

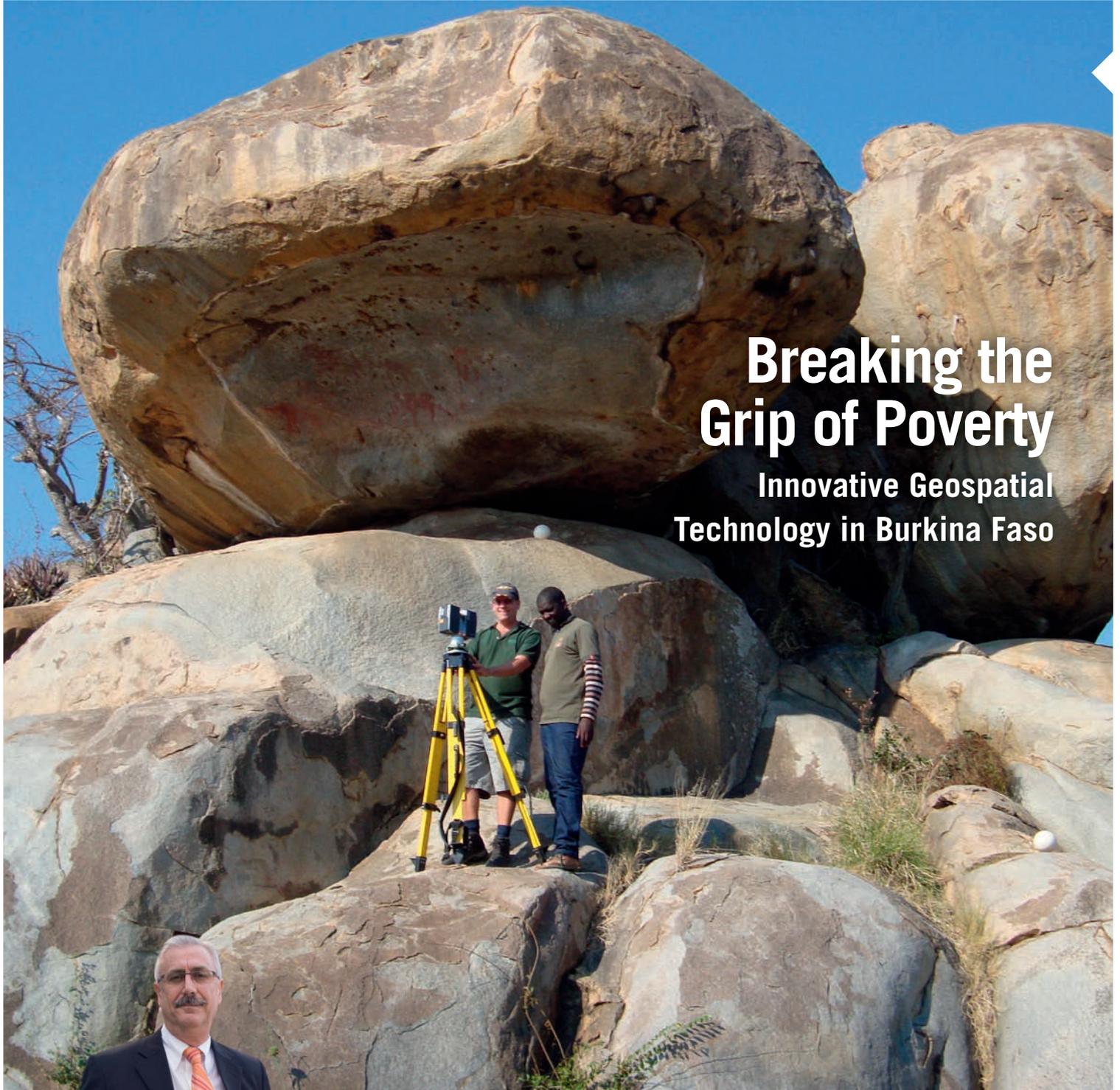
# GIM

INTERNATIONAL

THE GLOBAL MAGAZINE FOR GEOMATICS  
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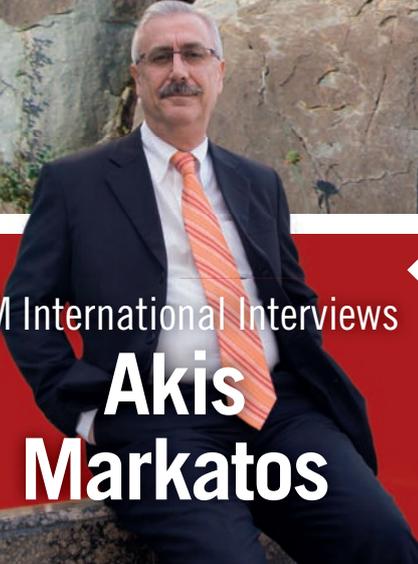
ISSUE 6 • VOLUME 28 • JUNE 2014



## Breaking the Grip of Poverty

Innovative Geospatial  
Technology in Burkina Faso

GIM International Interviews



**Akis  
Markatos**

## Point Clouds (1)

The Functionalities of  
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## 5 Questions to...

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## Common Thread

It's not hard to spot the theme running through this issue of *GIM International*. It's one that already won my heart – and that of this magazine's editorial board – many years ago. Especially in challenging economic times such as these, it's good to point out the positive effect of securing tenure rights, both on a large scale for country economies and at micro-level for household economies, and it's exactly this motto that runs like a common thread through this month's articles. Firstly, editor Frédérique Coumans interviewed the general director of the Greek Cadastre, Akis Markatos (see page 12). Markatos explains that in that economically troubled nation in the south-east of Europe, 60% of the territory still needs to be surveyed – accounting for 40% of the country's property rights. A daunting task, especially if you take into account that the deadline is 2020. But there are many benefits, and hence reasons to push on with the process: the project is generating 12,000 (!) new jobs for engineers, IT specialists, lawyers and of course land surveyors. Decision-making about regional development

will be easier, state income through property tax will increase and future investors will have a clear view of land parcels and their owners. Meanwhile in Burkina Faso, one of the world's poorest countries, the government saw the need for legal recognition of customary land rights a few years ago. In the 'Innovative Geospatial Technology in Burkina Faso' article on page 23, William Marbell and Alain Bagre describe how the government wants to break the grip of poverty on its citizens by using modern surveying techniques to secure tenure rights. A new law, dating from 2009, permits recognition of



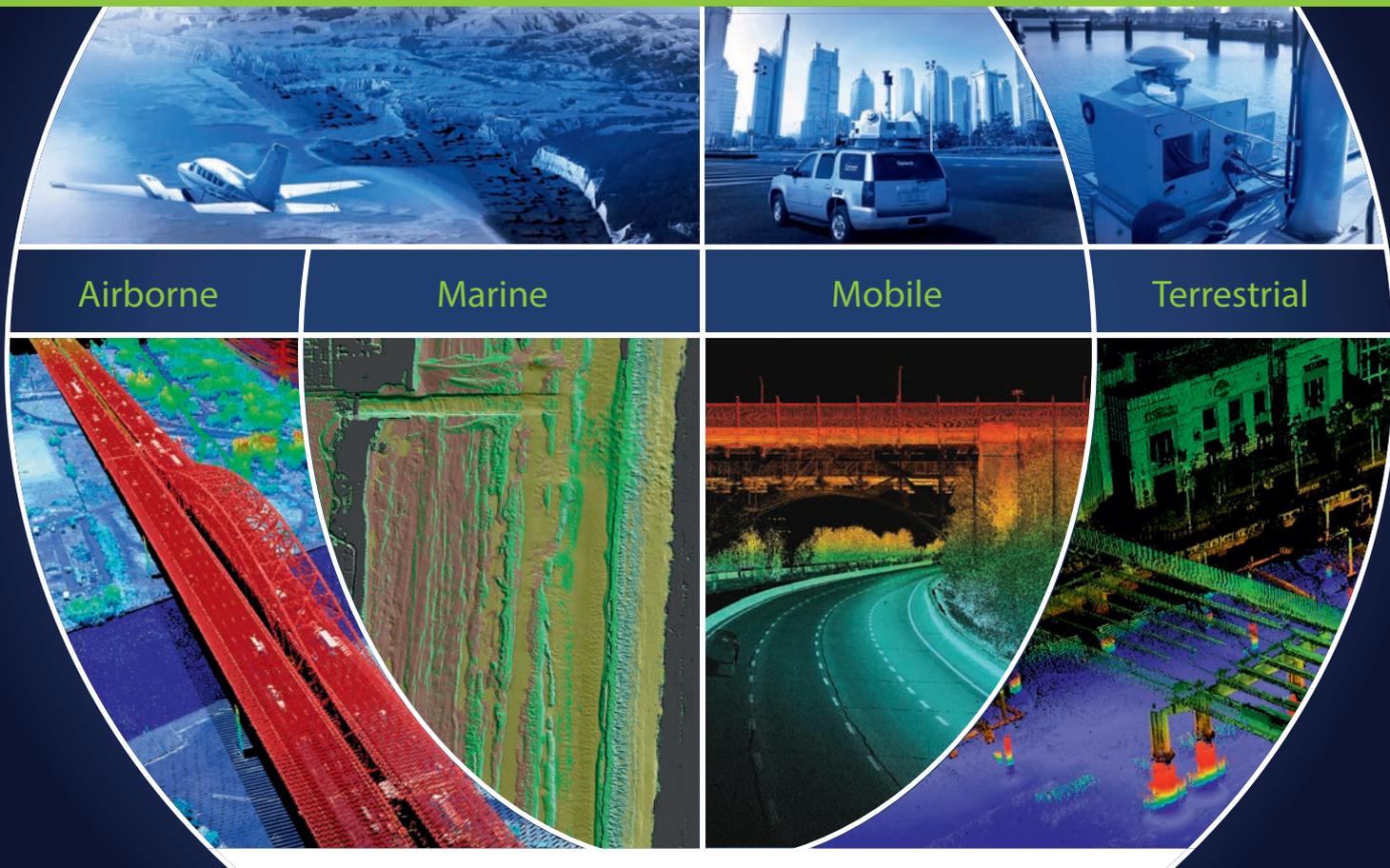
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Photography: Arie Bruinsma

customary land rights through the issuance of rural land certificates. A new network of nine continuously operating reference stations (CORS) has been set up, staff have been trained in new positioning technology and a start has been made with the production of georeferenced cadastral plans. Almost 14,000 titles have been issued so far, in three communities within the province of Ganzourgou, and there are many more to come since 47 cadastral offices are being opened up throughout the country. The government clearly envisions an increase of investments, creation of wealth and reduction of rural poverty by recognising land rights. The relationship between reducing poverty and increasing investment through an effective cadastre – made current again by Hernando de Soto, and covered extensively in *GIM International* – has always been opposed by people who didn't believe in this causal link. But Paul van der Molen, member of our Editorial Advisory Board, proves those opponents wrong in this month's Insider's View on page 6. Van der Molen shows, through examples in Vietnam, Thailand and China, that titling programmes boost economies. While those titling programmes were often part of bigger processes, the positive effect of recording land rights on economies large and small is undoubtedly proven by now. In turn, it also boosts the profession of surveying – the industry at large – and, on a smaller scale, the individual surveyor.

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The cover photo is dedicated to Africa because AfricaGEO is being held from 1-3 July. The image shows work of the University of KwaZulu-Natal's Programme of Land Surveying in the Kruger National Park, South Africa. UKZN is one of CyArk's Technology Center partners, and they have been working together to build skills and capacity within the Geomatics department, which owns three laser scanners and photography equipment.

(PHOTO COURTESY: CYARK AND UKZN)

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*GIM International*, the global magazine for geomatics, is published each month by Geomares Publishing. The magazine and related e-newsletter provide topical overviews and accurately presents the latest news in geomatics, all around the world. *GIM International* is orientated towards a professional and managerial readership, those leading decision making, and has a worldwide circulation.

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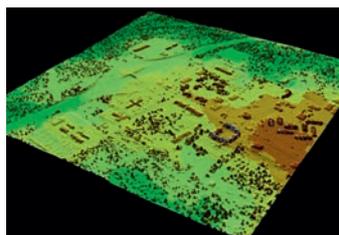
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## 'De Soto' Revisited

The informed reader knows, of course, that the debate on property rights and development is much older than 'De Soto' – we only have to refer to the Bible, the Koran, Socrates, Aristotle, Locke, Proudhon, Marx and Madison. Sharp criticism has been vented upon De Soto's idea that well-governed private property rights can make a difference in growth and poverty reduction. To mention just two, I remember one colleague saying "Naïve in the extreme" and another saying "That De Soto caught attention is a phenomenon in itself". Because the whole debate lacks scientific evidence it remains a highly political matter, but the boost to China's agricultural productivity right after the introduction of the household contract responsibility system can hardly be a coincidence. Thailand was a rice importer before the huge titling programme; afterwards it became the top rice exporter of the world. Vietnam too was a rice importer before the Doi Moi policy. Now, with 90% of its rural households possessing a land use certificate, it emulates Thailand as a top rice exporter. Of course, the development of these countries is caused by many factors, property rights being just one of them. Evidence of the effect of property rights is likely too complicated to obtain, but politically the relation is plausible. Obviously with this in mind, the European Parliament has made a remarkable decision: on 13

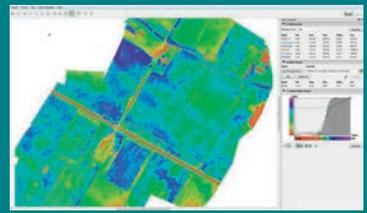


**PROF PAUL VAN DER MOLEN**  
Twente University (Faculty ITC), The Netherlands  
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March, by 340 votes to 19, it adopted a resolution "on the role of property rights, property ownership and wealth creation in eradicating poverty and fostering sustainable development". The underlying document, a report by the Parliamentary Committee on Development, is fully in line with De Soto's propositions to legalise extra-legal possessions. The report says that "establishing legal property law systems and empowering people to govern over their own resources could turn out to be the greatest development story of the 21<sup>st</sup> century". Isn't that 'De Soto' revisited? The Parliamentary decision has taken the stance that, besides individual land titling, a variety of alternative tenure options should be recognised. But, I would ask, how can secure possession and wealth creation be achieved when large tracts of lands are in the hands of chiefs, governments or communes? How can property be linked to credit markets when possession is not individualised? How can land-grabbing by investors, governments and elites be combated when ownership is unclear or unrecorded? I am in favour of a development towards well-recorded individualised land rights, but I am a distant Westerner. In line with Dambisa Moyo, who calls for African experts instead of "the white men" to lead the development debate, I call upon our African colleagues to lead us to an understanding of what should be done to let African land rights boost productivity for economic growth, food security and poverty reduction.



## Precision Agriculture Meets UAV Technology with Pix4Dmapper



Pix4Dmapper 1.1.

Pix4D, the Swiss provider of UAV processing software, has released version 1.1 of Pix4Dmapper. The new version includes additional features for precision agriculture as well as support for all GoPro models. The integrated Index Calculator allows users to create meaningful maps from any multi-spectral sensor and customise their NDVIs and any vegetation index map directly in the software. ◀

▶ <http://bit.ly/1fRAqYZ>

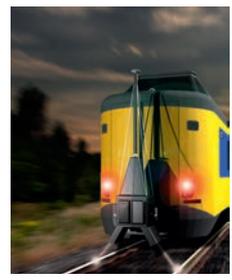


## Most Shared

Most shared during the last month from [www.gim-international.com](http://www.gim-international.com)

1. UAS Photogrammetric Sensor Package Launched at AUUVSI Conference  
- <http://bit.ly/1n0homG>
2. Hexagon to Take over Precision Agriculture Specialist  
- <http://bit.ly/1n0hxGx>
3. AfricaGEO to Highlight Geomatics Practice in Africa  
- <http://bit.ly/1n0hMl6>
4. Airbus to Deliver 3D Urban Mapping Solution to PASCO  
- <http://bit.ly/1n0hVVI>
5. Executive Director Gives Overview of Hexagon Conference  
- <http://bit.ly/1n0ii2r>

## Fugro Acquires Rail Data Mapping Company



Fugro has reached an agreement to take over RailData, which includes RailData International, in The Netherlands. RailData specialises in the measurement of absolute and relative position of railway tracks and has developed a patent-pending device that measures data in three dimensions. ◀

▶ <http://bit.ly/1fRA84o>

RailData RILA system. (Image courtesy: RailData)

## Satellite Navigation Contest: Turning Satnav Ideas into Business

Through the annual ESNC contest, ESA is helping people with great satnav ideas to develop their own businesses. Previous winners are now running companies with systems for athlete tracking and indoor navigation, and many are supported by ESA's Business Incubation Centres. ESA's Technology Transfer Programme (TTP) is again contributing to the ESA Innovation Prize for the most promising satnav application that can be quickly developed into a profitable business. ◀

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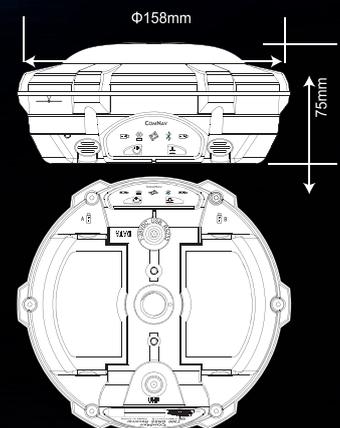
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## AfricaGEO to Highlight Geomatics Practice in Africa

The AfricaGEO conference (1-3 July 2014) promises a range of interesting papers with a focus on geomatics practice in Africa. Parallel sessions are organised to offer interesting sessions across a broad spectrum of areas, including: 1) cadastres and land tenure, 2) technology, engineering, precise surveying and scanning, 3) GIS, SDI and data management, 4) remote sensing and photogrammetry, 5) geodesy, and 6) education and professional aspects. ◀

▶ <http://bit.ly/1n0hMl6>



AfricaGEO.

### 5 QUESTIONS TO...

#### Aslam Parker



Aslam Parker is chair of Organising Committee, AfricaGEO.

**Why should people visit the AfricaGEO conference?**

AfricaGEO (previously known as CONSAS) has a long history as the premier geomatics conference in southern Africa, and it features

what is probably the largest geomatics exhibition in Africa (the exhibition was completely sold out back in March). AfricaGEO has a strong and well-filled technical programme, with most disciplines of geomatics covered including mine surveying and hydrographic surveying. We have secured top keynote speakers from most of the disciplines of geomatics, including the presidents of IAG, ISPRS, ICA, OSGEO foundation and many other high-profile presenters. We also have many members of the Young Surveyors Network who will be presenting and attending the conference. There will be special sessions where YSN members will have dedicated time with industry captains and the keynote speakers. We are confident of once again hosting a world-class African conference.

**What will be the main subjects covered at AfricaGEO?**

The conference has tried to cover most

aspect of geomatics, as can be seen from the technical programme, although we have struggled slightly to get more papers on mine surveying. However, there are many papers on GISc and mapping, SDIs, laser scanning, remote sensing and land tenure.

**Your event will pay attention to cadastral and land tenure. What is the current situation regarding this topic in Africa in general?**

The long-term stability of countries is dependent on equitable and stable land tenure and a secure cadastre. Surveyors are (or at least should be) at the heart of the land tenure debate. South Africa, for example, is going through an incredibly challenging time implementing its land reform and restitution programmes, trying to accommodate customary tenure as well as western-based tenure systems. I guess there are many lessons on land tenure that African countries can learn from each other. I think these are not sufficiently shared, and AfricaGEO is an ideal opportunity to do so.

**A dedicated workshop on education in Africa is also on the agenda. Can you tell the readers of GIM International something about geomatics education on your continent?**

Unfortunately, the AfricaGEO organising committee has cancelled the launch of AGEA at the conference due to the priorities expressed by our national government survey office. This is a great disappointment to those who have put energy into its proposed launch. Hopefully

we can pursue the vision of AGEA through another forum, perhaps FIG.

**Which developments in the geomatics field do you foresee in Africa for the coming years?**

I think that the adoption of geocentric reference frames by African countries will gain momentum with the pending UN Committee of Experts for GGIM proposal for a UN General Assembly resolution on the Global Geodetic Reference Frame (GGRF). The massive advances in precise point positioning (PPP) and other global geodetic services will also reduce the need for relatively dense permanent networks as previously envisaged for countries. The availability of Landsat8 data and rapid development of land cover products is creating numerous opportunities for land cover mapping in Africa. African countries can better monitor the change in resources and human activity and make more informed decisions based on this. Although the availability of UAVs for rapid data collection and visualisation is a global phenomenon, the challenge in Africa is the lack of regulatory clarity on this matter to ensure that this technology is maximised to its full potential.

If the geomatics community can be innovative in encouraging the rapidly expanding number of mobile-phone users in Africa to crowdsource, the available geospatial information in Africa can grow exponentially. The key is to create incentives, or to demonstrate the benefit of geospatial information to the ordinary citizen.

## Looking Back at 11<sup>th</sup> SPAR International Conference



SPAR International 2014.

The 11<sup>th</sup> annual SPAR International 3D measurement and imaging conference wrapped up a few weeks ago in Colorado Springs, USA.

The event gained accolades from exhibitors and attendees alike as an unparalleled venue for learning about the latest 3D capture, processing and visualisation technologies; for comparing and qualifying products in a platform-neutral environment; and for networking with thought-leaders and peers. 862 professionals attended SPAR International 2014, which was held from 14 to 17 April. ◀

▶ <http://bit.ly/1fRyWy0>

## EU and Korean GNSS Community Discusses Cooperation

The European GNSS Agency (GSA) recently joined key EU and Korean GNSS players from industry and government in Seoul for the 2014 GNSS.asia Korean Industrial Seminar. The seminar, which was held in partnership with the Korean National Geographic Information Institute, the Korean GNSS Society and the Korean Spatial Information Society, was an opportunity for industry experts to assess current opportunities for GNSS downstream cooperation and present up-to-date market information on various application domains. ◀

▶ <http://bit.ly/1fRz7tf>



2014 GNSS.asia Korean Industrial Seminar.

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3D city model of Silkeborg, Denmark.

## Online Platform for Streaming 3D City Models Now Open for GIS Developers

Agency9, the Swedish provider of online 3D visualisation platform and urban planning solutions for web and mobile, has announced the general availability of its software developer platform 3DMaps SDK 4.0 with support for HTML5 and WebGL. The platform is an addition to the existing framework for visualisation of large-scale terrain and 3D city models with unparalleled performance and rendering quality. ◀

▶ <http://bit.ly/1fRzHHd>

## Fraunhofer IIS Launches Open Software Interface GNSS Receiver Project

Fraunhofer Institute for Integrated Circuits IIS is participating in the 'GOOSE' project funded by the German Federal Ministry for Economic Affairs and Energy. The aim is to develop the first GNSS receiver with an open software interface. The project is headed up by the German Aerospace Center (DLR) with the involvement of navigation technology specialist navXperience and the University of the German Federal Armed Forces in Munich (UniBW). ◀

▶ <http://bit.ly/1fRyP5p>

## Ktimatologio

The term cadastre – in a variety of spellings – is the name used in Western countries for a register of land rights. The term stems from *katastikhon*, which is ancient Greek meaning 'down the line', i.e. a list or register. In modern Greek, though, the word 'cadastre' is not current. Instead *Ktimatologio* is used, a compound noun in which *Ktimato* means landowner. Since its foundation in 1996 Ktimatologio, the Greek cadastre, has completed only 8,400km<sup>2</sup> and settled a meagre 7 million rights, while the total area of Greece is 132,000km<sup>2</sup> on which over 37 million rights are vested. Despite receiving over USD100 million in EU support in the early 1990s, progress has been lean, as Dimitris Kaloudiotis, who has been president of the National Cadastre and Survey (NCMA) since May 2013, admits. The lack of an apt cadastre is a hurdle to growth and development as it encumbers collection of property taxes, deters foreign

investors, hampers privatisation of state assets, and leaks huge investment sums to lawyers to settle disputes. In rural areas, where things have not changed much through the ages, disputes arise because deeds may define boundaries using descriptions such as 'from the tree to the stream' or 'where you can hear a donkey on the path' or 'three olive trees near the well.' *The New York Times* (26 May 2013) attributes the state of Ktimatologio to a complex of flaws. Most records are still written in pen and logged in by last names. There are no lot numbers and there is no clarity



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on boundaries, zoning or how many people have rights to the same lot. The article also quotes NCMA's president Kaloudiotis: "If you calculated the total deeds that are registered, the country would be twice as big as it is." Another expert rhymes, "There has been a lot of money spent, and no one knows where it went." In a Greek newspaper, NCMA's president attributes the delays to past legacy. Greece is a patchwork of islands and landscapes where the peculiar land registry systems and institutions of the past persist. Together with localism and clientelism, this resulted in mixed and dispersed systems which were not abandoned following the launch of Ktimatologio in 1996. Added to this, consortia specialising in cadastral survey were not formed, allowing inexperienced contractors to respond to tenders. They devoted considerable effort to competition and quarrels, leading to over 300 lawsuits "so that the award of survey projects tendered even back in 2008 is still pending". In response to pressure from the EU, IMF and ECB to speed up progress, a law has been passed aimed at eliminating old conflicts and preventing new ones. Tendering will take no longer than 12 months, the officers now have the necessary skills and Ktimatologio has reached technical, administrative and planning maturity, according to NCMA's president. By 2020 the entire country should be surveyed and all rights registered. Let's cross our fingers.



GIM INTERNATIONAL INTERVIEWS AKIS MARKATOS

# Completing the Greek Cadastre



PHOTO COURTESY: JEROEN VAN BERKEL

**Earlier this year, work started on the completion of the cadastral registration in Greece, in the south-east corner of Europe. More than 60 percent of the territory still has to be surveyed, and the project should be completed by 2020. The IT infrastructure has been set up, new laws passed, 28 survey projects tendered, and a new board and management are in place at the National Cadastre and Mapping Agency. Here Akis Markatos, general director of the Cadastre, talks about their eagerness to tackle the many challenges.**

**What is the current cadastral situation in Greece?**

In a country in such great need of a well-functioning property market, fair property taxation and more investment in real estate and infrastructural projects, the importance of having effective property registration is obvious. Greece covers an area of 132,000 square kilometres and is home to 11 million people. But despite considerable effort and many millions of euros invested by both the state and the European Union, only 40 percent of the territory is currently covered in the national cadastre. That accounts for approximately 60 percent of the country's property rights. In the remaining part, a very 'heterogeneous' property system does exist but it is far from adequate. There is no certainty that private property is administered correctly, and coastal and forest zones and public property are not registered at all.

There have been numerous pilot schemes since 1996 but most of these merely resulted in high monitoring expenses, errors and delays. The results have improved in recent years, but candidate contractors for the survey work have frustrated many tenders by going to court (300 cases) to contest competition instead of forming consortia. A new cadastre law (2013) has simplified procedures

and cut red tape. 126 older survey projects are now being implemented and 28 new ones were tendered in October 2013.

**A new phase, a new management?**

Yes, new management has been in place at the NCMA S.A. (National Cadastre and Mapping Agency) since August 2013, and a new board of directors was installed in March. With our staff of 365 people, we are willing to move mountains to complete the national cadastral survey.

The NCMA is neither a private nor a public organisation, but was instituted as a legal entity of private law in order to operate according to the rules of private finance. The sole shareholder of the company is the Greek Ministry of Environment, Energy and Climate Change. This legal form was chosen in order to give NCMA flexibility and a government guarantee. However, due to the recent restrictions imposed on all government bodies, the initially intended flexibility and autonomy has been considerably limited. But I don't expect that to frustrate our efforts to achieve the 2020 deadline.

**What will be the total initial cost of the Hellenic cadastre?**

The total cost of the project was estimated at EUR1.5 billion. Our assessment is that the current cadastral survey tenders will be around 25 to 30 percent cheaper than the previous ones. In other words, we expect the remaining budget of

approx. EUR1.1 billion will be used to an extent of less than EUR800 million in the end.

It's not all publicly funded. An owner pays EUR35 per registered deed and – in the new projects – 1 per mille over the value of the property. For this, a new feature will be added in our systems in the next semester which will enable all transaction prices to be recorded in the cadastral database.

**Will the structural effects go far beyond the cadastre registration?**

Yes. The process of developing the cadastre has brought to the surface many administrative problems that have plagued Greece for the last 200 years. The state can now resolve these problems, which mostly involve the extent of state property, the illegal development of certain areas, and the lack of authoritative information on a series of administrative data layers. Furthermore, in the areas where a cadastre has been developed, the Greek state now has a reliable data source for the first time enabling it to make documented decisions about the country's development. And future investors now have a clear view of the extent and the boundaries of properties.

There will also be a growing effect on the state income through property tax. A link is currently being built between the cadastral database and the taxation database in order to develop a more comprehensive and fair taxation system.

It is very important to note that this process is creating 12,000 new ▶

**Akis Markatos**



**Akis Markatos**, who has been general director of the NCMA since August 2013, is based in Athens, Greece. After studying and working at the University of Athens and the University College of London, he became an experienced telecoms & investments executive and member of the board of directors in many start-up companies in the ICT sector. He has published various books and articles on techno-economic and lifecycle cost studies, risk assessments and investment strategies, mainly in the areas of telecoms networks, services and industrial applications. His background fits the high level of information technology that is involved in a modern cadastre.

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jobs for engineers, lawyers and IT specialists. A new IT infrastructure has been set up using EU budget for the digital conversion of Greece. For instance, the Hellenic Positioning System (HEPOS) is in place with accuracy of 2 to 4cm. And we now have a data infrastructure for the management of all spatial and non-spatial data to support all the organisation's projects. Important internet services have been developed, targeted at citizens as well as the contractors of the cadastral surveys. We also have unified national base maps.

#### **What kind of base maps?**

Colour digital orthophoto maps with a pixel size of 20cm have been produced for the major urban areas, and digital orthophoto maps with a pixel size of 50cm for the entire country. These are the main base maps of our cadastre with the same geometric features as a common map. An orthophoto map can be supplemented with any kind of mapping information: road networks, real-estate properties, etc. Property owners can easily identify the location of their property during the cadastral survey procedure using an orthophoto map thanks to it having a familiar appearance. The spin-off is a free 'orthoimagery viewing service'

on our website that is used very frequently by citizens and companies alike. Building data is collected during the cadastral registration procedure in order to assist in the identification of properties. But I must admit: due to a lack of adequate legislation, there's no way to keep this information updated. A legislative regulation is currently being drafted to resolve this issue.

#### **Can you outline the role of that orthoimagery in the total procedure?**

The cadastral projects are carried out as joint ventures between professional surveyors and lawyers. Before the declarations of ownership are submitted, the cadastral contractor has to produce a preliminary cadastral map, identifying all visible boundaries and sketching out land parcels. You have to realise: apart from the mainland, 20% of the country is comprised of 6,000 smaller islands, of which 127 are inhabited by more than 100 people. To determine the geographical position of each building/parcel, the orthoimagery maps are used in conjunction with surface topographical measurements. The outcome of the procedure is checked against well-accepted ISO standards in terms of accuracy and precision.

The owners then have to submit a photocopy of their passport and a declaration of their property rights. They must attach photocopies of the deeds that substantiate this and any topographic diagrams they may have depicting the properties declared. The owners also have to verify the location and the boundaries of the property on the preliminary cadastral digital diagrams. This procedure can be carried out either in the local cadastral survey office or through a free online service. After the collected information has been processed, the results are made public so that citizens themselves can verify, confirm and correct any errors

in the official cadastral data. The success of this procedure however, depends on the citizens' own contributions. Properties that are not registered, for whatever reason, and are hence listed as 'owner unknown', become property of the Hellenic State after a period of maximum 7 years. In the end, the contractor delivers all the data for input into our Esri GIS in line with the international standards for exchange of geographical information. Cadastral applications are built around Parcel Identification Numbers. Our data model, along with our GIS, is both parcel-oriented and property-oriented.

#### **And can you tell me about the update?**

The update of the cadastral database is permanent; 162 of our people are involved. By law, every cadastral deed is required to be registered in the system before the ownership status of a property can be changed on the deed. Furthermore, any mutation of land parcels must be requested based on a detailed topographic plan produced by a surveyor. The deed is only registered when all the preconditions are met. The 'Cadastral Sheet' – i.e. the map – and the alphabetical index of beneficiaries of the property are updated, and the deed and supporting documents are filed away.

124 people are working on the initial data gathering and processing for the cadastral survey, coast mapping and forest mapping programmes. If all goes according to plan, professional users will have online access to the land-data registers by 2016. Until then, they can either request a certificate of the registration or examine the cadastral database from the computers in the competent Cadastral Office. We have a new, efficient network of 12 cadastral offices. Last but not least: the average age of our employees is just 39, and 73% of them have a university education. I think our organisation is well prepared to do the job at hand. ◀

# Point Clouds (1)

**Whether based on Lidar, photogrammetry, radar, sonar or other remote sensors, systems for geodata acquisition create millions or even billions of 3D points. To be useful, the data needs to be organised, combined, georeferenced, measured and analysed, and that in turn requires software. This article first defines what point clouds are and identifies their sources. It then goes on to examine software functionalities such as visualisation and editing. The July 2014 edition of *GIM International* will be a themed issue covering collection and processing of point clouds and hence will include a selection of the many software packages currently available.**

A point cloud is a set of data points represented in a preferred coordinate system. The dataset consists of measurements taken at discrete points of a curved 2D surface in 3D space. This 2D surface may be smooth

or it may contain discontinuities such as facades of building. The number and density of the points should be such that the 2D surface can be reconstructed, i.e. at every point on the surface a value can be calculated from the measured values in the vicinity. This process is called 'interpolation'. The initial data is unorganised; processing software is needed to organise the unorganised into a point cloud and extract information from it.

## POINT CLOUDS

In principle, the curved 2D surface can represent any instance such as soil pollution, forest biomass, rainfall, terrain elevation or the seabed. In the field of geomatics, the phenomenon will usually be the terrain surface or the seabed in the form of a digital

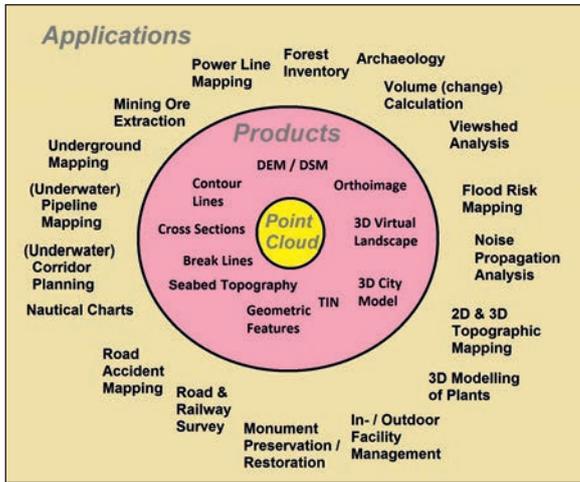
elevation model/digital surface model (DEM/DSM). The tools used to acquire the point cloud can include: levelling; GNSS; terrestrial laser scanning (TLS); airborne Lidar; airborne or spaceborne radar; terrestrial, aerial or spaceborne photogrammetry; or multibeam sonar. Another source can be contour lines digitised from maps. This article focuses on point clouds from which DEMs or DSMs can be created and products can subsequently be derived (Figure 1). These products can then be used in a variety of applications. For forest inventory, for example, the height of individual trees, the density of the canopy, biomass and the stand volume can be calculated, while in road construction volumes and masses can be calculated from a DEM to support earthworks. By comparing time series of DEMs, ore extraction of an open-pit mine can be determined as well as erosion and accumulation of sand in dunes to support flood risk management. The point cloud data consists of a set of x,y coordinates to which height/depth values have been assigned: one value per x,y location. Added to height or depth, other attributes may be attached to



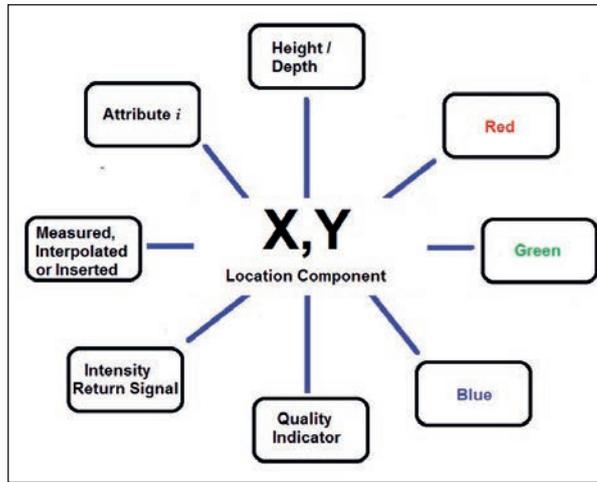
**Mathias Lemmens** gained a PhD degree from Delft University of Technology, The Netherlands, where he presently lectures on geodata acquisition technologies and geodata quality on a part-time basis on the recently renewed MSc in Geomatics. He is the author of the book *Geo-information: Technologies, Applications and the*

*Environment* published by Springer in 2011. He was editor-in-chief of *GIM International* for ten years and now contributes as senior editor.

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▲ Figure 1, Point clouds, derived products and fields of application.



▲ Figure 2, Diagram representing the nucleus of a point cloud consisting of location and attributes.

the x,y component, such as reflection intensities of the laser/sonar pulse or RGB of a colour image recorded by a camera at the same time (Figure 2). Hence, the x,y component and its attributes forms the nucleus of the point cloud and the number of nuclei may run into billions.

**SOURCES**

The vast majority of point clouds stem from the output of active systems, including airborne Lidar, TLS, radar or sonar, with the latter mainly being used for mapping seabeds and riverbeds. Thanks to advances in the underlying technologies over the past two decades, it is now easy to produce high-resolution terrain data at very high rates. For seabed mapping, for example, the shift from singlebeam to multibeam echosounders has increased the amount of data that can be acquired to billions of echo returns per day. Returns from Lidar and sonar are first stored in the form of range, angle and time. These are then integrated with 3D location data (latitude, longitude and altitude) collected by on-board GNSS and pose data (roll, pitch and heading)

measured by an IMU, which is usually integrated with the GNSS, and if applicable compasses, barometers and odometers. The integration of the raw data is largely automated and results in a georeferenced 3D point cloud which often needs editing to remove outliers and other improper points. Usually the point cloud is transferred to a 2.5D surface in the form of regular grids or triangulated irregular networks (TIN). These products often act as the basis for input in CAD, BIM and other tools for the creation of a variety of products, such as contours, nautical charts, volumes or 3D landscape models. Added to this, the output should be in a format which is readable by CAD, hydrological and other application-oriented software. Point clouds may also stem from overlapping imagery, captured by nadir-looking or oblique cameras, using photogrammetric image-matching software. The cameras may be mounted in manned or unmanned airborne systems. Lidar point clouds are captured either in the air or from ground / mobile stations whereas radar sensors are either mounted on aircraft or are orbiting.

**FUNCTIONALITY**

The functionalities of processing software differ widely. To understand types of use, it is key to gain insight into the ins and outs of the different packages. The functionality may start at the creation of the point cloud itself, as is the case for image-matching software which creates a DSM from overlapping imagery. The functionality can be tagged into eight groups (Figure 3). A first challenge in the use of point clouds is the huge file size: a 32-bit operating system can only handle files of up to a few gigabytes, and most computers are not designed for such large datasets. The amount of data produced by today's sensors is growing faster than the processing and storage capacity of database management systems (DBMS). An important aspect of point-cloud creation is the removal of unwanted points, which is called 'filtering'. Key for specific, industrial use is not only the manual measuring of length, height, distance, angle, area and volume, but also the extraction of geometric features such as lines and planes and the fitting of solid models through a set of points. The solid models may include cubes, spheres, cylinders or user-



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specified objects such as valves and elbows. Vendors often offer plug-in modules, which provide a sequence of functionalities adapted to particular needs, while others provide 'lite' versions aimed at users who do not need all the functions. The sequel to this article will focus on the following: georeferencing; visualisation and editing; interpolation; and the filtering aspect of point-cloud creation.

### GEOREFERENCING

3D patches of point clouds – i.e. individual scans – must be transformed to a single coordinate system to enable georeferencing or registration, which involves identifying common points in the overlaps. As a geometric transformation model, the 3D similarity (Helmert) transformation is usually applied (three translation parameters, three rotation parameter and one scale parameter). This process requires at least seven coordinates, i.e. two 3D ground control points (GCP) and one height GCP. To obtain redundancy and thus the ability to detect outliers and to compute precision through error propagation, seven or more GCPs that are evenly distributed along the border of the site are measured, usually with differential GNSS or a total station. The stitching of the single point clouds requires tie points in the overlaps. These are distinctive points in the scene or consist of targets placed, marked or painted in the overlaps. The latter requires a more thorough planning of the survey to ensure that the marks are placed in the overlaps. Of course, the GCPs should be clearly identifiable. In addition to the indirect method described above, direct georeferencing can also be conducted in some cases. For example, a TLS can be centred over a known point and levelled as if it were a total station. The position can also be determined using a GNSS antenna mounted on top of a TLS.

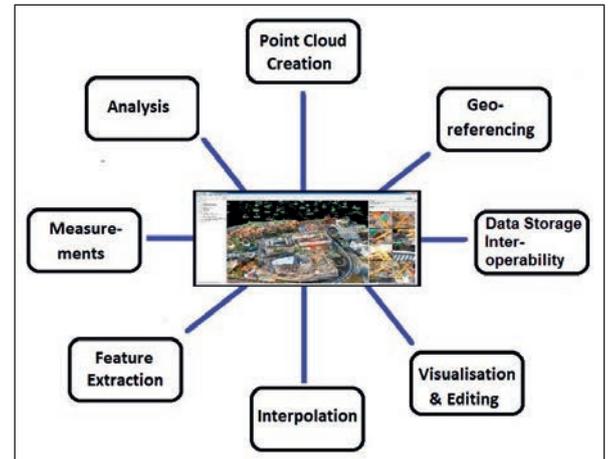
### FILTERING

Airborne Lidar, TLS, sonar as well as the DSM generated from automatic matching of overlapping imagery capture all objects present on the

site, including vegetation, cars, bikes, dogs, fish, shipwrecks and suchlike, all of which are irrelevant for the survey at hand and are thus 'noise' from the surveyor's point of view. The software should therefore be able to remove such points, either through manual editing or by automatic filtering. Most software contains tools to quickly and easily reduce such noise. Ground filtering is a specific method aimed at the removal of points reflected from vegetation when creating a 3D city model, or from vegetation and buildings when creating a bare-ground DEM (Figure 4). Many methods have been developed, which is a token of the complexity of the filtering problem. A broad overview of Lidar ground-filtering methods to guide users in selecting the optimal method for their specific applications is given by Meng et al. (2010).

### INTERPOLATION

The value of an unknown point is usually computed from measured points in the vicinity using a weighting scheme. The closer a known point lies to the unknown point, the more similar the behaviour will be. Hence, it is feasible to use the inverse of the distances as weightings. The inverse distance weighting (IDW) weights the known points in a search area around the unknown point using distance (Figure 5). The search area may be a circle, a square or any other shape. The result is a distance-weighted mean. Nearest neighbour (NN) uses area as the weighting criterion. IDW and NN both compute values which are within the range of those of the known points and thus do not generate peaks, pits, ridges or valleys if they are not present in the input. No action from the user is needed and the output is smooth



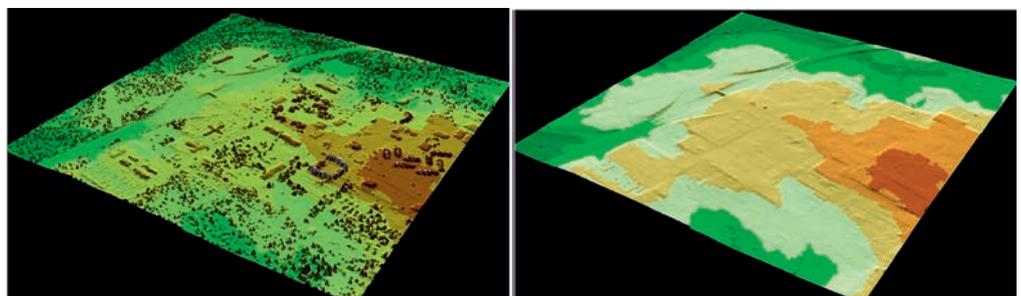
▲ Figure 3, Functionalities of point-cloud processing software categorised in eight main groups.

while the values of the known points are preserved. Another often-used method is Kriging whereby the weighting function is not based on distance or area, but rather on the covariance of the measured points. In general, the quality of the computed value of the unknown point of any interpolation method mainly depends on whether the points in the vicinity belong to the same type of points. For example, if the measured points are partly located on a building roof and partly on the street, the height of an unknown street point will be computed somewhere between street and roof level. Figure 6 shows this effect for a point located in a valley.

### VISUALISATION AND EDITING

The software should be able to visualise and edit clouds with many billions of points at a reasonable rate; it should not take hours before a view appears on the screen. All the points may be depicted in a single colour and size, but a colour code may also portray the strength of the return signal, the elevation or the RGB values of the same point in an image. Inspection of the point cloud requires zooming, panning, rotating, fly-through and adjusting point size. Editing operations include the

▼ Figure 4, Original DSM (left) and its bare-ground representation after ground filtering.





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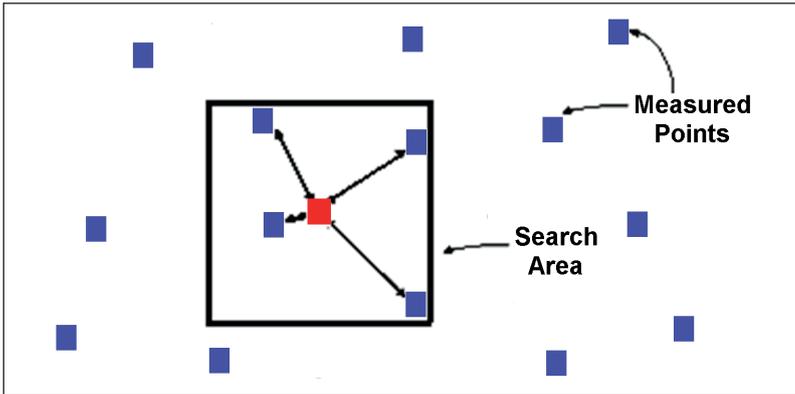
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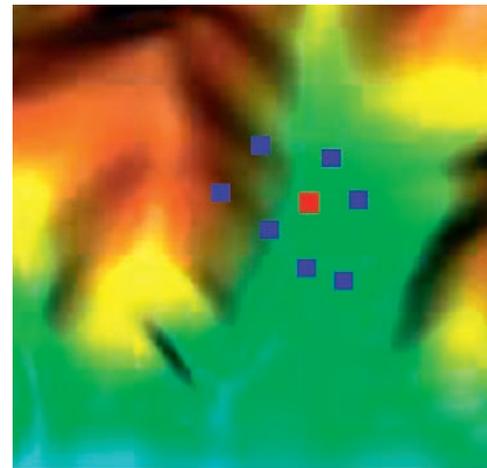




▲ Figure 5, Interpolation using inverse distance weighting in a square search area.

mouse-clicking of individual points for the removal of outliers or a group of points, addition of missing points or calculation of distances, angles, areas and volumes. The boundary of the group may be identified by drawing a cube, a rubber surface or other volume shape. Selection of a group of points allows geometric primitives such as planes, spheres, cylinders or NURBS (non-uniform rational basis spline) to be fit using an optimisation method – usually

this will be least squares. Selection of a group of points also allows the manual removal of unwanted points such as those reflected on vegetation



■ Measured point ■ Unknown point

and buildings if one wants to create a bare-ground DEM. Staking out a baseline enables the extraction of a cross section. ◀

▲ Figure 6, Points on the hill are used to compute an unknown point in the valley leading to an incorrect value.

**FURTHER READING**

- Lemmens, M. (2011) *Geo-information – Technologies, Applications and the Environment*, Springer, ISBN 978-94-007-1666-7.
- Lemmens, M. (2013) Massive point clouds, *GIM International*, 27:2, p. 13.
- Meng, X., Currit, N., Zhao, K. (2010) Ground filtering algorithms for airborne Lidar data: a review of critical issues, *Remote Sensing*, vol. 2, no. 3, pp. 833-860.

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INNOVATIVE GEOSPATIAL TECHNOLOGY IN BURKINA FASO

# Breaking the Grip of Poverty

Burkina Faso has a population of 17.5 million and is one of the poorest countries in the world. During the colonial period and after independence, land was vested in the state and hence there was no legal recognition of customary land rights. Several years ago, the country recognised the adverse impact of the lack of land tenure security on promoting investment and consequently increasing production in the agricultural sector. New approaches in registration have since been developed with the support of modern technology.

In 2008, the government of Burkina Faso entered into a compact with the Millennium Challenge Corporation (MCC) of the United States that aimed to reduce poverty through economic growth. When defining the objectives of the compact, a participatory country ownership approach was adopted to ensure that it addressed the needs considered by the government. In particular the compact seeks to improve rural land governance in order to enhance agricultural investment, improve access to markets by rehabilitating vital corridors of the road networks, and enhance rural agricultural production through irrigation and accessibility of improved extension services. The lack of legal foundation for the – predominant – customary tenure system for rural agricultural lands constitutes an inherent risk that deters the investment needed to produce the growth required to ameliorate the high incidence

of abject poverty prevalent in the country.

**LAND REGISTRATION AND CADASTRE**

Prior to implementation of the rural land governance project, the process of land registration was not decentralised to the provinces,

which is where most of the poor, peasant farmers reside. That meant that efforts to register land potentially involved a considerable amount of travel to regional centres often distant from the farming communities and at a great expense. Any attempt to improve and



**William Marbell** works for Trimble Export Limited, as a capture manager within the business development division with responsibility for funded projects in Africa. He was the project manager for the implementation of

the Burkina Faso CORS project and is a registered professional surveyor and civil engineer. His professional experience encompasses the design, execution and management of geodetic and civil infrastructure projects.

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**Alain Bagre** is a leading land administration specialist. He worked as the land tenure specialist for the project implementation consultants Messrs. ADR during the execution of the rural governance project. He is currently the coordinator of

the team of experts working on the expansion of the MCA Burkina Faso rural land governance project. Alain is a registered land surveyor and a land administration expert with significant experience in the design and implementation of land reform projects in Africa.

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► Figure 1, Spatial distribution of the nodes of the CORS network.



► Table 1, New national geodetic reference frame.

The new national geodetic reference frame and plane coordinate system is defined by the following parameters:
- Reference Ellipsoid ITRF 2008;
- Ellipsoid IAG GRS80 (Semi Major Axes $a = 6\,378\,137,00$ and flattening $1/f = 298.257222101$ );
- Map Projection BF-TM (Transverse Mercator)
- Central Meridian $1^{\circ} 30'W$
- Co-ordinates of Projection ( $X0 = 600\,000.00m$ , $Y0 = 0.00m$ )
- Scale Factor: $K0 = 0.9996$

streamline the process of registration of rural lands therefore needs to decentralise the registration process in order to make rural land administration more accessible to its intended beneficiaries.

A critical component of a functional land registration system is a cadastral plan that delineates the land that is to be registered. It captures the boundaries of registered land in terms of an unambiguous system of reference that supports demarcation of the boundaries of the registered parcels, should a boundary dispute arise.

Burkina Faso's existing geodetic infrastructure is underpinned by a network of 54 primary control points based on the Clark 1880 ellipsoid and a UTM projection. Rampant disturbance and destruction of the control points within the network from the primary to tertiary level meant that producing cadastral maps tied to the national control network was an expensive enterprise. As a result of the sparse density of control points, the process involved extensive traversing with

conventional optical instruments to long baselines requiring high-accuracy GNSS receivers and long occupation times using satellite positioning techniques. Hence most cadastral plans were tied to local coordinate systems, making it impracticable to create a homogenous record of all land transactions data using the existing spatial data. The rural land reforms envisaged under the MCA Burkina Faso rural land governance project include upgrading the existing geodetic infrastructure in order to reduce the cost and complexity of determining positioning.

#### THE DAWN OF A NEW ERA

To facilitate the implementation of the land policy under the auspices of the MCA-Burkina Faso rural land governance project, a new law governing the administration of land was adopted and enacted in June 2009. This law permits the recognition of customary land rights through the issuance of rural land certificates. Traditionally, women in Burkina Faso tend to have a right to the use of

communal land but do not qualify to legally own land, in spite of the fact that they are often active contributors in the sustenance agrarian system prevalent in the country's rural communities. Under the new land law that has been promulgated, provision is made for the recognition of the rights of women to own land. This provides a mechanism to bridge the yawning gap between men and women in land ownership.

To bring the process of land administration to the doorstep of its target beneficiaries, rural land officers from the project communities have received training in the use of satellite-based positioning techniques and appropriate application software to create and deliver affordable land registration documentation, including cadastral maps, at significantly lower cost than what existed before the reforms. In order to support the rural land registration programme and to update the existing land-governing technical standards for surveying work in tandem with recent developments in technology, a new technical standard for surveying work has been enacted into law (see Table 1).

The process of determining the positioning that enables the work to be done by rural land registration officers with minimum academic qualifications (equivalent to a high-school diploma) is based on the simplicity and streamlined workflow that is made possible by the appropriate technology which underpins the new registration process. A network of nine continuously operating reference stations (CORS) covering the national

► Figure 2, A CORS monument with an antenna, receiver and a modular solar energy system for power supply.



territory as shown in Figure 1, in conjunction with handheld GPS receivers and application-specific software, provides a cost-effective procedure for providing affordable land documentation, including cadastral plans at the local level, using trained staff from the project communities. The nine-station network, built on Trimble's proven technology, forms the foundation of the primary active geodetic infrastructure of Burkina Faso (see Figure 2). The network is scalable based on need into a fully fledged system that supports a continuum of accuracy in real time. The new geodetic infrastructure provides a foundation for producing cadastral plans within a unified coordinate reference system for effective and integrated management of land records.

Prior to the reforms, preparation of a cadastral plan necessitated the use of professional surveyors' services since the state of the geodetic infrastructure required extensive technical expertise to determine positioning in conformity with the existing technical and legal requirements. The cost of creating cadastral plans as a result of the reforms and the use of technology has been drastically reduced from USD200 prior to the project to a nominal value of USD10 (government of Burkina Faso, 2012).

#### STARTING TO BEAR FRUIT

A total of 13,696 titles have so far been issued in three communities within the province of Ganzourgou as part of the rural land titling component of the MCA Burkina Faso rural land governance project (see Figure 3). Under the new dispensation, community rural land registration offices submit registered rural land documentation to the regional office of the cadastral service for integration into a regional land information system that forms the basis of a national system. A total of 47 cadastral offices have been opened across the country



◀ Figure 3, A farmer from the Boudri community receiving a rural land certificate.

to bring rural land registration to the doorstep of the rural population.

The GNSS CORS technology adopted makes it marginally cost effective to produce georeferenced cadastral plans in conformity with new technical regulations while providing a more efficient mechanism for the maintenance and management of the geodetic control system for other applications. The technical capacity of staff of the national mapping agency, the cadastral service, the new rural land registration centres and professionals in both the private and public sector who will benefit from the use of the new geodetic infrastructure has been enhanced through the extensive training modules delivered in the use of satellite-based positioning techniques offered under the scope of the project. In excess of

1,200 individuals from various organisations have subscribed for the CORS network data and services.

#### CONCLUDING REMARKS

The rural land reforms are expected to facilitate an increase in investment in rural agriculture as a result of the reduction in the risk of tenure insecurity emanating from the recognition of customary rights guaranteed under the new land law and the associated reforms that are being pursued in the project intervention zones. The anticipated increase in investment in rural agriculture as a result of the land reforms will enhance the creation of wealth and reduction of rural poverty. The project in Burkina Faso has demonstrated that appropriate modern technology can be used to deliver affordable and sustainable land administration services to the often-marginalised rural poor. ◀

#### FURTHER READING

- Brasselle, Gaspart and Platteau (2002), Land tenure security and investment incentives: Puzzling evidence from Burkina Faso, *Journal of Development Economics* Vol. 67 (2)
- International Monetary Fund (2000), Burkina Faso Poverty Reduction Strategy Paper
- Millennium Challenge Corporation (2008), Burkina Faso Compact
- Smith, R. (2004), Land tenure, fixed investment, and farm productivity: Evidence from Zambia's Southern Province, *World Development* Vol. 32(10) pp. 1641-1661.
- United Nations (2013), Human Development Index

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TESTING THE SUITABILITY OF THERMAL INFRARED SENSORS

# Monitoring Volcanoes with UAS

**Insight into signs that prelude volcanic eruptions is key for protecting the lives, livestock and property of those living in the vicinity of a volcano. One key indicator is temperature rise. Using Mount Etna as a test site, the authors show that an unmanned aerial system (UAS) equipped with a thermal infrared sensor generates data similar to temperature data acquired by ground-based stations while avoiding safety risks for volcanologists.**

Data from Earth observation satellites with high temporal resolution can be used to monitor volcanic eruptions on an intraday basis when combined with images from satellites with a high ground sample distance (GSD) but low repetition time. For example, MODIS captures about four images per day of the same area with a GSD of 1km. This data can be combined with images from ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) which has a GSD of 90m in the thermal bands and a revisit time of 16 days. The resulting data enables indication of low-altitude emissions and the growth of domes and lava flows, and detection of course thermal anomalies. However, forecasting volcanic activity

also requires data on quacks, ground deformation, detailed temperature rises, gas emissions and other signs. These cannot be collected by satellite sensors but instead require in-situ visits. With their remote locations, well above sea level, volcanoes are difficult to monitor in regular site visits, while the use of manned aircraft for capturing time series of thermal images above volcanoes is costly and risky. Therefore, Istituto Nazionale di Geofisica e Vulcanologia (INGV) in Rome, Italy, started to investigate the usability of a UAS in 2004 by flying a remotely piloted fixed wing over the Stromboli. As the initial results were encouraging, the

experiments were continued using a rotary-wing aircraft enabling vertical take-off and landing, low speed up to hovering and high manoeuvrability. These are all favourable features for inaccessible terrain.

## UAS AND PAYLOAD

The pilot project described here used a rotary wing with six propellers, each powered by an electric motor and mounted rigidly to a low-weight carbon-fibre structure. The hexacopter used can conduct a single waypoint autonomous flight, can be manually controlled through a radio link and can stay in the air for 15 minutes. It can hover above a ▶



**Stefania Amici, PhD**, is with Istituto Nazionale di Geofisica e Vulcanologia (INGV), Rome, Italy. She focuses on multiple-scale remote sensing for hazard research. Prior to that, she worked on calibration of hyperspectral sensors for solar-system

exploration at National Research Council (CNR) for almost seven years.

✉ stefania.amici@ingv.it



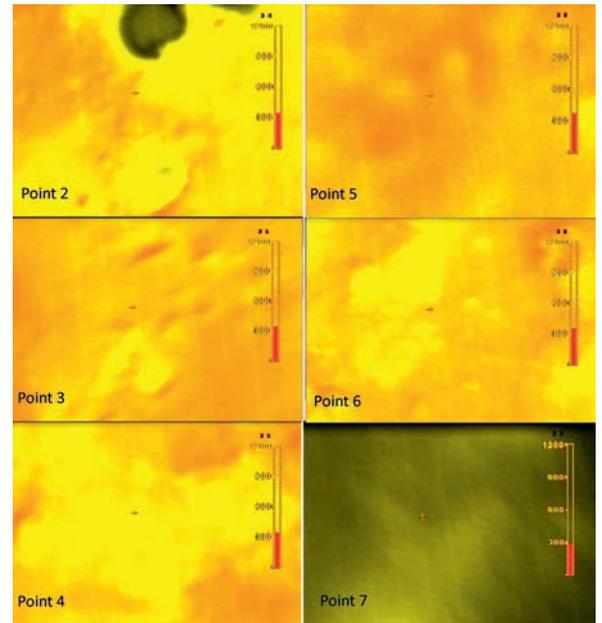
**Matteo Turci** is with the Department of Industrial Engineering, University Of Bologna, Italy. As a research fellow he works on UAS and is collaborating with INGV on mapping the Antarctic

Circle magnetic field and developing a UAS for monitoring volcanoes.

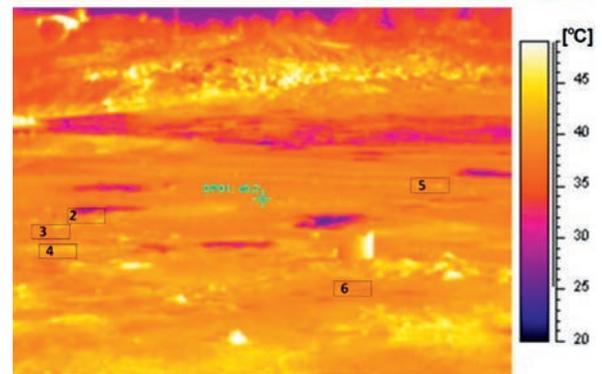
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▲ Figure 1, Google Earth image of Le Salinelle showing the location of take-off and landing (blue star).



► Figure 2, Points 2 to 6 are TC3600 frames of the first flight (top), which are compared with the same A310 frames; point 7 of the second flight has been compared with the Fluke temperature.



fixed point, carry a payload of 1.7kg and allows for an emergency landing in case of propeller failure. The on-board controller integrates GPS, IMU, magnetometer and barometer data to perform autonomous flights. A tablet PC acts as the ground station. The payload consists of a Thermal EYE 3600AS (TE 3600AS) based on proven amorphous silicon (AS) microbolometer technology. The thermal camera (TC) (Thermal EYE 3600) weighs 67 grams, captures the thermal band from 7 to 14 micrometres and generates PAL video at a frame rate of 25Hz. The customised solution consists of four PC-104 compliant stackable modules:

- DC-DC converter offering up to 75W for powering all modules
- Real-time PAL/NTSC Frame Grabber controller for PC/104+ bus
- PC with low power running

Windows XP; a specific driver able to store each video frame on a 4GB compact Flash

- Wi-Fi for wireless connection.

The system is integrated in a cube of 12 x 11 x 8cm<sup>3</sup> and weighs 600g.

#### FIELD SURVEY

The field survey was conducted on 26 June 2012 at Le Salinelle, a mud volcano located on the southwest flank of Mount Etna, and passable only with difficulty, which hampers in-situ measurements (Figure 1). Emissions of mud, salt water and gas are related to early stages of magma accumulation and thus form tokens of increased volcanic activity. The temperature of the salt water usually varies between 10 and 20°C but sometimes rises to 40 to 50°C which is in line with an increase in

gas emission and thus forms a token of a forthcoming eruption. In order to avoid sun reflection and heat release from the ground, the survey was conducted in the late afternoon when the air temperature was around 30°C. The UAS was remotely piloted by a human operator. During two flights, each lasting 15 minutes, two areas were mapped and the thermal video frames were transmitted to the ground station in real time. The same area was also captured by a calibrated A310 forward-looking infrared (FLIR) thermal camera for reference purposes. The A310 contains a 320 x 240 array, which captures the 8-14 micrometre thermal band and is sensitive to temperatures from 0 to 350°C with an accuracy of ±2%. The camera was handheld by a human operator which resulted in a high oblique view. Added to this, a Fluke

infrared thermometer was used for obtaining an independent validation measurement at a selected area.

**RESULTS**

After manual co-registration of the A310 and TC3600 imagery,

cross correlation between TC3600 and A310 is 0.64. The values of the A310 for points 3 and 4 show a large standard deviation due to the presence of a hotspot. One frame (point 7) acquired during the second flight was compared with the Fluke

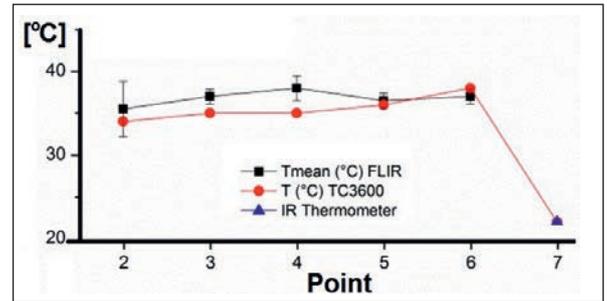
*To avoid sun reflection and heat release from the ground, the survey was conducted in the late afternoon*

six frames from the TC3600 UAS imagery were selected (Figure 2). The average temperatures of five frames (points 2 to 6) were compared with the averages of the ground truth collected by the A310 and the results plotted in Figure 3. The

infrared thermometer and shows perfect resemblance.

**CONCLUDING REMARKS**

The system worked properly even under harsh conditions, demonstrating that UAS thermal



imaging is a promising technique for acquiring data in volcanic areas which are difficult to access. To date, INGV has been involved in thermal mapping of volcanoes in various countries.

▲ Figure 3, UAS temperatures versus ground truth.

**ACKNOWLEDGEMENTS**

Thanks are due to Salvatore Giammanco, Letizia Spampinato, Maria Fabrizia Buongiorno, Fabrizio Giulietti, Mario Gattelli, Massimiliano Pompignoli and Alessandro Ceruti. ◀

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No 2568

COMNAV

# Making GNSS Receivers a Creative Technology

Located in Shanghai, China, ComNav Technology Ltd. develops and manufactures multi-constellation, multi-frequency GNSS measurement engine boards and receivers for ultimate high-precision positioning applications. It is the first Chinese company to have developed, designed and produced combined GNSS (GPS and GLONASS) plus BeiDou OEM boards. With its fast-paced business growth, ComNav is making waves in the global high-precision GNSS industry.

China has a long legacy in astronomy, space exploration and the invention, design and manufacture of precise observation instrumentation, and ComNav Technology Ltd. is

▼ Dr Yongquan Wang.



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.

continuing this tradition. ComNav is located in Shanghai, the commercial and economic centre of China. The company develops and manufactures multi-constellation, multi-frequency GNSS measurement engine boards and receivers for ultimate high-precision positioning applications. ComNav addresses specific demands in four key business areas: intelligent transportation applications; the entire geospatial industry including surveying, geodesy and civil engineering applications; deformation monitoring including the surveillance of man-made infrastructures and natural hazards; and precision farming.

## R&D-DRIVEN

ComNav was founded in March 2012 by Dr Yongquan Wang, who is an undisputed expert within the Chinese high-precision GNSS industry: in 1996, Dr Wang developed the first Chinese GNSS receiver, and in 2008 he developed the first Chinese high-precision GPS OEM

board. As an R&D-driven company ComNav invests 10% of its annual revenue in R&D, and over half of all ComNav employees have extensive experience in high-precision GNSS or engineering. The company currently employs 120 people, and that figure is increasing all the time.

ComNav has enjoyed rapid growth thanks in particular to two important factors. One was the BeiDou navigation satellite system which started deployment in 2012, and the other is the large demand from intelligent transportation systems. Within one year of being founded, ComNav had sold more than 10,000 units of its high-precision GNSS OEM board in the Chinese domestic market. On the day that milestone was passed, ComNav allocated USD15 million to building the largest R&D and manufacturing GNSS plant in China to enable production to keep pace with demand. In 2013, ComNav sold more than 20,000 units of its GNSS OEM board in China, accounting for 25% of the Chinese market. ComNav has already gained a reputation for supplying products with high quality and performance at a fair price. "We just want everyone to be able to invest in and enjoy a highly accurate GNSS receiver which is easy to use and does the job smoothly and efficiently



◀ Bird's-eye view of ComNav GNSS industrial park.



▲ T300 GNSS receiver.

at the right price and without any concession in term of accuracy and reliability. We are quality-driven, and we respect the industry standards in term of file format (RINEX) and data streams (RTCM, BINEX)," says Dr Yongquan Wang.

**INTERNATIONAL EXPANSION**

ComNav is already selling to more than 20 countries, and its customers are happy with the products and the support. Building on this success, the company is now looking to expand further in the international market. In particular, ComNav has defined two important targets. The first one is the OEM board market where ComNav believes the system integrators will enjoy clear documentation, easy plug-in and ultimate robustness with impressive tracking performances. The second one is the integrated GNSS RTK receiver for land surveying and construction. Needless to say, the GNSS reference station receiver will be part of the proposal including a totally fresh, new approach in terms of processing scheme.

ComNav believes that the quality, performance and reliability will make the difference. "We strictly manufacture every piece board/

receiver based on the ISO standard. We have a complete double-step testing process to certify the quality of our products. And for the international market we apply a complete testing cycle after the initial QC to ensure our overseas customers that we are very serious on delivering the excellence," explains Dr Yongquan Wang.

**NEW GENERATION**

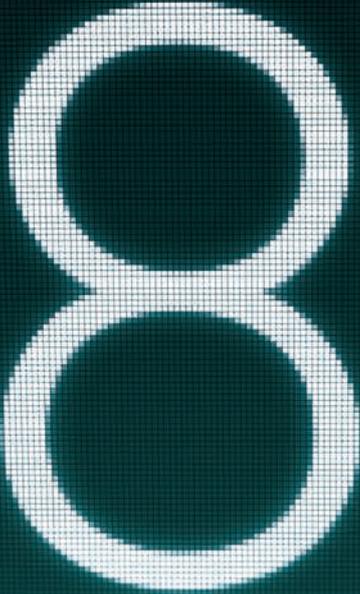
In 2014, ComNav is launching the new-generation RTK GNSS receiver T300 which is based on a totally new concept. It is not only the smallest and lightest of its category but it has also been built with lots of user-friendly functionalities. Considering the growing demands for the geodetic GNSS RTK receiver in Asia, Latin America and Africa, the company expects the T300 to rapidly gain a significant part of the market share thanks to its reliability and quality at affordable and competitive pricing. Likewise, ComNav anticipates that Russia and the Middle East will be equally excited by the newcomer. Meanwhile, in Europe it sees a clear and current need for setting up high-accuracy and reliable instrumentation at the correct pricing level.

ComNav intends to keep focusing on the GNSS core technology with ever-changing GNSS OEM board-integrated abilities (sensors, 4G, Bluetooth, Wi-Fi, embedded applications, etc.), new satellite systems, new processing schemes and other advanced positioning technologies.

**FUTURE AMBITIONS**

In 2015, ComNav will move to ComNav Industrial Park where it will have more space and facilities for continuing to develop and manufacture its large range of GNSS products. With a team of passionate and dedicated people for GNSS technology, ComNav is committed to maintaining its leading position as game rule-breaker to delight engineers and users looking for the ultimate high-precision multi-constellation and multi-frequency GNSS receiver technology. Who better to master the digital signal processing of China's first GNSS constellation, BeiDou, in order to deliver highest-accuracy positions than a Chinese high-tech company? ComNav has the ambition to be the only answer to that question. ◀

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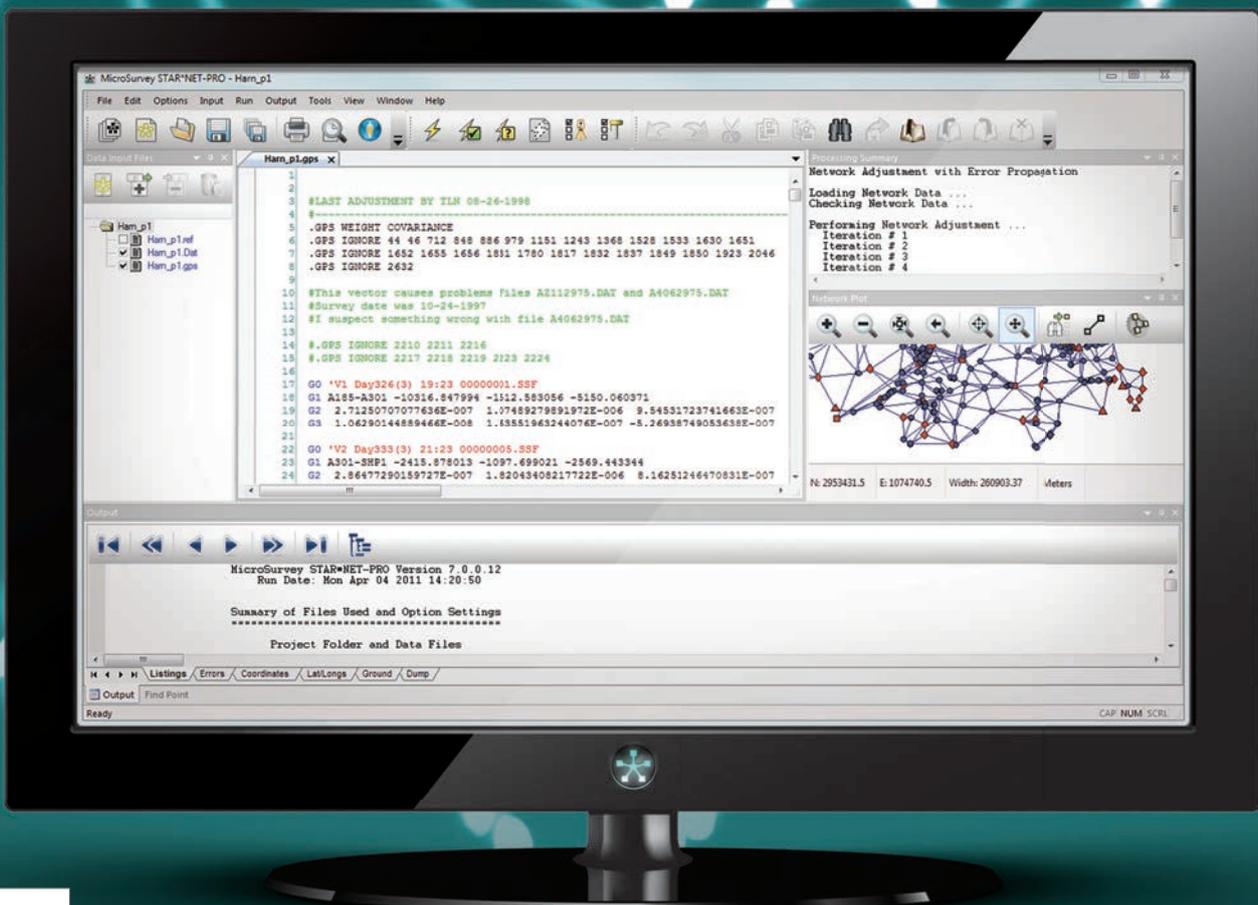
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## The Missing Key to Eradicate Poverty

The European Parliament states that land tenure security and property rights provide an opportunity to improve and consolidate bases for development and poverty reduction in some of the poorest regions of the world. With recognised rights and secure physical assets, farmers, small-business owners, slum dwellers and untitled urban inhabitants would be brought into the formal economy, enabling them to secure their investments and intensify production, access credit and start businesses. Property rights hold the key to sustainable development.

Within this perspective, the European Union (EU), as the leading partner on food security and nutrition, issued guidelines on land policies in 2004 and has financed 92 development projects since then. The EU now strongly supports the application of the Voluntary Guidelines on Responsible Governance of Tenure and the African Frameworks and Guidelines on Land Policies. Furthermore, the European Parliament has recently adopted a report on the role of property rights, property ownership and wealth creation in eradicating poverty and fostering sustainable development in developing countries. This report places land rights at the heart of the EU development policy.

The report emphasises that land tenure reform should begin with accurate land data collection and with systematic titling by means of cadastral mapping using low-cost technologies such as mobile technologies, GPS, GPRS and GIS monitoring tools. It calls for complete openness, and encourages the development and regional



Session on Improving Land Governance in Practice with Stig Enemark second from the left.

sharing of GIS, including satellite and aerial imagery. Technologies for participatory mapping should be taken into account. It congratulates Rwanda on the progress the nation has made with regard to land data, which has made it possible to register all land in the country within a remarkably short period. The report recalls that tenure security can be safeguarded under various forms, provided that the rights of land users and owners are clear. In addition to formal titles, security can be achieved through clear, long-term rental contracts, or formal recognition of customary rights and informal settlements, with accessible and effective dispute settlement mechanisms. Furthermore, the report calls for the EU to channel support towards capacity development and training programmes in land management with the aim of securing land rights for the poor and vulnerable groups, including through cadastral surveying, registration and efforts to equip educational institutions in developing countries.

Against this backdrop, a one-day conference was held at the European Parliament on 9 April 2014 to discuss the future of land policy in developing countries and the role of the international community, and the EU in particular, in the post-2015 development framework.

FIG was represented by Stig Enemark, honorary president, and Jean-Yves Pirlot, president of the Council of European Geodetic Surveyors (CLGE).

Professor Enemark held a brief presentation of the joint FIG/World Bank publication on Fit-for-Purpose Land Administration which was very well received. See the FIG page in the May 2014 edition of *GIM International* for an introduction to this concept, including a case study from Rwanda. ◀

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## The 2014 GSDI Small Grants Program: Early Reflections

Receiving *GIM international* each month gives readers the opportunity to learn about important emerging technologies and some great initiatives that are moving the SDI agenda forward. It can be easy to forget that not all jurisdictions enjoy the technology or the access to information associated with modern spatial data infrastructure. These are simply not affordable nor accessible everywhere – at least, not yet.

Since its launch in 2003, the GSDI Association's Small Grants Program has addressed this gap by supporting more than 100 projects across the globe. Through 2012, the program was sponsored through a partnership between the GSDI Association, the U.S. Federal Geographic Data Committee and the GISCorps of URISA. Three types of awards are available: a cash award of up to USD2,500 per project; SDI/GIS consulting services (offered through the GISCorps) up to the value of USD2,500; or a combination of cash award and SDI/GIS consulting services.

In 2014, funding for four Small Grants projects has been provided by GeoConnections, a national collaborative initiative led by Natural Resources Canada. GeoConnections supports the integration and use of the Canadian Geospatial Data Infrastructure (CGDI), an online resource that improves the sharing of, access to and use of open geospatial information. The CGDI helps decision-makers from all levels of government, the private sector, non-government organisations and academia make better decisions on social, economic and environmental priorities [1].



*Stakeholder analysis of institutions in Uzbekistan involved state cadastres in order to increase awareness on implementation of spatial data infrastructure.*

With the contribution from GeoConnections secured, a Call for Proposals was issued in March 2014. Volunteer reviewers from six continents were involved in assessing 40 proposals from organisations in over 20 countries. Eight proposals came from government agencies, another 17 originated in academic institutions, 5 were from private companies and 10 came from non-governmental organisations (NGOs).

The reviewers had a very difficult time in narrowing the field down to four proposals selected for funding. The majority of the proposals requested assistance in terms of introductory spatial data infrastructure initiatives familiar to most of us, such as data sharing, web portals, metadata creation and institutional cooperation. That said, several dealt with more advanced initiatives relating to application of remote sensing and GIS to support very worthy applications, as well as implementation of advanced geospatial standards, more extensive web-based services, and the next generation of training materials. Rather than cash support, at least 11 proposals were either seeking or would benefit from in-kind support of expertise from GIS Corps members.

In all cases, the reviewers were impressed by the calibre and enthusiasm of the proponents and the teams they had assembled.

So many worthy proposals and so little funding! We are hoping we can still interest some of the GSDI Association's members and other organisations in supporting some of the unfunded proposals. Progress on these and related projects will be discussed in a separate GSDI column in *GIM International* later this year.

*Dr David Coleman is president of the GSDI Association, a professor of geomatics engineering and dean of the Faculty of Engineering at the University of New Brunswick in Canada.*

*Gita Urban-Mathieux is FGDC grants coordinator for the Federal Geographic Data Committee within the US Geological Survey and a member of the Societal Impacts Committee of the Global Spatial Data Infrastructure Association. ◀*

**MORE INFORMATION**

1. [www.geoconnections.nrcan.gc.ca](http://www.geoconnections.nrcan.gc.ca)  
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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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Commission 4 promotes research that leverages current and emerging positioning techniques and technologies to deliver practical and theoretical solutions for a wide range of engineering, scientific and mapping applications.

## The Growing Importance of PNT

Activities carried out by Commission 4 are highly interdisciplinary, and many of these activities are co-ordinated in close co-operation with IAG sister organisations, US Institute of Navigation (ION), International Society of Photogrammetry & Remote Sensing (ISPRS) and the International Federation of Surveyors (FIG). Recognising the central role of GNSS in providing high-accuracy positioning information today and into the future, Commission 4 has a focus on developing tools that enhance and assure the positioning performance of GNSS-based positioning solutions for a range of geodetic and other scientific applications as well as engineering and other societal ones. In addition, Commission 4 promotes the study of back-ups to GNSS and integrated positioning solutions based on conventional and unconventional sensors to assure positioning, navigation and timing (PNT) in GNSS-challenged environments. In the past few years, the scope of Commission 4 has broadened to include geodetic remote sensing, using synthetic aperture radar (SAR), Lidar and satellite altimetry systems for a variety of applications.

One of the primary examples of inter-organisational collaboration is co-sponsorship of professional workshops and seminars, such as the International School on Mobile Mapping. Following on from the first event, the 2<sup>nd</sup> International School on Mobile Mapping will take place at the National Cheng-Kung University, in Tainan, Taiwan, 9-13 June 2014 [1]. This is an interdisciplinary event co-sponsored by IAG Commission 4, FIG, ISPRS and ION. Another example of a highly interdisciplinary and inter-



Flight testing a UAV at the UAV-g 2013 conference in Rostock, Germany; Commission 4 president Dorota Grejner-Brzezinska.

organisational event is the Mobile Mapping Symposium series, with the most recent 8<sup>th</sup> Symposium held in Taiwan in 2013 and the next event to be held in Sydney, Australia, in 2015.

A few recent and upcoming highlights of the numerous activities of Commission 4 include: (1) Sub-commissions 4.1, 4.2 and 4.5 co-sponsored the 2<sup>nd</sup> Joint International Symposium on Deformation Monitoring held at the University of Nottingham, UK, in September 2013; (2) Sub-commission 4.2 co-sponsored the UAV-g 2013 conference, with a focus on the use of unmanned vehicles in surveying, mapping and precision framing applications, held in September 2013 in Rostock, Germany; (3) Sub-commission 4.4 is co-organising the 17<sup>th</sup> General Assembly of WEGENER on Earth deformation and the study of earthquakes using geodesy and geodynamics, to be held in Leeds, UK, in September 2014; (4) Sub-commission 4.5 co-organised the 10<sup>th</sup> International Symposium on Location Based Services at Tongji University, Shanghai, China in November 2013 as well as (5) the International Workshop on GNSS Precise Point Positioning, held in Ottawa, Canada,

in June 2013; and (6) Sub-commission 4.6 co-organised the International Symposium on Planetary Exploration and Sciences and the International Summer School on Planetary Remote Sensing and Geodesy, both held in July 2013 in Shanghai, China.

A major upcoming event is the joint Symposium on Sustaining Land Imaging: UAS to Satellites, which is being co-organised by the ISPRS Technical Commission I, Sensors and Platforms for Remote Sensing, and IAG Commission 4. This event is part of the William T. Pecora Memorial Remote Sensing Symposium, organised by the American Society for Photogrammetry & Remote Sensing, and will be held in Denver, Colorado, USA, from 17-20 November 2014 [2]. ◀

#### MORE INFORMATION

1. <http://conf.ncku.edu.tw/mmt2014>
2. [www.asprs.org/ASPRS-Conferences/blog.html](http://www.asprs.org/ASPRS-Conferences/blog.html)  
[www.2ceegs.ohio-state.edu/IAG-Comm4](http://www.2ceegs.ohio-state.edu/IAG-Comm4)  
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## Ten Years of ICA Reports

This month marks the tenth anniversary of the first appearance of an ICA column in this magazine. In June 2004, the then-president of the International Cartographic Association, Milan Konecny, inaugurated this regular page in *GIM International* devoted to ICA news, views and projects. Since then, 120 articles have been published here describing the work of ICA and the nature of the cartography discipline which it represents in the international arena.

In order to archive this fascinating set of reports, the ICA home page under the Publications tab now presents scanned copies of each of the 120 pages which have appeared. Although ten years is a relatively short period in the history of an organisation which is over 50 years old, this set of *GIM International* columns does reveal developments and progress in the association over a vibrant period of its life.

Much of the day-to-day work of the ICA is undertaken through its topic-specific Commissions which are charged with research, promotion and education in the wide range of subjects related to cartography. The Commissions and their chairs have been a constant presence on the ICA page (always listed on the left). The *GIM International* pages have reported on many Commission activities – conferences and symposia, publications, personalities and office holders, outreach, international collaboration, web presence, contributions to the Association, and research. Commissions have been able to raise their profile and promote their important work through the column. Commissions



The ICA page in *GIM International* has addressed a wide range of topics.

dealing with ‘mainstream’ topics – Maps and the Internet, Mountain Cartography, Geovisualisation, Atlases, User Issues – have been regularly featured. Meanwhile more ‘niche’ interests, which are equally valid in the ICA context, have also been well-reported, e.g. Theoretical Cartography, and Standards. The Association-wide agenda for research, which guides much of the Commissions’ activities, has also been presented.

This page has featured major ICA events which have taken place over the past ten years: General Assemblies which elected both the Commissions and the office-holders of the Association took place in 2007 and 2011. The main international cartographic conferences (ICC) at which these assemblies met (Moscow and Paris) have been described, along with previews and accounts of the successful ICCs between these main symposia – the 2005 A Coruña gathering, the 2009 meeting in Santiago de Chile, and the recent 2013 Dresden conference.

Many of the personalities of ICA – award winners, presidents and vice-presidents, national leaders,

student grant-holders – have been profiled, and member nations have been highlighted, with presentations on national reports of cartographic activity, on map output reflected in exhibitions, on regional groupings and continental initiatives, and on educational, children’s and national society events at a country-wide level.

The increasingly wide range of ICA publications, notably our excellent newsletter (ICA News) and the valuable conference proceedings, has also been noted in these columns. The *GIM International* column is regular, widely read and informative, and therefore can be included in that portfolio of regular ICA publications. Thanks are due to Geomares, the publishers of *GIM International*, for their continuing support of our monthly contribution, and to David Fairbairn who with the help of contributors – notably Commission chairs and the editor of ICA News, Igor Drecki – has written the vast majority of the 120 columns. Here’s to the next ten years! ◀

**MORE INFORMATION**  
[www.icaci.org](http://www.icaci.org)

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## Operational Remote Sensing Applications: Opportunities, Progress and Challenges



*Dr V.K. Dadhwal, president of TC VIII (special address), Dr Raghavaswamy, chairman, ISPRS, Hyderabad Chapter, Dr Shailesh Nayak, ISPRS fellow & secretary, MoES, Dr SSC Sheno, director, INCOIS, Dr Srinivasa Kumar, chair, VIII/11, and Mr Pattabhi Rama Rao, chair, IV/4 at the WG VIII/1 & TC IV/4 workshop on 'Geospatial Data for Disaster and Risk Reduction' from 21-22 November 2013.*

'Operational RS Applications: Opportunities, Progress and Challenges' is the main theme for the ISPRS TC-VIII mid-term symposium which will be held at Hyderabad, India, from 9-12 December 2014. The mid-term symposium will focus on the operational applications of remote sensing in the nine Working Groups [1] of the TC. Participants are encouraged to share success stories, methodologies, challenges and experiences gained in the process of undertaking remote sensing applications. The focus will be on the entire chain of RS-based application services as well as methodology gaps and likely application scenarios with many missions in the pipeline. Contributions are also invited on the challenges associated with the standardisation of methods, operationalisation, upscaling and

in-house use by governments, official agencies and other stakeholders for timely and effective decision-making.

Discussions at the mid-term symposium will also form the basis for the ISPRS Congress to be held in 2016, enabling an improved roadmap for enhanced utilisation of the remote-sensing products and services. The mid-term event will organise the sessions in the form of presentations of scientific and technical papers, technical tours, scientific and commercial

exhibitions as well as TC VIII Working Group officers' meetings, besides bringing out publications.

For further information, please go to the TC VIII Mid-term Symposium website [2]. ◀

**MORE INFORMATION**

1. [www2.isprs.org/commissions/comm8/wgs.html](http://www2.isprs.org/commissions/comm8/wgs.html)
  2. [www.nrsc.gov.in/technicalcommission8.html](http://www.nrsc.gov.in/technicalcommission8.html)
- [www.isprs.org](http://www.isprs.org)



## Future events

► **JUNE**

**HxGN LIVE Conference**  
Las Vegas, NV, USA  
from **02-05 June**  
For more information:  
W: <http://hxgnlive.com/index.htm>

**GeoDATA 2014**  
Brussels, Belgium  
on **03 June**  
For more information:  
E: [geodata@geoaware.info](mailto:geodata@geoaware.info)  
W: [www.geoaware.info](http://www.geoaware.info)

**GEOSummit 2014**  
Bern, Switzerland  
from **03-05 June**  
For more information:  
E: [dkatzer@geosummit.ch](mailto:dkatzer@geosummit.ch)  
W: [www.geosummit.ch/de/index.html](http://www.geosummit.ch/de/index.html)

**17th AGILE Conference**  
Castellon, Spain  
from **03-06 June**  
For more information:  
E: [agile2014@uji.es](mailto:agile2014@uji.es)  
W: <http://agile-online.org>

**SPAR Japan 2014**  
Kawasaki, Japan  
from **04-05 June**  
For more information:  
E: [info@SPARPointGroup.com](mailto:info@SPARPointGroup.com)  
W: [www.sparpointgroup.com/Japan-2014](http://www.sparpointgroup.com/Japan-2014)

**UAS Anwenderforum Deutschland**  
Gelsenkirchen, Germany  
from **04-05 June**  
For more information:  
E: [info@air-verband.de](mailto:info@air-verband.de)  
W: <http://kongress.psv.io/impressum.html>

**2014 World Geospatial Developers Conference (WGDC)**  
Beijing, China  
from **11-12 June**

For more information:  
E: [longwei@3snews.net](mailto:longwei@3snews.net)  
W: <http://wgdc2014.3snews.net/en>

**Optech's 7th International Terrestrial Laser Scanning User Meeting**  
Rome, Italy  
from **12-13 June**  
For more information:  
E: [conference@optech.com](mailto:conference@optech.com)  
W: [www.optech.com/ugm2014](http://www.optech.com/ugm2014)

**5th International Conference on Cartography & GIS**  
Riviera, Bulgaria  
from **15-21 June**  
For more information:  
E: [bgcartography@gmail.com](mailto:bgcartography@gmail.com)  
W: <http://iccgis2014.cartography-gis.com/home.html>

**EARSeL & ISPRS Young Scientist Days 2014 accompanied by: 2nd Polish Student Conference on Geoinformatics and RS**  
Warsaw, Poland  
from **16-19 June**  
For more information:  
E: [monika.kacprzyk@student.uw.edu.pl](mailto:monika.kacprzyk@student.uw.edu.pl)  
W: [www.earsel.org/symposia/2014-symposium-Warsaw/YoungScientistDays.php](http://www.earsel.org/symposia/2014-symposium-Warsaw/YoungScientistDays.php)

**INSPIRE Conference 2014**  
Aalborg, Denmark  
from **16-20 June**  
For more information:  
E: [inspire-info@jrc.ec.europa.eu](mailto:inspire-info@jrc.ec.europa.eu)

**XXV FIG International Congress 2014**  
Kuala Lumpur, Malaysia  
from **16-21 June**  
For more information:  
E: [fig@fig.net](mailto:fig@fig.net)  
W: [www.fig.net/fig2014](http://www.fig.net/fig2014)

► **JULY**

**AfricaGEO 2014**  
Cape Town, South Africa  
from **01-03 July**  
For more information:  
E: [aparker@ruraldevelopment.gov.za](mailto:aparker@ruraldevelopment.gov.za)  
W: [www.africageo.org](http://www.africageo.org)

**FIG-Charting and Mapping the Pacific Paradise of the Pitcairners Conference**  
Norfolk Island, Australia  
from **06-10 July**  
For more information:  
E: [maria@travelcentre.nlk.nf](mailto:maria@travelcentre.nlk.nf)  
W: [www.fig.net](http://www.fig.net)

**Esri International User Conference 2014**  
San Diego, CA, USA  
from **14-18 July**  
For more information:  
W: [www.esri.com](http://www.esri.com)

**FOSS4G Europe**  
Bremen, Germany  
from **15-17 July**  
For more information:  
E: [foss4g-europe-board@googlegroups.com](mailto:foss4g-europe-board@googlegroups.com)  
W: [www.foss4g-e.org](http://www.foss4g-e.org)

**ESA INTERNATIONAL Summerschool on GNSS 2014 in conjunction with the JRC Summerschool on GNSS**  
Ostrava, Czech Republic  
from **21-31 July**

For more information:  
E: [esa.conference.bureau@esa.int](mailto:esa.conference.bureau@esa.int)  
W: [www.congrexprojects.com/2014-events/14m34/introduction](http://www.congrexprojects.com/2014-events/14m34/introduction)

► **AUGUST**  
**Brazilian Cartographic Congress**  
Gramado, Rio Grande do Sul, Brasil  
from **03-07 August**  
For more information:  
E: [contato@cartografia.org.br](mailto:contato@cartografia.org.br)  
W: [www.cartografia.org.br](http://www.cartografia.org.br)

► **SEPTEMBER**  
**Latin America Geospatial Forum**  
Mexico City, Mexico  
from **22-25 September**  
For more information:  
E: [info@lagf.org](mailto:info@lagf.org)  
W: [www.lagf.org](http://www.lagf.org)

► **OCTOBER**  
**Intergeo 2014**  
Berlin, Germany  
from **07-09 October**  
For more information:  
E: [dkatzer@hinte-messe.de](mailto:dkatzer@hinte-messe.de)  
W: [www.intergeo.de](http://www.intergeo.de)

**UAV Show Europe**  
Merignac, France  
from **07-09 October**  
For more information:  
W: [www.uavshow-europe.com](http://www.uavshow-europe.com)

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Trea Fledderus, marketing assistant, email: [trea.fledderus@geomares.nl](mailto:trea.fledderus@geomares.nl)

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