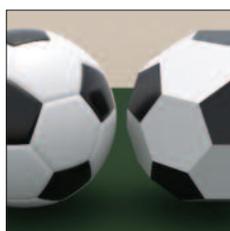


Surveying for geographical and spatial information in the 21st century

Highlighting the diversity of Geomatics

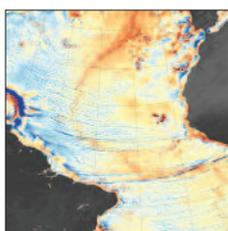
Are discrete global grid systems the answer?



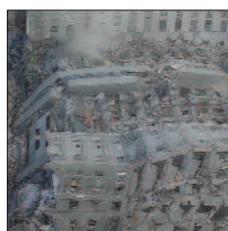
The future of making things with Autodesk



Satellite altimetry reveals sub-ocean topography



Fast image capture of Taiwan quake damage by UAV

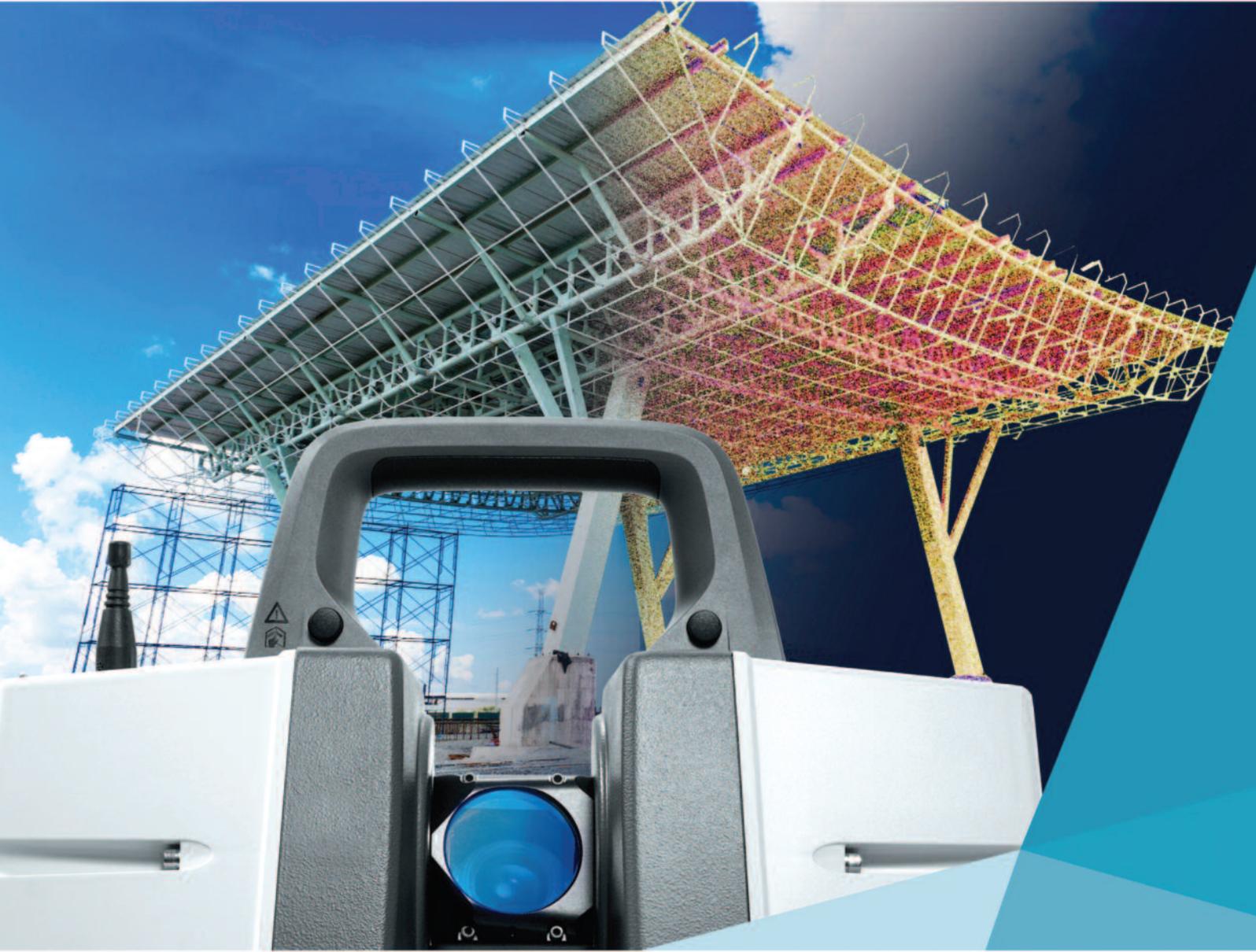


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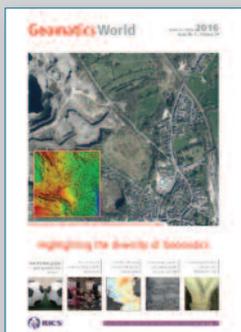
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COVER STORY

Superimposed on a 25 cm high-resolution digital orthophoto, a point cloud digital surface model has been generated from the same scene - full story page 22.

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At last surveyors are getting to grips with BIM, reports **Richard Groom** on the Government BIM taskforce's Survey4BIM committee.
- p.16 Going to university in... Las Vegas!**
With a reported 30,000 in attendance, Autodesk University 2015 had a strong focus on manufacturing reports **Adam P. Spring**.
- p.19 360° high-definition colour imaging**
Capturing the finer details and colours of a Norman castle for an orthophoto can be challenging. One survey company found the Spheron HDR camera was just right.
- p.20 LiDAR and laser mapping on the move**
3D Laser Mapping recently showcased the company's and its partners' technology. **Richard Groom** heard all about data capture on the move and... cheetah hunts.
- p.22 Generating synchronised elevation models**
Ordnance Survey GB's Remote Sensing department has put into production a digital terrain model flow line. **Diana Moraru**, remote sensing surveyor, explains.
- p.25 Seafloor mapping from satellite altimetry**
Compiled by **David Sandwell** and **Walter Smith**, a global dataset revealing the topography of the ocean bed has been created from satellite altimetry.
- p.30 WGS84 Lats and Longs or DGGS?**
The OGC is proposing a standard for Discrete Global Grid Systems to replace "legacy coordinate systems". **Roger Lott** takes a close look at what this might mean for geomatics.

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Are you registered for your FREE copy?

Engineering surveying showcase 2016 ISSUE ONE

Issue No 1 of *Showcase* for 2016 will be published on 25 April. RICS members in the UK are entitled to receive a FREE copy upon registration or request. Just drop us an email with your full postal address and we'll pop a copy in the post to you.

If you missed *Showcase No 2* for 2015 you can view the digital edition by following the link below.

Overseas readers can still view the latest issue by going to:
<http://www.pvpubs.com/DigitalEdition/Showcase>



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Note: the current edition can be viewed online and downloaded as a PDF at : <http://www.pvpubs.com/DigitalEdition/GeomaticsWorld>

IN THE NEXT ISSUE of GW...

- Preview: GEO Business 2016**
- RICS 2016 BIM Conference**
- Land Registration: public or private**

Copy dates for May/June 2016: Editorial: **11 April** Advertising: **19 April**

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A range of diverse applications for geomatics technologies are on the board for this issue. But they all need reference frames. But which type? Meanwhile, land registration is moving up our agenda.

Was the Internet such a good idea?

By some determined unsubscribing I have managed to reduce my inbox to around 50 emails a day; that's not counting the spammers who at times bombard it. The majority of unsolicited emails come from marketers who somehow think that you, dear readers, will be interested in the latest bathroom fittings, a painting contract in a primary school, portable generators and other irrelevant products to our business. Oh for the days of the posted press release when marketers had to consider cost. Now it is all just digital confetti.

The Internet is a wonderful thing, or is it? Apart from the aforementioned irritating spam, how many emails do you get that purport to reveal all sorts of great truths or skulduggery about government, politicians or celebs? How many of you take a moment to check the contents against the good guys' websites like *Snopes* or *FactChecker*, which debunk these myths and rumours? It's all too easy to read, shake your head and descend further into life's enveloping cynicism. With print books and magazines it's a lot less easy to circulate this nonsense, which undermines intelligent debate, democracy and the benefits of the Internet.

I have therefore been reading **Andrew Keen's** *The Internet Is Not The Answer*. A brilliant exposé of the history of the net from the idealistic founders like **Berners-Lee** to the Silicone Valley billionaires with their yachts and planes. Don't be deceived the next time someone argues the net is helping to create jobs. Ponder this: 30 years ago Kodak was turning over \$30bn (1989 prices) a year and employed over 145,000 worldwide. When Google reached that equivalent level of turnover it was employing barely 10,000. You can read our review on page 29.

Broad field

This issue of *GW* has no less than seven articles which demonstrate how broad a field Geomatics is. Using satellite altimetry to map the terrain below the deep oceans; applying laser scanners and high resolution cameras to capture the details of ancient castles, trees or cheetahs; how an efficient workflow is created by a mapping agency to create digital surface models from point clouds and orthophotography; how a CAD software developer is merging construction and manufacturing in applications as diverse as prosthetics, car manufacturing and distributed computing.

These applications of geomatics technologies

all require a reference frame, a coordinate system or a grid to enable data to be correctly analysed and interpreted. With the expansion of web mapping and the drive to integrate spatial data within interoperable systems, the Open Geospatial Consortium is proposing a standard for discrete global grid systems (DGGS) to replace what they quaintly call "legacy coordinate systems". Such grid systems operate in a very different way to continuous coordinate systems and are not suitable in every situation as **Roger Lott** explains on page 26.

Privatising the Land Registry

Readers may be aware that the UK Government is proposing to privatise the country's Land Registry. The registration of land title has been shown to be a critical element in a country's development. It provides security of tenure (see last issue's report of **Paul Monroe-Faure's** Michael Barratt lecture) and not only contributes to social stability but enables investment and lending to flourish, secure in the knowledge that it is backed by government controlled land registration.

Privatising this function per se does not necessarily mean that any of this is threatened or will change. But Britain's experience of privatising the public realm since the 1980s has had mixed outcomes, particularly in the rail, prison and health sectors. The proposal is surprising given that an extensive consultation by the Government only two years ago found extensive opposition to the move.

GW is keen to explore how land title registration works in other parts of the globe and would like to hear from readers with international experience in this field. We shall publish our findings in an upcoming issue together with a detailed article from a leading expert. Comments please to editor@pvpubs.demon.co.uk

Stephen Booth, Editor

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Disaster damage analysis



iRevolutions blog by Patrick Meir reports that following the earthquake which struck southern Taiwan on February 6th, UAVs were used to capture areal images of the damage. By the end of day, Taiwan's National Cheng Kung University had used the aerial images to create this 3D model. The model was processed using Agisoft PhotoScan and then uploaded to Sketchfab. Patrick is looking at using virtual reality platforms to enable 3D analysis of disaster damage. Get in touch to get involved: <http://wp.me/pecFU-4g5>

Legacy coordinates

Responding to the massive growth in the volume of spatial data and processing resources, the Open Geospatial Consortium is requesting public comment on a candidate Discrete Global Grid Systems (DGGs) Core Standard. The standard is a set of rules for defining efficient architectures for spatial data storage and analytics. The goal of DGGs is to enable

rapid integration of spatial data without the difficulties of working with legacy coordinate systems so content can be accessed directly from diverse contributors and used with other content without reliance on transformation processes.

James Kavanagh, director of the Land Group at RICS describes it as "a potential game changer and very much in line with United Nations thoughts on unified

geodetic systems". Documents for the standard are available for review and comment at (www.opengeospatial.org/standards/requests/143). In the meantime, for a detailed analysis of this move turn to **Roger Lott's** article, *WGS 84 Lats and Longs or DGGs?* on page 26.

Peaceful land swap in rare border deal

The BBC website reports that Belgium is to hand over to The Netherlands land which had become trapped in a meander of the River Meuse. In what is a rare example of a friendly re-arrangement of an international border, the land (amounting to the equivalent of about fifteen soccer fields) could only be accessed from Belgium by boat, involving a leap onto shore, or via The Netherlands, involving 'paperwork', and so had become ungovernable. Matters came to a head three years ago, when passers-by discovered a headless body (surely another opportunity for a BBC 4 Saturday night European crime series!). This event highlighted the inconvenience of the situation for the Belgian authorities. The two countries' parliaments should be able to complete a deal some time this year.

Mapping an asteroid

Teledyne Optech's OSIRIS-REx Laser Altimeter (OLA) is to be installed aboard the OSIRIS-REx spacecraft. Scheduled for launch in September 2016, OSIRIS-REx will visit the asteroid Bennu to survey, land, and return a sample of its surface material. During the approach, OLA will scan Bennu's surface and create a high-resolution 3D map of the entire asteroid to help scientists understand its morphology and select the best spot from which to collect the surface sample.

Time up and out for GPS satellites

Several users were reportedly hit by hours of system warnings after 15 GPS satellites broadcast time signals 13 microseconds out. Such a discrepancy is considered severe by monitoring company Chronos, whose telecoms clients faced 12 hours of system errors. Previously, the GPS errors had also been

blamed for disturbances with BBC radio broadcasts. According to the US Air Force, which manages the GPS satellite network, the problem was caused by a satellite named SVN 23, which was being decommissioned.

Arctic SDI

The Open Geospatial Consortium (OGC) has announced the "Arctic Spatial Data Infrastructure Standards and Communication Pilot" (Arctic SDI Pilot). Sponsored by USGS and Natural Resources Canada, the goal of the interoperability project is to demonstrate to Arctic stakeholders the diversity, richness and value of a spatial data infrastructure based on web services and standardized exchange formats in helping address critical issues impacting the Arctic.

OGC has also formed a Point Cloud Domain Working Group (Point Cloud DWG) to assess the current state of standards and best practices in the management of point cloud data and to guide its activities in working with or developing standards for point cloud data interoperability, discovery, and dissemination. Visit: www.opengeospatial.org/.

Indoor positioning survey

OGC, the InLocation Alliance (ILA) and the i-locate Project invite contributions to a survey on use cases and benefits of indoor positioning. **Kirk Burroughs** of ILA stated that they are reaching out to industries, from retail to transportation, from healthcare to emergency services, etc., where indoor LBS can be a transforming technology. The survey is intended to provide the three organizations with a current snapshot of the requirements of different stakeholders (within and beyond OGC and ILA members), so that they will have an up-to-date overview of the market for indoor positioning. The survey results will be published in a joint ILA and OGC white paper available to the public. The survey is available at: docs.google.com/forms/d/1X6lm1nlzph6mNc9vPiuymmROLoM8U4w6kgvuiyErdvc/viewform?usp=send_form

Equipment thefts down

Prompted by reports that equipment theft was still a serious problem,



RICS GEOMATICS Evening Lectures 2016

RICS Geomatics evening lectures are free and open to all (especially students) and we would ask that all those wishing to attend contact our PG support team pgsupport@rics.org to guarantee a place. Evening lectures have proved increasingly popular over the last few years and are often oversubscribed. All details on future evening lectures and for the latest from RICS Geomatics can be found at www.rics.org/geomatics. Online resources from the 2014-15 session can be accessed @ <https://communities.rics.org/connect/ti/Wikigeo/groupHome>

Tuesday 19th April 2016 – The Scottish Lecture
Synopsis: Measurement, be it of land, buildings or utilities, is central to the core practice of surveyors around the world. But just what is the 'essence' of Measurement and how do we ensure consistency in measurement and specifications? How do we communicate these needs to clients in a language they understand? And how do we price accordingly? How does the new International Property Measurement Standard (IPMS) directly connect valuation and measurement?

Speaker: James Kavanagh MRICS, Director Land and Resources RICS **Location:** TBC



GW polled a cross-section of survey companies. We received fifteen responses. Twelve firms reported no thefts since January 2014 whilst three companies had between them lost a total of at least ten instruments to thieves – although one company gave no details.

Three of the thefts were from locked vans. One theft took place in London. There was one in the Midlands and the remainder in the north. This contrasts starkly with our previous investigation when nearly all were stolen in London and from sites near the North and South Circular Roads. We have however since heard from another source that there have been a number of thefts of fixed monitoring total stations in London.

Of those instruments that were stolen whilst set on a tripod, three were being operated in robotic mode and four with a two-person team. All the instruments were Leica total stations and three were subsequently recovered. Thankfully, in no cases was violence used.

Those companies that had not suffered thefts said that they had implemented theft prevention procedures. They do not leave equipment unattended in exposed locations, although one company does allow lone working in rural locations. Another company reported that they try to find places where they can tie the instrument to a fixed object – rather than in the best locations for surveying the site. Another piece of advice was to be careful to guard against advertising the presence of expensive equipment by, for example, stating the company address on work vans.

UN-GGIM vision – 2nd Ed

A new report setting out a five to ten year vision of the rapidly growing geospatial information industry has been published by the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM). The report titled, 'Future trends in geospatial information management: the five to ten year vision', is the second edition of a report first published in 2011. Visit the UN-GGIM website: <http://ggim.un.org>

IoT Research Hub

Ed Vaizey, minister of state for culture and the digital economy, has announced a new interdisciplinary research hub to drive forward UK research in the Internet of Things (IoT). The PETRAS consortium of nine leading UK universities will work together over the next three years to explore critical issues in privacy, ethics, trust, reliability, acceptability, and security. Funding for the hub includes a £9.8 million grant from the Engineering and Physical Sciences Research Council (EPSRC), which will be boosted by partner contributions to approximately £23 million in total. www.epsrc.ac.uk

Heritage in Syria

The iSTAR panoramic camera has been selected for a mission to digitally document dozens of at-risk sites in Syria, Iraq and the Middle East. The mission, dubbed Project Anqa (Arabic for Phoenix), is a joint initiative between CyArk and the International Council of Monuments and Sites (ICOMOS). They will work with local experts in the Middle East to record cultural landmarks using reality-capture technologies such as 3D laser scanning, photogrammetry, and traditional survey.

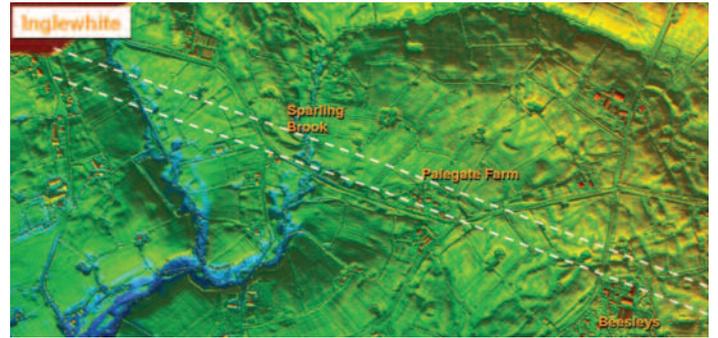
RICS Research

The RICS Research Trust has a remit of supporting, delivering and disseminating high quality, independent reliable knowledge and future thinking through research funding. The Board meets to consider awards twice a year in May and December. It will consider projects undertaken by chartered surveyors or others who are, in the opinion of trustees, adequately qualified to undertake the research. Both major research projects from established researchers and smaller scale proposals from younger researchers will be considered. Closing date for applications: Last week of March 2016.

Gender gap challenge

Topcon recently joined forces with Enterprise South Liverpool Academy (ESLA) to inspire female students to consider a career in engineering. The event took place at the school on 6th January and welcomed successful female industry professionals to discuss the benefits

Open data reveals Roman Roads



David Rateledge, former head of Lancashire County Council's GIS unit, has been using Environment Agency LiDAR data to look for evidence of Roman roads in the county. He has recently discovered one which connected Ribchester and Catterall. He imports the surface and bare earth LiDAR data into the Open GIS software package QGIS and experiments to find the best hill-shading angle to illuminate the road embankment (known as the agger) rendering it visible in the image as it passes in a straight line across several fields.

He found that rather than following the route shown on Ordnance Survey mapping, the road took a very sensible and economical route via Longridge and Inglewhite to Catterall, near Garstang, a distance of 10 miles. Site visits have confirmed this with several stretches surviving. Environment Agency LiDAR is now supplied as open data from

<http://environment.data.gov.uk/ds/survey#/download> For more visit: <http://www.romanroads.org/gazetteer/lancspages.html>

of a job in engineering. Through a series of talks they shared some of the highlights from their careers and what inspired them to take up a job in engineering. Topcon has been supporting ESLA since 2015 as part of Class of Your Own's (COYO) Adopt a School scheme. It is now the third school that Topcon has adopted since it first partnered with COYO in 2012.

Future City Pilot

The Ordnance Survey, IGN, the city of Barcelona and virtualcitySYSTEMS GmbH are sponsoring the OGC Interoperability Program's Future City Pilot Phase 1. The objective is to demonstrate how the use of CityGML data and IFC data together can assist the planning process by putting planned buildings (BIM models) into an existing city model and then automatically checking conformance with planning rules. The BIM data can then be incorporated into the city model. The pilot will also explore the linking of data held by multiple agencies for environmental simulation, disaster management and training simulation. Visit: www.opengeospatial.org/standards/requests/147

BUSINESS NEWS

Hexagon AB has announced the acquisition of Paul MacArthur Ltd ("SCCS") – one of the UK's leading suppliers of surveying equipment to the engineering and infrastructure market and a Leica Geosystems distributor for over 20 years. Ola Rollén, Hexagon President and CEO says, "... not only does this acquisition bring us closer to our customers in the region but also provides a wealth of knowledge and expertise in the area of equipment rental..."

Topcon has acquired a significant share of holdings in Viasys VDC. The company has developed a complete suite of tools and services to assist customers in building Virtual Design and Construction (VDC) models for 5D simulation of infrastructure and site-work projects. Utilising BIM technologies, its solutions create VDC models that optimise the construction process throughout the project's lifecycle.

Technics has taken over Cardno's office in Doncaster,

giving the company a presence in the north to complement its three offices in Guildford, Maidstone and Nottingham. Seven Cardno employees have joined the Technics workforce.

Ordnance Survey and Dennis Maps have signed an agreement for Britain's mapping agency to acquire a 25% shareholding in the business which prints its paper maps.

Bluesky has reduced the time taken to process its aerial photography data by more than 75 percent. The company has implemented the Vexcel UltraMap system, which has allowed for the introduction of a continuous, uninterrupted processing workflow.

IN BRIEF

FARO's handheld scanner won the 'Hardware Product of 2015' at the Construction Computing Awards, held last year at the Hotel Russell, London.

The Council of European Geodetic Surveyors (CLGE) member associations in each country of the EU are planning to coordinate the collection of data regarding disabled parking spaces. The aim is to create a database to assist people with reduced mobility to find parking spaces. The dataset will be compatible with INSPIRE. Information on parking spaces and will then be available on www.blueparking.eu.

Fugro is commencing site characterisation work in Moorside West Cumbria, under a major contract awarded by UK nuclear company NuGen. The contract is worth approximately £20 million. The work includes topographical and bathymetric surveys. The onshore investigation is the first stage of the project, which continues until summer 2016; the majority of the offshore element is scheduled to begin in spring 2016.

Bluesky is working with

Survey Solutions buys EALS



Survey Solutions, headquartered in Ipswich, has purchased Stowmarket-based East Anglian Land Surveys (EALS), following the retirement of EALS directors Robert Mullins and Jeff Bate (above left and right behind James Cooper). The plan is to gradually integrate EALS into Survey Solutions with the surveyors moving over to either their Ipswich or Norwich offices.

James Cooper, MD of Survey Solutions, adds: "Merging our teams will result in a stronger, more cost-effective and faster service to clients. The plan is to gradually integrate EALS into Survey Solutions. The welfare and happiness of the existing staff has been an important part of the merger and every member of the team now has an opportunity to work, develop and grow within the larger organisation."

FATMAP to create ultra-high resolution 3D mobile maps of major ski resorts and other outdoor pursuit destinations. FATMAP plans to roll out its

smart maps to all major European and American ski resorts and then 'summer' products for hikers, trail runners and bikers.

SURVEY REVIEW

Survey Review is a leading and prestigious journal published bimonthly by Taylor & Francis Group on behalf of Survey Review Ltd. The journal brings together an unrivalled body of knowledge in the land and engineering surveying professions, publishing papers on research, theory, practice and management. All papers are peer reviewed and are drawn from an international community, including government, private industry and academia. The Journal is invaluable to practitioners, academics, researchers and students who are anxious to maintain their currency of knowledge in a rapidly developing field.

Further information and abstracts of recent issues can be found at www.surveyreview.org. Orders and requests for inspection copies should be sent to: subscriptions@tandf.co.uk.

January/February 2016 Contents

- Structural integrity verification of cable stayed footbridge based on FEM analyses and geodetic surveying techniques
- An extendable linearised adjustment model for deformation analysis
- Investigating efficacy of robust M-estimation of deformation from observation differences
- Creation of land fund for the purpose of land management in the Republic of Serbia
- External error modelling with combined model in terrestrial laser scanning
- Property, human rights law and land surveyors
- Static GNSS precise point positioning using free online services for Africa

EVENTS CALENDAR 2016

- SEMINARS • CONFERENCES • EXHIBITIONS • COURSES • WORKSHOPS

GW welcomes advance details of events of interest to the Geomatics community. Details to: editor@pvpubs.demon.co.uk

For details of the current RICS lecture programme turn to page 06.

info@geospatialworldforum.org

Internet of Things

15 March, Central London

www.westminsterforumprojects.co.uk

European Space Solutions

30 May - 3 June, The Hague, The Netherlands

<http://www.gsa.europa.eu/>

FIG Working Week

2-6 May, Christchurch, New Zealand

www.fig.net/fig2016/

HxGN Live

13-16 June, Anaheim California

<http://hxgnlive.com/>

Esri UK annual conference

17 May, QEII Conference Centre

email: AnnualConference@esriuk.com

ISPRS Congress

12-19 July 2016, Prague

<http://www.isprs2016-prague.com/>

GEO Business

24-25 May 2016, Business Design

Centre, Islington, London.

www.geobusinessshow.com

InterGEO 2016

11-13 October, Hamburg

<http://www.intergeo.de>

Geospatial World Forum

23-26 May 2016, Rotterdam, The

Netherlands.

GSDI Conference

28 November-2 December, Taipei

<http://gsdiassociation.org/>

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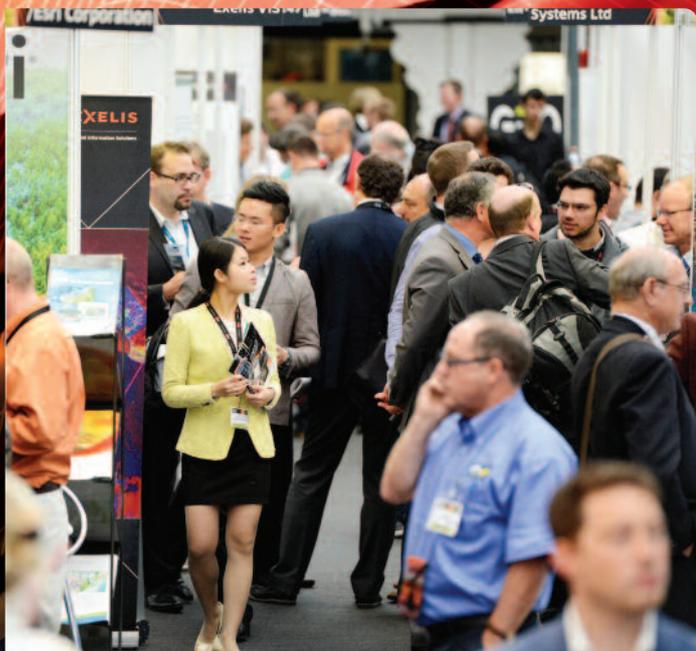
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Size and height are relative but could eagles dare?

With important upcoming events for our profession **Gordon Johnston** reflects on the global market for spatial data, height reference frames (both personal and established) and a novel potential survey platform.

I'll take this opportunity to declare my interest in the coastal and offshore sectors of our profession, an area which is growing in importance with an increasing awareness across the media and the public of the potential benefits and opportunities that responsible sustainable development of our seas could offer. The terms Blue Economy, Blue Growth and Blue Horizon all link to this strategic concept of beneficial development of our seas.

To gauge how this sector is faring, with the conflicting impact of depressed oil & gas prices against new technologies and automated systems, I shall be visiting Oceanology International at Excel, London in March, see www.oceanologyinternational.com/. Around the world the offshore oil sector's cities are being hit hard as reductions in capital expenditure and operational projects take their toll on people's lives. Such events are important as it's the innovation, flexibility and diversity in this important geospatial sector that insulates us from the worst effects of these cyclical downturns.

Whilst the marine sector is experiencing some really rough patches, it is clear that many land-based activities continue to evolve and expand. One such is automation – a constant theme in the collection, processing, analysis and management of spatial data. Automation leads to robotics so it was with some interest that I read news of trained eagles being assessed as possible protectors of our privacy and security by using them to grab or disrupt Remotely Piloted Airborne Systems (RPAS or to many simply, drones). Whilst almost every TV channel's news programme regularly manages to include footage from drones, there is increasing concern about their regulation and use in congested areas. Perhaps the alternative is to use the eagles as a platform for surveys.

I have numerous colleagues with divided opinions to quantify the size of the geospatial market. So I suppose it shouldn't come as a surprise to find that a study in the US has found that the assessment of a hill's size, steepness, difficulty of climb or height is subject to the individual's personal condition and fitness. Larger people appear to see and judge something as larger than a small person would. This may be an outdoor phenomena as I'm not convinced it holds true indoors where my cousin (2.03m or 6ft 8inches) has to duck when entering every room and complains about small beds. So things are often relative and subjective when it comes to height. . . as are many other measurements. This is why for consistency and repeatability it is

important to adopt and maintain standards.

Talking of height. . . vertical things are on the up! Sorry, that was a bit too obvious but it is a topic that appears, after many years, to be getting a broader and more engaged audience with some serious groups generating new guidelines and actively promoting its relevance. The Vertical Offshore Reference Frame (VORF) was developed in the UK to assist in resolving the vertical dimension. Across the North Sea, the EU's BLAST project provides "harmonized" data across the land and sea interface, with the main challenge being the vertical. Elsewhere, NOAA has the VDatum online tool and Australia has the AusGeoid09 model. These initiatives are important but it would be beneficial if users could rely upon a consistent and standard approach to how these models are described, accessed and supplied. The importance of standards and good practice guidance for professional users is key. Look out for work being completed by the IOGP (International Oil & Gas Producers) Geomatics division to assist users interested in this dimension.

As this edition of *GW* goes to press the third of ESA's Sentinel satellites has been launched. With three land and ocean observation satellites, providing high quality hyper-spectral data, the opportunities to use and benefit from these initiatives is tremendous, especially considering the data is free for most users (see also page 25).

Looking ahead there are numerous upcoming events to promote and raise awareness of our profession to the wider community. In early May (2-6) FIG holds its annual Working Week, this year in Christchurch New Zealand where a devastating earthquake challenged many who live and work there. The FIG community is a strong one and overseas visitors will be able to experience for themselves the impact and resolve to restore the city to its former glory. FIG's theme of "Recovery from Disaster" emphasises the critical importance of spatial data to the planning and sustainable management of community spaces, be that in urban, rural or coastal marine areas. See: <http://www.fig.net/fig2016/>

Later in May (24-25) is GEO Business in London, a showcase for the geospatial industries and profession, which is again set to break records. It offers the chance to hear experts present the latest developments and to meet and network with companies and fellow professionals. See: <http://geobusinessshow.com/>

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welcomes your comments
and thoughts so please
email to the following
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Athletes, surveyors, atlases and the inventor of nature

by Malcolm Draper, Rentalength

Caribbean travel, lectures, books and a trip to the RIBA to view some catastrophes.

I've had the good fortune to go to Barbados again (well it perks you up after Christmas!). Whilst there I met up with old friend **Brian Hart** of survey-company HHF. One of his crews was doing some simple hydrographic survey near our hotel. **Kenroy** was safely on land on the instrument assisted by **Rodney** while **Dave**, the better swimmer, was on the long rod and up to his waist measuring depths and wondering what surveying was like in London. I told him he wouldn't like it as the weather would freeze solid certain parts of his anatomy.

I also got chatting to a young lady sprinter. **Jade Bailey** is probably the fastest woman in Barbados. Jade has represented Barbados at the Olympics on two occasions and is limbering up as we speak for Brazil. I asked how much of 20 metres she would give me in a quick dash. She looked me up and down and said "oil (all) of it!" in that lovely Bajan lilt.

Being on holiday I missed a couple of good lectures at RGS, one of which was by **Nick Middleton** on countries that are not recognised by the UN or indeed by anyone very much else. Fortunately the Editor attended and told me all about it, relying on which I purchased two copies of Mr

Middleton's book. You can read the interesting review on page 29 of this issue of GW. I especially like the facts that there is a rival body to the UN and that FIFA has more member countries. FIFA also has a rival body with only two members. I wonder how their world cup works.

Interesting if not praiseworthy

This column often gives fulsome praise to lectures at the RGS. But on one occasion recently the editor and I agreed the lecturer was a far from fluid speaker. There was nothing wrong with the subject, except perhaps it was a little too wide ranging and didn't focus for long on any one aspect of the subject. Africa's labels, an odd title, by **Richard Dowden** rambled too widely. It left you feeling slightly embarrassed for the few Africans in the audience.

The speaker is Director of the Royal African Society, founded in 1901 in memory of **Mary Kingsley**, who made two trips to West Africa, apparently with an interest in "flora, fauna and fetishes", according to Dowden.

His lecture gave us plenty to think about but it might have been more entertaining had he told us more about those fetishes. He began by asking us all to pause for a moment and tell our immediate neighbour in the hall



Right: with Jade Bailey. Below: Jade (No 5) on the track at the Beijing Olympics.



Top: with surveyor Brian Hart. Background: Dave surveys with snorkel, mask and pole and left, surveying done, enjoying a rude comment from yours truly.

which words came to mind when thinking about Africa. A general hubbub ensued which took a little quietening.

Described on the front page of an edition of *The Economist* as the “hopeless continent”, Africa is enormous. Geographically its 54 nations could absorb the United States, India, Europe, China, Iberia and Japan and still leave some land over. It has over 2000 different languages. Dowden showed us a linguistic map with a dozen languages alone for Madagascar.

A much earlier map showed how the European powers in the late 19th century carved up the continent amongst themselves, with even tiny Belgium (which was only itself recognised as a country in 1830) grabbing territory more than 20 times its size and imposing a rule of terror amongst the Congo’s tribes: “sign here or we’ll cut your arm off!” And they did.

We learned that currently Ethiopia is experiencing the highest growth rate of any country in the world (but still has only one shoe factory!). Across the continent people have gone for mobile phones in a big way. From a base of 1.6 million in 2000, there are now over 600 million users (Nigerians often have two but that is more a reflection of their poor network). Africa also has 11 of the world’s 20 longest-serving leaders, despite many of them owning palatial homes in more expensive parts of the world like Monaco.

The inventor of Nature

Much more exciting was an outstanding lecture that ticked all the boxes and then some. **Andrea Wulf** is German but totally fluent in English apart from correcting our often poor pronunciation of her countryman, **Alexander von Humboldt**. Her lecture (inevitably accompanied by a book, “The Invention of Nature”) was on the said explorer, scientist and naturalist whose ideas about nature and the Earth in the late 18th/early 19th centuries would be regarded as very modern today. For many he is regarded as the founder of environmentalism.

The son of a wealthy Prussian aristocratic family, once the mother he hated had died he was off to discover the world, funded by his inheritance and pausing only to grab a couple of chums to accompany him on his first great journey to South America.

Intriguingly, despite being very well regarded in the 19th century by our scientists and explorers, Humboldt is not that well known in the UK today. Andrea wondered if this was because there was a tendency during the first world war to reject all things German (remember the Royal Family changed their surname at that time to Windsor). But she felt it was really because Humboldt, for all his voluminous writings did not discover any one big thing.

Climate summit

Professor **Michael Jacobs** gave a very spirited and informative account of the Paris Climate

summit last year and the events leading up to it. He began with a joke, indeed he said that as an economist he had been collecting jokes about economics for 30 years – he’d managed to get. . . . four! A great lecture in the traditions of the RGS which ended with a cartoon showing the delegates at a climate change conference looking askance at a doubter who’s saying ‘What if it’s all just a hoax and we’ve made the world a nicer place to live in for nothing?’

Miscellany

If you’re in the West End of London and at a loose end for an hour or so call in at the headquarters of the Royal Institute of British Architects (RIBA) – 66 Portland Place, W1 (right). They have an excellent Bistro restaurant where a two-course lunch and a glass of wine won’t cause a personal financial crisis. There’s also an interesting free exhibition on there until 24 April called “Creation from Catastrophe”. It’s all about how urban disasters, like the Great Fire of London (1666) or the Lisbon earthquake and tsunami of 1755 gave architects unique opportunities to redesign great cities. Many of the plans shown were not acted upon, fortunately in some cases. Endless and boring grids and squares don’t make for interesting places to live.

Longstanding readers of this column will know of my views on “Geomatics”. So, whilst at the RIBA I took the opportunity of enquiring in their library and bookshop if they had any books on Geomatics. Blank faces all round I’m afraid. I seem to recall a similar experience some years ago in the ICE’s bookshop.

A sad tale is reported in the RICS journal *Modus*, which recounts the end of a volcano visitor centre in the Cape Verde Islands. The centre was opened in 2014 to much approval including an award for the design. Surprisingly, the centre has been destroyed by. . . a volcano!



James Kavanagh has suggested readers might like to see a post on the RICS Facebook page. It concerns a set of stamps (above) sent to RICS by a member in 1971. They feature land surveyors and mark the move to metric measurement in Uganda, Kenya and Tanzania.



Above: the magnificent entrance to the RIBA building.

Got a tale to tell?

Please send letters for publication by e-mail to the Editor: editor@pvpubs.demon.co.uk or contact Undercurrents, in strictest confidence if you wish (we promise to change names, places, etc to protect the guilty!), via e-mail: rentamalca@aol.com

Getting Survey Together for BIM: a call to arms

The joint ICES/RICS lecture, held at the University of East London on 12th November was a rare insight into how the world could and should be. At last a group of surveyors is getting to grips with BIM, thought our technical editor **Richard Groom**.

“...surveyors will once again be professionals and hold their own...”

Joint presenters, Barry Gleeson and Martin Penny gave the audience, who had made out to the end of the Docklands Light Railway, a carefully thought out and vibrant talk on the place of survey in BIM. It was reminiscent of those talks given by David Philp, the former government advisor and undoubted master of words and pictures for BIM.

Survey4BIM is a technical committee under the auspices of the government's BIM task force. Note the order of the words in contrast to the other BIM4 groups. Surveyors support BIM; BIM does not support surveyors. The presenters stressed that everything does indeed happen somewhere as evidenced by the meteoric rises of Google and Uber, and that the internet of things will reinforce this. Yet the BIM world does not understand location and does not yet even appreciate its importance.

Survey4BIM is also a vehicle for bringing the profession together under one roof. The group has published two documents: a client guide for 3D laser scanning and data capture and the Survey4BIM digital plan of survey works. The latter is modelled on the RIBA stages of work. It promotes a structured approach to project management and encourages collaboration between all parties to a project by asking the right questions. As Gleeson put it: 'this is the key to communication between client and surveyor'. Success will be the end of clients asking for 'a laser scan survey' and the start of a process of discussion with the surveyor asking the client what he wants to achieve and advising him how to achieve it.

The suggestion was that surveyors have ceased to be the source of advice for their clients and that this has brought about the decline of the profession. If this initiative works – and we really need it to happen – surveyors will once again be professionals and hold their own with all other professionals involved in engineering and construction. Penny invited the audience to consider what surveyors will be doing in the future: 'the long-term future of the profession is not in turning angles'.

Addressing the issues

All government engineering and construction contracts should be using BIM Level 2 by April 2016, but the reality is that in 2014 only 50% of contracts used BIM. In February 2015, the push to BIM Level 3 was launched: a ten-year programme with the goal of a 'Digital Built Britain'. Location is, as the presenters stressed, essential to achieving these goals, but has been neglected.

The group has identified five issues that need addressing:

Accuracy: outside geomatics there is widespread ignorance of quantitative accuracy. Describing the accuracy of digital data is essential for the people who use it and surveyors can contribute to a better understanding. As Gleeson said, you can enlarge the graphics to 'nano', so it is no longer good enough to rely on plot scale to define accuracy or use words like 'good' to describe it.

Metadata: the same applies here. Information about the data has to be stored with the data, but currently it is not.

Interoperability: data has to move freely between all the people and systems that need to use it, yet there are still no standards for survey data.

Level of detail: how much detail should be included in BIM? In theory a BIM could include information about every bolt, nut and washer. But to what level of detail should it go?

Generalisation: making data understandable at the user end. This is a question that has exercised mapmakers for two hundred years and, early on in the digital revolution, Ordnance Survey realised the benefits to be gained from using generalisation to make the same data usable at all scales.

The presenters used a maturity model to assess where BIM stands on each of the issues and in all cases it falls short due to a lack of understanding by those professionals who are currently at the centre of BIM management.

Get involved!

The talk concluded with the presenters issuing a call to arms. They want to hear from all those with something to contribute – and that, they stressed, means everyone. By working together we can, they assured, steer BIM in the right direction and put geospatial experts at the centre of our increasingly geo-enabled world. The presenters can be emailed on martin.penny@technicsgroup.com and barry.gleeson@networkrail.co.uk.

Visit:

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Autodesk University 2015: The Future of

Autodesk continued to react to changes that shape the design and manufacturing markets at AU 2015. It was an event that catered to a world of "always on" media, where 30,000 people tuned into main-stage sessions live through social media channels. **Adam P. Spring** reports "live" from Las Vegas for *GW*.

Autodesk University (AU) 2015 was held at the Venetian Hotel, December 1st-3rd, 2015. For the 10,000 people in attendance, it was an event focused on collaboration and learning. There were, for example, several demonstrations on the ways in which humans and robots could work together; and where iterative design workflows can help develop more efficient and environmentally friendly products. Every aspect of infrastructure and asset management was geared toward a low waste economy.

Just an open air factory

General sessions were used to re-imagine what design and manufacture actually mean in a connected world of sensors and sensing; where processes once viewed as being separate to one another have now started to blend. Autodesk CEO **Carl Bass** used the construction process tied to the new Apple Campus in Cupertino, California, as an example. At first, he likened its construction to that of aircraft, where each part going into the build is catalogued. This and other practices taking place at the Apple site eventually led him to reframe how he viewed the construction process: "Building and manufacturing are converging... I'd realised that the Apple construction site is actually just an open air factory."

Themes linked to rethinking industrial, design and manufacturing based processes ran throughout the general sessions. Autodesk's chief technology officer, **Jeff Kowalski**, continued to outline the benefits of iterative and computationally driven design processes. Later sessions, chaired by podcast wunderkind **Roman Mars**, put several industrial revolutions

into context, and showed what it actually took to be a small sized car manufacturer operating out of Liverpool in the UK.

The Industrial Light and Magic (ILM) presentation given in the Mars sessions readdressed how films were made and consumed. **Vicki Dobbs Beck**, ILM Strategic Planning, used parts of past Star Wars films to show how storytelling is changing in an age of interactive media. Scenes from the desert planet Tatooine were reconstructed so that the audience could reimagine events through the eyes of C-3PO. ILM is re-examining what film actually means to an experience-driven audience, where virtual reality headsets and haptic sensors can be used to create immersive environments in a home or cinema setting.

New body identities

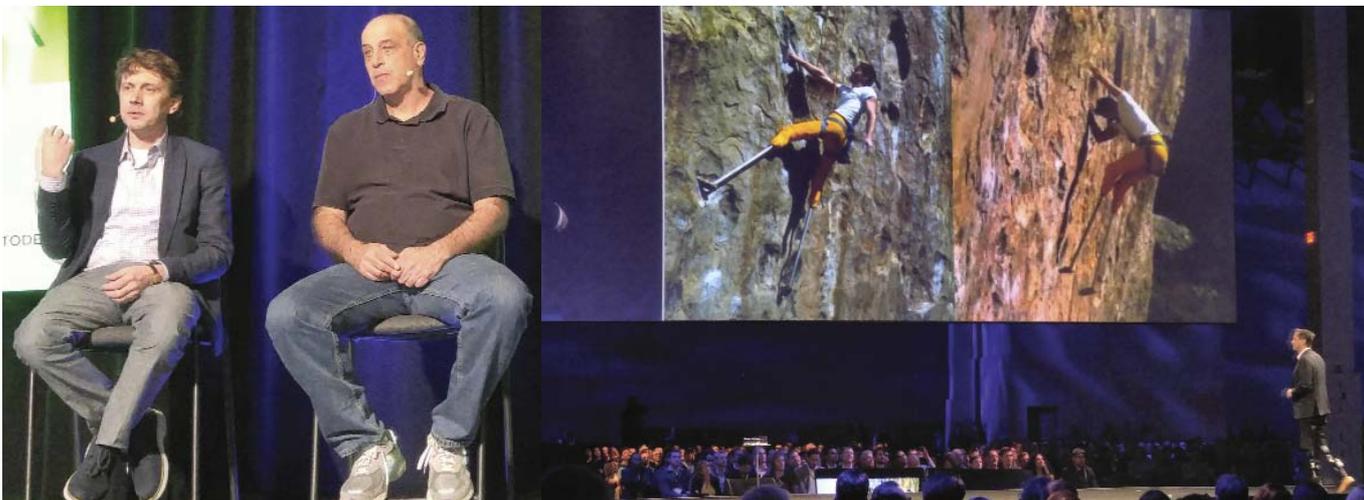
The MIT Media Lab presentation given in the opening general session showed how mind over matter was readdressing human disabilities as an idea. **Hugh Herr**, Biomechanics at MIT Media Labs, lost the bottom parts of his legs in a climbing accident in the 1980s. Since that time, he has developed a series of prosthetic legs. These were based on him working with the circumstances in place; not viewing his condition as a disability. His presentation was thought provoking for several reasons: the most powerful one was that body modification and upgrade will be part of human existence in the not too distant future.

Blended solutions

Chris Murray, a creative technologist at Autodesk, gave an interesting presentation on

Right: Carl Bass (left) and Jeff Kowalski:

Far right: Hugh Herr developed his own prosthetic legs after a climbing accident.



Making Things

bringing 3DS Max projects into Stingray. The latter is a game engine, which was known as Bitsquid before it was acquired by Autodesk in 2014. In many ways, Stingray was one of many examples where services and solutions across the Autodesk product line continued to blend with one another. The increased relationship between ReCap and AutoCAD also exemplified this notion of a blended approach to product development.

Construction

Autodesk was looking to increase its footprint in construction-driven markets at AU 2015. Indicators for this included Project Alexandria and an evolving relationship with Topcon. The BIM to Business (BIM2B) initiative promoted by Topcon, for example, is centred around Autodesk solutions. AutoCAD, BIM 360, Navisworks and Revit feed into solutions like Topcon's LN 100, PS and DS total stations. Information and communication technologies (ICT) now drive the business model, which Autodesk has been working on for some time.

Project Alexandria

Project Alexandria is a pragmatic example of cloud or distributed computing geared toward construction-based applications. This is a project management tool built around a now fully connected world, where multi-sensor devices like tablets and smartphones bridge the gap between onsite and office-based activities. Demand for Project Alexandria was so high that it shorted the timeframe in which BIM360 Docs were launched (<http://bim360.com/docs>).

Advancing BIM

Building Information Modelling (BIM) played a fundamental role throughout AU 2015. Revit sessions were fully booked and BIM City remained a key part of the exhibition area. It was, however, the subtle indicators of things to come that made BIM at AU 2015 particularly interesting.

Arol Wolford, who sat on the board of Revit before it was acquired by Autodesk, showcased his VIMtrek based solutions in the exhibition area. His Atlanta based start-up, which also has a sister company called SmartBIM, utilises the power of the Unity game engine. Workflows are centred around what is being called Visual Information Modelling (VIM), immersive and experiential-driven processes where the ability to work with smart information is paramount.

Members of Oregon based M-SIX were also in attendance at AU 2015. Their cloud based solution was called VEO; a smart database created from the ground up over a seven-year period. In a demonstration given post AU 2015, it became very clear just how powerful VEO was. This was especially the case in environments where construction and building design was of primary interest. The ability to access, organise and connect all types of project information easily and efficiently make VEO a very powerful management tool. ICT continues to impact upon design, manufacture and location aware based applications; much in the same way they have at previous AUs in Las Vegas and, more recently, the ESRI User Conference 2015.

Amar Hanspal, senior vice president at Autodesk, reaffirmed this in the media

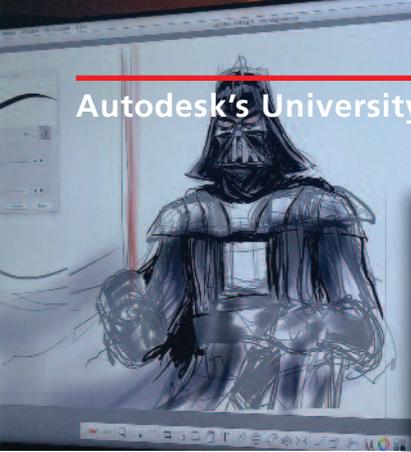
“The BIM to Business (BIM2B) initiative promoted by Topcon... is centred around Autodesk solutions.”

Far left: Humans stroll through the AU 'campus' while **(left)** humans and robots work toward the perfect drink and perfect hangover.

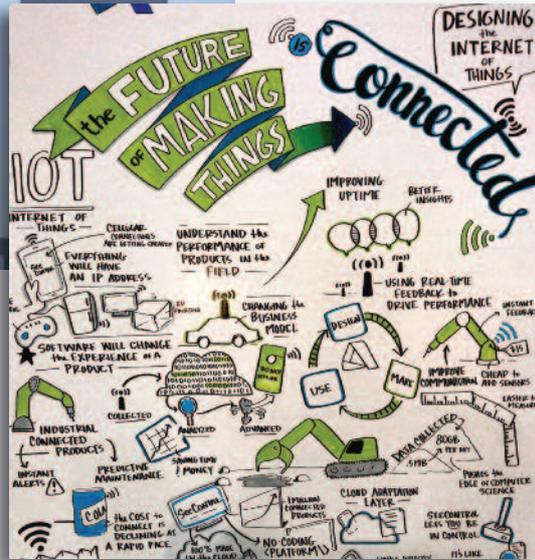


Far left: Briggs Automotive Company of Liverpool designed a roadworthy Formula 1 style vehicle.

Left: Close working relationships with UAV companies like Skycatch and 3D Robotics hinted at what might be on display and discussed at AU 2016.



Above: Autodesk used *The Force* to show the power of connected and affordable touch-screen devices as design tools.



Right: Sketchnotes are used extensively at conferences like AU and Hexagon. **Tom Wujec**, a Fellow at Autodesk, sees them as a way to give visual meaning to business strategy and communications.

analyst luncheon. He saw the company as focusing on four essential technology trends: cloud or distributed computing, new methods of manufacture, the Internet of Things (IoT) and customer engagement. ICT was the common ground between all of these trends, as are the low cost, multi-sensor based devices fuelling them.

The Venetian

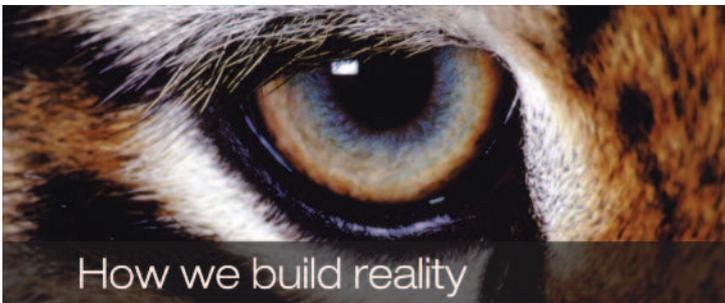
The Venetian Hotel is the second largest

hotel in the world. It contains 4049 rooms, 3068 suites and a 120,000-square-foot casino. Inspired by its Italian namesake, it contains several features based on Venice's famous landmarks. These include the Palazzo Ducale, Piazza San Marco, Piazzetta di San Marco, the Lion of Venice Column and the Column of Saint Theodore, St Mark's Campanile, and the Rialto Bridge. The Venetian was built and opened between April of 1997 and May 1999. Total cost of construction was USD \$1.5 billion.

Summary

Autodesk continues to adapt in marketplaces driven by and evolving around "always on" media. At AU2015, collaboration and imagination were at the heart of everything on display. In terms of imagination, there were no restrictions anymore. The digitisation of design and manufacturing processes now enables anyone to be a user creator.

The construction industry was a big part of AU 2015. Evolving relationships with companies like Topcon, who were using BIM 360 solutions alongside their total station and 3D layout product lines, were prime indicators of this. Collaborations between JE Dunn and Autodesk Construction also demonstrated where the future of project management is going.



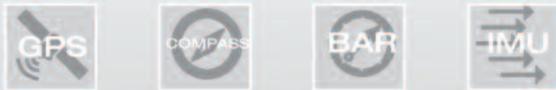
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Surveyors opt for 360° colour imaging camera delivers high-density resolution



Above: laser scan of Oxford Castle's Norman columns with colour from the Spheron SceneCam.

Left: MK Surveys surveyor with the Spheron SceneCam.

Capturing the finer details and colours of a Norman castle for an orthophoto can be challenging. One survey company found the Spheron HDR camera was just right.

There is an increasing demand for survey companies to use technology which effectively captures reality, right down to tiny details. One device which can help is the Spheron SceneCam, a unique mobile reality capture device – an automatic camera technology which is able to provide full spherical imagery of sites or locations. The camera captures high quality full spherical HDR 360° x 180° uninterrupted views and is also able to provide 3d measurements.

Following extensive evaluations of different colour imaging technologies, MK Surveys found that the Spheron camera's ability to automatically capture high quality HDR environments along with the SceneCenter visual asset management software offered a compelling advantage. MK invested in the HDR Camera and it has already been busy on a prestigious cultural heritage project.

They were commissioned to undertake a measured survey of the famous Oxford Castle, a grand Norman medieval building situated on the western side of Oxford, England. **Lewis Hook**, MK's survey manager explains 'We were contracted to document an underground part of the castle beneath St George's Tower. It was an area with minimal lighting known as the St George's Chapel Crypt.'

Hook found 'the camera's ability to capture automatically precise clear colour details of the 11th-century Norman column structures was exceptional. Both the high dynamic range and high resolution plus additional lighting capabilities allowed us to record excellent image quality throughout.'

The MK Surveys' team set out to use the data for a number of deliverables, such as the best HDR colour to apply to the laser-scan point data. 'Unlike other systems we had previously tested, this RGB overlay process was simple and the tone-mapped imagery matched the laser-scan data precisely with no parallax distortion issues,' adds Hook.

The data was also used in the production of orthophotographs, which formed a necessary part of the preservation documentation requirements as well as aiding in the digitizing of the captured detail within MK's CAD software. 'Being able to see such clear details, really assisted our CAD technicians to accurately highlight the ornate stone details,' explains Hook.

MK Surveys director, **Stuart Dimond** adds, 'Capturing reality is an emerging development within our geospatial markets and we see our investment in Spheron as a great complement to this. Spheron's image sensor technology delivers superb clarity, ensuring we can record onsite every detail, which can be vital on some of our latest client projects.'

Lewis Hook: 'the camera's ability to capture automatically precise clear colour details of the 11th-century Norman column structures was exceptional.'



- MK Surveys is a leading survey & technical geospatial service company, which operates from five office locations across the UK and offers a wide range of professional measurement services including topographical surveys, measured building surveys, 3D laser scanning, BIM, and various GIS / asset data collection and mapping. Their wide range of services cover numerous market sectors including, private, commercial, education, health, rail, utilities, as well as heritage and archaeology.

3DLM comes to London

– surveying on the move: tunnels, roads, seals and cheetahs!

3D Laser Mapping recently showcased the company's and its partners' technology. **Richard Groom** heard all about data capture on the move and... cheetah hunts.

“The technique is a quick method for laser scanning linear features, particularly highways, because it solves the safety problem...”

GW attended the second day along with about forty fellow delegates. But where were the surveyors? Not only could they have gained from a view of the technology on offer, but they could also have 'networked' with a range of potential clients.

StreetMapperIV

Graham Hunter, chairman of 3DLM, opened proceedings with an overview of the company and particularly of its flagship mobile mapping system StreetMapperIV, which has just been released. The advantages of mobile mapping are well known. The technique is a quick method for laser scanning linear features, particularly highways, because it solves the safety problem and, although the capital cost is high, the operating cost is low. One example of this was an as-built survey of the A42 following highway construction just before it reopened. With ground control the surveyors, Hunter said, achieved a vertical accuracy of better than 10mm.

Chris Cox enlarged on the use of ground control by giving an example: the survey of a dead-end tunnel, work on which had been stopped years previously due to funding difficulties. The work could not restart until the existing tunnelling had been surveyed. Without control, the trajectory of the MMS had drifted off by 170m, but with control targets embedded in the point cloud this was reduced to a few centimetres. When deciding on the spacing between control points the time taken for the vehicle to travel from one control point to the next should be considered

because IMU's drift with time, not distance. He also stressed the importance of using control to adjust the trajectory rather than trying to adjust the point cloud. A point that is obvious to surveyors but not, apparently, to everyone else.

Lidar

Riegl's airborne systems were covered by **Peter Rieger**. In addition to flying from conventional manned aircraft platforms, Riegl has developed systems for unmanned aircraft. The RiCOPTER multi-copter was on display and it is not something that would glide discretely through the air. But then it has to be big in order to carry Riegl's VUX-1UAV laser scanner and IMU/GNSS unit. Its maximum take-off weight is just 25kg which is heavier than the 20kg limit for small UAs set by the CAA in Britain and therefore operation in Britain involves complying with a tougher set of regulations. The VUX1 range of scanners uses waveform processing and a cunning method to distinguish correct from incorrect echo returns, which can occur in situations when there is a wide range of height between features in the terrain.

Bathy LIDAR

The company also sells bathymetric survey systems. The VQ880-G scanner operates from a manned aircraft. It is a dual-laser system: green to see through the water and red to reflect off the water surface. The laser reflecting off the surface has a circular motion, which enables the system to calculate the angle of incidence and so to apply refraction corrections to the green laser, which reflects off the river or sea bed. The system can 'see' to 1.5 times Secchi depth (Secchi is the standard means of estimating water turbidity). But bathymetric lidar systems require the bed to be bright; they do not like muddy bottoms. The range accuracy is 25mm and cloud density is 27 points per square metre from a flying height of 600-700 metres. Riegl has also developed a UA 'bathycropter' version which uses the same platform as the RiCOPTER. This system flies at between 10m and 30m above the water surface and uses a class 2M laser to see down to Secchi depth.

Riegl has developed the Bathycropter, an airborne lidar for hydrographic applications.



partners. This company produces medium format calibrated metric aerial cameras, claiming the pixel resolution of the large format cameras but at a fraction of the cost. There are four ranges of camera, including one specifically designed for UAV work with three or four models in each range. Lens focal length options are available from 40mm to 240mm. Forward motion compensation (FMC) is available for most cameras and they can be integrated with GNSS/IMU systems. **Steve Cooper** described the cameras and presented a case study set in the most inhospitable conditions for photography – icebergs. It was a sorry tale of a client having a go at doing it himself, giving up and then calling in the experts. Sound familiar? The task was to count endangered seals in an Alaskan harbour. Needless to say, the seals were crystal clear on the Phase One photography.

Trees and cats

Carbomap is an offshoot from the University of Edinburgh and a pioneer of multispectral lidar. **Antoine Cottin** explained how the technology is used to map forests. By analysing the intensity of the returns it is possible to estimate the health of the forest using simultaneous lidars operating at different wavelengths. This is definitely a technology with a future.

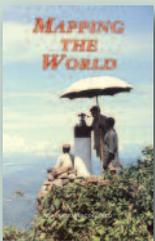


Desk study for UAV – the compact and versatile RiCopter.

Before despatching delegates to visit the stalls of each supplier for demonstrations and questions, Professor **Alan Wilson** from the Royal Veterinary College told us about cheetah hunting. Wilson is an expert on animal locomotion, researching the hunting and ranging characteristics of African carnivores. He has developed tracking collars for the cheetahs and is able to examine in amazing detail using laser scanning, how the animals move when they hunt.

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OSGB: Generating synchronised elevation models

In the summer of 2015, the 3D Data Generation team in the Remote Sensing department Ordnance Survey Great Britain (OS) put into production a Digital Terrain Model (DTM) flow line. **Diana Moraru**, remote sensing surveyor, explains.

Evolving user requirements have defined a need for consistent data and a synchronous approach to the creation of Digital Surface Models (DSM) and Digital Terrain Models (DTM). The OS's new flow line generates a synchronous DTM from the DSM and replaces the previous (and predominantly) manual approach used by the Imagery and Height team. The production of an improved DTM, synchronous with the DSM, provides consistency and accuracy for future 3D data analysis and modelling.

Moreover, it will enable the development of potential 3D identification and extraction of features. The results of this research will bring valuable benefits to areas where 3D modelling is essential in supporting initiatives such as BIM, smart cities, environmental modelling and land cover applications.

This project tested alternative approaches to the challenge of generating height models from a consistent source of data, i.e. multiple-overlapping digital aerial imagery.

The historical context

OS has been collecting data and mapping the nation for 225 years and is known traditionally for 2D mapping. In the 19th century, one of the first objectives in determining elevation information was to map the countryside to identify areas of terrain which an enemy army could hide behind during conflicts. For many years the terrain relief was shown in maps with the help of cartographical hachuring and hill-shading techniques – basic but effective graphic ways of representing changes in height.

Moving to the 20th Century and with the beginnings of aerial photography, OS started exploiting the science of photogrammetry by using analogue stereo plotting machines like the Wild A8 and A10, where three-dimensional measurements could be efficiently captured. Analogue plotting involved “chasing to contour” in the stereo image – for example, plotting contours every five to ten metres and estimating height through vegetation to model the terrain. This resulted in national contour coverage as depicted in OS small scale mapping.

Jumping forward a few decades OS began the process of extracting data from imagery rather than thinking of it as just a picture. We moved from analogue plotting to analytical plotting which coincided with the introduction of digital mapping and then digital photogrammetry.

We created a profile DTM product called OS Terrain 5 using a hybrid method. This combined a 10m Grid DTM derived from our contours with additional breaklines to enhance the data – still no DSM at this stage.

The need for synchronicity

With advances in digital photogrammetry, a DSM has been developed from our imagery for in-house use to extract heightened features and generate building height attributes. However, temporal consistency of the data (due to the legacy DTM) indicated that a synchronous DSM/DTM would be required for a successful outcome.

With the adoption of new technological solutions and the emergence of new algorithms for dense point matching from imagery, we can now create high resolution DSM or Point cloud data. The challenge our team faced was to create synchronised and consistent DSM and DTM models.

Classification or filtering

We identified two approaches:

1. The first method was to generate a point cloud from imagery and use point cloud classification techniques to leave a ‘bare earth’ model or DTM.
2. The second and chosen method was using the DSM as a source and applying algorithms to automatically remove above ground features to achieve the resultant DTM.

For both methods it is very important that the imagery is of a consistent high quality for height and image based data. The imagery we capture is more than just a picture; it includes more complex geographic information and the full value from the image should be understood and unlocked in order to generate data.

Developing the flowline

The development of the flowline had the following project stages:

Stage 1. Production of a Point cloud from the DSM to form the basis for DTM development.

Stage 2. DTM production via a series of software evaluations to either clean or classify the DSM or Point cloud (by removing anomalies, unwanted buildings and reclassifying vegetation and land)

Stage 3. Quality assessment of the DTM generated, to quantify the gaps which may need filling and to identify recommendations for ongoing development and reporting.

Approach 1. Point cloud Generation

For Stage 1, we used our DSM and Ortho tiles as an input and then extracted RGB colourisation and xyz values – they were then combined and output as a 2.5D colourised Point cloud in an LAS format.

For Stage 2, the team trialed a variety of

“... the full value from the image should be understood and unlocked in order to generate data.”

LiDAR-based software packages for classification purposes. Buildings, ground points and vegetation were classified and represented by different colours. The ground points showed a reasonably smooth DTM with minimal artefacts. However, the software presented issues of scalability – it was restricted by the number of processing blocks and time. It took up to ten minutes to classify one 1km² tile. Also, an issue of storage was raised. Each 1km² tile consisted of around 100 million points.

Approach 2. Height data filtering

The second approach did not need Stage 1, as the production of a point cloud was not required for this method. The input we used was the raw 1km² DSM geotiffs that were created from our 25cm aerial imagery.

For Stage 2, a series of filtering processes were applied directly to the DSM. *Figure 1* illustrates the quality of the input DSM and output DTM for a 1km² tile in Derby. The images are sample data at a resolution of 25cm.

The processing time was greatly reduced – about one minute for each tile. A great part of the processing is performed directly on the graphics card, which enables the software to generate geospatial data so quickly.

The software did an excellent job in removing the above ground features (buildings, vegetation, street furniture etc.) fully automatically through a DTM Extraction tool. The number of editing signatures (anomalies created by editing) in the DTM were also limited.

However, there are limitations in using this method:

- **Over filtering of the DEM resulting in overly smoothed data.**
- **Spikes and wells present poor correlation areas (for example, coastal regions, forest) – in both the DSM and DTM.**

The DTM extraction workflow involved:

- **DSM gridded data used as an input.**
- **DTM filtering through an automatic process.**
- **Extracting and converting DTMs into mass points format.**
- **Editing of DTM points and integration of breaklines.**
- **Refined DTM as a final output.**

The flowline is mainly automatic with some manual editing to refine both the DSM and DTM. The manual editing tasks involve correcting the spikes and wells in the elevation models (in areas like water bodies, solar/wind farms, ploughed fields) and capturing breaklines.

As a result of the over filtering in the DTM extraction, it was found that in some areas breaklines were needed to bring the data into the tolerances outlined in our specification.

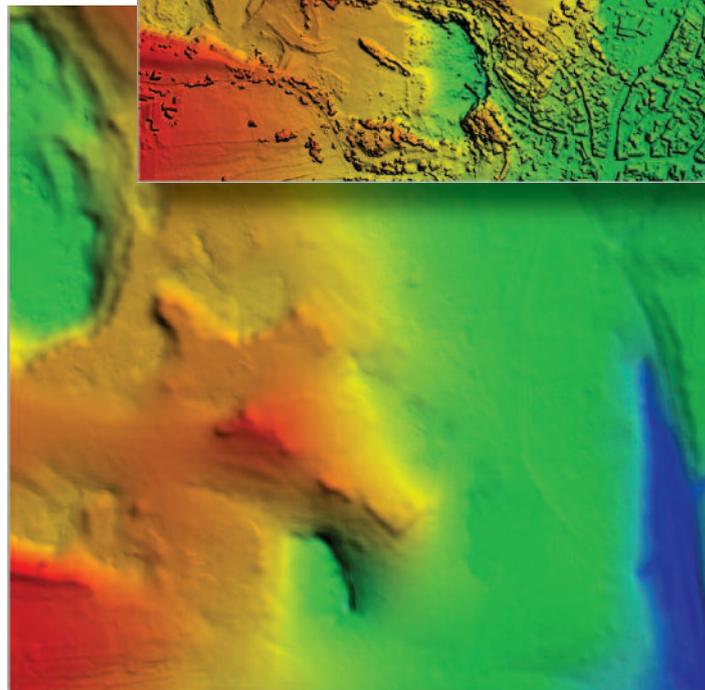
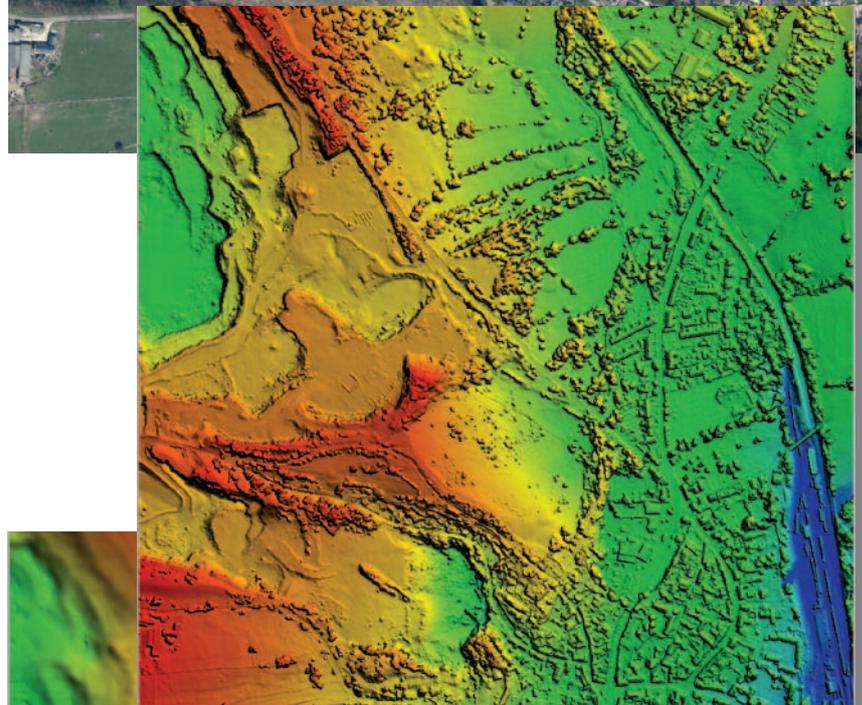
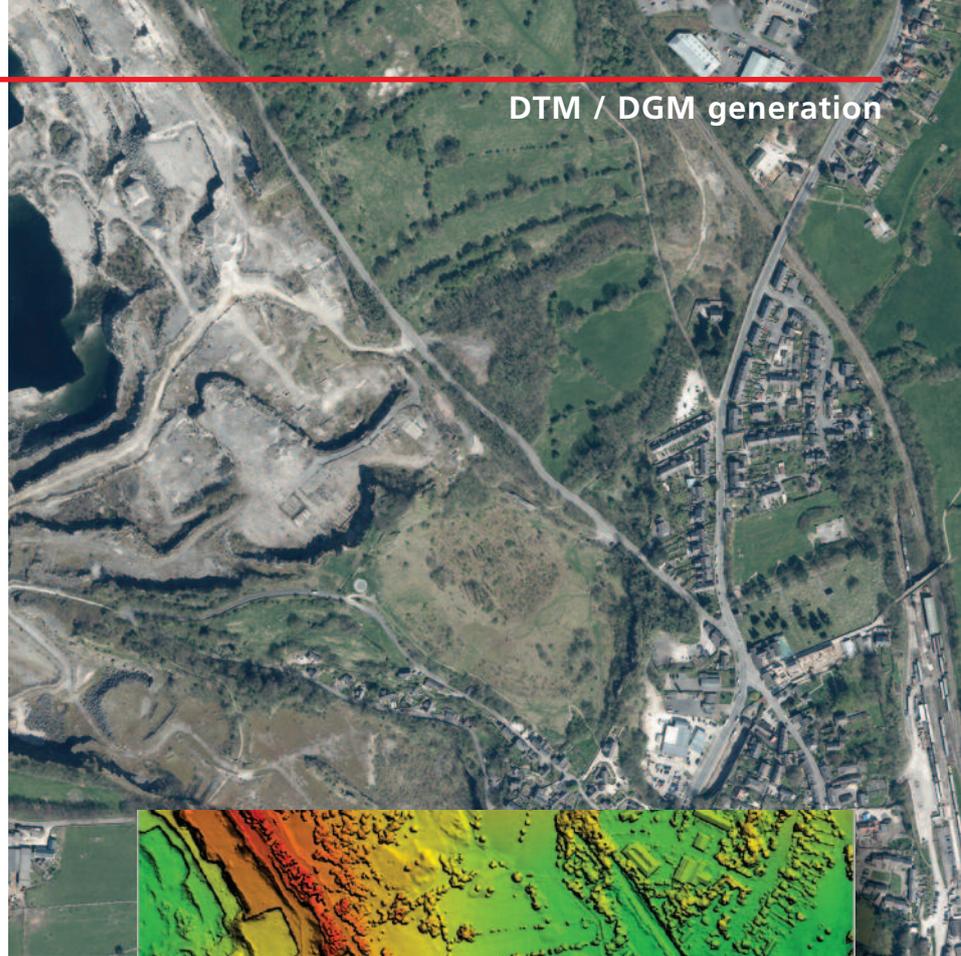


Figure 1, top: 25 cm Ortho Imagery, **middle** Digital Surface Model, **above:** Digital Terrain Model.

We are using our stereo imagery to create breaklines in order to refine slope changes in the data. There are considerably fewer breaklines needed in this data compared to the legacy DTM, reducing the manual editing time.

Work is done to focus capture on roads, railways, water bodies and quarries. Fortunately we have access to this data and can use it to focus the editing.

“An example product could be auto-generation of 3D building objects.”

Evaluation

A matrix was used to score the software tested for each approach. The results of the matrix evaluation showed that the second approach software out-performed all other software in the majority of the aspects. The quality of its DTM output, usability and speedy processing time outweighed the point cloud method and made it ideally suited for production.

OS is currently working on a three-year update, where large amounts of data are produced. This requires a large volume of work across various differing terrain types such as urban, rural, coastal and mountainous areas. After we started work, we realised that there were some issues that had to be overcome in the flowline:

- **Over filtering in some areas.**
- **Large point volumes in mountainous areas.**
- **Varying amounts of editing depending upon terrain.**

We had to work towards a specification for our customer and internal use to create a usable and consistent product.

Attribution

We also tested adding attribution enfolded in our data in order to hold all the information within the point cloud data. In this picture (Figure 2) we tested this by including information like area, volume, number of stories, maximum or minimum height and surface area.

However, attribution can be done at a feature level – including a variety of geospatial

information as well as third party information – from their position and geometry to colour, class and feature type. The more complex the attribution of data, the more useful it becomes for us to classify objects we are unable to classify at this time. This will allow us to run complex spatial queries.

An example product could be auto-generation of 3D building objects:

- **Automatically generated geomorphic features based on DSM, DTM, Classified Imagery (NDVI) and OS MasterMap.**
- **This is possible due to having integrated, interoperable and interdependent data.**
- **Fundamentally 2.5D not 3D.**

The 3D Data Generation team is now working fully into production. However, the proving work in Remote Sensing does not stop here. Further testing of 3D content generation methods will also continue as this will provide continuity for OS's ongoing 3D development programme and moreover this will develop the skills and knowledge required to enable future 3D feature identification and extraction.

The potential of 3D mapping in GIS is greater than ever and includes numerous areas such as 3D visualisation, situational awareness, line of sight, planning, modelling (for example, flood modelling) and the list could go on. Further research needs to be done to understand the impact of: storage of the data, what attribution is to be stored and how we can generate products from the data in the future.

About the author



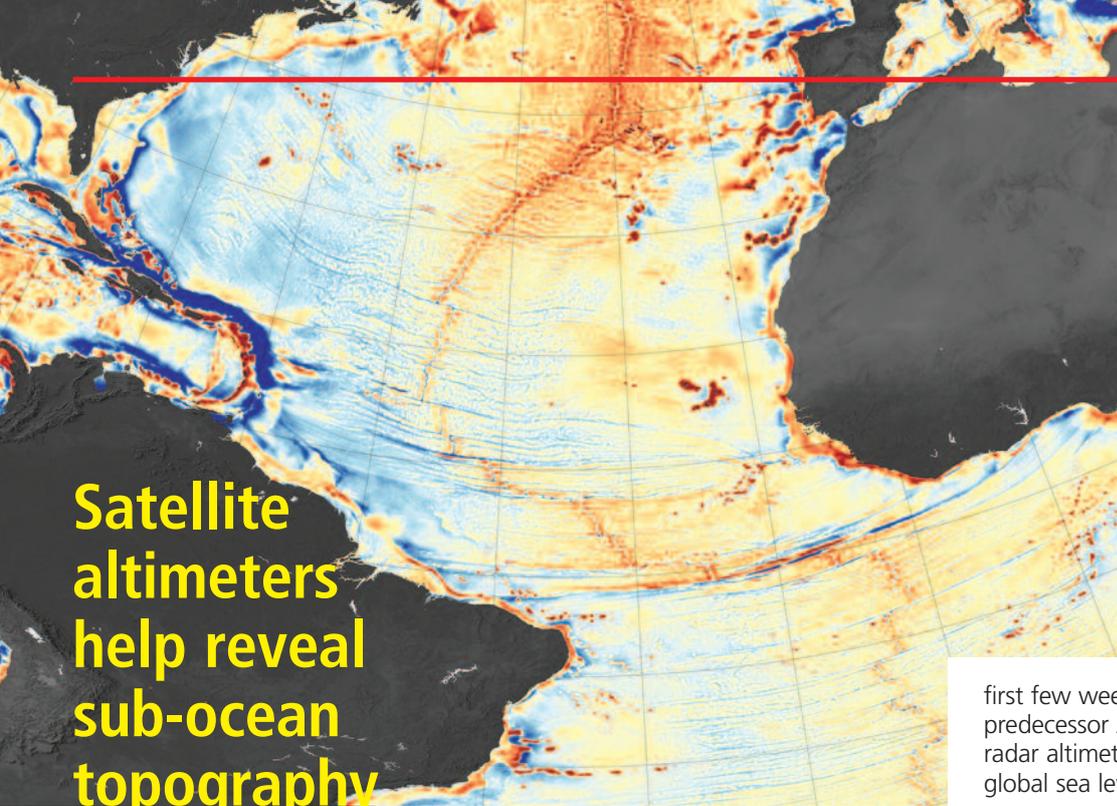
Diana Moraru has an Environmental Engineering Bachelor degree from Politehnica University of Bucharest and an MSc in Integrated Environmental Studies from the University of Southampton.

In Romania, she worked at the GeoData Institute where she was involved in GIS and Environmental Projects. She started working at Ordnance Survey over two years ago, where she is part of the 3D Data Generation team. She is also a member of the AGI Early Career Network at Ordnance Survey and enjoys engaging in activities and conferences that provide insights and opportunities in the Geographic Information industry and beyond.

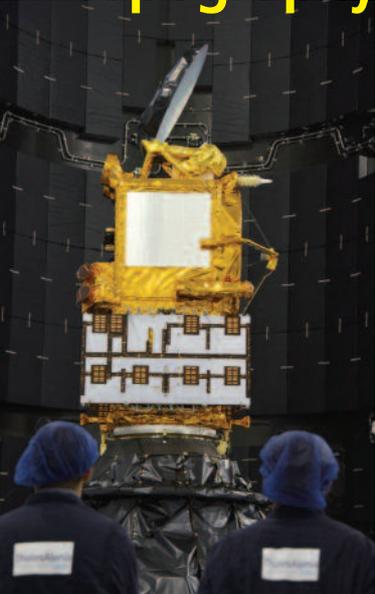
Figure 2: Automatically generated 3D geomorphic features.



Satellite altimeters help reveal sub-ocean topography



Left: This map shows a global view of gravity anomalies, as assembled by Sandwell, Smith, and colleagues. Shades of orange and red represent areas where seafloor gravity is stronger (in milligals) than the global average, a phenomenon that mostly coincides with the location of underwater ridges, seamounts, and the edges of Earth's tectonic plates. Shades of blue represent areas of lower gravity, corresponding largely with the deepest troughs in the ocean. Image credit: NASA]



The Jason-3 satellite is prepared for encapsulation in its payload fairing. Jason-3 is an international partnership consisting of NOAA, NASA, the Centre National d'Etudes Spatiales - France's space agency - and the European Organization for the Exploitation of Meteorological Satellites.

Source: <http://www.bbc.co.uk/news/science-environment-35339776>

It has been said that we have more complete maps of the surface of Mars or the Moon than we do of Earth. Close to 70 percent of our planet is covered by water, and that water refracts, absorbs, and reflects light so well that it can only penetrate a few tens to hundreds of metres. To humans and most satellite eyes, the deep ocean is opaque. But **David Sandwell** of the Scripps Institution of Oceanography and **Walter Smith** of the National Oceanic and Atmospheric Administration have produced a global dataset revealing the topography of the ocean bed.

Their methodology used a combination of global gravity anomaly data and sea surface height data. The sea surface heights were observed by Jason-1 and other satellite altimeter missions. They revealed ocean bed topography because the mass of the sea mountains applies a gravitational attraction on the surrounding water, so there are small ridges in the ocean surface above sea mountains and conversely there are depressions in the ocean surface above troughs. The new map gives an accurate picture of seafloor topography where each pixel represents five kilometres.

Jason-3 is launched

Jason-3 was launched in January from the Vandenberg Air Force base in California. It will measure sea level in the open ocean to an accuracy of 40mm. The satellite will spend the

first few weeks working in tandem with its predecessor Jason-2, to calibrate their microwave radar altimeters, and reliably continue monitoring global sea level topography.

El Niño: higher seas and shorter days

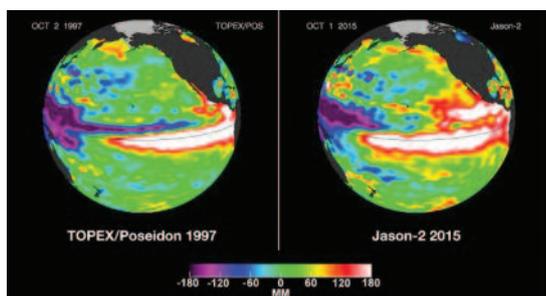
One might imagine that the onset of an El Niño event would be heralded by satellite remote sensing of increased water temperature in the Eastern Pacific. But the initial heating actually takes place at depth and it is the bulge in sea level caused by the expansion of the heated water that is detected by satellite altimetry, months ahead of surface water temperature. The 1997 El Niño was the first event to be detected by satellite altimetry from the TOPEX/Poseidon satellite, whilst the 2015 event has been recorded by Jason-2.

Shorter day

El Niño also has geodetic effects that are less obvious. The appearance of warm water in the eastern Pacific is accompanied by a rise of sea level due to the lower density of the water. Mass movement of water is however minimal and so this has a small effect on gravity anomalies. But, the slowing and reversal of the trade winds and equatorial current that takes place during an El Niño affects Atmosphere Angular Momentum (AAM). During an El Niño, the AAM increases which, to preserve global angular momentum, is matched by a decrease in momentum of the solid earth. This slows the velocity of the Earth's rotation with a consequent increase in length of day by up to a millisecond with a time lag of about a month. This is a daily change so the effect on time is cumulative. At the peak of the 1983/4 El Niño, 0.12 seconds of time had been gained. The AAM recovers, the length of day shortens and the gained time is lost as the event passes into the La Niña phase.

Studies have also shown El Niño has a high impact on the correlation between AAM and polar motion for single El Niño events, but not if the data spans more than one event.

Kotaczek et al report that the impacts have an impulsive character causing irregular variations in polar motion during El Niño events.



Right: 1997/8 and 2015/6 El Niño events as detected by satellite altimetry.



"... a candidate standard that may replace legacy coordinate systems" read the headline of an early January press release from the Open Geospatial Consortium (OGC). The claim was in an invitation for public comment on a proposed OGC standard defining Discrete Global Grid Systems (DGGs). **Roger Lott** assesses this startling claim and suggests what DGGs might mean for geomatics.

Discrete global grids were introduced to *GW* readers by **Goba Hobona** in the September/October 2014 issue. A Discrete Global Grid is a tessellation of the surface of the globe into a cell structure. Instead of adopting a sphere or ellipsoid as the model of the surface of the Earth, DGGs use some form of polyhedron. The polyhedron might be a direct tessellation of the surface of the globe, or perhaps through an initial choice of a Platonic solid (tetrahedron, hexahedron (or cube), octahedron, dodecahedron or icosahedron) to bound the globe.

The initial tessellation is then subdivided into identically-sized cells. The cells are given a unique identity and the whole collection of cells forms a grid referencing system. In DGG literature the ratio of child cells to parent cell is called aperture but the OGC draft standard proposes to adopt the more recognisable term refinement ratio. The subdivision may be carried out recursively to any level of nesting, in the OGC draft called refinement level.

Figure 2 shows a cube that has been chosen as the polyhedron for the initial tessellation, its six faces labelled A through F. Each face is then subdivided (in this example into four, i.e. the refinement ratio is 4) and each quadrant then further subdivided into

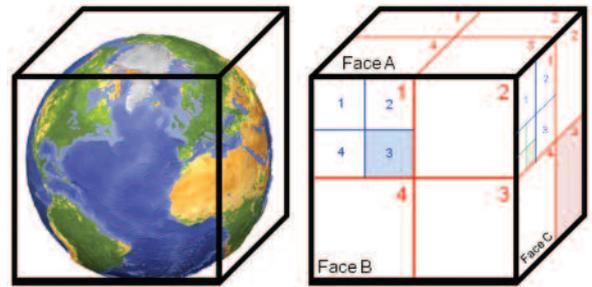


Figure 2: A DGGs initial tessellation (a cube is the chosen polyhedron) and its cell division.

four. The grid references for the blue, green and red shaded cells are B13, C143 and C3 at refinement levels of 2, 3 and 1 respectively. Note that for clarity in the diagram only selected cell boundaries are shown; in practice the whole grid would be nested to the same refinement level. The cell subdivision does not necessarily have to be into 4; for another grid it could have been some other value such as 9. Cells do not need to be square: a subdivision of the polyhedral football in Figure 1 might use triangular cell division.

A Discrete Global Grid System describes the basic reference frame for the tessellation, its structure and method of hierarchical nesting of tessellations, the cell identification schema and any algorithms for assigning and retrieving data to and from cells, performing algebraic operations on cells or translating cell addresses to other coordinate reference systems. It is discrete because it is cell-based rather than continuous as in a coordinate reference system - raster rather than vector. Global: it must fully and continuously cover the globe: a tessellation based on the graticule or on a map projection grid may not always cover the whole globe and inevitably encounters discontinuities at the poles and across the 180° meridian. The DG Grid is the systematic cell layout and referencing.

Why are DGGs of interest?

There is increasing expectation for spatial information to be integrated from various sources and to be available on demand. In a world where data volumes are increasing exponentially and forecast to continue to do



Figure 1: The football is the Earth and its polyhedral model is a truncated icosahedron.

so, computer scientists are investigating ways of managing and analysing this data more efficiently. Some spatial analyses, for example for adjacency or for nearest neighbour, can be more efficiently executed by computer algorithms operating on a regular cell structure than on a polygon whose boundary is described through a string of coordinates. So a cell-based reference system may assist some spatial data integration and processing. In the environmental sciences data is often statistically analysed on a cell basis.

So would 100m- or 10m-resolution cells of the British National Grid given as 6-figure or 8-figure grid references do for analysis of the flooding that has recently hit parts of the UK? Possibly. If all of the data were based on this grid and at identical resolution it would be straightforward. But if raster data were to come referenced to different grids and at different resolutions, for example lidar data from the Environment Agency on the British National Grid at 1m cell size were to be merged with weather information based on a Meteorological Office 1km grid referenced to the WGS 84 graticule, together with real-time imagery from some satellite referenced to yet another frame (for example the Equal-Area Scalable Earth (EASE) Grid), then the merging of the different raster grids is a non-trivial issue, especially in real time.

What is the OGC proposing?

The OGC standard is setting some specifications for what constitutes a DGGs and ground rules for its definition so that interoperability will be possible across different DGGs and between DGGs and conventional coordinate reference systems. It is not prescribing any one method for definition of a DGGs nor any particular DGGs – that may come later through profiles of the standard.

So what constitutes a conformant DGGs? A tessellation in itself does not necessarily conform. To conform:

- the tessellation must cover the full Earth, although data referenced to it may cover only a part.
- cells must not overlap.
- the method of cell refinement must be declared.
- at any one refinement level, cells must be of equal area. However, small deviations from exact equality of area may be permitted as long as the precision is declared.
- at each successive refinement level the total area of child cells must equal the total area of parent cells.
- cells must have a systematic referencing system.

For an implementation to be considered a conformant DGGs it must:

- include spatial operations for parent-child cell relationships and neighbourhood associations across the entire tessellation.
- be able to map imported raster and vector data to cells.
- be able to map the cell references of cell centroids, edges and vertices to geodetic coordinates.
- support spatial analysis using the dimensionally extended nine-intersection model DE-9IM, which uses manifold theory and set operations for describing the topological relationships of two geometries – whether one is contained within the other, or whether they overlap, touch or cross. It uses a 3x3 matrix (so 9 elements) describing intersections of interiors, boundaries and exteriors of two geometries. The dimensional extension is to describe the resulting intersections as points, lines or areas (or false). The DE-9IM model has been standardised for data exchange by OGC in an earlier specification¹ as a function returning a 9-digit string describing these intersections. Its inclusion as a DGGs requirement facilitates the interoperability of different tessellations.
- must support external queries. A variety of query types such as natural language or SQL are included in the specification. These may be used for querying for attributes such as spatial extent.

So whilst a National Grid grid reference meets some of these criteria, it does not meet all of them and so does not conform to the DGGs requirements.

The working group behind the draft OGC specification anticipate the tessellation extending to further dimensions (voxels rather than pixels, and/or to cells having a time dependency).

Historically most DGGs efforts have been put into mapping the graticule of the sphere or ellipsoid onto a polyhedron. Numerous ingenious solutions have been proposed to eliminate slivers and overlaps between cells and to minimise problems with unequal areas and other distortions. The author feels that this approach, driven by conventional cartographic views of the globe, has been mistaken. Why define a model of the Earth from another model? Any errors in the pre-existing spherical model will be carried through to the polyhedral model. The polyhedron should be defined with respect to an earth-centred, earth-fixed 3D Cartesian coordinate reference system, i.e. to the ITRS. If there is a need to convert ellipsoidal

“... it is cell-based rather than continuous as in a coordinate reference system...”

coordinates or projected map grid coordinates to polyhedral cell references the ECEF Cartesian coordinate reference system can be used as an intermediary.

What does it mean for geomatics?

There are some aspects of the OGC draft specification that remain unclear. The exact requirements for an initial tessellation are incomplete: there are no specific rules for how an initial tessellation should be described so it is unclear whether interoperability will be guaranteed. And it is unclear how the tessellation should be anchored to the real Earth. The specification requires that the tessellation be global and equal area: if the computing advantages to having a cellular model of the Earth are so compelling, one might ask why these advantages would not apply to any gridded dataset regardless of whether equal area or, as is most frequently encountered, on a conformal projection, and covering only a part of the world.

Using the example of the cube earlier in this article and continuing the quadrant cell division, it would take 25 levels of nesting for cells to be sub-metre and 31 levels to be sub-centimetre at the equator. I don't see this being useful for surveying and positioning. Nevertheless, DGGs technology appears to offer another option for spatial data collection, storage and analysis. The OGC specification is a step towards making that technology more viable through standardisation leading to improved interoperability.

DGGs may well have an important place in geo-statistical analyses and the environmental sciences, especially when the study areas are extensive, or indeed in any application using remote sensing, possibly including point cloud data handling. But those aspects of geomatics associated with geodesy, cadastre, engineering or hydrography are unlikely to feel any justification for dropping conventional coordinate reference systems.

A replacement for legacy coordinate systems?

This author is highly sceptical. It would be more reasonable to claim that DGGs offers an alternative modelling of the size and shape of the Earth. In some circumstances a polyhedron might be preferred to an ellipsoid and cell referencing preferred to coordinates. Any future decline in the use of ellipsoidal coordinates (latitude and longitude) may be as much to do with an increased adoption of geocentric Cartesian coordinates rather than cell-based reference frames. Where standardised DGGs with their raster cell structures lead to faster or cheaper spatial data processing they will be adopted. But not to the exclusion of legacy coordinate systems, or indeed any future coordinate reference systems that will be defined. There is a huge archive of spatial data referenced to coordinate reference systems that will continue to be maintained in that form, either for legal reasons or practical ones. DGGs is likely to be a complimentary technology rather than a disruptive one.

Footnote

(1) OGC Simple Features specifications. A 'simple feature' is one that does not deform and may be represented by a point, line or polygon. The currently published specifications cover two-dimensional geometry in Cartesian space but they are in the process of being revised for extensions to further dimensions and non-Cartesian coordinate systems (such as ellipsoidal latitude and longitude).

About the author

Roger Lott is a long retired former Chief Surveyor at BP, responsible for global survey and cartography matters. He now chairs the geodesy subcommittee of the International Association of Oil and Gas Producers (IOGP), which is responsible for maintaining the EPSG Dataset of geodetic parameters (www.epsg.org), and is involved with the development of ISO geographic information standards. He is a fellow of the RICS and of the RGS, and member of the AGI.

“... it would take 25 levels of nesting for cells to be sub-metre and 31 levels to be sub-centimetre at the equator.”

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The 50-year history of WILD and LEICA GEOSYSTEMS in the UK

Written by the editor of *Geomatics World*, Stephen Booth, this book is a history of a UK company that established its reputation through supplying accurate and reliable surveying and mapping products. An introduction traces the origins of the companies that became Leica Geosystems, together with short articles with simple explanations to Leica's technologies. The narrative is set against the changing infrastructure and times of Britain. Containing over 350 photographs, *when it has to be right* tells the history of the company, its products, applications and the people who've played key roles in its success.

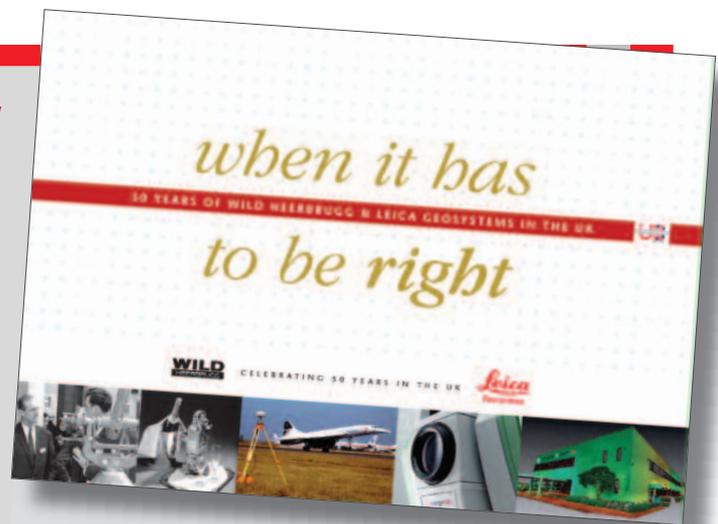
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• John Brock is a Registered Surveyor in Australia and is a stalwart of FIG and its Permanent Institution for the Art and History of Surveying.

FIG's working week in Christchurch is looming, meanwhile there was Australia Day to celebrate, a trip to the mountains plus 1606 and Australia's famous explorers, reports **John Brock**.

Below: Thomas Mitchell's duelling pistols used in the last official duel in NSW against Stuart Donaldson, later to become NSW Premier.

Below right: Mitchell's great sextant.



NZ trip looms but meanwhile there's plenty of history to enjoy down under

The FIG Working Week in Christchurch New Zealand is nearly upon us. The History Symposium on Saturday 30 April and Sunday May 1, just prior to the working week from 2 to 6 May, can still be booked to join us at the last minute down under.

The recovery of Christchurch since the destructive earthquakes four years ago is inspirational with the spirit and determination of the residents offering a brilliant experience to tour there. More details can be found on <http://www.fig.net/fig2016/plenary.htm>

One spot which is well worth making a detour to is Akaroa just south of Christchurch with a true tale of being the only French settlement made in New Zealand in 1840 shortly after the signing of the Waitangi Treaty by the various Maori tribes and the English, with all of the roads bearing the nom de plume "rue" in tribute to these early settlers, some of whose descendants can still be found around town chatting in French to each other.

Australia Day seminar

The Institution of Surveyors NSW staged the annual two-day seminar near our National Day on 26 January during which all Aussies find somewhere to join in the celebration. On 22 and 23 we had many speakers on assorted topics including internationally renowned young orator **Holly Ransom** who enlightened us on the composition of generations from baby boomers to X, Y and Z. From where I'm sitting she is plum out of letters so where does that leave my grandchildren? Punctuated by a Sydney Harbour cruise on the Thursday night, despite being beset by a tempest, we still had a great night inside the spacious vessel with tasty fare and colourful company.

Topp Tour to the mountains

January took us on a great bus tour to the Mt Piper Power Station, which demonstrated just

how minimal the pollution is when burning coal to generate electricity contrary to the green movement. Talking of iconic symbols of Blue Mountains heritage on the way home we stopped at the salubrious Hydro Majestic Hotel at Medlow Bath, just west of Katoomba, which has stood regally since 1904 after its opening by **Mark Foy**, the retail store magnate as a hydro therapy resort. Later to become the place to visit by train then later car in the 1920s it has only recently reopened after a \$34 million refurbishment, which has restored it to its former magnificence and made it a must see while touring this high western country of NSW.

1606! What a year for Australia!

At History House Sydney the Royal Australian Historical Society once again filled the room to hear author **Ian Burnet** tell us of the adventures of *The Duyfken* ("Little Dove") before she was the first recorded vessel to strike and chart the coast of Australia in 1606. Her captain **Willem Janszoon** thought that the west side of Cape York was New Guinea so his map lay unnoticed for nearly 400 years before it was identified as showing the Great South Land.

In the same year Spaniard **Luis De Torres** noted a small inlet at the tip of Cape York (now named after him), which was not to be verified as the access point passing between New Guinea and Australia until Lieutenant **James Cook** used it to return home from mapping the East coast of New South Wales (as named by him) in 1770. Cook had a secret map by **Dalrymple** from data seized in a raid on the Spanish stronghold in Manila showing this possible shorter route around the topmost point of our land.

Trailblazers - a great exhibit

The Australian Museum in Sydney has recently opened an exhibit about Australia's 50 Greatest Explorers, which was selected by a learned committee of those connected with adventure and history assembled by *Australian Geographic*. As you might expect such a list is over represented by surveyors and those skilled in the art such as Abel Tasman James Cook, Matthew Flinders, William Bligh, William Lawson, Thomas Mitchell, William Wills, Charles Sturt, John MacDouall Stuart, Paul de Strzelecki, Hubert Wilkins and Douglas Mawson. Most startling on the list is **Sydney Kirkby** from Western Australia who is said to have surveyed more of Antarctica than any other by dog sled and theodolite. This list of intrepid explorers can be found in the Nov/Dec 2015 issue of *Australian Geographic* No. 129 and it makes for interesting and debatable discussion.



An ancient statute is being used by a law enforcement agency in the US to force a company to change its software, explains **Carl Calvert**. What on earth would the founding fathers have made of it?

• Carl Calvert MA MSc PgDLaw FRICS CIP MBACS, is the sole principal of Calvert Consulting, specialising in Boundary litigation. He also lectures part-time in GIS law. www.calvertconsulting.co.uk Email: carlcalvert@aol.com or 023 8086 4643.

“...the court is ordering...that Apple creates a program to install into the iPhone... which would... disable the auto erase function... enable the FBI to insert passcodes... remove the automated delay of 80 milliseconds?”

Will FBI's windfall deliver a bruised Apple?

On 16th February 2016 in the US District Court for the Central District of California (Case No. ED15 – 0451M) it was ordered that, inter alia:

1. Apple shall assist in enabling the search of a cellular telephone, Apple make: iPhone 5C. . . pursuant to a warrant of this Court by providing reasonable technical assistance to assist law enforcement agents in obtaining access to the data on the SUBJECT DEVICE.
2. Apple's reasonable technical assistance shall accomplish the following three important functions: (1) it will bypass or disable the auto-erase function whether or not it has been enabled; (2) it will enable the FBI to submit passcodes to the SUBJECT DEVICE for testing electronically via the physical device port, Bluetooth, Wi-Fi, or other protocol available on the SUBJECT DEVICE; and (3) it will ensure that when the FBI submits passcodes to the SUBJECT DEVICE, software running on the device will not purposefully introduce any additional delay between passcode attempts beyond what is incurred by Apple hardware.
7. To the extent that Apple believes that compliance with this Order would be unreasonably burdensome, it may make an application to this Court for relief within five business days of receipt of the Order.

Cook's backdoor objection

Various news agencies and media have taken up the story and in a response to the Order Apple chief executive officer, **Tim Cook**, was reported as saying (*Bloomberg Business News* 19-02-2016) that the company will fight the court order in that it creates a security workaround for the FBI to access the iPhone. He called the demand by authorities a dangerous precedent that could lead to the government getting hold of “surveillance software to intercept your messages, access your health records or financial data, track your location, or even access your phone's microphone or camera without your knowledge.”

The Order, in effect, is asking Apple to create a ‘master key’ that could be used to unlock any number of other iPhone 5C's in use around the world. “While we believe the FBI's intentions are good, it would be wrong for the government to force us to build a backdoor into our products,” Cook wrote in a letter to Apple's customers after Tuesday's order. “Ultimately, we fear that this demand would undermine the very freedoms and liberty our government is meant to protect.”

Ten goes and you're out for good

The way that Apple protects its iPhone 5C data is as follows: (1) a user can program the phone to erase all data after ten unsuccessful attempts to enter the passcode: (2) the passcode works in conjunction with a code fused into the iPhone and is unknown by Apple or its suppliers, hence the passcode must be entered by hand: (3) the operating system (iOS) adds an 80 millisecond gap between passcode attempts; it would take 5½ years to try every lower case letter and number combination.

What the court is ordering is that Apple creates a program to install into the iPhone, the SUBJECT DEVICE, which would: (1) disable the auto erase function: (2) enable the FBI to insert passcodes by any or all of, physical device, Bluetooth or WiFi: (3) remove the automated delay of 80 milliseconds.

Apple has complained that, ‘Rather than asking for legislative action through Congress, the FBI is proposing an unprecedented use of the All Writs Act of 1789 to justify an expansion of its authority.’ So the question must arise, ‘What is the All Writs Act of 1789?’

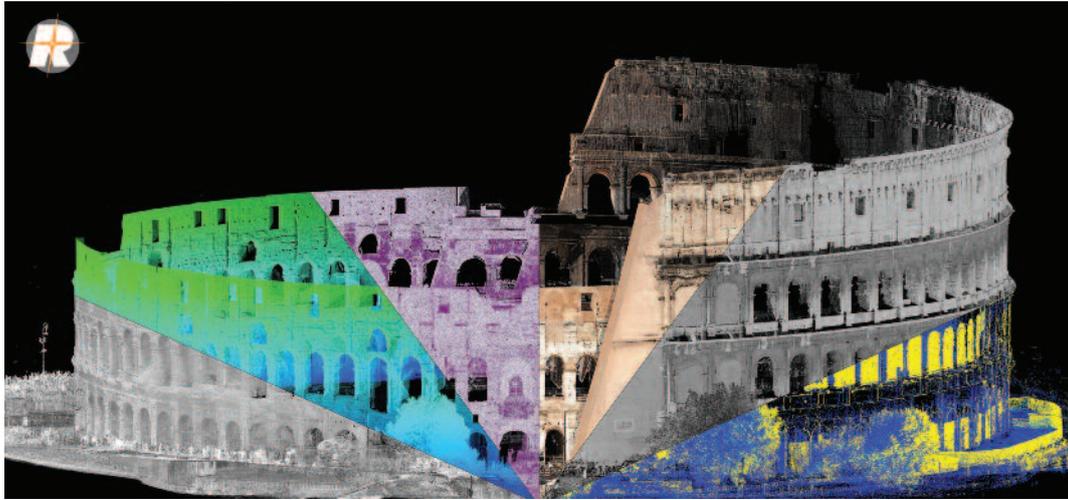
An unreasonable burden?

The All Writs Act was included in the Judiciary Act of 1789, which was enacted in the first ever session of the United States Congress. There are a few qualifications that must be met in order for the All Writs Act to be used as a way to compel Apple to create this software:

- **the All Writs Act is only applicable if no statute, law or rule is on the books to deal with the specific issue at hand.**
- **the business in question (Apple) has some connection to the investigation.**
- **there are extraordinary circumstances that justify the use of the All Writs Act.**
- **the All Writs Act only applies if compliance is not an unreasonable burden.**

The first three hurdles are cleared by the court as the iPhone was used by the terrorists who killed 14 and injured 22 (or 20 according to some reports) people in San Bernardino last year. It is the last point, that of unreasonableness, which is the sticking point. Is it an, ‘unreasonable burden?’ Doubtless there will be many who argue either way. Me, I shall wait to see the arguments proffered; but in any event what we are seeing is a confrontation between a national government and an international company of note.

Massive point clouds for Riegl software



Point cloud of the Coliseum acquired with a VZ-400 displayed by Reflectance, Amplitude, Deviation, True Color, Multiple Echo, and Height values.

RIEGL has released a major update to its terrestrial laser scanning software suite of RiSCAN PRO, RiMINING and RiSOLVE! It is now possible to visualize and manage massive files, hundreds of scans and billions of points simultaneously, with the ability to instantly toggle between a number of different 3D point attribute view-types. Point clouds generated from scans will retain all attributes, such as reflectance, echo number, and deviation values through the filtering process. RDB 2.0 Software Development Kit (SDK) has been released for support in third-party software packages.

Patrolling powerlines

NM Group, formerly known as Network Mapping, has announced a new service – Patrol+, for inspection of powerline corridors. The service enhances existing inspections by exporting data from the aircraft through a series of analyses to provide a simple set of intelligent defect reports. The results are then presented so that they can be actioned via the work management system and integrated into the asset management system.

TripleSat sample data

Earth-i, the distributor of imaging and data services from the new DMC3 / TripleSat constellation, has detailed sample imagery available for assessment by customers. Owen Hawkins, Operations Director at Earth-i, said: "We are delighted with the speed and success of the satellite commissioning carried out by our associates SSTL and 21AT. The definition, quality and integrity of the data has exceeded our expectations". Visit: www.earthispace/sample-data-request

Sokkia's new total stations

Sokkia has released two additions

to its CX total station series. The CX-50 is designed to provide an entry-level option with a fast and powerful EDM, reflectorless measurement up to 350m, 2" and 5" accuracy options and 15-hour battery life. The CX-100LN offers reflectorless measurement up to 2000m, 2" and 5" accuracies, 36-hour battery life and Bluetooth connectivity.

I-Site Studio 6

Maptek has launched I-Site Studio 6, with enhanced point cloud processing capability, snapping to angles and points in CAD and complex surface modelling and waviness analysis for geotechnical modelling and analysis.

Kelly Bros invest in Trimble MX7

Kelly Bros, a leading contractor in the road marking industry, has become the first company in the UK and Ireland to invest in a Trimble MX7 imaging system. The MX7 enables users to capture high quality 360-degree, 30 Mpx geo-referenced images at highway speeds through a clear and intuitive user interface. Back at

the office, Trimble Trident office software for data capture, extraction and analysis can be used to produce a range of deliverables, take off accurate measurements and produce pictorial records etc. Kelly Bros will be using the MX7 for everything from road condition surveys and asset data collection to the documentation of site conditions and the recording of bridge clearances.

One-stop shop drone training

KOREC has announced a partnership with the Drone Pilot Academy, which will offer a 'one stop' Unmanned Aircraft Systems (UAS) training solution for those who wish to undertake consecutive flight training and Civil Aviation Authority (CAA) accredited pilot training courses, all at the same location and all within one week. As part of the package, the academy will undertake all relevant paperwork and assist in the detailed production of the required operations manual, including proofing, before its submission to the CAA. This removes a time-consuming aspect of the process

for KOREC customers and brings a higher guarantee of success.

Inpho updated

Trimble has announced a new patch version of Inpho software suite (v7.0.2). The patch includes important fixes and new features such as:

- Use relative flying heights for processing instead of mean terrain height.
- Performance enhancements through the support of parallel processing of image pyramids.
- UASMaster includes the pre-defined camera calibration definitions in order to simplify the project setup for Trimble ZX5 and UX5HP UAS platforms.
- The SCOP++ modules are now offered as a special SCOP++ Education Package for educators.

New rugged handhelds

Juniper Systems, has released its Mesa 2 rugged tablet. It is the largest handheld device produced by the company to date, the first to run on the Microsoft Windows 10 and the only tablet with IP-68 rating. The Mesa 2 also provides complete visibility in any lighting condition, along with superior durability from the chemically-strengthened 7" Dragontrail glass touch screen.

Meanwhile, Handheld Group has also announced that it is now offering a Windows 10 version (Enterprise LTSB version) of its popular Algiz 10X ultra-rugged tablet computer, although Algiz 10X versions with Windows 7 and Windows 8 will remain available. The Algiz 10X is IP65-rated and meets stringent MIL-STD-810G military standards for protection against dust, water, vibrations, drops and extreme temperatures. It has a 10.1" touch screen with high-brightness MaxView screen technology.

Module enhances feature extraction

Blue Marble Geographics has announced an upgrade to its Global Mapper LiDAR module. Offered in conjunction with the recent release of version 17.1, the module includes functional enhancements and performance improvements that have been

Sokkia's GNSS light bullet



Sokkia has launched its smallest and lightest dual-frequency, multi-constellation GNSS integrated receiver - the GCX2. Nicknamed 'the bullet', it weighs just 375g, making it the lightest in its class and perfect for lightweight and convenient operation. With 226 channels and optimised satellite tracking technology, the GCX2 speeds up satellite acquisition, reduces power consumption and provides greater positioning accuracy - all resulting in improved workflow efficiencies.

designed to improve the quality and utility of LiDAR and other point cloud data. Functionality includes a custom feature extraction tool for creating 3D line and area features using Global Mapper's new perpendicular profile tool; a new toolbar button for quickly assigning the ground classification to selected points; and support for customizing the groups to which LiDAR classifications belong.

The LiDAR Module offers significantly enhanced point cloud management and processing capability. A new perpendicular profile tool, which generates a scrollable series of profile views perpendicular to a drawn or selected line feature, enables the feature extraction tool in the LiDAR module. This function offers the means to assign 3D points or vertices that correspond with recognizable objects such as curbs, guardrails, above-ground pipelines, or building roof lines. These points are ultimately connected and extracted as 3D vector features. For those wanting to evaluate capabilities of the module, a 14-day trial is available.

BRIEFS

UNDET point cloud software has produced a new extension for

Trimble SketchUp Pro – Undet4SketchUp V1.0, which was released on 1st December 2015. This offers a unique opportunity to use any point cloud directly in SketchUp Pro and provides tools for efficient visibility and colouring management.

SCCS are stocking the Leica Lino L4P1, a multi line laser for interior applications offering one horizontal and three 180° vertical laser lines and five layout points. The smart rotation base can be twisted 360° over a selected point and the accurate fine adjustment supports swift targeting of vertical laser lines for high-speed 90° layouts. More at: www.sccsurvey.co.uk

Teddyne Optech has introduced the latest model of its Lynx mobile LiDAR system, the survey-grade Optech Lynx SG-S.

Opti-cal Survey Equipment is now offering the MALÅ Easy Locator Pro, an end-to-end ground penetrating radar (GPR) system designed for utility mapping. The model is MALÅ's first which is able to export data to stand-alone software and comes bundled with the company's ObjectMapper software. More at: <http://surveyequipment.com>

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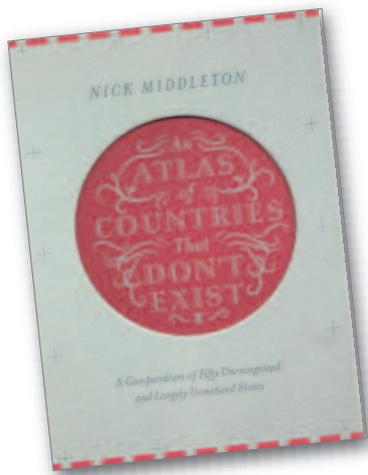


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An Atlas of Countries that don't Exist
By Nick Middleton
Published by Macmillan, ISBN 978-1-4472-9527-3

Subtitled "A Compendium of Fifty Unrecognised and Largely Unnoticed States", this work was the subject of a highly entertaining lecture at the Royal Geographical Society earlier this year. But lively

and interesting speakers don't necessarily make great writers. There's nothing wrong with the subject matter of the book; it's just that it's dealt with in a far too trite and perfunctory a manner. The text, which is all in italics (shame on you Macmillan – stop giving graphic designers carte blanche to wreak their havoc!), again and again left me aching for more information.

The author acknowledges his choice of fifty "states" was based on some "rules of thumb". All have failed to secure a seat at the UN and lack wide recognition. This has not stopped some of them forming a sort of rival UN, the Unrepresented Nations and Peoples Organization (UNPO) with 42 members. There is an excellent introduction on just what constitutes a state: the UN recognises 193 whereas the egregious FIFA has 209. There is even a rival body of territories that didn't get FIFA's approval, FIFI.

Alas its tournaments must be rather boring as it has but two members!

Some of the territories chosen border on the ludicrous, like Christiana – a self-declared squat in Copenhagen or Forvik, an islet off Shetland, Australia's Atlantium or Sealand, and were chosen presumably to recount the colourful characters behind their declared independence. Others exist, like the Isle of Man, in a sort of no-man's land under the protection of surrounding states. Yet more examples are now lost to history.

There are several interesting cases to which the author has provided insight. Northern Cyprus and the abandoned resort of Varosha where car showrooms and clothes shops still display the latest models from 1974. But no explanation is given as to why this bit of Cyprus was not properly taken over by the invading Turks (it's actually part

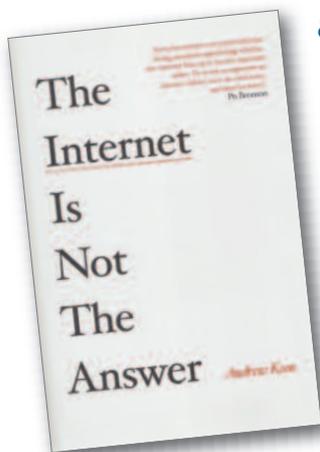
of Famagusta which the Turks are holding as a bargaining chip pending a negotiated settlement).

Several of the examples are unsettled business from history, like the Australian aboriginal territory of Murrawarri or Lakotah, a vast swathe of North America assigned under treaty to the Lakota Sioux in 1868 but soon reneged by the US Government. To date the Sioux have declined all offers of compensation.

Although I am critical of the irritating italics, the book is very attractively designed with territory-shaped cut outs on introductory pages but with a rigid one page of text per subject with a less than informative outline map of the territory and its location in the world. A great coffee table talking point but I await a more serious study.

Reviewer: Stephen Booth

an intelligent account of a technology that threatens to impoverish us all



The Internet Is Not The Answer
by Andrew Keen
published by Atlantic Books,
ISBN 978 1 78239 341 2,
hardback or soft-back.

There is an increasing sense of outrage around the world over the failure of tax authorities to collect much in the way of payment from the global digital giants – Google, Amazon and Apple and the plutocrats who run them. Close on their heels come Uber, Airbnb,

Facebook and Instagram. They are all able to pay eye-watering fees to accountants to run the proverbial rings around governments. Google is now so vast and enriched it owns no less than six aircraft, including intercontinental Boeings and a Dassault/Dornier Alpha light attack jet (to escort and protect said plutocrats?); all parked at a US government airstrip unavailable to commercial operators.

The author's sharp and witty text begins by recounting what happened to his family's fabric business in Oxford Street, London, and its proximity to Soho's music businesses and the "Golden Mile of Vinyl", which had attracted his early career. The fabric shop failed because it could no longer compete with third world products. What happened next hit the music and other creative businesses, with the arrival of the Internet and Napster,

YouTube, iTunes and Spotify. Thousands of jobs have been lost due to these platforms – in 2008 alone it is estimated that Britain lost 39,000 jobs in the creative sector.

One of the starkest stories of what these companies have wrought is the case of Rochester, NY. A once thriving town is now a dystopian place of down-and-outs, derelict buildings and decay. It was not ever so. Rochester was home to Eastman Kodak. In 1989, at the same time as a clever chap working at CERN devised an interface for the net that was to become the Worldwide Web, Kodak employed 145,000 people on an annual turnover of \$31 billion. Killed off by digital photography which Kodak had invented back in the 1970s but had failed to market.

In 2014 Facebook

acquired WhatsApp, paying an unbelievable \$19 billion for a company employing just 55 people. When companies like this can change hands for billions of dollars, it is hard not to agree with the author's contention that the Internet and its nursery Silicon Valley are destroying jobs, our culture, society and creating a level of wealth imbalance not seen since the Middle Ages.

If you care about the future of your children and grandchildren this book is very much a wake-up call. Annoyingly it doesn't have an index but there are pages of references from the text so you can check sources, which are mainly impeccable. You need to read it and think about where the future jobs might be other than in providing valet services to the digital winners or as Starbucks baristas.

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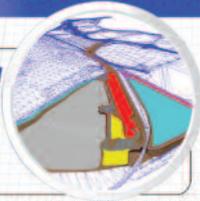
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