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In-depth interview with Lena Halounová

Director of the XXIII ISPRS Congress

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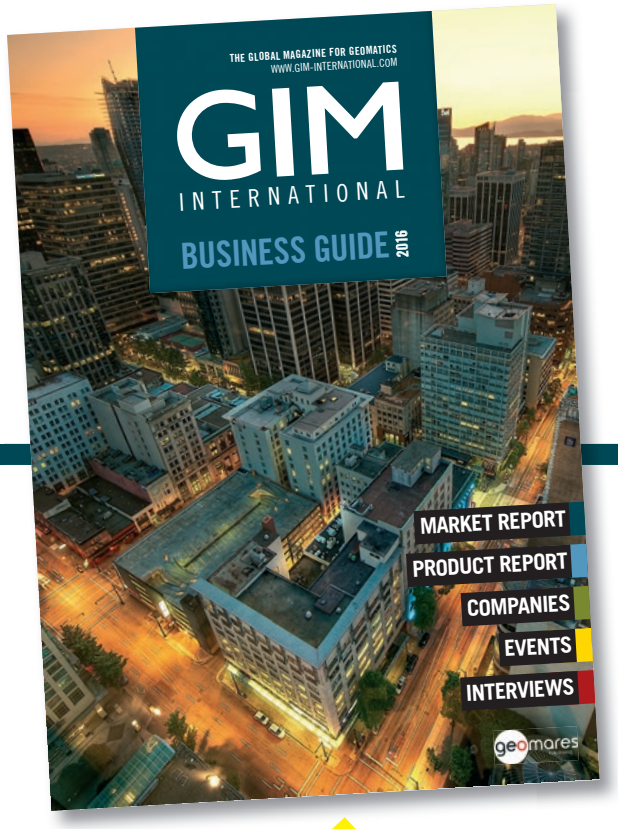

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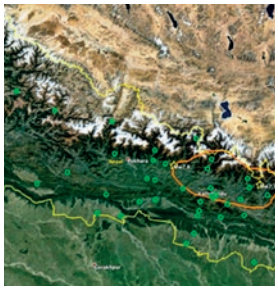

This month's front cover shows the crew of Czech company UpVision releasing a UAV to map the area around Prague Castle. The famous St. Vitus Cathedral is visible in the background. This edition of *GIM International* contains an interview with Lena Halounová, director of the ISPRS 2016 Congress that will be held in Prague. (Photo: UpVision)

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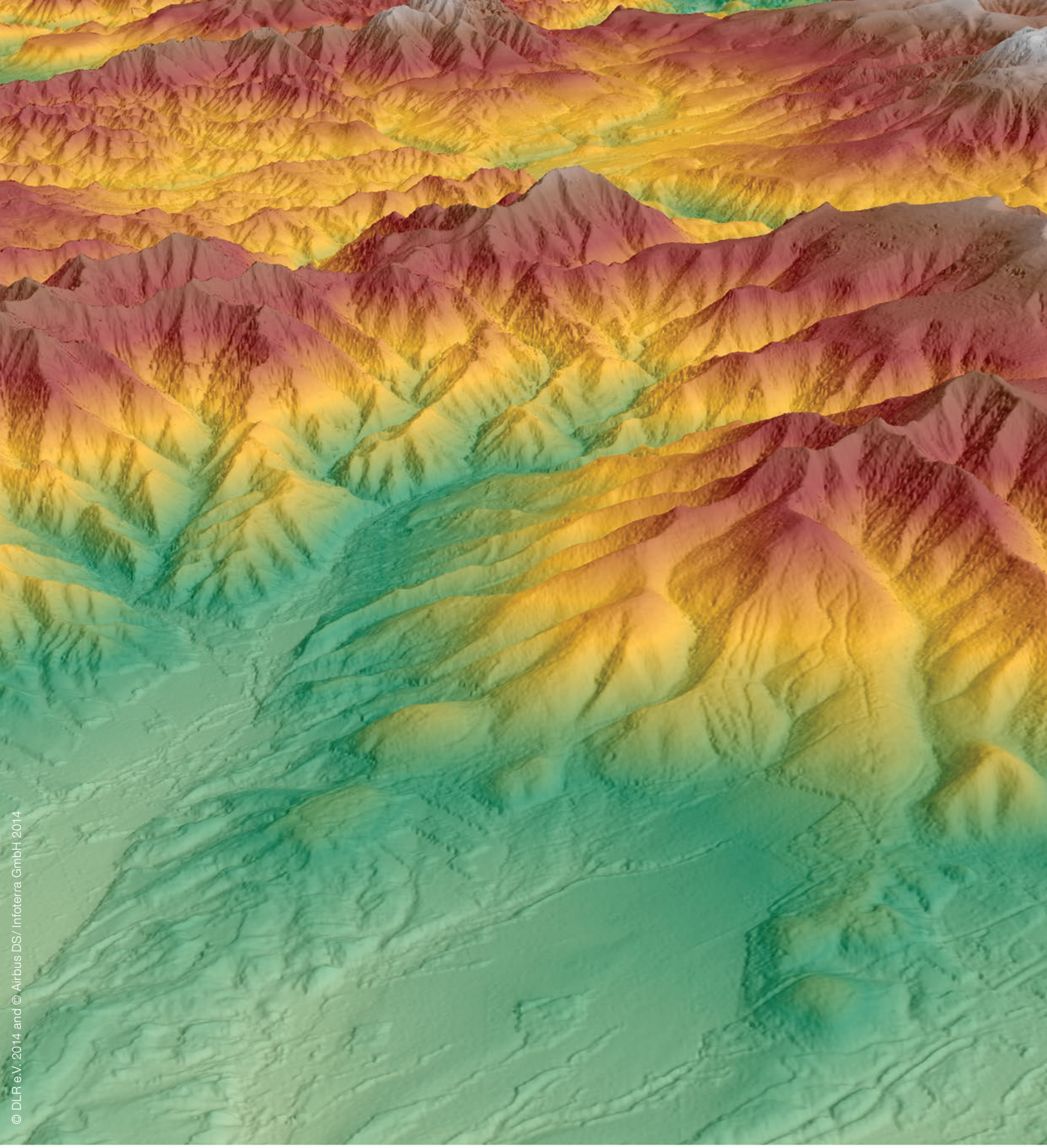

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Gardening

Putting geomatics in a day-to-day perspective can be an immense help in getting people to understand the possibilities. Some of the most complex techniques appear simple and straightforward and become immediately desirable once it is demonstrated that they make life easier. The interview on page 16 of this edition of *GIM International* is with Lena Halounová, associate professor in the Faculty of Civil Engineering at the Czech Technical University in Prague and head of the Remote Sensing Laboratory. She is also elected director of the XXIII ISPRS Congress, which will take place in Prague in 2016. When our editorial manager, Wim van Wegen, asked her how she envisions the future of the field of geomatics, she shared an example of applying photogrammetry, remote sensing and spatial sciences in her garden to relieve some of the stress in her busy life. Professor Halounová imagines using photogrammetry to create a detailed 3D model of her garden, including which parts are sunny and shaded, and when. Remote sensing repeatedly determines the health status of the flowers, trees and lawn. The model compares the change in status between "before" and "now" and classifies any problems. The model then sets the garden sprinkler with a certain chemical composition. Remote sensing also determines when to water, cut the grass, use herbicide, etc. Spatial science controls the growth of trees and which sprinklers should water the garden in the case of dryness. Professor Halounová: "It seems like a wild idea, but if you start to analyse other problems you will find many areas where all three sciences can be applied. And it's important for all of us to reduce the use of water and herbicides, isn't it?" Sometimes all it takes to answer the question is to ask it.


Photography: Arie Bruinsma

▲ *Durk Haarsma, publishing director*

At *GIM International* we are taking a similar approach with our upcoming GIM International Summit; we are thinking through and exploring the possibilities that the several sub-fields of geomatics could hold for real-world problems like migration, food security, urbanisation and social justice. In Lena Halounová's example, the problem and the solution come from the same source, since the remote sensing professor is a fervent gardener herself. At the Summit we are inviting speakers from the aforementioned sub-fields to set the scene and describe the problem, but it is the task of the delegates to come up with solutions. In other words, this will not be a conference where delegates are invited to just sit back and absorb the presentations; there's some work involved for them as well. Based on my experience over the years, I know that geoprofessionals generally care a lot about our planet and its wide variety of inhabitants, so here's my invitation: let's come up with those innovative solutions for gardens – big or small – all over the world. If you're prepared to rise to the challenge, please go to the Summit website, www.gimsummit.com, and register for this innovative geomatics event.

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No 2913

How Big is Global Insecurity of Tenure?

World Statistics Day, as declared by the United Nations Statistical Commission, was celebrated on 20 October 2015. Official statistics are crucial to help decision-makers develop informed policies that impact millions of people. Improved data sources, sound statistical methods, new technologies and strengthened statistical systems enable better decisions that eventually result in better lives for us all. One of the #StatsDay15 tweets highlighted that "70% of the world's population have no access to formal land administration services and have no security of tenure". This particular statistic both intrigued and worried me since I know the source of the figure.

It intrigued me because I obtained the statistic from Willie Zimmermann who, in conjunction with UN-FAO, took an educated guess at the figure. I then published the statistic with a caveat in my 'Crowdsourcing Support of Land Administration' paper in 2011. That statistic has now become a de facto standard that is quoted globally. Most people are surprised by the extent of global insecurity of tenure and the headline figure is very effective at raising awareness and support for global land issues.

However, it also worried me because this statistic is the best that we have. The land sector has not been good at monitoring progress of the global initiatives in fighting insecurity of land governance and tenure, but now there is no hiding. Solving land issues is on the radar of the G8, has been reflected in the adopted Voluntary Guidelines on the Responsible Governance of Tenure and, after a successful lobbying campaign, land is integrated into the post-2015 Sustainable Development Goals (SDGs). This tenuous 70% statistic highlights the challenge for the land sector to design and implement global land indicators and monitoring frameworks associated with land governance and land tenure security that are based on feasible data sources and data collection strategies. Even agreeing a global set of concepts and definitions is problematic!

Traditional sources of data, e.g. administrative data, national census and household surveys and global polls, to support land indicators for national statistical systems are currently limited, expensive and do not normally have the outreach to the most vulnerable. New, innovative sources of data need to be explored to create a much more comprehensive and meaningful set of statistics that are technically feasible, politically acceptable and obtain stakeholder ownership. Smartphones, satellite imagery, social media and the Internet of Things are continuously generating data everywhere, faster and more detailed than ever before. These technologies offer new measurement opportunities and challenges for the land sector.

A number of innovative land tenure initiatives are using this new technology and encouraging citizens and communities to directly record their evidence of land rights on global platforms, outside of the formal land administration systems. Cadasta Foundation is developing a global platform to record and manage crowdsourced land rights, for example, and Rights Resource Initiative is creating a global baseline of indigenous and community land rights. Pervasive smartphones could be used to capture perceptions on insecurity of tenure across populations not included in official statistics. However, their success in closing the land information gap is dependent upon convincing citizens to trust these solutions and understand the benefits of participation. Privacy and security of information is paramount. If not managed effectively, these sources of information will be switched off.

These are the challenges facing the Global Land Indicator Initiative meeting in Nairobi, Kenya, in November 2015 to find solutions to better our de facto 70%.

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No 2906

AibotX6 Version 2 with High-precision GNSS

Ahead of this year's Intergeo in Stuttgart, Aibotix (Germany) presented high-precision GNSS as a solution for high-precision surveying with Version 2 of its hexacopter AibotX6. The release of the system, which can also be installed in existing AibotX6 hexacopters as Version 2, was announced at this year's HxGN Live in Las Vegas and will be available as a serial product following the completion of all field trials.

▸ **http://bit.ly/1k9k15F**

Version 2 of the AibotX6.

Intergraph SG&I Becomes Hexagon Safety & Infrastructure

Intergraph's Security, Government & Infrastructure (SG&I) division has rebranded globally as Hexagon Safety & Infrastructure. The new name more closely aligns the business and its industry-leading solutions with parent company Hexagon. Since acquiring Intergraph in 2010, Hexagon has made many strategic and beneficial investments in safety and infrastructure solutions, varying from research and development to acquisitions and partnerships. According to the company those investments have helped to meet the needs of governments and service providers around the world – improving operations, enhancing enterprise-wide information and reducing the total cost of ownership for mission-critical and business-critical IT systems.

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No 2903

Aerial Mapping Project on Impact of Vegetation on Electricity Network

In the UK, Bluesky has completed a multi-million pound aerial mapping project to assess the impact of vegetation on the electricity network of East Anglia and the South East of England. Working on behalf of UK Power Networks, Bluesky undertook what is reportedly the largest ever combined laser mapping and aerial photography survey commissioned by an electricity distribution network operator in the UK, comprising some 34,000 square kilometres.

▸ http://bit.ly/1k9kNiX

Lidar survey plane.

Geo-matching.com Database Exceeds 1,000 Products

Geo-matching.com has developed steadily since its introduction in 2012 and is now the largest product database with 252 suppliers, 42 product categories and 1,002 products. Just some of the categories on offer include Digital Aerial Cameras, GNSS Receivers, Mobile GIS Systems – Hardware and Software, Mobile Mappers, Photogrammetric, Imagery Processing Software, Point Cloud Processing Software, Remote Sensing Image Processing Software, Terrestrial Laser Scanners, Total Stations, and UAS for Mapping and 3D Modelling.

▸ http://bit.ly/1k9l0rn

Geo-matching.com

Easter Island Mapped by UAVs

G-Wing, an unmanned aerial system developed by IDETEC, has covered the whole of Easter Island – 41,250 acres – in the south-eastern Pacific Ocean in about a week. The operation was conducted to obtain high-resolution orthomosaics and digital surface models of the island to support archaeology efforts, as required by the Chilean National Monuments Council. The project was executed by two AG-Wing UAVs flying simultaneously and equipped with standard 20mp RGB sensors. The last flight of the project took place on 27 September 2015.

▸ http://bit.ly/1k9lrx9

The G-Wing UAS.

RIEGL Silver Sponsor of GIM International Summit

The organising committee of the GIM International Summit is proud to announce that RIEGL has been confirmed as silver sponsor. "With 30 years of experience as one of the most recognised pioneers in the research, development and production of laser scanners, rangefinders and distance meters, the company perfectly matches with the forward-looking approach of the Summit," said Durk Haarsma, publishing director of *GIM International* which has initiated the event.

The GIM International Summit will be held on 10-12 February in Amsterdam, The Netherlands. Based on the concept of 'inside looking out', thought leaders and opinion-makers from not only inside but also outside the field of geomatics will gather in Amsterdam to explore how they believe the industry should develop.

GIM International Summit Programme Nears Completion

With the addition of Joyeeta Gupta to the speakers' list, the programme for the GIM International Summit has moved another step nearer to completion. The themes for the workshops are also increasingly taking shape. Confirmed topics for the workshop sessions include: climate change, integration for geo-ICT, urban planning, and food security & agriculture.

Joyeeta Gupta is based in The Netherlands as a professor of climate change law and policy at VU University Amsterdam and of water law and policy at the UNESCO-IHE Institute for Water Education in Delft. Her expertise is in the area of environmental law and politics. She is editor-in-chief of *Environmental Agreements: Politics, Law and Economics.* Gupta was lead author in the Intergovernmental Panel on Climate Change, which shared the 2007 Nobel Peace Prize with Al Gore, and of the Millennium Ecosystem Assessment. The speakers' line-up further includes Hans Rosling, Ed Parsons, Daniel Steudler, Pier Vellinga, Morten Jerven, Vanessa Watson and Geert Bouckaert.

RICS Joins as Conference Partner

The Royal Institute of Chartered Surveyors (RICS), one of the world's leading professional bodies for qualifications and standards in land, property and construction, has been confirmed as partner of the GIM International Summit. The RICS accredits 118,000 survey professionals, and any individual or firm registered with RICS is subject to its quality assurance.

James Kavanagh, director of RICS, stated: "Our geospatial industries have many threats and opportunities before them and one of the best ways to help develop our future profession is through collaboration and knowledge transfer. There are numerous geo-specific conferences and events around the world but we believe by reaching out to kindred sectors such as housing, planning, technologists and future trendsetters the forthcoming GIM International Summit is taking a tentative but brave step in this direction. It's time to start a serious conversation with our client base and we believe the GIM International Summit can help to provide this platform. RICS has no hesitation in supporting and taking part in this groundbreaking event. Fortune always favours the brave."

GIS Coalition to Aid Removal of Land Mines

Esri and the Geneva International Centre for Humanitarian Demining (GICHD) have signed a memorandum of understanding (MoU), strengthening a partnership to eliminate land mines and explosive remnants of war through the power of geography. The MoU furthers Esri's support in modernising GICHD's Information Management System for Mine Action (IMSMA). Built with Esri's world-leading GIS technology, the software system serves a critical purpose in the mine action process: understanding exactly where mines are located prior to conducting clearance.

▸ **http://bit.ly/1k9ksNr**

Stefano Toscano and Jack Dangermond.

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

1. Innovation at the Heart of Geospatial Growth Strategy - http://bit.ly/1jQpu1n
2. GPS for Land Surveyors: No Formulas Needed - http://bit.ly/1Xy4ESH
3. Mapping Flood Vulnerability - http://bit.ly/1Xy4wmj
4. Pioneering Location with an Out-of-the-box Approach - http://bit.ly/1PC3OiO
5. Benefits of Sweeping Airborne Cameras - http://bit.ly/1jQpC0U

Building Radar Becomes Copernicus Master

Tuesday 20 October 2015 was certainly a day to remember for the Munich-based start-up Building Radar, which provides a global, satellite-based online database for new construction projects. The company secured two prizes in the Copernicus Masters international Earth observation competition. Building Radar first won the European Space Imaging High-Res Urban Challenge and then went on to be named the overall winner, becoming this year's Copernicus Master.

▸ **http://bit.ly/1XsXOc6**

Copernicus Master of 2015.

YellowScan Demo Day Goes down a Treat

On Friday 2 October, coinciding with the last day of the ISPRS GeoSpatial Week, YellowScan hosted a demo day at its location near Montpellier, France. Guests attended from all over the world, ranging from academic research (University of Cambridge, Athabasca University, IRSTEA) to aerial survey (Australia) and civil engineering (Finland). They witnessed how easily and quickly high-accuracy 3D data can be acquired with the ultra-light YellowScan Lidar system, whether to monitor power lines or to uncover ruins or small ditches under vegetation.

▸ **http://bit.ly/1XsTOgE**

Field demonstration of the YellowScan Lidar system.

what3words Joins Forces with Safe Software

The FME software solution.

FME, the spatial data transformation technology created by Safe Software, now supports the innovative location-referencing system, what3words. Don Murray, president of Safe Software, said the collaboration with what3words helps to provide a way for people to integrate this new solution into their existing data and gives FME users a new option for identifying location information.

▸ **http://bit.ly/1k9mOff**

5 Questions to...

Steven Ramage

Steven Ramage serves as the conference chair of the GIM International Summit. We asked him 5 questions about the first edition of this new geomatics event, being held from 10-12 February 2016 in Amsterdam, The Netherlands.

You will serve as chair of the GIM International Summit in February 2016. Can you tell us why you agreed to take on this role?

I had a discussion with the team putting together the agenda and I liked the approach. I have chaired several events in the last year and I'm increasingly finding myself working outside the geospatial sector (more on technology and education). I've still been working on topic, i.e. what does geospatial enable, but speaking more to people who can benefit from geospatial tools, technology and services as opposed to those developing and selling them (which is still mainly what I do). I've also been a reader of *GIM International* for almost 15 years, so I know that the people behind it have a wealth of knowledge and experience to share.

What distinguishes the GIM International Summit from all the other conferences?

Its focus on global topics, such as Water, Food Security and Social Justice, and hopefully its ability to link the conference themes to other major activities, such as the United Nations Sustainable Development Goals (SDGs).

Which part of the programme are you particularly looking forward to?

For me there are probably three key areas: firstly, learning from some of the fabulous speakers that are lined up to talk, such as Hans Rosling; secondly, sharing my own story around what3words and how we are tackling the problem in poorly and inadequately addressed countries; and finally, networking. I attend events all over the world and I try to choose the most useful ones for developing new contacts. The GIM International Summit is setting out its stall to be one such event.

The Summit will be based on the concept of 'inside looking out'. Is there a need for a different approach?

I guess it depends on what you are trying to achieve. If we really want to tackle global challenges and show the value and importance of geomatics and geospatial technologies then we need to step beyond 'looking out'. It feels to me as if I have been attending conferences doing only that for 20 years. I attended a UN conference a few years ago in Thailand and presented to around a thousand attendees. They were blown away by the power of location and had no idea about the possibilities. This to me is the point we have reached and the requirement is to educate others who are 'outside looking in'.

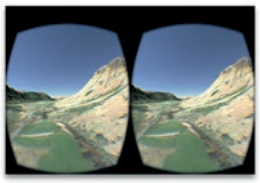
Why do you think it is important for your colleagues and peers to sign up for the GIM International Summit?

There are the obvious benefits of networking and knowledge sharing that I have already mentioned, but I also think we need to learn how to communicate better with policymakers and decision-makers in government and industry. I believe the GIM International Summit will offer guidance and ideas on how to do this, so therefore I would encourage industry colleagues to attend. And Amsterdam is also a beautiful location!

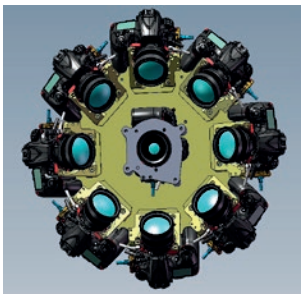
Ordnance Survey Data Gives Reality to a Virtual World

The spectacular setting of Ben Nevis provides the backdrop for an Oculus Rift game created by Ordnance Survey (OS) developers in which players race against the clock to find a hidden trig pillar. The recreation of Britain's highest mountain has been constructed by OS at 1:4 scale using OS data and covers an area of 10km x 10km. Britain's mapping agency, with a 224-year history of collecting and using data in imaginative and useful ways, has also released a virtual reality (VR) tour of the same rugged Ben Nevis mountainscape that is featured in OS's Oculus Rift game. The virtual tour is available for both iOS and Android devices to be used with Google Cardboard.

▸ **http://bit.ly/1XsU1R3**



Virtual-reality view of Ben Nevis.



Octoblique MIDAS survey camera.

Lead'Air Launches 360-degree Coverage Survey Camera

Lead'Air, the manufacturer of Track'Air aerial survey products, is unveiling a new 9-camera MIDAS system with 1 vertical camera and 8 oblique cameras covering a true 360 degrees. Instead of the classic arrangement with 4 oblique cameras, facing forward, backward, left and right, the new Octoblique MIDAS adds 4 additional oblique cameras which fill the gaps, thus doubling the amount of oblique photos collected without an increase in flying time. With 8 cameras spaced at 45 degrees from each other instead of 4 cameras spaced at 90 degrees, the Octoblique looks in all directions around the aircraft and generates twice as many oblique views as any other system, leaving no angular blind spots uncovered.

▸ **http://bit.ly/1XsVwP7**

Geodesy, Water and War

The branch of science dealing with obtaining precise measurements of the Earth, mapping points on the surface and studying its gravity field is known as geodesy. One of the advanced offshoots resulting from the efforts of geodetic scientists is the Grace Mission (Gravity Recovery and Climate Experiment), a joint German and USA undertaking. Grace consists of a constellation of two identical satellites launched in March 2002. The twins, nicknamed 'Tom & Jerry' by the press, follow each other 220km apart in a near-circular polar orbit and the instruments on board continuously measure the distance between the two satellites in a very accurate manner. Changes in the distances measured reveal variations in the Earth's gravity field. Analysing the changes thus provides insight into the dips and bumps of the gravity field and enables monitoring of how gravity changes affect Earth's natural systems over time.

Fresh water is the most valuable resource on Earth but its volume is limited. Food supplies and human, animal and plant health heavily depend on the availability of high-quality water. Humanity could survive for centuries without oil, gas and coal, but without water people would be doomed. No water means no life. A lot of fresh water is stored in aquifers, i.e. bodies of permeable rock that can contain or transmit groundwater. The Grace measurements provide clues for determining changes in the amount of water stored in groundwater basins.

In a joint effort, researchers from NASA and other institutions analysed the Grace gravity data which they derived from the distances measured at an altitude of 500km and reported their findings in *Water Resources Research* (mid-June 2015). About one third of Earth's largest groundwater basins are being rapidly exhausted by exploitation for human use, including irrigation, manufacturing and domestic use, they observed. The most overstrained aquifers are in the world's driest areas, where people draw strongly on water tapped from aquifers. The Arabian aquifer system, a vital resource for over 60 million people, the Indus Basin aquifer of north-western India and Pakistan and the Murzuk-Djado Basin in northern Africa are the most overstrained in the world, respectively in that order. The Grace mission also revealed that in the period 2003-2010 Iran, Iraq, Syria and parts of Turkey lost nearly 150 billion cubic metres of stored fresh water; this equates to the amount of water households in the Americas and Europe together flush through their toilets annually. This observation begs the question: What happens when a highly strained aquifer is located in a territory with high geopolitical or socioeconomic tensions? History provides the answer: violent confrontations erupt over access to water resources and can escalate into wars. Conflicts over water quadrupled in the last decade, and they are increasing because of population expansion and lack of good governance. Is it an exaggeration to state that water shortages lie at the heart of the present migration wave from the Middle East to Europe? Add to this the impact of climate change and the risk of war will surge in the coming years. Not only will the Middle East, northern Africa and southern Asia increasingly face shrinking water stocks but also the western and central parts of the US and southern Europe will experience water scarcity and desertification. Watering crops and playing fields, cleaning cars and buildings and manufacturing textile materials – all these activities take fresh water from the same waning supply. Water shortages threaten food security and access to safe drinking water, which puts a further burden on governors fraught with tackling poverty and appeasing social clashes. The geodetic mission, called Grace, has issued authorities and global leaders with a wake-up call to think about the effects of shrinking water stocks and to negotiate peaceful solutions. ◂

GIM INTERNATIONAL INTERVIEWS LENA HALOUNOVÁ

Celebrating Progress in a Historic City

From 12 to 19 July 2016, a major event in the geomatics field will be held in Prague, a city with a uniquely preserved historical centre that is on the UNESCO World Heritage List. *GIM International* took the opportunity to interview Lena Halounová, director of the XXIII ISPRS Congress – about Prague and the ISPRS, but also about how photogrammetry, remote sensing and spatial sciences are strongly supporting the future of our planet.

Thanks for taking the time to talk to us. I'm sure you're very busy with the preparations for the 2016 ISPRS Congress in Prague, aren't you?

Thank you. Yes, as you can imagine, preparing for the Congress is a long process but many colleagues from the Czech Society for Photogrammetry and Remote Sensing and from my department have been helping me from the very beginning. The ISPRS Council members, Technical Commission presidents (TCPs), presidents of the International Programme Committee and Working Group (WG) officers are all another source of great support. We already have about 500 reviewers in the Paper Reviewing system, where individual authors can submit their full papers or abstracts. The reviewers were selected by the WG officers and approved by the TCPs and their reviews will be of immense help – and that all within the space of one month! I would like to express a big thanks to all of them since they will create the entire Congress. As for me, I'm just coordinating all the individual steps and tasks and trying to create the final mosaic of the Congress.

▲ *A bird's-eye view of the Prague Castle area. (Photo: Upvision)*

During the 2012 ISPRS Congress held in Melbourne, Australia, Prague was elected as venue for the 2016 Congress. What were the decisive arguments for this choice?

That question should really be answered by those who voted at the General Assembly (GA) in Melbourne! I think there were several reasons. I guess that one of them was that Prague is such a beautiful city but one which isn't visited so often and by so many people as Paris, for example. I believe that I convinced members of the GA that the Czech Republic would be able to organise the Congress successfully and that the city would help to attract many participants.

What will be the main focus of the ISPRS Congress in Prague?

The main focus of the Congress is to show new progress in areas where the pace of development is breathtaking. Nearly everybody uses smartphones nowadays – most of them including maps – for finding the shortest or quickest route or to measure the distance travelled. Where does that function come from? Do you remember when you heard about digital navigation on smartphones for the first time? And how many

users of this tool are there worldwide today? Billions of people around the world have never heard of ISPRS or photogrammetry, but most of them use a navigation system or weather forecast maps. And what about the 'smart' car – the driverless vehicle? How is that possible? It's a combination of many sciences, but photogrammetry plays an important role in terms of determining the spatial position of the moving car on the road from a safety perspective. These are just a few of the topics our scientists are involved with to monitor, analyse, develop and preserve Earth and to protect humankind. I could give you thousands of examples of such 'secret' applications of our work.

What are your ambitions for the 2016 ISPRS Congress and why should geomatics professionals attend the congress and exhibition?

The Congress will be a meeting place for the world's top scientists in our field, including participants from other sister organisations like cartographers and geodesists from FIG and IAG, and experts from UNISDR and UNOOSA. ISPRS is organising forums for experts from National Mapping and Cadastral Agencies (NMCA) and Space Agencies (SA). These two forums will not only have separate sessions, but also common sessions to analyse demands and opportunities for the successful continuation of their cooperation. These forums are supported by UN-GGIM (NMCA) and IAF (SA). The Congress will also give the floor to young scientists. The ISPRS Student Consortium is preparing its scientific programme called Youth Forum. The best paper and poster authors will receive awards from ISPRS. Summer School and Tutorials represent the educative part of the Congress. There are additional activities prepared for participants, such as CATCON. The Congress will host top speakers from various countries during the plenary sessions. We believe that scientists will find inspiration for new projects, exhibitors will find new clients, participants will find new products, students will find support to continue in research and everyone will have enough time for scientific and non-scientific discussions and for enjoying good food, interesting Technical Tours and Optional Tours.

Can you tell us more about the exhibition?

The exhibition will be organised in the refreshment/lunch area outside the rooms where the Congress sessions are held, and will host many companies from all over the world, including a large group of them from Asia and particularly from China. The exhibitors can use the 'Hyde Park spot' for short presentations during all coffee breaks. They can also prepare presentations for commercial sessions. We are devising a game for participants who will be visiting booths and using the Congress App on their smartphone.

What can ISPRS Congress attendees expect in terms of the social programme?

The social programme is always a very important part of the Congress. The offering will include a theatre performance, concert, boat trip, welcome reception and ice-breaking party for the Student Consortium. The Exhibitors' Reception is an integral part of the Congress and is open to all participants. The Gala Dinner will be organised in one of Prague's most beautiful palaces, where the aristocracy held balls in the 19th century.

This will be the 23rd ISPRS Congress, with its history spanning more than 100 years and five continents. Isn't it about time for an ISPRS Congress in Africa?

That is a very valid idea. Africa is a very important continent for ISPRS, with many users of remote sensing, photogrammetry and spatial sciences. They are working very hard and ISPRS would like to strengthen their involvement in ISPRS. Many specialists around the world have worked on projects in Africa and have presented details of them at our congresses, so that can be one of the many reasons to organise the Congress in Africa in order to reach a larger local community. Local experts always form a strong group of Congress participants. I think it is necessary to work on it within the next ISPRS Council to find a dedicated volunteer to prepare the 2024 Congress bid. Why do I say "dedicated volunteer"? After spending just over three years on Congress preparation and one year on preparing our bid, I know

that the congress organiser has to have very strong support from ISPRS and the country and home organisation. The Congress takes up all your time, leaving you with no income and many expenses for a long period. You have to love travelling because you have to promote the Congress all over the world. You have to learn many new details connected to paper reviews and ISPSR rules and learn to collaborate and communicate with people on different continents mainly by email, etc., etc.

ISPRS is putting an incredible amount of effort into the publication and distribution of scientific articles and the organisation of conferences and symposia. Why are these so important?

One part of the ISPRS community comes from academia. All those ISPRS members are evaluated – from student level to professor – by publications. However, the publications are not merely counted but they are also classified and selected according to the classification, with only some being used for evaluation purposes. The selection means that only papers, which are published and recorded in Web of Science database, and in some cases in SCOPUS and other databases, belong to the countable group. Therefore ISPRS publishes two scientific journals (*ISPRS Journal of Photogrammetry and Remote Sensing* and *ISPRS Journal for Geo-information*), which are listed in the Web of Science and SCOPUS. A similar classification exists in the case of conference proceedings. ISPRS events produce two types of proceedings – Archives and Annals. Both are listed in the Conference Proceedings Citation Index (CPCI) of the Web of Science, SCOPUS and DOAJ.

What does ISPRS do to bridge the gap between the scientific world and the challenges of our society?

That depends on what you mean by "our society". If you mean humankind in general, all change detection tools are mainly focused on the permanent monitoring of the Earth and its impact on our survival – meaning not only us, but also future generations. Our results cannot save the world, but our results can show what is going on now, and 'what if' scenarios. Monitoring of deforestation in Brazil is one of the most high-profile examples, where remote sensing and GIS witness and prove the developments. We are still a long way from models that could show us predictions for any purpose in any place on Earth. There are models of floods using digital surface models and satellite and aerial imagery to calibrate the models for extrapolation and application for early-warning systems, for the evaluation of hazards, etc. A lot has been done at various scales, but we are still at the beginning.

What are the benefits of joining ISPRS for companies/industry?

ISPRS is a society of societies. The main members are Ordinary Members, which represent individual countries. Companies can become Sustaining Members and gain better contact with national members of other countries. Companies can thus profit from direct contact with top scientists and young scientists during ISPRS events. Mutual discussions help both sides. ISPRS supports the higher involvement of companies in ISPRS and thus organises meetings with Sustaining Members and potential Sustaining Members.

Does ISPRS also see role in bridging the gap between industry and policymakers in governments worldwide? If so, how are you helping to bridge that gap?

Our independent position allows ISPRS to play a special role in bridging the gap between industry and policymakers. ISPRS has countless top scientists all over the world in many different branches who are working as independent advisors and experts, both for policymakers and industry. It allows us to bring scientific achievements to decision-makers who can factor them into their future work.

How do you view the future role of a learned society such as ISPRS in relation to the fact that it is difficult to involve young people as active members in organisations?

It is necessary to work with the younger generation from the very beginning, when they are students. ISPRS offers such an environment: the Student Consortium. The Consortium itself is already a 'teenager' since it was founded during the XX ISPRS Congress in Istanbul. One of the important activities of the Consortium is the Summer School, which is organised in various countries several times a year. The Summer Schools are not only educative events, but also social ones – the ideal occasion for forging friendships and future cooperation. ISPRS recognises the best young scientists with awards during the Congress. At ISPRS, we realise that the financial situation of young scientists can limit their possibilities to participate in our conferences, which is why the ISPRS Fund provides selected students with financial support for taking part in ISPRS events.

Can we expect any exciting developments in the years ahead in photogrammetry, remote sensing and the spatial sciences?

Yes, I think we can. Our development work has several directions, from my point of view. One of them is to understand the environment and its behaviour better using the signatures we find in our data – starting from climate change and ending at road-traffic intensity for example. Another can be monitoring, including monitoring and analysis of the human body. The ISPSR events have sessions on Computer Vision, BIM, Smart

OUR INDEPENDENT POSITION ALLOWS ISPRS TO PLAY A SPECIAL ROLE IN BRIDGING THE GAP BETWEEN INDUSTRY AND POLICYMAKERS

Cities and Indoor 3D Mapping. We admire the online processing of mobile measurements performed by UAV/RPAS or by satellites weighing less than one kilogram for example. We are probably the most fascinated by increasingly reducing the difference between reality and digital representations of reality in landscape morphology and its changes, tree shapes, vegetation canopies, roof shapes and many others.

How do you see the future of the field of photogrammetry and remote sensing?

I see the future in complex automated models starting from measurements by sensors necessary for the given purpose which are then processed to produce the best solution. I love gardening, so I can imagine the following model: my garden has several trees, some of which are partly shaded behind the house, as is the lawn. My flowers are in the south-facing section, with brief shade in the morning and in the afternoon. Since I travel a lot, I need automated garden maintenance, so how can photogrammetry, remote sensing and spatial sciences help me? Photogrammetry creates a detailed description of the 3D model of my garden: which parts are more and less exposed to the sun and which parts are protected by shade from the house and trees, and when. Remote sensing repeatedly determines the health status of my flowers, trees and lawn. The model compares the change in status between "before" and "now" and classifies the problem. The model sets the garden sprinkler with a certain chemical composition…Remote sensing also determines when to water, cut the grass, use herbicide, etc. Spatial science controls the growth of trees and which sprinklers should water the garden in the case of dryness.

It seems like a wild idea, but if you start to analyse other problems you will find many areas where all three sciences can be applied. And it's important for all of us to reduce the use of water and herbicides, isn't it?
Thanks a lot for your interesting questions. They allowed me to stop for a short time and think about our sciences and their outlook from a different perspective. See you in Prague! ◀

More information
www.isprs2016-prague.com

Lena Halounová

Lena Halounová is associate professor at the Faculty of Civil Engineering at the Czech Technical University in Prague and head of the Remote Sensing Laboratory. She teaches remote sensing, GIS and image processing and is author of more than a hundred scientific papers. Her projects are focused on applications of remote sensing in water management, hazards in geology and GIS modelling in geology and other fields. She has been involved in EARSeL as a member of the Bureau, and ISPRS. She was elected director of the XXIII ISPRS Congress, which will take place in Prague in 2016.
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PROOF OF CONCEPT FROM COLOMBIA

Light **Mobile Collection Tools** for Land Administration

There is an urgent need for the administration of property and land use rights worldwide as the basis for social and economic growth. Notwithstanding the enormous investments by governments and international organisations in the development of such systems over the past decades, it is still estimated that, from a global perspective, 75% of the relations between people and their land are not documented. So which methods and techniques can be used to develop land administration systems for all, and within our generation? Light mobile collection tools may offer a solution, as presented in this proof of concept from Colombia.

The challenges in Colombia are extremely complex. The armed conflict, rooted in disputes over land, has an enormous human, social and economic impact. According to the UHNCR it has resulted in more than 5.7 million people being internally displaced, making Colombia the country with the highest number of internally displaced persons in the world. Another challenge is the informality of property in the rural areas of Colombia, with approximately 4 million rural parcels not formally registered.

DISTRIBUTED RESPONSIBILITIES

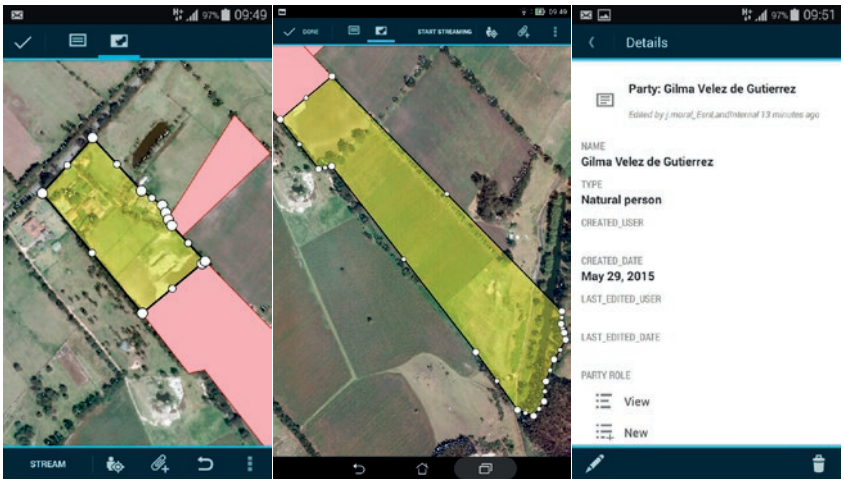
The responsibilities for the formalisation of land rights for rural areas and the administration of those rights are distributed between several organisations. The Colombian Ministry of Agriculture and Rural Development is responsible for the process of formalisation of rural properties. The Geographical Institute 'Agustín Codazzi' (IGAC) is, amongst others, responsible for the National Cadastre of Colombia and therefore includes the results of the formalisation into the cadastral map. The Register of the Notaries, the 'Superintendencia de Notariado y Registro' (SNR), maintains the formal deed register. According to the Ministry of Agriculture and Rural Development, there are approximately 1.7 million unregistered rural parcels. Another 1.8 million rural parcels are currently registered in the National Cadastre (under IGAC), but without the accompanying registration by the notaries. The Ministry wants to accelerate the formalisation process in rural areas, which is seen as a prerequisite to stimulate agrarian production and to combat poverty in rural areas. It should be noted that several other urban cadastres exist, such as the cadastre of main cities like Bogotá, Medellín and Cali.

LOOKING FOR ALTERNATIVES

For the cadastral maps of the rural areas, a centimetre-level representation of boundary vertexes is required, derived from very accurate field surveys. This high accuracy is based on well-defined standardised cadastral mapping approaches and is, for this reason, necessary even for remote rural areas. This demand is linked to time-consuming, costly and cumbersome processes and is perhaps characteristic of the disappointing results in land administration worldwide. It will take many decades and require substantial investments before the task can be finalised

▲ *Figure 1, Fit-for-purpose land administration. Identified boundaries are drawn in the field on top of an orthophoto (left), while administrative data is recorded simultaneously (right).*

▲ *Figure 2, The Trimble R1 has a Bluetooth connection with a mobile on which also Esri's Collector App is installed.*



▲ *Figure 3, Perimeters of spatial units (parcels), this is polygon-based cadastral data acquisition. Results of collected geometry with the Trimble R1 are superimposed on orthoimagery on the smartphone's screen (left and middle). At the same time administrative data is collected and linked (right).*

in this way. The Ministry of Agriculture, the Register of the Notaries and IGAC are therefore exploring alternative approaches, such as fit-for-purpose land administration.

FIT-FOR-PURPOSE APPROACH

In a fit-for-purpose approach, boundaries of parcels are identified in the field and drawn on plots of orthophotos using locally trained technicians. The approach is highly participatory. It has previously been implemented in countries such as Rwanda, Kyrgyzstan, Ethiopia, Lesotho and in some Eastern European countries. After the boundaries have been drawn, a preliminary identifier of the spatial unit (parcel) is drawn on the photo and provided to the claimant on a small piece of paper. The claimant gives this piece of paper to the person responsible for recording the administrative attributes. Surveys are only needed for data completion if the boundaries are not visible on the orthophotos. The fieldwork is paper-based and is a proven approach. Collected data can be digitised back in the office. The approach is creating scalable land administration solutions, and meets the societal needs of today. The Ministry of Agriculture and Rural Development in Colombia has experience with this paper-based fieldwork (Figure 1) and, along with the other land administration institutions, is very interested in a computerised version of this process. Lightweight devices in the field are very efficient to use in mountainous Colombia, and the tools and technologies to develop the application are available.

FIT-FOR-PURPOSE SMARTPHONE APP

The fit-for-purpose smartphone app enables farmers and grassroot surveyors to walk the perimeters of properties themselves. Those grassroot surveyors are young adults from the villages, trusted by the communities and educated and guided by professionals. The freely downloadable app comes with an orthophoto of the specific area, and the spatial and administrative information can easily be collected in the field based on a standard data model. The data is collected only once; the spatial and administrative details of one property are integrated right from the start of the formalisation process and are interoperable. All data can be collected offline and is later transparently uploaded in the cloud. At a village meeting in the town hall, the community members gather to view all the collected data on a map and discuss and reconcile the results. During the adjudication process in the field, disputes may lead to the creation of overlaps between polygons. In that case, those overlaps are mapped and the related conflicts have to be solved. Bigger 'gaps' represent areas to be surveyed. This may concern government-owned lands which have to be identified and included in the system. The design environment in this case is based on Esri's Collector App, which allows for very efficient data collection. The app was used in combination with the Trimble R1, for sub-metre accuracy, via a Bluetooth connection. The interface between the R1 and the Collector App could be managed from a smartphone (Figure 2). This configuration is fit for purpose, given the often rather low value of rural land, the intrinsic accuracy of boundaries and even the existing norms for area calculation. The data structure of the cloud-based database with collected attributes is based on the Land Administration Domain Model, a flexible ISO standard that is widely applicable in land administration. It includes the Social Tenure Domain Model, which provides the concept for the app.

POLYGON-BASED

The data collection method is 'polygon-based' rather than 'boundary-based' (Figure 3). The collected polygons with associated attributes are considered to be 'evidence from the field'. Data collected from the field can be processed and handled in a (cloud-based) geographic information system (GIS), where the collected polygons can be superimposed onto the imagery. Between the polygons, the boundaries will be visible as objects in most cases: fences, hedges, trees, ditches, roads, etc. If those visible objects are not spatial units in themselves, the boundaries can easily be vectorised today and in the future it may be possible to conduct automatic feature extraction. Topology can be introduced if needed.

IMAGERY

Imagery is loaded in advance. Most boundaries are clearly visible on aerial photos or on satellite imagery. This imagery should be

IN A FIT-FOR-PURPOSE APPROACH, BOUNDARIES OF PARCELS ARE IDENTIFIED IN THE FIELD AND DRAWN ON PLOTS OF ORTHOPHOTOS USING LOCALLY TRAINED TECHNICIANS

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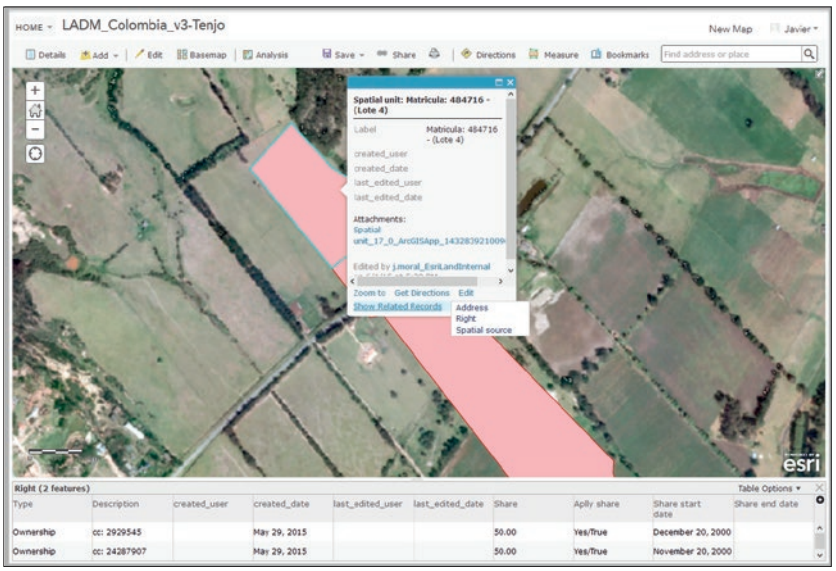

▲ *Figure 4, The results are available in the cloud immediately.*

'ready to go', with proper cache levels, scales, formats, etc. The imagery needs to be cached so it can be used as a base map or a 'layer' to facilitate very close zooming. Then physical features can be picked out of the imagery, such as fences, hedgerows, large stones, walls, ditches, etc. The polygons or tracks can be recorded with the R1 or with standard smartphone GPS. Tracks can be visualised by superimposition over the aerial photo. This allows identification of the visual boundaries.

PARTICIPATORY APPROACH

Community involvement is required; the very nature of cadastral survey requires the participation of neighbours, family members, etc. Therefore, the major is informed in advance to ensure awareness and involvement of all parties. Everyone can follow the process on-site in the field. Collected data can be sent with Esri's Collector App directly to a cloud-based GIS environment (Figure 4), enabling everyone to follow the process remotely – this is important for the involvement of stakeholders who cannot be on site – and it is possible to set up transparent access to this cloud environment. Usual procedures, such as public inspections, are conducted at village meetings in the town hall accompanied by trusted third parties.

ADMINISTRATIVE DATA

All citizens in Colombia have a unique ID number and this ID can be coupled to the app, which has the functionality to link names to polygons (perimeters). This means that names and other relevant attributes and observations can be linked. Digital photos can be attached; existing documents like passports and IDs, selfies, photos of groups of owners, photos of existing legal documents like deeds or titles and photos of the boundaries can all be linked to the polygon. Inconsistencies can be avoided when all attributes are collected only once and correctly, with verification options. This avoids situations such as spelling issues, for example, in which the same person is recorded with several different names in the administrative data causing an enormous bottleneck in land administration procedures.

CONCLUDING REMARKS

Data collection should be fast, reliable and cheap (i.e. grassroot surveyors can do the job). It is expected that this app for field data collection will speed up and improve the formalisation process. The app should support acquisition of spatial data and administrative data in an integrated approach. If only handheld devices are being used (i.e. no survey equipment is needed), the work can be done in very efficiently.

The proof of concept has been much debated and well received in several forums, both inside and outside Colombia, and the results are promising. The following should be noted in this context: currently, it costs around USD1,000 to measure and register an average two-hectare parcel in Colombia. With millions of parcels still to formalise, fit-for-purpose methods and techniques should be explored, tested and implemented as soon as possible.

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FUSING HYPERSPECTRAL DATA AND PHOTOGRAMMETRIC IMAGERY

Mapping Nocturnal Light Pollution

Artificial light in urban conglomerates causes nocturnal light pollution. Excessive light radiation is expensive as it wastes energy and not only impacts the environment but may also harm human health. Authorities are showing a growing interest in quantifying the amount of artificial light radiated at ground level in their jurisdiction. The authors developed an approach based on fusing simultaneously acquired hyperspectral data and photogrammetric imagery. The resulting luminance maps are accurate and have a high spatial resolution.

Nocturnal light pollution is a side effect of industrial civilisation and accounts for excessive, misdirected or undesired artificial light produced by dwellings, factories, offices, sport fields, billboards, street lights and so on. Reliable methods to quantify the amount of artificial light radiation are a prerequisite to detect light/energy waste and to assess the effectiveness of policies and actions. With respect to the data acquisition part of such methods, space-borne imagery has limited spectral bands and coarse spatial resolution, and the dynamic range of the sensors is optimised for daytime data acquisition rather than for data capture at night. Field campaigns are time-consuming, thus costly, and unable to provide a synoptic view over a large area. Accurate quantification of artificial light radiated at ground level from the air requires high spectral and spatial resolutions while the spectral bands have to be recorded with a high dynamic range. To obtain images with these characteristics, the authors fused data simultaneously recorded with a hyperspectral sensor, which combines synoptic view with multiple narrow spectral bands, and a digital photogrammetric camera.

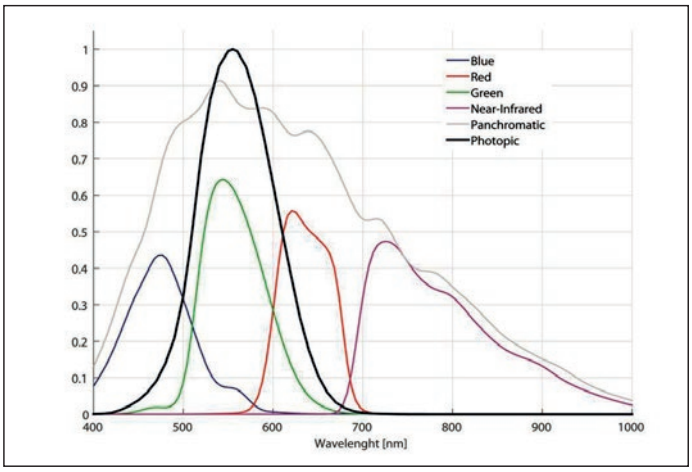
SENSORS

The airborne approach developed by the authors to overcome the limitations mentioned above uses the AisaEAGLE-II hyperspectral sensor from SPECIM, configured to acquire 128 bands in the visible and near-infrared (VNIR) part of the electromagnetic spectrum covering the range 406.3nm to 993.8nm. The ground sampling distance (GSD) of this VNIR sensor is 1.5m. Light sources which may disturb the observations can be avoided by selecting time windows, such as new moon phase. Most bands have a low signal-to-noise ratio (SNR). Furthermore, the approach uses a digital mapping camera (DMC) from Z/I (currently Hexagon), capturing the panchromatic band with 0.25m GSD and the blue, green, red and near-infrared bands with 1m GSD. This photogrammetric camera has been developed for high-accuracy mapping.

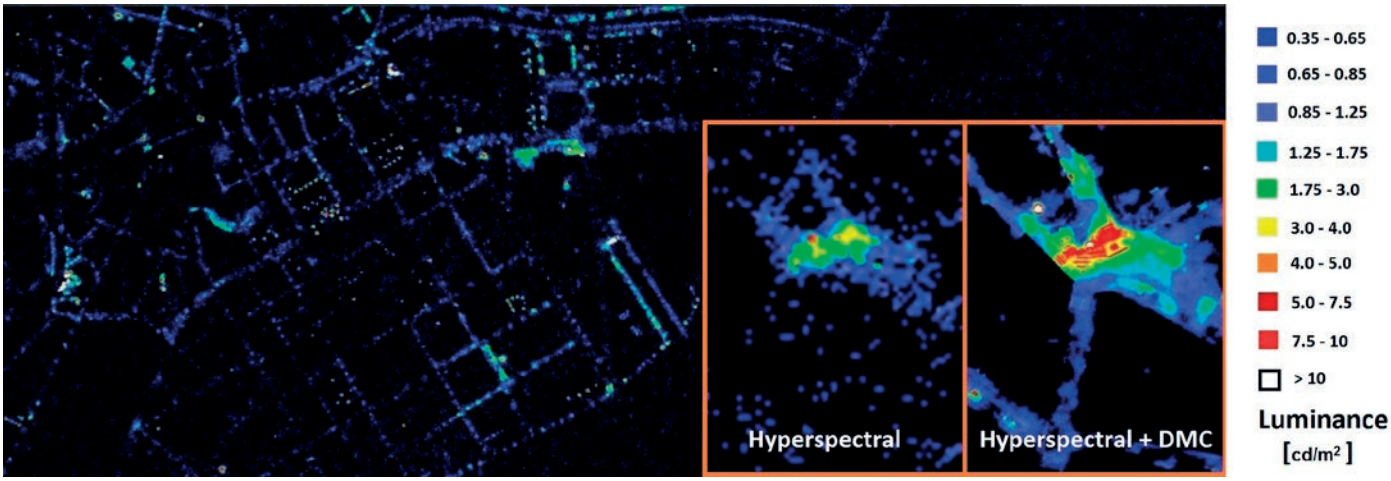
STUDY AREA

The study area used to test the approach covered three urbanised municipalities near Barcelona, Spain, which have been promoting efficient artificial lighting policies in recent years. They funded the study, which was carried out by Institut Cartogràfic i Geològic de Catalunya (ICGC). To capture the 150km^2 area at maximum spatial resolution, the

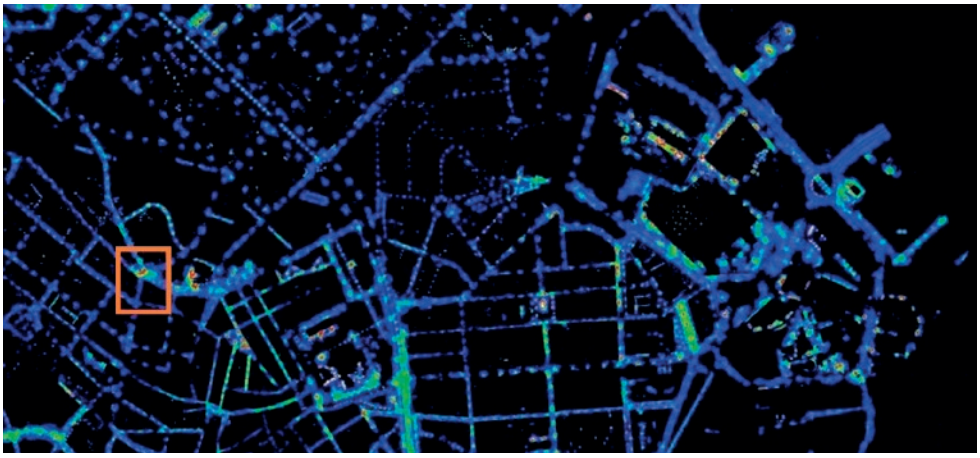
▲ *Figure 1, Flight plan.*



▲ *Figure 2, The photopic curve (black line) together with the spectral sensitivity of DMC bands.*

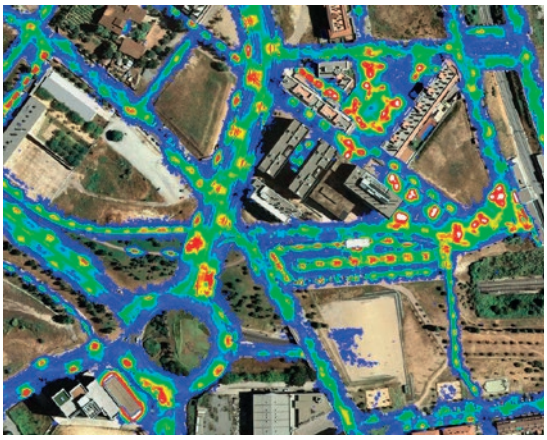


▲ *Figure 3, VNIR luminance map obtained from hyperspectral VNIR imagery, GSD 1.5m. Pixels with a luminance <0.35cd/m2 are black. The two insets cover the area outlined in orange in Figure 4.*



▲ *Figure 4, Luminance map obtained from fusing VNIR and DMC data, GSD 1m. Legend as in Figure 3.*

minimum altitude permitted for night flights over urban areas was used. The area was captured in 19 flight tracks from 23:00h on 18 October 2014 until 02:00h the next day, a date which was chosen to avoid recording moonlight. The aircraft flew at 2,200m above ground level (Figure 1).



▲ *Figure 5, Detail of the final luminance map, GSD 0.25m. For pixels with a luminance <0.35cd/m² the underlying orthoimage is shown. Legend as in Figure 3.*

LUMINANCE

For each pixel, the VNIR sensor collects a spectral sampling of the radiation in the blue, green, red and near-infrared range emitted by the surface. During moon-free nights it may be assumed that the radiance is due to artificial illumination alone. Most studies suffice with adding the radiance values of the diverse hyperspectral bands – 128 in this case – recorded at flying height. However, this project aims to mimic how the human visual system perceives the radiance of light, or brightness, at ground level. For this purpose the radiance values of the 128 bands must be converted to luminance values at ground level and then combined in a way which mimics the visual perception of human beings. Luminance is a photometric measure which describes the amount of light that is emitted by a unit of area and is expressed in candela per square metre (cd/m²). The spectral sensitivity of the human visual system is described by the photopic luminosity function defined by the Commission Internationale de l'Éclairage (CIE). This function indicates the sensitivity of human eye to incoming light radiation at different wavelengths (Figure 2). The conversion from radiance values to luminance values at ground level is performed in several steps using humidity values and other atmospheric observations. Firstly, a radiometric calibration converts the values (digital numbers) captured by the VNIR sensor into radiances at flying height. Then, these radiances are transferred to radiances at ground level by conducting atmospheric corrections and combining the 128 radiances recorded per pixel using the photopic luminosity function. Finally, a luminance map of the entire area is created by mosaicking the flight tracks (Figure 3).

FUSION

Up to this stage only the data recorded by the VNIR sensor has been explored and the luminance map looks blurred compared to the map created using both hyperspectral and DMC data, as the insets of Figure 3 demonstrate. Even individual street lights become detectable after fusion. The dynamic range of the DMC panchromatic band is higher compared to the VNIR sensor as the DMC bands are much broader so that more photons can reach the charge-coupled device (CCD) in the image plane. As a photogrammetric instrument the DMC has been designed for recording reflected sunlight and not for capturing artificial light. The relatively low intensity of artificial light causes multispectral and panchromatic DMC images to be affected by band-dependent noise and residual vigneting. These undesired effects have been eliminated through spectral filtering. The fusion consists of fitting the radiance values of the blue, green, red and near-infrared bands of DMC images to the VNIR luminance map. Once this calibration process has

been completed, the luminance map can be computed from DMC imagery alone. A linear combination of the blue and green DMC images provided the best fit and resulted in a luminance map with 1m GSD (Figure 4). The two insets in Figure 3 clearly demonstrate the differences in noise levels, sensitivities and spatial resolutions between the hyperspectral luminance map and the luminance map obtained from fusing hyperspectral and DMC data. Finally, a luminance map at 0.25m GSD was created by searching for the best fit between the panchromatic, green and blue DMC bands and the luminance map. The best results were obtained using panchromatic and green bands. Figure 5 shows the resulting luminance map superimposed on the orthoimage.

ACKNOWLEDGEMENTS

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RUPTURE AREA COVERED BY A 5HZ GPS NETWORK FOR THE FIRST TIME

GPS and the 2015 Gorkha Earthquake

Nepal is prone to earthquakes and throughout the centuries the country's capital city, Kathmandu, has been regularly struck by earthquakes which appear to have similar epicentres and behaviour. The portion of the Main Himalayan Thrust ruptured by the 2015 Gorkha earthquake lies directly beneath a network of GPS continuously operating reference stations (CORS) recording three-dimensional positions at a high rate of 5 samples per second (5Hz). This is the first time a large continental thrust earthquake has been measured by a 5Hz GPS network with receivers on both sides of the fault rupture.

The various earthquakes which have plagued Nepal over the centuries have caused major destruction. The earliest-recorded quake was in 1255, with subsequent earthquakes occurring in 1344, 1408, 1681, 1833, 1934 and most recently in April 2015. The latter, the Gorkha quake, had a magnitude of 7.8 and was similar to the 1833 event. The quake in 1934 destroyed 20% of the buildings in Kathmandu and appears to be a repeat of the 1255 one. In comparison, the Gorkha quake destroyed less than 1% of the buildings. Considering the magnitude of the Gorkha quake and its proximity to Kathmandu one would have expected more damage to the vulnerable dwellings, although they are four storeys tall at most. Meanwhile, some high-rise buildings suffered severe damage, such as the 60m tall Dharahara tower which collapsed, despite having partially survived the 1934 earthquake.

GPS CORS NETWORK

Since the 1990s the California Institute of Technology (Caltech) has partnered with the Nepal Department of Mines and Geology (NDMG) to build a network of 28 GPS stations, consisting of Trimble NetRS, NetR8 and NetR9 reference station receivers. This largest and highest-quality CORS network in Nepal aims at monitoring tectonic strain. In total there are about 50 GPS CORS stations operational, established by several national

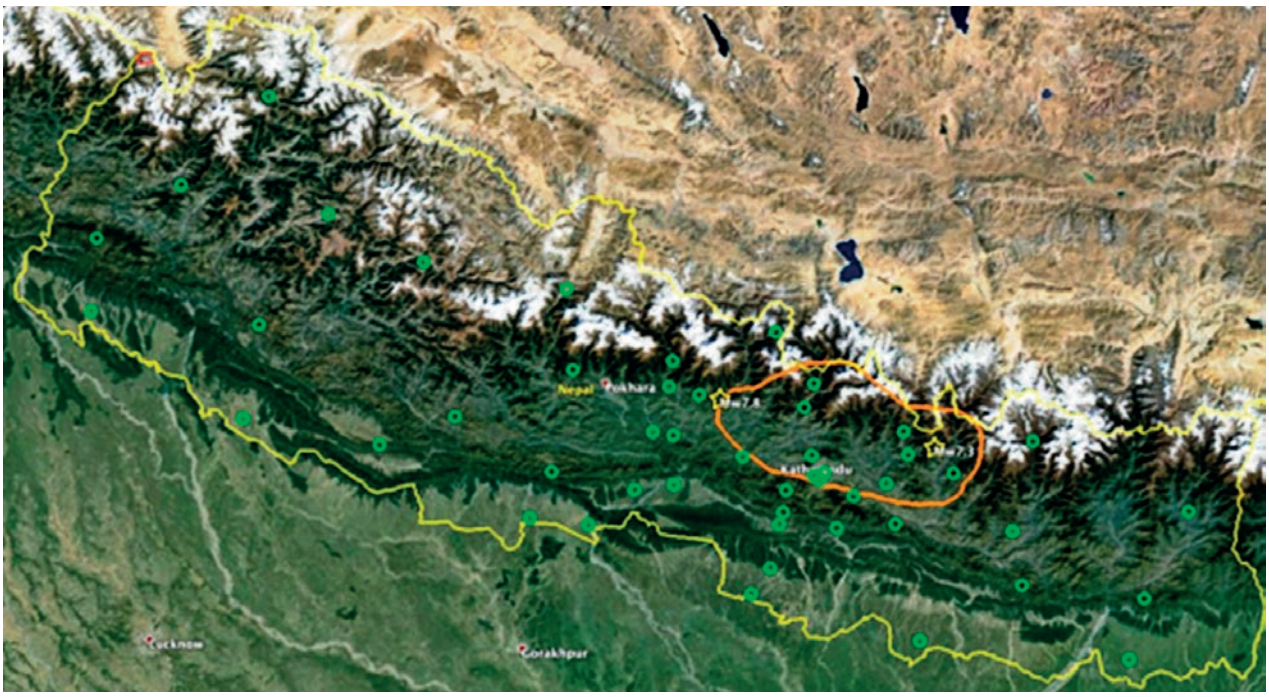

Figure 1, GPS CORS network in Nepal; green circles indicate GPS stations; the orange line shows the Gorkha rupture zone (data courtesy UNAVCO, background image via Google Earth).

Figure 2, Damaged French GPS station GUMB; neither the GPS receiver nor the antenna was harmed (image courtesy: John Galetzka).

organisations in close cooperation with various scientific institutions from France, Italy and UAS. Figure 1 shows a map of the GPS CORS network in Nepal based on data provided by UNAVCO, a non-profit university-governed consortium which facilitates geoscience research and education using geodesy. The Caltech GPS receivers capture data at 15-second and 0.2-second (5Hz) intervals. The 15-second intervals provide information on the normal, slow plate motion over several weeks, months and years. The 5Hz data provides details on the shaking during the quake itself. In 2013 the stations were equipped with cellular modems to transmit 15-second GPS data to FTP servers at UNAVCO for long-term monitoring of the plate motion and geophysical research. As the 5Hz data is only needed for examining behaviour and effects when a quake strikes and the volume of data is also too big for the limited bandwidth of cellular connections, the data is stored on the receivers for several weeks. Once a quake happens there should be sufficient time to collect the data by on-site visits. In order to deal with connection failures the receivers can also store 15-second data for up to one year or up to three years, depending on the type of receiver. As the 5Hz data accumulates very rapidly and recent data prevails, older data is overwritten by newer data within several weeks. Therefore, to prevent loss of important data, the data must be downloaded during on-site visits within just a few weeks of an earthquake striking.

TWO YEARS AFTER INSTALLATION, THE WIRELESS CONNECTIONS OF MANY GPS STATIONS WERE DISRUPTED

DATA RESCUE

Notwithstanding all these precautions, data retrieval became precarious once the Gorkha quake struck. Two years after installation, the wireless connections of many GPS stations were disrupted. At the time of the quake, just nine stations could transmit data while the status of the others was unknown. Although many stations had lost connection, they continued to store GPS data. However, retrieval through on-site visits appeared to be very troublesome due to landslides and other hazards making the area difficult to access. Added to this, there was only limited availability of helicopters since they were, of course, more urgently needed for rescuing people in dire need. Through funding by Trimble, helicopters could be hired in for the few hours they were not occupied with rescue work. On site, data was downloaded and, wherever possible, receivers with a broken connection were fixed. Irreparable receivers, including those damaged by lightning strikes and vandalism or other causes, were replaced

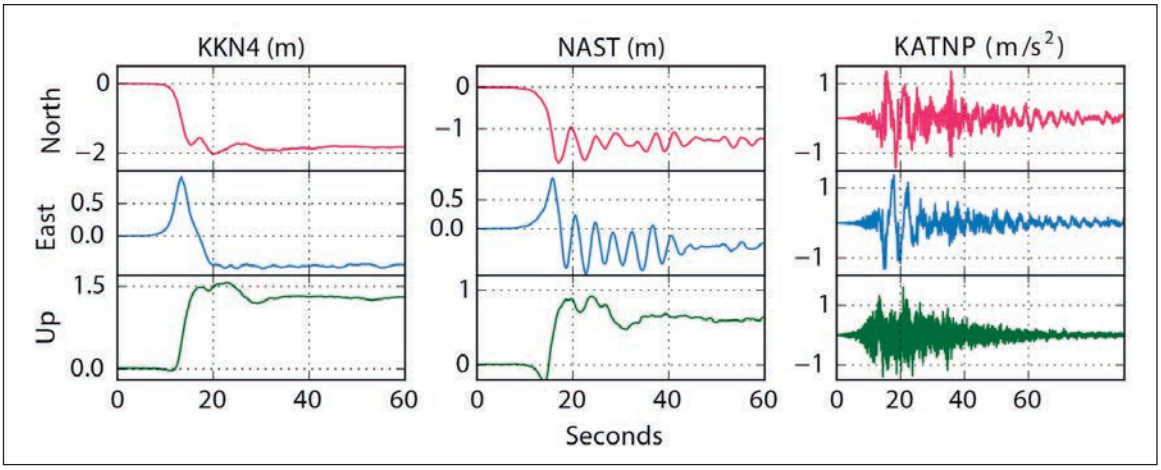

Figure 3, Records of ground displacements and accelerations (right) during the Gorkha earthquake (source: Avouac et al.).

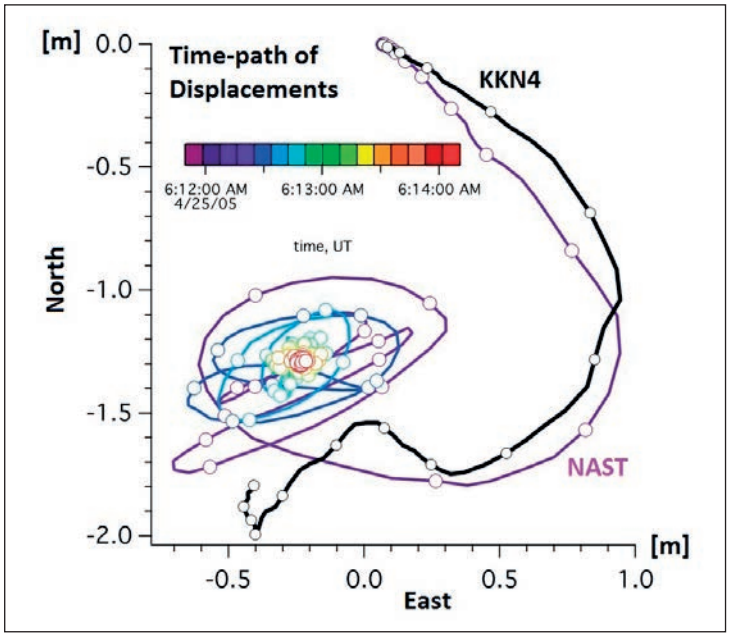

Figure 4, The north and east displacements of KKN4 and NAST in Figure 3 shown as two time paths (courtesy: Dave Mencin, UNAVCO).

by new GNSS receivers and transported to Kathmandu for data recovery and repair and reuse if possible. The quake caused differing degrees of damage to the various sites and battered the receivers somewhat but it did not incapacitate any of them or damage any antennas, despite some of the stations being located directly over the fault rupture (Figure 2). The integrity of the GPS data appeared to be consistently good. Obviously, the short-braced monuments were solid enough to withstand the shock waves.

RESULTS

Figure 3, showing the 5Hz GPS measurements at two individual CORS (KKN4 and NAST) during the quake, clearly demonstrates the occurrence of large initial displacements and accelerations associated with the shaking at the strong motion accelerometer KATNP, installed at the American Club operated by the U.S. embassy in Kathmandu. KKN4 is located on rock and NAST on sediment in a valley. The north and east displacements of the two stations clearly show different behaviours (Figure 4). NAST shows prolonged sediment resonance with a sweeping path of almost 2m. The small circles on the KKN4 displacement path indicate one-second intervals; the larger circles on the NAST displacement path indicate intervals of 0.2 seconds. Combining 5Hz GPS data and data captured by KATNP shows that the Kathmandu valley heaved upwards by 60cm and moved southwest by 1.5m at velocities of up to 50cm/s in less than 5 seconds. In the following 60 seconds valley sediments oscillated laterally at 4-second intervals with 20-50cm amplitude. Surfaces horizontal prior to the quake are now tilted down to the southwest by less than 1 degree. The runway at Kathmandu's airport lifted roughly 50cm and tilted by 12cm. The shaking in Kathmandu was not as violent and severe as one would expect based on the large amount of strain released. More work is needed to understand whether the Gorkha quake has put additional stress on other faults in the area, which could influence occurrence of future earthquakes. Surface displacements were also measured with interferometric synthetic aperture radar (InSAR). The combination of all these measurements enables visualisation of the kinematics of the sources and the strong ground motion that led to the pattern of damage.

GNSS RECEIVERS

Nepal's GPS network continues to monitor tectonic motion. Because the GPS equipment at the existing stations was largely undamaged, many of the receivers donated by Trimble for replacing incapacitated receivers were instead used to establish new stations. Since those receivers are GNSS-capable, they capture not only GPS signals but also signals from GLONASS, Galileo and BeiDou. This extension of the amount of signals allows placement of receivers in deep valleys where they are easily accessible. Seismic sensors are installed at many CORS sites.

CONCLUDING REMARKS

The earthquakes occur at regular time intervals but that does not mean that the moment they will strike can be predicted exactly, even with the use of the most advanced instruments and technologies. However, modern measurement technology enables an understanding of the pattern of earthquakes and GPS data enables modelling of the tectonic strain accumulating along the plate boundaries and estimation of the strength of upcoming quakes. Added to this, the measurements taken during the Gorkha quake enable construction improvements to mitigate future damage and loss of life.

ACKNOWLEDGEMENT

Thanks are due to John Galetzka, UNAVCO, and Roger Bilham, University of Colorado, for providing background information.

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CLIMBING TO THE PEAK OF PRECISION

New Elevation for North America's Highest Peak

Surveyors, mappers, geodesists and other scientists, as well as climbers and mountaineers from around the world have long held a curiosity to know the official elevation of Denali, officially the highest peak in the continent. Since the last survey of Denali's apex in the 1950s, GPS/GNSS equipment technology has significantly improved. In June 2015, the U.S. Geological Survey (USGS) along with NOAA's National Geodetic Survey (NGS) and the University of Alaska Fairbanks (UAF) partnered to re-survey Denali's peak using the most advanced precise point positioning technology. The survey party was led by CompassData, a subcontractor for Dewberry, under contract to the USGS and consisted of four experienced climber-scientists.

Denali, Alaska's most magnificent natural treasure within Denali National Park, remains the highest mountain in North America and the third highest mountain of the world's renowned 'Seven Summits'. About 1,200 mountaineers attempt to summit the mountain each year and typically about half of them are successful. The previous summit elevation of 20,320ft (6,193.5m) was established using 1950s' technology. In 2013, it was called into question when a report stated an updated estimate of 20,237ft (6,168.2m) near the summit. This measurement was part of a larger project to collect revised elevation for the entire state under a national initiative called the 3D Elevation Program (3DEP). This newer number was collected from an interferometric synthetic aperture radar (IFSAR) sensor. IFSAR is an extremely effective tool for collecting map data in large and challenging areas such as Alaska, but it can struggle to provide precise point elevations in very steep terrain and narrow ridges.

In June 2015, the USGS, NGS, UAF and CompassData partnered in a mission to officially update Denali's peak elevation using advanced precise point positioning technology. In September of that year, just days after Sally Jewell, U.S. Secretary of the Interior, announced that Mount McKinley would be renamed to officially carry its Native Alaskan name of Denali, the USGS and its partners announced that the updated height for Denali's peak had been set at 20,310ft (6,190.5m).

▲ *Figure 1, The survey party began their ascent to the summit from the base camp on the Lower Kahiltna glacier, looking up at the summit of Denali from base camp. (Photo: Blaine Horner, CompassData)*

▲ *Figure 2, Crossing the Lower Kahiltna glacier during peak freezing, which on this trip was at about 1:00 a.m. (Photo: Udi Karriere, CompassData)*

TREK TO THE TOP

The team began their precarious trek to the summit in mid-June to take advantage of a narrow window for good weather, with scientific instruments in tow. The team took the 40-minute flight from Talkeetna Airport near the entrance of Denali National Park onto the Kahiltna Glacier to begin their ascent. The Lower Kahiltna has massive crevasses with the potential for lethal falls. The best way for the team to mitigate this hazard was to cross the glacier during peak freezing (between 11:00 p.m. and 5:00 a.m.). The move to the first camp on 16 June took the team about six hours and covered roughly 11.3km.

On 24 June, after 9 days of climbing and acclimatising, two of the climbers from CompassData left their camp at 14,000ft (4,267m) at 6:30 a.m. with the aim of surveying the summit. The goal was to move as much as possible, while acknowledging that the weather could change quickly and strand the team away from their cache. The team used a 'double hauling' method, which refers to the process of leaving a camp intact and carrying extra food, cooking fuel and clothing up the mountain and then burying these supplies to help reduce the load and aid in acclimatisation. This method had been implemented to cache most of the survey gear including a summit snow probe at 17,000ft (5,181m) prior to this summit attempt.

PROTECTING HIGH-TECH EQUIPMENT

The area immediately above this cache point is statistically the most dangerous part of the climb and is extremely cold in the morning. A primary concern was that the high-tech equipment might not work in the cold temperatures. To avoid this, each piece had been wrapped in closed-cell foam to provide insulation and wired to run on an auxiliary lead acid motorcycle battery. These efforts paid off and neither survey unit experienced any technical difficulty.

The 'Autobahn', as it is known, is an upward-trending traverse across a 3,500ft (1,066.8m) face to finish at Denali Pass. The survey team was pleased that Denali National Park staff had established a thorough network of pickets and runners at 30m intervals across the traverse to allow climbers to perform what is called a 'running belay'. Here, the first climber clips the rope into a carabineer attached to the picket and second climber removes the rope from this carabineer. This prevents the team from falling off the Autobahn and down onto the St. Peters Glacier (an often fatal fall).

THE SUMMIT SURVEY

Three days before the summit attempt, a Trimble R10 GNSS receiver was established close to 13,400ft (4,084m) on solid rock. The antenna was operational for six days in total: three days before the summit survey and then two days after. The purpose was to provide a shorter base line for processing and help tighten the network calculations of the summit receivers.

The team reached the summit at around 3:15 p.m. on 24 June and a small, prominent diamond of snow near the south-face cliff edge was identified as the highest point. A range pole was driven into the snow near this point and levelled with it. The GPS equipment (Trimble NetR9 powering a Zephyr-2 antenna) was installed onto the pole and powered on. A second range pole was then driven into the snow 2.5m away from the summit range pole and the trail, and levelled with the first pole using the tank antenna and a level. This second set-up, a Trimble R10, gave redundancy to the survey, and its off-trail location reduced the risk of tampering. Snow depth was measured at both poles.

Both units were connected to an external lead acid motorcycle battery in addition to their fully charged internal batteries. The external battery could have been run as the primary battery in which case the unit would operate until that battery died and would then switch to the internal battery. This was the most energy-efficient option but risked freezing of the internal battery during the switch, losing power and data. Therefore, the internal battery was 'charged' with the external battery instead. In pre-trip tests

A PRIMARY CONCERN WAS THAT THE HIGH-TECH EQUIPMENT MIGHT NOT WORK IN THE COLD TEMPERATURE

Figure 3, Climbers Tom and Udi continue towards the Denali summit, with sleds in tow. The amount of gear required to climb Denali is too heavy for single backpacks, so each team member also pulled a plastic sled with equipment. (Photo: Blaine Horner, CompassData)

Figure 4, Using a 'double hauling' method, the team continued with an aggressive ascent schedule. Lower Peters Glacier and Peters Dome are in the background. (Photo: Blaine Horner, CompassData)

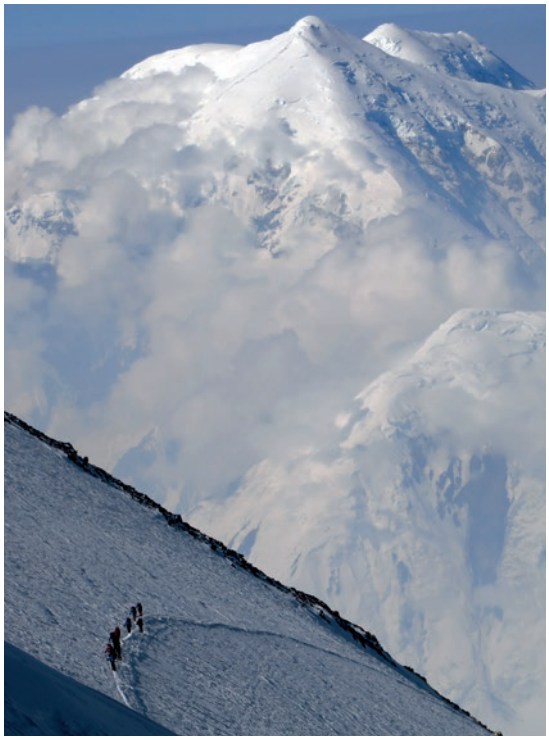

Figure 5, After leaving the 17,000ft camp for the final leg, the climbers performed a running belay to cross the 'Autobahn'. (Photo: Udi Karriere , CompassData)

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▲ *Figure 6, The lower section of a one-metre range pole was driven into the snow about half a metre north of the summit point. Udi Karriere demonstrates the method used for the levelling process. (Photo: Blaine Horner, CompassData)*

▲ *Figure 7, Survey equipment was powered on. The Zephyr-2 antenna was connected to the NetR9 on the summit and the R10 was established at a 2.5-metre offset. (Photo: Udi Karriere, CompassData)*

this method generated some heat in the survey receiver, which obviously represented a power loss, but it kept the unit warm and was determined as the preferred option.

The team of two returned to 14,000ft (4,267m) following the summit survey. The equipment was left collecting data until the following day when a team from Mountain Trip guiding service removed the receivers. Two days later the CompassData team returned to the summit and removed all remaining equipment. The entire team safely descended the mountain and arrived at base camp at 7:00 a.m. on 29 June.

DETERMINING THE NEW ELEVATION

The distance between the two antennas was measured in the field to a precise 2.500m, and the two antennas were very accurately levelled (shared with all groups), but the distance between the two antennas was kept confidential by the field crew as a quality check on the initial rounds of processing. All three processing teams calculated the data to within a few centimetres of this 2.500m.

To ensure the most accurate elevation number, specialists from CompassData, UAF and NGS all independently processed the survey data and a meeting was held to compare those calculations. All findings were very consistent and remaining questions focused on how to express the new height. Ultimately, an agreement was reached on the reference surface to be used and the rationale for using the North American Vertical Datum of 1988 (NAVD 88) as the vertical datum. NAVD 88 is the official vertical datum for Alaska in the National Spatial Reference System (NSRS), a system that is defined and maintained by NGS to provide a consistent coordinate system across the entire USA. A new effort underway at NGS to modernise the NSRS by 2022 will incorporate an improved model of where the average sea level, or 'zero' elevation, is located. This will result in elevation values being more accurate with respect to mean sea level.

A SMALL DIFFERENCE SPEAKS VOLUMES

The final elevation number is remarkably close: within 10ft (3.05m) of the previous official elevation number. This is a testament to the skills and determination of the early surveyors and mountaineers who, with considerably less-sophisticated equipment, calculated an elevation that stood the test of time. It is only now, with major advances in GPS/GNSS technologies, that a more precise elevation could be calculated. It is impossible to say for certain that the early survey was not accurate and that in the ensuing 60 years there has been an elevation change at the summit. The similarity between the new number and previous surveys validates notions that the summit snowpack remains nearly constant from year to year. And finally, it answers the ultimate question by establishing a revised official elevation of 20,310ft (6,190.5m) for Denali's peak. ◀

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Blaine Horner is the accounts executive for CompassData, located in Centennial, Colorado. He worked as a field surveyor for CompassData for the last 7 years including in Haiti, Turkey, Japan, the Caribbean Island chain, 14 locations throughout Greece and the Greek Isles, surveying in 45 U.S. states, and once performing 88 days of straight survey work throughout nine countries in Europe. During the years in the field, he spent winters ski-patrolling at Crystal Mountain, Washington, and has worked on Denali as both National Park Service search and rescue and as a mountain guide for Mountain Trip.

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ISPRS GEOSPATIAL WEEK 2015

11 Events under One Umbrella

France hosted the ISPRS Geospatial Week 2015 which was held in La Grande Motte near Montpellier from 28 September to 2 October. The event attracted more than 500 participants from 52 countries. Conference director Nicolas Paparoditis together with programme chair Clément Mallet and the rest of the team designed a rich programme and organised in a total of 11 independent events running in parallel during the week (Laserscanning, Silvilaser, CMRT, ISSDQ, ISA, Gi4DM, GeoBigData, GeoVis, GeoUAV, GeoHyper and RSDI).

After Nicolas Paparoditis had kicked-off the ISPRS Geospatial Week, Christian Heipke, secretary-general of ISRPS, addressed the audience. He anticipated that so many fields from within the photogrammetry, remote sensing and spatial sciences family mingling together in one place would produce very interesting results. Heipke emphasised the importance of education as one of the three pillars of the ISPRS and also took the occasion to look forward to the ISPRS Congress in Prague, which will be held from 12-19 July 2016 in the Czech capital.

SPEAKERS

A total of 19 plenary and keynote speakers gave a very interesting overview of the state of the art and trends within a wide range of areas, including 3D city modelling, Lidar forestry applications, UAV photogrammetry, data quality, emergency mapping, big data processing, computer graphics and spatial data infrastructures. These presentations were followed by in-depth discussions in smaller groups within oral technical or poster sessions. The poster sessions took place in the exhibition area.

Among the highlights were plenary speaker Mike Wulder of the Canadian Forest Service, who talked on the perspectives of Lidar for forest management applications. The integration of Lidar with Landsat data offers many opportunities, such as the estimation of forest canopy cover. Benoît St-Onge of the University of Québec, Montreal, animated the audience with an excellent keynote on Lidar and photogrammetric point clouds for describing forest canopies, and he raised the question of whether these are competing or synergistic technologies. Bruce Cook, who gave a presentation on behalf of David Harding, received loud applause for his keynote on the evolution of NASA airborne and spaceflight Lidar.

Ed Parsons, geospatial technologist at Google, took to the floor to give a presentation themed 'Change of Focus: the Requirements from Beyond Using a Picture'. Parsons' entertaining contribution touched on Google's acquisition of Skybox, within which the prime driver is to develop satellites that visit places much more frequently than they do nowadays. What can we expect from Google? A much more down-to-earth approach when it comes to building satellites, Parsons promised the audience.

PAPERS

350 papers were submitted to the different events and most of them went through a double-blind review process. The papers

▲ *Palais des Congrès Jean Balladur.*

▲ *Delegates enjoying the daily lunch.*

▲ *Delegates attending one of the numerous conference sessions.*

▲ *La Grande Motte.*

are published in the ISPRS *Annals* of the Photogrammetry, Remote Sensing and Spatial Information Sciences (Vol. II-3/W5) and *Archives* (Vol. XL-3/W3) of Photogrammetry, Remote Sensing and Geospatial Sciences and are accessible online on the ISPRS website (www.isprs.org).

ORGANISATION

The ISPRS Geospatial Week 2015 was organised by the French Society of Photogrammetry and Remote Sensing (SFPT) together with the French National Mapping Agency (IGN), the French National Research Institute of Science and Technology for Environment and Agriculture (IRSTEA) and the French National Forests Office (ONF).

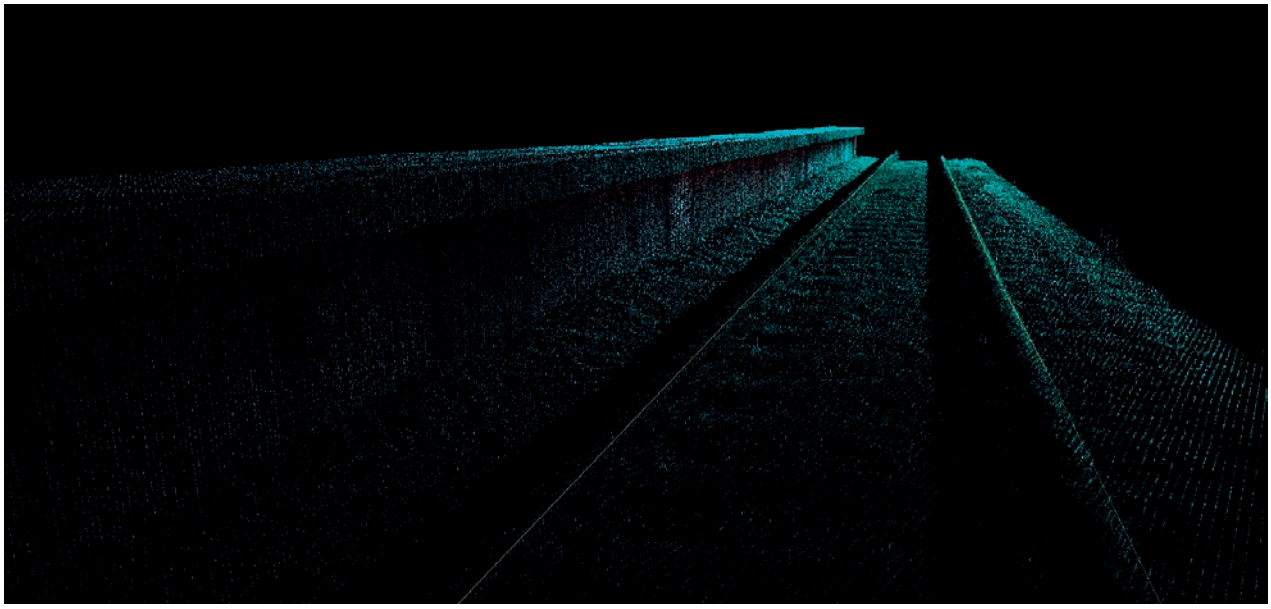
During the Geospatial Week 2015 the decision was taken to hold the next edition of the ISPRS Geospatial Week in China, organised by Wuhan University. A strong Chinese delegation had submitted a winning application to the panel and was successful with their bid. The ISPRS Geospatial Week 2017 will take place from 18 to 22 September. ◀

More information
www.isprs-geospatialweek2015.org

GEOSIGNUM

Automatic Feature Extraction **in the Cloud**

GeoSignum is an innovative start-up company headquartered in Delft, The Netherlands. The company is part of the YES!Delft High-Tech Incubator. Taking advantage of the increasing importance of airborne, mobile and terrestrial 3D laser scanning, the young start-up has been developing technologies to automatically model and extract geographical features from 3D laser datasets.



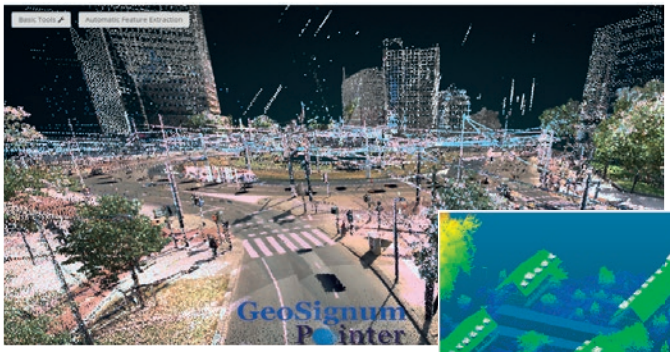
▲ *Automatically detected and vectorised rail track from mobile laser data.*

The private high-tech company GeoSignum was founded in October 2011 by Dogan Altundag, who holds an MSc in Geomatics from Delft University of Technology. The company is growing rapidly as it is already working on multiple international projects. Its team consists of highly experienced scientists and engineers in the remote sensing and 3D laser scanning fields. While it offers mobile, airborne and terrestrial Lidar data processing applications, the start-up's main activity is feature extraction from Lidar datasets. The process of extracting features from 3D laser datasets is typically an arduous task that can take many weeks or even months to complete. GeoSignum is automating this process by up to 99% for certain features so that users can obtain the end results faster than ever. While the company is involved in multiple solutions, the current main focus is the cloud-based GeoSignum Pointer web platform. Any organisation, anywhere in the world, can now automate feature extraction and analysis tasks using only a standard web browser. This has transformed what used to be a month-long job into an operation that requires just a few days or even hours. "Clients no longer have to wait for the future of automatic extracting features and analysis. With our cloud-based technology we are bring this solution to the market right now," says Dogan Altundag, founder and CEO of GeoSignum.

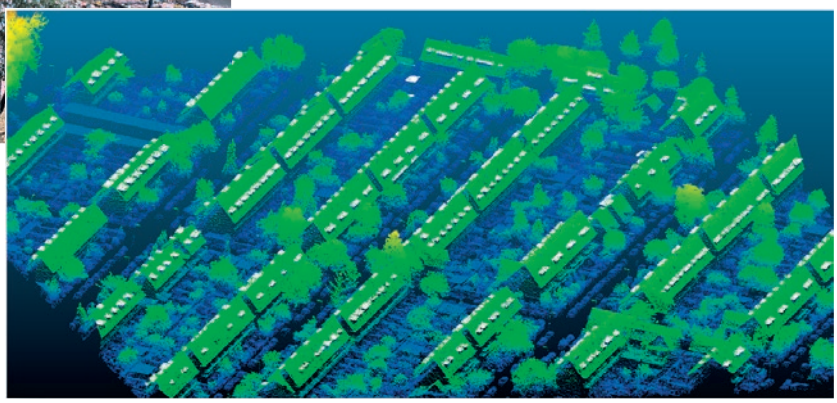
Every month *GIM International* invites a company to introduce itself in these pages. The resulting article, entitled Company's View, is subject to the usual copy editing procedures, but the publisher takes no responsibility for the content and the views expressed are not necessarily those of the magazine.

FEATURE EXTRACTION FROM LIDAR DATASETS

GeoSignum's mission is to provide unique solutions to local and global companies, municipalities and other agencies to increase productivity in the field of laser remote sensing, which involves the collection of large amounts of Lidar data. Extracting useful



▲ *GeoSignum Pointer web platform.*



▲ *Automatically detected dormers from airborne Lidar data.*

information from Lidar datasets often requires many hours of human labour. It might for example be necessary to manually inspect the dataset to identify specific objects. The start-up's technology has numerous mobile laser scanning applications in order to accelerate the processing of the massive amount of Lidar data. The complex algorithms developed by GeoSignum allow features to be extracted and mapped (in both 2D and 3D) for many significant road assets (i.e. curbs, crash barriers, street lights, power lines, fences, sound walls and much more). GeoSignum has developed new technologies for automatically interpreting huge volumes of 3D laser datasets which it has integrated with the GeoSignum Pointer web platform. The company's technology also has many uses for railway laser scanning applications. For instance, it can detect rail tracks, measure wire movement and extract and model certain assets in both 2D and 3D automatically. Despite being such a young firm, the professional atmosphere within the company stimulates its scientists and engineers to be creative, further motivating them to provide unique solutions for the 3D laser scanning industry.

GLOBAL SCOPE

GeoSignum is currently ramping up operations in Europe and also doing pilots in Asia and the USA. The feedback from clients is continually very positive feedback and the company is in constant dialogue with them to better understand their needs in order to optimise the solutions that it brings to the market in the future.

GeoSignum turns costly manual feature extraction into an automated process, saving organisations that use 3D laser scanning thousands of euros and months of time. The company therefore sees huge potential in many countries and across many industries where organisations are involved in mapping, planning, civil engineering and surveying using 3D laser scanning data, including highway and railway civil engineering companies, local and national governments and manufacturing businesses.

With the GeoSignum Pointer web platform, users can now immediately access terabytes of Lidar data via a web browser, create and manage an unlimited amount of projects (with download and share functions), extract features and visualise Lidar data in 3D on a high-performance web browser. This enables individuals in international organisations to access and manipulate their Lidar datasets anywhere in the world, simultaneously. GeoSignum is committed to bringing accessibility, efficiency and performance to international clients that use Lidar.

FUTURE VISION

The global 3D laser scanning industry is growing tremendously year on year. The industry includes 3D point cloud management, scanning, visualising, modelling and feature extraction, which are typically complex. Therefore, the ease of operating the technology has become increasingly important for a client's success with 3D laser scanning products and services. In addition, the cost of using 3D scanning data is reduced by approximately 30-40% when feature extraction is automated. For example, entire municipalities (such as Rotterdam in The Netherlands) are now utilising 3D laser scanning data and automated feature extraction via GeoSignum. GeoSignum's unique solutions to automate feature extraction enable users to gain powerful insights into the growth of cities at a much quicker pace and lower cost than previous solutions, thereby resulting in more efficient use of public funds.

Furthermore, the global 3D laser scanning industry is heavily characterised by intense competition and technological developments while also being highly price-sensitive. In the coming years, the companies in the 3D laser scanning field that are expected to make the most significant impact to the 3D laser scanning market are those that can reduce the costs associated with automatic data processing.

GeoSignum is the first to bring this solution to the market based on new cloud-based technology. The company's continued efforts to further optimise the technology while adding value for customers demonstrate its firm belief in the huge future potential for Lidar-related markets and industries such as highway, railway and city projects, and hence for society as a whole. ◀

More information
www.geosignum.nl
pointer.geosignum.nl

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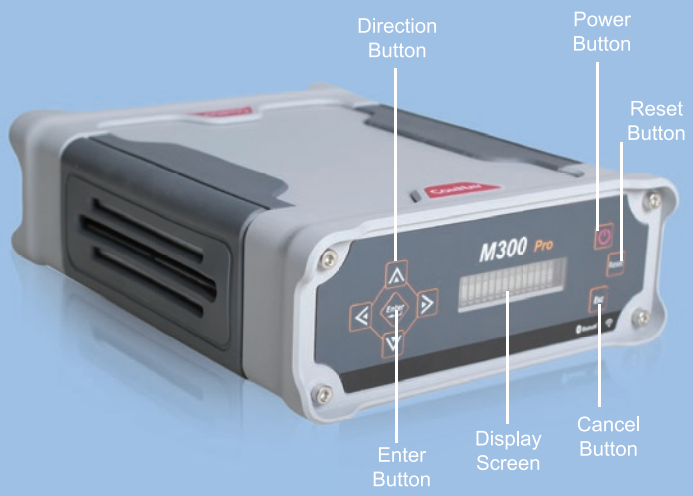
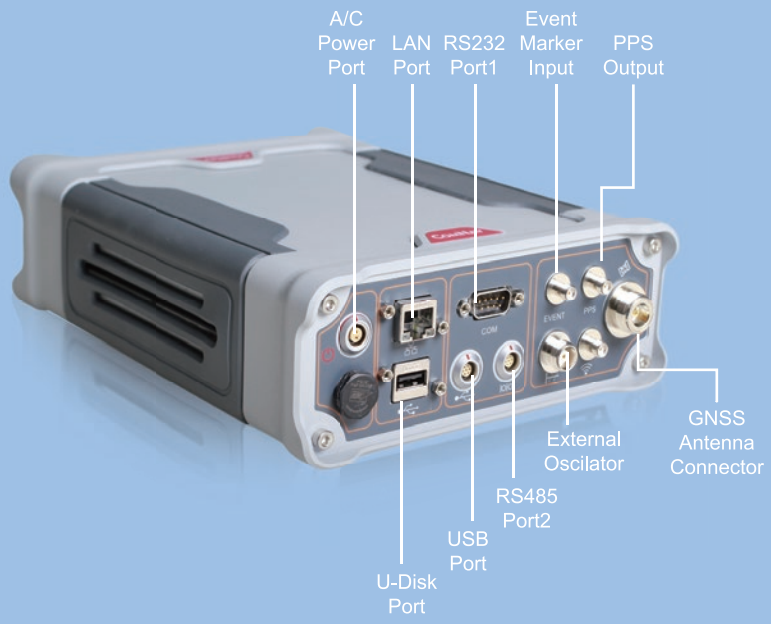
Low power consumption
Built in memory card slot

THE NEXT LEVEL RTK

GNSS RECEIVER M300 Pro





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Recovery from Disaster

Over the past decades, there has been a rise in the number and magnitude of natural and man-made disasters worldwide. Many inhabitants face various kinds of events such as earthquakes, flooding, storms, tsunamis, drought and the after-effects of conflicts. The various disasters and their consequences are a global challenge, especially when the effects of climate change are taken into consideration. In particular, surveying and spatial professionals play an essential role through their work related to land, sea, air and space in terms of preventive action, post-disaster activities and the long-term rebuilding and planning of areas.

Surveying and spatial professionals make an important contribution to improving, simplifying and shortening the disaster mitigation, rehabilitation and reconstruction phase through their capabilities in land management, geodetic engineering, geoinformation, satellite technology, remote sensing, etc. In addition to these engineering skills and knowledge, good governance and capacity development are central components.

FIG, in cooperation with New Zealand Institute of Surveyors (NZIS), is hosting the FIG Working Week in Christchurch, New Zealand, from 2-6 May 2016, the overall theme of which will be 'Recovery from Disaster'. The FIG Working Week is an exciting week-long conference that brings together the international community of surveying professionals to share innovative science with policymakers and stakeholders. Scientists, policymakers, decision-makers, students and stakeholders are invited to join the discussions on risk management as well as other issues affecting the international surveying and spatial community today and in the future.

FIG Working Week
Christchurch
New Zealand
2–6 May 2016
Recovery from disaster

New Zealand, and Christchurch in particular, is an ideal location from which to consider this theme. New Zealand is a relatively geologically active country with a history of seismic events. In 2010 and 2011 the Canterbury region experienced two major earthquakes, one at magnitude 7.1 on the Richter scale which was followed by thousands of aftershocks, causing major structural damage to the city. The local surveying and spatial communities were actively engaged in the Christchurch recovery immediately after this event and were at the forefront of the efforts to rebuild a new and vibrant city. Despite the earthquakes, Christchurch is now fully functional again and repairs to the essential service infrastructure have largely been completed.

In the recovery and rebuilding of Christchurch and its environs, critical lessons have been learned that can be applied to any global disaster. These various experiences will provide the platform for the FIG Working Week 2016, which will take place at the inspiring Horncastle Arena. Apart from an interesting mix of high-level plenary sessions, content-driven technical sessions, attractive technical tours and a dynamic exhibition, the FIG Working Week offers a 'once-in-a-lifetime' opportunity to visit New Zealand and enjoy the 'New Zealand experience': a welcome by Maoris (the indigenous people of New Zealand); visits to the best aspects of

▲ *The 2010 and 2011 earthquakes caused major structural damage to Christchurch.*

Christchurch and the surrounding area with a mix of stunning landscapes, unique flora and fauna and unspoiled countryside; a cultural New Zealand Evening as well as the Gala Dinner; the chance to join a haka or learn how to swing a poi; and the possibility to cheer on the All Blacks in a rugby stadium. ◀

More information
www.fig.net/fig2016

GSDI Small Grants Program 2015-2016 Awards

Since its launch in 2003, the GSDI Association's Small Grants Program has supported more than 100 projects around the world. Support for the programme comes from a partnership between the GSDI Association, the U.S. Federal Geographic Data Committee, Canada's GeoConnections Program, 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 up to the value of USD2,500; or a combination of cash award and SDI/GIS consulting services. The consulting services are offered through the GISCorps.

In 2015, GSDI secured additional funding from the GeoConnections Program within Natural Resources Canada for four more GSDI Small Grant projects, outlined below, which were selected from highly rated 2014 proposals.

Title: GeoCommunity Galapagos: Creating a Community-Based SDI for the Galapagos Islands
Institution: GeoCentro – Universidad San Francisco de Quito (USFQ), Ecuador

Project summary: This project supports the development of a community-based SDI Galapagos (GeoCommunity Galapagos) that will allow local authorities and communities in the Galapagos Islands to take informed actions in meeting the challenges of sustaining a vulnerable and unique island ecosystem in the 21st century. Project deliverables include:

- A conceptual framework for the community-based SDI Galapagos including a GeoCommunication framework focusing on citizen participation in spatial planning.
- A system architecture and design of the SDI Galapagos.
- Implementation of flagship projects that are simple and easy-to-use GIS-applications based on shared spatial data and information.
- Publications in scientific media/ conferences and local media and an online tutorial for designing and implementing community-based SDIs.

Title: Survey of SDI Readiness in Indonesian Local Government
Institution: Research Centre for Spatial Data Infrastructure Development (PPIDS), Universitas Gadjah Mada, Yogyakarta, Indonesia

Project summary: This project will complete a comprehensive survey of SDI readiness at the local government level. The survey will obtain evidence-based information required to devise appropriate strategies for SDI development. Project deliverables include:

- Web-based self-assessment tools for SDI readiness.
- Interactive maps of Indonesian local governments' SDI readiness. The map will also present an interactive analysis of SDI components and roles.
- A workshop for validation and analysis as well as launching the web-based tools and maps.

Title: Upgrading in the National Metadata Portal
Institution: National Spatial Data Management Division, Ministry of Water, Land, Environment and Climate Change, Jamaica

Project summary: This project supports upgrading the current metadata portal that is used by Land Information Council of Jamaica (LICJ) member organisations. The portal will enable discovery and use of geospatial resources including datasets, rasters and web services and will support a standards-based clearinghouse and metadata discovery applications. Project deliverables include:

- Creation and publication of user guide for the platform.
- Creation and publishing of metadata records on the upgraded platform.

Title: Developing a Framework for South African SDI Education and Training
Institution: Committee for Spatial Information (South Africa), Sub-Committee on Education and Training

Project summary: The project will initiate a discussion on GIS market sector demand in southern Africa with academics, researchers and industry representatives. In addition, a survey of GIS user needs will be conducted in order to better inform education and training curricula. Project deliverables include:

▲ *GSDI Small Grant recipients from South Africa.*

- A workshop to prepare a framework for South African SDI education and training, at the University of Pretoria.
- A survey of tertiary education sector curricula (SDI contact) in South Africa.
- A database of currently available SDI education and training material that will be published on a central web page.

Once completed, summaries and final reports of these projects will be posted to the GSDI website by April 2016, so subsequent news will be available about these projects at that time. ◀

Brigitta Urban-Mathieux is GSDI Small Grants Program project leader. Contact smallgrants@gsdi.org

More information
www.gsdi.org

Harald Schuh's Presidential Address: IAG's 4-Year Vision

On 1 July 2015, the new IAG president Harald Schuh gave his inaugural address at the 26th General Assembly of the International Union of Geodesy and Geophysics (IUGG), in Prague, Czech Republic. In his introduction, he especially thanked one of his former mentors, James Campbell, who introduced geodetic Very Long Baseline Interferometry (VLBI) to Europe, as well as the current IAG secretary general Hermann Drewes and his co-workers, colleagues and friends.

▲ *IAG's new president, Harald Schuh.*

Professor Schuh reminisced about the 1980s when he took his first steps in space geodesy with contributions to NASA's Crustal Dynamics Project. This was contrasted with today's situation. A global network of almost 500 continuously operating global navigation satellite system (GNSS) stations within the International GNSS Service (IGS), densified by thousands of additional GNSS sites in regional networks (e.g. Japan's GEONET, Europe's EUREF, the Western USA's PBO and others).

In addition, the geodetic infrastructure includes a network of globally distributed satellite laser ranging (SLR) and VLBI stations of the highest technical standard, complemented by other ground-based and space-based technologies. Professor Schuh then highlighted IAG's Global Geodetic Observing System (GGOS), which is dependent upon these global geodetic networks, and summarised the main tasks of the GGOS: the integration and combination of different measurement systems, observations, analysis methods and models; connecting the geometric techniques with those of physical geodesy; and representing IAG within high-level organisations and forums such as GEO, CEOS, UN-GGIM and others. Professor Schuh then reminded the audience of the vision of GGOS, which is to facilitate a better understanding of the dynamic Earth system through the quantification of spatial and temporal changes to our planet. He stressed the importance of the GGOS Inter-Agency Committee (GIAC) as a group of stakeholders that fund and operate the geodetic infrastructure.

In his address, Professor Schuh went on to mention the UN Resolution No. 69/266 on the importance of geodetic reference frames (see the May 2015 issue of *GIM International*). After the long-lasting and vigorous efforts of many individuals in the geodetic community, supported by many others such as the member organisations of the Joint Board of Geospatial Information Societies (see the July 2015 issue of *GIM International*), the resolution was adopted by the UN General Assembly on 26 February 2015. This resolution is indeed a landmark for geodesy because it recognises the economic and scientific importance of, and the growing demand for, an accurate and stable global geodetic reference frame for the Earth, and encourages Member States and relevant international organisations to enhance global cooperation and to increase investment in upgrading of the global geodetic infrastructure.
In his conclusion, Professor Schuh touched on IAG's future perspectives, including some 'dreamlike' developments. As feasible examples, he referred to the use of quantum mechanics for geodesy, as indicated by the establishment of a Collaborative Research Centre at Leibniz University Hanover titled 'Relativistic Geodesy and Gravimetry with Quantum Sensors'. Professor Schuh also highlighted the rapid developments in satellite technology (e.g. the growing interest in swarms of low-cost mini-, micro-, nano-, pico- and even smaller satellites). In his final remarks, Professor Schuh imagined a world of low-cost sensors transmitting geodetic data from billions of points to central units for continuous processing, and even the establishment of a World Geodetic Organisation (WGO) which could implement geodetic infrastructure anywhere it is needed in the world.

We wish Harald Schuh all the best for his next four-year term as IAG president! ◀

Chris Rizos

More information
www.iag-aig.org

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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Ordem e Progresso (2): Around the World

▲ *Delegates voted at the ICA General Assembly in August 2015 under the scrutiny of Marek Baranowski (Poland) and Kristoffer Kristiansen (Norway).*

The 2015 ICA General Assembly in Rio de Janeiro, Brazil, in August was the occasion of the election of a new Executive Committee (EC), as reported on the ICA page in the previous edition of *GIM International* (September 2015). The outgoing EC (2011-2015) can look back with pride on an effective period of office, during which ICA has succeeded with some notable achievements. A total of six individuals, all of whom contributed significantly to ICA, have left the EC. Most prominently, past-president Bill Cartwright is retiring after 16 years on the EC; his achievements in office have been outstanding and ICA will miss his wise and incisive leadership and judgment. The other five to depart all came from governmental mapping agencies: Tim Trainor (USA) and Derek Clarke (South Africa), both on the EC since 2007, have successfully ensured that ICA does not forget the cornerstone role of national mapping agencies throughout the world. Their mastery of detail, wealth of contacts and globally high reputation will not be lost to ICA as they will continue to represent the Association in other arenas, lead ICA committees and direct future conferences. Anne Ruas (France) also served two terms on the EC; her dedication to the international dimension of ICA will be missed but, as joint editor (along with Bill) of the new ICA journal, she will continue to benefit ICA with her outstanding research reputation. Anne also helped to organise the International Cartographic Conference in 2011, as did Paolo Menezes (Brazil), memorably, in Rio this year; Paolo leaves the EC but remains as chair of a Commission. Last but not least, Sukendra Martha was the first ICA vice president from Indonesia and was also able to contribute to the global nature of the past EC.

Newly elected as secretary-general in 2011, Laszlo Zentai (Hungary) has travelled widely in that role, engaging with member nations in many parts of the world. He has also proven to be a most effective administrator, liaising closely with his near-neighbour ICA president Georg Gartner in an impressive 'Austro-Hungarian alliance'. Laszlo has been re-elected for 2015-2019 so ICA is in safe hands for the next four years. As past-president, Georg also remains on the new EC which will surely benefit from his wise counsel and experience.

Menno-Jan Kraak has served on the EC from 2007, so he brings significant experience to his 2015-2019 role as the Association's new president. One further vice-president from 2011-2015, Yaolin Liu (China), retains his position, bringing an energetic approach to the work of raising ICA's profile still higher in Asia. The other six members of the 2015-2019 EC are newly appointed. The Rio election has something of a Euro-centric nature, but there are still representatives from around the world. The spread of working environment is also broad, with ICA still retaining EC representation from national mapping agencies and government ministries.

The workhorses of ICA, the Commissions listed below, are each hosted by member nations of ICA, and the distribution is satisfyingly global. 18 different nations host a total of 27 Commissions – 11 in Europe, 11 in the Americas, two in Asia, two in Africa, and one in Australia – whilst the important post of Newsletter Editor remains with the enthusiastic and skilled Igor Drecki in New Zealand. The 2015-2019 ICA leadership is all ready to go! ◀

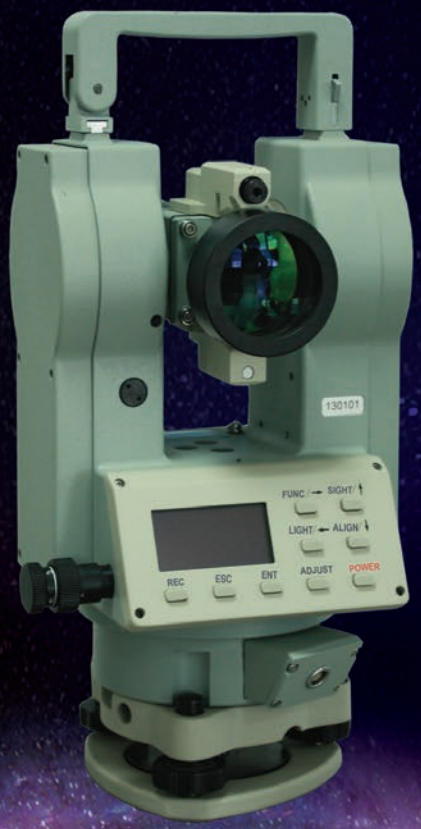
More information
www.icaci.org

RTS010 Total Station

1 " angle measuring accuracy

1mm+1ppm

distance measuring accuracy



DT010-Z
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1 " angle measuring accuracy

EL03 Digital Level

0.3mm standard deviation of 1km double run

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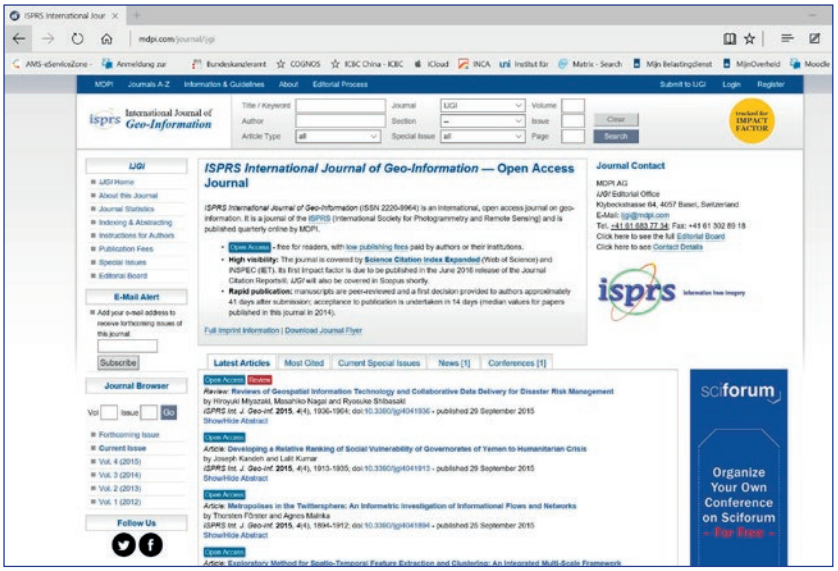

▲ *The* ISPRS International Journal of Geo-Information *is an open-access journal.*

The journal covers the whole range of geoinformation by regular research papers, reviews and communications. Guest editors are invited for special issues to address larger sub-domains of geoinformation that deserve special attention or are of special interest to the scientific community. So far, 21 special issues have been published and 10 more are currently open for submissions:

- Spatial Ecology
- Applications of Internet of Things
- Recent Trends in Spatial Analysis and Modelling of Built-environment Characteristics
- Geosensor Networks and Sensor Web
- Geographic Information Retrieval
- Mathematical Morphology in Geoinformatics
- Research Data Management
- Geoinformation Fostering Innovative Solutions for Smart Cities
- Unmanned Aerial Vehicles in Geomatics
- Big Data for Urban Informatics and Earth Observation

This year marked a great success for the journal. Only after three years of operation, in April 2015 we received confirmation that the *ISPRS International Journal of Geo-Information* is being indexed by the Thomson Reuters Web of Science (Science Citation Index Expanded) and will also be covered by Scopus. We expect the first official impact factor in June next year.

As editor-in-chief I would like to encourage all scientists from around the world to submit contributions to this journal. My wish is to stimulate scientific exchange by high-quality papers and contributions. For more details, please visit www.mdpi.com/journal/ijgi. ◀

Wolfgang Kainz
Editor-in-chief

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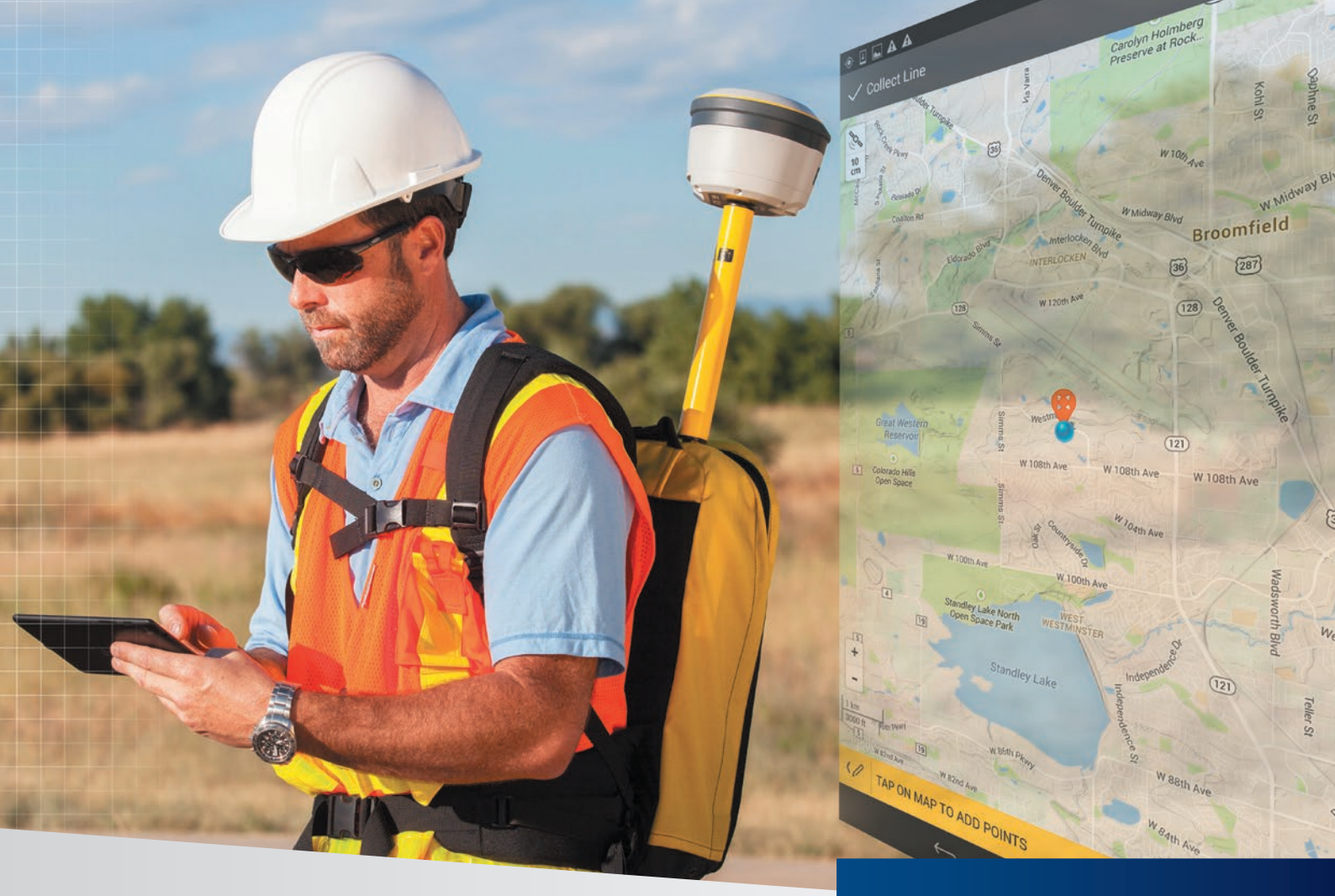

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