GIM INTERNATIONAL

THE GLOBAL MAGAZINE FOR GEOMATICS
WWW.GIM-INTERNATIONAL.COM

geomares PUBLISHING

ISSUE 8 • VOLUME 28 • AUGUST 2014

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A Unique Constellation of Optical Satellites from Europe

Airborne Lidar in Rainforest

Towards a UAV-based System

GIM International Interviews

Peter Cosyn

A Field Trip to Rhodes

Young Geo in Focus

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No 2504

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BPA WORLDWIDE BUSINESS

Reflection

The summer is often a time of reflection; many people take a break from their daily routine, freeing up time for them to ponder their professional life. The best ideas, most radical decisions and most valuable insights often occur at such times. At *GIM International* we recently conducted a readers survey as a way of reflecting on the role of our magazine and whether it is still aligned with our intentions. I'm happy to share some of the findings here. The survey was sent to 6,000 subscribers and completed by close to 20% of them, i.e. around 1,200 readers submitted their responses. At *GIM International* we aim to target decision-makers in geomatics and related fields, and the outcome of the survey showed that we succeed in doing that – over 80% of our readers have a managerial role. 41% of the respondents hold degrees in geodesy/surveying, and a further 40% in adjacent fields like civil engineering, cartography, geography and hydrography. One important question related directly to our editorial formula: do the topics we select for our readers every month, in a mix of articles, interviews and news, match the interests of those readers? The answer to this question made me happy; most of our readers are interested in mapping, land surveying, remote sensing, photogrammetry, cartography, geodesy, Lidar, GNSS and engineering surveying, and all those topics are widely covered in *GIM International*. Three out of four readers pick up the magazine at least once a month, and often more frequently. We also learned that the majority of our readers pass the magazine on to colleagues, which results in a much larger total readership than merely our official subscribers.

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Photography: Arie Bruinsma

Always one of the most interesting questions is the one that asks for 'any other comments'. Quite a few readers asked if there's a Spanish version available. Answer: yes, we publish *GIM International* in Spanish too. Other people are seeking reviews of products; we publish those on www.geo-matching.com, and everybody is invited to leave one of their own. Our readers are also looking for more information about countries like Nepal, Bangladesh, Sri Lanka and Sub-Saharan Africa, including South Africa. As a global magazine we do our best to cover as much of the world as possible, but this can be quite a challenge. Finally, many readers thanked us for providing them with useful information that they can apply in their daily professional life. After all those kind words, which we are grateful for, it's now my turn to thank all our readers who have shared their insights and given us new ideas to mull over in the coming months. Please remember that we always like to receive your feedback, even when we're not conducting a survey. So feel free to send me an email anytime, or share your thoughts with me the next time we bump into one another at a conference or trade show!

ComNav

T300 GNSS Receiver

Easy to use

Super light (less than 1kg with two batteries)

GPS L1/L2/L5, BeiDou B1/B2/B3, GLONASS L1/L2

Built in Tx&Rx

Ultra small

Hot swappable battery design

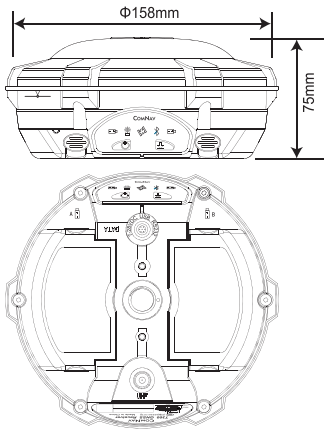
Compatible with other brands GNSS RTK

Many user-friendly conveniences built in

Low power consumption

Choose Right, Measure Right!

With decades' experience on the surveying GNSS receiver, the T300 is an ultra small and light product which combines lots of market proved advantages together. It could track all the working GNSS constellations. By using ComNav's unique QUAN™ algorithm technology, it could work as RTK mode by using any single GNSS constellation such as GLONASS or BeiDou. The strong anti-interference ability of the receiver makes it possible to work in any environment. It frees surveyors to do the work in any place.



The front cover shows Port Isabel, Texas, USA, located along the southwestern shore of the Laguna Madre and just north of the land mass delineated by the Rio Grande Delta. It is in the Gulf Prairies and Marshes eco-region and part of the Tamaulipas biotic province. The image has been captured by the SPOT 6 satellite.

(COURTESY: AIRBUS DS/SPOT IMAGE 2014)

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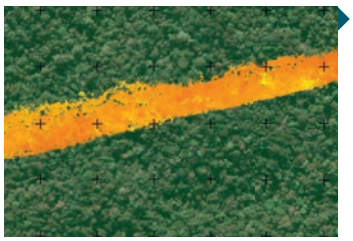

Bon Voyage on the GI Road!

After a long journey through the French mapping agency IGN and its sister organisations in Europe, I arrived at the French ministerial departments, firstly as an outsider at the French National Council for GI and then as an insider at the Directorate General for Spatial Planning, Housing and Nature as advisor for geographic information to the director general: the last stop on my professional journey. After so many years of spreading the good word about geoinformation and evangelising my colleagues, I'm satisfied that much progress has been made, both technologically and in terms of the role of GI in daily management and decision-making.

Along the route I have encountered various 'vehicles', including housing, spatial planning, landscape, non-energetic and water resources, biodiversity and coastal zone management. I oiled the workings of the Flood Directive and green infrastructure, and I helped to refine property files and other such key data.

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Continuing with this vehicle analogy, while IT is the engine, the geographical data remains the fuel and we will not get far without it. Central and local governments have made progress on both those aspects of geoinformation as reported in several editions of *GIM International*. New types of fuel have also been emerging from community- or crowdsourcing, and renewable energy is now available through mobiles and RFID.

But if we do not know where we want to go, there is a risk we will go nowhere. Therefore, identifying the questions – and hence the destinations – must remain the key focus of the action. Geomatics is one of the tools to help answer important questions related to social, societal, environmental and economic issues once they are properly formulated. The GI professional is an essential catalyst for stipulating the operational question and hence finding the best route.

Then comes the answer to the question – spatial analysis, cartographic rendering – with its related information on the response relevance – the quality, requirement meeting – which is still an area for improvement.

One must still arrive at the destination on time, which in this context means providing 'just-in-time' information. This implies being able to anticipate vehicle maintenance needs: the availability of tools, and filling the tanks with fuel (in this case data). And of course you must know how to drive (i.e. training), respect the rules of the road (legal aspects) and treat other road users with courtesy (sharing information and good practices).

This editorial, in the form of modest allegory, has been an opportunity for me to share my vision of the technical area in which I have spent my entire career. A new spatio-temporal perspective lies ahead for me as I will be retiring on 1 November 2014.

NEW VERSION OF POINT CLOUD PLUG-IN FOR AUTOCAD UNVEILED ++ FIRST RUSSIAN PRIVATE EARTH REMOTE SENSING SATELLITE ++ THIRD LATIN A NFERENCE FOR SOUTH ++ CALL FOR PAPERS: INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT ++ HISTORY OF AMERICA'S MAPS IN ONE APP EXPANDS INTO

First Russian Private Earth Remote Sensing Satellite

TabletSat-Aurora.

ISC Kosmotras successfully launched a cluster of small spacecraft by the RS-20 rocket (Dnepr) on 20 June 2014. The first Russian private Earth remote sensing satellite from the company Sputnix, named TabletSat-Aurora, also was sent into its target orbit. The data from the microsatellite will be received by a ScanEx UniScan ground network for use in commercial, scientific, educational and environmental projects.

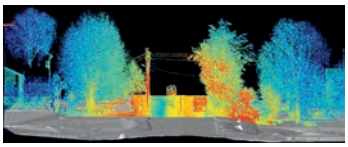
http://bit.ly/VO0ewz

Most Shared

Most shared during the last month from www.gim-international.com

1. UAS Photogrammetric Sensor Package Launched at AUVSI Conference
   - **http://bit.ly/1n0homG**
2. UAV Maps Landslide on Czech Highway
   - **http://bit.ly/S7cxSb**
3. Satellite Images of Brazilian Stadiums Captured by DMCii
   - **http://bit.ly/1nwomiG**
4. UAV River Survey Generates Data for Ecological Restoration
   - **http://bit.ly/1nwp6Ex**
5. History of America's Maps in One App
   - **http://bit.ly/TYgZnu**

New Version of Point Cloud Plug-in for AutoCAD Unveiled



Undet V2 features mesh editing.

InfoEra, Lithuania, has announced the release of its Undet ToolBox V2. Undet is a plug-in for AutoCAD and its verticals that facilitates evaluation, visualisation, processing and advanced modelling of point clouds. It has been developed to provide best value for users who want to work efficiently with point clouds in AutoCAD and speed up as-built documentation for multiple laser scanning tasks.

http://bit.ly/VNZY0u

SPOT 7 Joins Twin in Orbit to Complete EO Satellite Constellation

The SPOT 7 Earth Observation satellite which has been designed and developed by Airbus Defence and Space was launched on 30 June at 6:22 a.m. (Central European Summer Time) by a Polar Satellite Launch Vehicle (PSLV) from the Satish Dhawan Space Centre in India. It will now complete the constellation by joining the same orbit as its twin, SPOT 6, and the very-high-resolution observation satellites Pléiades 1A and 1B. It will be positioned at 180° in relation to SPOT 6. After a period of in-orbit testing, Airbus Defence and Space's optical constellation will soon be at its full operational capacity.

http://bit.ly/TO69jH

RUIDE

GNSS POSITIONING SYSTEM
R90-X

- 220 channels dual frequency antenna.
- Compatible to GPS, GLONASS, GALILEO & BDS.
- Dual Bluetooth.
- RX/TX internal radio using TRIMTALK protocol.
- GSM/GPRS module integrated.

TOTAL STATION
RTS-820R5

- RDM5 technology delivers 500m non-prism range.
- ATMOsense system detects and corrects PPM value automatically.
- Dual-axis tilt compensator.
- SD card, USB, RS232 interfaces.
- Various applications.

RUIDE_

No 2590

Front view of Chillon Castle.

High-precision 3D Modelling of Historic Monument in Switzerland

Pix4D has created a highly accurate and very dense 3D model of Chillon Castle (*Château de Chillon*), Switzerland's most visited historic monument. The 3D point cloud integrates the indoor and outdoor structures of this highly complex architectural object with a resolution of up to 5mm. It is based on both aerial and terrestrial images captured using DJI Phantom 2 Vision, GoPro Hero 3+, Canon 6D and Sony alpha 7r cameras with fisheye lenses.

http://bit.ly/TO6iUo

5 QUESTIONS TO...

Iwan Kokhuis

Iwan Kokhuis, sales manager Industrial Applications, Xsens

Which problem does your company's product help to solve?

As an innovator in 3D motion tracking technology and products, Xsens supplies a complete portfolio of miniature MEMS-based motion trackers (IMU, VRU, AHRS and GPS/INS) for industrial applications such as antenna/camera stabilisation and unmanned system control. In addition, Xsens supplies solutions for 3D character animation and human motion analysis.

What is the most appealing application of your sensor within the field of geodesy?

We have a strong background in the underwater control and position aiding market. However, in the geodesy market we're seeing a trend towards mobility of mapping and scanning devices, also on ground and aerial applications. Our MTi (Motion Tracking Inertial) technology offers a cost-effective tracking solution for such mobile applications.

Your company was recently acquired by Fairchild, a semiconductor manufacturer that has been around for more than 50 years and employs 9,000 people. What does this mean for Xsens?

We are excited to join the Fairchild team, as it means we can supply our customers with unique and differentiated sensor-focused solutions for a variety of end markets – both traditional industrial markets and emerging ones such as smart interconnected devices and wearable technology. Being part of Fairchild will also allow us broader access to the technologies and resources required to further strengthen development of 3D motion tracking products. It will help to further increase our support of current and future customers alike. Fairchild's pioneering approach, organisational structure, people and innovative approach are very much in line with the Xsens culture. Fairchild is completing a major transformation. The 'new' Fairchild is focused on innovative products, design expertise and bringing more added value to its products, and the Xsens acquisition is one result of that. Naturally, after a merger, there are different markets and thus different approaches, but we are eager to learn and take the best from both.

Your sensors rely on MEMS technology. What is the advantage of these sensors over the fibre-optic ones that are commonly used in geodesy today, and what are your expectations for the future?

The main advantages of our MEMS-based MTi lie in low-cost solutions or where motion tracking is a valuable add-on. For a fraction of the price and weight of a FOG (fibre-optic gyro), the MTi is a turnkey solution for mobile mapping, handheld mapping and UAVs with limited payload. The MTi makes low-cost mobile mapping possible. With our Xsens XEE algorithm, we have proven that we can approach this accuracy by combining information from various sensors in the Xsens MTi.

We see FOG and MEMS as complementary. The FOG is still unmatched in terms of stability, which some applications need. The introduction of MEMS in the industry is often mentioned as disruptive technology; it opens up a new market and eventually disrupts an existing market and value network, displacing an earlier technology. Today, however, there is MEMS availability from the very high end up to MEMS for consumer devices. There seems to be a place for both technologies existing side by side, based on specific customer requests.

With the prices for MEMS decreasing, use of these sensors is becoming more affordable. Where do you see the biggest growth potential?

Besides an ongoing trend towards lower costs, there is also a trend towards power to keep applications up and running continuously. An ideal MEMS solution would address the power management demands of 'always on' sensing, while providing the high degree of accuracy needed for indoor navigation and pedestrian dead reckoning (PDR) or any other device that needs to be tracked without having GPS access. Moreover, the solution needs to be in a package suitable for small-space applications and easy to integrate into designs. The challenge is out there: having still relatively new but fast-evolving technology, our success is based on that of our customers.

MORE INFORMATION

www.xsens.com

Third Latin American Dealer Conference for SOUTH

From 26-28 May, the SOUTH Group successfully held its 2014 Latin American dealer conference in Bogotá, Colombia. Following on from the previous two conferences held in Peru (in 2010 and 2012), this was the Chinese company's third event for all its partners in that region. It was attended by more than 50 guests who came from 19 companies in 15 different countries.

▸ **http://bit.ly/TYgSs2**


Participants of the SOUTH dealer conference in Bogotá.

History of America's Maps in One App

Two of the United States' most authoritative mapping sources, the U.S. Geological Survey and Esri, have partnered to put the rich tapestry of U.S. historical maps into the hands of everyone. Available in time for the Fourth of July – Independence Day – celebrations and able to be accessed on all digital devices, the USGS Historical Topographic Map Explorer brings to life more than 178,000 maps dating from 1884 to 2006.

▸ **http://bit.ly/TYgZnu**

LARGE-AREA PROJECTS ++ HIGH-PRECISION 3D MODELLING OF H

3D MEASURING INSTRUMENT IN DEVELOPMENT NEW VERSION O

EyesMap measuring instrument.

Portable 3D Measuring Instrument in Development

E-Capture R&D, a Spanish technology-based company, has announced the upcoming introduction of an accurate 3D measuring instrument embedded in a tablet. The product, which will be launched at the beginning of 2015, is intended to revolutionise the world of measuring with a new generation of portable, easy-to-use and highly accurate instruments that are ideal for most architectural and civil engineering tasks.

http://bit.ly/TO7abq

Call for Papers: International Symposium on Remote Sensing of Environment

The organising committee of the 36th International Symposium on Remote Sensing of Environment (ISRSE) has issued a call for papers. The event will take place from 11-15 May 2015 in Berlin, Germany. This 36th Symposium will represent a major event in the long series of internationally recognised ISRSE meetings. The overall theme of the symposium is the use of Earth Observation systems and related remote sensing techniques for understanding and managing the Earth environment and resources.

http://bit.ly/VO9uAM

Pencil

The annual Hexagon User Conference 2014 was held from 2 to 6 June in Las Vegas, USA (see my report on page 30). A series of keynote addresses – spread across the various days and amounting to over 8 hours in total – were presented by Hexagon's top managers in the Arena of the MGM Grand Hotel. If you had been hoping to gain great views of the future, you would have been left feeling disappointed. Hexagon's top management is well aware that we are living in an era typified by 'Changing Technology in a Changing Society', which is also the title of my book published in 2003. Hence: 'Prediction is difficult, especially when it concerns the future.' The only vision one can adopt is that change is permanent and the best you can do is to accept that reality when trying to anticipate the future. That is probably the reason why the keynotes were not particularly visionary. However, that was compensated by a rousing event, especially in terms of showmanship and fun. When change is ubiquitous, a leading global company needs to constrain the uncertainties by acquiring firms, amongst other things. Indeed, Hexagon has adopted this policy to insure its future resulting in a wave of takeovers – most recently (12 July 2014) of Geodata Diffusion, a French provider of RTK corrections. Often the firms are small, but creators or users of high-tech equipment. The main criteria are: 'Does the expertise the "prey" is specialised in show sufficient growth potential, and will there be enough synergy with what one has already in house?' Of course, a takeover today does not mean buying bricks and engines, but rather patents, talent and brains. The value of synergy among the various parts of the company was expressed by Mladen Stojic, president of Hexagon Geospatial, using the Dutch windmill as a metaphor. The chaotic phenomenon of wind has been tamed centuries ago to benefit mankind using wings mounted on towers. However, one wing is not enough to set the wheelwork in motion – four wings forged together are needed. The same is true for big companies. The expert knowledge from the various 'wings' has to fit together tightly and in a synergetic way to deliver optimal solutions to customers. 'The whole is greater than the sum of its parts,' as Aristotle said. In order that Hexagon could gain optimal feedback from its customers and hence insight into their problems, attendees were encouraged to recount their professional experiences, not only during the regular sessions but also freely during interviews recorded by a camera crew throughout the event. In case Mladen Stojic is searching for a metaphor for next year, here is one for free: it is the pencil. A pencil is made up of components which at first sight have nothing to do with one other: graphite, clay, wood and a coating. But when forged together, the user gains a synergetic means – a robust tool – for collecting (geo)information.

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ISTORIC MONUMENT IN SWITZERLAND ++ SPOT 7 JOINS TWIN IN ORBIT TO COMPLETE EO SATELLITE CONSTELLATION ++ PORTABLE 3D MEASURING INSTRUMENT - PORTABLE
F POINT CLOUD PLUG-IN FOR AUTOCAD UNVEILED ++ FIRST RUSSIAN PRIVATE EARTH REMOTE SENSING SATELLITE ++ THIRD LATIN AMERICAN DEALER CO TH ++ CAL

GIM INTERNATIONAL INTERVIEWS PETER COSYN

The Rapid Rise of UAS in Geomatics

Peter Cosyn co-founded Gatewing in 2008. The start-up company's X100 fixed-wing UAS soon attracted interest from Trimble, which acquired the company in 2012. In this interview with *GIM International*, Peter provides insights into the company's evolution and shares his thoughts on the future.

Gatewing was founded as a spin-off from your PhD research at Ghent University. How did you experience the transition from a scientific environment to running a company?
My PhD research involved micro air vehicle development and optimisation. Such vehicles are only about the size of a big smartphone, so the research did not have much in common with what we later did at Gatewing and it was a significant transition. Although the two other co-founders, Maarten Vandenbroucke and Maarten Van Speybroeck, came from a business environment, running a start-up was new for them too. I benefited from my PhD experience. For example, I had to apply for government funding for my PhD and post-doc, which meant I knew how to attract innovation funding. At the university, I had to work independently, think 'out of the box' and work in a team with others to explore unmanned aerial solutions (UAS) as I could not rely on a 'UAS lab.' My lab consisted of experts in computational fluid dynamics (flow simulation), not UAVs. So that experience helped as well. In general, starting the business was a real endeavour but we were eager to learn from business experts while trusting our ideas and gut feelings about the market. We made a prototype and checked it with a few key accounts such as big mining companies. Then we just went for it and started developing the Gatewing X100.

What were the main hurdles to overcome in the design and operationalisation of the X100, and what are its distinguishing features compared to other fixed-wing UAS?
A big hurdle was the fact that we were not experts in autopilot or control design. I had experience in wing design, aerodynamics and propulsion. My colleague, Maarten Van Speybroeck, had the most experience in CAD and knew a lot about manufacturing and materials. We had to learn it the hard way, making prototypes and testing them. The major issue here was that a UAS is not that forgiving if you make a mistake. You need to be resilient when gathering up the broken pieces of a prototype you've been working on for days and that cost you a significant chunk of your limited funds. Today, with all the open-source platforms, making a UAS might seem straightforward. But making it reliable, industrialising its design and manufacturing, and ensuring

compliance with FCC, CE and other organisations actually involves following a long, arduous path.

The fact that we were not RC (radio-controlled aircraft) enthusiasts probably helped us develop a system intended for professionals who lacked 'piloting skills'. A distinguishing feature of the X100 compared with other (at that time typically bigger or rotary-type) UAS on the market was that it was completely autonomous from start to landing, with user interaction limited to simple commands (land, go home, etc). This reduced the barriers to entry for the commercial market. Manually assisted landing and pilot 'override' for take-off, landing or emergency was still the norm when we started and it is still an aspect of many UAS.
An additional distinguishing feature was the foam structure we used with internal composite reinforcements. We basically did the opposite of what was common for most (military) fixed-wing UAS. It gave us an advantage in production, plus resistance to shock and a significant improvement in safety. This looked important so we went for a patent.

The X100 is one of the few fixed-wing UAS on the market. What are its main strengths and weaknesses compared to rotary wings?
A fixed wing has an important advantage: it benefits from wing lift enabling it to fly efficiently at high speed, whereas a rotary UAV does not. This means that a fixed-wing UAS of comparable size and weight will be able to map a much bigger surface than a rotary UAS in a given amount of time. Knowing that size of the airframe impacts the costs of acquiring and operating a UAS and also the risks (and regulations) involved, it is clear that fixed wings have an advantage for mapping. There is a trade-off and it depends on the size of the area covered. A Gatewing X100 or Trimble UX5 is a good match when users need to cover from tens of hectares up to tens of square kilometres. Meanwhile, if you just need to fly and map a building or a small field, a rotary UAS of the same scale might do just fine. In addition, rotary UAS are a match when you need vertical surveying (e.g. of buildings) or you need to take off and land in a very enclosed area. A disadvantage of a traditional fixed wing is that it needs significant space to land, whereas a rotary wing can take off and land vertically. The UX5 addresses this limitation with its steep take-off and landing capability.

Trimble acquired the company in early 2012. Why was this giant geomatics company interested, and what are the main advantages for yourself?
Trimble was probably the first multinational geomatics company that understood the power of combining the massive point clouds and geospatial data our solution provides with the geospatial data of the optical and GNSS solutions that Trimble provides to its customers. Trimble's move came as a bit of a surprise to us. We knew the geospatial giants of course – some of our Gatewing distribution partners were Trimble or Topcon distribution partners – but we did not expect Trimble to be interested so early. We were a 3-year-old start-up that would normally go through a VC-funding stage to keep growing. A 'born global' company such as Gatewing with a new, complex hardware product needs a big team and significant investment to succeed. When Trimble contacted us, we were at first reluctant to give up our 'baby'. With our uncertain funding options, the fact that Trimble would keep the organisation intact after acquisition and Trimble's expected, positive impact on our current and future products and sales were deciding factors. Trimble's professional distributor networks and its UAS-relevant vertical markets are an advantage for us.

What is the profile of your present consumer base (e.g. user types, geographical distribution)?
Our main user is the surveyor focused on asset mapping who typically works for a service company or is an internal supplier of geospatial data for a big company. Additionally, we sell to mining companies and those involved in construction and engineering work. We also have clients in agriculture, forestry, energy, dredging, governments and a significant number of universities. Geographically we sell almost everywhere. However, our main focus is on countries with Trimble geospatial distributors and where we have airspace access. The latter limits our exposure at the moment; we don't have any distributors in the US, for example, since the FAA (US Federal Aviation Administration) does not currently allow commercial use.

How are training and services arranged?
We provide training to our distributors, who then train their customers, as well as training to customers who apply for it. A training course consists of a classroom session, two field days and an

Peter Cosyn

Dr Peter Cosyn is co-founder and R&D director of Gatewing NV, a company based in Ghent, Belgium, which was acquired by Trimble in 2012. He obtained a PhD in electromechanical engineering from Ghent University in 2006. He has 12 years' experience of developing unmanned aerial systems and is author of multiple international papers and a patent on the subject. He has been involved in multiple technical working groups and European Commission hearings to support the EU legislation process of UAS.

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examination which you need to pass to become an approved pilot. It's not rocket science; the procedures are straightforward, but it's important to keep certain operational standards and safety aspects in mind and that is what we measure during the exam. Our training courses are recognised and our certificate is required by multiple Civil Aviation Authorities. In addition, we provide training on our office software (Trimble Business Center), which has a photogrammetry module and delivers optimal accuracy. Trimble manages the support to our distribution partners and customers. New service centres are expected to be added in the coming months to further improve our customer service.

On which major developments are you working now?

I can't give you details, but the main theme is that we are working to increase flexibility in our planning and flight operations. This improves the workflow for different project types and also improves it for the challenging environments that customers face. We plan to tackle this with software updates and additional hardware options.

Another key element is data accuracy. For example, if you measure your assets at our minimal ground sample distance and you check the point cloud, you will see that we reach on average 2cm in Z and even better in XY. Sigma values have similar results. That's why we consider our solution 'survey-grade'. This quality depends on multiple elements of the solution, especially our data acquisition stability, image quality, camera stability and image processing algorithms. Low-cost solutions (and even some high-cost solutions) available on the market today will not provide users this accuracy and data consistency, which sometimes makes a significant difference. They might be well suited for a client with limited needs but we also see many people considering them for survey tasks. In addition, the Trimble UX5 is now available through Trimble's Agriculture distribution channel. Point clouds and surface models play a role here but the image interpretation part may be a driver in the future.

One of the operational issues affecting UAS is legislation; most jurisdictions require permits and pilot licences. How do things stand presently, and what do you expect for the near future?

Legislation is a big issue at the moment but primarily because the rules of the game are not established, are incomplete or are very restrictive in many countries, including the US. Proper legislation is essential to market growth. UAS airworthiness approvals, operator certificates and pilot licences are all needed in order to create accountability, reduce the risk of accidents in the air and on the ground, and allow insurance to capture the excess risk. Safety is the main driver and this also means that the legislation should be scaled to the risks involved. I was involved as an industry specialist in a few working groups on rules and regulations, and I know that it is a huge task to accomplish a well-balanced rule set. There is a 'chicken and egg' problem here because there is limited flight data available to validate the rules, but we first need rules in order to be able to fly....

I expect governments to address the easy part first: flights close to the operator with vehicles that have acceptable risk in case of failure. This is the approach of both the US and EU. We expect to see the first harmonised rulemaking in 2015 leading to actual rules in the US, EU countries and beyond shortly afterwards, and a gradual entry of more complex operations (with increased requirements for the UAV and pilot) probably resulting in a full merger of UAVs (big and small) and aircrafts in our airspace by 2030. For our scale and operations, the earlier date is more important than the later one but some applications might take a few more years before they become really marketable (e.g. long-range corridor mapping).

To what extent do you foresee that UAS will replace traditional survey methods?

At this moment it appears the main markets are created when timely access to the airspace is possible and where a significant market exists for mapping large and changing industrial or civil assets. I'm talking about emerging markets or developed regions with favourable rules (driven by their low population density) such as Canada, Australia or Scandinavia where vast areas need coverage. Because of the increasing data quality, the decreasing cost of ownership and especially the improvements in legislation, I do expect that the accessible market will gradually increase to a point where every surveyor or professional who can benefit from mapping assets for themselves or for clients has access to the technology, whether in ownership, on loan or as a data client. In parallel, we will see a growing number of UAS applications that span the 'survey spectrum' from small-scale vertical mapping of infrastructure to large-scale mapping that competes with the traditional photogrammetry companies.

Although UAS have their own domains where they are especially powerful and already in use, the overlap with existing technology will continue to grow. A powerful element of UAS mapping is the fact that it can gather data in an automatic, consistent way for later analysis in an office environment rather than in the field. UAS create a 'virtual scene': a snapshot of the state of the project or asset.

Still, there are limits and they will be mainly driven by the regulations. I expect that training and permits will remain a necessity for any professional device, regardless of its scale or price. Products that ship in a box without proper service and certificates or products that flirt with the B2C market could

face a very strict regulatory burden because of the safety and privacy issues involved, and this will limit their market potential. So I believe that UAS will remain a tool for the professional who is committed enough to make the investment.

A lot of new companies are entering the UAS market. How do you see the UAS sector developing in the long run?

A UAS is a very 'cool' product and anybody who starts brainstorming will find an almost unlimited number of potential applications. This definitely fuels the sector in general. However, due to the regulatory burden there is a huge barrier for individual companies to test their business case and then, when proven, grow their business. At the same time, this artificial situation gives new start-ups the impression that the market is a 'free for all' and we see them popping up everywhere. The market is undoubtedly huge, but there is also a lot of hype. Proven applications, and I certainly consider our surveying solution to be one of them, will eventually emerge as the clear growth paths. But growing is not easy; an industrialised solution requires effort and investment. Therefore we will see many companies disappear as quickly as they appeared, we will see consolidation between those players who already have a footprint and we will see a few smaller players specialising in useful niche applications.

In the long run, the commercial UAS market is definitely a multi-billion-dollar business. The biggest part of the market, however, will not be selling UAS but rather selling the software and services that enhance the solution to address real customer needs. We will keep focusing on the solution rather than on the aircraft only.

Do you think the 'cool factor' of UAVs can make the geomatics sector more appealing to students?

I definitely believe so! Aircraft are just cool and although flights are automatic, it is still an exciting experience to pilot a UAV or even just see one fly. And it's not just the UAS! Flying virtually through 3D models or stereo images of the scene that you just created with your 'toy' gives you a great feeling. I'm still amazed when I see the astonishing detail created by the power of automation and computation. And remember, this comes from a small device and software running on your laptop, not from a manned aircraft, helicopter or satellite! ◂

A UNIQUE CONSTELLATION OF OPTICAL SATELLITES FROM EUROPE

SPOT Tandem Completed

The launch of SPOT 7 on 30 June 2014 at 6:22 a.m. CET completed the constellation of four optical spacecraft operating in the same orbit. The constellation further consists of twin sister SPOT 6 and Pléiades 1A and 1B. To mark the occasion, the author discusses the features of the extended family of 7 SPOT satellites here.

The English word 'spot' means a small area, but SPOT is also the acronym for *Système Pour l'Observation de la Terre* ('Earth Observation System'). The SPOT 1 to 5 satellites are a product of the CNES (*Centre National d'Etudes Spatiales*) in France which were initially built with the support of Sweden and Belgium. SPOT 6 and 7 have been designed by Airbus Defence and Space. Two key design features in all SPOT generations are continuity and adaption to changing user needs.

Mathias Lemmens gained a PhD degree from Delft University of Technology, The Netherlands, where he presently lectures on geodata acquisition technologies and geodata quality on a part-time basis on the recently renewed MSc in Geomatics. He is the author of the book *Geo-information: Technologies, Applications and the Environment* published by Springer in 2011. He was editor-in-chief of *GIM International* for ten years and now contributes as senior editor.

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SPOT 1, 2 AND 3

The sensors of the early Earth observation satellites such as Landsat looked straight down to Earth, i.e. they scanned left and right to the track. Users could order the imagery from an archive. SPOT 1, launched February 1986, brought major progress as a pointable mirror enabled a push broom scanner to look to the side of the track. Now users could – for the first time – request capture of a specific area within a certain time span. SPOT 2 was launched on 22 January 1990 and was in service for 19 years. SPOT 3 started to orbit on 26 September 1993, but failure of the attitude control system limited its lifetime to just four years. The SPOT 1, 2 and 3 sensors are identical and consist of two HRV (High Resolution Visible) push broom scanners operating simultaneously, each with a swath width of 60km when pointing nadir. The two spectral modes are panchromatic or B/W (0.51 - 0.73µm) with a ground sample distance (GSD) of 10m, and multispectral (MS) with a GSD of 20m. The MS mode captures three bands: green (0.50 - 0.59µm), red (0.61 - 0.68µm) and NIR (0.79 - 0.89µm). The scenes cover 60 x 60km^2. Each HRV can be pointed up to 27 degrees left or right to nadir. The off-nadir facility allows the capture of strips with a width of nearly two times 60km (117km to be precise) within a 950km corridor. The oblique viewing increases the revisit interval to between four days and as little as one day depending on latitude, and enables DEMs to be created from overlapping images with different viewing angles acquired from adjoining passes.

SPOT 4 AND 5

On 24 March 1998, SPOT 4 was launched with two HRV sensors on board plus a sensor capturing the shortwave infrared band (1.58 - 1.75µm) and a GSD of 20m. The name

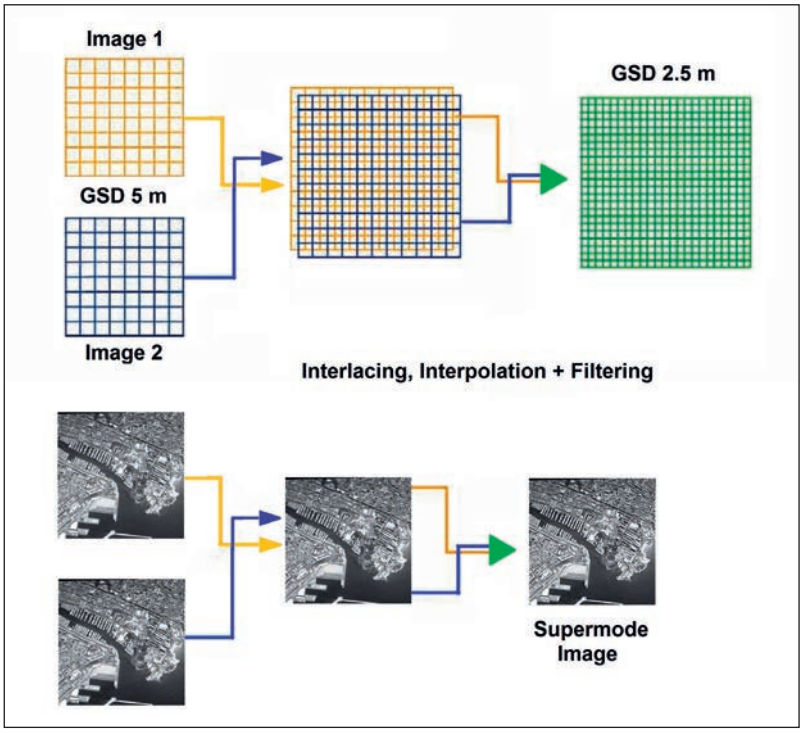

Figure 1, Schematic overview of the creation of supermode images.

SUPERMODE

The supermode imagery of SPOT 5 has a GSD of 2.5m. This is not the result of placing a new sensor on board, but instead is based on advanced processing on the ground of two B/W images which have been captured of the same scene yet shifted slightly. By interlacing and interpolating the two images, which have an offset of 2.5m both vertically and horizontally, a new image is created. This is then filtered to compensate for blur and to remove noise, resulting in an image which is twice as sharp as each of the original two images (Figure 1).

HRV was thus extended to HRVIR. SPOT 4 retired in 2013. The two HRG (High Resolution Geometrical) sensors on board SPOT 5, which has been orbiting since 4 May 2002, differ from the HRVIR in that the GSDs of the B/W and MS modes have been augmented by a factor of 2 to 5m and 10m respectively, but the GSD of the SWIR band has remained at 20m. In supermode, a GSD of 2.5m can be obtained (see sidebar). Added to this, SPOT 5 features a B/W sensor system that points forward and backward; the along-track stereo pairs are free of temporal differences as they are captured nearly at the same time, which eases DEM creation. The payload of SPOT 5 differs considerably from its four precursors, but the real game-changer came with SPOT 6, which was put into orbit on 9 September 2012.

SPOT 6 AND 7

Although SPOT 6 and 7 preserve the swath width of 60km, which can be viewed as the hallmark of the SPOT family, the spot size of the B/W mode has been improved more than 40-fold to 1.5 x 1.5m^2 compared to the 100m^2 of SPOT 1 to 4. SPOT 6 and 7, each weighing 712kg, are positioned in the same orbit, but when SPOT 6 passes Spitsbergen SPOT 7 passes Antarctica, i.e. they are phased at 180°. The 10-year design lifetime ensures that images will be on offer until at least 2024. At an altitude of 694km, SPOT 6 and 7 complete a full cycle within 98.79 minutes. They pass each other at 10 a.m., i.e. the orbit is sun-synchronous, and the nadir revisit rate is 26 days. However, the pointing agility allows each site to be captured once a day if SPOT 6 and 7 operate in conjunction. The two imaging systems – the New AstroSat Optical Modular Instruments (NAOMI) – produce B/W products with 1.5m and MS imagery products with 6m resolution. The radiometric resolution is 12bit (4096 values) per band per pixel; its predecessors have to make do with 8 bits. Details can be made visible in parts of 12-bit imagery made bright by reflections or overcast and dark due to (cloud) shadow. It is also easier to detect objects in areas with little texture such as dunes and ice. Table 1 shows the five spectral bands. Colour images with 1.5m resolution are produced through pan-sharpening (Figure 2). SPOT 6 and 7 together capture up to 6 million square kilometres a day, which is equivalent to an area ten times larger than Texas, USA. While any other direction is possible, the images are oriented north to south by default, i.e. the scan lines are

Figure 2, Pan-sharpening.

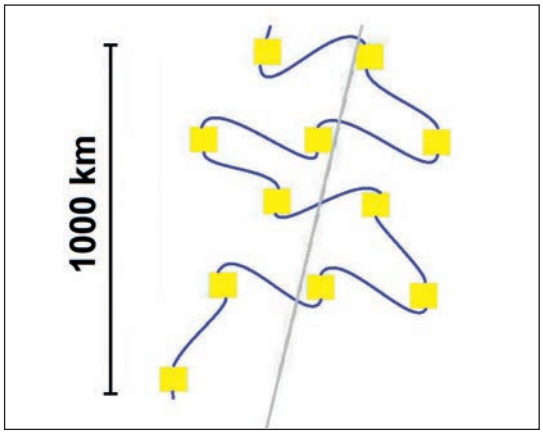

Figure 3, Rapid pointing allows distributed areas of interest within a corridor to be captured in a single pass.

not perpendicular to nadir but are skewed. To maintain the north-to-south direction, the sensors have to be slowly moved away from nadir while the satellite orbits. But at a certain moment, the north-to-south recording has to be discontinued and the sensors have to rotate to their start positions. Therefore, the maximum length of one north-to-south strip is 600km.

Three functionalities enhance the flexibility of SPOT 6 and 7: (1) high agility; (2) automatic uploading of weather forecasts, and (3) tasking plans with a high update frequency.

AGILITY

Control moment gyroscopes (CMGs) allow high agility for capturing areas of interest located off-nadir on the same pass. Thanks to CMGs, SPOT 6 and 7 can pitch and roll forward, backward and sideways up to 45°, i.e. the sensors can point to areas of interest within a 1,500km-wide corridor twice as fast as earlier solutions. This opens up the opportunity to conduct various image collection set-ups in a single pass, and one of these is the capture of no less than 11 scenes measuring 60 x 60km by rapidly switching views up to 750km to the right or to the left of nadir within a 1,000km orbit segment (Figure 3). This enables a multitude of users to be served without priority conflicts even when their areas of interest lie close together. The areas may be larger than the standard size of 60 x 60km. Longer north to south-oriented strips with a maximum length of 600km can be captured (Figures 4A and 4B) as well as more than one target on the same pass at the same latitude (Figure 4C). For example, SPOT 6 covered Cyprus's entire land area of 9,251km^2 in 4 strips from east to west within 90 seconds (Figure 5). SPOT 6 and 7 may also be tasked to follow elongated objects such as power lines, rivers or other corridors (Figure 4D). The agility not only enables the capture of along-track stereo images created through oblique views but also tri-stereo through a nadir image, which looks straight down to the bottom of (urban) canyons. This enhances DEM quality as occlusions are avoided (Figure 6).

Figure 4, High agility allows various coverage scenarios.

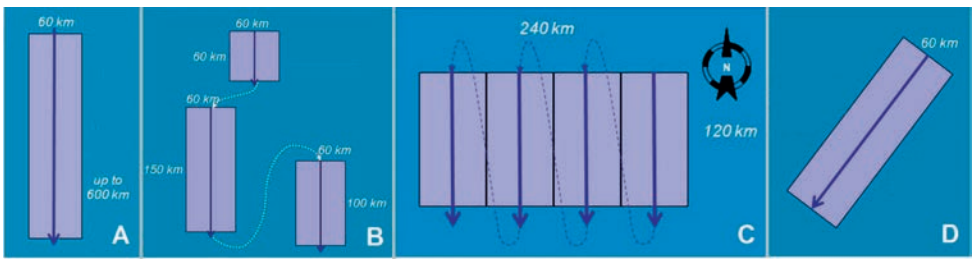

Figure 5, SPOT 6 image of Cyprus covered in 4 strips within 90 seconds.

WEATHER AND TASKING

The high agility allows tailored tasking based on the requests of users, who may define the area of interest, desired viewing angle, capturing in (tri-)stereo and other parameters. However, the tasking is not programmed blindly, solely based on user requests, as areas may be covered by clouds. Another asset is that weather forecasts are incorporated in the mission planning. Based on the forecasts, mission plans are adjusted to steer

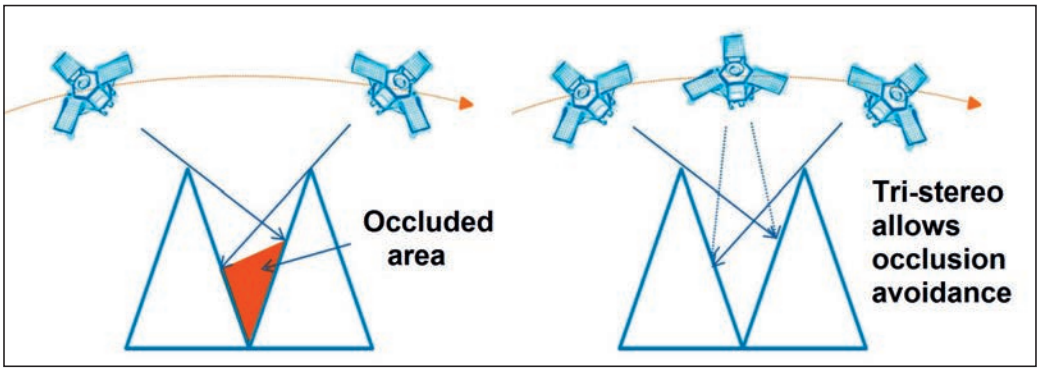

Figure 6, Difference between stereo and tri-stereo.

the pointing of the sensors away from clouded areas and thus to minimise the number of scenes hidden by clouds. As a result, 60% of images have less than 10% cloud cover. Users facing an emergency situation are served by instant tasking. Mission plans are uploaded 6 times per day enabling requests to be executed quickly. Fully automatic processing and immediate (online) delivery ensures that the imagery is rapidly ready for use.

SPOT 6 covered Cyprus's entire land area of 9,251km² in 4 strips from east to west within 90 seconds

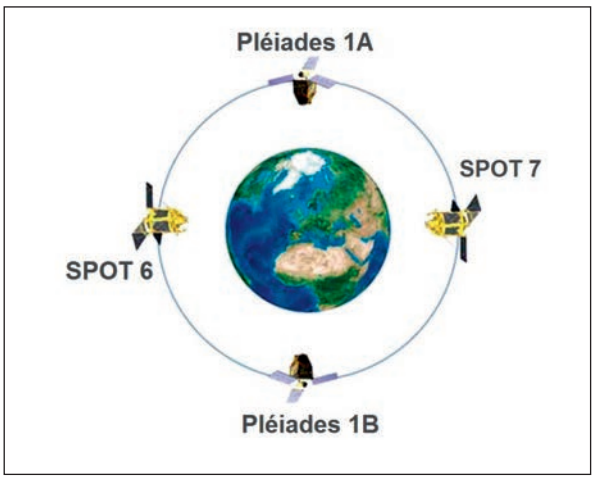

Figure 7, SPOT 6 and 7 and Pléiades 1A and 1B operate in the same orbit, each phased at 180°.

FOUR IN HAND

SPOT 6 and 7 circle in the same orbit as their Pléiades twins, launched on 17 December 2011 and 2 December 2012, respectively (Figure 7). Likewise, Pléiades 1A and 1B are phased 180° apart, have a repeat cycle of 26 days, acquire stereo imagery in the same pass and capture five bands (see Table 1), while the CMGs provide similar agility abilities. Pléiades also refreshes its mission plans three times a day, leading to similar low cloud cover and time reactivity. The main operational differences between the two sets of twins can be typified by the number 3 or its multiple 6. The swath width is 20km vs. 60km, the GSD of the B/W band is 0.5m vs. 1.5m and the GSD of the MS bands is 2m vs. 6m. The daily acquisition capacity per satellite is 0.5 million km² vs. 3 million km². Designed as a dual civil/military system, Pléiades meets the needs of defence and civil purposes in a scheme in which over 90% of the capacity is available for commercial use.

CONCLUDING REMARKS

As SPOT is commercially operated, the imagery is not available for free and there are some licensing restrictions on usage and sharing. Because the tasking facility means that sites are visited on demand, gaps in location and dates may occur. Prices vary depending on the level of processing, GSD, scene size and the use of tasking. The images that have been archived since 1986, covering over a billion square kilometres, are for sale but some of them are free for the public and research institutes. One question remains: can the two sets of twins fulfil high-definition topographic demands? The answer: yes they can, as the content, spatial resolution and positional accuracy of Pléiades imagery are high enough for topographic mapping at the scale of 1:5,000 while SPOT 6 and 7 are suited for mapping at scale 1:25,000.

	SPOT 6 & 7	Pléiades 1A & 1B
Panchromatic	0.450 - 0.745	0.480 – 0.830
Blue	0.450 - 0.520	0.430 – 0.550
Green	0.530 - 0.590	0.490 – 0.610
Red	0.625 - 0.695	0.600 – 0.720
Near Infrared	0.760 - 0.890	0.750 – 0.950

Table 1, The five spectral bands of SPOT 6 and 7 and Pléiades 1A and 1B; band range in µm.

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TOWARDS A UAV-BASED SYSTEM FOR MEASURING CANOPY HEIGHT

Airborne Lidar in Rainforest

At the experimental forest site Paracou in French Guiana, a range of data is being collected to enable the short-term dynamics within the tropical rainforest canopy to be better understood and quantified. Airborne Lidar was used to obtain high spatial resolution data of the 3D canopy structure. The data has been utilised to build a canopy height model and provides valuable information about the foliage density. The sensing system can also be mounted on an unmanned aerial vehicle (UAV). The French Guianian project demonstrates proof of concept for the further application of this technique.

Within the CANOPOR research project, various research institutes and companies are cooperating to map the canopy of an experimental forest site. Of particular interest is the spatial and temporal exchange of carbon dioxide and other gases between the atmosphere and the vegetation inside the canopy. These dynamics are key to understanding the role that forests play in maintaining the local ecosystem, but also for understanding how they respond to and influence global climate change. The canopy area is where vegetation and atmosphere interact, a so-called 'ecotone', but the area is hard to access for research. Therefore, the UK-based forest mapping company Carbomap processed an airborne Lidar survey using an approach which has never been applied before in the tropics. The application of airborne Lidar

Sam Fleming is a remote sensing expert with an MSc from University College London and a BSc in Geography from the University of Edinburgh, UK. His expertise lies in utilising Lidar data over forests for extracting structural parameters. He most recently worked for Greenstone as a carbon consultant and is currently head of client services at Carbomap.

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Iain Woodhouse is a professor of Applied Earth Observation at the University of Edinburgh, UK. In 2008 he co-founded Ecometrica and was a non-executive director from 2008-2012. In 2009 Iain founded REDD Horizon, a capacity-building programme in Malawi, and in 2012 he was funded by a Royal Society of Edinburgh Enterprise award to help set up Carbomap. He is currently CEO and lead co-inventor of the multispectral canopy Lidar.

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Antoine Cottin is an expert in bathymetric Lidar processing. He did his PhD in Quebec and then a postdoc working in Mississippi with Optech and the US Army Corp of Engineers. He has a decade of experience processing full waveform systems. Antoine has also led teams in successful field campaigns and has experience in the application and processing of terrestrial laser scanners. He is currently CTO of Carbomap.

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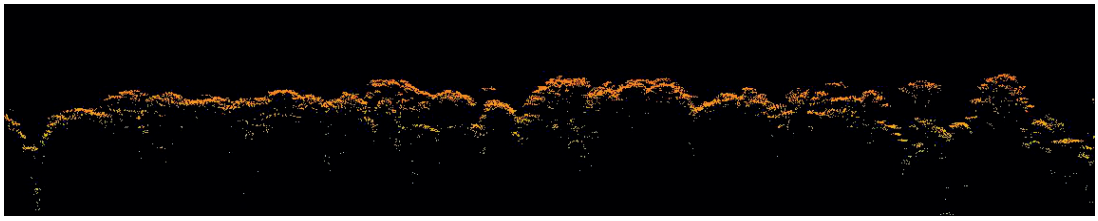

Figure 1, A cross profile of the scan data on the forest, showing the height of the canopy.

for forest mapping is well established within academic research, and its use within commercial applications is a growing industry. Airborne Lidar allows data of the forest structure to be captured at a level of detail that is not possible using other sensing systems which are often applied in the tropics, such as satellite remote sensing or radar. This enables 3D maps of the forest to be created, and further relevant metrics such as forest carbon to be calculated or estimated. This technology can be used within a range of different forestry areas, such as timber, conservation, management and fire risk management. A key product for these applications is the canopy height model, which describes the height of the foliage relative to the ground. It is computed by subtracting the heights of a ground model from the absolute heights of the foliage.

LASER SCANNING SYSTEM

The French company L'Avion Jaune has created the YellowScan laser scanning system which was used in the forest mapping project. It is a laser scanner intended for UAVs and other ultra-light aircrafts. It weighs less than 2 kilograms and incorporates a laser scanner head, an inertial measurement unit based on MEMS technology and a high-grade GNSS receiver. To allow operation on UAVs, it has a low power consumption and compact dimensions of 20 x 20 x 15cm^3. The scanner can operate at up to 150m above ground level with a point spacing of 10cm^2 at a flying speed of 50km/h. The typical scan angle measurement is ±50°. The spatial accuracy of the system is 30cm to 1m, whilst the range accuracy of the scanner is 10cm.

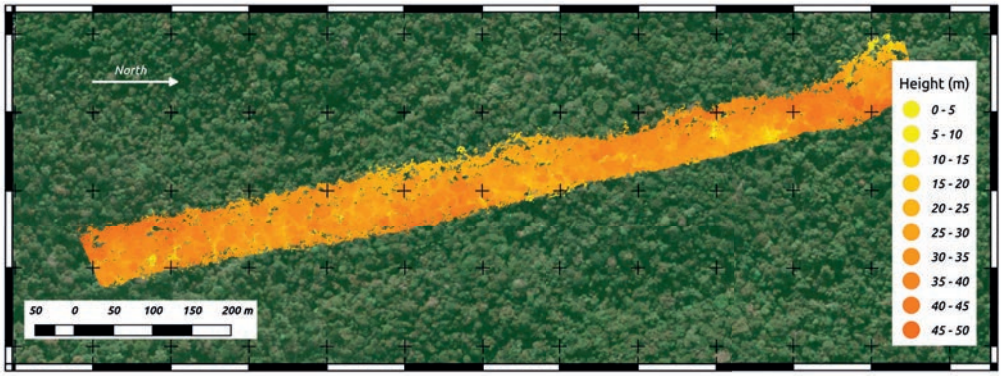

Figure 2, The canopy height model overlaid on a satellite image shows how individual crowns are apparent in the data.

YellowScan provides up to 3 returns per pulse. This helps to extract terrain information under vegetation cover as the probability of registering points from underneath the foliage increases with more pulses. This in turn is crucial for generating a canopy height model which relies on an accurate digital terrain model.

DATA ACQUISITION

Data for the canopy height model was collected by mounting the YellowScan system on a manned helicopter. A helicopter was used as it enables a range of flight characteristics and scenarios to be tested. The primary considerations for replicating the flight of a UAV are the low altitude of the aircraft and the low speed of flight. The helicopter flew several test strips to cover the forest area of approximately 0.35km^2, with a total of over 600,000 points being collected. Figure 1 shows a cross profile of the scan data over the forest. A base station was used during the flights for RTK positioning. However, due to failure of the radio link it was not used and the less accurate SBAS correction was applied instead. Although no ground control points were used, a traditional Lidar dataset was collected within the same week as the UAV Lidar data and the two sets were matched.

To generate the canopy height model, Carbomap extracted the terrain model from the point cloud. The particular challenge was the high foliage density of the forest itself, which limited the ease of ground identification. To overcome this problem Carbomap developed an algorithm to identify the points on the ground. Overall, only 673 of the 600,000-plus returns were found to be on the ground. The achieved accuracy of the DTM had a RSME of 9.6cm, a bias of 1cm and terrain elevation standard deviation of 6.9m. These were calculated by determining the difference between the ground mesh layer and the identified ground points.

PROCESSING

Once the DTM was extracted from the point cloud, the canopy height model was determined from the height of the trees above this ground layer. Figure 2 gives an impression of the result. The next stages in a forest mapping workflow are to extract other forest metrics from the data. Examples of this are the amount of above-ground biomass and carbon stored within the forest area. If multiple datasets over time are available, then the change in

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forest cover can also be measured to reveal the changes in forest carbon.

TOWARDS UAVS

The scanning system used in this project, although mounted on a manned helicopter, is optimised for use in a UAV. To provide proof of concept of UAV-based forest mapping, the helicopter replicated the flight parameters of a typical UAV. The use of UAVs is more adapted to this type of work, in comparison to the current industry standard which uses full-sized aeroplanes for airborne Lidar surveys. The flight altitude of a UAV is significantly lower than that of a manned aircraft, which helps to overcome problems of cloud and atmospheric interference in tropical regions. UAVs also fly at much lower speeds than normal aircraft, resulting in a much higher point density. The result is a more cost-effective system that is especially appropriate for use in developing countries where airborne Lidar can be expensive to deploy.

DEVELOPMENTS

Work is ongoing to apply this project's UAV forest mapping approach in other parts of the world, demonstrating its use in a range of different forest types. Carbomap is helping to lead the use of UAVs for forest mapping to provide a low-cost alternative for mapping small areas of forest. Meanwhile, research and development on laser mapping technology is continuing. For example, full-waveform laser scanning can be used to extract sub-canopy data about the forest which is particularly useful for fire risk mapping. Another development is the fusion of multispectral remote sensing with the 3D structural information from laser scanning, through a multispectral canopy Lidar. Once airborne this will provide biophysical information about the full 3D profile of the forest canopy, including the understorey as well as the top canopy layer. ◂

▲ *A view of the forest from above (Image courtesy: CIRAD).*

BIOGRAPHY

Sören Leitz and **Steffen Kagerah** are students on the Geomatics master programme with specialisation in Geodetical Measurement at the HafenCity University of Hamburg, Germany. They have written this article also on behalf of the other HCU students who participated in the HERICT field trip to Rhodes: Sabrina Bingel, Gordeon Thie, Sebastian Sieh and Sebastian Prott.

More information about the project, the participants and the results are provided on http://herict.survey.ntua.gr/2013.

SÖREN LEITZ AND STEFFEN KAGERAH
HafenCity University of Hamburg, Germany

Modelling the Ancient Ruins of Kymissala

A Field Trip to Rhodes

The ancient Hellinistic settlement of Vassilika of the Kingdom of Kymissala is located in the eastern part of the island of Rhodes, between the modern towns of Monolithos and Lakki. Following a devastating earthquake in the 15th century, the Kingdom failed to recover and Vassilika became fertile ground for tomb raiding and rogue archaeological expeditions up until the latter part of that century. The ancient remains show only the basic structures of the roads and some ruins of the village's houses, but they are nevertheless important cultural heritage objects. To protect these remains, they need to be properly identified and documented by aerial photography and laser scanning so that archaeologists and architectural historians may continue to identify, monitor, investigate and expand the knowledge about European cultural heritage.

The need for geospatial data about the 2,500-year-old ancient ruins of Vassilika, Kymissala, was met within the ERASMUS Intensive Program by the 'HERICT' project. This was organised in 2013 by the Laboratory of Photogrammetry of the National Technical University of Athens (NTUA) and brought together more than 40 students and scientists from several nations. In fact, excavations in the area were already in progress, having been started by the University of the Aegean (UoA) in 2008. The use of geospatial technology was seen as a critical component of that work, and spawned the ERASMUS partnership with NTUA, Nicolaus Copernicus University (NCU) of Torun, University of Siena (UNISI), University of Florence (UNIFI), Vilnius Gediminas Technical University (VGTU), Cyprus University of Technology (CUT), Technical University of Madrid (UPM) and the HafenCity University of Hamburg (HCU).

The main objective of HERICT was to build a common working language and exchange knowledge between the disciplines of architecture, archaeology and geomatics within a common cultural heritage project. Six enthusiastic students of geomatics from HCU were invited by their lecturers, Carlos Acevedo and professor Tom Schramm, to participate in the acquisition campaign in Vassilika for two weeks. They were highly motivated to extend their scientific competencies and very keen to develop their networking skills in an international and culturally rich setting.

DATA ACQUISITION

With a base camp at Lake Apolakkias, around 10km from the excavation sites, the group was divided into six multidisciplinary and multicultural teams in order to optimise the opportunities for knowledge exchange. The leading team was responsible for the general communication between groups, setting the campaign goals and managing the outputs. They also explained the importance of the ruins to the students of architecture and geomatics, and their data needs. For example, orthophotographs and laser point clouds would be used to

Figure 1, Ancient building footprints measured during the field campaign.

Figure 2, Laser scanning the site of Vassilika.

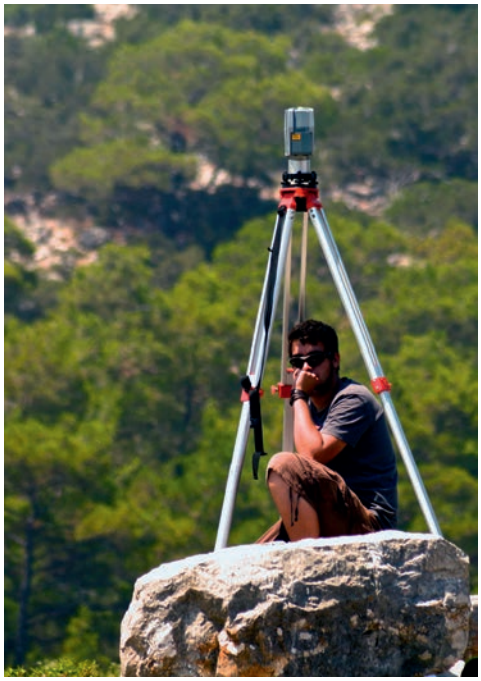

Figure 3, The HERICT team pack up at the end of the field day.

identify ruins or room boundaries and spatial arrangements from above. Acquisition was completed over four days, with the following ten days spent on image processing and data analysis.

The second group was responsible for the geodetic network and determination of the 3D coordinates of ground control points. The network was densified using two control points by a Trimble R8 GNSS receiver and a Trimble VX total station. It was important to finish this work early as the output was the basis for the georeferencing of the point clouds and orthophotos. Three groups were responsible for aerial image acquisition of the sites starting from the northern end. Three different flying systems were used in an experimental way to compare the quality of the results: multispectral aerial images were acquired using a UAV from CUT, an octocopter from HCU, and a kite from NTUA. While the UAV and the octocopter group had to wait for a windless day, the kite required some wind. Fortunately, each group performed successful flights. Ground targets were positioned using RTK measurements with the base station mounted over known control points (A4 sheets homogenously distributed in open fields) to georeference the acquired orthophotos during post-processing. Simultaneously, the sixth group started at the southern end with laser scanning using the Z+F IMAGER 5010 and Trimble TX5 scanners, using the same ground control points. The result was a referenced point cloud of the entire archaeological site, from which a 3D model was generated.

A COMMON LANGUAGE

At the end of the trip, the results of each group were presented and discussed regarding the three methods of aerial imaging. We experienced difficulties in stabilising the images obtained by the kite, whereas the octocopter and UAV methods were stable and relatively insensitive to wind conditions. We also learned that effective communication in interdisciplinary groups is challenging because of different work processes and technical needs, rather than cultural barriers. Time needs to be spent on building a common language as it is important for a geomatics engineer to understand the data needs and use cases in order to plan the appropriate acquisition campaign.

Now, a year on, we can look back on the excursion with pride. We were able to improve our professional and networking skills, and each individual contributed to the success of the project. At the same time we were able to practise these skills on a beautiful island in an area that rarely features on a tourist map. The shared experiences gained both during the practical work and in our free time contributed to the fact that members of the group still maintain contact with one another today.

Young Geo in Focus

'Young Geo in Focus', published bimonthly, offers recent graduates or postdocs the opportunity to share their experiences with our worldwide audience. If you've just completed an innovative project with your first employer or finalised your PhD research with results that are of interest to practitioners feel free to contact the editorial manager at wim.van.wegen@geomares.nl.

The XXV FIG Congress 2014, 16-21 June 2014, Kuala Lumpur, Malaysia

Engaging the Challenges, Enhancing the Relevance

The theme of the XXV FIG Congress, 'Engaging the Challenges, Enhancing the Relevance', could not have been more apt. Firstly, a series of impressive developments are under co-ordination for implementation, such as the Global Geodetic Reference Frame, Global Geospatial Information Management and GNSS World. Furthermore, a series of approaches and tools such as, for example, 'fit-for-purpose' Land Administration and the Social Tenure Domain Model, demonstrate that FIG, together with its partners and the profession, is ready to use its scientific and technological knowledge and practices to engage challenges including undernourishment, shelter, climate change and economic progress.

▲ *Young and experienced surveyors - FIG Foundation Board with 8 sponsored young surveyors.*

▼ *Experiencing the amazing Malaysian culture.*

The first FIG Congress in Asia was held successfully from 16-21 June 2014 in Kuala Lumpur, Malaysia. The event covered a wide range of activities, from technical sessions and special sessions in co-operation with FIG partners such as the World Bank, FAO, UN-ESCAP, UN-GGIM and UN-Habitat/GLTN to technical and social tours. Co-organised by FIG and the Association of Authorized Land Surveyors Malaysia (PEJUTA), the Congress attracted some 2,600 participants from almost 100 countries. The event was a celebration and culmination of the collective efforts and collaborative actions of the past four years. In his opening speech, FIG president Teo said: "The surveying profession is a real-world, people-centric, solution-oriented profession. It is a creative and constructive profession engaged in idea generation, conceptualisation and constructive development, engaging the creative and innovative processes that generate new approaches and opportunities, including that which has never before existed."

THE WORLD WE WANT

"Politicians and governments can do more to embrace the revolution in data gathering and analysis; to use evidence-based policymaking to design programmes that work. So too the surveyors who produce some of the most important data of all," said the Prime Minister of Malaysia, the Honourable Dato' Sri Mohd Najib bin Tun Haji Abdul Razak, in his opening speech. He added: "We should work to improve existing information infrastructure, including spatial data infrastructure, and to implement policies to ensure that spatial data is reliable, accessible for re-use, and can be easily integrated into collaborative environments." Keynote speakers including Greg Scott and Vanessa Lawrence from UN-GGIM referred to the first report of the UN System Task Team on the Post-2015 UN Development Agenda from 2012, entitled 'Realizing the Future We Want for All'. That vision sets out four core dimensions where progress needs to be made:

- Inclusive social development, including empowering people through land tenure security
- Environmental sustainability, including improved land use planning and food security
- Inclusive economic development, including ensuring access to land and natural resources
- Peace and security, including no land conflicts.

FIT-FOR-PURPOSE LAND ADMINISTRATION

The new joint FIG/World Bank publication on 'fit-for-purpose' land administration is aligned with that vision. During the FIG Congress it became clear that further talks are needed with surveying colleagues and professionals from other disciplines in order for this approach to be fully understood. Keith Bell highlighted the Word Bank's support for the 'fit-for-purpose' approach also in the context of the challenges of the Post-2015 Development agenda. Likewise, Dr Clarissa Augustinus from UN-Habitat/GLTN expressed support, underlining the responsibilities of professionals: leadership; more attention on managerial aspects rather than merely data creation; understanding the shift at global level, e.g. the continuum of land rights; working with other disciplines; and large-scale innovation and institutional strengthening. Dr Augustinus was also happy about the open source software of the Social Tenure Domain Model. During the Congress, the open source software and

▲ *At the plenary session.*

▼ *The view from the Congress Centre.*

▼ *FIG members planted 100 trees in the name of the congress. Vice pesident Rudolf Staiger by his tree.*

the commercial software packages were widely seen as being complimentary in a win-win environment. Meanwhile Chris Rizos from the International Association of Geodesy presented innovations concerning a 'Multi-system GNSS World' which were very well matched to 'fit-for-purpose' land administration, especially for georeferencing of imagery and for future upgrading and maintenance of boundary data.

HIGHLIGHTS

Ahmad Fauzi Bin Nordin provided a clear overview of the relevance of geospatial information for crisis management and national development, putting the Malaysian case in an international context. The relevance of a good link to spatial data in the marine environment was highlighted by Mustafa Iptes from the International Hydrographic Organisation. Ben Elder from the Royal Institute of Chartered Surveyors explained the impact of, and developments within, the International Property Measurements Coalition. The standardisation activities are fundamental to property markets and to the profession, he said. Jean-Yves Pirlot from the Council of European Geodetic Surveyors explained the relevance of his organisation. Dato Sri Mustapa Muhamed, Minister of International Trade and Industry, Malaysia, and David Mitchel from RMIT University, Australia, discussed environmental and economic aspects in a sustainable future. Fittingly in this context, the local host organised a special Carbon Offset Tour during which presidents from FIG member associations contributed to the sustainability of our Earth by planting more than 50 heavy hardwood trees.

CELEBRATION

Within its framework of celebration, contributions and commitment, the Congress celebrated the Cadastre 2014, which not only represents ideas and concepts but also the collective professional passion and ability to better comprehend and apply evolving concepts. The authors of Cadastre 2014, Jürg Kaufmann and Daniel Steudler from Switzerland, were highly recognised during the Congress for their contribution to the development of the profession. A new FIG publication is available on Cadastre 2014. A number of joint declarations were also celebrated including the Joint FIG-World Bank Declaration on Fit-for-purpose Land Administration, the Suva Statement on Spatially Responsible Governance in the Context of Small Island Developing States, and the UN-GGIM-AP Kuala Lumpur Declaration on Spatially Enabling Governments and Societies.

EXHIBITION

The well-organised exhibition hosted 56 international and national exhibitors, including stands from platinum Congress sponsors Trimble, Esri, Leica and Topcon. A new feature, the Bunga Raya Platform, was located in the exhibition area for technical/product presentations, briefings or launches and various exhibitors held presentations there throughout the day.

YOUNG SURVEYORS

The young surveyors held their own successful Congress in a hotel next door. The atmosphere was dynamic, interactive and with a focus on documentation via social media. Eva-Maria Unger from Austria summed up the results of that event for the FIG General Assembly: "Yes, we are the future and we are dreaming big!". ◀

MORE INFORMATION
www.fig.net/fig2014

Point Clouds Everywhere at HxGN Live 2014

'Great Stories Start Here'

This year's HxGN Live, Hexagon Metrology's annual user conference, was once again held in Las Vegas, USA, from 2-6 June. Its maxim: 'Great Stories Start Here'. From a geomatics point of view the event can be typified as 'point clouds everywhere'. This report focuses on their creation by airborne Lidar, mobile mapping, trolleys and handhelds.

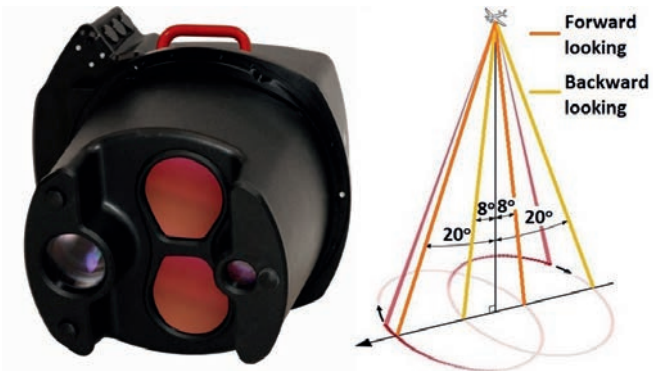

Figure 1, View of the sensors of the DragonEye (left) and diagram of the oblique scan pattern (Courtesy: Leica Geosystems & M. Lemmens).

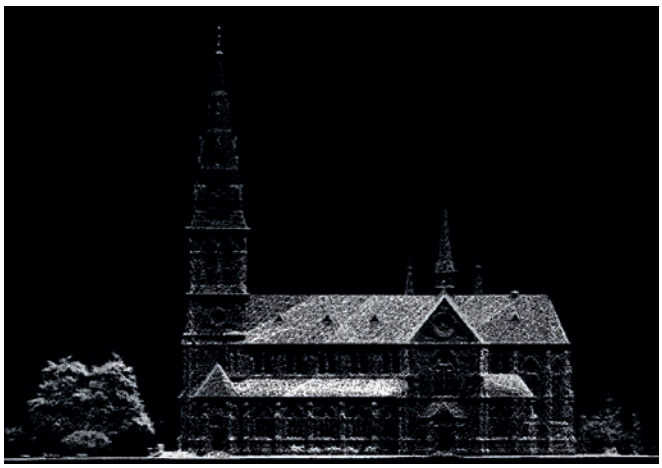

Figure 2, Point cloud of a church and its surroundings captured by the DragonEye oblique Lidar system showing similar details as when the scene would be recorded with a terrestrial laser scanner (Courtesy: Airborne Hydrography AB).

Although Leica Geosystems, part of Hexagon, has been a prominent manufacturer of airborne Lidar systems for decades, in October 2013 it acquired Swedish Airborne Hydrograph AB (AHAB) – a small firm which has been specialised in bathymetric airborne Lidar for over 20 years. Today, AHAB manufactures three types of Lidar systems: one for capturing land and two aimed at seabeds and riverbeds. The systems can be arranged in various configurations, fitting in one standard casing but stamped with different logos. DragonEye is a purely topographic Lidar system. In March 2014 the Dual Head was launched consisting of two scanners each emitting up to 500,000 pulses per second summing up to a pulse rate of 1MHz and joined by an RCD30 80MP camera recording RGB and near infrared. When flying at a height of 1km, the point density is 16 points/m^2. The scan pattern is circular (Figure 1) enabling the receipt of up to four returns per ground point. One sensor is pointing forward and one backward; the resulting oblique view enables the recording of facades on both sides of buildings without occlusion (Figure 2). Its uses include 3D modelling of buildings and cities; monitoring of forests and power transmission lines; and survey of roads and railways. Bathymetry can be captured by two oblique Lidar systems: one for shallow water (max. depth: 15m; pulse rate 35kHz) and one for deep waters (max. depth: 50m; pulse rate 10kHz). Both use the green band and record the full waveform, and the penetration depth depends on how clear the water is. Both bathymetric systems can be combined with the DragonEye land Lidar to seamlessly capture seabeds and the adjoining land. Now that Leica has directed its gaze towards 'the sea', it raises the question of which manufacturer of multibeam echosounders is the first in line to be acquired.

Figure 3, Aldo Facchin, R&D manager for Mobile Mapping Geosoft Srl (Italy) – part of Leica Geosystems – mounting a Pegasus:Two on a van of the Spicer Group, a surveying, engineering and planning firm based in Michigan (USA) (Courtesy: M. Lemmens).

ROAD SURVEYS

Many countries have adopted road safety strategies and these often involve 3D modelling. Mobile mapping systems (MMS) mounted on cars are ideal for this purpose, as they can drive at speeds of up to 100km/h while acquiring data. As a follow-up to Pegasus:One, the Pegasus:Two MMS was launched at HxGN Live 2014. All sensors and computers are integrated in the same casing. The trunk of the vehicle stores only the rechargeable 11-hour battery. The MMS consists of one Lidar sensor and six horizontal

▲ *Figure 4, Pegasus: T2 (Courtesy: M. Lemmens).*

cameras (rear and skyward-view cameras are optional) while there is space for a thermal camera, ground-penetrating radar, sonar, pollution monitor or other sensors. The MMS can be extended with a Leica ScanStation P20. Positioning is done with Novatel's ProPak6. A handle surrounding the unit enables easy mounting on any moving platform (Figure 3). Stuart Woods, vice president of Mobile Mapping, admitted that the handle took longer to design than any other component.

TROLLEY AND HANDHELD

A prototype of Pegasus:T2, a trolley-based MMS weighing 20kg, was also on display (Figure 4). Designed for original data capture, updating or extending existing 3D models of construction sites or plants, for example, the system will be available by the end of 2014. The greatest challenge will be adaption for indoor use. To date, the collection of point clouds has focused on creating new 3D models but once these are in place the need for updating will arise as pipes are subsequently replaced and valves added. At a booth on the exhibition floor, the company DotProduct presented its DPI-7 Kit handheld device composed of off-the-shelf hardware: an Android tablet computer and PrimeSense Carmine 1.08 RGB and depth sensor (Figure 5).

▲ *Figure 5, DPI-7 Kit for rapid capture of point clouds (Courtesy: DotProduct).*

However, the heart of the handheld is the patent-pending Phi.3D software which stitches newly captured point clouds to existing ones in real time using the overlaps. This tool allows not only updating but also capturing of those parts of a scene which are invisible or not accessible to regular laser scanners.

Over 3,500 attendees from 80 countries participated in HxGN Live 2014. Two user conferences will be organised in 2015: one in Las Vegas from 1-4 June and a second one in Hong Kong from 18-20 November. ◀

MORE INFORMATION
http://2014.hxgnlive.com/

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FIG General Assembly, June 2014, Kuala Lumpur, Malaysia

The FIG General Assembly was held from 16-21 June in Kuala Lumpur, Malaysia, in conjunction with the XXV FIG Congress 2014. Prof Chryssy Potsiou, from the Technical Chamber of Greece, was elected as new president of the International Federation of Surveyors for the upcoming 4-year term (2015-2018). Prof Potsiou has been active within FIG since 1982 and has served as vice-president since 2011, chair of Task Force for Housing and Property (2011-14), and chair of Commission 3 (2006-2010).

Current and incoming FIG Council after elections at the General Assembly. From left to right: vice president Rudolf Staiger, also elected for the term 2015-18, FIG president CheeHai Teo (2011-14), incoming president Chryssy Potsiou (2015-18), incoming vice president Diane Dumashie (2015-18) and vice president Pengfei Cheng (2012-16). Vice president Bruno Razza (2012-16) was not present.

Prof Potsiou has been working at the Lab of Photogrammetry, Topography Division, School for Rural and Surveying Engineering, NTUA, in a permanent position since 1992, initially as a research and teaching scientist, then from 2005-2010 also as a lecturer teaching Cadastre, Land Management and Real Estate Valuation; in 2010 she was elected to the position of assistant professor in the same field of activity, and in 2013 she became associate professor at NTUA. In parallel, she has been involved in several research projects and private sector projects. Prof Potsiou is also an elected bureau member of the UN ECE Working Party on Land Administration (2001-2015) and an elected member of the management board of the Hellenic Association of Rural and Surveying Engineers. With over 30 years of experience in education, training and international capacity building in land management and administration, she will represent FIG, as a widely recognised non-governmental organisation, on the global stage. Prof Potsiou, who was the sole candidate for the presidency, was elected for the position of FIG president by a secret ballot and the General Assembly welcomed her election with applause.

Two FIG vice-presidents were also elected for the same period: Rudolf Staiger, DVW, Germany, and Diane Dumashie, Royal Institution of Chartered Surveyors, United Kingdom. Prof Rudolf Staiger was re-elected as member of the FIG Council after a very successful four-year term (2010-2014). Prof Staiger chaired the FIG Commission 5, Positioning and Measurement, from 2006- 2010. He is a full professor at the University of Applied Sciences, Department of Surveying Engineering and Geoinformatics in Bochum, Germany. He represents the *Gesellschaft für Geodäsie, Geoinformation und Landmanagement e.V.*, DVW (Society of Geodesy, Geoinformation and Land Management) as FIG member association. Dr Diane Dumashie is chair of the FIG Africa Task Force. She is a doctor in land economics and coastal planning, and is managing director of Dumashie Ltd. She has been substantially involved in the Royal Institution of Chartered Surveyors (RICS). She was chair of the FIG Commission 8 on Spatial Planning and Economic Development (2002-2010). She is a well-known international expert in the areas of African land issues, land and property development and economic regeneration as well as related institutional building.

Furthermore, all chair-elects of the 10 FIG Commissions and Young Surveyors Network were appointed as chairs of Commission for the term 2015-2018.

The General Assembly chose Helsinki, Finland, as the location for the 2017 FIG Working Week. This will be organised by the Finnish Association of Geodetic and Land Surveyors (MIL) and Finnish Association of Surveyors (MAKLI), with the National Land Survey of Finland (NLS) as partner. The 2018 XXVI FIG Congress will be organised in Istanbul, Turkey. This FIG main event will be hosted by the Turkish Chamber of Survey and Cadastre Engineers. ◂

MORE INFORMATION
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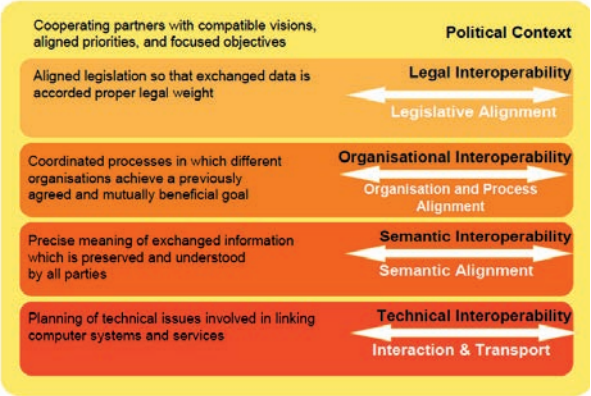
GLIM: Geo Legal Interoperability Map of the World

The GSDI Association's Legal and Socioeconomic (L&SE) Committee welcomes a new co-chair, Dr Joep Crompvoets of KU Leuven, and a new work plan for 2014-2016. The Committee explores the legal, institutional and socio-economic frameworks within which spatial data infrastructures are developed within individual nations and multi-nation regions. It encourages dialogue in regard to varying public policy and legal jurisdictions and explores models, approaches and experiences that may enhance cooperation among nations in sharing spatial data and spatial information technologies.

Among the major future issues that are relevant for the Legal and Socioeconomic Committee are licensing, privacy, liability, open data, volunteered geographic information (VGI), crowd sourcing, transparency, accountability, funding, governance, policy alignment, business models for SDI management, performance assessment and legal issues related to cloud computing, mobile computing and location-based services. The committee especially aims to explore the legal, institutional and socio-economic frameworks within which spatial data infrastructures are developed.

In this column, we have focused on communicating the importance of legally interoperable geodata and services, especially with respect to interoperable licences and systems of data protection. In our new L&SE 2014-2016 Work Plan, we will carry out the next step in exploring and making transparent the global utilisation of open licences for geographic data and services. We will also globally explore data protection (privacy) frameworks that apply to geographic data. Both explorations will be communicated through the Geo Legal Interoperability Map (GLIM) of the world, which may provide a glimpse of the status of the legal interoperability of SDIs globally.



Legal interoperability in the European Interoperability Framework for Public Services.

We aim to finalise the exploration by the end of 2014. Readers of *GIM International* are encouraged to contribute to the GLIM by providing us with relevant input for their country or region. Do you have great examples of open licences for geographic data in your country or region? Let us know through the L&SE Committee website at 1 send an e-mail directly to the co-chairs, Joep Crompvoets (Joep.Crompvoets@soc.kuleuven.be) or Bastiaan van Loenen (b.vanloenen@tudelft.nl).

The GSDI L&SE Committee is open to all who are interested in legal and socio-economic issues relating to geospatial data, services and networks, used in all sectors of society. You do not have to be a member of the GSDI Association or a member of the Association's individual member arm, the International Geospatial Society (IGS), in order to participate.

Find out more about the work of the Committee at 1 and consider joining the L&SE discussion forum at 2. Check out the IGS at 3 and consider joining this group of over 450 individuals from across the globe who are interested in a wide range of SDI issues.

Finally, we would like to take this opportunity to thank Dr Katleen Janssen for her excellent work as past chair of the GSDI Legal and Socio-Economic Working Group. ◂

Dr Bastiaan van Loenen is a past co-chair of the GSDI Legal and Socio-economic Working Group of the GSDI Association. He is a faculty member of the Faculty of Architecture and The Built Environment at Delft University of Technology in The Netherlands.

MORE INFORMATION
1. www.gsdi.org/standingcomm/legal
2. http://lists.gsdi.org/mailman/listinfo/legal-socioecon
3. www.igeoss.org
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No 2589

The mission of the Association is the advancement of geodesy.

IAG implements its mission by:

- advancing geodetic theory through research and teaching,
- collecting, analysing and modelling observational data,
- stimulating technological development, and
- providing a consistent representation of the figure, rotation and gravity field of the Earth and planets, and their temporal variations.

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Advances in geodetic technology – in particular GNSS precise positioning, new geodetic services, new geodetic products such as the International Terrestrial Reference Frame (ITRF), and new Earth observation and mapping systems – offer opportunities for the development of new geospatial services, capabilities and industries.

How Can Advances in GNSS and Geodesy Benefit the Geomatics Industry?

A keynote address at the XXV FIG Congress (Kuala Lumpur, Malaysia, 16-21 June) by Chris Rizos, IAG president, on 'Opportunities & Challenges for the Surveying Industry in a Multi-system GNSS World', identified five mega-trends influenced by developments in geodesy: the decades-long revolution unleashed by GPS; the forthcoming era of multi-constellation GNSS; the evolution of precise positioning from niche to mass markets; the importance of global geodetic reference frames; and the acceptance that geodesy is indeed an Earth observation science.

Chris Rizos speaking at the XXV FIG Congress.

Taking these as starting points enables articulation of a uniquely geodetic perspective on the challenges and opportunities for the geomatics discipline – with consequences for the future of geomatics education, innovation and product development, evolution of practices and service provision, and the promotion of geomatic skill sets.

Become GNSS experts

The GNSS future will be more complex than the relatively simple GPS world. The range of techniques is expanding, with Precise Point Positioning (PPP) services now offered on a commercial basis. Advances in PPP will challenge the current GNSS-RTK differential positioning paradigm. As the world transitions from GPS to multi-constellation GNSS, much of what we know about GPS procedures and capabilities must be relearned. Meanwhile, GNSS receiver technology will evolve in different ways. For example, there will also be low-cost, dual-frequency hardware based on interoperable GNSS signals – perhaps even smartphones with decimetre-accuracy PPP capabilities. Because precise positioning (PP) will no longer be the preserve of the geomatics-educated elite, the industry could differentiate itself by becoming the most-expert group of GNSS users.

Be ready to address new precise positioning applications

Surveyors have traditionally used GPS/GNSS for static point coordination. They must be able to execute kinematic PP tasks, for example in support of mobile mapping, and for new indoor and outdoor PP applications. Technologies to be mastered include inertial navigation systems (INS), Wi-Fi, terrestrial ranging and vision-based systems. Advanced Intelligent Transport System (ITS) applications will require PP technologies be adapted for mass-market users. The geomatics industry should prepare to take advantage of developments in PP technologies, methodologies and services to address such new (and challenging) ubiquitous, reliable and precise positioning applications.

Become mapping experts

The range and capability of mapping systems is developing rapidly. A variety of imaging and scanning systems, deployed on ground, aerial and satellite platforms, is revolutionising mobile mapping. In particular low-cost systems based on consumer products, such as video-game controllers, smartphones, handheld lasers, portable radar and hobby robotics systems, will bring mapping capability to everyone. The demand for underground utility mapping will rise. Hence the geomatics industry needs to master a variety of mapping systems, and use different imagery sources, to address above- and below-ground mapping applications.

Become coordinate and datum experts

Surveyors have unique skills in coordinate manipulation. Expertise in the use of local, national and global datums, transformations involving 4D coordinates and the appropriate use of different height systems should be nurtured. For example, geomatics professionals should be advocates of the adoption of ITRF-based national datums. They must be comfortable with a dynamic, deforming world and reinvent themselves as 'coordinate experts' who manage high-fidelity geospatial data.

The above-mentioned advances in geodesy and GNSS are likely to lead to many exciting opportunities for the geospatial disciplines in the near future. ◂

MORE INFORMATION
www.iag-aig.org

The Military Cartography of the Habsburgs

Ever since its foundation over 50 years ago, ICA has been concerned with celebrating, documenting and learning from the history of cartography. The flowering of scientific cartography in the 18th century is an example of a leap in mapmaking activity which has had a profound effect on our discipline. That is when the first systematic nationwide topographic surveys were started, with the Cassini-inspired *Carte géométrique de la France* being perhaps the best-known example.

The area around Budapest on the First Military Survey (1783). (Courtesy of the Institute and Museum of Military History of the Ministry of Defence, Hungary).

Further east, on 13 May 1764, Maria Theresa, the Empress of the Habsburg Empire, started a large-scale topographic survey of her realm. Today it is remembered as the First Military Survey, and named the *Josephinische Landesaufnahme* after her successor, Joseph II, in whose reign it was completed. This First Topographic Survey was performed without the requirements of a modern survey (like rigorous datum, projection and triangulation). The work was carried out in 19 relatively uniform survey regions covering the contemporary areas of Austria, Hungary, Czech Republic, Slovakia, Slovenia, Croatia and Belgium as well as parts of Poland, Ukraine, Romania and Serbia. Although systematic, the resultant survey was not completely uniform across the whole of the empire.

About 4,000 map sheets were created, each covering an area of approximately 216km^2. As for the scale, the *Militärmaß* is 1 Viennese inch to 400 Viennese fathoms; as 1 fathom equals 72 inches, the representative fraction 1:28,800 was used (just like in most countries at that time). Due to the strict confidentiality, only two hand-drawn copies were made of each sheet; luckily these were all saved by the Austrians, and after the First World War the newly formed 20th-century countries received copies (along with sheets of the subsequent surveys) covering their area.

At the time of the survey, Austria-Hungary was a larger (by area) political entity than France, so this comprehensive large-scale topographic survey was a major task. Without it, the Central European Arc Measurement would not have been created in 1862 as the first international scientific organisation of significance; without that survey, the International Society for Photogrammetry would not have been founded in Vienna in 1910; and without that survey, the International Cartographic Association would probably not have an Austrian president and a Hungarian secretary-general.

On 13 May 2014 a special celebration was organised by the civil (BEV: *Bundesamt für Eich- und Vermessungswesen*) and the military (IMG: *Institut für Militärisches Geowesen*) cartography institutes of Austria. The programme for this two-day celebration (1) reveals a number of ICA personalities involved, alongside the direct successors of the 18th-century military cartographers, in presenting their views of the importance of this 250-year-old project.

ICA has maintained a strong Central European perspective, with 6 of the 28 ICA Commission chairs coming from Austria, Croatia, the Czech Republic or Hungary. The region plays a leading role in world cartography today. ◂

MORE INFORMATION
1. www.ovg.at/uploads/media/Einladung_250Jahre_Landesaufnahme_Festsymposium.pdf
www.icaci.org

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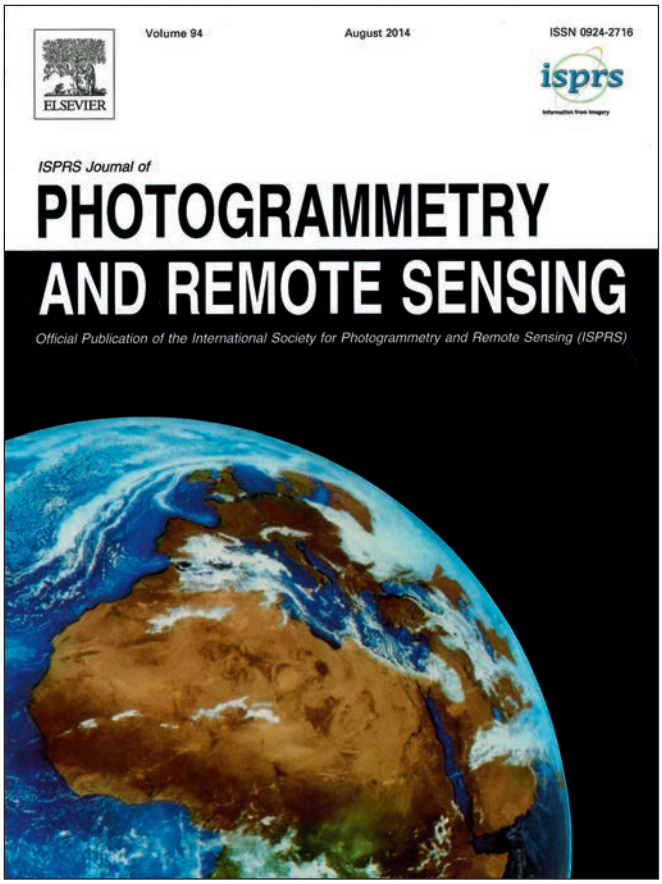
No 2619

Seeking a Co-editor-in-chief for the *ISPRS Journal of Photogrammetry and Remote Sensing*

The flagship journal of the International Society for Photogrammetry and Remote Sensing (ISPRS), the *ISPRS Journal of Photogrammetry and Remote Sensing* (P&RS) seeks a second editor-in-chief, responsible for optical remote sensing. Published by Elsevier B.V., the journal is one of the top-ranked in remote sensing (impact factor 3.313 and 5-year impact factor 4.026). Due to splendid development over the past few years, a second editor-in-chief is needed to work along with editor-in-chief Derek Lichti, University of Calgary, to further the journal's aim to be a channel of communication for scientists and professionals in all countries working in the many disciplines of photogrammetry, remote sensing, computer vision and other related fields. The scope of the journal is extensive and covers sensors, theory and algorithms, systems, experiments, developments and applications. A list of topic areas can be found at 1.



Cover of the ISPRS Journal of Photogrammetry and Remote Sensing.

DUTIES:

- Manage the editorial process for papers submitted to the Journal in the area of optical remote sensing.
- Ensure high-quality scientific content for the Journal, taking into account the aims and scope and Elsevier's editorial policies.
- Work closely with the associate editors and guest editors who will report to the successful candidate.
- Work closely with the incumbent editor-in-chief on matters of the Journal's strategic direction and manuscript decisions (general philosophy, editorial speed, ethics and difficult cases).

Experience and required qualities:

- The successful candidate should have a demonstrated track record of publishing high-quality papers in peer-reviewed journals.
- The successful candidate should have editorial experience.
- This position demands a great deal of time, so the successful candidate must not only possess strong time-management skills, but must also have the capacity to devote the necessary time to the job.
- Strong written English communication skills.

Candidates with demonstrated commitment to P&RS (as an author, reviewer, associate editor or guest editor) are highly encouraged to apply. Interested individuals should submit a cover letter with statement of previous experience and vision for the journal and CV to Christian Heipke, ISPRS secretary general, by 15 September 2014 [isprs-sg@ipi.uni-hannover.de].

Marguerite Madden, ISPRS 2nd vice president

MORE INFORMATION
1. www.journals.elsevier.com/isprs-journal-of-photogrammetry-and-remote-sensing
www.isprs.org

Future events

AUGUST

Brazilian Cartographic Congress
Gramado, Rio Grande do Sul, Brasil
from **03-07 August**
For more information:
E: contato@cartografia.org.br
W: www.cartografia.org.br

2014 ICGIS (International Conference on Geospatial Information Science)
Seoul, Korea
from **27-28 August**
For more information:
E: exhibit@smartgeoexpo.kr
W: http://smartgeoexpo.kr/eng/main#none

SEPTEMBER

9th European GIS Education Seminar
Cork, Ireland
from **04-07 September**
For more information:
E: eugises2014@eugises.eu
W: http://eugises2014.eugises.eu

1st International Geomatics Applications "GEOMAPPLICA" Conference
Skiathos Island, Greece
from **08-11 September**
For more information:
E: geomapplica@prd.uth.gr
W: www.geomapplica.prd.uth.gr

5th ESA Advanced Training Course on Land Remote Sensing
Valencia, Spain
from **08-12 September**
For more information:
E: julia.amoros@uv.es
W: http://seom.esa.int/landtraining2014/index.php

ION GNSS+ 2014
Tampa, FL, USA
from **08-12 September**
For more information:
W: www.ion.org

FOSS4G
Portland, OR, USA
from **08-13 September**
For more information:
W: http://foss4g.org

Geodesign Summit Europe
Delft, The Netherlands
from **11-12 September**
For more information:
E: fholsmuller@esri.com
W: www.geodesignsummit.com/europe

Congreso Internacional de Tecnologías de Geo Información y Gestión de Desarrollo Urbanístico
Bogota, Colombia
from **22-23 September**
For more information:
W: www.geomatica-andina.com/project/geomatica/geomatica/index.cfm

Latin America Geospatial Forum
Mexico City, Mexico
from **22-25 September**
For more information:
E: info@lagf.org
W: www.lagf.org

2014 Esri Latin America User Conference
São Paulo, Brazil
from **25-26 September**
For more information:
E: lauc@esri.com
W: www.esri.com/events/latin-america

OCTOBER

Symposium on Service-oriented Mapping 2014
Potsdam, Germany
from **06-08 October**
For more information:
W: http://somap.cartography.at

Intergeo 2014
Berlin, Germany
from **07-09 October**
For more information:
E: dkatzer@hinte-messe.de
W: www.intergeo.de

UAV Show Europe
Merignac, France
from **07-09 October**
For more information:
W: www.uavshow-europe.com

GeoForm+
Moscow, Russia
from **14-16 October**
For more information:
E: ledenyova@ite-expo.ru
W: www.geoexpo.ru

The Commercial UAV Show
London, UK
from **21-22 October**
For more information:
E: matthew.pullan@terrapinn.com
W: www.terrapinn.com/exhibition/commercial-uav/index.stm

AARSE 2014
Capetown, South Africa
on **27-31 October**
For more information:
W: http://africanremotesensing.org

FIG Commission 7 Annual Meeting and GeoConference 2014
Quebec, Canada
from **07-11 October**
For more information:
W: www.fig.net

NOVEMBER

GeoDATA 2014
Glasgow, Scotland
on **04 November**
For more information:
E: geodata@geoaware.info
W: www.geoaware.info

Unmanned Systems Canada Annual Conference 2014
Montreal, QC, Canada
from **04-07 November**
For more information:
W: www.unmannedsystems.ca

4th International FIG 3D Cadastre Workshop
Dubai, United Arab Emirates
from **09-11 November**
For more information:
E: p.j.m.vanoosterom@tudelft.nl
W: www.gdmc.nl/3dcadastres/workshop2014/

Calendar Notices
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