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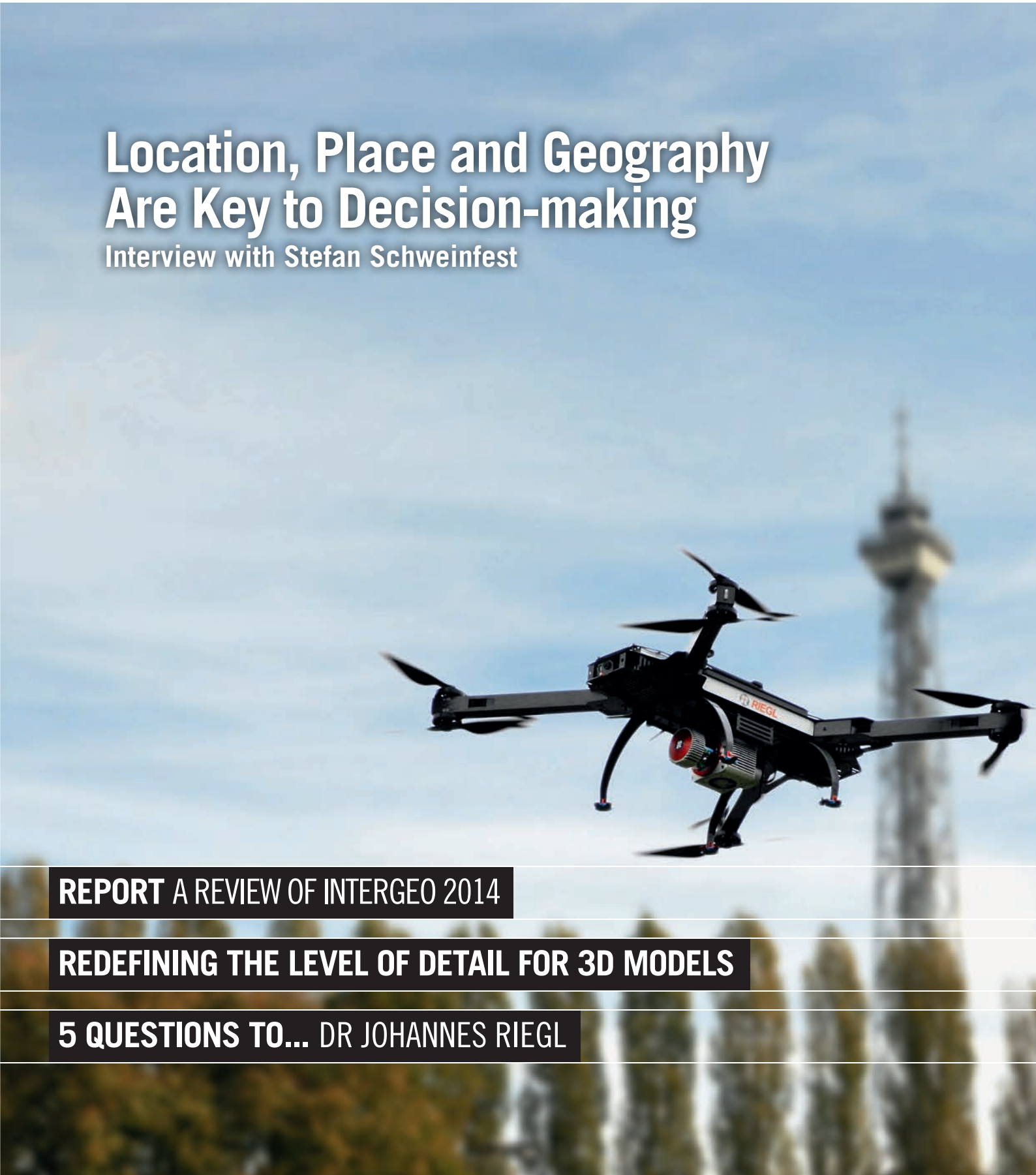
Location, Place and Geography Are Key to Decision-making

Interview with Stefan Schweinfest



REPORT A REVIEW OF INTERGEO 2014

REDEFINING THE LEVEL OF DETAIL FOR 3D MODELS

5 QUESTIONS TO... DR JOHANNES RIEGL

New Products Coming.....

Total Station

GNSS

GIS

Gyroscope

Levels

- A50 New Generation GNSS Receiver
- RTS812M Motor Total Station
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- DT402-Z Auto-collimating Digital Theodolite
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The front cover of this issue of *GIM International* shows the recently launched UAV from RIEGL, the RiCOPTER, flying in the flight zone of Intergeo 2014. Read more on this year's Intergeo in the report on page 36 and 37. (PHOTO COURTESY: RIEGL)

ComNav

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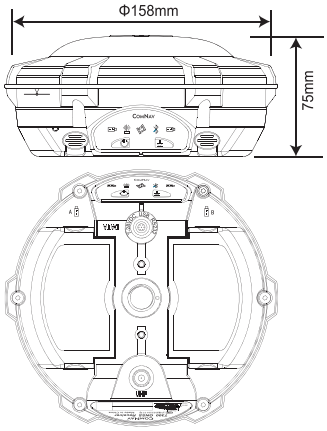

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BPA WORLDWIDE BUSINESS

Data Revolution

The amount of data that humankind has gathered and stored over the past few decades is mindboggling. So too is the amount that is added every day, and every minute even – and the speed and volumes are only increasing. Just think of all the satellites up there in orbit, continually adding new imagery to the existing pile. Not to mention all the drones flying over locations that were previously inaccessible, or the terrestrial laser scanners capturing up-to-date 'pictures' of all kinds of buildings and infrastructure, historic monuments and archaeological or agricultural sites. Add to that all the data that is collected, whether intentionally or unintentionally, by citizens using mobile phones or the internet all over the globe. The sheer size of the total, disconnected bulk of data is simply staggering. And the devil is in the disconnection, because what if we could connect all that data together for the betterment of the world? That idea is at the core of the data revolution which UN secretary general Ban-ki Moon called for in 2013. He sees that the availability of qualitative and accessible data could support sustainable development, and therefore believes that a data revolution should dictate the UN's Post-2015 Development Agenda, replacing the Millennium Development Goals as a tool for reducing poverty and increasing sustainable welfare all over the world. Just a few months ago, a group of experts convened at the UN in New York for the first time to discuss how to put the plan for a data revolution into action.

Photography: Arie Bruinsma

▲ *Durk Haarsma, publishing director*

The data revolution represents a massive opportunity for the geomatics industry – after all, geoinformation is very much at the heart of every dataset – because XYZ coordinates are so vital in the usefulness of data. Geotechnology is on the brink of a new phase of development and the sooner professionals, entrepreneurs, companies and governments start directing their resources at turning the data revolution into reality, the better it will be for the industry, the people who work in it and ultimately global society as a whole. Linking satellite imagery to data derived from crowdsourcing and social media as well as the development of ways to visualise and analyse those new, combined products will be an amazing step, taking us from unimaginably huge chunks of stand-alone data to understandable, supporting grids upon which governments can base their policies.

At the highest level within the United Nations, there is consensus that the data revolution will be a major tool in the next decade. That has already trickled down to the United National Global Geospatial Information Management (UN-GGIM) initiative which is discussing the data revolution (see also the interview with Stefan Schweinfest, director of United Nations Statistics Division [UNSD] and the secretariat of the United Nations Committee of Experts on Global Geospatial Information Management on page 16). Ideally, members of the industry should now step up to the challenge, join the UN-GGIM in discussing and consulting, advocate a data revolution in their own countries and with their government representatives, and set their R&D departments to work with a focus on creating links between data. This will secure the place of geoprofessionals and the whole geomatics community – companies, societies and educational institutes – right at the heart of this revolution. Which is precisely where they belong!

Resourcing the Democratisation of Land Rights

A number of initiatives are emerging, led for example by Rights and Resources Initiative, Rainforest Foundation UK, FLOSS SOLA and MapMyRights Foundation, that are based on the concept of democratising land rights through citizen empowerment and crowd-sourcing. This involves citizens and communities capturing their evidence of land rights on mobile devices and recording it on a platform that is accessible globally. These fit-for-purpose approaches are trust-based rather than legally based systems and increase security of tenure through societal evidence and global publicity.

With only 350,000 land professionals worldwide and the challenge of registering the 4.5 billion parcels which are currently outside of formal land administration systems, there is the need to create a new, scalable model. Otherwise, at current rates, it will take several hundreds of years to register all properties in some countries. The initial phases of implementing these crowdsourced initiatives plan to use trusted intermediaries (sometimes called 'para-surveyors' or 'barefoot surveyors') to collect evidence of land rights on behalf of communities and citizens. This approach has been successfully used in Rwanda and the Kyrgyz Republic, for example, to provide national registration coverage in around three to five years.

These trusted intermediaries would be trained by land professionals and NGOs/CSOs. They would initially be vetted by the NGOs, but over time the network of intermediaries would self-organise into collaborating networks and provide the essential scalability. To increase trust among the citizens, the intermediaries could obtain qualifications as has happened with the BRAC property rights initiative. The BRAC's Land Entrepreneurship Model is a unique model where government-certified land measurement training is provided to a cadre of land entrepreneurs who provide free-of-charge services to ultra-poor clients.

The trusted intermediaries could support a number of information services, including health, finance, agriculture and weather, for example, as well as land rights. Land rights could simply be a by-product of other services, e.g. microfinance or micro-insurance. This would add further trust between citizens and the trusted intermediaries and limit unintended consequences.

Such innovative models for service delivery are having a major impact on land professionals and are rapidly redefining their role, shifting it from measurement to management. New opportunities are being created in communities for training, quality control, information management and the delivery of land-governance capacity building. Democratisation of land rights will create a significantly larger base of customers, many of whom will require upgrading of their land rights under the fit-for-purpose approach. This is a great opportunity for land professionals. However, if land professionals do not quickly embrace this new paradigm then other professions will fill the vacuum.

Robin McLaren, Know Edge
robin.mclaren@knowedge.com

Large-format Mapping and Modelling Solution for Manned Aircraft

WaldoAir, TN, USA, has announced the launch of an integrated, large-format, low-cost camera system for use on single-engine aircraft bundled with a new edition of Pix4D's image processing software that treats multi-camera systems. This complete system offers the manned aircraft industry the same image capture capabilities that until now could only be realised by legacy, large-format sensors and dedicated aircraft platforms. Meanwhile, investment and operational costs are now much lower.

▸ http://bit.ly/11iDx6d

RIEGL Launches UAS at Intergeo

One of the most eye-catching product launches at Intergeo 2014 was RIEGL's self-developed UAS, equipped with the VUX-1 survey-grade Lidar sensor. The new UAS, called RiCOPTER, marks an important step in the history of the Austrian Lidar manufacturer. The RiCOPTER was unveiled by company founder and CEO Dr Johannes Riegl himself.

▸ http://bit.ly/11izqHe

Dr Johannes Riegl unveiled the RiCOPTER at Intergeo.

Rapidlasso Launches LASzip Compatibility Mode for LAS 1.4

In the same week that Intergeo 2014 was held in Berlin, rapidlasso completed the first prototype that extends the LASzip Lidar compressor to the new point types 6 to 10 introduced with the LAS 1.4 specification. Sponsored in part by NOAA, this upgrade introduces a new 'Compatibility Mode' for LAS 1.4 that deploys a clever point re-coding strategy so that legacy Lidar software – without LAS 1.4 support – can readily read the new point types as well.

▸ http://bit.ly/11iAiM7

Juniper and Effigis Join Forces in GPS Accuracy

Juniper Systems, a manufacturer of rugged handheld computers, and Effigis, a geomatics solutions provider, have partnered to provide a powerful and inexpensive solution to easily capture and post-process GPS data to attain sub-metre accuracy. Effigis' OnPOZ precision positioning software suite takes advantage of the GNSS performance provided by Juniper Systems' Archer 2 rugged handheld to collect high-accuracy GPS data.

▸ http://bit.ly/11iAzP2

Topcon Adds Imaging Capability to DS-200 Total Station

Topcon Positioning Group has announced the addition of imaging capability to its direct aiming line of motorised total stations. The DS-200i provides real-time, touchscreen video and photo imaging to capture measured positions and is designed so that every measurement has the option of a photo which can be tagged as an attribute.

▸ http://bit.ly/11izCX4

DS-200 total station.

New Solution for Directly Georeferenced Mapping from UAVs

Applanix, a leading company in products and solutions for mobile mapping and positioning, has introduced a new solution that enables major improvements in unmanned airborne mapping: the Applanix APX-15 UAV GNSS inertial system. The APX-15 UAV is designed to maximise the efficiency of mapping from small unmanned aerial vehicles (UAVs) by reducing – or even eliminating – ground control points (GCPs). Sidelap is also significantly reduced, thus increasing the area flown per mission.

▸ http://bit.ly/11iAOK7

5 Questions to...

Johannes Riegl

Dr Johannes Riegl, founder and CEO of RIEGL.

Congratulations on the launch of your very own UAS, the RiCOPTER, at Intergeo 2014. Why was it the right time for that now?

The use of unmanned aerial systems has increased dramatically over the past two years and has opened up completely new areas for aerial surveying. Our survey-grade UAS Lidar sensor, the VUX-1, has already been integrated into various UAS systems, such as SARAH by FlyingCAM or Scout B-100 by Aeroscout. As it is our mission to surpass our customers' expectations and we saw the market desire for a turnkey UAS survey solution increasing, we decided to develop a RIEGL UAS aircraft, the RiCOPTER, specifically designed for our VUX-1 Lidar sensor. Intergeo 2014 was the perfect moment to introduce this game-changing new turnkey solution!

Can you tell the GIM International readers more about the RiCOPTER? Who are the potential users?

The RiCOPTER is a high-performance UAV which can be equipped with the RIEGL VUX-1 survey-grade Lidar sensor to offer a fully integrated turnkey solution. RIEGL puts itself again at the forefront of this industry: our customers now can rely on a fully integrated Lidar UAS solution coming from a single manufacturer. From integration, training and acquisition to data processing, a complete UAS solution is now made available thanks to RiCOPTER – the first 'flying laser scanner'!

The RiCOPTER was demonstrated live in the UAV flight zone at Intergeo. What was the general reaction?

We received overwhelmingly positive reactions. We were very glad we were able to fly demonstrations in the Intergeo flight zone. We really appreciated the co-operation of the other companies in the outdoor area who had already planned the demo flights to fit us in the schedule! Spectators in the UAV flight zone were impressed by the sonorous sound of RiCOPTER and also by the very stable hovering and flight characteristics, even under very demanding wind conditions.

RIEGL has additionally launched a brand-new airborne Lidar system, the VQ-880-G. Can you describe this system for our readers?

The VQ-880-G is RIEGL's first fully integrated airborne Lidar system for combined hydrographic and topographic surveying and represents the 'big brother' of the proven VQ-820-G bathymetric Lidar scanning engine. The system is offered with integrated and factory-calibrated high-end GNSS/IMU system and cameras. The design allows flexible adaptation of these components to specific application requirements.

You have also added a new terrestrial laser scanner to your portfolio, the VZ-2000. How is the VZ-2000 different from your previous laser scanners?

The VZ-2000 is our fastest terrestrial laser scanner yet, with a maximum PRR of 1MHz and an effective measurement rate of up to 400,000 points per second. This is all for a time-of-flight instrument offering range performance of more than 2,000 metres! The VZ-2000 complements our VZ terrestrial product family and fills the range gap between the VZ-1000 and the VZ-4000. The VZ-2000 is an ideal instrument to upgrade to mobile scanning when needed using our VMZ hybrid mobile mapping system. We offer our valued customers more options to meet their specific requirements.


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2. Great Wall of China 3D Modelling Project - http://bit.ly/11iECLj
3. Remote Sensing Experts Train Tomorrow's Earth Observation Scientists - http://bit.ly/11W82PF
4. Surveying UAS for Use with RTK Base Stations - http://bit.ly/11W8jSV
5. Delair-Tech Starts Partnership with Pix4D - http://bit.ly/1AG1xuJ
6. Point Cloud Solution for Processing Laser Scan Data - http://bit.ly/11W9mST
7. Sentinel-1A Radar Satellite Shows Capabilities - http://bit.ly/1uht0mm
8. Topcon Partners with MAVinci for Worldwide UAS Distribution - http://bit.ly/1qlX6wF
9. Global Alliance to Improve Farming Through Remote Sensing - http://bit.ly/1uhtbOr

Belgian Road Research Centre Chooses Mobile Mapping System

imajbox mobile mapping system.

The Belgian Road Research Centre (BRRC) has recently chosen imajbox, a mobile mapping system from imajing, to perform road network condition assessment and monitoring and to store details of field status. imajbox can be installed on various vehicles in order to record field data which will be valuable for results interpretation and validation.

▸ **http://bit.ly/11iFMq5**

SimActive Introduces Technology for Mosaic Creation

SimActive, a leading developer of photogrammetry software, has announced the release of Correlator3D version 5.4, with faster mosaic creation and a further increase in quality. The process has been entirely revamped to profit from multi-core CPUs and solid-state drives (SSDs), leading to a significant increase in processing speed compared with previous versions.

▸ **http://bit.ly/11iBoYb**

Great Wall of China 3D Modelling Project

Great Wall of China.

Acute3D's Smart3DCapture solution has been chosen for the 3D automatic reconstruction part of the 'Great Wall of China in 3D' modelling project. The project was officially launched on 16 September 2014. It will be supervised by China's Ministry of Culture and State Administration of Cultural Heritage and part-funded by UNESCO.

▸ **http://bit.ly/11iECLj**

Towards Mobile Mapping Systems for the Mining Industry

3D Laser Mapping, a global developer of laser scanning solutions for the infrastructure and mining sectors, has signed a global OEM agreement with Neptec Technologies, a provider of real-time intelligent 3D robot vision products. With the agreement, both parties aim to lay the foundations for the creation of mobile mapping systems specifically for the mining industry.

▸ **http://bit.ly/11iDSFX**

Neptec's OPAL 3D laser scanner.

SPECIM Launches Full Spectrum Sensor at Intergeo

SPECIM, a leading manufacturer of hyperspectral imaging instruments and systems, introduced AisaFENIX 1K, a full spectrum sensor that cuts the costs of hyperspectral data capture, at Intergeo 2014 in Berlin, Germany. The full spectrum hyperspectral sensor with 1,024 spatial pixels produces readily co-registered VNIR and SWIR data and is developed to take the productivity of hyperspectral imaging to a new level.

▸ **http://bit.ly/11iAFq7**

AisaFENIX 1K full spectrum sensor.

Routescene Presents New 3D Mobile Mapping Solution

Routescene launched a new turnkey 3D mobile mapping solution, the Routescene LidarPod, at Intergeo. With the solution, surveyors can save time and achieve more detailed and faster results, enabling them to address many of the challenges currently facing the surveying industry. The Routescene LidarPod has been developed specifically for use on unmanned aerial vehicles (UAVs) but can also be fitted onto any mobile platform as required, such as cars and boats.

▸ http://bit.ly/11iAWcD

LidarPod.

Satlab Geosolutions Expands with New Americas Office

Swedish survey and GIS equipment maker Satlab Geosolutions has announced its formal expansion into the US and Americas with the creation of a new sister company: Satlab Geosolutions (USA) Inc., based in Scottsdale, Arizona. Setting up a formal base of operations in the US will allow Satlab to better service its clients and expand its customer base in the US, Canada, Mexico and Latin America.

▸ http://bit.ly/11iCmDL

Satlab SL600.

CORRECTION

In the October 2014 edition of *GIM International* the article 'Surveying in the Valley of the Temples' by Mauro Lo Brutto and Fabio Di Salvo was published. Regrettably, the opening sentence of the second paragraph is missing in the left-hand column on page 31.
This reads as follows: Long-range terrestrial laser scanning (TLS) for 3D topographic modelling has become one of the most effective and rapid techniques for geomorphological and geotechnical analysis of unstable rock areas. In the digital edition (accessible via http://member.gim-international.com) the correct version of the whole article has now been reproduced.

ALTM Galaxy.

Optech Announces Airborne Lidar Sensor for Wide-area Mapping

Optech has unveiled the latest addition to its line of airborne laser terrain mappers, the ALTM Galaxy. With the Galaxy, the Canadian company aims to raise the bar in sensor capability. Boasting a similar compact form factor to the award-winning ALTM Orion sensor platform for Tier-II UAV, heli-pod, gyro-stabilised or fixed-platform installations, the new ALTM Galaxy maintains the same survey-grade data precision and accuracy for the highest-quality datasets in the industry.

▸ http://bit.ly/11iBBe6

SLAM-based Portable Indoor Mapping System

At Intergeo, SBG Systems joined VIAmetris in announcing the MID, a SLAM-based portable indoor mapping system. For this innovation, VIAmetris has chosen SBG Systems' brand-new miniature AHRS, the Ellipse-A. With this system, just walking is enough to map the interior of a complete building. MID integrates 2D Lidar, a camera, an AHRS and a tablet PC that shows the map being drawn while the user walks through the building.

▸ http://bit.ly/11iCXW6

AHRS Ellipse.

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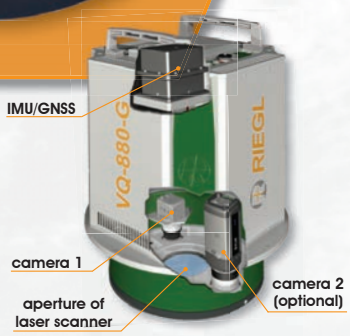

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A Student's View of Intergeo

Just as in 2013, I once again visited Intergeo this year – held in Berlin, Germany – to guide my students around the exhibition halls. Having all gained a BSc in a geomatics-related field, these international students, 19 in total, started in September 2014 on the MSc in Geomatics for the Built Environment programme at the Faculty of Architecture, Delft University of Technology, The Netherlands. In this month's column, I would like to hand over the reins to one of my students so that you can enjoy their young and fresh views: "The Intergeo exhibition, which we visited as part of the course GEO1001 'Sensing Technologies for the Built Environment', was a unique opportunity to learn more about state-of-the-art equipment and software. A great surprise was the size of the event. I didn't realise that so many people are involved in geomatics. It's very encouraging to know that the community is so big. On the first day our professor guided us along a variety of booths and showed us how to fearlessly shoot off questions and ask for demonstrations. This was a very good ice-breaker. On the second day he recommended a number of particularly interesting booths. I liked the demonstrations by PCI Geomatics, Microsoft Ultracam and Terrasolid; they visualised and enlightened the theory and concepts we had been taught in the weeks before. PCI from Canada showed solutions to increase the quality of DEMs using Python tools and scripts. I knew Microsoft from their software but at Intergeo I learned that they are also involved in photogrammetry. Microsoft Ultracam provides integrated solutions including computing units, solid-state storage devices, flight management systems and the aerial camera itself of course, but you have to buy the aircraft yourself. The use of most software on display appeared complicated, but the software from Microsoft is very intuitive and almost aesthetic. One example of a company offering software for processing point clouds is Terrasolid. Their software can handle point clouds from any type of laser scanner or camera system on airborne or mobile platforms and the diverse point clouds can be processed in one integrated environment. Point clouds can depict highways, their surroundings and the road surface very accurately, but can also capture buildings and thus enable automated production of textured 3D building models using images captured simultaneously. Point clouds of wires, structures, vegetation and the ground along power-line corridors can be processed into vector models for monitoring purposes. The point clouds generated by laser scanners are so amazingly accurate that they can be used for many tasks. The RIEGL Lidar systems can be put under UAVs for capturing small areas, under helicopters for scanning power lines and other corridors, and on cars and trains for scanning roads and railways to detect damage and repair needs. UAVs were omnipresent and applied for uses varying from land administration to point cloud generation from imagery, laser scanners or a combination of both. I personally have an interest in consultancy and that is the core business of COWI from Denmark. The firm operates worldwide and exploits a variety of geomatics devices, software and methods to serve governmental agencies and other clients with Lidar point clouds, orthoimagery, maps, 3D models and thermal and bathymetric data. They use a variety of platforms including manned and unmanned aircraft and mobile mapping systems. Their airborne Lidar survey enabled Rijkswaterstaat (The Netherlands) to produce an accurate national height model. Many of the innovative businesses are small and experimental with an informal atmosphere and the people are young, enthusiastic and open to new ideas. The international orientation and openness makes the industry really appealing. All the demonstrations were very well aligned with the topics of GEO1001 and really helped us to understand what the theory we have learned is used for."

GIM INTERNATIONAL INTERVIEWS STEFAN SCHWEINFEST

Location, Place and Geography Are Key to **Decision-making**

Earlier this year, United Nations secretary-general Ban-ki Moon officially approved the appoinment of Stefan Schweinfest as director of the United Nations Statistics Division (UNSD) and, thus, the Secretariat of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM). As the importance of UN-GGIM continues to grow, *GIM International* talked to Schweinfest to gain a comprehensive progress update.

Congratulations on your appointment as director of the United Nations Statistics Division (UNSD) and the Secretariat of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM). You are a statistician yourself, so one could say that it's a case of 'statistics meets geospatial'. Is that a good combination?

Indeed, it is a good combination. The geospatial and statistical professional communities are major contributors of data used for evidence-based decision-making across many sectors, both public and private. Globally, there is clear recognition of the need to link – or integrate – geospatial information (principally environmental information) and statistical information (principally socioeconomic information) to improve the relevance of the evidence on which decisions will be made. The challenge has always been how best to achieve this integration in an effective and consistent way. In 2013, at each of their respective intergovernmental meetings, the United Nations Statistical Commission and UN-GGIM acknowledged the critical importance of integrating geospatial information with statistics and socioeconomic data, and the need to develop a statistical-spatial framework as a global standard for doing so, especially in the context of the ongoing debate on the Post-2015 Development Agenda. Therefore, they established an Expert Group on the Integration of Statistical and Geospatial Information. The Expert Group convened a Global Forum on the topic in New York, USA, from 4-5 August 2014 on the margins of the Fourth Session of UN-GGIM. As a way of reaching out and developing best practices involving both the statistical and geospatial professional communities, the Global Forum brought together more than

180 senior leaders. They discussed the strategic vision and goals for the integration of statistical and geospatial information, marking a continuation of the global consultation and communication on the development of a global statistical-spatial framework.

For the readers of GIM International, can you explain UN-GGIM, its importance and purposes?

Established by the United Nations Economic and Social Council (ECOSOC) in July 2011, UN-GGIM is a formal intergovernmental mechanism that seeks to guide the agenda for the development of global geospatial information and promotes its use to address key global challenges. It also makes joint decisions and sets directions on the use of geospatial information within national and global policy frameworks. It comprising representatives from Member States and provides a forum for liaison and coordination among and between Member States and international organisations. The main purposes of UN-GGIM are to work with governments to improve policy, institutional arrangements and legal frameworks; to address global issues and contribute collective knowledge as a community with shared interests and concerns; and to develop effective strategies to build geospatial capacity, particularly in the developing countries. UN-GGIM is important because it signals to national leaders the significance of geospatial information in addressing national, regional and global challenges. It also provides the forum for developing common global goals, guidelines and best practices to make the use of geospatial information for sustainable development pervasive.

What was the most important outcome of the most recent UN-GGIM meeting in New York in early August?

Our Fourth Session in August had many important outcomes. There were 11 items on the agenda for discussion and consideration, including a knowledge base for geospatial information management, the integration of geospatial, statistical and other information, legal and policy frameworks, determining global fundamental geospatial data themes, developing a shared statement of principles on the management of geospatial information, and a global map for sustainable development. All of these are of great significance to the geospatial community. However, if we were to judge the importance on the number of interventions from delegates across all agenda items, the adoption of the decision on the Global Geodetic Reference Frame (GGRF) by the Committee of Experts could be regarded as the most important. The Committee recommended that the amended draft resolution on a GGRF for sustainable development should be referred to the Economic and Social Council for endorsement and further to the United Nations General Assembly. The resolution calls for greater global co-operation and data-sharing to strengthen our ability to measure and monitor the Earth and positioning of objects relative to it. A more sustainable GGRF will ensure that more consistent locational positioning will be available across the globe. This is especially important as precise positioning is being applied in virtually every aspect of people's lives, from civil engineering and transportation, climate change and sea-level monitoring to sustainable development and emergency management.

What is the next step in your view?

In terms of the top three priorities, the first is to complete the establishment of the regional UN-GGIM architecture. We are well on our way to achieving this within the next year. We have already established UN-GGIM-AP for Asia and the Pacific and UN-GGIM:Americas, plus UN-GGIM:Europe was formally launched in Moldova on 1 October. We will have the first preparatory meeting of UN-GGIM:Africa in Tunis from 8-10 December, and the second preparatory meeting of UN-GGIM:Arab States in Jordan in February 2015. So we are making very good progress. Secondly, and because we are a UN body, it is imperative that we are able to bring geospatial information science, technology and innovation more comprehensively into the Post-2015 Development Agenda, and to assist in measuring and monitoring the sustainable development goals in particular. Quite simply, in these modern times, one cannot measure and monitor sustainable development without location, place and geography. Thirdly, the Committee of Experts is required to go back to ECOSOC in 2016 with "a comprehensive review of all aspects of its work and operations, in order to allow Member States to assess its effectiveness". So we are initiating a programme review to report our efforts and value to ECOSOC and the Member States.

IN THESE MODERN TIMES, ONE CANNOT MEASURE AND MONITOR SUSTAINABLE DEVELOPMENT WITHOUT LOCATION, PLACE AND GEOGRAPHY

How can countries which are not currently represented be convinced to become involved?

We have seen growing interest and diversity of representation over the past four years. Building consensus, awareness and communication is a continuous process, and we expect the number of Member States represented to continue to increase. The regional UN-GGIM entities have been significant enablers in this process of increased communication and geospatial ambassadorship. This year's Session saw unprecedented representation from the Caribbean with 13 Member States in attendance. This was achieved through the hard work and tenacity shown by the UN-GGIM:Americas regional body, led by its president, Rolando Ocampo, in Mexico. In 2013 at the 10th Regional Cartographic Conference for the Americas, one of the decisions from the meeting was to increase the participation of Caribbean countries in regional and global geospatial information management matters. The president has been able to garner regional agreement and sponsorship to support these small island states in being a part of this important global process. UN-GGIM:Americas held its first regional meeting during the Latin Americas Geospatial Forum in Mexico from 24-25 September 2014.

What are the main challenges the global geospatial community will face in the years ahead?
Financing; keeping abreast of innovation given the rapid pace of technological change; harnessing big data and data from the cloud, and making it authoritative; being able to provide data to support instantaneous decisions. Furthermore I foresee a number of challenges in terms of legal and policy concerns, and privacy.

The UN-GGIM High-Level Forum is calling for a 'data revolution'. What are the main ingredients of such a revolution?
In May 2013, the secretary-general's High Level Panel of Eminent Persons on the Post-2015 Development Agenda called for a data revolution for sustainable development, and emphasised the need to improve the quality of information available to citizens. The availability, quality and accessibility of today's data just isn't good enough. Too often, development efforts are hampered by a lack of the most basic data about the social and economic circumstances in which people live. Member States are actively discussing the various aspects of the data revolution, such as the need for capacity development, the modernisation of statistical systems, big data and the development of new indicators in order to address existing data gaps and to be able to satisfy the significantly greater information needs resulting from the Post-2015 Development Agenda. In recognition of the vital role that geospatial information plays in almost all of these aspects, UN-GGIM discussed this at the Third High Level Forum in Beijing in October 2014. In order to obtain more complete and timely data, and to close the data gaps in national settings, it will be necessary to ensure availability of and access to fundamental data themes and spatial data infrastructures that reliably collect, integrate, analyse, model, fuse and aggregate data for dissemination and decision-making.

NATIONAL SPATIAL DATA INFRASTRUCTURES NOW HAVE THE REAL ABILITY TO PROVIDE THE MEANS TO 'ORGANISE' AND DELIVER CORE GEOGRAPHIES FROM ANYWHERE, AT ANY TIME

What is the geospatial industry's role in this data revolution?
The geospatial industry has a vital role to play because the data revolution – just like leveraging big data and the cloud – requires innovation and technology to be harnessed and advanced. Bringing the data revolution to fruition will rely on promising new technologies and tools – satellite imagery, geocoding, crowdsourcing, social media, mobile devices, other digital mechanisms as well as data visualisation – to engage the broader community. This is the geospatial industry's domain. There has been a fundamental change in the nature of data, which is now generated continuously and in enormous quantities, and in the innovative sources from which it is derived. Technology-driven trends will continue to have a major impact on the growth and direction of geospatial information as we manage a world of data in the coming years.

Data is key to strengthening worldwide human development. Can you give us some inspirational examples of big data initiatives?
Several interesting big data initiatives are being undertaken within my purview in

statistics, for instance. In March 2014, the UN Statistical Commission established a global Working Group mandated to provide strategic vision, direction and co-ordination of a programme on big data for official statistics, while finding solutions for the challenges, and to promote capacity building and sharing of experiences in this respect. In fact, my division organised an International Conference on Big Data for Official Statistics in Beijing, China, from 28-30 October 2014, which considered the use of big data and analytics with geospatial information.

Many countries have their own spatial data infrastructure or are developing one. Is creating a successful national spatial data infrastructure (NSDI) essential to a country's sustainable future?

The concept of NSDIs is not new – they have been around for more than a decade now. However, and as mentioned previously, the paradigm of data availability and usefulness is changing rapidly; volumes are greater and increasingly real-time information is required. So NSDIs are evolving and will become more important than before, but their value must also be viewed differently. NSDIs are no longer just a means of storing and delivering data. They now have the real ability to provide the means to 'organise' and deliver core geographies from anywhere, at any time. For this to be accomplished it is necessary for the data to be available, standardised and widely accessible, and to allow new geospatial datasets to be developed through user co-operation. From an aspirational perspective, I would like to see countries invest in and strengthen national statistical capacities and geospatial information systems for the collection, analysis, production and dissemination of disaggregated data to measure and evaluate policy effectiveness, and promote a culture of evidence-based decision-making. ◂

Stefan Schweinfest

Stefan Schweinfest was appointed director of the Statistics Division (STAT/DESA) effective on 1 July 2014. Mr Schweinfest studied mathematical economics at the universities of Würzburg and Bonn, Germany, and he holds a *Diplome D'Etudes Approfondies* from the University of Paris (Sorbonne/Pantheon) in that field. During his MPhil studies at the London School of Economics, he also held a position as teaching assistant there. Mr Schweinfest joined UN DESA's Statistics Division in 1989 and worked in various areas, such as national and environmental accounting, statistical capacity-building programmes and indicator frameworks. He was also responsible for the Division's external relationships, both with member countries as well as with international partner organisations. In this context, he has been the substantive secretary of the United Nations Statistical Commission since 2002. He was also closely involved from the start in establishing the UN-GGIM programme and acted as the key liaison between the Division and ECOSOC during the negotiations of the UN resolution that formally launched UN-GGIM in 2011.

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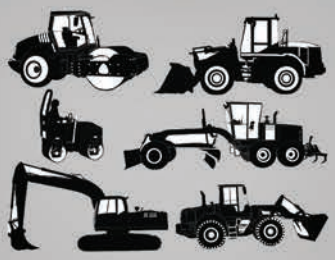

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No 2674

IMPROVEMENT OF THE LOD CONCEPT FOR 3D CITY MODELS

Redefining the **Level of Detail** for 3D Models

Cities are increasingly adopting 3D city models for 3D visualisation, computing solar panel potential of roofs, and other applications. In a similar way to traditional maps, 3D models are an abstraction of the real world: certain elements are simplified or omitted. The amount of detail that is captured in a 3D model, both in terms of geometry and attributes, is collectively referred to as the level of detail (LOD). The CityGML standard from OGC defines five different LODs, but the specification is not very precise. In this article, the authors propose an improved specification for defining the level of detail in a 3D city model.

Figure 1, The concept of five LODs as defined by CityGML.

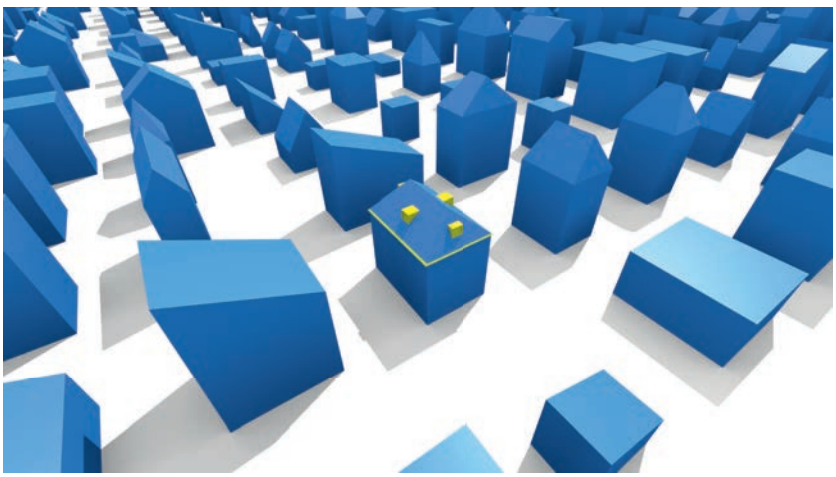


Figure 2, Comparison of 3D buildings with and without dormers and overhangs. Both variants are valid LOD2.

The level of detail (LOD) is a concept in 3D city modelling which is used to indicate how thoroughly 3D data should be surveyed and how much detail should be modelled. For instance, a municipality will specify an LOD when tendering 3D modelling work to a company. The most popular LOD classification is the one found in the CityGML OGC standard. This defines five LODs, ranging from a simple 2.5D model of footprints to a detailed architectural model containing indoor features such as rooms and furniture (Figure 1). Higher LODs do not only increase in their geometric complexity but also in their semantic richness, that is the description of the geometry. Practitioners actively use the LOD designations as shorthand of the specification and for expressing the fineness of a 3D model, and it has become a de facto standard even when models are not related to CityGML.

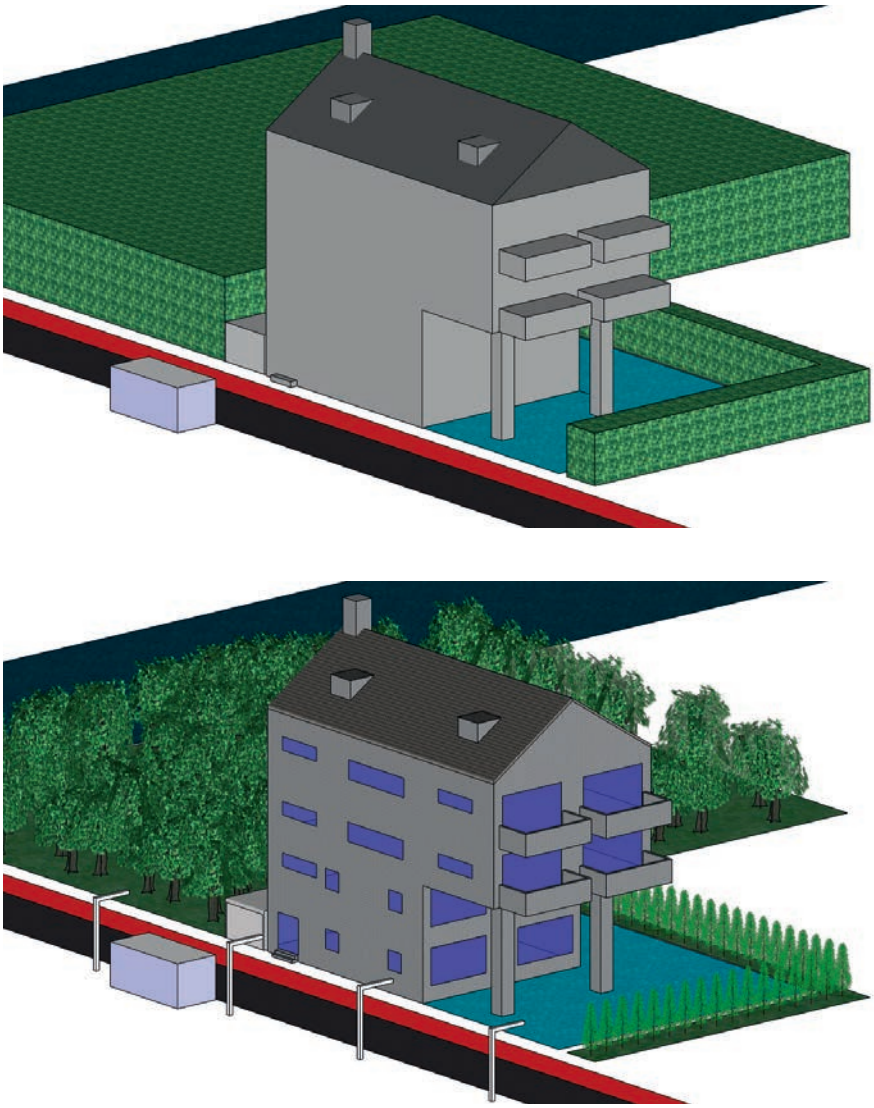
SHORTCOMINGS OF LOD IN CITYGML

The geospatial industry relies on the CityGML LOD definition for communicating the design quality of 3D data. However, the standard defines the LODs only narratively, without clear specification of the requirements for each. As a result, ambiguities and misunderstandings are possible.

Because CityGML's LODs are not strictly specified, the standard allows a high degree of freedom in the acquisition of the models. Hence, two models of significantly different complexities may still be considered as the

	3D City Model LOD specification				LOD i			
General metrics	Feature complexity				0.4 m			
	Appearance resolution				0.3 m/px			
	Semantics				Yes, full spatio-semantic coherence			
City objects and elements	**Object**	**Feat. C.**	**Attributes**	**Elements**	**Feat. C.**	**Dim.**	**Appearance**	**Attributes**
	Buildings		+ Occupancy + Energy Rating	Wall		2		+ Material
				Roof	0.2 m	3		*None*
				Roof.Dormer	0.2 m	3		*None*
				Chimney	0.2 m	3		*None*
				Balcony		3		*None*
				Pier		3		*None*
				Opening		2		*None*
				Interior				
				Storey		3	*None*	+ Use
	Roads		+ Road Use	Traffic area-Cars		2	Black	+ Speed Limit
				Traffic area-Bicycles		2	Red	*None*
	Street lights	1 m	+ Power Consumption	Pole		3	*None*	*None*

▲ *Figure 3, Specification format for defining level of detail in 3D models.*



▲ *Figure 4, Depiction of LOD6 and LOD7 models in the refined series of LODs.*

same LOD. A prominent example is LOD2. In practice, if an LOD2 model is ordered, it is not certain if semantics are defined and if dormers are present, which might be important for the intended application (Figure 2). Due to this shortcoming in the standard, the data behind an LOD2 model could be almost anything. This hinders the use and exchange of models in practice. In particular, it is difficult to estimate and compare costs if the definition of an LOD is not clear. On the other hand, the LOD concept provides too little granularity to describe a model which exactly suits the user's needs.

LOD-DEFINING PARAMETERS

The authors examined dozens of specifications of 3D data, internal practices of companies and tenders, and spoke with users about their views on the LOD concept. The LOD concept has been decomposed into six defining metrics as follows:

1. Presence of features: the real-world objects and their elements that are to be included
2. Feature complexity: the complexity of the geometry of the features and the minimum size of the real-world features
3. Spatio-semantic coherence: the richness of the semantics
4. Texture: whether features have to be textured, and if so to which level of quality
5. Dimensionality: the dimension of the geometry of each feature
6. The list and values of the attributes that are required for each feature.

BECAUSE CITYGML'S LODS ARE NOT STRICTLY SPECIFIED, THE STANDARD ALLOWS A HIGH DEGREE OF FREEDOM

Thanks to this decomposition, and because each of the metrics can be quantified, it is possible to define the LOD unambiguously for each model.

NEW SPECIFICATION

During the research, it became apparent that it is difficult to uniformly specify requirements for each of the six metrics. Different applications rely on different types of models, and thus the metrics may vary. The authors therefore developed a specification format

(Figure 3) intended for industry use for precise specification of the requirements prior to the acquisition of a 3D city model.

Based on the framework developed, the authors constructed their own series of 10 precisely defined LODs which do not leave much ambiguity or gaps between them in order to address the shortcomings of the CityGML concept. A visual example can be seen in Figure 4, which shows the LOD6 and LOD7 of the series for direct comparison.

STANDARDISATION

The developed framework enables each stakeholder to define their own series of LODs. It is hoped that this will lead to unambiguous specifications and clear procurement of 3D models, eliminating many potential misunderstandings. Because of the influence that the CityGML LOD concept has in the industry, the authors regard it as a high priority to improve it. OGC has also recognised the need for refining the concept, and relevant efforts are already underway. The authors of this article are involved in the CityGML Standards Working Group which is currently developing the new version of the standard, due in 2016. ◂

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No 2566

ACCURACY ASSESSMENT FOR DIVERSE GRID SIZES

Interpolation of **Lidar Point Clouds**

For representing terrain heights INSPIRE, which is aimed at creating an EU spatial data infrastructure, has developed specifications for digital terrain models (DTMs). DTMs are preferred as the main source for computing risks of flooding and other analytical tasks while their quality should be specified in terms of accuracy and resolution, i.e. grid size. Here, the author applies five interpolation methods to two airborne Lidar datasets both located in northwest Italy – one capturing a mountainous area and the other a flat urban area – and investigates the resulting accuracy for diverse grid sizes.

The five interpolation methods used are: inverse distance weighting (IDW), natural neighbour (NN) and three variations on splines. In both the IDW and NN methods, heights of unknown points are calculated as a weighted average of known points in the vicinity. In IDW the influence of known points depends on a power of the distance to the unknown point. Other setting parameters are the number of known points and the size and shape of the search area. The power was set to 2, the radius to variable and the maximum number of points to 12. NN uses area derived from a Voronoi tessellation to define the weight. No parameters have to be specified. The third, fourth and fifth methods are based on splines. This approach is well suited for the creation of smoothly varying surfaces. The three variations on splines are: regularised (SpR), tension (SpT), and tension with barriers (SpTb). Breaklines may be included in SpTb by defining weight and number of points. For the regularised method, the weight defines the smoothness of the surface; the higher the weight, the smoother the surface. Typical values are 0, 0.001, 0.01, 0.1 and 0.5. In this study, 0.1 was used. In the tension method: the higher the weight, the coarser the surface. Typical values are 0, 1, 5, and 10. In this case, 0.1 was used. The more points, the smoother the surface will be at the expense of longer computation times. Here, the same number of points was used as for IDW, namely 12. Kriging has been excluded as the results would be similar to splines.

TEST DATA AND AREA

The test data, which was captured over two areas in Italy – Bardonecchia and Grugliasco (Figure 1) – has been acquired through airborne Lidar using the Leica Geosystems AL S50-II. This system employs multiple pulses in air (MPiA), has a maximum pulse rate of 150kHz and a scanning frequency of 90 lines per second while it records 4 returns, including first and last. The survey was originally aimed at creating orthoimagery at scale 1:5,000 and bare ground DTMs with height accuracy (combined systematic and random error) of 0.6m and a grid size of 5m. The actual survey was conducted with a pulse rate of 66.4kHz and scanning frequency of 21.4Hz while the intensities of the four returns were recorded. Points reflected on vegetation and buildings were removed using filters. Table 1 shows other key survey parameters.

Flying height	200m-6,000m above ground
Field of view (FoV)	58°
Average point density	0.22 pts/m²
Average point spacing	2.12 pts/m

Table 1, Lidar survey specifications.

Although similar in size, the terrain characteristics of the two test areas differ significantly. Bardonecchia is located in the western Alps, close to the border with France, and covers an area of 39.20km² with altitudes varying from 1,230m to 2,200m. Grugliasco is an urban area located 10km

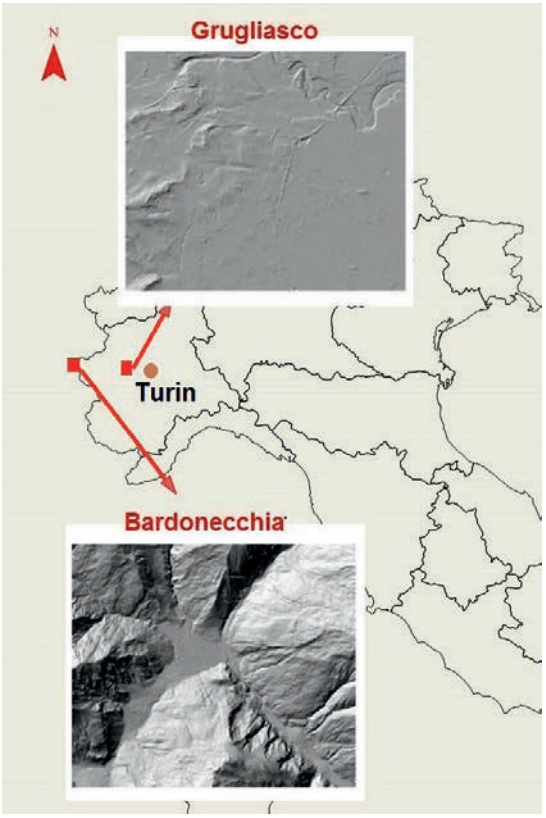
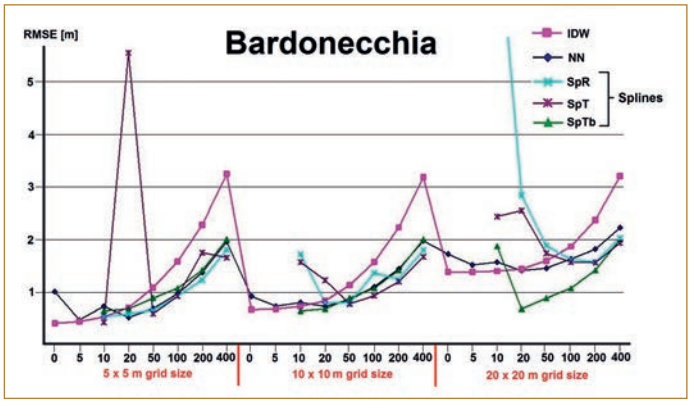
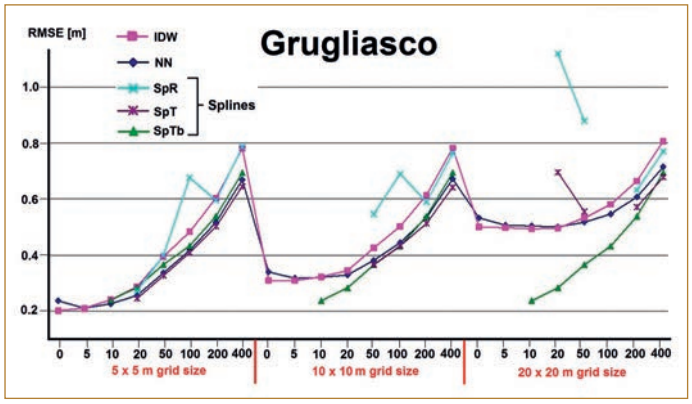


Figure 1, Location of Bardonecchia and Grugliasco sites in northern Italy.



▲ *Figure 2, RMSEs of Bardonecchia.*



▲ *Figure 3, RMSEs of Grugliasco.*

	Density [1 pnt per]	Bardonecchia	Grugliasco
1.	3.54m²	11,897,765	10,855,704
2.	5m²	7,841,600	7,687,680
3.	10m²	3,920,800	3,843,840
4.	20m²	1,960,400	1,921,920
5.	50m²	784,160	768,768
6.	100m²	392,080	384,384
7.	200m²	196,040	192,192
8.	400m²	98,020	96,096

▲ *Table 2, Eight subsets created by iteratively resampling to courser densities.*

west of Turin and covers 38.44km² with altitudes varying from 260m to 470m and is thus relatively flat. Over 12 million Lidar points were captured of the Bardonecchia site and nearly 11 million of the Grugliasco site, which results in – given the area – average densities of 1 point per 3.26m² and 1 point per 3.54m² respectively. Breaklines necessary for conducting interpolation by SpTb have been manually extracted from stereo imagery using a photogrammetric workstation.

RESULTS

As the aim was to quantify how interpolation diminishes the accuracy with respect to the original Lidar points, around 1% of the Lidar points were randomly selected as check points. The other 99% were iteratively resampled to generate eight subsets with subsequent lower densities (Table 2). Each subset was interpolated with the five methods described above at three grid sizes: 5 x 5m, 10 x 10m and 20 x 20m. Next each grid height was compared with the height at the check point. To determine the height at the exact corresponding location, bilinear interpolation was applied using four surrounding check points. The root mean square error (RMSE) was computed using Esri ArcGis 10.1 and Python scripting. Residuals and statistical analyses were executed using the free software environment for statistical computing and graphics of the R project (1).

The resulting 24 RMSEs per method for Bardonecchia are shown in Figure 2 and for Grugliasco in Figure 3. Note that 0 on the horizontal axis indicates the original point density. The RMSEs of Grugliasco (flat urban area) are an order of magnitude of 3 to 4 better than those of Bardonecchia. IDW and NN succeeds in generating the grids of all 8 subsets. Splines are unable to cope with the denser datasets up to 1 point per 10m² and even produce peaks. The saw-tooth shapes of the graphs clearly indicate that – as could be expected – accuracy decreases as point density decreases, i.e. RMSE becomes larger, with IDW being most affected (pink lines). With increasing grid size, accuracy decreases rapidly for all methods and this effect is more severe for the urban area (Grugliasco) than for the mountainous area (Bardonecchia).

ACKNOWLEDGEMENTS

Thanks are due to Gianni Siletto for providing the airborne Lidar data. ◀

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No 2669

DETERMINING VOLUME CHANGES OF THE CHUQUICAMATA OPEN PIT MINE, CHILE

UAS in the Andes

In mining, the determination of volume changes over time is an important surveying task. However, harsh environments can make gathering precise and up-to-date geodata challenging. Traditional land surveying and terrestrial laser scanning are faced with many hurdles when used in remote open pit mines. UAS provides an alternative without compromising accuracy. Here, the authors present UAS surveys carried out high in the Andes.

The gathering of information in open pit mines is associated with many risks. If security protocols are not strictly followed, heavy equipment may injure surveyors operating on site. In addition, digging ore produces dust, noise and other unfavourable working conditions. When located in mountainous areas temperature may be well below zero. Access is often limited due to safety regulations, or even impossible due to the harsh environment. Terrestrial laser scanning (TLS) is a proven tool under such conditions but requires substantial investment and logistics as well as many set-up points to avoid blind spots. A UAS allows regular aerial surveys to be conducted without blind spots. Also, there is no need for access to the pit as a UAS can be remotely piloted, while the efficiency and timelines of a photogrammetric workflow can be fully exploited.

CHUQUICAMATA MINE

Chuquicamata, Northern Chile, is the biggest open-pit copper mine by excavated volume in the world, and at 1,000m from top to bottom it ranks second in terms of depth (Figure 1). The diameter is 4km. Particularly, the depth level between 200 and 400m is being explored at present and thus has to be surveyed regularly. The pit lies at 2,800m above sea level; wind speed and direction may change rapidly which precludes replication of flight plans, while turbulences can cause air drops of several metres which requires the endurance of a fixed wing. The high altitude raises energy consumption and thus reduces flight time ,while safe landing zones are rare. Since landing places may be small and rough, lightweight fixed wings are preferred in order to prevent damage to aircraft. To preserve a constant ground sample distance (GSD) the height above ground has to be upheld, which further defies flight planning. The wind also causes dust to blow around which obstructs sight and thus contaminates the measurements, while digging may destroy ground control points (GCPs). However, experiences gained during numerous flights have given an understanding of where and when wind and dust are most severe, and this helps when defining the flight variables.

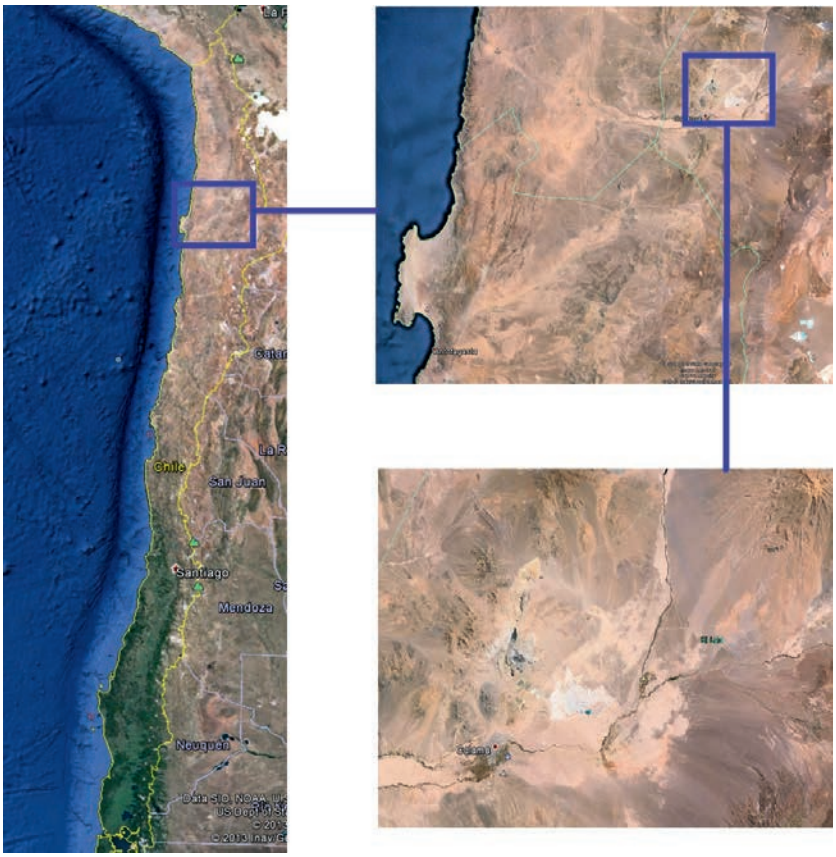
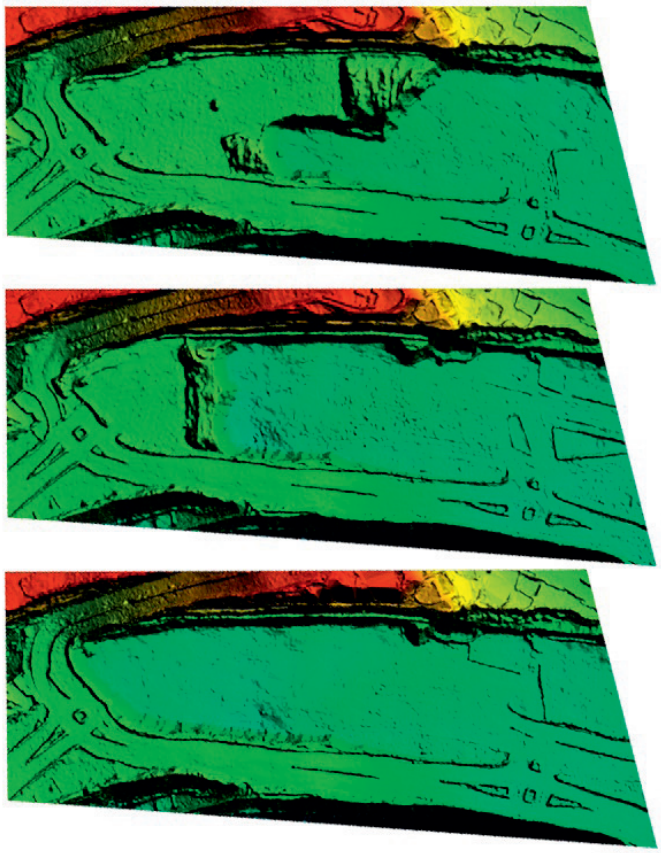


Figure 1, Location of the Chuquicamata mine in Chile.

VOLUME EXTRACTION

The UAS used was a senseFly eBee fixed wing, equipped with GPS / IMU and a 16MP Canon Ixus 125HS camera. During two months, weekly flights were conducted under equal circumstances. From the eight datasets, digital surface models (DSMs) were generated and volumes calculated. The features of the first dataset are presented here. The 266 images were acquired from a height of 250 metres with a GSD of 14cm. The images were processed with Pix4Dmapper within 1.5 hours on a standard desktop PC (a detailed



▲ *Figure 2, Time series of three DSMs at two-week intervals.*

description of Pix4Dmapper can be found in *GIM International*'s previous UAS special, published in 2013). Over 758,000 key points were automatically extracted, of which 263,000 3D points were generated for use in the bundle block adjustment (BBA), achieving a mean error of 0.16 pixel. Five GCPs were used for georeferencing purposes and two as check points. The height accuracy (1-sigma) was revealed to be 15cm which is consistent with the theoretical limit of 3 times the GSD. To create a DSM, all pixels were used resulting in 4 million height points. They were stored in a true-colour LAS format and automatically filtered and interpolated to generate a DSM with a GSD of 14cm.

THE 3D DIGITAL LANDSCAPE ALLOWS PROGRESS TO BE MONITORED AND POTENTIAL ISSUES TO BE IDENTIFIED

Figure 2 shows a sequence of DSMs and Figure 3 shows the volume change.

COMPARISON

Before the use of UAS, volume changes were computed from DSMs generated by TLS. Comparison shows that the volume computed from UAS imagery differs by less than 1% from the TLS volume. Hence, the accuracy of UAS is similar to TLS while UAS is safer, more efficient and more productive. Added to this, the orthomosaic created from the imagery and DSM can be draped over the DSM and this 3D digital landscape allows progress to be monitored and potential issues to be identified. Table 1 shows a UAS versus TLS workflow comparison when using two scanners.

OTHER EXPERIENCES

A flight over a 3.4km^2 discharge area of a mine tailing dam, located in the Atacama Desert in northern Chile, revealed that perpendicular flight lines, resulting in an overlap of over 85%, were necessary to prevent reflecting water bodies from hampering automatic processing. The area was captured within 45 minutes; from the images with a GSD of 10cm, a dense DSM and accurate contour lines were generated. They provide indicators where soil and rock have slipped into the lake, which may cause flooding threats.

Conducting height measurements for creating a DSM of a 7.5km^2 valley with height differences of 900m deep in the Andes can take 7 surveyors up to 10 days. Using UAS it took one day to install and measure 8 GCPs and one day to conduct 5 flights resulting in 1,290 images. Matching 12 million key points to generate 5 million tie points for BBA and next producing 50 million height points, both with Pix4D, took 12 hours on a standard Windows PC, resulting in a DSM and orthomosaic both with a GSD of 8.7cm. ◀

	TLS	UAS
Point density [pnt / m^2]	4	100
Operators	4	2
Vehicles	2	1
Need to access pit	Yes	No
Time on site	2 days	6 flights in 4 hours
Blind spots	Yes, depending on topography	No, because of vertical view and overlap
DEM generation	Extrapolation needed	Only measurements used
Availability of data	3-4 days	24-48 hours
Traceability of data	No	DSM and DTM allow traceability and comparisons

Table 1, Comparison between terrestrial laser scanning (2 scanners) and UAS.

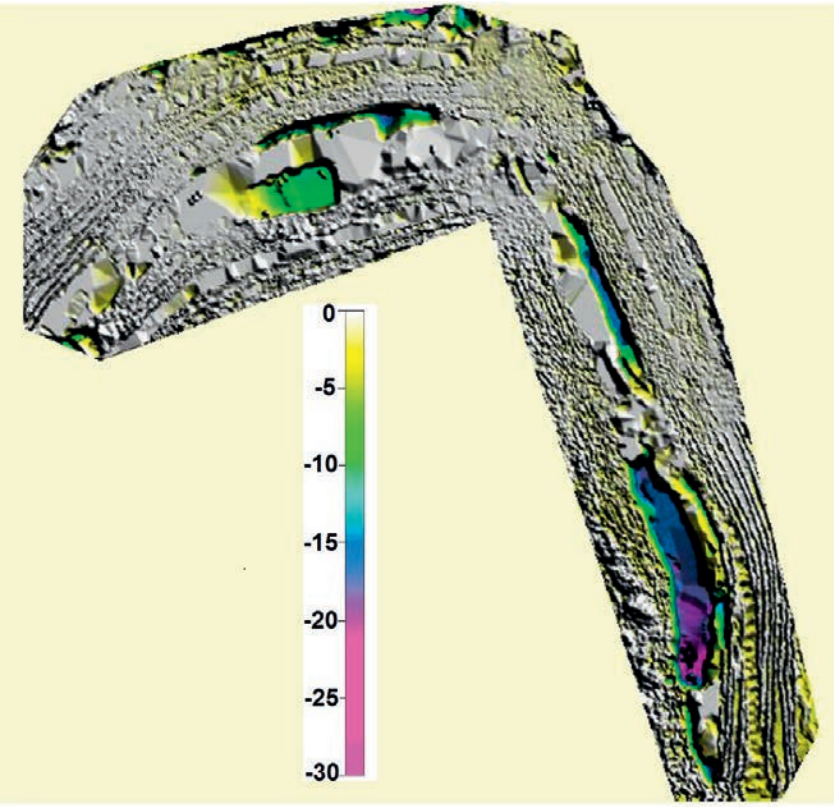


Figure 3, Copper ore extracted during one month (scale bar in metres).

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OLIVIER KÜNG

Olivier Küng has a background in computer vision and, together with fellow scientist Dr Christoph Strecha, he co-founded Pix4D in 2011. The company specialises in software for creating 3D landscapes from images taken with small-format / consumer cameras, and this is already being used by hundreds of organisations.
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This article has previously appeared in the second Spanish-language edition [2014] of *GIM International*.

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No 2675

THE IHO-IOC GEBCO COOK BOOK

Updating Landsat Satellite-derived Bathymetry Procedure

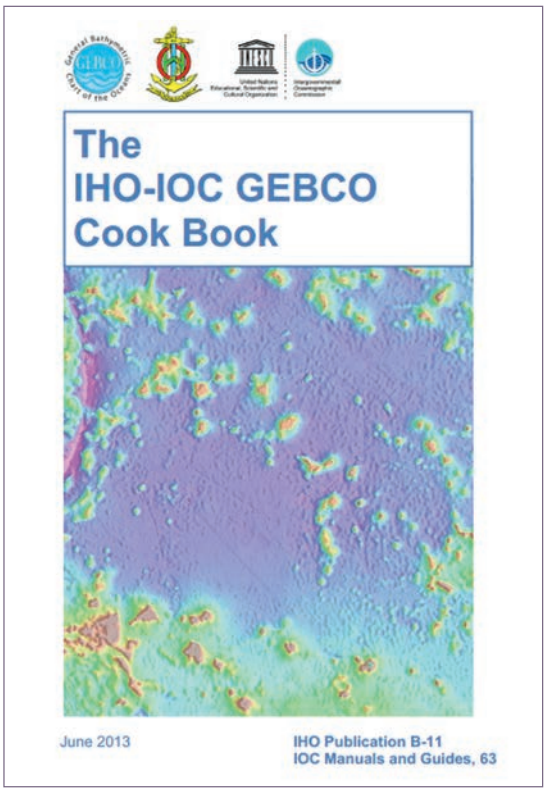
The General Bathymetric Chart of the Oceans (GEBCO) is an international body of experts that develops bathymetric datasets and products that are made available for public use. Among these products is the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) GEBCO Cook Book that provides the international community with a set of procedures for processing and analysing bathymetry data. Landsat 8 was launched in February 2013. The imagery from this new multispectral satellite is free and publicly available. This paper discusses updates in the IHO-IOC GEBCO Cook Book chapter on using Landsat imagery to derive bathymetry.

The IHO–IOC GEBCO Cook Book provides easy steps to follow for users that do not have a background in Hydrography or Geographic Information Systems (GIS) [1]. One of the procedures provided in the Cook Book is for Landsat satellite-derived bathymetry (SDB), as outlined in Chapter 11 (version 6.10.13) (Figure 1). The SDB procedure provides a quick reconnaissance of the nearshore bathymetry at low cost and allows the user to identify bathymetric changes between two satellite images from different periods or between a current satellite image and a nautical chart. Key steps in the updated SDB procedure are: pre-processing, water separation, radiometric correction for clouds and sun glint, applying the bathymetry algorithms, and referencing the bathymetry to the chart datum.

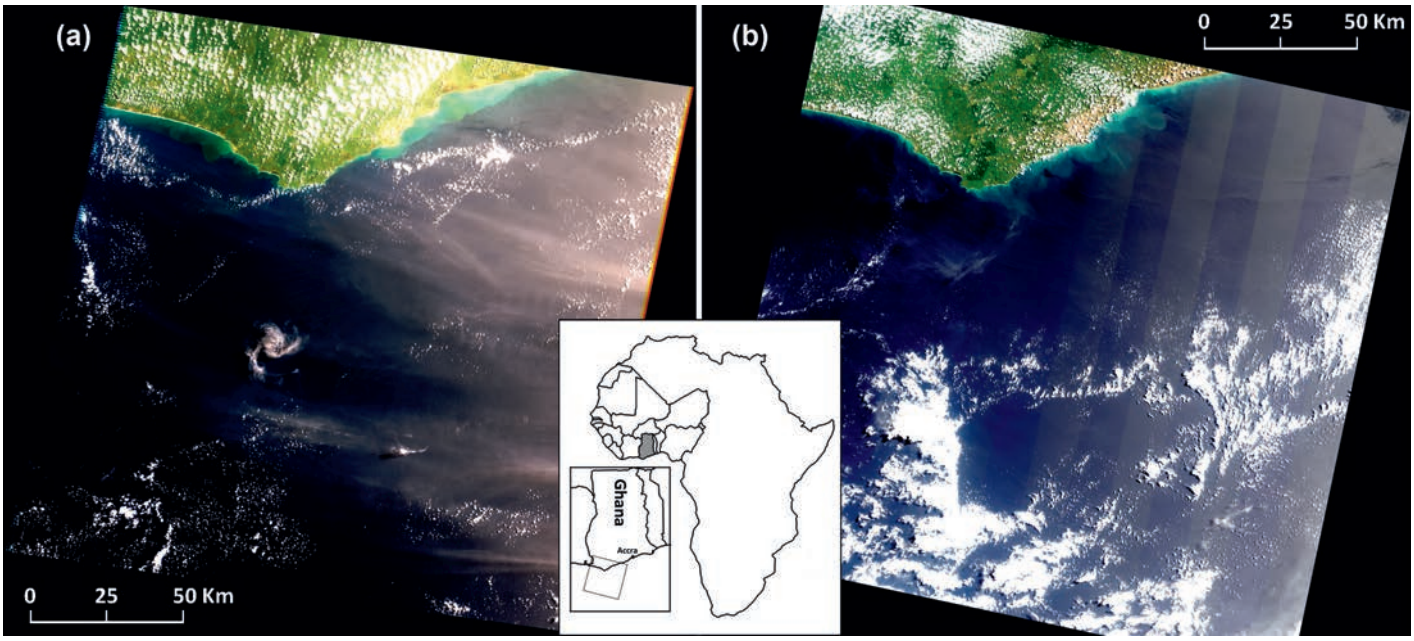
SDB PROCEDURE IS HEAVILY DEPENDENT ON WATER CLARITY AND THE QUALITY OF THE CHART SOUNDINGS

LANDSAT IMAGERY

There are several commercial multispectral satellite platforms (e.g., Ikonos and WorldView) that can be used for deriving bathymetry. But for users with limited funds, Landsat imagery provides a free and publicly available resource [2]. Early this year (2013), the eighth Landsat imagery satellite was launched. Similar to its predecessors, a multispectral-scanning radiometer mounted on the satellite continuously collects imagery with a swath-width of 185km and an image resolution of up to 28.5m. The Landsat imagery is ortho-rectified and referenced to the WGS84 ellipsoid. The new radiometer, called operational land imager (OLI), provides nine spectral bands at a larger dynamic range compared to the previous scanner mounted on Landsat 7, the Enhanced Thematic Mapper plus (ETM+) (Figure 2). In addition, the stated positional accuracy of Landsat 8 has improved to 14m ▸



▲ *Figure 1, Cover page of the IHO-IOC GEBCO Cook Book.*



▲ *Figure 2, Landsat imagery over Accra, Ghana: (a) Landsat7 (21 April 2002) and (b) Landsat 8 (4 April 2013).*

from the 50m accuracy stated for Landsat 7 imagery.

PROCEDURE UPDATES

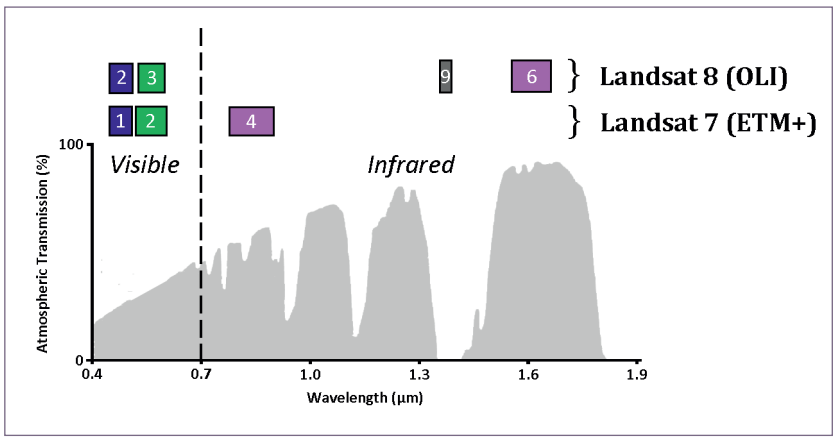
A major difference between Landsat 7 and Landsat 8 is the number of bands and the wavelength ranges that are available in the imagery (Figure 3). The updated procedure provides the user with the recommended bands to use for each of the satellites images. The main differences in the procedure using the two satellite imagery datasets are:

Bathymetry — Although the bathymetry is calculated using similar wavelength ranges, the band number for blue and green bands have changed from band 1 (0.45 - 0.51μm) and 2 (0.52 - 0.60μm) in Landsat 7 to bands 2 (0.45 - 0.52μm) and 3 (0.53 - 0.59μm) in Landsat 8.

Land/water separation — Band 4 (0.77-0.90μm) in the near infrared is used to separate the submerged areas from dry land, whereas band 6 in the short-wave infrared (1.57 – 1.65μm) is used for Landsat 8 imagery.

Clouds — Landsat 8 imagery provides a new band (Band 9) in the infrared (1.36 - 1.38μm) that can map cirrus ice clouds. Data from this band can be used to correct some of the atmospheric contributions from the derived bathymetry.

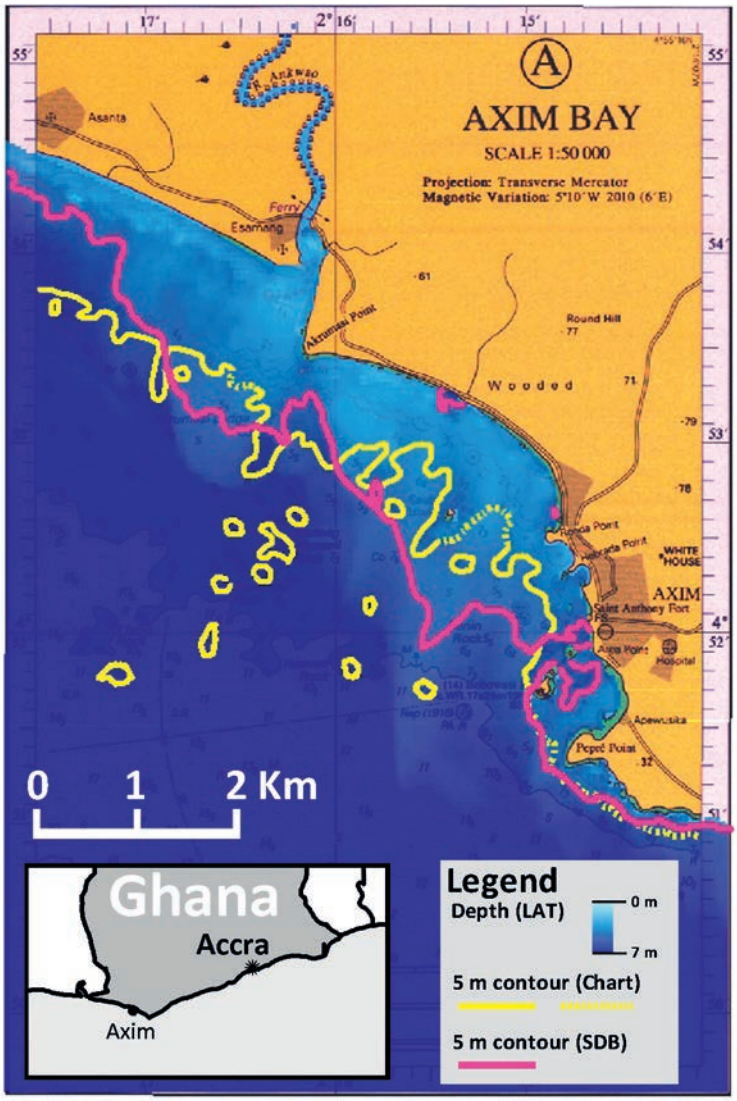
LANDSAT IMAGERY PROVIDES A FREE AND PUBLICLY AVAILABLE RESOURCE



▲ *Figure 3, Bands of Landsat 7 and 8 imagery used in the SDB procedure.*

GHANA AS A TEST SITE

The updated procedure was first tested over a US calibration study site (Rockport, Massachusetts), using a reference Airborne Lidar Bathymetry (ALB) survey that was collected in 2007 by the US Army Corps of Engineers. Landsat 8 bathymetry was compared to bathymetry produced from Landsat 7. Although the time difference between the two images is 14 years and some sediment transport occurred around the inlets, the depth difference over the stable areas was small (less than 1m). After configuring for Landsat 8 imagery, the procedure was tested over the Axim Bay study site in Ghana. British Admiralty Chart 3113 at 1:50,000 scale was used to reference the bathymetry to the chart's datum, Low Astronomical Tide (LAT). The source diagram indicates that all surveys in the waters of Axim Bay are lead-line surveys that were conducted between 1911 and 1924. The satellite-derived results enabled the identification of areas where bathymetry has not changed since the last survey used for the chart. The water depth that bathymetry can be derived was 7m. Accordingly, a 5m contour line was used to visually compare changes in bathymetry in the dataset (Figure 4). Around the mouth of the Ankwao River (center of the



▲ *Figure 4: Axim Ghana study site: SDB bathymetry overlaid on BA3113 Chart.*

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figure), changes in bathymetry were noticed. These changes are probably transport of sediments influenced by large volumes of water coming out of the river.

USE OF THE IHO-IOC GEBCO COOK BOOK

The updated procedure using Landsat 8 is now available in the IHO-IOC GEBCO Cook Book and has also been used by the Marine Charting Division in NOAA to evaluate the coastal waters of Haiti. It is important to note that the SDB procedure is only a reconnaissance tool and is heavily dependent on water clarity and the quality of the chart soundings that are used to reference the Landsat imagery. In addition to the SDB procedure, the Cook Book provides step-by-step instructions for producing grids from xyz data, procedures for processing, analysing, and imaging bathymetry data, an overview of available software, and available archives for datasets around the world. The Cook Book is continually maintained, and scientific contributions from the hydrographic community are encouraged (contact Karen Marks).

ACKNOWLEDGEMENT

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1. www.gebco.net
2. http://earthexplorer.usgs.gov

This article has previously appeared in Hydro International, edition 3, 2014. For more information on this publication see www.hydro-international.com.

FURTHER READING

- General Bathymetric Chart of the Oceans (GEBCO), 2013. GEBCO Cook Book V6.10.13: http://www.gebco.net/data_and_products/gebco_cook_book/.
- U.S. Geological Survey, Landsat Missions, http://landsat.usgs.gov/.

A REVIEW OF INTERGEO 2014

Berlin: Three-day **Geomatics Capital of the World**

Intergeo is the annual gathering in Germany of geomaticians, surveyors and GIS experts from around the world. The show provides an excellent opportunity to meet other professionals and to compare products. It is also an occasion to assess the state of business and innovation in the field of geomatics. This year, Intergeo was celebrating its 20th anniversary and enjoyed an increase of around ten percent in overall attendance (attracting over 17,000 visitors). A survey held among the visitors indicated that more than 45 percent of them were responsible for, or involved in, decision-making processes, which further enhanced the status of the world's largest geomatics event.

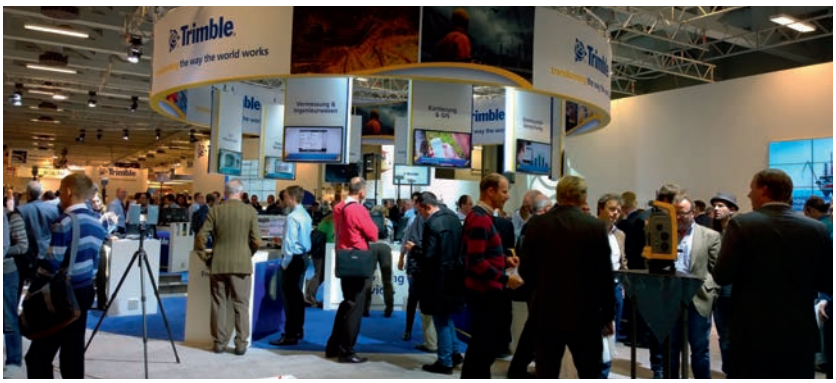
In terms of exhibitors and visitors alike, Intergeo gets more international every year, and the 2014 event saw a further rise in the number of visitors from outside Germany (around 35 percent of the total). Intergeo also gets 'younger' every year: Karl Friedrich Thöne, president of the DVW (German Surveying Association) remarked that he had never seen so many young visitors attend Intergeo, which he regarded as a very good sign for the future of the geomatics sector.

Chinese manufacturers exhibited their latest survey instruments among the booths belonging to the well-known US and European brands. As at previous editions, a number of French companies once again joined forces to display their products in a large 'Made in France' area, and this year several British companies did the same. The Brazilian company Bradar was one of the very few representatives from South America. As in previous years, Leica Geomatics and Trimble covered a lot of space of the exhibition floor. Leica staff presented the broad spectrum of products and services at a multitude of differentiated stands within the booth. Trimble had chosen to inform (potential) clients by holding PowerPoint presentations in a large, open theatre area. Live demos relevant to particular branches such as Inpho's photogrammetric software or eCognition had to be followed in rather narrow spaces, if you could find them at all.

TRENDING: UAVS

About five years ago, when mobile mapping had just been introduced to the market, many companies at Intergeo exhibited their mobile mapping solutions. While mobile mapping was still prominently present at the show this year, the focus has clearly shifted onto a new trend: UAVs. To illustrate the changing face of the geomatics world, it is worth mentioning that 55 of this year's exhibitors were UAV

▲ *The Brandenburg Gate.*



▲ *The Trimble booth. Trimble is one of the members of the Intergeo Advisory Board.*

▲ *GIM International senior editor Mathias Lemmens guided his TU Delft students through Intergeo.*

▲ *senseFly demonstrated the brand-new eXom.*

companies. All around the tradeshow, UAV producers and service providers displayed their capabilities. Clients can now select from a wide range of UAVs with various specifications. Many UAVs rely on the use of cameras to capture images that can be processed into point clouds or orthoimages. However, the use of laser scanners in drones is rapidly accelerating too. The company RIEGL, normally known as a manufacturer of laser scanners, even launched a new UAV complete with laser scanner and INS system at this year's Intergeo.

The Swiss company Pix4D and the Russian company Agisoft both develop advanced software to process images that are captured with UAVs, and both companies exhibited their latest developments in Berlin. It is becoming increasingly simple to process a large amount of images, even images taken from the ground, and render them into beautiful 3D scenes and accurate point clouds.

POINT CLOUD

Terrasolid from Finland had come to Berlin with a solid bunch of technical people and specialists able to give in-depth details of their pioneering point cloud processing software – a real relief. In the large, centrally located booth Terrasolid displayed a demo of a pilot showing how images and point clouds captured by a mobile mapping system mounted on a car can be processed with its software to support road damage detection and asphalt repair work, as many parameters can be accurately calculated from the 3D model. The pilot has previously been covered in the July 2014 issue of *GIM International*.

Although RIEGL introduced an innovative airborne scanner, there have been no major improvements to the mobile and terrestrial laser scanners available on the market apart from incremental changes. However, the developments in point cloud processing are moving fast. Over the past few years, the Australian company Euclidion has become known for its very fast rendering of 3D point clouds, for example. The British company PointFuse joined the show this year for the second time, approaching point clouds from a different angle. Instead of displaying all points, an automatically generated mesh represents the structure of the cloud with much less data. In addition, many companies presented solutions for manual or semi-automatic modelling from point clouds.

PHOTOGRAMMETRY

Around the year 2000, it seemed that airborne Lidar would emerge as a serious threat for photogrammetry as the main source of 3D point clouds for producing DEMs and DSMs, and some people even predicted the downfall of photogrammetry. Microsoft Ultracam, Pix4D, PhaseOne, Leica and many others cogently showed that predicting the future is perilous. As a result of two developments – aerial multi-camera systems, which are able to capture oblique and nadir imagery at the same time, and dense image matching – photogrammetry is more vivid than ever before. Oblique images allow a full and intuitive view of both building footprints and facades which is a great benefit when creating 3D city models. Dense image matching allows point densities similar to the ground sampling distance (GSD) of the imagery from which they are derived. For example, images with a GSD of 10cm may deliver a density of up to 100 height points per square metre.

FUTURE OF GEOMATICS

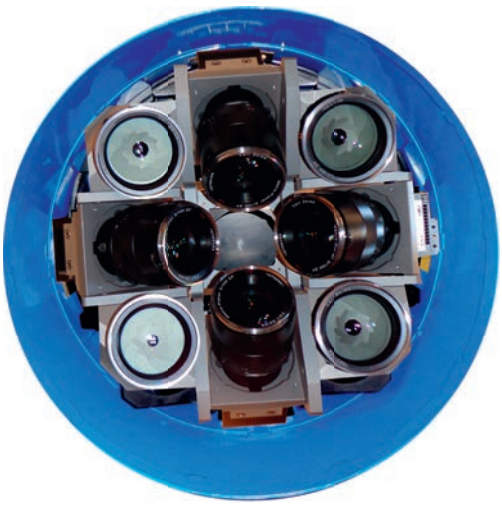
Intergeo is the ideal occasion to take stock of the latest situation in 'geomatics land'. During the traditional press conference, held as always on the Wednesday, it became apparent that the key players in the sector have clear views on the industry and its future. Eric Arvesen, vice-president of Trimble's geospatial division, and Jürgen Dold, president of Leica Geosystems, seemed to be in agreement with one another about the sector's future direction.

Arvesen stated that the trend is towards meeting the needs of surveyors and their customers by providing 'ready-made', all-in-one solutions which reveal to them which action to take and which decisions to make. In a world in which apps and UAVs are becoming ever-more important, he does not expect a slow death of traditional surveying equipment. After all, laptops and iPads exist alongside each other, he said by way of example, since they are not rival technologies. Jürgen Dold interjected that it is necessary to give customers choices. The industry must modernise its software to be more 'app-like'. Dold looked back at 20 years of Intergeo by saying that the measurement market was the primary focus back then and it remains so today, although now much more in the form of GNSS-integrated applications. He also pointed out the rise of UAVs and the rapidly growing opportunities they offer. Companies such as Google and Microsoft have served as a catalyst for making geomatics techniques familiar to a wide audience, he added.

The 21st Intergeo will be held in Stuttgart, Germany, from 15-17 September 2015. The focus of the conference has already been announced and will be on modernising infrastructure. With the *Stuttgart 21* project in mind, the capital of the state of Baden-Württemberg certainly is an interesting place for this particular focus. ◀

Creative Thinking Helps Image Providers Grow Their Business

Visual Intelligence LP is an industry-leading software and sensor technology company that delivers world-class geoimaging solutions for airborne, terrestrial and mobile applications. The company provides innovative technology solutions, including the iOne modular and scalable family of oblique/3D and engineering mapping multipurpose geoimaging sensors which includes automated 2D/3D software workflows for high-speed, actionable information-product generation. Visual Intelligence is known for its industry innovations and patents, and is proud to hold USGS Digital Aerial Sensor Type Certification and the 2013 Geospatial Forum World Technology Innovation in Sensors Award.



▲ *The iOne reconfigurable sensor array configured as oblique system. This unique array design has widespread uses and applications beyond aerial imagery.*

Every month ***GIM International*** invites a company to introduce itself in these pages. The resulting article, entitled Company's View, is subject to the usual copy editing procedures, but the publisher takes no responsibility for the content and the views expressed are not necessarily those of the magazine.

Founded in Houston, Texas, USA, Visual Intelligence LP is a privately held company that was started in 2003. The company's founders began with the idea that their user-centric approach to a traditional industry would result in a new and non-traditional solution. They set forth to rethink the way aerial sensors are built, and ultimately designed and patented a sensor system like no other, using an architecture and array that lets the user reconfigure, expand and change the size and type of image that is captured. Visual Intelligence developed this new approach to give the user more options, provide a high-quality product at a reasonable price, and give customers a flexible and stable growth path for the future.

INNOVATIVE SOLUTIONS

The Visual Intelligence team is a highly skilled engineering group devoted to providing superior imaging technology. Their customer-centric focus is fundamental to the Visual Intelligence sensor solution, building products that are in production use today and are also an essential platform for image providers to use as they grow and expand. The use of the technology expands beyond standard aerial image collection to influence the development of innovative imaging products in a variety of industries.

President and CEO, Armando Guevara, says: "At Visual Intelligence we have the vision to incubate a lot of new ideas and provide products that have a lifespan that supports our customers' future needs. We provide world-class digital aerial imaging technology solutions and at the same time we raise the bar and strive to become even better."

The framework of the sensor systems allows the product development team to quickly create innovative solutions that keep pace with new opportunities. Executive vice president Phil Kern states, "Our flexible solution suite allows Visual Intelligence to respond rapidly to the constantly evolving needs of our clients, and be ready when new requirements and business opportunities affect the geospatial marketplace."

The foundational array design in the Visual Intelligence sensor solution provides the platform for multiple cameras to be used in various configurations. The solution uses high-end machine vision cameras that deliver

Imagery captured after a hurricane with the iOne sensor system.

a frame rate of 1 frame per second, have extreme precision of less than two pixels absolute accuracy, and are field-proven to be reliable with no internal moving parts or shutters to break down. The sensors are coupled to the array architecture housing, and users can expand the image footprint by adding additional cameras to the array.

COMPETITIVE EDGE

Being able to accelerate jobs and bid on new project types improves the ROI for image providers when they purchase a cost-effective flexible solution instead of a single-purpose camera. Adding the ability to collect a range of image sizes from 108 to 238 megapixels, configure oblique sensors for 3D imagery, or co-register and co-mount various sensor types for image fusion projects with Lidar and other sensor types expands the possibilities even further. By taking advantage of the lightweight sensor options, image providers can look at new ways to save money using lighter-weight and more versatile single-engine planes or expand their offerings to UAV/UAS collection if necessary.

NEW OPPORTUNITIES

Visual Intelligence's insight into the industry uniquely positions its customers to take advantage of new business opportunities as they arise – for example, the fast-growing demand for highly accurate 3D imagery. Because customers who have the iOne sensor suite can potentially use it for orthophotos and oblique/3D mapping projects, they already have a sensor system in place to accept these new business opportunities without incurring high front-end costs. The company's iOne SRK (Sensor Reconfiguration Kit) allows for reconfiguration of sensors to meet mission-specific requirements. In 2014, the iOne claimed both the Technology Innovation award and the overall Grand Award in the Geospatial Product and Services Excellence competition sponsored by the MAPPS Association.

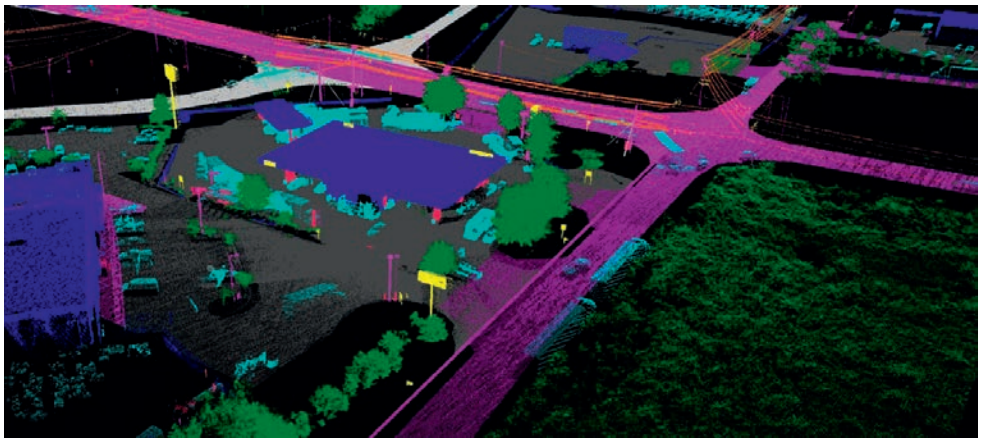


Image fusion combines targeted data to provide detailed insight into specific project needs (image courtesy of McKim & Creed).

Visual Intelligence customers can expand or possibly use their existing system to capture imagery with extremely high 0.6 base to height (b/h) ratio, giving them the ability to provide precise 3D oblique imagery with extreme vertical accuracy.

Combining different data types into a single next-generation geospatial data product using 'image fusion' gives customers more image detail and information than ever before. The Visual Intelligence sensor system's patented technology allows users to co-mount and co-register cameras and other types of sensors such as Lidar, video or thermal sensors in order to co-register and fuse different types of imagery collected in a single pass. When the images are collected, the data is merged together to provide valuable geospatial products that can be used to make informed decisions.

The ability to add more precise and better-quality data to aerial imagery opens up business opportunities with professionals such as property specialists, engineers, planners, transportation managers and utility providers who now depend on these geospatial data products to make informed decisions when planning or implementing new projects. This new demand brings fresh opportunities to the image providers who are prepared and ready to capture this new business.

Image providers no longer have to buy a single-purpose sensor for one project type and rely on it for other projects that may not be a good fit. Instead they can field-configure their Visual Intelligence sensor solution for a variety of different mission requirements, allowing even small providers to bid for more projects and generate new revenue streams.

More information
www.visualintelligenceinc.com

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Nikon

No 2670

New FIG Publications

Four new FIG publications and a review of the Social Tenure Domain Model are now available from the FIG website. The FIG publications are available to students, surveyors, geodesists, land professionals, managers in mapping and cadastre agencies, decision-makers and anyone else who is interested in the latest developments in the profession. The publications are of great interest and importance to academia and schools providing education in surveying or other related knowledge domains. A total of 64 high-level publications are now available.

▲ *The new FIG publications that have been published recently.*

The new FIG Publication 61 is *CADASTRE 2014 and Beyond. CADASTRE 2014* was published in 1998 as a result of a FIG Commission 7 working group (active from 1994-1998) which was mandated to identify trends in the cadastral field and to predict the progression of the cadastre over the next 20 years. The publication presented and explained six vision statements, suggested some new definitions in order to make those visions possible, and also made some recommendations for action. The publication has since been translated into many different languages. Now, upon arrival in the year 2014, it seemed very appropriate to revisit the topic and to review the statements, to evaluate them and to put them in context. The XXV FIG Congress held in June 2014 was an excellent opportunity to do just that: two special sessions were part of the congress programme, and are also presented in this new publication.

FIG Publication 62 is titled *Ellipsoidally Referenced Surveying for Hydrography*. The hydrographic surveying community uses high-accuracy global navigation satellite system (GNSS) positioning techniques for vertical positioning of survey platforms, the sea surface and the sea floor. This method of hydrographic surveying is known as ellipsoidally referenced surveying (ERS). ERS provides a direct measurement of the sea floor to the ellipsoid, as established by GNSS observations, and a translation of the reference from the ellipsoid to the geoid and/or a chart datum. In order to meet required vertical positioning standards, it is of paramount importance that the entire ERS process is thoroughly understood and that the appropriate procedures are in place during the data acquisition, validation, cleaning and processing phases.

The FIG Publication 63 presents the objective and work design of *The Africa Task Force – 2009-2014*. The key purpose of the Task Force was to enable the surveying profession in Sub-Saharan Africa to deal with social responsibility in terms of contributing to achieving the Millennium Development Goals (MDGs).

FIG Publication 64 is the *Reference Frame in Practice Manual*. One of the most significant technologies to emerge in recent decades has been GNSS. The rise of such a global technology has highlighted the need for countries to move from locally defined geodetic datums to more global datums based on the International Terrestrial Reference Frame. This FIG publication responds to that trend by bringing together a series of factsheets to better inform surveyors about some of the key issues they need to consider as they realign and upgrade their professional knowledgebase.

Finally, a second edition of FIG Publication 49, *Cost Effective GNSS Positioning Techniques*, has been published. ◀

More information
www.fig.net/pub/figpub

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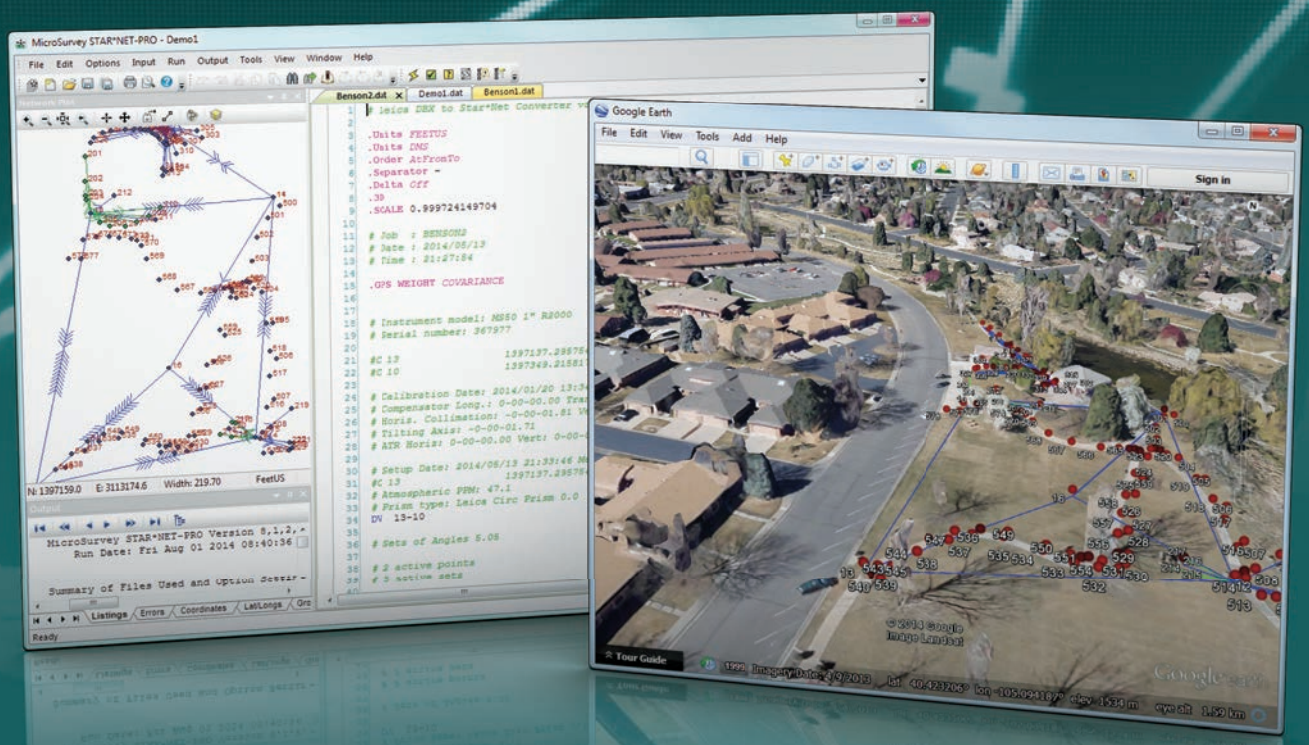

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No 2662

Building a Solid Foundation for the Next Generation of Disaster Management and Public Safety

As natural and human-induced disaster events around the world increase in frequency and severity, research in the field of disaster management is evolving and expanding. The emergence of drivers such as climate change, poorly planned developments, poverty and environmental degradation, along with the predicted increased extreme weather events, are prompting responses from researchers and organisations across the globe to envisage the next generation of disaster management.

The Centre for Disaster Management and Public Safety (CDMPS) at the University of Melbourne, Australia, supported by GSDI, is one organisation responding to these concerns. CDMPS has established a number of key research priority areas and a research agenda to address these challenges. Building relationships and collaborating is a key goal of the Centre, which will help to address the impending challenges the world faces from increased disasters.

A number of initiatives have emerged in response, as well as numerous research programmes, technologies, strategies and solutions developed at both local and international levels to tackle such emergency events. There is, however, poor co-ordination among researchers and governments, including little integration and sharing amongst countries. Without some level of integration, much of the extensive work carried out in the realm of disaster management is often relevant only to the country in which the research was conducted. Therefore, it is necessary to develop an overarching framework to enable better integration of relevant solutions across the board.

▲ *Abbas Rajabifard.*

An approach to cohesive and comprehensive solutions built on a solid foundation requires greater consideration. While it is a reactive response to search for a solution in times of disasters, the importance of first developing a strong foundation should not be trivialised. Without a base to build on, there will not be the impetus for collective support that underpins disaster management knowledge. Hence fragmented research will continue, with only pockets of the global community benefiting from research and technological advances.

One of the primary overarching challenges to building this framework is to establish principles for information-sharing. This challenge relates to the co-ordination and integration of information. Current systems inhibit both small and large-scale knowledge and expertise-sharing. The establishment of principles for information-sharing could bring together existing information, thus preventing unnecessary duplication. The aim should be to develop them just once and, where appropriate, adapt them for use multiple times. An open-standards platform for the sharing of ideas and research in the realm of disaster management would facilitate closer ties among global communities, which in time will lead to better knowledge-sharing and transfer and a more cohesive, collective approach to providing solutions for disaster management.

There is no 'quick fix' for this problem. However, through developing a solid foundation to support strategies and research outcomes as we move forward into developing the next generation of disaster management, a resilient future may be achieved. ◀

Prof Abbas Rajabifard is immediate GSDI past president, and CDMPS director, and a member of the GSDI Association Executive Committee.

More information

For more information about the Centre for Disaster Management and Public Safety visit: www.cdmps.org.au

Learn more about the GSDI Association and how to participate here: www.gsdi.org/joinGSDI

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No 2631

UN-GGIM Global Geodetic Reference Frame Resolution

The 3rd meeting of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) met at the UN Headquarters in New York, USA, from 6-8 August 2014. The first day saw them endorse a draft Resolution on the Global Geodetic Reference Frame (GGRF).

A geodetic reference frame refers to the science of very finely measuring the Earth: its orientation in space, its gravity field and its shape. Since these three aspects of the planet are constantly changing, it is even more imperative that, globally, we have the best data possible in order to respond to everything from climate change to disaster management.

The UN-GGIM recognises that there is a growing requirement for more accurate measuring of the changing planet, down to millimetres. Such data will have enormous economic benefits since the data impacts on countries' economies as well as their environments. Mr Rajendra Pachauri, chairman of the Intergovernmental Panel on Climate Change (IPCC), gave his support to the work of the UN-GGIM and the GGRF Working Group at a recent climate symposium in Ny-Ålesund, Norway, saying "Their work is making a vital contribution to our understanding of climate change." [1]

There is a growing awareness that no single country can maintain the GGRF alone. Instead, a high-quality GGRF requires global collaboration and contributions, sharing of geodetic data and the maintenance of geodetic infrastructure at the national level. Furthermore, the 'best efforts' principle currently in place will not be sufficient for the future.
The IAG makes considerable contributions through its services, especially those that contribute to the International Terrestrial Reference Frame (ITRF), which is the most stable GGRF currently available. However its maintenance is dependent upon the continued support of national mapping departments, space agencies, research organisations and universities. There is a need for coordinated global efforts, working under the umbrella and mandates of overarching structures like the United Nations. Some countries are already collecting data as part of the GGRF and making it freely available, and the UN-GGIM hopes that more Member States can work towards improved open sharing of geodetic data, standards and conventions.

Attendees at the 4th meeting of the Committee of Experts of the UN-GGIM listening to a presentation from the GGRF Working Group chair, Mr Gary Johnson (Australia).

However the GGRF, and geodesy is general, is far more than a valuable geoscience. Geodetic concepts, tools and services underpin a vast range of geospatial activities, being critical for delivering on 'spatial enablement' of society, addressing the needs of sustainable development and evidence-based decision-making with respect to land use, resource management, production of clean energy and food for a growing world population, to mention just a few applications.

The IAG wishes to acknowledge the strong support from many Member States whose representatives attended the meeting, as well as sister geospatial organisations organised under the Joint Board of Geospatial Information Societies (JBGIS), including FIG, ISPRS, ICA and GSDI.

The draft Resolution will now pass to the Economic and Social Council (ECOSOC), UN-GGIM's parent body and the United Nations' central platform for reflection, debate, and innovative thinking on sustainable development. The intent is for ECOSOC to then refer the Resolution to the General Assembly.

More information

1. http://bit.ly/1wd1Qw5
http://webtv.un.org
http://ggim.un.org/ggim_committee.html
https://vimeo.com/89695290

The UN-GGIM recognises the growing demand for more precise positioning services, the economic importance of the Global Geodetic Reference Frame and the need to improve global co-operation within geodesy.

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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No 2657

Scientific Progress

The International Council of Science, commonly abbreviated from its previous name of International Council of Scientific Unions (ICSU), was established in 1931 as a unique global organisation dedicated to the application of science to environmental and social issues for the benefit of our planet and mankind. ICSU's mission is to 'strengthen international science for the benefit of society'. Its scientific credentials are outstanding, and are based on its experience of mobilising the knowledge and resources of the international science community.

ICSU is a membership organisation, with national members covering 141 countries. These members tend to be the primary national academies of sciences, providing multidisciplinary perspectives and links with national governments and science agencies. In addition, ICSU membership incorporates international scientific unions which provide the disciplinary backbone of ICSU. These bodies are the global learned societies and associations which bring together scientists from all parts of the world to consider issues of particular interest to individual disciplines.

ICA is proud to announce that, at the 31st triennial General Assembly of ICSU, held in Auckland, New Zealand, in September 2014, it was unanimously elected as the 32nd full scientific union, taking its place alongside notable organisations such as the International Mathematical Union, the International Union of Pure and Applied Chemistry, the International Brain Research Organization, etc. Several of the ICSU scientific unions are focused on geospatially related science, including ISPRS, IGU and IUGG, the parent organisation of IAG.

▲ *The website of the International Council of Science.*

ICA is delighted to be able to engage with the wide scientific community to address issues which involve the strengths and skills of the global cartographic community. ICSU priority themes and actions, as presented in its current strategic plan, are listed as: Earth system sustainability research and global environmental change; Global Earth Observing Systems; Polar research; Disaster risk; Ecosystem change and society; Sustainable energy; Human health and wellbeing; and New horizons and future directions. The majority of these themes will benefit from the input of cartographic research and practice, as directed through the relevant ICA Commissions.

As well as pursuing scientific research and having an interest in the management of scientific endeavour and funding, ICSU also has significant input into policy, with its participation in international initiatives such as the UN Commission on Sustainable Development, the International Panel on Climate Change (IPCC) and other United Nations conferences and forums. Initially considered at an ICA Executive Committee meeting in Mexico City in 2005 (ICA had been an associate member of ICSU since 1990), previous and the current Executive Committees of ICA have been working towards the goal now achieved. They are to be commended on their persistence and vision in ensuring that ICA takes its place at the highest scientific table, with a commitment to joining with the global scientific community in addressing a range of tasks, problems and circumstances. ICA president, Georg Gartner, was present in Auckland to witness the successful election of ICA to full ICSU status. ◀

More information
www.icaci.org

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No 2676

RUIDE_

Two Well-known ISPRS Workshops in One

Automated extraction of objects from remotely sensed data is an important topic of research in the fields of computer vision, photogrammetry, remote sensing and geoinformation science. In order to discuss recent developments and future trends in research in automatic object extraction and their influence on sensors and processing techniques, the two well-known ISPRS workshops, 'Photogrammetric Image Analysis' (PIA15) and 'High-resolution Earth Imaging for Geospatial Information' (HRIGI15/ISPRS-Hannover Workshop) will be held jointly for the first time. The event will be taking place from 25-27 March 2015 in Munich, Germany.

While in the past PIA was specialised on the automatic exploitation of the image content, the strongest focus of HRIGI was the geometric processing of aerial, and in particular of space, imagery. Realising that both areas – geometry and semantics – can significantly support each other when considered together in photogrammetric image exploitation, the two events will be organised under the same roof in 2015. At the same time they will each keep their own identity, as the conference will be organised as two parallel workshops with common plenary sessions and common proceedings.

The aim of the joint event is to seek, exploit and deepen the synergies between geometry and semantics, and to give the two scientific communities the opportunity to discuss with and learn from each other. The conference will address experts from research, government and private industry. It will feature high-quality papers and provide an international forum for discussion of leading research and technological developments as well as applications in the field.

GIM International readers are encouraged to contribute to the conference by submitting their latest research and development work by the deadline of 30 November 2014. Accepted papers will be published in the *ISPRS Archives and Annals* series. Please note that the Archives were recently included in the CPCI, the Conference Proceedings Citation Index, and the Annals are expected to follow very soon. More information can be found at [1].

The meeting is being organised by IPI (Institute of Photogrammetry and GeoInformation), Leibniz Universität Hannover (University of Hannover) and PFL-Photogrammetry and Remote Sensing from TUM (Technical University Munich). It is supported by EARSeL (European Association of Remote Sensing Laboratories), EuroSDR and IAA (International Academy of Astronautics). The exclusive sponsor is Hexagon Geosystems. ◀

More information
1. www.pia15.tum.de
www.isprs.org

NOVEMBER

GEODATA 2014
Glasgow, Scotland, UK
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

5TH DIGITAL EARTH SUMMIT
Nagoya, Japan
from 09-11 November
For more information:
E: gis@office.chubu.ac.jp
W: http://isde-j.com/summit2014/

FIG

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/

14TH ANNUAL UNMANNED AERIAL SYSTEMS 2014
London, UK
from 17-18 November
For more information:
W: www.uasconference.com

PECORA 19 & ISPRS COMMISSION I SYMPOSIUM
Denver, CO, USA
from 17-20 November
For more information:
W: www.asprs.org

PACIFIC GIS/RS USER CONFERENCE
Suva, Fiji Islands
from 25-27 November
For more information:
W: www.fig.net

11TH INTERNATIONAL SYMPOSIUM ON LOCATION-BASED SERVICES (LBS2014)
Vienna, Austria
from 26-28 November
For more information:
W: www.lbs2014.org

DECEMBER

EUROPEAN LIDAR MAPPING FORUM
Amsterdam, The Netherlands
from 08-10 December
For more information:
E: info@SPARPointGroup.com
W: www.lidarmap.org/europe

SPAR EUROPE 3D MEASUREMENT & IMAGING CONFERENCE
Amsterdam, The Netherlands
from 08-10 December
For more information:
E: lcorkhill@divcom.com
W: www.sparpointgroup.com/europe/

2015

JANUARY

INTERNATIONAL WORKSHOP ON SPATIAL DATA, MAP QUALITY
Valleta, Malta
from 20-21 January
For more information:
E: carol.agius@mepa.org.mt

FEBRUARY

TUSEXPO 2015
The Hague, The Netherlands
from 04-06 February
For more information:
E: a.hagenstein@tusexpo.com
W: www.tusexpo.com

MARCH

AUVSI'S UNMANNED SYSTEMS EUROPE
Brussels, Belgium
from 03-04 March
For more information:
W: www.auvsi.org/UnmannedSystemsEurope/Home/

GEOSPATIAL ADVANCEMENT CANADA 2015
Ottawa, Canada
from 03-05 March
For more information:
E: neilthompson@wcgroup.ca
W: www.geospatialcanada.com

APRIL

THE WORLD CADASTRE SUMMIT, CONGRESS AND EXHIBITION
Istanbul, Turkey
from 20-25 April
For more information:
E: tahsin@itu.edu.tr
W: http://wcadastre.org

INTEREXPO GEO-SIBERIA-2015
Novosibirsk, Russia
from 20-22 April
For more information:
E: argina.novitskaya@gmail.com
W: www.expo-geo.ru

AAG ANNUAL MEETING 2015
Chicago, IL, USA
from 21-25 April
For more information:
E: meeting@aag.org
W: www.aag.org/annualmeeting

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Leica ALS80 systems come complete with peripheral products and software that provide a seamless workflow from mission planning through point cloud generation.

Highest productivity in all applications
Imagine an affordable city-mapping LIDAR system with an industry-leading 1.0 MHz pulse rate, capable of meeting your specialized needs now, and that is easily upgradable to a full-capability configuration as your business grows. Imagine producing high density point clouds for corridor, urban, flood plain or general-purpose airborne mapping in a fraction of the time it took previously. Imagine being able to perform wide-area mapping from high altitudes to obtain nearly 8 km swath.

Leica CloudPro – fast, flexible, functional

Want to get data processed fast, in your desired format and projection ... without having to leave your point cloud generation software? Don't waste valuable upload/download time going to additional software packages to get data in the right projection. Process large point clouds, even in the field on a laptop computer.

Leica AHAB LSS viewer – fast viewing for LAS point clouds

The Leica AHAB LSS Viewer is the perfect companion to Leica CloudPro. Bundled free-of-charge with Leica CloudPro point cloud generation software, the Leica AHAB LSS Viewer provides all the speed and functions you expect from a professional point cloud viewer. Whether viewing point clouds by elevation, intensity, return number, attached RGB value or classification, the Leica AHAB LSS viewer lets you zoom and roam with speed and agility, allowing you to find what you're looking for in your point cloud data.

PART OF HEXAGON

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