

A New Era in Land Administration Emerges

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EXCHANGING GEODATA PACKAGES

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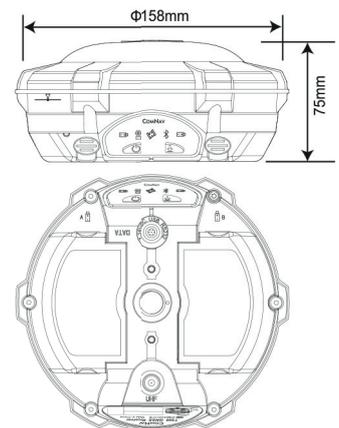
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UAV thermal mapping over critical points on the highway bridge in Czech Republic. Image courtesy: UPVISION (and The Road and Motorway Directorate of the Czech Republic).

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Optimistic

As I write this first editorial of 2015, I'm filled with a great sense of joy and optimism. Ahead lies yet another year in which *GIM International* will bring you a monthly update of all the news and developments in the world of geomatics. And we literally mean the 'world', since not only do we report on projects and innovations in all four corners of the globe, but we also distribute our magazine right around the world – both physically and digitally.

The start of a new year – still a completely blank canvas – always fills me with excitement about what it will hold in relation to everything I am working on, passionate about and keen to pursue. In our specific case, looking at the scope of this magazine, we are very passionate about geomatics, not just as a technique but also in terms of what it does for citizens – especially those in regions where land rights are not secured by formal land administration. We have been writing about the Millennium Goals of the United Nations, specifically those aimed at reducing poverty, which is where the issue of tenure rights becomes relevant. The United Nations Initiative on Global Geospatial

Information Management (UN-GGIM) is on precisely the same wavelength as the World Bank's Land Governance Assessment Framework (LGAF). All these initiatives are advocating and supporting secure land rights for owners in order to decrease poverty, because a written and formally recorded right to a parcel of land means economic recognition. Hence is often the owner's first step towards loans for investments, a mortgage, welfare benefits and suchlike, bringing greater financial security for families.

I am therefore very pleased that this first issue of 2015 includes the article called 'A New Era in Land Administration Emerges – Securing Land Rights for the World is Feasible', written by our editors Chrit Lemmen and Rohan Bennett together with Robin McLaren and Stig Enemark (see page 22). The authors are all well-known authorities in the field of land administration and they share their optimistic views of the future of land administration. As the title suggests they see a new era emerging out of a wave of innovative thinking, making secure land rights for the global community a real possibility in the decades ahead thanks to a set of maturing and scalable techniques such as UAS and imagery data resources like Google Maps or Microsoft Virtual Earth. The developments in automatic feature extraction and post-processing are also helping, as is the functionality of the cloud as a storage and access tool. The authors are expecting a lively debate within the profession in the near future. That debate is very welcome in view of the urgent need for secure land rights in order to avoid land-grabbing, forced evictions and social injustice. I know that the authors are looking forward to receiving your input, as are we here at *GIM International*. Please share your thoughts – whether optimistic or not – by email, or in person whenever you meet us somewhere around the world in the year to come. In turn, we will globally disseminate the views and comments we receive through our various channels.

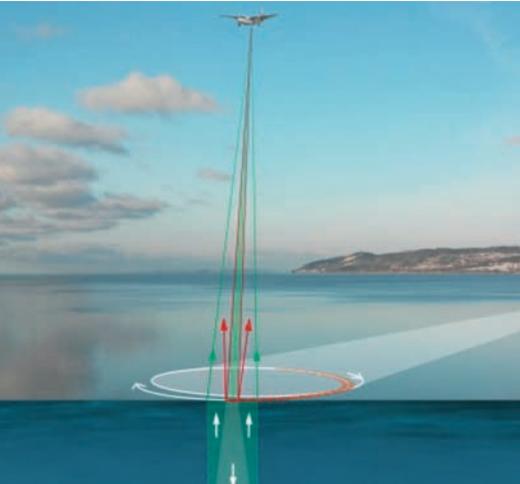
I'd like to end this first editorial of 2015 by wishing you a happy, healthy, successful and above all optimistic new year!



▲ Durk Haarsma, publishing director

Photography: Arie Bruijnsm

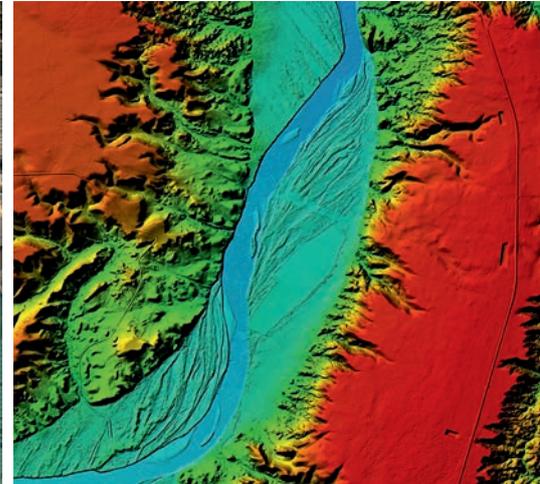
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Airborne Bathymetry



3D City Modelling



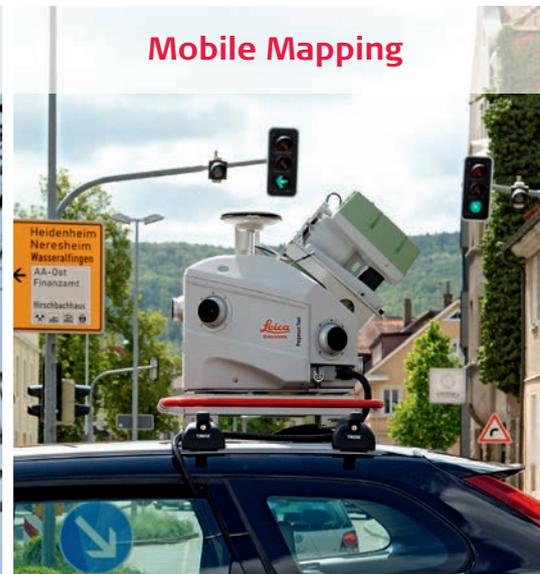
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During the past two years, the thinking of construction-industry leaders seeking ways to transform current modes of operation has been dramatically impacted by the rapidly evolving convergence and integration of the supporting vendor technologies. This technology convergence has been facilitated by the vendors beginning to incorporate and leverage 3D coordinates in real-world reference frameworks into their products as a key component. This new approach allows them to provide accurate spatial integration of their product information with other vendor technologies. For example, we see this approach in the new forms of scheduling software (called 4D) in which CPM scheduling is integrated with accurate 3D CAD model entities. The 4D approach allows construction staff to work together in meetings as an integrated group using 3D computer graphics displayed on monitors or using augmented reality (AR) viewers to visualise and modify the underlying CPM schedule. This approach improves planning for construction sequencing and the supporting logistics.

Underlying and supporting this phenomenon occurring in construction, the global geospatial community has itself been experiencing accelerating technological change resulting from the fusion of 3D technologies. Examples of these rapidly developing and converging technologies include robotic construction systems (automated mine



Mr Joseph Betit

trucks, earthwork machine control, automated rail slab construction, automated brick wall laying machines, etc.), robotic mobile unmanned sensor platforms (UAV and ocean-floor oil and gas mapping systems), automated conversion of infrastructure raw-data point clouds into 3D CAD model entities including finite element modelling, augmented reality, avatar gaming systems and many forms of information modelling.

The new forms of mobile sensor platforms lend themselves to real-time integration of their data with all forms of 3D coordinate-based digital models (CAD, BIM, VPD, etc.). Here is an example of how UAV technology resulting from the fusion of miniaturised technology components can be used to improve client communication (electrical propulsion motors, GPS, inertial navigation, remote sensor units with their operations integrated by a computer on a chip). Using a remote-control UAV sensor platform would allow construction planning meetings with clients in which photographic image and/or Lidar data of actual site conditions could be gathered in real time, streamed back to the meeting over the network and then integrated with the plant model data (existing and new design) in real time for viewing and analysis during the meeting.

These are indeed exciting times for those of us who work with geospatial technologies because we now have a quickly expanding universe of potential new client domains. Rapidly growing consumer access to 3D AR devices, 3D models and 3D printing will help popularise this technology, so we should expect our clients to be increasingly educated and willing to explore the creative use of 3D technologies. Yet there is something more that is emerging from the new technology context. Providing more data, with improved accuracy, more quickly does not necessarily equate to improved construction-project performance and returns on investment. The object of our services is to assist clients to improve their situation. As an industry, we have a business opportunity before us: to develop our ability to provide advice and support over the project life cycle to many new clients as they seek to optimise their use of the rapidly expanding capabilities and products available from the 3D geospatial community.

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HxGN LIVE 2015 with the Hexagon Geosystems Track

HxGN LIVE, Hexagon's annual international conference and exhibition, is going global in 2015 with two locations – 1-4 June in Las Vegas and 18-20 November in Hong Kong – featuring the Hexagon Geosystems Track. Customers, partners and the global brand network of Hexagon will all come together. This premiere conference is aimed at highlighting the latest trends in information, measurement and visualisation technologies and at fostering discussion, ideas and solutions towards creating a better and smarter world.

► <http://bit.ly/1DARUUG>

Robin McLaren Receives Honorary Doctorate from the University of Glasgow



At a ceremony at the University of Glasgow on 5 December 2014 an honorary Doctor of Science title was conferred on Robin McLaren, director of Know Edge and member of *GIM International's* Editorial Advisory Board, in acknowledgment of his contribution to geomatics.

► <http://bit.ly/1DASAtf>
Robin McLaren.



The Toronto skyline.

UAV-g 2015 Issues Call for Papers

The organising committee of UAV-g 2015 has issued its first call for papers and tutorials. UAV-g 2015 will be held from 30 August to 2 September in Toronto, Canada. The aim of the event, themed 'sUAS: a disruptive technology for geomatics', is to bring together experts in photogrammetry and remote sensing, surveying, robotic mapping, computer vision, artificial intelligence, aerospace engineering, geosciences and various user communities.

► <http://bit.ly/1DAT6aN>

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

1. Deformation Analysis of a Test Dike - <http://bit.ly/1wPOuZY>
2. Debut for GPS-less UAV Lidar Surveying and Mapping System - <http://bit.ly/QbOCRv>
3. Surveying UAS for Use with RTK Base Stations - <http://bit.ly/11W8jSV>
4. Google Buys Satellite Maker Skybox for USD500m - <http://bit.ly/TO6umw>
5. Berlin: Three-day Geomatics Capital of the World - <http://bit.ly/1temcm4>

ILMF 2015 Programme Includes over 60 Presentations

The International LiDAR Mapping Forum (ILMF) 2015 conference programme has been posted online. The event, taking place from 23 to 25 February 2015 at the Hyatt Regency Denver in Denver, Colorado, USA, will be celebrating its 15th year. The technical conference and trade show focuses on data acquisition, fusion, processing and point clouds for airborne, terrestrial and underwater Lidar used to support transport, urban modelling, coastal zone mapping, utility asset management and more.

► <http://bit.ly/1Az5jqH>

Septentrio's RTK Technology Selected for UAV Lidar Solution

Septentrio, Belgium, has announced that L'Avion Jaune, a service provider and airborne sensors integrator in the field of aerial surveys, has selected the Septentrio AsteRx-m for its robustness and low power consumption to equip the YellowScan system. YellowScan is an all-in-one solution designed to deliver high-quality aerial surveys carried out using a Lidar sensor aboard UAVs. The self-contained system integrates into a small package all the necessary equipment for conducting airborne surveys: a 3D laser scanner, an AHRS, a controller, an autonomous power supply module and the AsteRx-m, a high-performance precision GNSS receiver.

► <http://bit.ly/1DAVWwo>

Rapidlasso Joins Forces with Carbomap

Rapidlasso, a technology start-up specialised in Lidar processing tools, and Carbomap, a new spin-out company from the University of Edinburgh, have teamed up to further the

development of tools that better exploit full-waveform Lidar for the forestry and carbon market. This partnership unites many years of expertise in processing full-waveform Lidar with a wealth of experience in applying that technology within forestry and biomass applications.

► <http://bit.ly/1DAV4Yy>

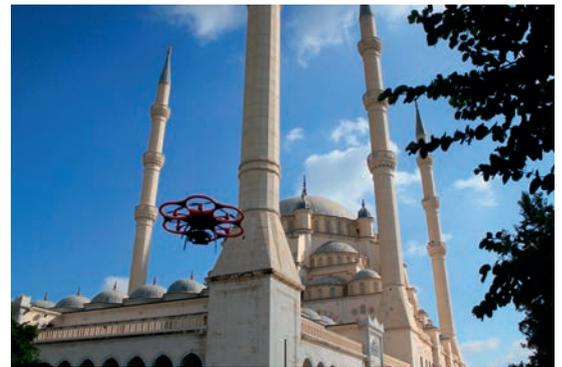


Antoine Cottin (Carbomap) and Martin Isenberg (rapidlasso).

Detailed 3D Model of Turkey's Largest Mosque

The Turkish distributor of Leica Geosystems, Sistem A.S., the project management service provider NRJ Engineering and the German multicopter manufacturer Aibotix have inspected the famous Sabanci Merkez Mosque in Adana, Turkey, using a UAS and have created a detailed 3D model. The surveying team needed only three flights to cover all relevant areas and generate comprehensive data.

► <http://bit.ly/1DAU6PK>



Aibot X6 mapping the mosque in Adana.

GameSim and US National Geospatial-Intelligence Agency (NGA) Join Forces

GameSim, a provider of software and services to the gaming, simulation and GIS industries, has announced its Cooperative Research and Development Agreement (CRADA) with the National Geospatial-Intelligence Agency (NGA). The company is interested in furthering the process of fusing together a single 3D environment by supporting additional data products (e.g. Lidar, OTW video and thermal video) to create a richer and more accurate 3D environment while still maintaining near-real-time performance.

► <http://bit.ly/1DATsyb>



Preview screenshot of GameSim's 3D content.

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No 2707

Catsurveys Introduces Rapid Vehicle-based MGPR Innovation

New mobile ground-penetrating radar (MGPR) from Catsurveys Group is challenging traditional approaches to utilities and other subsurface surveying. Catsurveys' MGPR is a georeferencing system and synchronisation process which enables data generated using a vehicle-towed MGPR system to be combined with a global positioning system (GPS) for maximum accuracy and detail.

► <http://bit.ly/1DAUudi>



Catsurveys' MGPR survey.

Guatemalan Maps Available in the Cloud

The Geographic Institute of Guatemala recently launched its first set of cloud-based geoservices. Its 'news view' service provides open access to more than 20 thematic layers on topics such as geodesy, vegetation cover, land use, geology, hydrology and road networks, among others. The services use Geoserver and Geoexplorer, and were developed with support from the GeoSUR Program and PAIGH, with funding from the Eye on Earth Alliance.

► <http://bit.ly/1Az20jd>

5 Questions to...

Clarissa Augustinus



Dr Clarissa Augustinus is chief of the Land, Tenure and Property Administration Section, Shelter Branch, Global Division, in UN-HABITAT.

What are the latest achievements in the Global Land Tool Network (GLTN)?

The first version of the Costing and Financing of Land Administration services for Land Agencies has been developed and validated by the land industry and is being piloted. The software codes of the pro-poor

land information system, the Social Tenure Domain Model (STDM), have been made public to facilitate further development. The STDM for slums is being scaled up and is already being used in many countries and regions of the world, including in over 4 municipalities in Uganda, by the Mombasa city council (a city of over 2 million people) in Kenya, and in customary areas experiencing urbanisation in Zambia. A methodology for participatory and inclusive land readjustment, which can also be used for slums, will be available in early 2015 for piloting at country level. GLTN partners have created the Global Land Indicators Initiative which has identified indicators for monitoring at the global and country level, as well as for the Sustainable Development Goals being developed by the UN.

Are the tools to achieve and maintain global coverage in land administration available now?

Some of the GLTN tools are more mature such as the STDM and participatory enumeration approach – the latter is often used to generate the data, the Continuum of Land Rights, the Gender Evaluation Criteria which are being used to evaluate the gender responsiveness of land systems in over 40 countries. Other tools are still in the first phase, such as the Participatory Inclusive Land Readjustment which is ready to go to pilot. The Land Indicators will be piloted in a number of countries using a range of methodologies beyond the land registry data. Land-based financing now includes a sufficient body of knowledge for capacity development to be undertaken. Critical tools for land administration still in an early stage of development include: the valuation of unregistered land; customary land tools including for families and groups, which are especially critical for Africa and the Pacific; and land use planning particularly for the peri-urban areas. Tools not yet started include public-private, deceased estates, expropriation and compensation, and the prevention of evictions.

Are the tools accepted and supported by the global community?

The recent game-changing publication on 'fit-for-purpose' land administration by the International Federation of Surveyors and the World Bank has shown a new way to approach land administration, and the publication used a number of the GLTN tools and experiences to argue for that approach. Freehold is now no longer the only way of doing business, and instead the

continuum of land rights has been accepted at the global level. In 2011 the countries linked to UN-Habitat approved a resolution accepting the GLTN tools (Governing Council 23/17). The African Union, UNECA and African Development Bank Land Policy Initiative have welcomed the tools and showcased many of them at their first continent-wide inaugural conference in 2014. The Malaysian Prime Minister, the World Bank, a range of GLTN partners, and the Housing sections of some governments and municipalities have accepted the tools.

Do the tools really contribute to poverty reduction?

It is too early to measure the impact using indicators. An early poverty reduction result is that GLTN tools are used by a range of international NGOs to help them to meet the needs of their poor constituencies at national level in over 40 countries in South America, Africa and Asia.

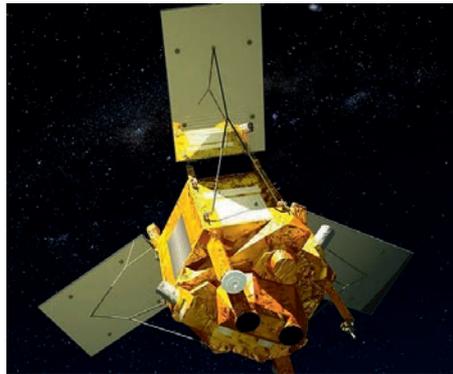
What and where are the bottlenecks?

Ministries of Land do not yet know how to use pro-poor tools. While many in the industry want to see increased coverage in their countries, vested interests remain in the professions. Land needs to be placed at a higher level globally as the politics of land at country level remains a key problem, also in regard to the frequent use of the land registry by the rich to protect their land rights and claims against others (also known as 'elite capture'). Corruption in the land industry remains high, and many people often do not want greater transparency.

SPOT 7 Satellite Commercially Launched

SPOT 7, the Earth-observation satellite designed and built by Airbus Defence and Space, was commercially launched on 2 December, making its high-resolution imagery available to all users. Together with SPOT 6, Pléiades 1A & 1B, TerraSAR-X and TanDEM-X, SPOT 7 makes Airbus Defence and Space the first operator in the world to offer customers a full palette of Earth-imaging data spanning multiple resolution and spectral wavelengths.

► <http://bit.ly/1Az3UQW>



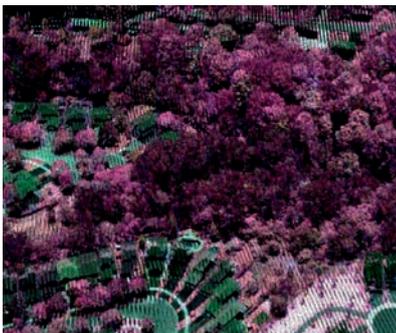
SPOT 7 satellite.

Acute3D and Visual Intelligence Sign Partnership

Acute3D has announced its partnership with Visual Intelligence, a provider of high-quality multi-purpose digital sensor systems for airborne geoinformation applications. Visual Intelligence's technology innovations include sensor systems that are field-configurable to support a variety of applications including 2D stereo (large area collection) to oblique for 3D applications.

► <http://bit.ly/1DASSjW>

Optech Announces Multispectral Airborne Lidar Sensor



Vegetation discrimination using the Optech Titan.

Optech has announced the latest addition to its line of airborne laser terrain mappers (ALTM), the Optech Titan. The Canada-based company regards the Optech Titan as the launch of a new era in remote sensing as the mapper offers the possibility of multi-spectral active imaging of the environment at day and night, allowing new vertical applications and information extraction capabilities for Lidar.

► <http://bit.ly/1Az4huL>

DroneMetrex Launches Solution for Directly Georeferenced Mapping from a UAV

DroneMetrex, an Australian manufacturer of the TopoDrone photogrammetric mapping UAV systems, has introduced a solution for directly georeferenced mapping from UAVs. According to the company, the difference and main advantage of DroneMetrex's direct georeferencing solution is that it encompasses post-processed kinematic (PPK) principles.

► <http://bit.ly/1Az4y0C>



TopoDrone-100.

GeoSUR Award Granted to TerraMA2 Project

The 2014 GeoSUR Award was granted to the TerraMA2 project for the development of an open source platform to manage natural disasters, presented by Brazil's National Center for Spatial Research (INPE). The GeoSUR Award is granted annually and recognises the application of spatial data and the development of geospatial information services.

► <http://bit.ly/1Az3Ro5>



The GeoSUR Award being received by INPE's representative.



Arrow series.

Eos Launches New Line of High-accuracy GNSS Receivers

Eos Positioning Systems has announced the introduction of a new, innovative product line of high-accuracy GNSS receivers for smartphones and tablet computers, including both sub-metre and RTK performance for all mobile platforms: iOS, Android and Windows. With the entry-level product, the Arrow Lite, Eos aims to set a new performance standard for high-accuracy GPS receivers compatible with all mobile devices.

► <http://bit.ly/1DRqmuq>

Confronting the Geomatics Professional's Identity Crisis



While I was presenting an educationally themed paper at GeoBusiness2014 in London last May, attendees were polled in real time on which title/role most accurately represents our industry's graduates (from a choice of: Geospatial Scientist, Spatial Information Surveyor, Geosurveyor, Geomatics Professional, or Other). 'Geospatial Scientist' and 'Geomatics Professional' were chosen. However, worldwide it is generally accepted by our industry that a lack of clarity persists regarding what title a geomatics professional should use. Primarily this confusion reflects a lack of recognition by the general public of what the geomatics/spatial information sector encompasses. There is also evidence that academics continue to toil with defining a consistent set of competencies/skills for geomatics graduates. The decision to add new skills and knowledge to rapidly evolving 'geo' programmes appears easier than knowing which 'legacy' or traditional skills should be omitted, and when. This ambiguity is further reinforced when geoprofessional roles are unregulated within some jurisdictions, i.e. when the title of 'Land Surveyor' or 'Geomatics Surveyor' is not protected by legislation (as is currently the case in Ireland). This absence of a recognised and industry-consistent professional (and, in many cases, statutory) title is a real difficulty for educators, with many arguing that this issue alone is significantly affecting the sustainability of the profession.

Cognisant of these issues generally, and of the vulnerability of its geomatics programme specifically, academic staff within the Spatial Information Sciences Group (SISG) at the Dublin Institute of Technology (DIT) –

where Ireland's only bachelor-level geomatics programme is delivered – are responding to emerging industry developments, clarifying what the current core geomatics graduate attributes are and ensuring that these are reflected within its programmes. Further to this, the Group has introduced options such as problem and project-based interdisciplinary learning, outreach activities such as work placement/internships (where learning during the normal working week is supported by workplace mentors and SISG academic supervision) together with student 'learning with communities' projects. Work placement/internship providers are asked annually to give formal feedback on the technical and professional skills of students placed within their organisation/department. As a result of this informed feedback from industry, it was decided to develop two further programmes: an MSc in Geographic Information Systems and an MSc in Geospatial Engineering (in addition to an existing MSc in Spatial Information Management). Additionally, the SISG alumni are surveyed (twice in the past five years) on their career paths, skills needs, etc., while masterclasses, workshops and seminars are hosted in collaboration with relevant professional bodies (mostly free of charge) for professionals across the AEC sectors.

Back in 2007, DIT recommended that 'all programmes will provide students with a range of opportunities to develop, practice and be assessed on an agreed range of key employability skills or graduate attributes'. By early 2013, overarching attributes were defined which anticipated that DIT graduates would be 'Engaged, Enterprising, Enquiry based, Effective, Expert in chosen subject discipline'. From recent successes the Group is assured that through integration of these attributes with specialised discipline-specific competencies it continues to attract high-quality applicants and to secure the survival of its programmes.

It is important to state that much of what is described here is not unique. Programme

teams on 'geo' courses worldwide are adopting comparable initiatives. However, SISG is acutely aware that only with such changes to existing paradigms of education will its programmes be reactive to, and reflective of, our evolving profession. Educators everywhere must exact a similar partnership-based approach with industry in order to showcase that the breadth of 'geo' skills is broader than that of the traditional 'land surveying' profession and, in so doing, begin to address the identity challenges confronting geomatics graduates and established professionals worldwide. Perhaps an industry-led discussion on discipline-specific geomatics/spatial information graduate attributes might get the ball rolling?

For more information on DIT graduate attributes, see: <http://www.dit.ie/litc/about-thelitc/litcspotlight/ditgraduateattributes/>

HELEN MURRAY O'CONNOR, FRICS, FCSI

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A chartered geomatics/land surveyor and lecturer in spatial data management, e-government service provision, land management, spatial data applications and geodetic/land surveying, she has served as chair and vice chair of the SCSi Geomatics Professional Group (PG) and as a member of the RICS Global Geomatics Professional Group (2011-2012). She is currently a member of the RICS UK and Ireland Regulatory Board, and a member of the RICS FIG delegation. Helen was appointed to the board of the Property Registration Authority of Ireland in early 2014.

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Leica Geosystems Extends GNSS Product Family



GR25 GNSS receiver.

Leica Geosystems has extended its Spider product family with the new GNSS Unlimited for the Leica GR10 and GR25 GNSS receiver series, allowing

receivers to be upgraded to the latest technology standards at any time. Both receivers are especially designed for continuously operating reference stations (CORS) infrastructure and monitoring applications, supporting GPS, GLONASS, Galileo, BeiDou and QZSS. Furthermore the classic Leica GRX1200+GNSS has been enhanced to support the Chinese BeiDou navigation system.

► <http://bit.ly/1Az2ea0>

First GISTAM Conference Announced

The first edition of the GISTAM conference (International Conference on Geographical Information Systems Theory, Applications and Management) organised by INSTICC (Institute for Systems and Technologies of Information, Control and Communication) will take place from 28-30 April 2015 in Barcelona, Spain.

► <http://bit.ly/1DAWouA>

MicroSurvey CAD 2015 Announced

MicroSurvey has announced the release of MicroSurvey CAD 2015, a major update to its flagship desktop survey and design program for land surveyors and civil engineers. The latest release is powered by the all-new IntelliCAD 8 engine and is the first-ever 64-bit version of MicroSurvey CAD.

► <http://bit.ly/1DRqpX3>



MicroSurvey CAD 2015.

Ford and the Art of Map Maintenance



In the wake of the recent monetary turmoil, an often-heard quote is one by the late Henry Ford – founder of the Ford Motor Company and management guru – who once said: “It is well enough that people of the nation do not understand our banking and money system, for if they did, I believe there would be a revolution before tomorrow morning.” Ford understood that the cars he produced needed buyers and so he turned his workers into consumers by doubling their wages. When faced with questions by critics as to how he got the money to fill their pay packets, he responded with the abovementioned quote. He also understood that the success of car use depends on infrastructure, which is why he promoted road building and stimulated the construction of waypoints providing fuel and care. After all, a car needs maintenance to keep it running and to ensure it retains its value.

It appears that many seemingly lasting insights have faded away in the recent decades of shareholder and manager worship, or have been buried in the cemetery of outdated ideas. I recently came across a geomatics-related example in Kenya. A World Bank loan enabled the Ministry of Nairobi Metropolitan Development to conduct aerial surveys and mapping of the Nairobi Metropolitan Region (NMR). Between October 2011 and January 2014 an area of the size of Belgium was captured by overlapping airborne digital imagery and airborne Lidar. The project was aimed at

providing an accurate, up-to-date and detailed digital map of the NMR, at scale 1:2,500 for areas with high development rates and population density, and at scale 1:15,000 for less-developed areas such as forests, group ranches, national parks and farm land. The Lidar data, captured by a RIEGL sensor, was transferred to a point cloud resulting first in a digital surface model (DSM) and subsequently, by removing the points reflected on buildings and vegetation, in a DEM representing the bare ground. The levels of quality and information in the product are astonishingly high. The 1:2,500 maps show the outlines of buildings, roads, trees, rivers, power lines and more. Combining images with the DEM resulted in orthoimagery, and contour lines generated from the DEM have been superimposed on the topographic maps.

Products need care to retain their value. However, no provisions have been made for updating the maps and the point clouds regularly. This is common in Africa, not only for maps but also for physical constructions such as roads. When travelling throughout the continent you may drive over impressive, brand-new highways but within five to ten years a crack in the surface will have become a cavity, and a cavity will have become a pit. After a decade or so, the road will have become unpaved and potholed, resembling little more than a path through the jungle. This is happening time and again. Why are lenders repeatedly making the same mistake? They provide the initial capital as a loan with interest but put no restrictions on maintenance and continuation, resulting in rapid deterioration of the goods manufactured. To go back to Henry Ford's main product: the car. The starter should ignite the engine to get the car running and ultimately increase the driver's earnings. That is how a loan should work – acting as a starter to enhance yield – but this is not how it works in Sub-Saharan Africa. All that is left is high debt and low productivity. Economic growth drops behind and erodes the ability to settle principal and interest. The burden remains and the need for new loans accelerates to fill the existing debt holes. A classic case of the debt trap. ◀

Nigeria Needs Federal Commitment to its Geodata Policy

Nigeria has all the prerequisites to install an effective national geospatial data infrastructure (NGDI) from which all its 170 million inhabitants would benefit. The country has many educated professionals, a national policy concept, money, lots of projects, more and more data, etc. But what is missing is the will to make a conscious effort to implement an NGDI in order to facilitate coordination of the geospatial resources and provide easy access to data such as Earth observation images. So says Jide Kufoniyi, president of the African Association of Remote Sensing of the Environment and member of Nigeria's National Geospatial Data Infrastructure Committee, in this interview with *GIM International*.

What are the main characteristics of the Nigerian spatial data infrastructure?

In a nutshell, national geospatial data infrastructure (NGDI) implementation in the country has so far been largely characterised by unfulfilled expectations. We have a national geoinformation policy, adopted by the Minister of Science and Technology. We also have a 27-member NGDI Committee, together with five sub-committees (Geospatial Datasets; Standards; Clearinghouse and Metadata; Capacity Building and Awareness; Legal; Sustainability

and Funding). The policy was submitted to the Federal Executive Council for approval in 2004, but it was subsequently returned for review of the membership of the NGDI Committee and the funding mechanism (since the proposed budgetary provision was 2.5% of the federal government's total annual budget). Many years have passed since the draft was reviewed, but the modified version has still not been presented for approval by the federal government, let alone been processed for enactment by the National Assembly. It is obviously not regarded as a priority.

The failure to get the policy approved so far has greatly affected the sustainable implementation of an NGDI because the lead agency – the National Space Research and Development Agency (NASRDA) – could not really support the request for adequate yearly funding. Despite the lack of an enabling law and funding, NASRDA implemented a pilot project in 2009 involving three other NGDI node agencies: the Office of the Surveyor General of the Federation, the National Population Commission, and the Nigerian Geological Survey Agency. That project was

successful and showed the country's NGDI readiness. We used international standards to provide low-cost, domestic solutions for SDI development and used indigenous professionals in the complete design and implementation of the SDI pilot. The resulting web portal, based on ISO 19115, has a metadata search page where the (limited) metadata from the four agencies can be found and includes a web map view for visualising framework data. There is also a forum to facilitate communication among the various NGDI groups [1].

In 2011, a follow-up activity, titled 'Integration of Web Map Services with the Current Nigeria NGDI Portal', achieved limited success. Unfortunately, there has not been any other activity relating to NGDI implementation since then. Although the geoportal is still up and running, none of the four agencies have captured additional metadata records since early 2010. This clearly highlights the challenge of the initiative's sustainability. Nigeria is a federal country with 36 states, yet only one of them, Lagos State, has so far developed its own draft GI policy – a kind of domestication of



the national policy – and two other states are planning to do so.

So the 'NGDI fire' is still burning, albeit slowly?

What is encouraging is that there are currently many geospatial programmes and mapping projects in many government and private-sector organisations. The awareness of the need for a coordinated SDI at various levels has increased tremendously. In addition to the usual need for adequate funding, we could benefit from some SDI 'champions' in strategic positions.

Encouraging is also the ongoing land reform programme, which is aimed at achieving nationwide, systematic land titling and registration. It requires the use of faster and relatively low-cost data acquisition methods. Also many surveying and mapping organisations, at both federal and state levels, are transforming their production methods and services into fully digital, thereby necessitating relevant education.

18 universities are offering degree programmes in surveying and geoinformatics, while 29 polytechnics and four specialised institutions are offering ordinary and higher national diplomas and postgraduate courses. The surveying and mapping community in Nigeria feels the need to review the curricula once again to fully reflect today's geospatial technology, and the two national agencies in charge of quality assurance within university and technical education have this recommendation on their agenda.

Nigeria is Africa's biggest oil producer. Are there fewer financial constraints to support SDI projects than in other African countries?

Indeed, the oil wealth has contributed both positively and negatively to socio-economic development in the country, including in the area of SDI-related projects. To cite some positive examples, all of which are being executed without external funding or loans: Nigeria has launched three Earth observation (EO) satellites – NigeriaSat-1 (32m spatial resolution) in 2003, and NigeriaSat-X (22m resolution) and NigeriaSat-2 (2.5m PAN and 5m MX) in 2011 – as well as a communication satellite (NigComSat-1R). Moreover, many of the federation's states have implemented mapping and GIS programmes. Cross River State carried out digital aerial mapping at

20cm ground sampling distance (GSD), resulting in the production of orthophotos of the entire state at 1:10,000 and five major towns at 1:2,000. Lagos State acquired digital aerial photography of the entire state at 10cm GSD and Lidar data to generate large-scale orthophotos/photomaps, a DTM and various layers of digital line maps as well as a web-based enterprise GIS. Osun State acquired aerial photography of the state at 25cm GSD for the production of a DTM, orthophotos/photomaps, various layers of line maps and a land information system. The Federal Capital Territory provided one-stop land information and geospatial services for government and citizens in the Abuja region. Many other states are planning or already executing similar projects. Furthermore, at the moment, there are about 21 continuously operating reference stations in various parts of the country.



Although Nigeria is the 26th-biggest economy in the world, the country performs less favourably on the poverty scale: 61% of Nigerians live in absolute poverty, of whom 90% survive on less than a dollar a day. It is the most populous nation on the African continent: 188 million inhabitants by 2015.

IT IS ENCOURAGING THAT THERE ARE MANY GEOSPATIAL PROGRAMMES AND MAPPING PROJECTS IN GOVERNMENT AND PRIVATE-SECTOR ORGANISATIONS

Do the benefits outweigh the costs of the three Nigerian Earth observation satellites?

In terms of costs, many Nigerians believe that it is money well-spent. Meanwhile, the utilisation of the products of these satellites can only bring benefits to Nigeria. The 2.5m PAN and 5m MX images of NigeriaSat-2 are appropriate for implementation within many applications and infrastructure development projects, including road design and construction, agricultural production, urban renewal, water resource management, mitigation of various hazards such as desert encroachment and erosion, oil spills. In particular, with only 200,000km of various categories of roads within the country's 923,768km² of territory, the images would be very useful in the design and construction of new roads and maintenance of the existing ones.

Half of the population live in urban areas, and in view of the rate of urbanisation of 3.75%, increase pressure is expected on urban land with its attendant impact on risk. This is another area where the country's EO images can play pivotal roles. My concern is the difficulty of gaining access to the images; they are not readily available.

There is tremendous growth in mobile communication, but the density of ICT facilities is still low. In 2012, 95% of Nigerians lacked access to computers and the internet, and the bandwidth is often still too low to support geographical information transfer. The launch of our telecom satellite came with the hope that its services would improve this situation but it has made no evident contribution so far. ▶

Jide Kufoniya

Prof Jide Kufoniya is Professor of Geoinformatics (Remote Sensing and GIS Programme, Department of Geography) at Obafemi Awolowo University, Nigeria. Among other functions, he is a member of Nigeria's National Geospatial Data Infrastructure Committee, current president of the African Association of Remote Sensing of the Environment, and Fellow of the Nigerian Institution of Surveyors. He gained a BSc in Geography and Postgraduate Diploma (PGD) in Surveying in Nigeria, and obtained a PGD and MSc in Photogrammetry and a PhD in Geoinformatics in The Netherlands.



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Hundreds of highly educated surveyors pass their exams each year. Is that too many or too few?

It is true that the universities, polytechnics and specialised institutions produce about 500 new highly educated surveying professionals of different cadres every year. The Surveyors Council of Nigeria has 2,344 people on its register, either in private practice or paid employment, although that number includes deceased surveyors. However, there are

mention its maritime borders. Most of these boundaries are yet to be fully demarcated and surveyed. Furthermore, according to the Presidential Technical Committee on Land Reform, most of the country's states have issued fewer than 10,000 Certificates of Occupancy, and the process (including the cadastral survey) often takes a minimum of six months from the date of application. It is not unusual for an entire state to have fewer than five qualified surveyors in its

THE REGIONAL SPACE PROGRAMME WOULD BE BETTER REALISED IF A COORDINATING AGENCY IN THE FORM OF AN AFRICAN SPACE AGENCY COULD BE ESTABLISHED

many more surveying and geoinformatics graduates from universities and polytechnics who are not registered but are nonetheless working in appropriate jobs. In addition many other departments, such as geography, are producing postgraduate-level application-oriented GIS professionals. Taking these different categories together, it could be tempting to say that there is little cause for concern in terms of manpower. However, when we consider the need to produce, manage and disseminate adequate, fit-for-purpose and easily accessible geospatial data for various national development programmes, it is evident that the number is grossly inadequate for such a large country as Nigeria.

The country has about 4,000km of international land boundaries and about 22,000km of interstate boundaries, not to

employment, many of whom require retraining to cope with modern technology.

You are also president of the African Association of Remote Sensing of the Environment (AARSE). What difference is AARSE making for the continent?

Since 1992, the association has been playing a modest yet important role in capacity building and in the overall development and uptake of Earth observation and geospatial technology in Africa. We participate in many programmes and partnerships. AARSE has been very active in the development of a framework for the implementation of the AfriGEOSS initiative, which is the African realisation of the Global Earth Observation System of Systems (GEOSS) programme. As a member of the UN-Executive Working Group on Geoinformation [see p.14 of the

September 2014 issue of *GIM International*, Ed.], AARSE contributes to various pan-African initiatives including the 'Mapping Africa for Africa', the 'African Reference Frame' and the 'Global Geospatial Information Management' programmes.

To further contribute to knowledge in our field of operations, we publish books, monographs and special editions of journals. Plus the edited proceedings of the large international conference we organise every two years on Earth observation and geospatial information sciences. The declarations from these conferences have certainly contributed to change, such as to the development of the African Resource Management Satellite (ARMS) constellation programme.

What do you expect from that satellite constellation programme?

Both the awareness and uptake of geospatial information have increased on the continent since Algeria, Nigeria and South Africa have launched EO satellites. The recognition of the immense opportunities for regional cooperation (despite different national policies and priorities) through the implementation of joint programmes was instrumental in the development of the ARMS constellation programme. That has been supported by Nigeria, South Africa, Kenya and Algeria and will soon welcome other African countries to join. Our expectation is that the programme will help satellite technology to be developed and transferred. African human resources will grow by means of joint participation and knowledge sharing. The region will gain rapid, unrestricted and affordable access to satellite data, thereby ensuring effective indigenous resource management: in Africa, by Africa.

The stakeholders have strongly advocated that the programme should be the primary focus of the African Space Policy and Programmes which are being finalised by the African Union Commission. However, the regional space programme would be better realised if a coordinating agency in the form of an African space agency could be established. Then we would have an effective platform for the implementation of ARMS and other future regional African satellites. ◀

More information

1. www.ngdi.gov.ng

3D Modelling of Fez

The ancient imperial city of Fez, Morocco, is an important tourist attraction and has been listed as a UNESCO World Heritage Site since 1981. The layout of the city is complex, which presents challenges in terms of 3D modelling. Here, the authors discuss a pilot aimed at creating a 3D model of Fez using topographic maps and aerial and terrestrial imagery. Overlapping 1:4,000 aerial images were used to create a digital surface model (DSM) and orthoimages. Orthoimages and topographic maps were used to manually delineate the footprints of buildings, roads, rivers and suchlike. Terrestrial imagery of single buildings from multiple viewpoints was captured with a digital camera to enable draping texture on the facades.

Founded in 789 and covering an area of 95 square kilometres, Fez has approximately one million inhabitants. The city is home to Quaraouiyne University which is the oldest university in the world (built in 857). In 1250 it replaced Marrakesh as the country's capital, and remained so until 1912. Buildings, roads, trees and the terrain surface are the most important objects and features of a 3D city model. Potential uses for the 3D city model of Fez include urban planning, (flood) risk modelling, car navigation and transportation, positioning of mobile phones transmitters and solar panels, and visualisation of architectural designs and building restoration projects.

DATA

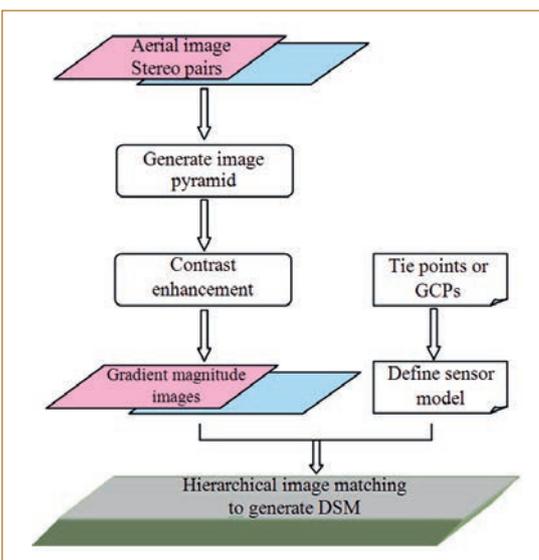
The aerial survey was conducted and

georeferenced by Cabinet Belmlih (GeoData) in 2007. Fez was recorded in seven north-south strips using a Zeiss RMK-A 15/23 film-frame camera with a focal length of 152mm. The 350 images (60%/30% overlap) at scale 1:4,000 were scanned with a ground sample distance (GSD) of 10cm. The GPS/IMU data collected on board combined with ground control points (GCPs) resulted in georeferenced images with a geometric accuracy of 1m.

DSM GENERATION

The Leica Geosystems LPS software was used to create the DSM. Figure 1 outlines the processing steps. LPS first requires selection of the sensor/camera type; definition of the sizes of the target and search windows, setting the threshold of correlation coefficient

and other parameters; and input of the imagery to be processed and the coordinates of the GCPs and the automatically determined tie points. The quality of a DSM and derived products is largely determined by terrain roughness, point density, grid resolution or GSD of the DSM, and the interpolation method. Grid resolution and the interpolation method are interconnected since a DSM with a large GSD results in little detail whereas an interpolation technique such as Kriging may enhance the details. Additionally, the presence of height discontinuities affects the DSM quality; places with sudden changes in heights – such as where buildings rise up – may result in few, if any, matches or incorrect ones and hence low DSM quality. The geometric accuracy of the results has been checked using points located both



▲ Figure 1: Outline of the DSM generation work process.



▲ Figure 2: Orthoimage (left) and DSM.





▲ Figure 3: Building footprints manually delineated from orthoimages and topographic maps.

in the centre of building roofs and on the ground (at a sufficient distance from facades to avoid any influence from the buildings). Before selection, visual inspections ensured that none of those points were outliers or mismatches. The checkpoints were then measured manually in stereo pairs. The root mean square error (RMSE) was 22cm, i.e. around twice the GSD. Figure 2 shows an orthoimage and DSM.

3D MODEL

To create the 3D model from the DSM, the orthoimages, the topographic map and the terrestrial images, ArcGIS 10.2 was

used together with CityEngine, which is 3D modelling software consisting of a full suite of tools for combining geodata from different sources. It enables the creation and editing of 3D buildings and road networks. Building footprints were manually delineated from orthoimages and topographic maps (Figure 3). Roads, rivers and land use derived from the orthoimagery were then draped over the DSM. Footprints were extruded in the third dimension using DSM heights resulting in a block representation (Figure 4). Next, texture from terrestrial images was projected on the facades of building models. Finally trees, lampposts,

ABDELKADER EL GAROUANI



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SAID EL GAROUANI

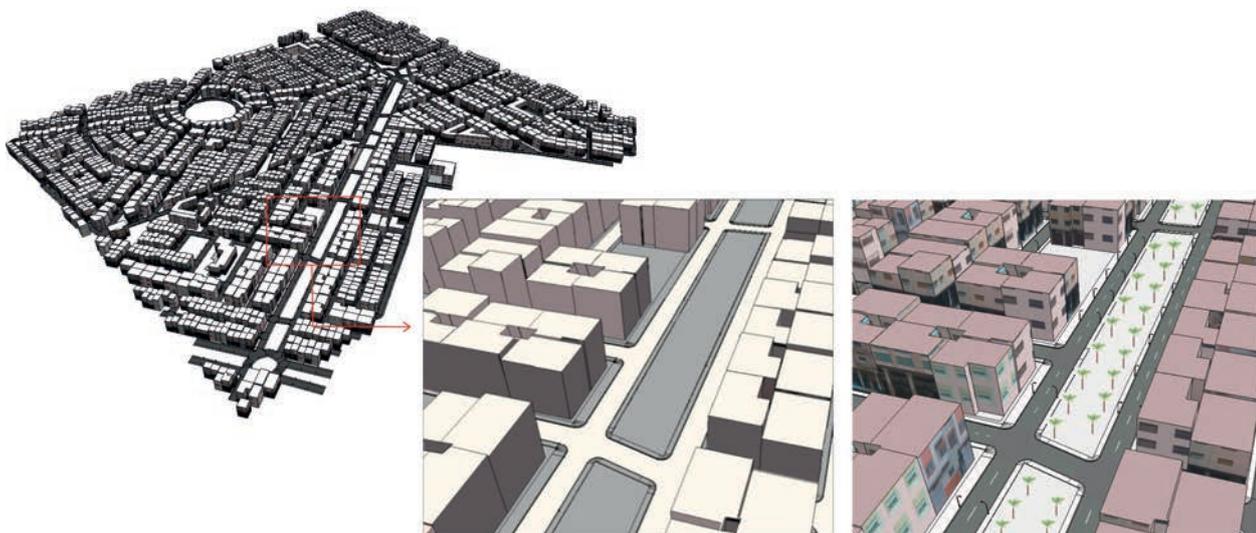


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road signs and other objects were added by a human operator.

CONCLUDING REMARKS

This pilot was the first phase of a project to create a 3D model of the entire city of Fez. The model will not only support general planning, monitoring and navigation tasks but will also help to preserve the heritage of the historical city. ◀



▲ Figure 4: Block model derived from extruded footprints (left), detail and the final 3D representation (right).

A New Era in Land Administration Emerges

The challenge for the global land community is clear: secure land rights for all people, in all places, at all times. The response: a new era in land administration, one underpinned by a wave of innovative thinking and coupled with quickly maturing, scalable approaches that can be applied globally. Supported by world-leading private companies, modern geospatial technologies and a new professional mindset, the provision of global land administration that supports good land governance now appears to be a feasible objective within the current generation. This article charts the new way of thinking and uncovers why there are good reasons for optimism about the future security of global land rights.

Securing land rights has been a priority of the international development sector for decades. An often-quoted estimate indicates that 75% of the world's people-to-land relationships are not documented and are outside the formal land administration domain. Meanwhile, populations and cities are growing and the pressure on land and natural resources is continuing to increase significantly. In the scramble for land it is often the poor who suffer most through dispossession, disputes and distrust. Appropriate administration of land normally marks the start of land-related conflict resolution and subsequent sustainable land use planning and natural resource management. This is crucial for

people's fundamental needs – including food security, housing and gender equality – and it is a human right.

GLOBAL DEVELOPMENTS

Land is a cross-cutting theme in the global development discourse. The UN Post-2015 Development Agenda includes consideration of the land issue across a wide range of objectives. The UN Committee of Experts on Global Geospatial Information Management (UN-GGIM) guides the development of technology infrastructure to support land applications. The critical role of land and geospatial information management in support of global sustainable development

is fully agreed at these levels. UN FAO has initiated and developed the 'Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security' (VGGTs). This comprehensive guide recommends that, where possible, states should ensure that the publicly held tenure rights are recorded together with tenure rights of indigenous peoples and the rights of the private sector in a single, or at least linked, land record system. Meanwhile, the World Bank has started assessment of good practices in the land sector through the Land Governance Assessment Framework (LGAF). The LGAF also provides tools for monitoring land



▲ Figure 1: Collecting evidence in the field using imagery. Case Rwanda.



▲ *Figure 2: Results of boundary drawing on top of an image. Case Ethiopia. Image courtesy: Dr Zerfu Hailu.*

governance as reforms are implemented. In addition, the UN-Habitat's Continuum of Land Rights is now a widely accepted philosophy. This breakthrough in the perspective of land rights is implemented in current land tools, as well as in those under development by the Global Land Tool Network (GLTN). There is now clear interest among the key global stakeholders to solve the land problem within our generation. Implementation of the VGGTs and the Continuum of Land Rights is the driving force behind the new era of land administration.

FIT-FOR-PURPOSE

The International Federation of Surveyors (FIG) argues for the need to move beyond mere advocacy of the accepted continuum concept and to focus on embedding it into real land administration solutions. In

approach recommends the use of 'general boundaries' to identify the delineation of land rights. The term 'general boundary' means that the position has not been precisely determined, although the delineation will usually relate to physical features in the field. It may be better to use the term 'visual boundaries', since this may perhaps be better understood by stakeholders outside the profession.

VISUAL BOUNDARIES

Visual boundaries can be easily identified on high-resolution imagery in the field using participatory mapping approaches. In some countries, members of local communities have been successfully trained to become 'grassroots surveyors' within the space of a few weeks. The required human resources for collecting evidence from the field can be

THERE ARE ALTERNATIVE DATA ACQUISITION APPROACHES THAT CAN BE ADOPTED

practice this translates and expands into developing a continuum of adjudication and demarcation methods, a continuum of appropriate surveying technologies and techniques, and so on. The World Bank and FIG jointly promote the fit-for-purpose land administration approach that enables appropriate land administration systems to be built within a relatively short time, at affordable costs, and with the opportunity to upgrade when required. The fit-for-purpose

effectively organised and scaled up in this way. Based on briefings with neighbours and community members, the boundaries can be drawn on top of an image using a pen. Administrative data, such as names and personal IDs, can be linked on site during this process using preliminary reference identifiers for the spatial units. If boundaries are not visible either in the field or on the image, some simple field surveys may be needed for data completion.

Finally, it is important to remember that the local community should be allowed to check and agree on the data, preferably on the same day. The community 'sits around the map' – a social process where people determine their own rights to land, guided by a grassroots surveyor and/or land professional.

DATA ACQUISITION

There are alternative data acquisition approaches that can be adopted within the context of purpose, budgets and availability of human resources. These range from accurate measurements supported by continuously operating reference stations (CORS), through total stations and handheld GPS, to the use of a plane table, tape, chain and rope. UAVs are emerging as a promising alternative in cases where only highly accurate data is accepted. Imagery data sources such as Google Maps or Microsoft Virtual Earth can be used, and the inclusion of high-resolution data at those sites may be agreed. Administrative data collection can be paper-based or digital. All these data acquisition options can include methods to describe and label data quality elements. Quality labels are crucial for decision-making in dispute cases and also for later quality improvements.

Monumentation in the field should be avoided – unless people organise this themselves. Placing beacons is expensive, time-consuming and not efficient for achieving land administration with complete coverage. High-resolution imagery is normally of sufficient resolution to resolve conflicts about landholdings. The approach is not new and has been successfully used in several countries during the last few decades, such as in Cambodia, Ethiopia, Kenya and Rwanda for example (see Figures 1 and 2). The new aspect is that it is now scalable and can be applied in a massive way, including management of large volumes of data.

AUTOMATIC FEATURE EXTRACTION

Today, automatic generalisation techniques have progressed to production environments, which would have been unimaginable some time ago. Similarly, automatic feature extraction from orthoimagery to support topographic mapping is now mature and can be used to assist spatial data collection for land administration purposes. This assumes a cloud-free satellite imagery composition. Images from fieldwork can be scanned and then compared with the results of ▶

automatic feature extraction from the imagery in a GIS environment. Automatic feature classification is not needed for this purpose. A pass generalisation can first be completed to obtain a set of vectors, which reasonably represents the visual boundary. Some interpretation and editing will be required as there may be topographic features inside a spatial unit of a right-holder. In the case of invisible boundaries on the imagery, some extra field observations may be needed. As a next step, the vectors obtained as a result of feature extraction can be reused in the spatial unit layer for land administration. The polygons can then be closed and corresponding spatial units automatically referenced to their final identifier. Administrative data collected by paper can be linked based on the preliminary identifier (see Figure 3).

POST-PROCESSING

Proper georeferencing and automatic feature extraction can be done later through post-processing, once resources are available. From an information management perspective, this requires versioning and management of historical data. The scanned imagery from the field has to be archived as source data. If automatic feature extraction is not available then digitisation can be executed on top of the scanned images with boundaries drawn in the field. Version management is needed in any case because

quality improvement of geometric data is an important second step. This upgrade can be organised sporadically during data maintenance, based on accurate field surveys, with GPS for example. As soon as a set of new coordinates is available in an area, the existing data can be transformed. Systematic quality improvements can be related to land consolidation and implementation of urban plans.

SOFTWARE SOURCES

GIS functionality is available to support all the data acquisition and data handling processes. An example of functionality for data collection in land administration is the Social Tenure Domain Model (STDM) provided as open-source software by GLTN or FLOSS SOLA with support from FAO. STDM-compliant software is also available from industrial software providers. Meanwhile, many software vendors offer functionality for surveying and feature extraction.

INFORMATION MANAGEMENT IN THE CLOUD

A number of initiatives are emerging that are based on the concept of democratising land rights through citizen empowerment and crowdsourcing, including Open Tenure in SOLA from UN-FAO, MapMyRights™ Foundation, the Rights and Resource Initiative, the Missing Maps Project and MappingforRights. These initiatives involve citizens and communities capturing their

evidence of land rights on mobile devices and recording that evidence on a global platform that is accessible globally in the cloud. These are trust-based rather than legal-based systems, and increased security of tenure through societal evidence and global publicity might become the norm for rights not yet recognised by national governments. These innovative initiatives are embracing scalable, fit-for-purpose approaches, and many are initially working with indigenous communities. They hold the potential to accelerate global coverage, but the matter of how crowdsourced land rights can be formalised over time still needs to be resolved.

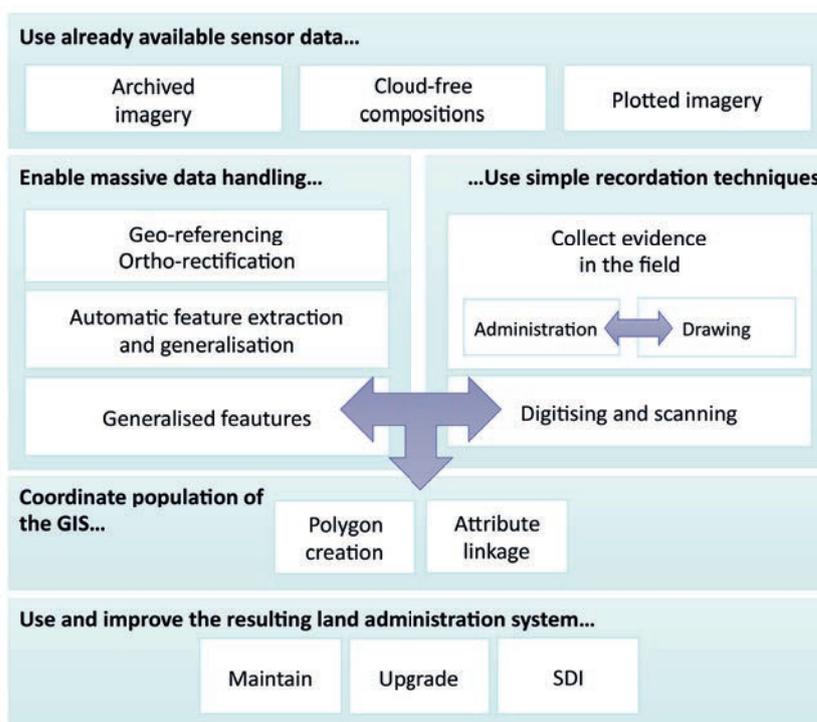
LEGAL IMPLICATIONS

The STDM and similar approaches such as FLOSS SOLA from FAO allow the inclusion of all people-to-land relations. This may include spatial units which are not legally occupied but are nevertheless legitimate according to the VGGTs. The converse may also be possible; land grabbing may result in titles, and land policies may require such situations to be repaired. This may imply a new and unconventional type of transaction: from freehold back to customary.

DEBATING THE NEW ERA

Within the profession there is a serious debate on the key elements of the approach outlined above. That debate is about quality of spatial data; in essence it is about the positional accuracy of boundaries of spatial units. However, it is often not mentioned that data quality concerns completeness (coverage), logical consistency, topological consistency, positional accuracy, temporal accuracy and thematic accuracy. In many countries those issues are not considered in an integrated way, primarily because responsibilities are distributed across different stakeholder groups. This must be solved by means of data integration and data harmonisation and also by integrating crowdsourced data.

This fits very well with the needs of land administration, which is in principle not about accuracy based on highly technical nationwide standards. Total coverage is urgently needed to secure land rights and manage the use of land, and also to avoid land grabbing and forced evictions and to ensure social justice. These fit-for-purpose approaches are fast, affordable and ideal for meeting this requirement. As a second stage, positional accuracy can be improved over



▲ Figure 3: Data acquisition and handling.

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time using sporadic approaches. All activities require good management of quality-related metadata. Continuous maintenance is needed and should be aligned with quality upgrading through the well-known processes of cadastral renovation, homogenisation, reconciliation and revision. ◀

FURTHER READING

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Exchanging Geodata Packages

As the use of smartphones continues to expand, the amount of geodata transferred to and from mobile devices is exploding at a similar pace. The rapid growth in indoor navigation and in-car apps is adding to the boom. Efficient exchange of raster and vector data over a wide variety of platforms requires standards. GeoPackage is a new, file-based standard developed for mobile devices which supports vector and raster data, metadata, map projections, text labels and other annotations.

People use smartphones, tablets and other mobile devices differently from laptops and desktops, and geodata is essential to many of those applications. Users want to quickly share location-tagged photos, their present location and other data. Each application running on any of the various platforms requires its own proprietary geodata store, which may be platform-specific and complicates exchange. These stores of different application running on a device may contain the same geodata, thus wasting the limited storage capacity available. This

in turn disturbs operation when network connectivity is limited or absent. Since exchange between different types of stores requires facilities for data translation, replication and synchronisation, there is an urgent need for a file-based standard.

NEW STANDARD

Standards for the exchange of geodata do exist, such as the Spatial Data Transfer Standard in USA and file formats developed by Esri and other firms, but these have not been designed for mobile platforms.

GeoPackage is a new standard developed by the Open Geospatial Consortium (OGC) to fill the gap. It is a simple, stand-alone open file format for sharing geodata [1]. The simplicity keeps the data stream small, ensuring faster transmission while easing developer compliance. It uses the platform-independent SQLite database which is widely deployed on mobile devices [2]. Another requirement is extensibility without massive efforts. The standard APIs for data access and management provide consistent selection and update results in response to identical SQL series from different types of applications.

SPECIFICATIONS

The geodata store allows direct use of vector data and/or satellite and aerial images and other raster data at different scales without the need for format translations. The standard defines a set of tables with fixed names and columns, allowed data types and other constraints for the contents of each cell in the table, and it defines integrity rules ensuring consistency. The specification supports data types, table definitions and metadata defined in widely implemented ISO standards. Some tables are mandatory, such as the spatial reference system, while others are optional. In addition to vector and raster data, tables/columns or SQL constructs (data types, functions, indexes, constraints or triggers) that are not specified can be stored in tables reserved for an Extended GeoPackage.



▲ A platform-neutral standard.



Emailing data



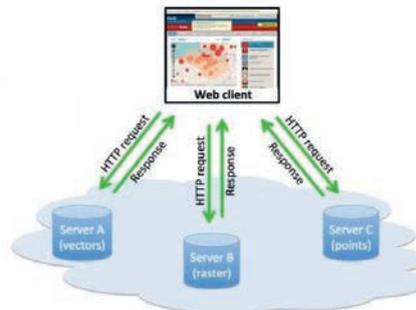
Mobile applications



Website publishing



Sharing spatial data on a USB stick



File-based access

▲ *The new standard makes many applications easier.*

SQLITE

Instead of files containing geometry, index and attributes of traditional exchange formats, the GeoPackage standard transfers a database file to a mobile user, usually for a limited region of interest. GeoPackage is based on the widely deployed open source SQLite database. Applications can analyse spatial and attribute data within the relational database using the standard query language SQL. Since SQLite requires little support from external libraries or

enterprise data stored on mobile devices can be updated. Once the connection has been restored, the data can be synchronised with the enterprise data stored on a remote server.

ADOPTION

GeoPackage1.0, released in early 2014, has been developed by OGC members with the help of other developers on GitHub, the web-based hosting service for software development projects. The industry has widely adopted other OGC

CONCLUDING REMARKS

All OGC standards are free and available to all. Work is continuing by the GeoPackage Standards Working Group (SWG) on enhancements, extensions and documentation such as an implementation guide. ◀

More information

1. www.geopackage.org
2. www.sqlite.org
3. www.opengeospatial.org/pressroom/pressreleases/2080
4. www.opengeospatial.org/pub/www/ows10/rfq/index.html

THE SIMPLICITY KEEPS THE DATA STREAM SMALL, ENSURING FASTER TRANSMISSION

from the operating system, it is developer-friendly. The Open Mobility GeoPackaging Engineering Report [3] prepared as part of OGC's Testbed 10 describes a Web Processing Service profile for automating GeoPackage creation from OGC services and keeping it synchronised with other instances of the same source data stored in other places and formats. If a dataset has an ID and a revision ID, then it is often possible to synchronise it with another system that has the same dataset. When data acquisition is done in the field, where internet connectivity may be disrupted,

standards, and implementing GeoPackage in their applications enables software vendors to further develop new capabilities for mobile users. Vendor support began with them taking part in the development: Luciad played a key role, and Augmented Technologies, Envitia, Carbon Project, Cloudant and Compusult soon followed with implementations demonstrated in OGC Testbed 10 [4]. After the release, several open source projects announced their support, including GDAL, OpenJUMP, GeoTools, GeoServer and SpatialLite. Esri offers support in ArcGIS.

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Help! What Should We Do With All These 3D Points?

SPAR Europe and European LiDAR Mapping Forum 2014 was held from 8-10 December 2014 in Amsterdam, The Netherlands. The event focused on the acquisition, generation, storage and processing of 3D point clouds. Today's sensors are able to collect billions of points in just one hour of surveying. But help! How can we query these huge volumes of 3D points and how can we convert them into useful information?

The sheer amount of 3D points and their attributes – such as intensity and RGB – collected by airborne and mobile Lidar sensors or terrestrial laser scanners, or computed from overlapping nadir or oblique imagery, is placing a huge burden on computers and storage devices. Indeed, the storage, management and processing of the brontobytes of data produced by Lidar or calculated from overlapping images requires considerable effort, and there is a growing consensus that massive point clouds raise issues which need to be tackled.

POINT CLOUD MANAGEMENT

During the event, Oscar Marinéz-Rubib (Netherlands eScience Center) presented a paper by himself and Peter van Oosterom (Delft University of Technology). The paper compared the time of loading and querying

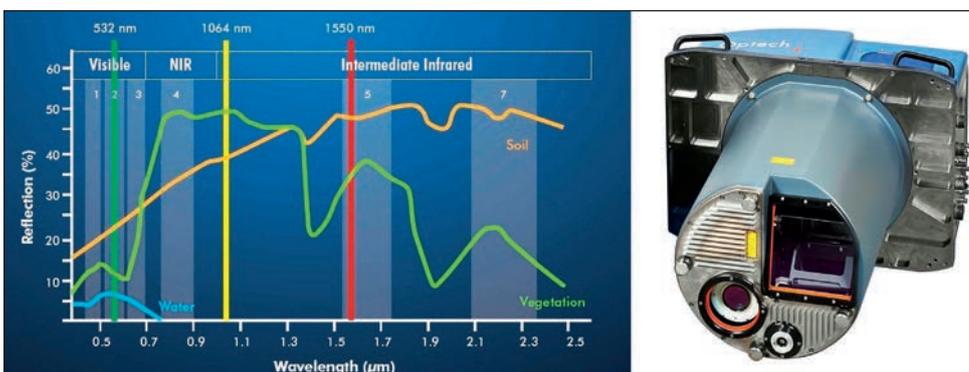
of The Netherlands' AHN2 height dataset as a whole and as subsets in several point cloud data management systems including Oracle, PostgreSQL, MonetDB and LASTools. The first three are database management systems (DBMSs) and the fourth one is file-based. AHN2 has a point density of 6 to 10 points per square metre resulting in a total of 640 billion (i.e. over half a trillion) 3D points covering the entire country. The queries concerned rectangles, circles and complex polygons of different sizes. A generic comment about which is the best system is almost impossible because performance depends on the type of queries one wants to carry out and these will be different for different users. Nevertheless, a tentative conclusion is that the databases using blocks perform better for the more complex queries, while LASTools performs best for rectangles, circles and other simple queries.

LASTOOLS

Rapidlasso is the creator of LASTools, the open-source LASzip compressor and PulseWaves. LASTools processes billions of 3D Lidar points quickly and with high throughput, achieved through robust algorithms with efficient I/O and memory management. Martin Isenburg, scientist and owner of Germany-based rapidlasso, discussed the benefits of LASlayers: a new functionality that enables changes to raw LAS or LAZ files to be stored in small, separate files. The idea is that X,Y,Z coordinates, intensities, RGB, scan angles or other attributes do not usually change when processing 3D point clouds. Therefore, rewriting and duplicating unchanged data is unnecessary and only contributes to I/O load and slows down the workflow. Modifications, additions and removals of a few points or attributes extends the original data files with just one or at most a handful of LAY files, which require negligible storage space. A contractor based in India, for example, no longer needs to send entire LAS or LAZ files containing billions of 3D points to his client in Europe, but can instead send small files containing the few hundreds or thousands of modifications only.

AIRBORNE LIDAR

Optech introduced its new multispectral Lidar, which has been baptised 'Titan'. The standard configuration emits three



▲ Figure 1, The Titan, an airborne Lidar emitting independent pulses in three narrow spectral bands (Image courtesy: Optech).

independent pulses in the wavelengths of 532nm, 1,064nm and 1,550nm – each with a 300kHz effective sampling rate for a combined ground sampling rate of 900kHz (Figure 1). The minimum flying height for both topographic and bathymetric surveys is 300m while the maximum height is 600m over water and 2,000m over land. The envisaged applications include topographic surveying, 3D land cover classification, environmental modelling, vegetation mapping and shallow water bathymetry. Nearly as new as the Titan is RIEGL's VQ-880-G, an airborne Lidar designed for combined topographic and bathymetric surveying which was introduced at Intergeo 2014. The measurement rate is up to 550kHz while 160 scans per second can be made. Typical applications include mapping of coastlines, shallow waters, aggradation zones and habitats; point cloud collection for flood prevention; and surveying for hydraulic engineering and underwater archaeological sites. RIEGL also showcased the RiCOPTER UAS it has developed in-house. It can carry a payload of 16kg and is equipped with the VUX-1 Lidar sensor,



▲ Figure 2, YellowScan lightweight laser mounted under an OnyxStar copter (Image courtesy: M. Lemmens).

which has a measurement rate of up to 500kHz and can make up to 200 scans per second. The eye-catcher from the French company L'Avion Jaune, founded in 2005, was YellowScan. With a weight of 2.2kg and a size of 20 x 17 x 15cm, the laser scanner has been designed for use on fixed-wing or multicopter UASs (Figure 2). It operates in the 905nm band and the maximum range is

100m. The sensor emits 80,000 pulses per second and records up to 3 returns per pulse.

The annual International LiDAR Mapping Forum, organised by SPAR Point Group, will be held from 23-25 February 2015 in Denver, USA. This event will likewise centre around 3D point clouds from airborne, terrestrial and underwater sensors. ◀

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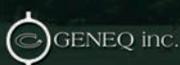
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Innovative GIS Solutions for a Sustainable World

Having received the Geospatial World Excellence Award 2014 and Asia Geospatial Excellence Award 2014, Supergeo has once again added new trophies to its honour wall for contributive technologies and widely applied solutions. The relatively young GIS vendor has grown from a small firm with less than 10 employees into a highly influential GIS innovator in the worldwide geospatial industry.

Located in Taiwan, which is one of the most developed countries in terms of information technology (IT), Supergeo is a fast-growing company based on geospatial technologies. Within less than one decade, it has launched SuperGIS total solutions covering desktop, app and cloud platforms, recruited over 30 resellers, and evolved into a leading GIS provider on the global stage.

Super Wang, the founder and CEO of Supergeo, started his first consultancy company in the 1990s using GIS software to run government projects. At that time, he observed that software vendors could not fully satisfy local demands. Users, especially in Taiwan, wanted advanced functionality and customised services for diverse project needs. In 2001, Wang decided to research and develop his own GIS software, SuperGIS, in order to better serve local users.

BROAD MARKET COVERAGE

After developing the first GIS product, SuperPad (mobile GIS for Windows Mobile devices), in 2003, Supergeo found the entry point for the ArcGIS-dominated market and has achieved great sales results since then. In head-to-head competition with equivalent product lines, new users were impressed with Supergeo's offering. The SuperGIS product family now offers broad market coverage, including desktop, server, SDK (software development kit) and mobile apps for Windows, Android and iOS. SuperGIS software has already assisted users around the world in solving spatial problems related to disaster control, natural resources, land management, urban planning, public health, public safety and the utilisation of 3D technologies. Users are primarily from government bodies, higher educational institutions and private enterprises.

COMPANY GROWTH

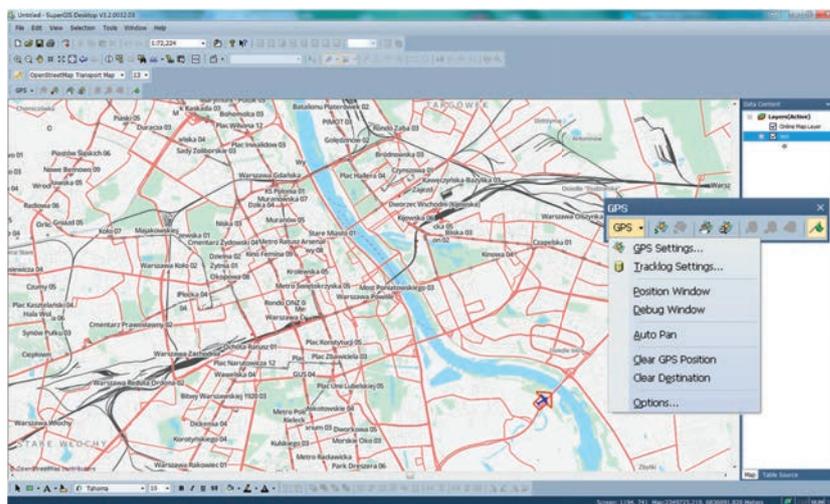
Over the past decade Supergeo has grown in size from 20 employees to 100, and it now has an overseas branch in Malaysia as well as resellers in over 30 countries. Besides the research and development team, the company also operates GIS projects in various domains.

In Taiwan, Supergeo has three partners in the corporate group: TMS, EMTC and BluePlanet, who specialise in developing intelligent transportation systems (ITS), environmental management and digital archives respectively. Supergeo and its partner companies form the largest geospatial group in Taiwan and also an important industry player in Asia as a whole.

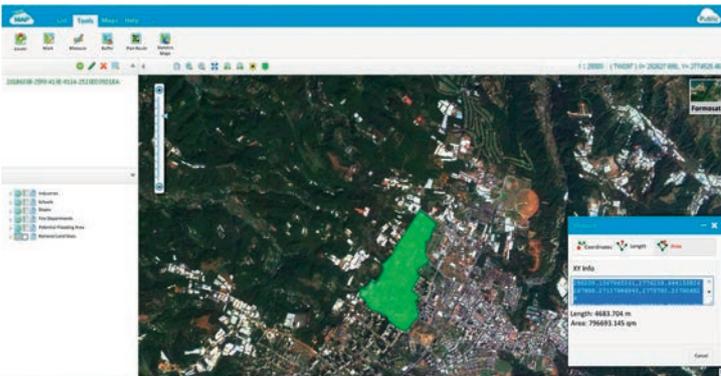
INNOVATIVE TECHNOLOGIES

Cloud computing has become mainstream, with scalable data storage, efficient data sharing and cost savings for organisations taking GIS technologies to a higher level. In Taiwan, Supergeo firstly helped the Ministry of the Interior to develop Taiwan Geospatial One Stop (TGOS) which gathers comprehensive geospatial data such as up-to-date digital maps and satellite images. 3D and 2D map APIs have also helped numerous sectors to build up their own map websites effortlessly.

TGOS supports catalogue querying, metadata storage and many useful map APIs. Users can create customised mapping applications with a map API to embed in their projects. Government bodies and private enterprises can publish maps and spatial data as GIS services and obtain various analyses without incurring further costs. So far, there are nearly 100 government



▲ SuperGIS Desktop integrates with rich GIS tools, GPS, OpenStreetMap and more.



▲ SuperGIS-powered Taiwan Geospatial One Stop won the Geospatial Excellence Award 2014.



▲ SuperSurv, the mobile mapping app for Android and iOS.

institutes contributing geospatial data and maps to TGOS, supported by Supergeo, amounting to millions of US dollars of cost savings each year.

3D TREND

In recent years, a huge leap in 3D technologies has changed the face of the geospatial industry. Responding to that trend, Supergeo released SuperGIS 3D Earth Server. The 3D Server product combines Google Earth-like visualisation effects with GIS functions. It enables users to share 3D data, view GIS data imposed on the surface of a globe and further analyse the conditions using professional GIS technologies. It changes the way that enterprises and governmental users alike use the GIS platform. The 3D product is considered affordable yet powerful enough to give a strong and positive impression and demonstrate technical capabilities, further benefiting decision-making by providing insightful three-dimensional views.

CUSTOMER NEEDS

For the innovators in the Supergeo Research & Development team, hearing client feedback always stimulates their creativeness. Take SuperGIS Mobile applications, for example. The pricy rugged devices are no longer the only choice for surveyors; Supergeo has seized on the popularity of smart devices, and quickly delivered a solution for Android and iOS users, aside from existing Windows Mobile apps, for easy data collection work. Since the app was launched in March 2014, it has achieved over 3,000 downloads from Apple Store and Google Play. In 2015, more new features will be continually added to the app, such as augmented reality (AR), GPS enhancements, support to external Bluetooth GPS receivers and NTRIP signals and suchlike for advanced field work.

In addition, the Forestry Inventory app announced at Intergeo 2014 originated

as a client request. Specially designed for foresters, this task-oriented app integrates the necessary GIS functions, like geotagging, measurement, positioning, querying, data capturing by menus, etc., to enhance the survey efficiency in the forest.

FREE TECHNICAL RESOURCES

In the professional GIS domain, customised training and rich technical resources are critical to sustain users. The Supergeo GIS Training and Support Centre plays a key role in interacting with users. The centre not only offers professional GIS training courses and technical support, but also publishes GIS tutorial materials for educational institutes worldwide. Meanwhile, the SuperGIS Forum is a platform managed by the centre to solve users' technical problems and promptly acquire knowledge of market needs. The Centre also enables the Supergeo Webinar Team to provide more free GIS resources online, instantaneously demonstrating key features and solutions to users.

GLOBAL NETWORK

SuperGIS software resellers can be found from Asia to the Middle East, from America to Europe and also in Africa and Oceania. Important clients include the Ministry of Education in Kuwait, Ministry of Public Works in India, Ministry of Agriculture in Indonesia, several city halls in Italy, SMEs in USA, and universities in Malaysia, to name but a few.

The resellers not only promote SuperGIS software, but also apply the software to various applications in local markets by observing special user requests. More importantly, professional training and close services supported by Supergeo are also available to local users through Supergeo's global resellers. The company aims to achieve globalisation through localisation, by continually modifying its software based on

feedback from users and resellers alike. Supergeo is constantly looking for partners around the world. Having established its reputation as a leading GIS brand in Asia and built solid relationships within its reseller network, the next step is to focus on deeper operation in the global user network. The company's objective is to establish long-term relationships with partners and offer enhanced, locally based services to users.

OPPORTUNITIES

By the fourth quarter of 2015, the whole new-generation SuperGIS 10 series software is expected to be fully ready. In addition to enhancing existing product capabilities, SuperGIS 10 will add more comprehensive GIS functions for users and mark a major improvement to the user interface.

Supergeo is full of confidence about future developments and now sees global expansion as its main business. The company is ready to reach out to more geospatial users in all fields and to compete with the mighty GIS firms. It will continue to provide excellent services and strengthen core techniques to develop innovative and suitable products for its clients, and hopes in the near future to become the best choice on the global GIS market. ◀

More information
www.supergeotek.com

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.

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Review of FIG-GLTN Workshops in Bangkok



FIG is one of the partners in the UN-HABITAT/ Global Land Tool Network (GLTN). This alliance contributes to poverty alleviation through land reform, improved land management and security of tenure – particularly through the development and dissemination of pro-poor and gender-sensitive land tools. Tool development is related to reviews and evaluations by land professionals and potential users of the tools, which is why GLTN organised workshops in Bangkok, Thailand, in October 2014.

A tool on valuation of unregistered land was evaluated and a tool on land agencies budgetary approach was validated. There was also a workshop on a strategy for country-level implementations of UN-Habitat's Continuum of Land Rights Approach and the Social Tenure Domain Model.

LAND AGENCIES' BUDGETARY APPROACH

The first workshop was convened jointly by GLTN and FIG. Costing and Financing of Land Administration Services (CoFLAS) focuses on the cost of developing and maintaining a land administration system. A key initiative that underpins the approach adopted in developing CoFLAS is the concept of the 'fit-for-purpose' land administration approach. CoFLAS was developed to assist policymakers and those responsible for land administration in adopting appropriate technologies and methodologies that will provide and sustain land administration services more efficiently, cost effectively and with options most appropriately tailored for incorporating all tenure types. The experts provided observations and some considerations, and they validated the tool.

VALUATION OF UNREGISTERED LAND AND PROPERTIES

The second workshop was again a joint



Participants at the workshops in Thailand, October 2014.

FIG and GLTN initiative. There is general consensus that about 70% of land ownership units in developing countries are not formally registered and that the land registration initiatives are not achieving the desired results. This adversely affects owners of unregistered land and properties who, in most cases, are the disadvantaged groups that could not access valuation services. The key objective of this initiative is the development of a land tool to support the valuation of unregistered land and properties that can benefit the vulnerable and marginalised groups.

The expert Group Meeting:

- discussed the coverage of current thinking and methodologies for the valuation of unregistered land based on current standards, practices and research
- reviewed the background discussion paper, debated and commented, all to ensure that the background discussion paper addresses the intended purpose
- provided a forum for the experts present to understand and creatively contribute towards the development of a concept and to conceptualise a framework for the valuation of unregistered land and properties.

This approach should also be underpinned by the fit-for-purpose concept (FIG/World Bank, 2014). In the coming months, GLTN will conclude this phase of the initiative and will be strategising how to take this tool-development process forward.

CONTINUUM OF LAND RIGHTS AND STDM

The third workshop was organised by the Dutch Kadaster and GLTN. It discussed a strategy for country-level implementation of UN-Habitat's Continuum of Land Rights Approach and the Social Tenure Domain Model. A concept has been introduced for flexible implementation of the continuum of land rights combined with a continuum of spatial units (accuracy), parties and recordation methods related to the land administration goals. ◀

Teo CheeHai
President of FIG

More information
www.fig.net



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GSDI Support for SDI Initiatives Continues

In 2014, the GSDI Association was once again able to support international spatial data infrastructure (SDI) initiatives through the Small Grants Program. With resources and cooperation from Natural Resources Canada's GeoConnections, U.S. Federal Geographic Data Committee, and the GISCorps of URISA, four projects received awards. Since 2003, the GSDI Association's Small Grants Program has supported more than 100 projects worldwide with outcomes that include convening national or sub-national seminars or workshops related to SDIs, producing training manuals and modules related to SDI and Earth observation systems (EOS), establishing metadata and clearinghouse nodes, establishing web mapping services and applications, accomplishing geodata and/or SDI surveys or inventories, producing and disseminating newsletters and awareness-raising materials about SDI, and drafting policy and legislation related to SDI.

A Call for Proposals was issued in March 2014, resulting in 40 proposals from organisations in over 20 countries. The proposals were reviewed by volunteers from six continents and those selected to receive USD2,500 are listed below. The project in Ghana is also receiving consulting services from the GISCorps.

Establishing standards-based web mapping and data access services using open source geospatial software technologies for CERSGIS

Institution: Centre for Remote Sensing and Geographic Information Services (CERSGIS), University of Ghana, Legon

Summary: The project focuses on development of a clearinghouse for spatial data for CERSGIS and is a case study for full-scale implementation of recommendations and activities for the National Spatial Development Framework for Ghana. Activities include:

- Developing data policies and standards
- Developing metadata for datasets based on defined standards



Gita Urban-Mathieux.

- Implementing a web-based SDI portal for public access to datasets
- Presenting a workshop on the SDI portal to stakeholders.

Towards GIS Interoperability for Environmental Protection and Sustainable Development

Institution: Makerere University, Kampala, Uganda

Summary: Develop a structured organisation of geodata and geographic information based on OGC and ISO standards to guarantee interoperability in Uganda. Activities include:

- Evaluating existing spatial datasets and value of geoinformation
- Documenting spatial data according to the ISO 19115 standard
- Developing a one-stop gateway to discover, access and evaluate spatial data.

Developing a Reliable Agriculture GIS Database for Belize through Partnership with Key Stakeholders

Institution: Land Information Center, Ministry of Natural Resources and Agriculture, Belmopan, Belize

Summary: Develop a reliable agriculture GIS database in collaboration with agriculture stakeholders to:

- Establishing an Agriculture GIS data integration working group comprising key

stakeholders from government, the private sector and other relevant stakeholders

- Identifying the types of agriculture-related data and data gaps that exist for large farms (and commercial farms) within the country
- Establishing standards for data integration based on identified needs of stakeholders, best practices and international standards
- Developing and providing accessibility of the final database through the Belize NSDI geoportal to enable improved decision-making.

Introducing EnviroSDI for Armenia: Piloting Publicly Accessible Online Platform

Institution: Institute of Archaeology and Ethnography, National Academy of Sciences, Republic of Armenia

Summary: Create an online SDI open-source-based platform (e.g. Ushahidi), enabling the non-profit sector and the wider public to access a wide range of geographic data including base maps and sector-specific thematic maps. Main components of the project are:

- Designing the concept of the online SDI platform, with specifics of its use/users in mind
- Developing (customising) an (existing) open-source platform and implementing the platform online
- Populating it with base maps
- Populating the platform with geographic (environmental, conservation) thematic data collected during fieldwork over a pilot area.◀

Gita Urban-Mathieux is vice-chair, Small Grants Program, GSDI Societal Impacts Committee and works for GSDI members at the U. S. Federal Geographic Data Committee. burbanma@usgs.gov

More information

www.gsdi.org

www.gsdi.org/sic1



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Review of Symposium on Reference Frames for Applications in Geoscience

Accurate reference frames are fundamentally important for Earth science studies, satellite navigation, mapping, international time transfer and many applications relying on geospatial information. Increasingly, they are also used for demanding commercial applications such as agriculture, aviation, construction, public safety and transportation.

Approximately 100 geodesists and geoscientists from 24 countries met recently to discuss the role of global and regional reference frames in science and practice. The international symposium, REFAG2014, took place at the Melia Hotel in Kirchberg, Luxembourg, from 12-17 October 2014. The symposium featured sessions on six topics: the theory and concepts underpinning reference frames; the space-based geodetic techniques required to generate the reference frames; the theory to tie the terrestrial reference frame (TRF) to the celestial reference frame (CRF) (and the associated Earth rotation parameters); regional and national reference frames; the importance of reference frames in the geosciences; and how georeferencing is used in practice.

Among the most-discussed topics at the meeting was the analysis of station positions, velocities and Earth orientation parameters from the space geodetic measurement techniques

Accurate reference frames are fundamentally important for Earth science studies, satellite navigation, mapping, international time transfer and many applications relying on geospatial information.

that will eventually be incorporated into the next update of the international TRF: the *ITRF2013*, which is expected to be released in early 2015.

The meeting gave researchers detailed insight into the background modelling in the satellite laser ranging (SLR), global navigation satellite system (GNSS), very long baseline interferometry (VLBI), and Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) data processing. Presentations examined efforts to improve modelling of the neutral troposphere propagation delay and solar pressure models on the satellite orbits, compared error characteristics of station positions from SLR and GNSS data, reported on ongoing efforts to measure and improve the inter-station vector ties at ground stations equipped with co-located techniques, and presented progress on a proposed space-based mission to link the space geodetic techniques.

The question of the relationship of regional reference frames to the global reference frame was also discussed, in particular in light of the large-scale effects of mega-earthquakes. The possible use of a 'two-frame' geodetic datum was proposed, a system that would benefit from both a time-based reference frame such as ITRF as well as a plate-fixed datum for local geospatial applications.

Scientific applications, in particular observations of sea-level rise, present-day ice-mass loss and elastic ground rebound due to local and regional water extraction, place the most stringent demands on the reference frame stability. The uncertainties in the realisation of the ITRF for long-term sea-level rise studies were discussed.

Reference Frames for Applications in Geodetic Science 12-17 October, 2014 Luxembourg



REFAG2014 also provided a forum for attendees to discuss the question of how reference frames are used in practice (e.g. for national geodetic/mapping datums and precise positioning). This is an issue that is of considerable interest to the International Federation of Surveyors (FIG), and the IAG and FIG will continue to work closely to ensure that the ITRF is promoted to the wider user community. This includes joint initiatives such as 'Reference Frame in Practice' workshops (see IAG article in the September 2014 issue of *GIM International*). ◀

More information
www.iag-aig.org
<http://itrf.ensg.ign.fr>



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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Commissioning the ICA Commissions

This year, 2015, is a notable one for the International Cartographic Association: we can look forward to the 16th quadrennial General Assembly and the 27th International Cartographic Conference, in Rio de Janeiro, Brazil, at the end of August. These highlights for the global cartographic community are the culmination of a four-year period of work by committees of the ICA and its constituent Commissions.

The ICA Commissions (listed at the bottom of this page) are the core of activity in addressing ICA's mission statement – to promote the disciplines and professions of cartography and GIScience in an international context. Their work is often reported in these columns, and their endeavours can be examined in more detail through their individual Commission pages accessible through the main ICA website.

The schedule of Commissions' meetings and workshops is of particular note, as it is these activities which most effectively promote discussion and progress in the specific topics. Many Commissions organise such activities throughout their four-year term. Supplementary to these, there is a longstanding tradition for Commissions to arrange a more informal workshop/symposium prior to the main International Cartographic Conference, and there will be a number of such 'taster' events in August this year before the main event in Rio de Janeiro. If the subject matter appeals to you, or if you are interested in engaging with an ICA Commission, you are encouraged to participate in these events.

Already scheduled are the following events:

- the Art and Cartography Commission presents 'Mapping ephemeralities/



ICA Commission chairs discussing procedural and strategic matters relating to Commission management, Vienna 2011.

- ephemeral cartographies' in Rio de Janeiro (21-22 August) [1]
- a workshop of the Commission on Geoinformation Structures and Standards, jointly presented by the Commission on Open Source Geospatial Technologies, on 'Spatial data infrastructures, standards, open source and open data for geospatial' will also be held in Rio de Janeiro (21 August) [2]
- a joint meeting of the Commission on Cognitive Visualization, the Commission on Use and User Issues, and the Commission on Geovisualization will be held in Curitiba (21-22 August), including a workshop on 'Designing and Conducting User Studies' [3]
- a joint meeting of the Commission on Education & Training with the Commission on Maps & the Internet will take place, also in Curitiba (20-21 August) [4].

Anyone unable to attend these events can still engage with the work of these, and all other, Commissions at the regular business

meetings held by Commissions during the main conference. At these meetings, reports on the Commission activities and plans for the future are presented. It is at the concurrent ICA General Assembly that Commissions are approved, confirmed and renewed. The Commissions also have significant input into the programme of presentations, demonstrations and posters of the main conference. Geomaticians from around the world are strongly encouraged to connect with ICA in 2015 through the Commissions, their events and the main ICC in Rio de Janeiro in August. ◀

More information

www.icaci.org

1. <http://artcarto.wordpress.com>
2. <http://sdistandards.icaci.org>
3. www.univie.ac.at/icacomuse
4. <http://lazarus.elte.hu/cet>



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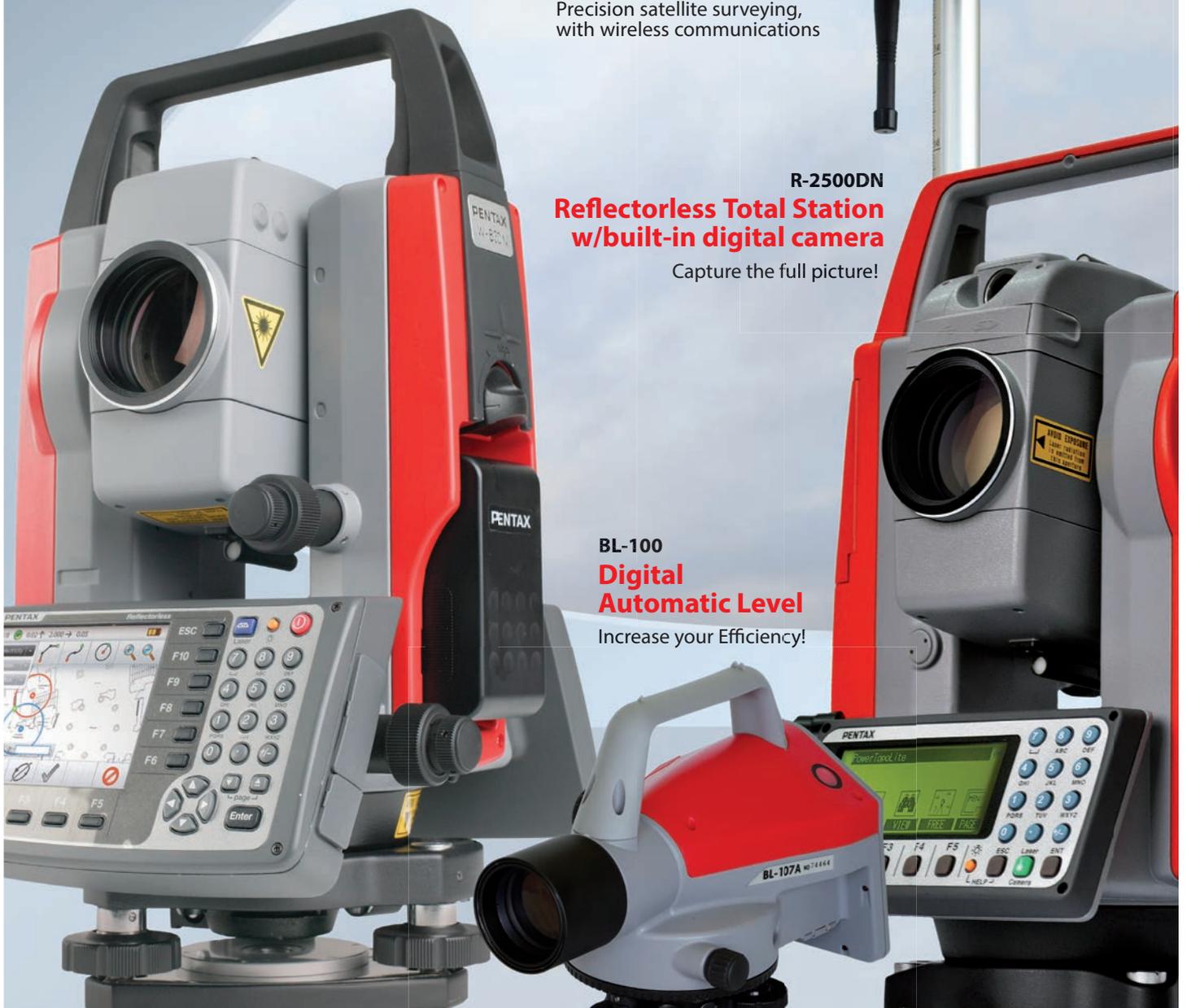
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ISPRS in Southeast Asia



International participants at the ISPRS Summer School in Hanoi in 2010.



ISPRS Council members in Myanmar at ACRS 2014.

There are eleven countries in Southeast Asia: Brunei Darussalam, Cambodia, East Timor, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. Southeast Asia is a region with diverse cultures, religions and ethnicities, and with a relatively fast-growing economy. The key to success for this region is to get people to meet, and to encourage, initiate, support and maintain collaboration.

The Asian Conference on Remote Sensing (ACRS) is an annual event which is organised by the Asian Association on Remote Sensing (AARS). It is held in one of the AARS member countries each year. AARS is a regional member of ISPRS, and ACRS is an excellent platform for collaboration between AARS and ISPRS.

The 35th Asian Conference on Remote Sensing was organised recently (27-31 October 2014) in the Myanmar International Conference Center II, Nay Pyi Taw, Myanmar. This was the first time ACRS had been held in Myanmar. Thanks to the enormous effort of the organisers and the support from various organisations, including ISPRS, the conference was a great success. There were

415 participants from 32 countries and regions, with 211 oral and 66 poster papers submitted. 25 firms and organisations took part in the exhibition. Subsequently, the 12th ISPRS Summer School was held at University of Forestry, Yezin, Nay pyi Taw, which attracted 43 participants from five countries.

ACRS is gaining more and more attention from ISPRS and its officers, and ISPRS is becoming increasingly popular in the region through many activities in the form of workshops, seminars, conferences and the ISPRS Summer School. Present in Myanmar were ISPRS president Chen Jun, ISPRS general secretary Christian Heipke, congress director Lena Halounová and other distinguished guests, including former president Ian Dowman, former vice presidents Armin Grün and Manos Baltasvias, and Clive Fraser from Australia.

ISPRS and regional representatives in Southeast Asia have been working hard to promote ISPRS in the region. Since 2010, every ACRS has been followed by an ISPRS Summer School. In 2010, it was held in Hanoi, Vietnam; in 2011 in Taoyuan, Taiwan; in 2012 in Pattaya, Thailand; and in 2013

in Bali, Indonesia. The 9th International Conference on Geoinformation for Disaster Management (Gi4DM) was held in Vietnam in collaboration with ISPRS and the Institute of Geography, Vietnam Academy of Science and Technology. In addition, an ISPRS workshop entitled 'Geospatial Information for Sustainable Development' is scheduled for 15-17 October 2015. The venue is Halong Bay, Vietnam, which is a World Heritage site.

Today, ISPRS has seven ordinary members in Southeast Asia: Brunei Darussalam, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam. Hopefully the abovementioned activities will lead to an increase in this number and to an even wider spread of photogrammetry, remote sensing and geospatial information sciences in the area in the near future. ◀

Dr Nguyen Dinh Duong

ISPRS regional representative for Southeast Asia, Vietnam

More information
www.isprs.org



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Oldenburg, Germany
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For more information:
E: christina.mueller@jade-hs.de
W: www.jade-hs.de/3dtage

TUSEXPO 2015

The Hague, The Netherlands
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For more information:
E: a.hagenstein@tusexpo.com
W: www.tusexpo.com

▶ **MARCH**

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Brussels, Belgium
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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

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY 2015

Washington, DC, USA
from 23-27 March
For more information:
W: www.worldbank.org/
en/events/2014/08/06/
landconference2015

JOINT URBAN REMOTE SENSING EVENT

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For more information:
E: contact@jurse2015.org
W: http://jurse2015.org/

▶ **APRIL**

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Hammamet, Tunis
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W: www.geotunis.org

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For more information:
W: http://sovzondconference.ru/2015/

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from 20-25 April
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E: tahsin@itu.edu.tr
W: http://wccadastre.org

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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

GISTAM 2015

Barcelona, Spain
from 28-30 April
For more information:
E: gistam.secretariat@insticc.org
W: www.gistam.org/

▶ **MAY**

ASPRS 2015 ANNUAL CONFERENCE

Tampa, FL, USA
from 04-08 May
For more information:
W: www.asprs.org/ASPRS-Conferences.html

MUNDOGEO#CONNECT LATIN AMERICA

Sao Paulo, Brazil
from 05-07 May
For more information:
E: connect@mundogeo.com
W: http://mundogeoconnect.com/2015/en/

RIEGL LIDAR 2015

Hong Kong and Guangzhou, China
from 05-08 May
For more information:
E: rieglidar2015@riegl.com.
W: www.rieglidar.com

ISRSE 2015

Berlin, Germany
from 11-15 May
For more information:
E: isrse36@dlr.de
W: www.isrse36.org

FIG WORKING WEEK 2015

Sofia, Bulgaria
from 17-21 May
For more information:
E: fig@fig.net
W: www.fig.net/fig2015

GEO BUSINESS 2015

London, UK
from 27-28 May
For more information:
E: dsmith@divcom.co.uk
W: http://geobusinessshow.com/
conference/

▶ **JUNE**

HXGN LIVE

Las Vegas, NV, USA
from 01-04 June
For more information:
E: contactus@hxgnlive.com
W: http://hxgnlive.com/las.htm

28. INTERNATIONAL GEODETIC STUDENT MEETING (IGSM)

Espoo, Finland
from 01-06 June
For more information:
E: felix@igsm.fi
W: www.igsm.fi

INTERNATIONAL CONFERENCE ON UNMANNED AIRCRAFT SYSTEMS

Denver, CO, USA
from 09-12 June
For more information:
W: www.uasconferences.com

▶ **JULY**

ESRI INTERNATIONAL USER CONFERENCE

San Diego, CA, USA
from 20-24 July
For more information:
E: uc@esri.com
W: www.esri.com/events/user-conference

▶ **AUGUST**

27TH INTERNATIONAL CARTOGRAPHIC CONFERENCE

Rio de Janeiro, Brazil
from 23-28 August
For more information:
E: christina@congreg.com.br
W: www.icc2015.org

UAV-G CONFERENCE 2015

Toronto, CA, Canada
from 30 August-02 September
For more information:
W: www.uav-g-2015.ca

▶ **SEPTEMBER**

PHOTOGRAMMETRIC WEEK 2015

Stuttgart, Germany
from 7-11 September
For more information:
W: http://www.ifp.uni-stuttgart.de/
phowo/index.en.html

INTERGEO 2015

Stuttgart, Germany
from 15 -17 September
For more information:
W: www.intergeo.de

CONVENTION OF SURVEYING "AGRIMENSURA 2015"

La Habana, Cuba
from 23-26 September
For more information:
E: silvia@unaicc.co.cu
W: www.agrimensuracuba.com/

▶ **OCTOBER**

INTERNATIONAL SYMPOSIUM OF DIGITAL EARTH 2015

Halifax, Nova Scotia, Canada
from 06-10 October
For more information:
E: sponsorship@digitalearth2015.ca
W: www.digitalearth2015.ca

CALENDAR NOTICES

Please send notices at least 3 months before the event date to: Trea Fledderus, marketing assistant, email: trea.fledderus@geomares.nl

For extended information on the shows mentioned on this page, see our website: www.gim-international.com.



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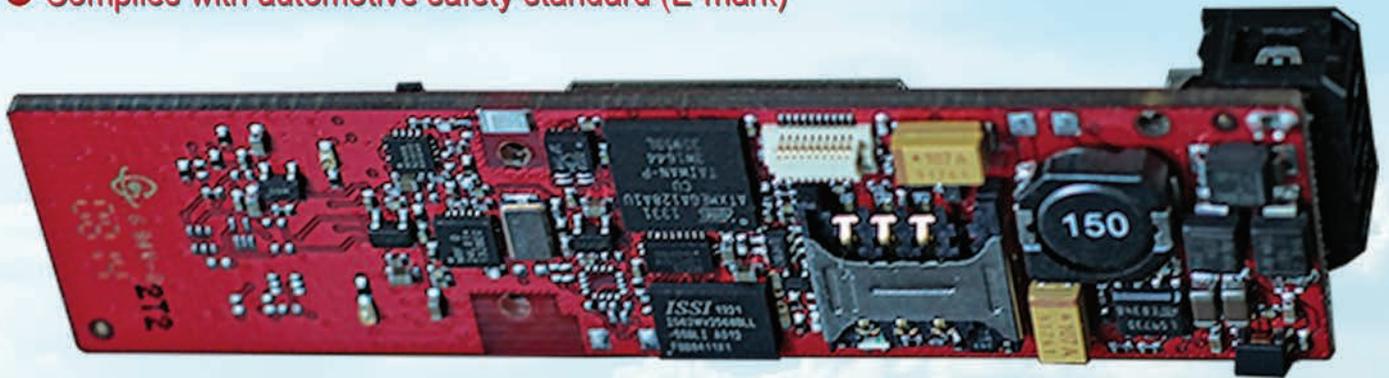
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