P20.

The rifle and the bullet

"Creating an accurate 3D laser representation of the crime scene using the Leica ScanStation P20 made documenting the precise location of the gun as well as the primary point of bullet impact possible. Using the Leica Cyclone software for bullet path reconstruction, we recreated a line segment for the original trajectory and any secondary trajectories," says Michael Haag. For the Nova documentary, Michael Haag and Tony Grissim of Leica Geosystems, a technical advisor for the Firearms and Tool Mark Examiners, collected laser scan data to create an entire 3D representation of Dealey Plaza and of the sixth floor of the TSBD. This representation, along with Doppler radar and high speed videography, provided accurate information that was previously unavailable to investigators.

"When I want to look at a new conspiracy theory about what happened, I don't have to go back to the scene; I can just go to my computer and start clicking on scan data to look at distances and angles, and compare those points and angles to what I know occurred ballistically," Michael says.

The Haags also recreated materials similar to the density and resistance of human muscle tissue to test the bullet's impact and exit velocity, and to test its strength and stability. Could it pass through two people, a car seat and bone material and remain intact? The 3D laser maps were analysed with the tests made to this recreated material using the same type of bullets and rifle used in the shooting. This newly acquired data plus the now public documents and evidence that was hidden for the last 50 years

Collecting data from the sixth floor window where the bullets were fired.

Single bullet theory

The "single bullet theory" advocates that one and the same bullet hit and passed through the president and also Texas Governor Connally's torso, shattering his wrist and landing in his thigh, and yet remained undamaged. Luke Haag, forensics scientist specialising in ballistics and his son, Michael Haag, senior forensic scientist with the Albuquerque Police Dept., worked for nearly two years researching and recreating the assassination to determine whether this was possible.

Critics have argued the unlikelihood of this theory, claiming that one man could not possibly have had the time to load and remove a cartridge, aim and fire three shots within approximately six seconds with the Carcano sniper that was found on the sixth floor of the Texas School Book Depository. The first shot was fired and missed, but shots two and three, the non-fatal bullet that went through JFK and Connally and the bullet that hit Kennedy in his head, are the controversial ones. The Haag team set out to prove once and for all whether these two bullets hitting the president could have been shot from the depository within six seconds and whether just one bullet could actually do so much destruction to two people and remain relatively undamaged.

helped Michael and Luke Haag to prove that the "single bullet theory" could have been reality. It was possible to load, aim and fire two bullets within these few seconds and destroy so much. Luke Haag says, "It's a very clear picture. There was plenty of time to shoot all three shots from when the car turned the corner into Elm. We tried replicating it ourselves and could do so many times. We ruled out the conspiracy hypothesis, the shots from the grassy knoll ... two shooters."

Michael Haag has been using 3D scanning technology from Leica Geosystems for nearly a decade to reconstruct shooting incidents. His experience provides key insights on why an increasing number of law enforcement agencies and crime scene investigators have begun to rely on this valuable tool. "It's a way of documenting crimes scene more thoroughly, more completely than we have ever had the capability to do," says Michael. "We can re-examine the cases from our computers as new hypotheses appear, over and over, from new angles with new measurements, calculations – it's all right there. As a forensics scientist you try to rule out hypotheses, not go into it with the idea that you want to prove something. Physical evidence always supports the truth of the matter."

For more information about this investigation and other forensics applications of laser scanning, visit the Leica Geosystems Ready Room at http://psg.leica-geosystems.us/ready-room.

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Watch the exciting documentary "Cold Case JFK" produced by PBS:
http://www.leica-geosystems.com/jfk_video

Earthworks: Doing more with less

by Konrad Saal

The wheel loader is probably the most commonly used machine in the construction industry today. Because of its flexibility and high load capacity, the wheel loader is the preferred construction machine for many cost-efficient tasks. It is used for material handling, digging, loading and transportation, road construction and site preparation. For his local infrastructure project, Swedish contractor Ytterviks Maskin AB was able to take full advantage of all the benefits a wheel loader has to offer by utilising the new Leica iCON grade for wheel loaders machine control system. With the help of this innovative system, the company was now able to complete the job faster and properly from the very beginning.

In late September, Wheel Loader Operator, Joakim Ostensson, added the final touches to pedestrian and cycle paths near Skellefteå using his brand new Volvo L60G wheel loader, which is equipped with Leica iCON grade for wheel loaders, the machine control solution with dual GNSS from Leica Geosystems. Using this system, Ostensson was able to perform both rough grading and also add highly precise, finishing touches, even with challenging materials on soft and rough terrain. Wheel loaders are faster than dozers, are especially mobile and do not damage paved surfaces. With the Leica iCON 3D machine control system, Ostensson could perform these tasks at high speed and also quickly accomplish control measurements for as-built records with centimetre precision. Says Ostersson, "This system gives me exactly the information I need to work effectively and independently with confidence, so I can get it right, the very first time, every time!"

Saving time, material and fuel while increasing safety

With the new 3D machine control system, Ytterviks Maskin AB saved time and material by excavating exactly what was planned, thereby also saving expensive fuel of a minimum of 35%. Ostensson adds "It works really great. A great advantage for me is getting rid of all the staking out. No pegs, no stakes and no batter boards sticking out of the ground all over the site." He knows that these are often run over by machines and people, after which he can no longer rely on their positions or heights. In addition, the fact that there are hardly any people in the working area makes his work place even safer.

Another important benefit for Ostensson is time: "I save a lot of time with the iCON grade system, because there is hardly any machine downtime caused by stake out or height level checking tasks. I already know what needs to be done on the project since I have all the data with me in the cab. My work flows smoothly for me now."

Ostensson could perform precise, finishing touches to projects using the iCON grade for wheel loaders.

Easy control in the cab

Design information and real-time cut & fill indications are displayed on the control panel in the cab where Ostensson has the full picture of what the project looks like. The panel's user interface with graphical colour display provides full guidance and allows easy operation. Leica Geosystems' 3D machine control system for wheel loaders uses modern GNSS technology for accurate positioning and earthmoving results. The dual GPS solution provides Joakim Ostensson with the real-time position of the bucket, allowing him to simultaneously make adjustments to keep the level of material where it needs to be.

Unique PowerSnap to switch panels between machines

Joakim Ostensson's new machine control system features the unique patented PowerSnap functionality, which enables a quick and easy exchange of control panels between machines at Ytterviks Maskin AB. Leica iCON also supports Leica iCON telematics, which enables users to easily transfer data from office to machines, receive remote support and utilise basic fleet management via the iCONnect website.

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Watch a short video about this project:
http://www.leica-geosystems.com/wheelloader_video

Scanning the top of Europe

by Marie-Caroline Rondeau

Reaching the top of Mont Blanc, Europe's highest peak, is a formidable challenge even to the most experienced alpinists – not only because of its elevation, but also because of its severe weather conditions. Strong winds and snowfall at the summit constantly cause altitude and volume fluctuations to the mountain's ice cap. This motivated a team of expert surveyors to take on the mountain's challenge and every two years, determine the actual variations of the ice cap using the latest in measurement technology. This year a team consisting of two surveyors from Leica Geosystems France and the Chartered Land Surveyors, based in France's Upper Savoy region, decided to make the first ever 3D laser scan of the shape and volume of this legendary glacier using the Leica Nova MS50 MultiStation.

The team of 14 climbers included the surveyors and their technical partners: Covadis (Géomédia), Teria (Exagone) and Leica Geosystems. They were accompanied by guides, a photographer and a cameraman. Leica Geosystems, responsible for measuring the elevation and shape of the ice cap of Mont Blanc, was represented by Farouk Kadded, Product Manager at LGS France, an experienced alpinist and who founded the partnership that was formed with the surveyors from the Upper Savoy region. Farouk has taken part in the expedition since 2001 and explained why 2013 offered an opportunity to add a new technical dimension to the adventure.

Farouk says, "It seemed altogether appropriate to use the world's first MultiStation, the Leica Nova MS50, to capture the first ever 3D laser scan of the Mont Blanc ice cap. This would save time and provide higher point density than GPS measurements, which we took in previous years. With such extreme

temperatures and with wind chill factors of – 10°C (14°F), fast data collection is a real bonus. For the first time, we had at our disposal an instrument that not only combines the latest technologies in the fields of total station measurements, digital imagery, 3D laser scanning and GNSS positioning but is also designed to operate in extreme conditions. Our only consideration was the additional weight. Transporting the instrument to the summit added about seven kilograms to my backpack but the results were certainly worth it."

Measurement ambassadors

After taking a deep breath and appreciating the extraordinary view, the team had little time to lose. The temperature felt like – 25°C (– 13°F), with gusting winds of over 50 km/h (31 mph). In order to make a 3D laser scan of the ice cap, they had to quickly prepare and set up the Leica Nova MS50 MultiStation as well as two Leica Viva GS14 receivers: one for taking precise altitude measurements that would later be analysed during post-processing and one receiver on a pole for taking kinematic measurements.

After setting up the first GNSS antenna for two hours of observation, the surveyors got started with the second antenna that would take approximately one hundred measurements of the ice cap. At the same time, Farouk, in charge of the MultiStation, positioned it to scan the ice cap. Minutes later, it recorded almost 100,000 points, despite freezing conditions, which were immediately displayed on the MultiStation's screen. This confirmed that the survey was complete and the team could begin their descent.

Philippe Borrel, owner of the survey company, Cabinet Borrel and an experienced member of the expedition team, said, "Using the Nova MS50 MultiStation to model the Mont Blanc summit was an exercise in

Farouk Kadded, carrying the Leica Nova MS50 MultiStation in his backpack, makes his way through a glacial well.

precision measurement, resulting in greater accuracy than traditional topographic surveys. The speed of the data collection and being able to use a minimum number of control points is particularly advantageous when working in such a hostile environment. We significantly cut back the amount of time and energy needed to get the job done and the MultiStation's size and weight made it surprisingly easy to carry in a backpack, considering the rocky terrain, steep slopes and windy ridges we had to climb."

What were the exact measurements of Mont Blanc?

The 2013 expedition proved that the current elevation of Mont Blanc is 4,810.02 m (15,780.91 ft), which is 42 cm (16.5 in) less than in 2011. The actual rock summit has an altitude of 4,792 m (15,722 ft), however the snow covering the peak may vary the actual summit's altitude anywhere from 15 to 20 m (49 to 66 ft). Expedition partner Géomédia calculated the volume of the ice cap covering the rocky summit at 20,213 m³ (26,438 yd³) and produced a 3D animation from the scan data as well. In the future, these results will help researchers determine possible changes to the ice cap caused by global warming.

Year	Altitude measured		Snow volume over 4,800 m / 15,748 ft	
	m	ft	m³	yd³
2013	4,810.02	15,780.91	20,213	26,438
2011	4,810.44	15,782.28	21,281	27,835
2009	4,810.45	15,782.32	21,626	28,286
2007	4,810.90	15,783.79	24,062	31,472
2005	4,808.75	15,776.74	14,248	18,636
2003	4,808.45	15,775.75	14,598	19,094
2001	4,810.40	15,782.15	Not measured	

Farouk Kadded noted, "The MultiStation added a new dimension to the measurement campaign enabling us

Setting up the MS50 MultiStation on the top of Mont Blanc.

to produce, for the first time, a precise 3D model of the ice cap of Mont Blanc. Collecting data to millimetre accuracy is a human and technical achievement and this campaign demonstrated that this technology is at the top of its game."

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Watch the short film on this exciting expedition:
http://www.leica-geosystems.com/montblanc_video

Leica Viva CS15 controller and Viva GS14 GNSS receiver.

Optimising gold production

by Nicolette Tapper

African Barrick Gold's (ABG) North Mara mine is a high-grade open pit gold mine located in northeast Tanzania. The life-of-mine for North Mara is estimated to be around ten years. The economy and the shareholders are demanding smarter mining solutions that increase productivity and reduce required resources. The North Mara processing plant has the potential to process an average of 8,000 tons (8,818 tn.sh.) of ore per day. In response to the current climate, ABG has gained significant benefits by adopting the Leica Jigsaw Mine Management Solution.

In September 2010, ABG North Mara operations implemented the Leica Jigsaw Mine Management Solution to 70% of their production fleet. The results obtained after the implementation surpassed expectations and was the justification needed to install the solution on the entire production fleet. In 2012, Leica Jigsaw was successfully installed across all three open pit deposits. The primary goal of adopting this solution was to improve time management, increase production, and reduce costs.

Improved time management

The scale and size of the mine site presented several challenges: production at North Mara spans across

several large pits separated by a distance of 15 km (9 mi). Supervisors couldn't be present to constantly monitor all fleet-related activities in all the pits.

After using Leica Jigsaw for the first time, the average truck and shovel cycle time was significantly reduced by a third. As North Mara produces 2,000 tons (2,205 tn. sh.) per hour, using the Leica Jigsaw Solution added approximately 450 tons (496 tn. sh.) of additional output per day. The tools used to complete this analysis satisfied one of the major goals of North Mara dispatch supervisors: to be able to produce up-to-the-minute end-of-shift reports and loading details.

Increased production

Within six months of starting with the Leica Jigsaw Mine Management Solution, North Mara mine reported a marked improvement in equipment usage and efficiency. Isaac Yiadom, Fleet Management Supervisor at ABG North Mara Mine said "we had an illusion or rule of thumb, that if we could increase our equipment usage, then production would also be increased by about four times that amount, and this has been accomplished just by improving time management alone". ABG uses a variety of the tools available within the Leica Jigsaw Solution, including Joptimizer.

Before using Leica Jigsaw, supervisors would appoint assignments to truck operators without any concern for what would happen after they unloaded material at the dumping location. Trucks would go to their respective dumping locations and return to where they originally loaded the truck.

Now, when using the Leica Joptimizer module, trucks dump loads at the dumping location, then they receive new assignments leading them to alternate loading units with shorter distances, making the assignment routes shorter and more efficient than previously. By using Joptimizer, only 13 trucks were needed to accomplish assignments, compared to 15 trucks that were necessary to complete the isolated circuits – saving time and increasing overall productivity.

Before North Mara mine could benefit from using the Joptimizer module, it was important for the mine to understand the different variables that affect

production, configure the system to take these variables into account and assign vehicles to circuits according to the results taken from the Joptimizer system.

Reduced costs

Initially, consultants were used to create the North Mara mine design and to recommend routes to and from each location. In one project, the consultants relocated a stockpile with an estimated one million tons of sensitive material to a more adequate location. The original route assigned to move the material was labelled 'Old Route'. After implementing Leica Jigsaw, North Mara mining engineers ran a simulation using the Leica Joptimizer tools. The findings presented the 'Proposed New Route', as the shortest path that yielded the best output.

Operators began using the 'Old Route' and recorded an average travel time between points A and B as almost 21 minutes. After using the Joptimizer's 'Proposed New Route', the average travel time between A and B was reduced by a third. Using the optimised route resulted in increased truck productivity and has significantly increased output tons.

"We aimed for moving about 40,000 tons (44,092 tn. sh.) per shift, by improving on the road network and identifying the shortest routes, thus improving productivity. We moved 925,000 tons (1,019,637 tn. sh.) in 18 days instead of the 25 days that were originally planned. This means that equipment that was scheduled to work for 25 days can now do something else for seven days. These seven days are a big cost savings in terms of equipment," said Issac Yiadom.

Operating a dump truck at North Mara mine costs about $ 236 USD per hour, and the cost of operating a Terex 170 shovel is $ 814 per hour. If the project took the full 25 days, $ 965,345 would have been spent to move material from points A to B. By using the Leica Jigsaw, and specifically the Joptimizer, ABG saved time, and the operating cost of moving the material was reduced to $ 663,068 – a saving of approximately $ 300,000. ■

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■ **After using the proposed routes from Joptimizer, dump trucks reduced travel time by a third.**

Fast and accurate asset mapping on the go

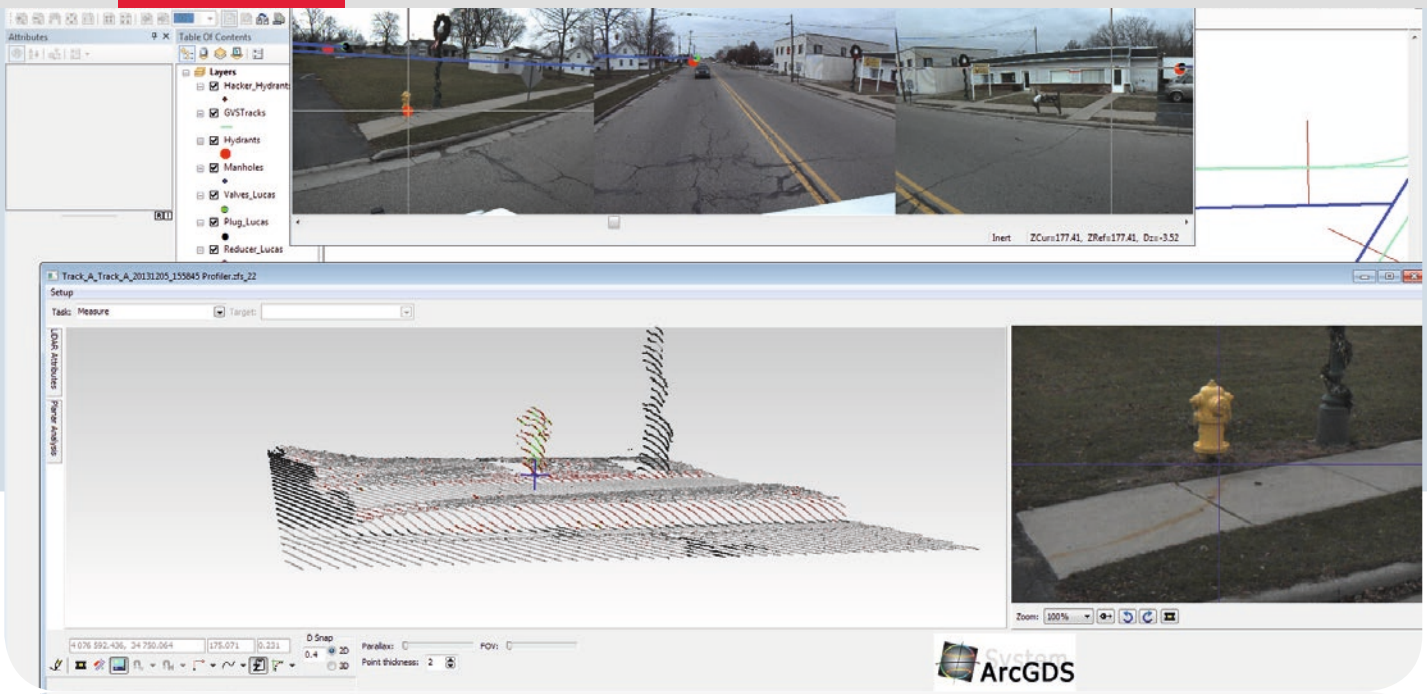
by Christine L. Grahl

Widespread collection of water assets has traditionally been difficult and dangerous, with unreliable results. The newest generation of mobile mapping is changing that. Monroe County (MI, USA) Drain Commissioner David Thompson has managed a number of water asset collection projects in his 20 years of experience in the Drain Commissioner's Office. One aspect that has always bothered him is safety; many water assets are located in or near busy roadways, making field workers vulnerable.

"A typical project requires multiple crews working near vehicle traffic for extended periods of time," says David Thompson "It's dangerous and expensive." In 2013, the county embarked on a project to create a GIS base map of the entire South County Water System, which consists of approximately 220 miles of water mains. The project would be handled by Spicer Group Inc., the county's engineering services firm based in Michigan.

The beginning with LiDAR

In 2008, the firm purchased a Leica HDS3000 and has been providing laser scanning services ever since. Spicer Group has since upgraded and now uses a Leica ScanStation P20 for scanning highways, bridges, industrial plants and confined spaces. By 2012, the firm had begun investing in mobile mapping capabilities by acquiring new software and by training staff to allow the firm to process mobile mapping datasets, and in September 2013, the company purchased its own mapping platform, a Leica Pegasus:One. The compact, highly flexible mobile



The ArcGDS interface used within ArcGIS simplifies the identification and extraction of features.

mapping solution provides full 360 degree coverage at 2 cm absolute accuracy with low noise levels while driving at posted roadway speeds, while also combining imagery and accurate, easy to manage LiDAR data into one GIS-enabled platform.

Capturing assets faster with Mobile Mapping

Eric S. Barden, PS, geospatial lead and partner at Spicer Group, saw mobile mapping with the Leica Pegasus:One as the ideal way to collect assets for the South County Water System geodatabase. "This solution enables us to quickly capture all assets of interest for the initial pass when making our base map. At the same time, we can also capture survey-grade data on the entire network that could be used to support future engineering projects without mobilizing survey crews," Barden says. "The ability to access Esri ArcGIS desktop directly through the Pegasus:One software also allows us to give the South County Water System the actual dataset, which they could then use within the Esri platform to view the data and mine additional assets. Even more importantly, mobile mapping would keep survey crews out of harm's way."

These benefits were enough to convince Thompson. "With mobile mapping, the crews would be safer and could work faster," he says. "I didn't see any downside."

A quick turnaround

Southeast Michigan averages 75 to 100 cm (30 to 40 in) of snowfall each year. With the South County Water System project beginning in late November, Spicer Group knew they would have to work quickly to collect all of the assets before they were hidden by snow.

On the first day, the crew collected billions of points of data on 145 kilometres (90 miles) of the system. "That was really impressive," Thompson says. "Previously, covering that much ground would have taken several weeks and would have required a lot of people out in traffic. It was a significant improvement in safety and efficiency."

High speed data processing

Collecting the assets over the entire network took just under four days. But the real benefit was in the processing of the data. Traditionally, one day of mobile mapping data collection could require as much as six or seven days of processing in the office. With the Leica Pegasus:One, Spicer Group was experiencing a one-to-one ratio of field and office time. "Spicer Group has done a tremendous job of efficiently implementing the Leica Pegasus:One mobile mapping solution into their project workflow," says Bradley Adams, Leica Geosystems' mobile mapping manager. "They progressed from purchase through training and profitable projects in less than a month, which is proof in itself of their internal resources and also of the intuitiveness and ease-of-use of the Pegasus solution."

An improvement in the software allowing configurable multi-core use shortly after Spicer Group purchased the system enabled the firm to colourise

Water lines, hydrants and valves inside a small community in the South County Water System.

the LiDAR data within the same one-to-one time frame. "It's incredible," says Barden. "Eight hours of data can be processed and colourised in less than eight hours of time. We were able to turn this project around much faster than the client anticipated."

Adding value with data

By January 2014, Spicer Group had extracted more than 4,000 water assets from the dataset and added them to an Esri geodatabase. When they presented the data to the South County Water System board, officials immediately recognised the value. "They saw uses for the data that we never even thought of," says Spicer Group Project Manager Phil Westmoreland.

For example, providing the data to the local fire department through a free Google Street View style interface will make it easier for the department to locate hydrants near a fire and relay that information to the field. "It's really about having easy access to valuable information," Westmoreland says. "The more people you get involved from the community or from a water authority like that, the more valuable the data becomes. Their eyes light up as they start thinking about what they do every day and how they could apply the data."

Unlike 2D paper maps that quickly become outdated, the South County Water System's 3D geodatabase will be a living map that will continue to grow and add value over time as more information is added.

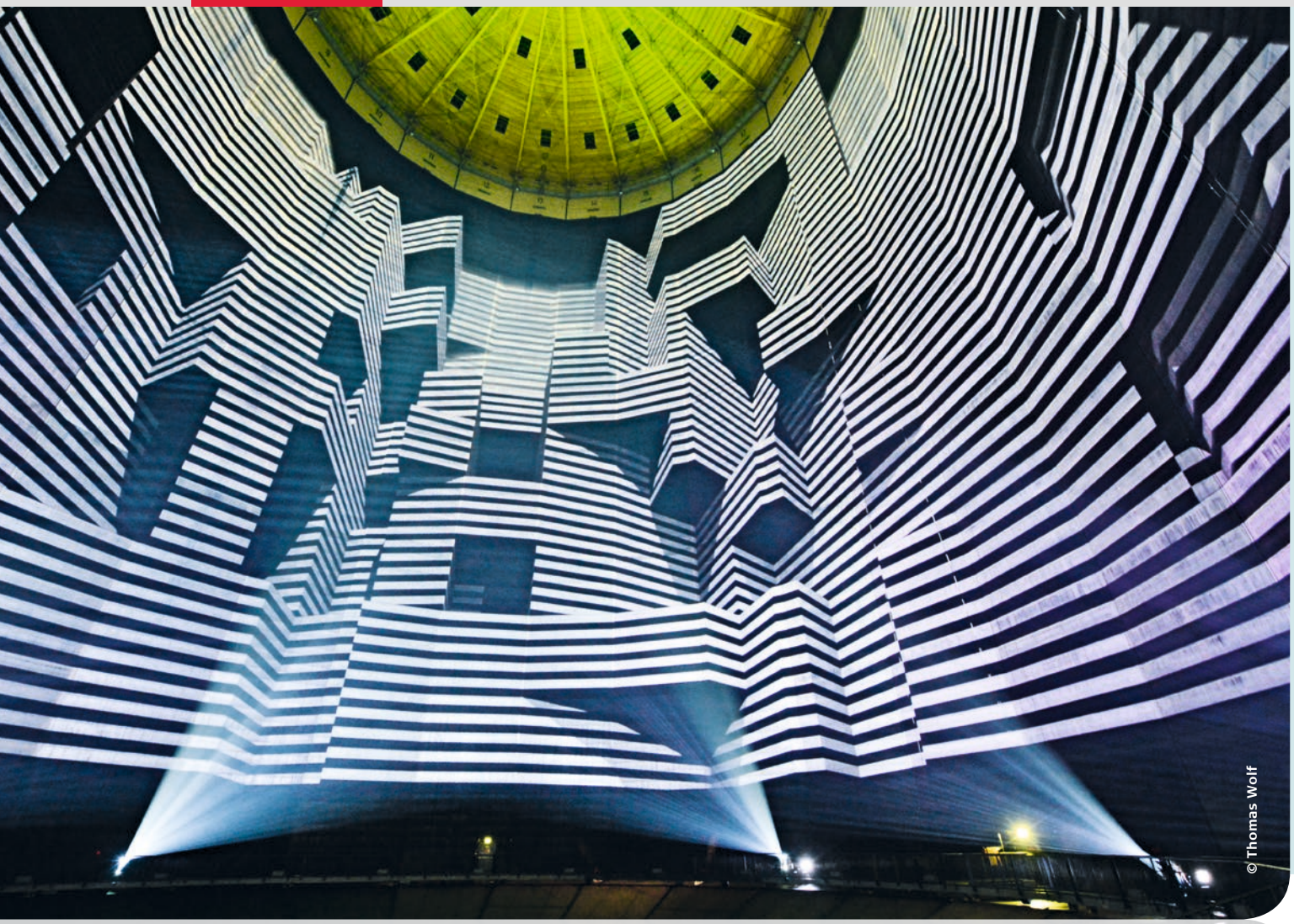
"Adopting mobile mapping and having this dataset really puts them ahead of the game," Westmoreland says. "It allows them to showcase what's possible." It also provides an example of how the expectations of municipalities are changing as technology empowers them to improve efficiency and safety.

"This project has changed my outlook on how asset collection should be accomplished," says Thompson. "Ultimately, we have to move forward with technology and be innovative. We have to be efficient and cost-effective so we can make the best use of taxpayer resources. Mobile mapping is one way to do that." ■

Related: Listen to the podcast interview with Eric Barden at www.hxgnnews.com.

For more information about Spicer Group Inc., visit www.spicergroup.com.

Find out why the Spicer Group decided on Pegasus:One:
http://www.leica-geosystems.com/spicer_video



Magic or deceptively real?

by Roland Herr

Optical effects shimmer deceptively over the surface of a large building, which appears to move. Suddenly, the lines break, and new geometric shapes arise. The building wavers, without budging. The optical illusions are supported with acoustics, in order to further blur the lines between the real and virtual worlds. The artists at Urbanscreen create media installations, which bring the viewers to the very edge of their perceptive abilities. Leica Geosystems' 3D laser scanner makes these feats possible.

The 10 person team at Urbanscreen is at home surrounded by computers and brainstorming tables in the chilly northern German city of Bremen. But when Thorsten Bauer, the young company's creative director and co-founder, discusses beginnings, projects, and visions, there's a fire in his eyes. In 2005, the founders dared to take the first step, and today they have executed close to 50 of these spectacular media installations around the world. "We create and develop media installations that involve a highly technical play of optics and acoustics," Bauer explains. "This is only made possible thanks to 'Projection Mapping', which allows high-quality, custom projection onto

The Leica ScanStation P20 positioned in the gasometer ready to scan.

the objects in question. The technology itself is not so new at all, but there has been a lot of development in the field of realistic 3D mapping with laser scanners, and this has opened the door to countless possibilities."

Bauer's team is made up of both artists and technicians. Architects, media artists and designers are just as involved in the technical production of the images as media technicians are responsible for their implementation. The core of each project lies in the correct production of the images, and the precise production techniques. This is only possible through an absolutely perfect measurement of the situation at hand.

At first, the team used a portable laser by Leica Geosystems, but as the projects became more and more complex, the tool became limiting. Its measurements were too complicated and not precise enough for the media specialists' demands. After taking down measurements with the portable laser, photos had to be taken, from which the measurements could be modelled. A sophisticated, secure system had to be found, so the resourceful artist researched four laser scanner companies, including Leica Geosystems. It was clear to him from his very first discussions with the technicians that Leica Geosystems' laser scanners were the right fit, and that the "chemistry" was right too.

In 2012, four productions went live on four different continents. The use and implementation of the Leica ScanStation P20 is easy. "We take the laser scanner out, set up the equipment, and all we have to focus on is entering the location data. This is a tremendous advantage for us, since we can work much more creatively and innovatively with excellent data," Bauer explained on site.

While the set up can be described in fairly few words, the actual execution of each project is far more complicated and elaborate. In most cases, Urbanscreen is asked to come up with a media installation. That

The Gasometer Oberhausen installation "320° Licht" is open until December 30, 2014.

was the case with the 110 meter (547 feet) high gasometer in Oberhausen/Germany, which offers its space to different artists every eight months. During the laser scan, preliminary ideas and sketches for the presentation are developed on site. These ideas are then brought back to Bremen, where the collected data is used to develop a concrete concept. Since the middle of April – and scheduled to continue until the end of December 2014 – Urbanscreen's "320° Licht" project has blurred the boundaries between real and virtual rooms in the gasometer, with a fascinating interplay of shapes and light. Spherical sounds in the background dazzle the viewers' senses.

For the technical execution of the installation, it is especially important for the images being generated

CAD Modelling

The buildings are scanned to generate huge amounts of data in a point cloud. This information can be fed into different CAD and modelling software, like AutoCAD, MicroStation, 3ds Max and manipulated from there. Then, specialists "build" the entire building in their computers. For art installations, enormous amounts of data are required. A good 3D model needs to generate a work plan for calculating the different derivations of different requirements. "Each aspect of the building can be shrunk or expanded, angles and corners can be transformed, and we can create new geometries or illusions of space," Thorsten Bauer explains of the development of an installation. This realistic, computerised re-creation of the building is the basis for the artistic modelling, and thus for the link between the real and virtual worlds.

How does it work?

Leica Geosystems' ScanStation P20 produces highly precise 3D point clouds, which are made up of several million individual dots. These dots recreate reality with an unbelievable level of detail. They are then manipulated using software like 3ds Max, using Leica CloudWorx, in order to create a three dimensional surface model. This model serves as a virtual projection screen, and as the basis for perfectly distorted images, animations, and videos.

The 3D laser scans also have the unique additional effect of incorporating all the surroundings, and of recreating potentially distracting elements like lamps or trees. These might be in the way, but this data is useful for finding the perfect positions for the projectors.

and manipulated on the computer to perfectly reflect reality. In the cylindrical Oberhausen gasometer, 21 large, high-performance projectors were placed in precisely designated positions around a platform, which was roughly the height of a third storey building. Viewers could then stand on this platform to admire the projection on a 20,000 m² (23,920 yd²) section of the interior wall and ceiling of the approximately 110 m (547 ft) high, 24 corner cylinder.

Bauer is fascinated by the possibilities of the Leica Geosystems' 3D scanner. 'Without the scanner, we could never do what we do. We use the tool artistically, in ways nobody else has ever tried. Everything is measured perfectly, and we are free to create models, knowing they are tailor-made for their environments." If a balcony protrudes from a wall, the projection can build a new one, move the original, or integrate it into a whole new setting. Now, not only the projection, but the entire object finds itself renewed and changed in its old environment.

Urbanscreen is now world renowned for its installations at the Sydney Opera House, at Rice University in Houston, and the Light-Sound compositions exhibited at the Kunsthalle in Hamburg, Vienna's Kunstquartier, and Dessau's Bauhaus. ■

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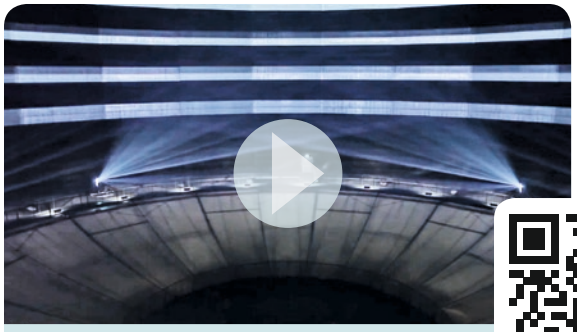

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http://www.urbanscreen.com

Building renewable energy

by Katherine Lehmuller

Our society uses immense amounts of energy. As the costs of oil, electricity and gas go up, the advantages of using renewable forms of solar energy are becoming increasingly more important and popular. Capturing solar energy brings enormous, benefits for the environment. If developed and applied properly, it could provide several times more energy than the world currently consumes. At the same time, it can also reduce emissions that cause air pollution, slow down global warming by reducing CO_2 combustion and does not produce waste, as nuclear power does. But best of all, it is an unlimited natural resource. The efficiency of solar photovoltaic collectors depends on how accurately solar panels are aligned with the sun. Leica Geosystems' iCON robot 50 helped the French company Sunseo to install panels of solar fields quickly, accurately and efficiently.

Since founded in 2010, the Sunseo Company, whose main activity is installing solar panel fields, have installed around one million panels to date, including France's biggest photovoltaic solar plant, which produces approximately 144 megawatt hour. Currently, they are working on the Toucan project in Guyana, South America, which is the first solar plant able to store energy during the day for use at night.

Until recently, Sunseo worked with very simple means, setting up solar posts every 50 metres (55 yards), using strings and measuring tape to calculate placement to a tolerance within five centimetres (two inches). Because Sunseo is involved in setting up large photovoltaic tables on farms with up to 1,000 hectares (2,500 acres), it was absolutely necessary to find a more efficient and less time-consuming solution.

Post stake out using Leica iCON robot 50

The decision to buy a robotic total station took a long time because Sunseo lacks in-house knowledge about measurement technologies. Estimating the return of such an investment was difficult, however precision accuracy had become a "must" in solar panel placement and Sunseo had to invest in order to remain competitive. After six months of evaluating Philippe Daubigney, Manager of Sunseo for 30 years, bought an iCON robot 50 because its solution was extremely easy for people working on site, required no previous experience, offered user friendly onboard software and was specially designed for construction workers.

Today Sunseo, with only 15 employees installs 2,000 posts per day, which not many solar panel field installers can claim. The posts must be extremely precise. "After only a week, we had the iCON robot 50 running 12 hours a day at full speed. We always get millimetre accuracy." says Daubigney, "We work with pre-established points from the customer's AutoCAD plan, which is transferred to the iCON robot 50 so on site workers can easily stake out a pole at any time." All tasks must be executed with highest possible accuracy so that the final work is quality. The poles must be driven into the ground up to 2.60 metres (2.84 yards), with perfect alignment and flatness, so the panels can collect sun rays efficiently.

"This exact work determines the quality of the results and allows us to assemble with speed that is economically feasible, because in the solar energy industry, prices have been reduced by 50% within the past four years. "We have been a Leica Geosystems customer since we began in the solar industry but the Leica iCON robot 50 has truly changed the way we work. It's precision that few thought would be possible," so Philippe Daubigney. Completely satisfied, Sunseo is currently considering buying another four Leica iCON robot 50.

With the help from Leica iCON robot 50, Sunseo has made a contribution to creating a greener, cleaner world, installing millions of solar panels in Europe and South America. Just imagine how many megawatts per hour are delivered, how much CO_2 emission has been reduced and how many households are now supplied with renewable energy? ■

About the author:
Katherine Lehmuller received her Bachelor of Fine Arts from Tufts University, NY, and works as a copywriter for Leica Geosystems AG, Heerbrugg, Switzerland.
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Smooth ride for the Nottingham tram extension

by Ruth Badley

Nottingham, a city best known for its lace-making heritage and the legend of Robin Hood, is laying foundations for its future prosperity with an expansion to its existing tram network. One of the least car-dependent cities in the UK, the local council's investment in clean, convenient public transport is helping to attract sustainable new businesses and employment opportunities, whilst supporting the commitment to achieve a 26% reduction in carbon emissions by 2020. Starting in early 2015, convenient new routes will offer increased mobility for a growing working age population, which is estimated to be approximately 512,000 across the city region.

The extension to the Nottingham Express Transit (NET) is being constructed using Appitrack™, a pioneering mechanised system, developed by Alstom Transport, using integrated PaveSmart 3D machine control technology by Leica Geosystems. The concrete slab track and rails are being laid over a distance of 17.5 km (10.9 mi) and these, within a challenging urban environment, where reliability on both planning and delivery is critical.

In tune with the city

Laying a tramway within a busy city and in close proximity to the local community places particular constraints on productivity. For reasons of safety, there may be tight onsite timelines to adhere to and the need to minimise levels of noise and dust pollution to the environment. The speed, certainty and high precision of the Appitrack™ system guided by Leica PaveSmart 3D allows a construction team to work within these limitations in a unique way, allowing slab track to be built in congested urban environments in a patchwork arrangement.

Following the process of paving and base plate installation, Alstom has developed an innovative method of rail installation and adjustment. Instead of a final phase of intensive manual adjustment, the time spent on site is reduced and the errors minimised by using survey data to pre-determine the shims that are required. A colour-coded shim plan is created

that the workforce follow to ensure the track is in its correct final position.

The technology delivers the necessary consistent and reliable millimetre accuracy during the building process to allow for the successful link up of separate sections during the rail laying stage. The system uses Leica Geosystems' total stations and Leica PaveSmart 3D software to ensure the design calculations, surveying and guidance meet the project's demands for the highest tolerances in speed and comfort.

First UK city to adopt world class method

Whilst Nottingham is the first application in the UK utilising the Appitrack™ system, Alstom Transport has used the technique to build Light Rapid Transit systems throughout the world and in similarly sensitive urban environments. It was used in the French

Extending the vision

Nottingham's innovative commitment to cleaner, greener public transport began in 2004 with the opening of the city's first tram line. The current extension to the Nottingham Express Transit (NET), an Alstom /Taylor Woodrow joint project, links areas south of the city to the centre, via two new lines. When the project is completed in early 2015, some 20 million passenger journeys a year will be made by tram, supporting the local council's commitment for Nottingham to remain one of the least car dependent cities in the UK. The three-line network has 13 substations with the potential to input electricity into the grid via the tram's regenerative systems.

Guided by Leica Viva TS15 total stations and PaveSmart 3D, Alstom's Appitrack™ ensures a smooth tram platform.

cities of Toulouse and Lyon, the Israeli capital, Jerusalem and in Singapore. A recent major contract win will take Appitrack™ to Riyadh, Saudi Arabia where there are ambitious plans to transform the city's transport infrastructure with a modern metro network.

Joint approach for R&D

Over several years a close working relationship between Alstom and Leica Geosystems has spearheaded research and development work on Appitrack™, with the software for the control and guidance of the system's convoy vehicles tailored to meet Alstom's particular requirements.

Track Survey Manager James Douglas at Alstom Transport, said that the highly specified interface of Leica Geosystems' instruments and software helped his team develop customised, quality-controlled solutions that increase efficiency.

James Douglas said, "The traceability of the data flow, cross checks and balances with existing software, coupled with the comprehensive nature of the MMI gives professionals exactly what they need to develop their own solutions. This powerful contract-winning tool is the result of continuous refinement and improvement over the last decade to achieve the unparalleled level of accuracy, speed and flexibility that survey and paving innovators require. I believe on NET 2 we have perfected this system. This technology gives us a 30 – 40 % saving in production time, therefore contact in the environment is significantly reduced. The technology used on this project has contributed greatly to our timely and efficient delivery of the new tramway for Nottingham."

Speed with high precision

Appitrack™ or Automatic Plate and Pin Insertion uses a concrete paver to lay the track slab, guided by Leica PaveSmart 3D software. Some 10,000 m³ (13,080 yd³) of concrete has been laid on the NET 2 project to date. The convoy comprises a Wirtgen SP25 concrete slipform paver, the Appitrack™ laying vehicle, concrete delivery trucks and five Leica Viva TS15 total stations.

As the paver moves forward, the Appitrack™ machine follows, inserting base plates into the track slab whilst the concrete is still curing. Both machines are continually tracked and positioned by the total stations. The high level of accuracy is achieved as measurements made to both machines are individual. This system ensures the baseplates are inserted to the correct position, independent of the actual level of the concrete laid by the paver. The setting out, concreting and adjustment is carried out in one pass.

Planning work on the baseplate insertions is carried out in the office, then the design data is uploaded into Leica PaveSmart 3D which integrates with Alstom's in-house AppiWay software. As the convoy moves forward, two other total stations are set up, one to overlap on the Appitrack™ machine and the other to 'leapfrog' on the paver. Machine outputs are checked and monitored to allowed millimetre adjustment of the paving and baseplate insertion. As each cycle is completed two total stations are rotated out of the convoy and set up in readiness for the next.

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For more information and a video demonstration of Appitrack™:
http://www.leica-geosystems.com/appitrack_video

Protecting Brazil's coastline with GIS

by Camila Fabiana da Silva and Saulo Folharini

The Brazilian Coastal Zone is an area of unique biodiversity and contains extremely complex and fragile ecosystems known as biomes. The flora and fauna of these areas are dependent on each other for survival. They are important to our world as well, supplying us with fresh water and oxygen. If they are destroyed then our world cannot survive. Many endangered parks within this zone are planning to research and assess these damaged environments using Leica Zeno GIS in order to prevent further loss.

Located in the northeast part of the state of Rio de Janeiro, the Jurubatiba National Park is a remnant of the ecosystem sandbank. After years of human activities and urban expansion, less than ten percent of the original vegetation still survives. This area is under enormous pressure because it offers an abundance of natural resources and plays an important role in Brazil's economy. However this critically endangers these coastal areas.

Conservation of the ecosystem of sandbank areas using Leica Zeno GIS

The work performed in Jurubatiba National Park falls under the Long Term Ecological Research Program

(PELD/CNPQ), developed by NUPEM/UFRJ (Núcleo em Ecologia e Desenvolvimento Socioambiental de Macaé/ Universidade Federal do Rio de Janeiro) in partnership with Embrapa Satellite Monitoring and IG/UNICAMP (Instituto de Geociências / Universidade de Campinas (UNICAMP)), seeks to understand how human occupation in the area around the National Park Jurubatiba interferes with the stability of the sandbank natural system. Integrating this project, several researchers in different fields are seeking to contribute with their knowledge to the understanding of the man/nature of the site. The involved institutions encourage the production of scientific projects and dissemination of results, understanding that these results are part of world's international realities.

The project was conducted on the environmental status of the ecosystem the sandbank employing Leica Geosystems' Zeno Field CS25 GNSS with satellite navigation system (GPS) and L1 frequency to help identify areas threatened by close proximity to human activities. The field work aims to create a 3D elevation model of the coastline's true surface known as a Digital Terrain Model (DTM). To make this DTM model, a team of four researchers were sent out in the field to locate and accurately measure specific, predetermined points, already loaded onto the Zeno. A satellite image was also quickly loaded using the CS25 GNSS computer tablet's 1.6 GHz processor and both were applied as a back ground. After the data was collected, it was sent by the handheld tablet to the research centre for analysing and was then transformed into a 3D Digital Terrain Model into Esri's ArcGIS Desktop.

Saulo Folharini, who is working on his master's degree in Geography (IG/UNICAMP) and does research in Geotechnologies for Embrapa Satellite Monitoring, was one of four persons in the field crew, who located and measured the pre-established points. The use of only one device to collect database information saved time and costs and the easy integration of data using ArcGIS Desktop, needed to create digital terrain models, was optimal. Saulo described working with the user-friendly Leica Zeno Field as ideal. "The user drives with a car to locate points so using the CS25 GNSS tablet's large screen and Zeno Field's

"Go To" software function made it much easier. And field work was performed under intense sunlight, so it had to be done efficiently, with equipment that not only withstands high temperatures but is also protected from water and sand."

Embrapa Satellite Monitoring and UNICAMP researchers using Leica Zeno GIS have successfully helped to assess the threatened area by quickly and efficiently collecting necessary data and thereby preventing any further loss of these precious environments. ■

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NUPEM/UFRJ
UFRJ is a public university in the state of Rio de Janeiro, Brazil. The Ecology and Socio-Environmental Center of Macaé (NUPEM / UFRJ) is a multidisciplinary research group, which belongs to UFRJ, and it is specialised in environmental related research. *www.macae.ufrj.br/nupem*

IG/UNICAMP
The Institute of Geosciences (IG) is one of twenty research and teaching units at the State University of Campinas (UNICAMP), located in Campinas, São Paulo. Since 2005, the Center for Environmental and Coastal studies (NEAL), a group member of IG, has been developing geomorphology related research and applying it to planning activities. *www.ige.unicamp.br/, www.ige.unicamp.br/neal/*

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Embrapa, the Brazilian Agricultural Research Corporation, develops technologies and tech-nical/scientific knowledge for agriculture and livestock production. The Satellite Monitoring Unit specialises in geotechnologies. *www.cnpm.embrapa.br/*

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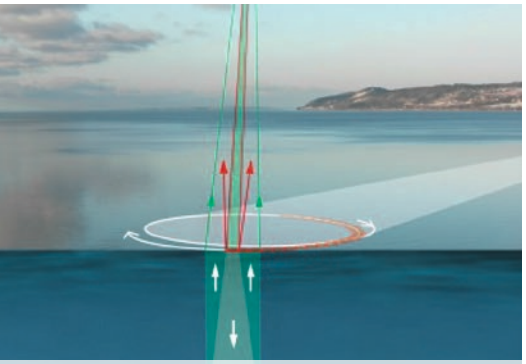
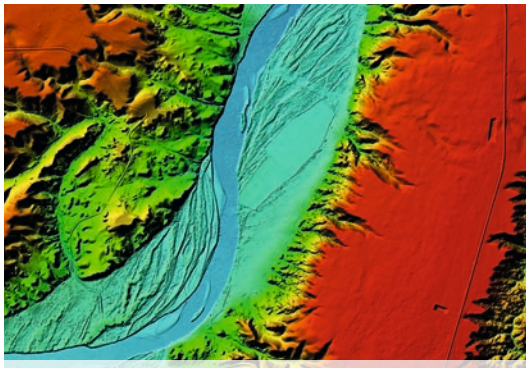


Airborne Bathymetry

3D City Modelling



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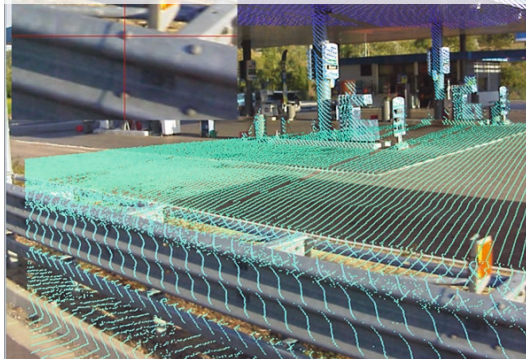

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