

## Bringing Geography into Everything

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Technologist of Google

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 Copper & Gold Inc.



**Scott Widmann**  
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 DPR Construction



**Gregory Walden**  
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 Ak n Gump Strauss Hauer  
 & Feld/LLP: Small UAV Coalition



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**Serious Gaming**

Improving Stakeholder Communication in Urban Development Projects



**FEATURE PAGE 23**

**Building a Global 3D Routing Map**

Using Mobile Mapping to Collect Trillions of Points around the World



On the front cover of this month's issue: A Google Trekker heads south from the Hillsboro Inlet in Broward County, Florida, USA. On page 14 you will find an interview with Ed Parsons, geospatial technologist at Google. Parsons is responsible for evangelising Google's mission to organise the world's information using geography. (Photo by Peter W. Cross)

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# Geo in everything

There's a little bit of geography in everything. That's one of the main statements that 'man with the mission' Ed Parsons is trying to spread around the world. Ed Parsons is responsible for evangelising Google's mission to organise the world's information using geography and he was interviewed in this issue of *GIM International* by our editorial manager Wim van Wegen (see page 14). Parsons is a geospatial technologist and has seen many changes in the field of geo-information since he started at Google in 2007. The most striking message that Parsons has for the field of geomatics is that there's 'geography DNA' in almost every product or service that one uses on the web or the smartphone. Geo-information is ubiquitous and that holds a big promise for the future.

There's already enough reason to celebrate. Maps are used every day by hundreds of millions of people: close to a billion are using Google Maps in one way or another and

maps are improving the lives of those users in several ways. For example, a lot of time can be saved by not having to study routes while travelling and it is now very easy to find the quickest way to a restaurant or shop when in the city. On top of that, it also gives people the right to call a piece of land their own, thus acquiring a registered economic life with increasing welfare for themselves and their families. All in all, consequences that have come with that widespread use of geo-information fall in the spectrum of 'nice-to-have'.

In the upcoming years it's important to spread the use and therefore the beneficiary outcomes of embracing geo-information as part of daily life. A pleasing message in the interview with Parsons is that it is not Google alone that will help the poorer and developing parts of the world to benefit from the digital geo-revolution. It will require teamwork between hard- and software companies to bring fast internet to as many people as possible and new and other business models will have to be thought up for these companies to be able to make it happen.

The geospatial industry is more influential, says Ed Parsons in this issue of *GIM International*, than ever before. Maybe not as obvious to everybody in the outside world, but, again, 'geo' is part of a lot of the activities of citizens, businesses, organisations and governments – day after day. The fact that geography is in everything and is everywhere makes the opportunities for the geospatial industry to grow their number of products and services immense, says the evangelist of Google. Here at *GIM International* we couldn't agree more.



Photography: Arie Bruijsma

▲ Durk Haarsma, publishing director

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## The 'Art of Recording'

Creating a viable state requires money. Governments that don't have money cannot spend. Not, for example, on infrastructure, health care or education. Economic growth much depends on education, as Thomas Piketty in his book *Capital in the Twenty-First Century* convincingly explains. In rich countries public spending on important things for society amounts to 50-60% of the GDP, in other countries much less. As a consequence the tax burden in rich countries is high, say up to 45% of the GDP, while in other countries the government doesn't collect more than 10-20%. In some cases those governments mainly receive tax income from mineral exports and not from income, profit and land taxation, which makes the state budget extremely volatile (e.g. Nigeria, Angola and the Middle East). But how can poor countries collect taxes when the necessary tax administration does not exist or is not maintained? How can income tax be levied when there are no reliable census and income records? The same goes for taxing business profit without business records, car tax without car records, land and transfer tax when there is no cadastre. I would like to bring to the fore that one of the important drivers of state building is the capacity of the

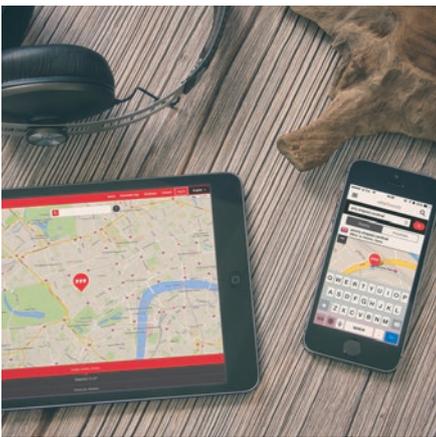
government to levy taxes and to claim an equitable share of the national income. Morten Jerven in *Poor Numbers* unveils how often governments fail to invest in correct and reliable datasets on persons, businesses, vehicles, finance, land and real estate, which are actually fundamental to their ability to govern the country. I sometimes wonder why surveyors do not defy their governments to develop such fundamental datasets, and ostensibly accept the current situation tacitly. I feel that this attitude impairs the further building of the state and that the lack of fundamental datasets warrants intervention. After all, surveyors are professional in collecting data, safeguarding accuracy and reliability through process design and process management, and are amongst the few professionals that can handle big and complex IT systems. Surveyors are traditionally focussed on land and real estate, but my question is whether the overall skill of surveyors shouldn't actually be the 'art of recording'? Does it really matter whether registers concern land, persons, cars, and such like? I challenge the propensity of surveyors to do their daily cadastral work in a modest way, while they are so versed in 'the art of recording'. By upgrading their professional image to 'recording expert', they could deliver an urgently needed contribution to the building of states. Better taxation has yet another benefit, namely becoming less dependent on external aid. As Dambisa Moyo in *Dead Aid* explains, governments which are forced to be accountable to donors cannot be accountable to their own population at the same time, while the latter appears to be fundamental to state building. Why should citizens otherwise comply with fiscal rules? Surveyors could be more important than they think they are.



## what3words Wins Innovation Grand Prix at Cannes Lions

The young British company what3words has won the prestigious Innovation Grand Prix at the Cannes Lions awards in France – the world's biggest annual awards show and festival for professionals in the creative communications industry – for its revolutionary service that gives every location in the world an easy-to-remember three-word address. The solution tackles a problem that affects about 75% of the world's population, who have either no address or an inadequate one. Without an address, people struggle to secure microfinance, run a business or join the global economy.

► <http://bit.ly/1LTUFTB>



what3words on various devices.

## Geo-matching.com Adds Handheld Scanners Category

Geo-matching.com has recently added Handheld Scanners to its broad spectrum of product categories. FARO Europe, DotProduct and Artec 3D Scanners are the first suppliers in this category. In addition to general specifications, detailed information is given about scanning characteristics, connectivity and sensors and functionality. To see the Handheld Scanners category, visit [www.geo-matching.com](http://www.geo-matching.com).

► <http://bit.ly/1C8aaoP>

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



1. Rwanda Launches First-ever Land-use Portal in Africa - <http://bit.ly/1MJWjHI>
2. Hans Rosling to Share His Insights into Global Change at GIM Summit - <http://bit.ly/1MJVfnj>
3. Wearable Reality Capture with Leica Pegasus:Backpack - <http://bit.ly/1Rf9rDx>
4. Integrated Land Management – A Dream? - <http://bit.ly/1MJVI8Q>
5. What a UAS Actually Is and Does - <http://bit.ly/1MJVUFk>



# EXTENDED BATTERY LIFE MEANS EXTENDED PERFORMANCE.

The new ADL Vantage 35 is better than ever with improved battery life without any loss in range.

The Pacific Crest ADL radio line provides configurable power for the challenges of GNSS/RTK surveying and precise positioning. The ADL Vantage operates between 0.5 and 4 Watts and the ADL Vantage 35 can deliver up to 35 Watts. A full-function user interface on both radios streamline field configuration and troubleshooting.

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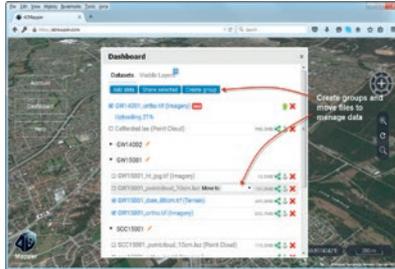
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## 4DMapper Launches Complete Geospatial Data Solution

4DMapper, a browser-based 3D geospatial data gateway, has been launched recently to change the way geospatial data is stored, delivered, visualised and shared. Powerful cloud processing enables the fusion of multi-source content and seamless streaming of massive data files, immediately, to unlimited users on their browsers. According to 4DMapper, this turns the geospatial world inside out, enabling access to big data without local storage, hardware and software.

► <http://bit.ly/1eJ0ICv>



4DMapper.

## Second Edition of Commercial UAV Show in Bigger Venue

On 20 and 21 October 2015 the UAV community will gather in London, UK, where the Commercial UAV Show premium conference brings end users from a range of industries together in one room to evaluate how UAVs can deliver cost and operational efficiencies. The event is the right occasion to meet organisations currently using UAVs successfully alongside the companies supplying the latest technology so that visitors can decide where and how their organisations can benefit most.

► <http://bit.ly/1eJ3TVt>

## The Hague to Host Second TUSEXpo for UASs

From 2-4 February 2016, the Dutch city of The Hague will host the second edition of The Unmanned Systems Expo (TUSEXpo) at the city's World Forum. TUSEXpo is a European trade fair aimed at the growing market for unmanned systems such as drones and will feature both commercial and civil applications in areas including security, agriculture, industry, science,

entertainment and environmental protection. The event is expected to attract 2,500 international visitors.

► <http://bit.ly/1gsLZb5>



TUSEXpo 2015.

## Planet Labs to Acquire BlackBridge

BlackBridge has entered into a definitive agreement for Planet Labs to acquire the RapidEye suite of core offerings. Planet Labs is a provider of a dataset of satellite imagery based in San Francisco, USA, that designs, builds and operates a fleet of Earth-imaging satellites. The transaction is subject to the customary closing conditions and is expected to close during the third quarter of 2015.

► <http://bit.ly/1gsLduE>

## FIG Working Week 2016 Programme Unveiled

FIG is inviting geomatics professionals to the FIG Working Week 2016 which will be held in Christchurch, New Zealand, from 2-6 May 2016. The Working Week is hosted by FIG and the New Zealand Institute of Surveyors (NZIS) as the local host. The FIG Working Week 2016 has wide support throughout New Zealand with a commitment already pledged by Christchurch City Council and Land Information New Zealand, which is New Zealand's government department responsible for land titles, geodetic and cadastral survey systems and topographic information.

► <http://bit.ly/1eIX4TI>



Carlson Surveyor2.

## Carlson Software Releases Surveyor2 Data Collector

Carlson Software recently released its new Carlson Surveyor2, the newest model in the Carlson Surveyor line of data collectors. The Surveyor2 is paired with Carlson's software to provide a complete solution for surveying, stake out, construction layout and GIS mapping.

► <http://bit.ly/1gsLOYi>

## Intergeo Launches UAS Side Event

In line with the growing role of UASs in geomatics Intergeo is increasingly looking skywards, as demonstrated by interaerial SOLUTIONS, an integrated platform for all aspects of UASs. Visitors can witness the incredible pace of developments in applications and the very latest solutions – whether multi-

copter, helicopter or fixed wing – at the upcoming Intergeo in Stuttgart, Germany, from 15-17 September. International UAS manufacturers will be on hand alongside hardware and software suppliers and service providers.

► <http://bit.ly/1gszyfo>



senseFly eBee UAS.

## Hans Rosling Confirmed as Keynote Speaker

The Conference Committee is excited to announce that Hans Rosling will be appearing at the GIM International Summit as a keynote speaker. The professor of international health in Stockholm, Sweden, is a high-profile public speaker on global change, and *Time Magazine* listed him among the 100 most influential people in the world. Thanks to his inimitable style of presenting data and information, delegates at the GIM International Summit in February 2016 are in for a real treat!



Hans Rosling studied statistics and medicine in Sweden and then worked as medical doctor in Mozambique, where he identified a new epidemic paralytic disease that

was named konzo. His research across rural Africa linked it to hunger and organic dietary toxins. He initiated Médecins sans Frontières in Sweden, is a member of Scientific Academies and an author of a

textbook on global health.

With his son and daughter-in-law he co-founded Gapminder and developed animation software that Google acquired. By using it to animate statistics, Hans Rosling raises understanding of global economic, social and environmental trends. His award-winning lectures are described as 'humorous, yet deadly serious'. His key message is that the old division between developed and developing countries has been replaced by countries on a continuum of social and economic development. ◀

## WHAT IS THE GIM INTERNATIONAL SUMMIT?

The GIM International Summit is focused on discussing the future of the field. The discussion will be fuelled by speakers from outside the traditional geomatics world, all of whom are experts in their own field. They will explain the needs and desires of the wider world and how they would like to see the geomatics sector develop.

The summit will be very much based on the concept of 'inside looking out' rather than merely insiders' perspectives. The main topics of the Summit – Water, Food Security and Social Justice – will be brought together under the overarching theme of 'Seeking Space for Future Development'.



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Do you want to be part of the geomatics innovation? Sign up to attend the GIM International Summit at [www.gimsummit.com](http://www.gimsummit.com).

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## Satel Launches Extremely Small Radio Data Transceiver Module

Satel, a Finnish manufacturer of radio data transmission systems, aims to set a new milestone with the launch of the new Sateline TR4. This compact UHF transceiver with transmitting power of 1,000mW is compatible with the protocols of Pacific Crest, Trimble and Satel. The type certifications in all important regions of the world make the Sateline TR4 very suitable for integration in end devices that are intended for international use.

► <http://bit.ly/1eIXeKP>



Sateline TR4.

## 100 Resilient Cities Launches London Office and Announces Esri Partnership

100 Resilient Cities – pioneered by The Rockefeller Foundation (100RC) has announced the opening of its regional headquarters in London to serve member cities in Europe and the Middle East. 100RC has also announced new partnerships with AIR Worldwide and Esri. 100RC is dedicated to helping cities around the world become more resilient to the physical, social and economic challenges that are a growing part of the 21st century, including UK member cities London, Bristol and Glasgow. The move comes less than six months after London was named part of the presently 67-city global network.

► <http://bit.ly/1eJ08Zl>



Cutting the new office's ribbon.

## Symposium Programme Released for UAS Mapping 2015 Reno

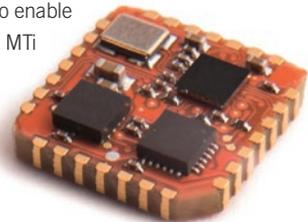
The programme has been announced for the second annual technical UAS Mapping 2015 Reno symposium, sponsored by the American Society for Photogrammetry and Remote Sensing (ASPRS). The conference will take place on 29 and 30 September 2015 at the Reno Ballroom in Reno, Nevada, USA. In addition to the technical symposium, ASPRS is also sponsoring a workshop on UAS Data Processing on Monday 28 September.

► <http://bit.ly/1eIZB0n>

## Xsens Launches New Family of Motion Trackers

Xsens, a Dutch innovator in 3D motion tracking technology, has expanded its successful 4<sup>th</sup>-generation MTi product portfolio by releasing a new series of complete, self-contained 3D IMU/RU/AHRS motion tracking modules for high-volume industrial and prosumer applications. The new MTi 1-series of motion trackers incorporates the latest in advanced sensor fusion and miniature MEMS technologies. Individually calibrated and tested to enable minimal implementation effort, the MTi 1-series delivers a dynamic accuracy of 1° RMS for roll and pitch, making them the most accurate 3D motion trackers in their class.

► <http://bit.ly/1LTUJ74>



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## Swiss Use TatukGIS SDK for Road Infrastructure Management

Switzerland-based geologix AG has used the TatukGIS Developer Kernel to develop GIS functionality in its 'Logo' information system for planning, managing and maintaining road infrastructure. Logo is targeted at all people and organisations entrusted with road administration, including road engineering and construction planning. Logo customers in Switzerland and Germany range from small villages with up to 30km of roads and streets to cities with up to 500km of road and streets and counties/states with more than 3,000km of roads and streets to manage.

► <http://bit.ly/1e1WYTH>

## Dutch Prime Minister Embraces Tygron's Digital Urban Planning System

The Dutch Prime Minister Mark Rutte, Minister of Infrastructure and the Environment Melanie Schultz van Haegen and alderman Boudewijn Revis of BSKB The Hague experimented in a real-life digital urban planning system by Tygron last month in the Binckhorst area of The Hague. This interaction marked the start of Tygron's collaboration with the Dutch government. It was clear that the Tygron Engine led to all parties reaching a consensus, thus underlining its role as the urban planning tool of the future.

► <http://bit.ly/1e1Z7qQ>



*Dutch PM Rutte and Minister Schultz van Haegen during the workshop.*

## Supergeo Announces SuperGIS Server 10 Series



*SuperGIS Server 10 series.*

Supergeo is upgrading all its products to a new level, the 10 series, including SuperGIS Server. The most notable change in SuperGIS Server 10 is its integration of 2D and 3D capabilities. In the SuperGIS 3 series, SuperGIS Server and SuperGIS 3D Earth Server provide 2D and 3D map visualisation respectively. With the integration of 2D and 3D, users can view the same map layers in two different modes and gain a better understanding of their data.

► <http://bit.ly/1e1ZP7u>



*60mm x 67mm*

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# How a Well-functioning Cadastre Can Help Greece to Emerge from the Crisis



Acropolis, Athens.

Last year *GIM International* took the opportunity to interview the general director of the Greek Cadastre, Akis Markatos. Earlier in 2014, work had started on the completion of the cadastral registration in Greece. More than 60 percent of the territory still had to be surveyed, and the project was destined to be completed by 2020. The IT infrastructure had been set up, new laws passed, 28 survey projects tendered, and a new board and management were in place at the National Cadastre and Mapping Agency. Now, one year later, not much seems to have changed and there are still many challenges to overcome. The interview from June 2014, which is still relevant today, illustrates just how important a well-functioning cadastre is in helping the Greek government to find a way out of the debt crisis.

► <http://bit.ly/1gsLEoC>

# Grand Prize for Boston's Snow Story

Esri revealed the winners of its Storytelling with Maps Contest on 20 June 2015 at the Esri User Conference in San Diego, USA, highlighting grand prize winner Joyce John's Snow Journal story map for the city of Boston. John's story map



Boston, February 2015.

incorporated data-rich maps, videos, photos and text to craft an engaging story of how the city dealt with historic amounts of snow in Boston earlier this year.

► <http://bit.ly/1gsMoKff>

# ITRF



Nowadays, we are living in an interconnected world with road and sewerage networks, oil and gas pipeline networks, power lines and drainage canals. Not all these networks are visible and geodetic reference systems belong to these invisible networks. Billions of people use these systems every day, quite unknowingly, for positioning and navigation purposes.

In the era of industrialisation it took decades to establish nationwide reference systems. For example, the creation of the famous Great Arc forming the geometric backbone of the Indian subcontinent took 50 years. This undertaking was led by George Everest as surveyor-general of India during the period 1830 to 1843. Indeed, Mount Everest, the highest mountain on Earth, was named after the surveyor to honour his efforts in determining the height of the peak. Today, the creation of a reference frame with centimetre accuracy takes a matter of months rather than decades, thanks to GNSS. For many centuries the surveyor was limited to attaching his measurements to a local or – at best – a national frame. Even to this day no unified and accurate geodetic frames are available in some developing countries. For example, Burkina Faso now has nine continuously operating reference stations (CORS) covering the whole nation, but up until recently the country had to make do with multiple frames: one established in 1950 by IGN France covering French-speaking West Africa, one made in 1958 in and around the capital Ouagadougou, one set up in 1960 by the US army and one based on Doppler measurements created in 1979. Since 1997, a first-order network of 55 GNSS points has covered the entire nation. When so many systems are used at the same time

the value of modern GIS and surveying technologies becomes scant. Launching CORS is a first step towards unified frames.

Since the turn of the millennium the amount of geodata has grown at a compound rate of 20% annually. Nowadays, 15 times more geodata is available than 15 years back and its use by diverse managers and planners is supported by Global or National Spatial Data Infrastructures and open geodata. Nearly all modern geodata acquisition tools, including mobile GIS, Lidar, mobile mappers, aerial photogrammetry and unmanned airborne systems, use INS and GNSS linked to a CORS for positioning the sensors. GNSS positions are given in the worldwide standard WGS84. Civil engineers, dike builders and water boards do not need heights above a mathematical surface, which is an artificial construct, but 'physical' heights above sea level, or better geoid, to prevent water from running the wrong way in a network of drainage canals. Added to this, the increasing cross-border use of geodata requires inter-regional reference frames.

The International Terrestrial Reference System (ITRS) is the most accurate global frame and today nearly all countries have adopted ITRF. Plate tectonics cause movement of land masses, meaning that Africa and South America, for example, are drifting away from each other and Europe is colliding with Africa and Asia. The mutual position of reference points therefore deforms in the course of time – the coordinates are time dependent and need revision once in a while. It is not enough to know that a frame is connected to ITRF. Its epoch also has to be known as well as the seven parameters (scale, 3 translations and 3 rotations) of the 3D similarity transformation to link the various frames. ITRF ensures compatibility of a variety of cross-border geodata. GNSS users benefit a great deal when the transfer from the WGS84 outputs to ITRF is carried out by the device itself. Once the 7 parameters are known, a little piece of software embedded in the system suffices to conduct the transformation automatically. The scripting of such software can be done by the users themselves or by the vendors of GNSS receivers and GIS software. Many users will prefer the latter. ◀

# Bringing Geography into Everything

As Google's geospatial technologist, Ed Parsons is responsible for evangelising Google's mission to organise the world's information using geography. *GIM International* caught up with this 'man with a mission' in Barcelona during one of his countless foreign trips.

***You're the geospatial technologist at Google, responsible for evangelising Google's mission to organise the world's information using geography. Can you describe that mission?***

In many ways it's quite a unique role since the number of people within Google that are really focused on outside the organisation is quite limited. A key aspect of the role is communicating what Google is trying to do in very broad terms to different communities. For me those communities specifically include the academic research community and also potential partners: people that might want to use our technology for applications they are building, or people that might want to contribute content to Google Maps. The broadest community is our users. Here, I've already spoken this week to people from travel magazines and from cookery magazines, all making use of Google technologies.

***When you were hired by Google back in 2007 your task was to improve the interface between the new geoweb company and the GIS industry, to bring those two worlds together. How long did it take to succeed?***

I'm not sure how far we have succeeded. Maybe the challenge has moved a little bit. I think the traditional GIS world and the mass-market, consumer use of geography have become closer. You see that with the greater use of APIs from companies like Esri. Meanwhile, traditional data providers are opening up and having open data programmes like Kadaster in The Netherlands and Ordnance Survey in the UK. So those

have come together a little bit. The challenge that has emerged over the past 10 to 15 years is to try and get the GIS community to adapt more standard web technologies. You could argue that the GIS community has developed a particular way of doing things, almost in parallel to the rest of the internet. We've developed our own web services for producing maps and so on, and for communicating the content of geographical databases. But we've never really made them truly web-compatible. I think that's the next challenge: to make the GIS community more web-savvy. To become citizens of the web, take a less GIS-specific approach to publishing data. We need to recognise that 95% of the consumers of whatever we create will not be GIS specialists. We can't expect them to understand GIS metadata catalogues and particular ways of encoding geographic content that they have never come across before.

***You come across as a geospatial technologist preaching to his own community of the like-minded, marching a little way ahead of the troops but never forgetting where he's come from. Is this a fair reflection of you?***

Yes, I think so. I'm a geographer at heart and I think geography is a very important science, a very important way of looking at the world. The fundamentals of geography, spatial autocorrelation and intercorrelation, the fact that things close to each other are more related than things further apart, is actually really important in many realms of human activity. So yes, I'm always going to be a geographer. Perhaps what I'm

trying to do is bring a bit of geography into everything. I'm less precious than I once was, thinking we need to teach everyone about GIS so that they understand geographic principles. In reality we do need to make small elements of geospatial technology accessible and available to everybody but they don't necessarily need to understand it. Take a company like Uber – it can only exist because of the underlying geospatial technology. But it's not a GIS company, just like social networks are not GIS applications, even though they all have an element with geographic intelligence. That's our future. I often draw the analogy that each organism has DNA and certain sequences are responsible for particular characteristics of that organism. I think there's probably 'geography DNA' in almost every product or service that you use on your mobile phone or on the web nowadays. That's the big difference; it's now possible for that to happen.

***Over the past decade, maps have become much more present in everyday life due to internet, mobile devices and social media. The globe is in our pocket now – almost a revolution. Is this a big win for mankind?***

[Laughs] Well...maybe a 'big win for mankind' is overselling it a bit. It's certainly transformative. You're absolutely right; mapping is much more accessible and available than it has ever been, largely through the internet and mobile devices. At a very practical level it means that, as individuals, we probably now take for granted the fact that we're always able to know where we are, anywhere in the world, and we're



always able to know – to a reasonable level of accuracy – what’s happening around us. Where are the bus stops, where are the restaurants, where’s the police station, how do I get from where I am to my hotel? That’s crept up on us, that capability. Now we travel with much less planning than we used to. It wasn’t that long ago that you’d see people on trains with printouts of maps and their itineraries. Now, we get off the train somewhere and we fire up our smartphone, or smartwatch even, and off we go and find wherever we need to be. Maybe, as result of doing less planning, we’re saving a few minutes every day which in we can do other things, and potentially that makes a big difference for us.

On the other side of the equation, if you’re a small business looking to attract customers, such as a bicycle shop in The Hague, and you know that there are people in your neighbourhood who are looking for a particular accessory right now for that

bike that you have in stock, that can add value as well and help to keep the business moving forward. It works on both sides, for the supplier and for the consumer of that information. Both people benefit from the underlying capabilities that are touching everyone.

***Not everyone on the planet is benefiting from the digital revolution that has changed cartography dramatically. How is Google going to solve this?***

I don’t think that’s something that Google alone can solve. Fundamentally we need to get internet access to as many people as possible around the world – not only in countries where the infrastructure isn’t yet well established, but also in Europe since there are still many Europeans who don’t have access to broadband at home or don’t have smartphones. So we need to reduce the costs of the technology as well. At Google we’re trying this. For instance,

we’re looking at developing Android One – a cheaper smartphone. We’re looking around the world at different technologies to make internet access both more affordable and more practical. Think of Project Loon, for example (see box on page 16). But there’s no silver bullet to solve it yet, and it will take developments in terms of hardware and software but also in terms of different business models.

***On your blog you wrote that the development of OpenStreetMap as told by its founding father, Steve Coast, is going to be a great read (the book is scheduled for publication in the second half of 2015, Ed.). You called it a truly game-changing event in the mapping industry. Why?***

It’s hard to deny the impact that OpenStreetMap has had. It’s a demonstration that mapping can be carried out by a community of enthusiasts. Given the tools and the internet, you can crowdsource and develop a map of the world which is at least as detailed as those produced by international mapping agencies, and in many ways perhaps more detailed. I remember in my time at Ordnance Survey, that was a big question: would this be possible? If you look at what has happened over the last decade, the answer is obvious. How influential is that going to be on the way that mapping agencies will have geospatial content to create with from now on? We probably don’t know yet, but certainly ourselves at Google and Nokia and TomTom have all bought into the concept of our users helping us to keep our maps up to date. Ultimately I think the future role for many mapping agencies will become one of validating and qualifying content that has been created elsewhere. We as individuals change the world around us by our day-to-day activities, so we’re the experts in our neighbourhood; we’re the people that can tell when the landscape has changed.

***In 2014 Google launched a new mapping tool called Cartographer. How does it work?***

Cartographer is an experiment. It’s a way of potentially solving what we see as one of the big challenges of mapping moving forward: mapping indoors. In the West, we spend the vast majority of our time inside buildings, but most of the geospatial technologies that we’ve come to rely on – things like GPS and crowdsourced maps, for example – don’t



work when you go inside. Indoor spaces are usually private, you need permission from whoever owns the buildings to map them. And there's no easy or consistent way of gathering floor plans or architectural designs – BIM is still in its infancy in terms of adoption. Cartographer is an attempt to take some of the lessons we've learned from Streetview and from developing self-driving cars. Can we use that technology to map indoor spaces? Cartographer consists of a backpack with a specialised computer and some laser rangefinders and an inertial measurement unit. It creates a 3D model of an environment as someone simply walks through it. From that 3D model we can create a floor plan available in Google Maps. It's interesting technology and quite quick to develop. It's a different take on solving the problem. It might work, but it might not work – it's an experiment.

### **Project Loon**

Two-thirds of the world's population do not yet have internet access. Project Loon is being developed by Google with the mission of providing internet access to rural and remote areas. The project uses high-altitude balloons placed in the stratosphere at an altitude of approx. 32km to create an aerial wireless network with up to 3G-like speeds. More information: [www.google.com/loon](http://www.google.com/loon)

### ***Indoor mapping seems to be the new frontier, and indoor mappers are the new explorers. What can we expect in the years ahead?***

As with mapping outdoors, we're fundamentally trying to answer the question of 'Where am I?' But indoors, where you no longer have access to reliable GNSS signals, there has to be an alternative to locate where you are. There are many candidates out there – including Wi-Fi, ultra-wideband technology, beacon technology – that might solve that problem. Another challenge is, how do you know what's inside? How do you create maps of the world around you? One method could be BIM and CAD models for 3D mapping. Potentially we could do this photogrammetrically – such as in Project Tango, which is another experiment where we're trying to use photogrammetric techniques to capture 3D data. We always face the challenge of scale. This can be – and already has been – done for the big buildings, e.g. stations, airports, hotels – but how do you scale it to all the buildings you might want to visit? No one has really solved this yet.

### ***At the International Cartographic Conference, the International Map Year will be officially launched – a worldwide celebration of maps and geographic information. What should be celebrated in particular?***

The main thing we should celebrate is our success. The fact that maps are now in the hands of hundreds of millions of people and are used by a billion people a month in the case of Google Maps. The fact that maps are impacting on and improving people's everyday lives is a huge change. Maps and geographic information have always had the potential to have that impact, but today we're getting to the point where we can actually deliver on that. Partly because it's no longer just in the hands of the specialists or government agencies – everyone can take part in this now. And obviously that comes with some challenges; after all, you get some pretty poor maps these days because anyone can create a map. But clearly, when technology like this becomes accessible for everyone the world benefits.

### ***A year full of festivities is well-deserved to honour the contribution of maps to our lives, but are there also challenges for the cartography and mapping industry?***

Where there are people, there are always challenges. We talked already about indoor mapping, but there are also some residual challenges in mapping the world around us. They are perhaps societal challenges rather than technological ones. The European and North American view of access to information – that information is of benefit to citizens – isn't necessarily shared by everyone. That leads to difficulties when you're trying to create a global map; something that is OK to map in one part of the world is not OK to map in another. How do you deal with those complexities? I'm not making any sort of value judgement about whether a country is right or wrong in their approach; you just have to be able to deal with that. Perhaps, as a result, you need more educated users who recognise that a map is not reality. Instead it is a reflection of the world for a specific purpose. Every map is designed to communicate a particular message. We need to make sure that people are aware that every map will have had some compromises made in its design.

### ***Do you still like paper maps and printed atlases?***

I do still like paper maps! I still have a collection of Ordnance Survey 1:25,000 maps. I occasionally pick up maps if I'm travelling, because they are something of interest. I think I probably always will – as long as they are still produced, I will make use of them. Paper maps are not going to

completely disappear, but they will become a more specialised, luxury product that is of more niche interest than it once was. I have memories of picking up an atlas as a child and just looking at it and imagining travelling to the places shown, imagining what the world represented by those maps looked like. Maybe that's something only us geographers experience, maybe that's not generally widespread. Actually I think my true love was computers early on, and it was nice to be able to connect the two. In the very early days it was difficult to represent geography in computers and lots of compromises had to be made. I've always had an interest in the world around me. Most of the people in the industry have that sense of wanting to know why the world is the way it is – its cities, mountains and rivers. That's a fundamental question that we all have and geographers are good at answering it.

**Is there anything else you would like to say to the readers of GIM International?**

Celebrate our success! Our industry is more influential than it has ever been, although that's perhaps less obvious than it once

was. We're increasingly a small part of lots of other activities that are happening. It might be that geospatial technology/GI is not at the forefront of these, but nevertheless it's a very important component of them. And that's a good place to be. Google's business model is to make a relatively small amount of money from lots and lots of transactions – it's the scale that brings the benefit. I think there's still potential for the geospatial industry to massively increase its scale in terms of the number of products and services, the

number of people that are using geographic and geospatial technology. But to get to that scale we have to simplify what we do. We're making good progress... ◀

**More information**

<https://www.google.com/atap/project-tango/>

<http://techcrunch.com/2014/09/04/google-unveils-the-cartographer-its-indoor-mapping-backpack/>

**Ed Parsons**

Ed Parsons is the geospatial technologist of Google, with responsibility for evangelising Google's mission to organise the world's information using geography. In this role he maintains links with universities, research and standards organisations which are involved in the development of geospatial technology. Parsons was the first chief technology officer in the 200-year-old history of Ordnance Survey, the UK government agency responsible for the official, definitive topographic survey and mapping of Great Britain. He played a vital role in moving the focus of the organisation from mapping to geographical information. He joined Ordnance Survey from Autodesk, where he was EMEA applications manager for the GIS division. Ed Parsons earned a masters degree in applied remote sensing from Cranfield Institute of Technology, holds an honorary doctorate in science from Kingston University, London, UK, and is a fellow of the Royal Geographical Society.

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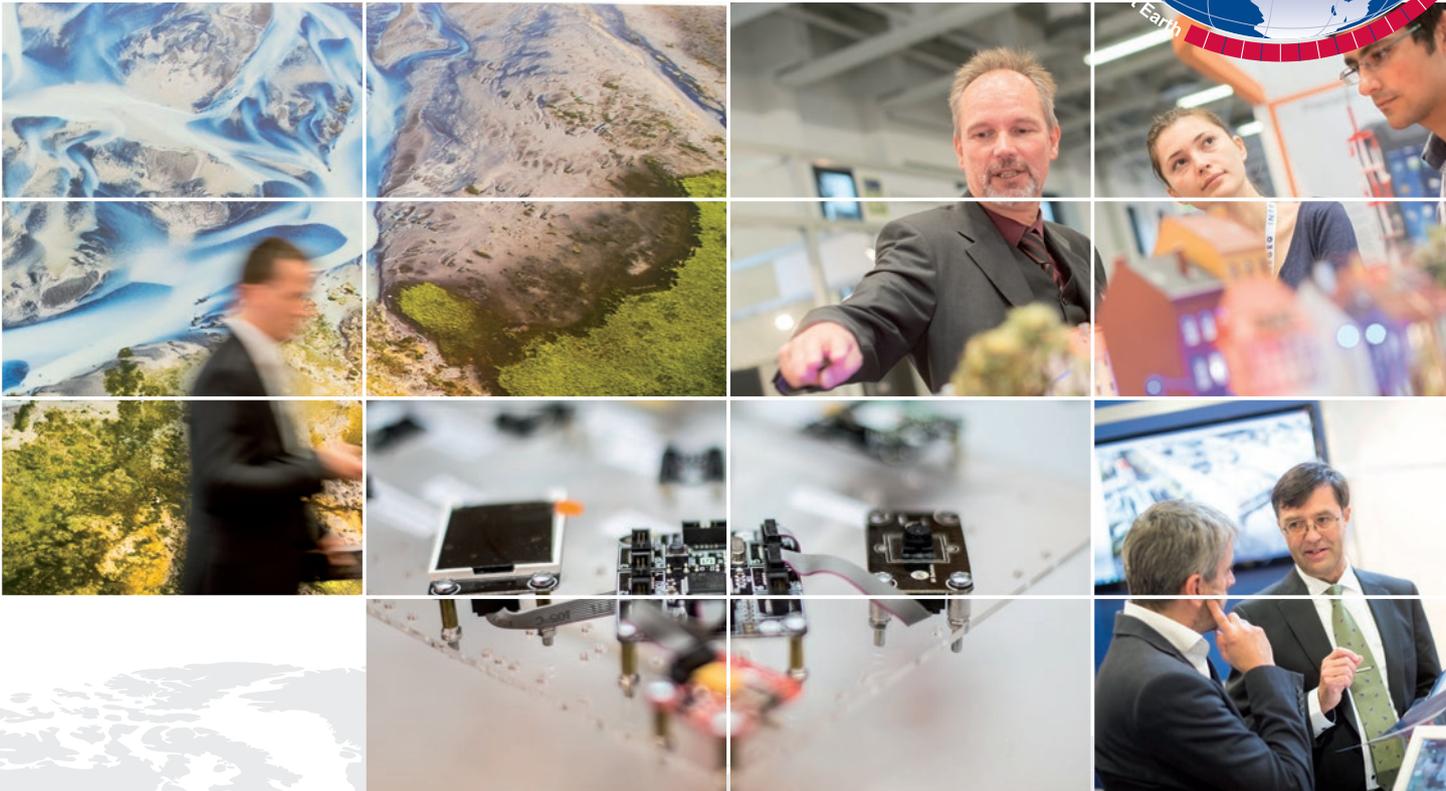
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*IMPROVING STAKEHOLDER COMMUNICATION IN URBAN DEVELOPMENT PROJECTS*

# Serious Gaming

Today's advanced computer technology enables several players to play the same game at the same time. Can the visualisation technology used in 3D multiplayer games designed for leisure and entertainment purposes also be used to improve communication between the various stakeholders in spatial development projects? The authors have developed a platform, called the Tygron Engine, which supports decision-making by visualising geodata, modelling it and facilitating interaction in a virtual 3D environment.

The Tygron Engine offers a visual and interactive 3D platform which enables stakeholders to examine, plan and negotiate solutions for city designs and development projects. The software helps to streamline planning, to build stakeholder consensus and to reduce time and costs. The platform supports decision-makers, urban planners, architects and engineers as well as citizens and others with little experience of geoinformation in viewing and manipulating complex geodata easily and intuitively. It is possible to expand its functionalities and automated interaction using an application programming interface (API).

**DESIGN CONCEPT**

The virtual 3D environment is based on gaming in which several players are able to interact simultaneously. In this case, the

'players' are representatives of government authorities, project developers, interest groups, citizens and other stakeholders. In an urban development plan, for example, the effects of constructing new buildings or demolishing old ones are presented to all players at the same time. The changes are not brought in by just one authoritative user, such as the project developer, but rather all users can interact and make their own changes. Since all users may apply geodata and place, move or remove 3D objects, they can discover for themselves the effects of the changes on their own or other stakeholders' budgets, on heat stress and on other relevant issues. A project developer gains insight into the effects of the plans on citizens' quality of life, for example, while the water board sees the effects on water storage capacity. All users may respond on

**SUCCESSFUL SPIN-OFF**

Tygron is a software company with offices in The Netherlands and New York City, USA. It was founded in 2005 as a spin-off of the Delft University of Technology. The founders started with the simple idea of supporting city planning by allowing stakeholders to try out various scenarios in a realistic 3D environment. Inspired by games such as Sim-City and LinCity, they wanted to create a gaming engine for processing accurate geodata and 3D modelling of cities which supported citizen participation. Today, the company employs 20 people.

the spot as changes are presented in near real time.

**JOINT SESSIONS**

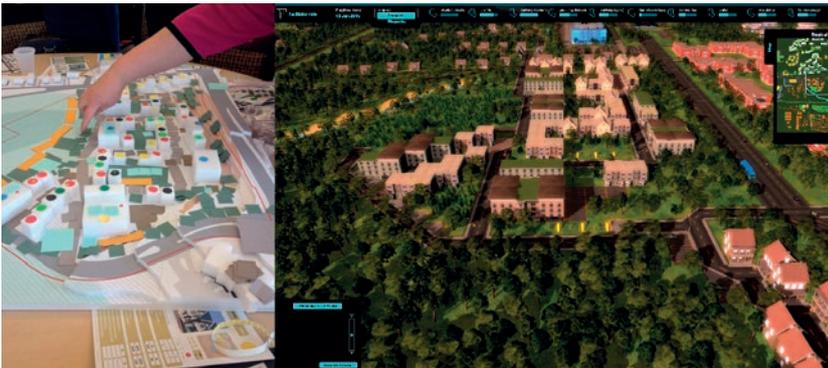
The project starts with the upload of geodata from online sources, such as cadastral data, heights and images. 3D virtual representations of buildings, water bodies, height maps and more are created from that data. Building costs, parking demands, water storage capacity, carbon emissions, ownership details, other rights holders and many other parameters can be attached to each of those objects. Whenever stakeholders modify or move objects, the platform automatically calculates the effects on the parameters. In such a parametric model, road capacity can be increased by widening the roads for example. This will use more asphalt and reduce green space. Together, the two have a negative impact on heat stress and liveability. The widening of the road also requires involvement of the owner.



▲ Figure 1, Stakeholders examine the effects of alternative scenarios in joint sessions.



▲ Figure 2, Visualisation of Lower Manhattan, created in response to Hurricane Sandy.



▲ Figure 3, A spatial development project in Tarrytown, where citizen participation greatly contributed to reaching a consensus.

The Tygron Engine is linked to Esri's ArcGIS for data visualisation and datasheet creation. The 3D representations are vector-based and thus allow realistic visualisations. Stakeholders add specific data, such as scenarios and options – parameters like the ones discussed above – and relationships to other stakeholders. During joint sessions, stakeholders implement alternatives to which the other stakeholders may respond (Figure 1). As the alternatives are explored, the plans can be adjusted in line with new insights or new developments. Throughout the sessions, the stakeholders gain a better understanding of their own and the other stakeholders' roles. They negotiate and implement their plans and receive feedback on the effects. The platform speeds up the spatial development process, thus benefiting all parties. The results are saved and

presented to residents, interest groups or other parties. As the project progresses, the stakeholders might collect new information which may impact financing and projected results or shift interests. The adjusted project

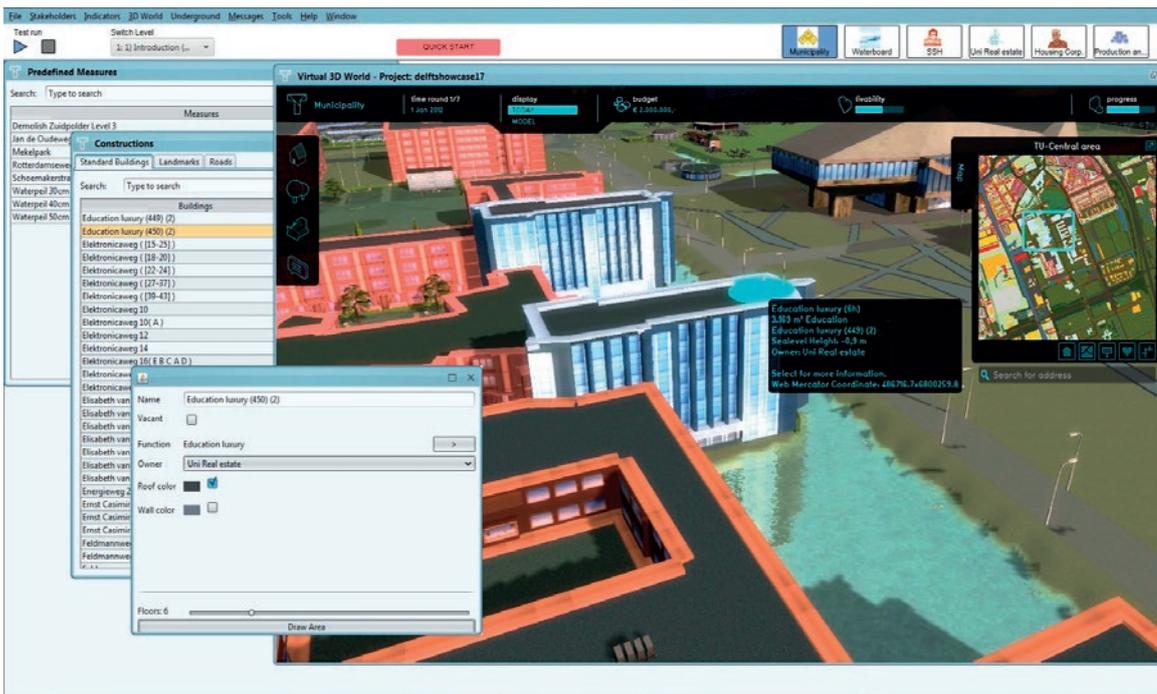
## **CHANGES AND THEIR EFFECTS ARE TRANSPARENT FOR ALL STAKEHOLDERS AND THIS INTRODUCES A BEHAVIOURAL CHANGE**

also acts as a template for similar projects in the future. Such an adaptive approach has already allowed the development of a Climate Game template, for example, which provides new projects with a full set of climate-related stakeholders, data models and options such as green roofs, levees and dikes.

### **REVITALISING A STAGNANT PROJECT**

The power of the platform was first demonstrated in a deadlocked urban development. The local government of Delft, The Netherlands, had sold a land parcel to a project developer, but refused to grant a permit for development as long as the buyer would not allocate part of the land as an overflow reservoir to prevent inundation. Costly lawsuits dragged on for five years and the delay caused a loss of EUR12 million. Residents feared an increase of traffic in their neighbourhood, thus decreasing liveability. After years of stagnation, local infrastructure was degrading, a primary school suffered a drop in the number of pupils and the quality of life declined – a textbook example of a stagnant project in which stakeholders hire consultants to defend individual interests. The serious game introduced by Tygron enabled

stakeholders to implement their ideas in a virtual 3D environment, resulting in consensus and understanding. This put an end to lawsuits and streamlined communication and progress. Today, the potential of this serious game has been recognised by municipalities, project developers and water boards, not only

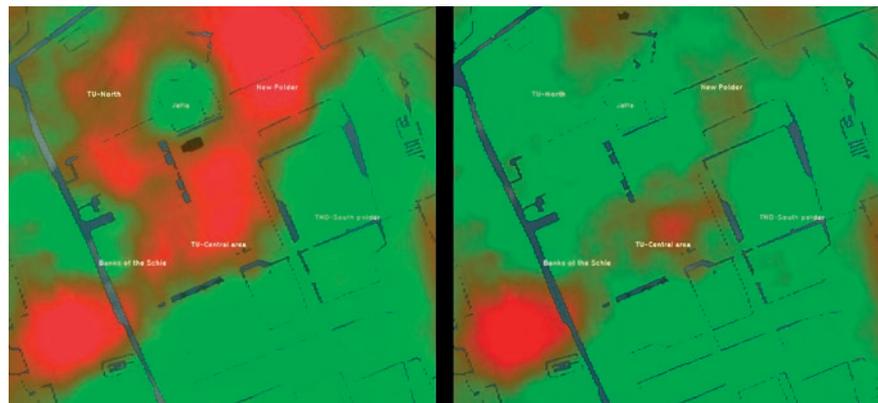


◀ Figure 4, The editor allows stakeholders to tune the project.

in The Netherlands but also in the USA (see Figures 2 and 3), South Africa and other parts of the world.

**EDITOR**

The functionality of the Tygron Engine is sufficient to present an initial overview but, as demands increase, users want to implement case-specific data. The built-in editor allows customisation of projects in a graphical ‘what you see is what you get’ environment (Figure 4). The parametric design discussed above shows the effects of, for example, building a new neighbourhood from the perspective of water-storage capacity and other related components. Hence any changes and their effects are transparent for all stakeholders, and this introduces a behavioural change; communication is more open since the data can be explored by all stakeholders and implementing incorrect or inaccurate data would harm one’s own interests. In one project, some stakeholders complained that the data was wrong and provided their own data. That stimulated the sharing of information, active engagement and transparent communication. In the traditional approach, each stakeholder would hire consultants, architects and lawyers to raise



▲ Figure 5, Maps of air quality in an area of Delft before (left) and after taking measures.

and defend their own interests. The Tygron platform helps stakeholders to collaborate, negotiate and develop scenarios.

**EXTERNAL MODELS**

Users can expand the functionality by connecting the platform to their own models using the API. One example is the calculation of the effect of a new road on the emission of particulate matter. The platform sends a request to the stakeholder’s external model, retrieves buildings, roads, key performance indicator targets, measures and other data, and calculates concentrations. The results are sent back to the platform which displays maps and data sheets (Figure 5). External models can also be called up by the platform through web services. To facilitate working with the API, a free open-source software development kit (SDK) is available. ◀

**FLORIAN WITSEBURG**



Florian Witsenburg, owner and CEO of Tygron, is a member of the Dutch government’s Smart Cities group and guest lecturer in software use for community engagement at the Massachusetts Institute of Technology, Cornell University and Oxford University.

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**RUDOLF KOSTER**



Rudolf Koster is software developer and specialises in API and SDK for interaction with the Tygron Engine.

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**More information**

[www.tygron.com](http://www.tygron.com)  
[www.github.com/Tygron/SDK](https://github.com/Tygron/SDK)

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## USING MOBILE MAPPING TO COLLECT TRILLIONS OF POINTS AROUND THE WORLD

# Building a Global 3D Routing Map

Nokia's mapping division, HERE, uses a fleet of more than 200 cars to collect dense point cloud data about roads around the world. The data from these mobile mapping vehicles is processed to secure privacy and produce detailed routing maps. This data is the input for various applications, ranging from traditional car navigation to analysis of the steepness of ramps. The most compelling application, however, is the application of this data to enable self-driving cars.

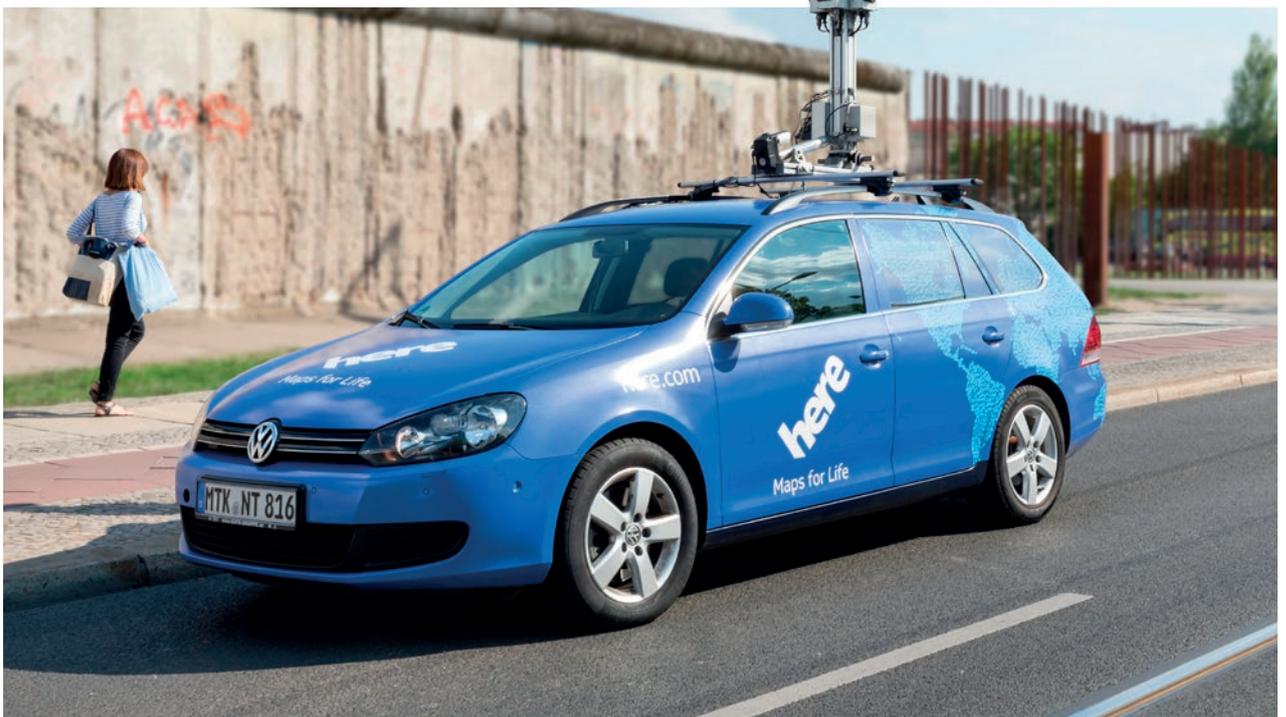
Digital street maps are essential to car navigation and visualisation of online mapping products. Traditionally, such maps are made of annotated vectors in a spatial database that can be queried to retrieve optimal routing information. Increasingly, the maps are enriched with 3D contextual information. This 3D data is used for smart city management or as the foundation for driverless cars. At Nokia's mapping division, known as HERE, the 3D data is collected by mobile laser scanning on a large fleet of cars around the world.

### MOBILE MAPPING

Over 200 cars, known as TRUE cars, are driving around the world to collect the data (Figure 1). Each vehicle is outfitted with a 1.5m-high rig that holds a laser scanner, cameras and a GNSS/IMU system. The scanner, a Velodyne HDL-32E, is a small rotating scanner that contains 32 independent lasers which emit pulses in a swath of 40 degrees. In total, the scanner collects up to 700,000 points per second. The ranging accuracy of

In early August 2015, Nokia announced an agreement to sell its HERE digital mapping and location services business to a consortium of three leading German automotive companies comprising Audi, BMW and Daimler.

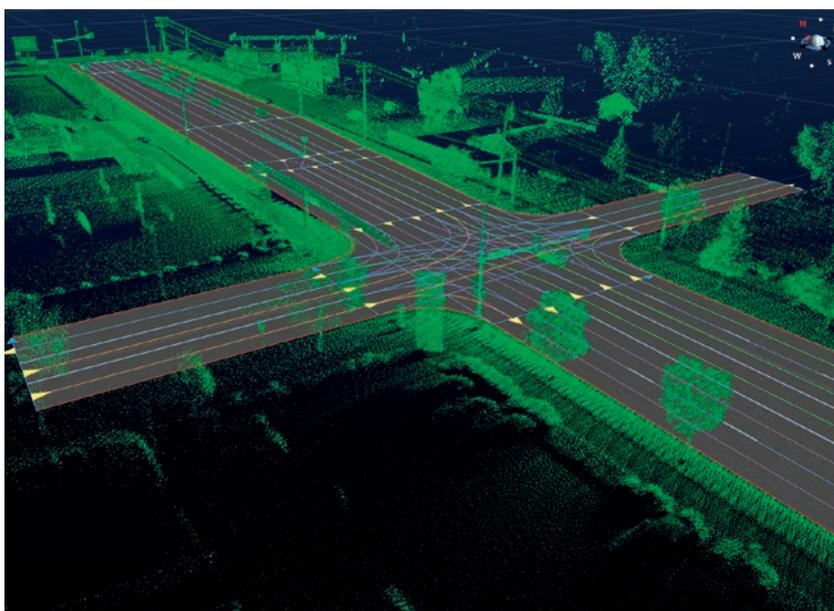
the scanner is 2cm and points can be scanned at a distance of up to 100m. Thanks to the inclined position of the



▲ Figure 1, A TRUE car maps the streets of Berlin.



► *Figure 2, Collected 3D point cloud with derived road centre lines.*



▲ *Figure 3, Digitised lane centre lines at an intersection.*



▲ *A point cloud as collected for the HD maps*

scanner on the roof of the car, shadow effects are mitigated as much as possible.

The rig contains a GNSS receiver and an inertial measurement unit (IMU) which collects position, heading and attitude data. For street imagery, the TRUE cars also include four wide-angle 24MP cameras. The images from these cameras can be stitched into panoramic photos. It is advantageous to use a small number of cameras for panoramic photography, as this reduces the number of seam lines in the stitched photo.

### OPERATIONS

For efficient data collection, each TRUE car has a routing system installed that guides the driver to collect data from unmapped areas or zones which require refreshed data. The drivers focus primarily on major urban areas but data is collected in some less populated regions too, such as highways outside of urban centres or rural roads. The combined sensors generate approximately 140GB of data per day. Globally, the fleet of TRUE cars collects 100 terabytes of data, capture 9.5 million images and drive more than 50,000km in a single week. Between 2010 and 2015, 5 million kilometres of roads were mapped in 30 different countries. Once the encrypted hard drives are full, the drivers send the contents to one of three processing centres in Fargo (North Dakota, USA), Leon (Mexico) or Mumbai (India). These centres process the data and the hard drives are returned to the field for reuse after reformatting.

### PROCESSING

After the new data is received by one of the processing centres, it undergoes a number of processing steps. These steps are partly automated, but a human operator is needed to complete many of the checks. All images are visually checked for quality. Photos with bad weather or sun glare are deleted. To eliminate privacy concerns, blurring filters are automatically applied to people's faces and licence plates. After the privacy check, each map is tagged with road attributes such as stop signs and speed limit signs. Those street signs are automatically detected from the images using algorithms that are capable of recognising signs in 22 countries. A team of analysts cross-checks the automated results with the images to confirm the output of the tags and eliminate ambiguities. The resulting map is also cross-referenced against other sources, such as government databases and city maps, and run through a program that uses a set of rules to detect illegal situations or database inconsistencies. Internally developed algorithms are run on these different data sources looking for discrepancies as the data is processed.

The point cloud data is then analysed to retrieve lane markings and curb edges (Figure 2). Lane markings can be recognised from the point cloud because each point contains a value for reflected intensity. As lane markings are bright in comparison to the pavement, they also stand out very clearly in the point cloud. Curb edges can be detected by searching for clear break lines at the roadside.

**END RESULTS**

The end result of all processing is a database containing the detailed geometry of the road and its attributes including lane boundaries, curb edges, lane restrictions, speed limits, etc. This data can form the basis for car navigation databases, for example. The point cloud data is stored as a separate product in a cloud environment. The collected point clouds have an absolute accuracy of 5m and a relative accuracy of 20cm over a distance of 100m (Figure 3).

**SELF-DRIVING CARS**

The development of self-driving cars is giving significant impetus to the collection of point clouds around the world. Compared to 2D maps, the HD 3D maps provide more information at a higher fidelity and accuracy, including features such as lane markings and roadside barriers. Autonomous cars are equipped with an array of sensors to recognise the roads. The HD map is able to provide additional context for the real-time sensors, thus allowing the vehicle to distinguish anomalous situations from regular

driving conditions – e.g. is a lane divider knocked down? Has a tree fallen into the street?

Additionally, while sensors on autonomous cars can detect a distance of around 30 metres, a car travelling at high speed such as on a motorway has a sensing horizon of just one or two seconds. A detailed 3D map helps cars to ‘peek’ around the corner. In addition, self-driving cars will be able to improve their positioning by referencing the information contained in the map against what they sense in real time. This is an additional level of reliability compared with regular GNSS/IMU positioning. In 2013, Mercedes used the HD map to recreate the world’s first long-distance journey driven by Bertha Benz – an equally historic 100km drive, but this time completed by an autonomous vehicle.

In other applications of the technology, inspecting the road condition can lead to safer roads while also reducing costs. The Americans with Disabilities Act (ADA) stipulates a certain size and maximum

slope for ramps, and the City of Oakland in California used the 3D scan data to reduce the costly and labour-intensive field work required to identify and catalogue ADA-compliant ramps across the city. High-resolution panoramic imagery in conjunction with the overlapping 3D point cloud data allowed accurate measurements to be taken quickly and the necessary geometry to be extracted for cataloguing purposes. ◀

**JOHN RISTEVSKI**



John Ristevski is vice president of reality capture and processing at Nokia’s mapping company, HERE. John joined HERE in 2012 through the acquisition of his company, Earthmine, which developed mobile mapping systems. He was director of R&D at non-profit CyArk, and has lectured at Stanford’s Civil and Environmental Engineering Department. He has a master of science degree from the University of California at Berkeley and has degrees from the University of Melbourne, Australia, in both geomatic engineering and law.



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*PCC CONFERENCE IN RIGA*

# Permanent Committee on Cadastre has Become a Solid Value in Europe

The 28 organisations responsible for the national cadastres in the countries of the European Union cooperate on a structural basis in the Permanent Committee on Cadastre (PCC). Their aim is to have a strong, top-level personal and institutional network that facilitates exchange of knowledge. It is impossible to point out clear results on a pan-European level, but the PCC definitely helps each cadastral agency to make individual progress faster, with a clear vision of shared strategies

By invitation only, all of the cadastral organisations in the European Union come together once per six months at a conference of the Permanent Committee on Cadastre (PCC). It is an efficient way of evaluating the trends and learning about best practices in a small group of peers. Through coordinated efforts, the cadastral organisations ensure that cadastral data can be used widely, even across European borders. 28 different

institutions in as many EU countries provide information about more than 560 million land parcels. They feel strongly that cadastral and land registry information and services should be an integral part of national e-government infrastructures.

#### PROPERLY CONNECTED

“The value of cadastral information is still underestimated and decision-makers too

often do not recognise that our information is fundamental, not only for taxation purposes but also for secure land tenure, environment protection and sustainable land development at both national and European level. Cadastral and land registration data – in particularly when managed by different institutions – should be properly connected. We strive to achieve full coverage and high-quality data: secure, up-to-date, well-described, transparent and accessible. In that way fiscal, legal and administrative information becomes available for stronger economic, social and environmental development,” stipulates Ms Elita Baklane-Ansberga, president of the PCC during the first half of 2015 and director general of the Latvian State Land Service.

She made an inventory of the current crucial projects among the PCC members. Most of the issues mentioned by the country representatives are connected to necessary supportive legal changes and attempts to make the cadastral information part of the national e-government infrastructures. When talking about future business challenges, most of the countries mentioned integration of information systems with partly overlapping workflows: land registry, survey, cadastre, valuation of real estate and other public registers. New sources to update cadastral data are being invested by several countries, varying from interconnection with other public



▲ Elita Baklane-Ansberga (Latvia) hands over the flag to the next president, Raymond Dhur (Luxembourg).

**2.5. Which cadastral data in your country are now open / planned to be open in the future?**

	All cadastre data		Only cadastre textual data		Only cadastre spatial data		INSPIRE set		Cadastral data without personal data		Buildings		Taxation/valuation information		Address data		Land Register information, e.g. ownership, bonds etc		Other data	
	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*
Austria																				
Cyprus		X		X		X		X		X		X		X		X				X
Czech Republic					X		X				X				X					X
Denmark	X																			
Estonia		X	X		X		X							X		X				X
Finland						X														
France							X		X						X					
Germany																				
Greece	X		X		X			X	X									X		
Hungary																				
Ireland							X										X			
Italy								X					X			X				
Latvia							X		X		X		X		X					X
Lithuania	X																			
Luxembourg					X		X		X		X				X					X
Poland						X		X		X		X		X		X		X		
Portugal									X									X		
Romania										X						X				
Slovakia									X								X			
Slovenija	X		X		X		X		X		X		X		X		X			
Spain	X						X		X		X			X	X	X				X
Sweden																X				
The Netherlands					X	X				X	X			X	X					
UK (England and Wales)							X													X

1\* Already open  
2\* Planned to open in the future

▲ Table: Survey on PCC Member States' Opinions about Open Data, Table 2.5, Riga, May 2015 (Belgium, Bulgaria, Croatia and Malta did not respond).

administrations to crowd sourcing, very-high-resolution photogrammetry and the use of drones.

**EXCHANGE**

Cadastral issues are not directly regulated in Europe and they are an internal matter for each country, except for some requirements imposed by the INSPIRE Directive (a law at EU level). To ensure that the spatial data infrastructures of the Member States are compatible and usable in a trans-boundary context, the Directive requires that Implementing Rules are adopted in a number of specific areas. PCC members are responsible for many INSPIRE data themes; most common are cadastral parcels, addresses, buildings and administrative units. Secure ownership rights are important to support basic principles of the EU: freedom of market, movement of goods, capital and people. In view of the influence of real property cadastres on the legal system and the economies of the EU, and because of forthcoming technological challenges and the INSPIRE regulations, the cadastral agencies thought it necessary to facilitate the exchange of information, expertise and best practices. Therefore the PCC was constituted in 2002, also to promote awareness of the activities and importance of cadastres and to achieve greater coordination among the different cadastral systems in the EU. Three

international organisations (EuroGeographics, CLGE and WPLA) and four national cadastral organisations from non-EU countries (Iceland, Switzerland, Norway and Turkey) currently have the status of PCC observer.

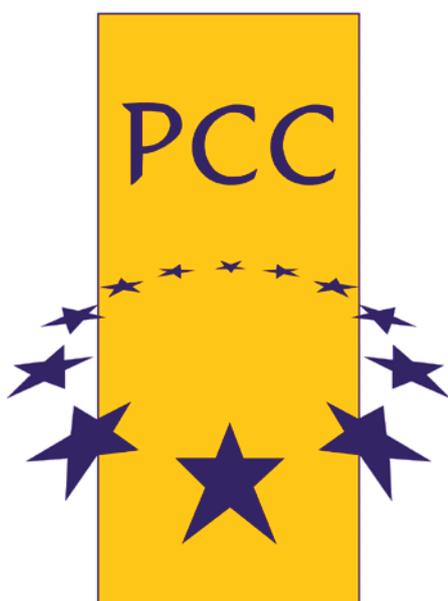
This way of finding solutions to common challenges is still appealing today, confirms Mrs Baklane. Latvia became an EU member in 2004. "In the PCC I share knowledge, make contacts for exchanging experiences and find partners for different projects. To name one example, last year our experts worked with the National Land Survey of Finland and the Swedish Mapping, Cadastral and Land Registration Authority. It concerned a project to implement sustainable ICT solutions for electronic data archiving and for mass digitisation of paper documents. The shared experiences from Sweden and Finland helped to make state administration processes in Latvia more effective."

**REVOLVING PRESIDENCY**

In the EU the presidency of the European Council (that comprises the 28 heads of state to define the EU political direction) changes to another Member State every six months, and so too does the presidency of the PCC. The active president organises a conference. The most recent two-day conference was held in Riga (Latvia) in May and the next one will take place in Luxembourg in November. To ensure the continuity of the PCC there is a Steering

Committee where the active president, the outgoing and the incoming president work together. The PCC works without any regular budget and there are no membership fees; all activities are financed by the presiding organisation. This organisational structure does not help the implementation of long-lasting projects. Elita Baklane-Ansberga admits: "In Latvia we have a saying: 'The one who pays can order the music'. The presiding institution of the PCC actually defines the agenda and has the possibility to speed up certain cooperation projects and to encourage certain discussions. That doesn't mean that I'm sceptical about the PCC at all. It's true that there are no specific continuous projects because of our differences in character and traditions; we all choose to accentuate other things. But that's also the most important strength: our competences diverge. And we don't have to prove anything to anybody; we can be honest about solutions in detail. No empty words here, but rather in-depth discussions with a focus on cadastral relevancy."

During the Latvian presidency of the EU Council the leading theme was the development and strengthening of the information society in Europe, so it should come as no surprise that the then-active president of the PCC chose the same theme. "More and more data which is the



responsibility of the cadastral organisations is used both in the public and private sector. It's necessary to ensure that the information is as up-to-date as possible and that the data structure supports decision-making processes for future planning requirements." Therefore the main issues on the conference

agenda in May were related to the digital infrastructure for land administration, new solutions/sources to improve data quality and access to and reuse of cadastral data.

#### OPEN CADASTRAL DATA

Based on a questionnaire developed by the Latvians (which was completed by all but four PCC members), it became clear that the discussion about implementing 'open data' on the national political level is ongoing in most countries, but the definition varies. However, 'open data' is mostly identified by the PCC members as open access, machine-readable and reusable without restrictions. In Denmark, Greece, Lithuania, Slovenia and Spain all relevant data – e.g. on cadastre, buildings, taxation, address and land register – is already open. Austria, Germany and Hungary have decided to be completely restrictive to cadastral datasets, either free or paid for, even the INSPIRE-related ones. The other countries are somewhere in between (see figure).

The obstacles to making cadastral data open are diverse. Some countries have the

opinion that cadastral data are private data, also when connected to other data layers, and therefore confidential (67%). 30% of the participants also mentioned the need for technological developments, business process reengineering or changes in the internal business culture. Last but not least, there is the financial barrier (63%). Elita Baklane-Ansberga comments: "There is strong pressure from EU initiatives and domestic data users to provide free-of-charge services for reuse of cadastral data. In most of the countries cadastral institutions are financed partly from self-revenues and data distribution fees are applied. Of course, we see that fees are an obstacle for the wider use of our data. But making the data free of charge for non-governmental users would require a financial contribution from the state to keep our public registers in good shape and in line with modern needs. In this day and age, that's not realistic." ◀

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# Mobile Laser Mapping Systems for all Pocketbooks

Siteco S.r.l., based in Bologna, Italy, is among the first companies to develop mobile mapping systems. Initially based on FARO sensors, the Road-Scanner system now supports most commercially available scanners and inertial navigation systems (INSs). This strategy is based on the development of flexibly configured, easy-to-use systems and software, allowing for large-scale adoption.



▲ Top: Road-Scanner4 with 2 Z+F 9012 laser-scanners, bottom: Road-Scanner4 with 2 RIEGL VQ450 laser-scanners.

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.

Siteco is a private company founded in 2000 by Augusto Burchi. In December 2014 it joined the Gavio Group, an Italian leader in infrastructure construction and motorway management. Siteco currently employs 15 people in 3 main areas: system production, software development and training/support. The company generated a turnover of EUR2 million in 2014 and has enjoyed steady growth of 10% p.a. in the last 3 years.

The original company activity was the development of road information systems for asset management and engineering design but since 2005 the core business has been progressively extended to include surveys of large road networks and roadside asset databases. To achieve this, proprietary technology for photogrammetric survey was developed, based on the Applanix INSs.

The sub-metre accuracy achieved with the imagery technology was quickly revolutionised with the adoption of the first FARO LS 880 laser-scanner, generating massive georeferenced point clouds. The density of the first model in 2007 allowed generation of cross-sections every 15-30cm (depending on the driving speed), thus increasing the accuracy of all roadside asset measurements (clearance, guardrails, pavements, lanes, etc.). In 2010, the new FARO Focus model became more lightweight

and offered faster scanning. This allowed for the development of the Road-Scanner3 model, equipped with up to 3 lasers, which achieved complete environmental coverage of 120m per side and accuracy of 2-3cm.

"The point clouds obtained can be merged with the imagery to obtain high-grade deliverables of traditional static surveys with GPS/total station, but with an increased productivity some 2-5 times greater. Since 2009, we've been able to compete with the top mobile LMSs," says Augusto Burchi. "We offer similar performance at lower prices thanks to the more cost-effective FARO sensors."

## LASER MAPPING SYSTEMS TAKE OFF

The company's mission and primary business is to improve the cost-effectiveness of laser mapping systems (LMSs) and to open the market to thousands of mid-size surveying and engineering companies. The LMS market is almost ten years old yet has barely reached 10% of potential applications due to high costs and complexity of operation. Current LMS software requires a high level of skill and, depending on the application, different software licences to execute lengthy conversions of big datasets.

Siteco is focused on producing the best price/performance mobile mapping systems



▲ *Road-Scanner3 with 3 FARO Focus laser scanners.*

and supplying them with a complete project planning, execution and data-delivery software package. The Road-Scanner can be flexibly configured with almost any brand of sensors (Lidar, spherical cameras, thermal cameras, pavement inspection equipment, etc.) and INSs. Whereas hardware producers typically try to capture market segments by offering dedicated closed-architecture designs with expensive task-specific sensors, this flexible strategy allows everyone to benefit from the technological advancements.

#### **TRANSLATING CUSTOMER NEEDS**

The company serves the international market with 15 years' experience in software and hardware development. The technical team has proven its competence and global mindset by supporting customers on almost every continent. There are also SitecoBG operations in Sofia, Bulgaria, a team of 10-15 experts who are fully trained and experienced in processing GIS or CAD deliverables. The team is available to assist Road-Scanner customers in need of excess processing capacity at short notice.

Augusto Burchi describes the company challenge as: "Always understanding the client's needs and quickly showing them that the hardware and software products can fit those needs". Hence Siteco works side by side with its customers, quickly understanding their needs to adapt the system and software for their specific application, as demonstrated recently with ASCO, for example. This 200-strong



▲ *The Siteco team.*

engineering company based in Osaka, Japan, had been operating an expensive mobile mapper for several years but was not fully satisfied with its complexity and low-resolution imagery. After seeing the Road-Scanner system at Intergeo 2014, ASCO requested a pilot test in a 140km road survey on Okinawa. This was completed in March 2015 and data was delivered to the final customer. In April, ASCO subsequently ordered a new system configured with Applanix POSLV 510 INS and which can be used with either Z+F or FARO Focus laser scanners. It is now fully operational and the customer is completely satisfied.

Siteco achieved similar success in France where the feature extraction software had to fulfil ERDF's demanding specifications for high-grade maps (1:200 scale) of large urban communities (Bordeaux, Nantes, Paris). Thanks to that cooperation, Road-Scanner users can now deliver the high-grade maps without the delays experienced with traditional GPS and total-station survey methods.

Another rewarding experience was Amberg Technologies' decision to adopt the Road-Scanner mobile mapping system. Following three years of collaboration in road and railways surveys in Switzerland, Siteco was able to demonstrate that the Road-Scanner system could achieve the extreme accuracies required by the railway sector using Amberg's own Z+F-based scanners.

#### **FUTURE OUTLOOK**

The mobile mapping industry has evolved into several clear vertical markets: mass image-based collection (e.g. Google, Microsoft and other map tools), limited-accuracy roadway inventory management systems, and engineering/survey-grade

projects with high performance demands. Siteco has always strived to offer customers the highest possible accuracy balanced with the cost-effectiveness of the best choice of scanner, camera and INS components. This allows optimum flexibility for any customer, especially if they already use a laser scanner and Lidar sensors for other purposes. Integrating them into a mobile system platform provides cost savings by reducing component duplication. Survey companies are demanding more effective usage of their capital assets and no longer leave expensive systems sitting idle between jobs. Siteco's ongoing R&D focus is on offering the most flexible and compact platforms, with a comprehensive set of software for project planning, execution and data deliverables while staying highly compatible with clients' existing software platforms. While system performance is never a compromise, cost competitiveness and system flexibility are the main drivers of Siteco's innovation initiatives.

The demand is growing for new applications in factory environments and interior data collection, and also for more compact and diverse vehicles. There are new technology sensors appearing on the market and even flash Lidar cameras are beginning to see mainstream markets. These have all been part of Siteco's most recent technology roadmap. The challenge lies in ensuring that there is flexible, scalable hardware coupled with software which makes the operator's tasks simple and efficient. The company's history of innovation combined with close consideration of client demands has been the mainstay of Siteco's success so far. ◀

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# 3<sup>rd</sup> Young Surveyors European Meeting, Sofia, Bulgaria

The future of young surveyors, as professionals as well as individuals, entails endless possibilities and unique opportunities, interspersed with various challenges and new agendas. What is our role in this future and how can we best meet those challenges and seize those opportunities?

Those are just a few of the questions which were discussed during the 3<sup>rd</sup> Young Surveyors (YS) European Meeting held at the University of Architecture, Civil Engineering and Geodesy in Sofia, Bulgaria on 16 May 2015. About fifty young professionals from twenty countries gathered to share and explore new ideas, address pressing issues and focus on the future development of the European YS Network. By organising the meeting as a pre-event of the FIG Working Week 2015, young surveyors from Malaysia, China, Japan, Nigeria and Ghana were able to join.

## PAST EXPERIENCES

During the opening ceremony FIG president Chryssy Potsiou shared her conception of the involvement of the YS Network in FIG as a joint effort to ensure a prosperous and sustainable future of the profession. Eva-Maria Unger, chair of the Network and Paula Dijkstra, the vice chair presented the agenda and gave an overview of the work plan for the next term of office. The Council of European Geodetic Surveyors presented its recent project activities, followed by speeches from the Chamber of Engineers in Surveying in Bulgaria and from the hosting University. Speakers encouraged the participants to get involved in various international organisations.

During this event a variety of topics was covered, the first being astronomy and how



▲ Participants of the 3<sup>rd</sup> Young Surveyors European Meeting send their regards to the world.

it is related to surveying. A journey through our surveying history was then presented, covering the most outstanding discoveries and groundbreaking inventions. It started with Aristoteles, highlighted surveying achievements during the time of Napoleon and ended in the modern world of surveying with an extraordinary tale from Japan.

## THINK GLOBALLY, ACT LOCALLY

This was followed by an interactive working session, themed "Wisdom through Trial and Error". Group discussions focussed on the need for broader integration in different organisations; on the role on an international scale and on unfolding tasks and responsibilities. Some of the objectives presented at the end of this session included the establishment of a global professional forum as a platform for data, the sharing of experience and resources and far more extensive promotion of young surveyors' activities to students' associations worldwide. The afternoon session was dedicated to 'Challenges of the Modern World, Innovations

and Land Management'. The goals and missions of the UN-Habitat Global Land Tool Network were presented, followed by the 'Fit for Purpose' concept for land administration, fundamentals of modern photogrammetry, achievements in 3D laser scanning and unlimited data management. During the concluding session diverse topics were discussed such as digital mapping of urban change, the perspective of different roles as a young surveyor in a professional career, and an innovative project for raising awareness and advertising the many aspects of our profession among the young generation. One of the participants summarised the outcome of this amazing event as follows: 'Alone We Can Do so Little, Together We Can Do so Much'. ◀

Anna Shnaidman, Israel, Eva-Maria Unger, Austria and Paula Dijkstra, The Netherlands.

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# GSDI Members' Global SDI Work: Dutch Kadaster

GSDI members contribute to the development of spatial data infrastructures throughout the world. While tackling institutional and technical issues domestically, many also work to identify innovative approaches and appropriate technologies in other countries. Innovative and appropriate are operative words, since every country has unique sociopolitical dynamics and public administration structures. The establishment of SDI cannot be easily standardised. Other guiding principles are simple, low cost, and user-friendly.

GSDI member, the Dutch Cadastre, Land Registry and Mapping Agency (Kadaster) was named 'National Geospatial Agency of the Year' at the INSPIRE-Geospatial World Forum in Lisbon in May 2015, owing in part to Kadaster International's efforts to empower land and mapping agencies in developing countries worldwide.

Kadaster shares its knowledge of modernising its own organisation, changing it from a governmental to an independent body, moving from an analogue to a digital environment, moving from a task-oriented organisation to a customer-oriented organisation. The Kadaster therefore has a variety of methods, procedures and IT-systems at its disposal for realising land administration and SDI objectives. Some of these methods are illustrated in the following highlights from recent Kadaster assignments in Croatia, Jordan, Rwanda and Colombia. For 15 years, Turkey and The Netherlands have also cooperated in the field of land use and rural development.

## CROATIA

The Ministry of Justice in Croatia is computerising part of its archives, including source documents for the land book. Apart from safeguarding and preserving those archives, the Ministry recognises options for potential future use of these documents and that management of sustainable archives is a knowledge domain in itself. The archives need to be accessible over decades or even centuries. An international team from Austria, Slovenia, Greece and The Netherlands shared experiences during a workshop with experts from the Croatian Ministry in May 2015. Apart from relevant legislation, they debated the organisational and IT impact involved and presented recommendations in support of the



▲ Mapping land rights in Colombia in support of the peace process.

harmonisation process between the land book and the cadastral map. This ongoing operation may lead to the use of web services for citizen participation. Efficiency improvement, compliancy and trust in the government are all relevant to the process.

## JORDAN

The Swedish cadastre agency, Swedesurvey, and Dutch Kadaster are cooperating on an EU-funded project in Jordan with the Department of Lands and Survey. The aim is to reduce discrepancies between the physical reality and documented graphical cadastral information. Swedesurvey and Kadaster are sharing their experience both domestically and internationally in this field. Other joint activities are underway in Saudi Arabia and Malawi.

## RWANDA

In March 2015 the Land Administration Information System (LAIS) went live in Rwanda. District Land Bureaus under the Rwanda Natural Resources Authority (RNRA) now have access to this system. LAIS supports the registration of rights on immovable objects, such as houses and land, and creation of land certificates and efficient maintenance processes. The first LAIS module was introduced in 2012 in the Kigali City District Land Bureaus. Supported by a Kadaster GIS-expert, RNRA launched the second version of LAIS. As a web-based land registration tool, LAIS allows working with many users without creating inconsistencies and conflicts in maintaining the data. This

ensures all land owners in Rwanda receive land title documents that are legally valid.

## COLOMBIA

The Colombian government is mapping land properties, with a land administration system at the forefront of peace negotiations with the FARC. Land rights are being formalised and incorporated into national laws. People driven from their homes during the civil war will receive restitution. Many small farmers in Colombia are not able to prove that they own specific land. With the international land administration school, ITC, the Kadaster will assist Colombia to formally register those land rights. On 13 March 2015, an agreement was signed with the Dutch Embassy in Colombia and Colombian stakeholders. ◀

More information  
[www.gsdi.org](http://www.gsdi.org)



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# Achievements and Highlights of the IAG 2011-2015

This is my last contribution as president of the IAG. The new IAG president is Harald Schuh, and the new vice-president is Zuheir Altamimi. Hermann Drewes remains secretary-general. I'm pleased to take this opportunity to summarise some of the achievements and highlights of the IAG during the past four years.

**Milestones.** Over 500 scientists attended the IAG Scientific Assembly in Potsdam, Germany, from 2-6 September 2013 to celebrate the 150<sup>th</sup> anniversary of the founding of the IAG's forerunner organisation, which was established in 1862 to oversee the Central European Arc Measurement ('Mittteleuropäische Gradmessung') Project. The International GNSS Service (IGS) celebrated 20 years of service at its biennial workshop, 23-27 June 2014, in Pasadena, California. The 19<sup>th</sup> International Workshop on Laser Ranging from 27-31 October 2014 in Annapolis, Maryland, marked the 50<sup>th</sup> anniversary of the first successful satellite laser ranging measurement.

**Noteworthy Progress.** Never before has the investment in geodetic infrastructure been so high, its outputs so accurate and its utility so widely recognised. On 26 February 2015 the United Nations General Assembly adopted the Global Geodetic Reference Frame for Sustainable Development recognising the growing role of geodesy in people's lives and its contributions to the geospatial discipline and the geosciences. For example, more new radio telescopes have been inaugurated than ever before. The latest version of the International Terrestrial Reference System, the ITRF2014, has been released. Progress has also been made in gravimetry networks and standards, gravity field mapping from space (including monitoring of time-varying features), in developing guidelines for an

International Height Reference System, refining the structures of the Global Geodetic Observing System (GGOS), launching new GNSS-based services to support real-time geohazard-related applications and system integrity monitoring, and continued regional campaigns and collaborations.

**Engagement and Collaboration.** The IAG engages with many national and international science agencies, professional associations and non-government organisations, including the International Union of Geodesy & Geophysics (IUGG), International Council for Science (ICSU), Group of Earth Observations (GEO), UN Office for Outer Space Affairs (UN-OOSA), UN Global Geospatial Information Management (UN-GGIM), and its sister associations in the Joint Board of Geospatial Information Societies (JBGIS). Such engagement manifests itself among other things as joint conferences, workshops, publications and collaborative projects, thanks to the fact that many officers of the IAG (its Commissions and Services) also hold positions in a range of scientific and professional organisations and hence are able to promote geodesy more broadly.

**Outreach and Education.** During the past four-year period the IAG sponsored 65 conferences or workshops, ran more than 10 schools (GNSS, space geodesy, reference frames, geoid, heights), published (or prepared) 11 conference proceedings in the IAG Symposia Series, and published over 300 peer-reviewed articles in its Journal of Geodesy. Particularly noteworthy is the fact that the IAG granted 94 scientists, 49 of whom in developing countries, a travel award for attendance of conferences or workshops.

**Organisational Matters.** The IAG continues to pursue goals aimed at improving its operations,



▲ Participants at the 2013 Scientific Assembly in Potsdam.

its governance structures and its visibility. Amongst the initiatives in this regard are the restructure of GGOS (and its components), the commencement of the IAG Service Assessment Exercise, increased engagement with the UN (through the UN-OOSA and UN-GGIM), and of course the election of a new IAG leadership team at the IUGG General Assembly, held in Prague, Czech Republic, from 22 June to 2 July this year.

I have enjoyed a stimulating and highly satisfying four years at the 'helm' of the IAG and I wish to thank all the people (both within and external to the IAG) who have assisted me in so many ways. I look forward to continuing to serve the interests of the IAG. I wish my successor well and am confident that under his leadership the IAG will continue to provide essential geodetic services to our modern world. ◀

Chris Rizos

**More information**  
[www.iag-aig.org](http://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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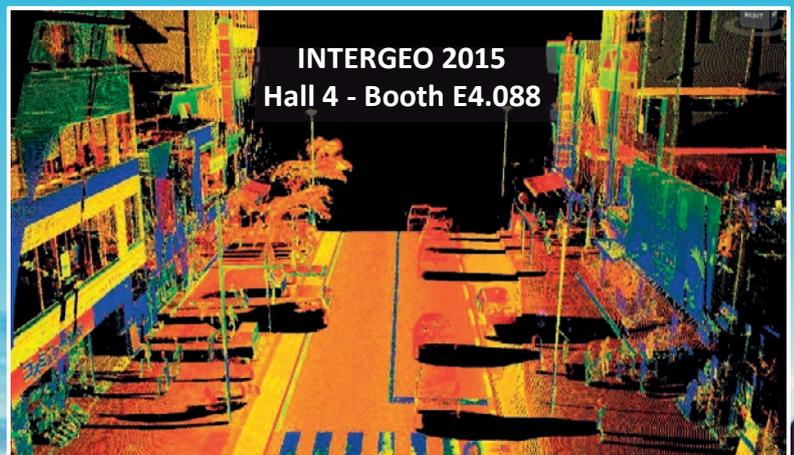
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# ROADSCANNER4

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# The Brazilian Experience

August 2015 sees the most important event of the year for the International Cartographic Association: the 27<sup>th</sup> International Cartographic Conference (ICC) and the 16<sup>th</sup> General Assembly of ICA. The venue is the SulAmérica Convention Center, the most modern and complete convention centre in Rio de Janeiro. The venue is strategically located in Cidade Nova: next to the City Hall and to metro stations, allowing visitors fast and easy access and just 15 minutes from the airport. It is also close and well-connected to Rio de Janeiro's diversified network of hotels and restaurants.

This is a unique opportunity to meet colleagues, present work, exchange ideas, display cartographic products, get connected with the global community of cartography and GI science, and have a good time in one of the world's most famous cities. This is also a vital opportunity, as the fields of cartography and geoinformation science are becoming more relevant than ever. Modern cartography is a key to all human activity – without maps we would be 'spatially blind'. As mentioned in this column in the April 2015 issue of *GIM International*, anyone with a connection to our vital geospatial discipline is invited to make the trip to the vibrant country of Brazil and the exciting city of Rio de Janeiro.

In addition to the multiple formal sessions of presented papers, the conference will offer a host of cartography-related events and opportunities. The General Assembly is the quadrennial decision-making body of ICA, consisting of all the member nations. It is when elections for the office-holders and Executive Committee are held; the important commissions, which are the core of the



▲ Rio de Janeiro's amazing cityscape forms the backdrop for the 2015 International Cartographic Conference.

association's day-to-day research work, are nominated, and terms of reference and chairs are approved; changes to statutes and ICA working practices are debated; and reports of the varied work and outputs of the previous four years – by ICA, its Commissions, its Committees and the member nations – are tabled.

The exhibitions are an important part of ICA, and a number will be staged in Rio. The commercial exhibition presents contemporary technologies and publications associated with the discipline; the cartographic exhibition is always an impressive showcase of maps produced by member nations and affiliate members of ICA; and the children's map exhibition is a keenly competitive affair for the Barbara Petchenik awards.

Furthermore the programme includes a range of technical visits and two possible

orienteeing events. Social events are a major focus of ICCs, and lively opening and closing ceremonies will also be presented. An interesting trip to Brazil can be supplemented by some valuable pre-conference workshops which have been arranged by several commissions and tours of the fascinating country.

The invitation from one of the most dynamic members of ICA to meet in the world-renowned 'Marvellous City' is heartfelt and open. Come on down to Rio this month! ◀

## More information

[www.icaci.org](http://www.icaci.org)

[www.icc2015.org](http://www.icc2015.org)



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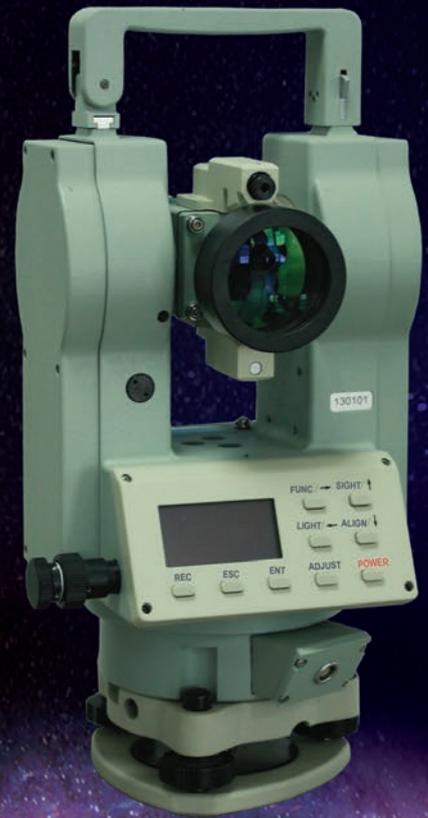
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ISPRS recognises individual accomplishments through the sponsorship of awards and honours which are granted at each quadrennial ISPRS Congress. Nominations for deserving candidates for awards are welcome and may be made by individuals or organisations at any time, but before the relevant deadlines [1].

**An ISPRS Honorary Member (1926)** is elected by the Society in recognition of distinguished services to ISPRS and its aims and there may not be more than ten living Honorary Members of the Society at any given time.

**An ISPRS Fellow (2010)** is elected by the Society in recognition of sustained, excellent service to the ISPRS and its aims.

**The Brock Gold Medal Award (1956)** is presented for an outstanding landmark in evolution of the photogrammetry, remote sensing and spatial information sciences.

**The Otto von Gruber Award (1964)** is presented to a young (less than 40 years of age) sole or first author of a paper of outstanding merit in the photogrammetry, remote sensing and spatial information sciences (Phot&RemSens&SIS) written in the four-year period preceding the Congress.

**The Samuel Gamble Award (1988)** is presented to up to three individuals who have contributed significantly to the development, organisation or professional activities of Phot&RemSens&SIS at the national or international level.

**The Willem Schermerhorn Award (1988)** is granted to a person who has most significantly contributed to the activities of a Working Group of the ISPRS during the four-year Congress period.

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**The ISPRS Prizes for Best Papers by Young Authors (1988)** are given to authors who are less than 35 years old and are the first author of a high-quality paper presented to the Congress.

**At the Congress, the CATCON Prizes (1996)**, a software Computer Assisted Teaching Contest, will be organised by ISPRS Technical Commission VI and funded by The ISPRS Foundation.

**The Eduard Doležal Award (1996)** consists of a complimentary registration and a grant for limited travel and expenses of at least one individual, from developing or reform countries, to participate in the ISPRS Congress.

**The U. V. Helava Award (2000)** consists of a grand prize of SFR10,000 and a silver plaque presented to the author(s) of the most outstanding paper published exclusively in the *ISPRS Journal* during the four years preceding the Congress.

**The Wang Zhizhuo Award (2008)** will be granted at each quadrennial ISPRS Congress to a person who has made significant achievement or innovation in the spatial information sciences.



▲ Franz Leberl receives the Brock Gold Award.

**The Karl Kraus Medal (2010)** is awarded to authors of excellent textbooks in the fields of Phot&RemSens&SIS written in one of the official languages of the ISPRS, and published no more than eight years prior to the commencement of the quadrennial ISPRS Congress at which the medal is to be presented.

**The Frederick J. Doyle Award (2012)** will be awarded to an individual who has made significant accomplishments in advancing the photogrammetry, remote sensing and spatial information sciences and technologies. The recipient of the award should typically be less than 50 years of age.

**The Giuseppe Inghilleri Award (2012)** is presented to a person who has significantly enhanced the applications of Phot&RemSens&SIS in the four years preceding the Congress. ◀

## More information

1. [www.isprs.org/society/awards/Awards\\_Brochure\\_2014.pdf](http://www.isprs.org/society/awards/Awards_Brochure_2014.pdf)



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 W: www.icc2015.org

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 W: www.isprs-geospatialweek2015.org

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 W: www.uav-g-2015.ca

▶ **SEPTEMBER**

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 W: www.ifp.uni-stuttgart.de/phowo

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 W: www.interdrone.com

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 E: joly@euroconsult-ec.com  
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 E: silvia@unaicc.co.cu  
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 E: sdconf@sd2015-eg.org  
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 E: lmurray@divcom.com  
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Halifax, Nova Scotia, Canada  
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For more information:  
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- + IP53 dust & water resistance

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## TRANSFORM YOUR SMART DEVICE INTO A HIGH-ACCURACY DATA COLLECTOR.

Achieve high-accuracy data collection using your smart phone or tablet when paired with the Trimble® R1 GNSS receiver. The ideal solution for mapping and GIS professionals who use smart devices to carry out GIS field work for their business or organization, the lightweight and rugged Trimble R1 delivers the accuracy you need without slowing you down. Providing multiple satellite constellation support and a range of correction services including SBAS, VRS and RTX, the Trimble R1 offers a truly global solution. Plus, combining the Trimble R1 with mapping and GIS field software such as the customizable workflows of Trimble TerraFlex™ will give you an integrated hardware and software solution that flows seamlessly from field to office. Make accuracy personal with the Trimble R1—delivering professional-level positions to everyone.

**Discover how to collect accurate location data on consumer-grade smart devices at [Trimble.com/R1](http://Trimble.com/R1)**

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Capture professional-grade location accuracy on consumer smart devices, such as iOS and Android



Small, lightweight, and rugged for easy use and durability in the field



Streamlined cable-free operation with Bluetooth® connectivity



Integrate with Trimble TerraFlex for a seamless field to office workflow



Achieve submeter accuracy with RTX ViewPoint corrections over IP or satellite