

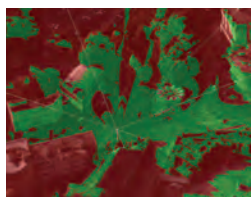
Leading edge technologies for 2017



Surveying for geographical and spatial information



The little black dome that will disrupt the world of scanning



The digital tool to pave the way for 5g mobiles and more



Costain's site photogrammetry move uses smartphone technology



UAVs in an Italian vineyard can lead to better Prosecco



Professional Guidance lights the way for Rights to Light

Small enough to care Big enough to deliver



The most comprehensive hire fleet in the UK

Contact our dedicated sales and hire team on **01480 404888**
or visit **www.sccsurvey.co.uk** for further details.

Leica
Geosystems

AMBERG
TECHNOLOGIES

SCC
SURVEY CONTROL CENTRE

SCCS
THE SURVEY EQUIPMENT COMPANY

www.sccsurvey.co.uk

Geomatics World is published bi-monthly by Geomares Publishing UK Ltd on behalf of the Royal Institution of Chartered Surveyors Geomatics Professional Group and is distributed to group members and other subscribing professionals.

Editor: Stephen Booth
Technical Editor: Richard Groom
Advertising: Sharon Robson
Sub-editor/Subscriptions: Jason Poole
Publisher: Durk Haarsma

EDITORIAL BOARD

Ian Coddington, Pat Collins, Professor Ian Dowman, Richard Groom, James Kavanagh, Professor Jon Mills, Dr Stuart Robson, Dr Martin Smith

OVERSEAS SOURCES

Roy Dale – New Zealand
Nick Day – USA
Editorial: e-mail: editor@geomares.co.uk
Advertising: sharon.robson@geomares.co.uk
T: +44 (0) 1438 352617
F: +44 (0) 1438 351989

MAILING

Geomares Publishing UK Ltd
Unit A2 Mindenhall Court, High Street
Stevenage, Hertfordshire, SG1 3BG, UK

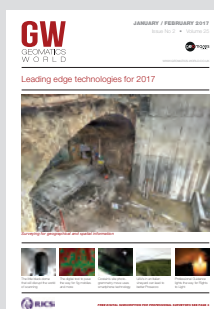
MATERIAL TO BE PUBLISHED

While all material submitted for publication will be handled with care and every reasonable effort is made to ensure the accuracy of content in Geomatics World, the publishers will have no responsibility for any errors or omissions in the content. Furthermore, the views and opinions expressed in Geomatics World are not necessarily those of the RICS.

Reprints: Reprints of all articles (including articles from earlier issues) are available.
Call +44 (0)1438 352617 for details.
Advertising: Information about advertisement rates, schedules etc. are available in the media pack.
Phone or email Sharon Robson (sharon.robson@geomares.co.uk).

Subscriptions: Yearly subscriptions (six issues) are £45 (UK) £49 (worldwide). For more details visit www.geomatics-world.co.uk

No material may be reproduced in whole or in part without written permission of Geomares Publishing UK Ltd. © 2017 ISSN 1567-5882
Printing: The Manson Group, St Albans, UK

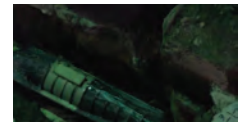


COVER STORY

Photogrammetry has traditionally needed expensive cameras. But thanks to better processing one construction company is capturing imagery with smartphones at the London Bridge Station Redevelopment project.

P. 14 SMARTPHONE SURVEYING ON SITE

Photogrammetry is on the increase, thanks to better software and smartphones. So just what is it capable of? Costain's Richard Bath reports.



P. 18 GEOSPATIAL AND THE RIGHT TO LIGHT

Andrew D. Thompson explains how geomatics measurement techniques are being used in rights to light cases.



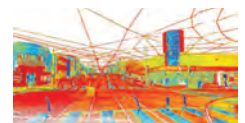
P. 20 RIGHTS OF LIGHT ILLUMINATED

Andrew Maltby gives a Geomatics perspective on the RICS Professional Guidance on Rights of Light published in March 2016.



P. 24 KOREC'S TECHNOLOGY AT SILVERSTONE

No track action and drizzly rain, but interesting presentations and technologies. But what's happened to the telescope? GW reports.



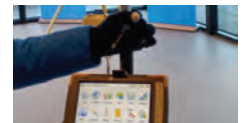
P. 26 UAVS IN THE VINEYARD

A low-cost and small-scale remote sensing platform for aerial monitoring and survey applications and precision agriculture is presented by the authors.



P. 30 TOPCON'S ELITE AT OLYMPIC PARK

How Topcon's Elite software suite integrates with the company's latest hardware. GW reports.



P. 32 LEICA'S MOBILE MAPPING DAY

Two new models and a refresh of others. The day at Milton Keynes was a mix of indoor presentations and outdoor demos, reports Richard Groom.



P. 05	Editorial	P. 34	Jonathan Davy Obituary
P. 07	News	P. 35	Legal Notes
P. 10	RICS Policy Watch	P. 36	Products & Services
P. 11	Chair's Column	P. 38	Book Review
P. 12	Undercurrents	P. 39	Classified
P. 33	Downunder currents	P. 39	Advertisers' index

GET THE ELECTRONIC EDITION FIRST

If you would like to receive a FREE link by email to the latest issue of GW before the print edition is published, please register at www.geomatics-world.co.uk/magazine. To subscribe for a printed edition, please email jason.poole@geomares.co.uk. Please note that RICS overseas members need to advise us if they want to receive the printed edition.

Next Issue: March/April 2017
Copy dates Editorial: 06 February
Advertising: 14 February

**REGISTER
FOR FREE***

Image © Blom Aerofilms - Stand K11

GEO
BUSINESS 2017
LONDON • UK 23 - 24 MAY

Keep one step ahead at the
**fastest growing geospatial
event in the industry**

Register to attend the world class **exhibition**, cutting edge **conference**, commercial **workshops**, associated **meetings** and innovative **networking** and **social** events

GeoBusinessShow.com



GEO Business

@GEOBusinessShow #geobiz

Organised by:

diversified
COMMUNICATIONS ■ UK

In collaboration with:



*The exhibition and workshops are free to attend. There is a nominal fee to attend the conference.

All change ahead, so where's the prosecco?

A refreshed layout, a strong focus on new technology and applications for existing ones kick-start the new year.

Welcome to 2017 and a refreshed *Geomatics World*. The first issue of the year is all about the tools of our trade. With a strong technology focus, we take a close look at three significant developments in laser scanning: mobile, miniature and total station integration. In their own way each one charts the way ahead for the next few years.

But we are seeing other interesting developments in the supplier market. The manufacturers, worried perhaps that their technology has become so accurate and reliable that sales will fall, are developing new revenue streams. Welcome to the cloud: here's the sensor, it's very modestly priced and oh, did we mention you'll need a subscription to our partner's cloud services to process and store the data? So, is the sensor just a loss leader? It's all going a bit like desktop printers, which are ridiculously cheap; except when it comes to consumables. It's not just about monetising, it's creating a reliable cash stream from which customers will be reluctant to stray. So, could we do it for surveying deliverables? Now there's a challenge.

The specialised world of rights to light has not (yet) experienced these problems. But this is a significant and growing area of practice for geomatics. As we build ever closer and higher to existing developments conflicts arise with neighbours whose properties lose daylight or are overlooked; like the disastrous development at the Tate Modern on London's south bank where a new viewing platform allows visitors to peer into an adjacent apartment block. Better the architects had run the proposals through Maltby's software. Read more on pages 18 and 20.

During the coming year we shall doubtlessly continue to report on new applications for data capture from existing technologies. An interesting one is the potential for accurate geodata capture from a smartphone. Trimble already has an app which, when connected to a simple GNSS antenna, puts centimetre positioning capability in your hand. But why collect point data? Better just to capture imagery with your phone and use time-honoured photogrammetry to get the data.

Turn to page 14 for how Costain are doing just this on a major London development.

Turning to interesting applications, **Luca Zanchetta** and **David R. Green** and colleagues at the University of Aberdeen have been testing the suitability of UAVs to capture data in a variety of applications. Their latest involves an Italian vineyard (hey, it's Prosecco time again!) but see also the latest edition of *GIS Professional* (December 2016 page 24) for one about river habitat monitoring for fish breeding including the use of a thermal imaging sensor. For more on the Italian vineyard story turn to page 26.

Staying with our sister publication *GIS Professional*, the latest issue (December 2016) has a full report of the AGI's GeoCom16 conference, Why location matters in data analytics held at the Royal Geographical Society last November. There were some sparkling presentations on topics like block-chain computing, green corridors in city planning, and the impact of Big Data on aspects like geology, UAV applications, the weather and combating hunger.

So there you have it, another busy year ahead of change and I haven't even mentioned Brexit. But don't worry, you haven't escaped; **Carl Calvert** provides some timely guidance on a certain case in the Supreme Court, see page 35.




Stephen Booth, editor of *Geomatics World*.

Stephen Booth, Editor

PLEASE NOTE OUR NEW ADDRESSES:

The editor welcomes your comments and editorial contributions by e-mail: editor@geomares.co.uk or by post:
 Geomatics World
 Geomares Publishing UK Ltd
 Unit 2A Mindenhall Court
 High Street, Stevenage
 Herts, SG1 3BG
 United Kingdom



Leica Pegasus:Two Mobile reality capture

Leica Pegasus:Two creates new business opportunities by leveraging the concept of a multisensor platform, enabling you to add pavement assessment cameras and sky cameras for city modelling, ground penetrating radar or thermal imaging, noise pollution, and air quality sensors. By moving the work from the field to the office, employees are safer, insurance is less, deployment is faster, and site visits are decreased.

Vehicle and application independent

Visit www.leica-geosystems.com/en-gb Mobile Sensor Platforms for more information or to request a demo.

© Copyright 2016 Leica Geosystems. All rights reserved.

Leica Geosystems Ltd
uk.sales@leica-geosystems.com
01908 513464
www.leica-geosystems.com/en-gb



ANTARCTICA SURVEYED

A major survey of the vast continent at the South Pole has been undertaken by scientists. Mainly funded by the European Space Agency, the survey involved gravity and magnetic sensors, as well as radar and a laser altimeter. As well as finding previously unknown valleys and mountains, the team says it has acquired important data that will have uses far from Antarctica.

The project, known as PolarGAP, has captured remote sensing data over an area of Earth that satellites cannot see, as they generally only fly up to about 83 degrees in latitude. Much of the data is still being processed, but already the team can confirm the existence of a vast basin that appears to play a key role in controlling the flow of ice towards the ocean. Commenting, British Antarctic Survey team-member Dr Fausto Ferraccioli said, "It's an over 1,000km-long basin that extends from the Weddell Sea right down to the pole. It's really one of the major features of the Antarctic continent and it's likely to have very large significance because it underlies some of the fastest flowing ice streams in this region."

Read more at:

<http://www.bbc.co.uk/news/science-environment-38333629>

AUTOMATING LAND SURVEY

The Land Survey Automation Challenge aims to significantly expedite real estate and financing transactions by drastically lowering the cost and time burden of land boundary survey. The Challenge seeks a technology that efficiently and remotely automates process such as by using drones or satellite data. The challenge consists of a Concept Phase: propose a solution to automate ALTA land surveys. And a Prototype Phase: build your solution and conduct two ALTA land surveys.

The AiLTA Land Survey Automation

GALILEO QUARTET IN ORBIT

On 17th November, an Ariane 5 rocket launched four more Galileo satellites, accelerating deployment of the satellite navigation system. The satellites are at their target altitude, after a flawless release from the new four-satellite dispenser. Engineers will nudge the satellites into their final working orbits and begin tests to ensure they are ready to join the constellation. This is expected to take six months or so. The mission brings the Galileo system up to 18 satellites and will allow the European Commission to declare the start of initial services, expected towards the year's end.

The previous 14 satellites were launched two at a time using the Soyuz-Fregat rocket. "Now that we can rely on the powerful Ariane 5, we can anticipate the quicker completion of Galileo deployment, permitting the system to enter full operation," said Paul Verhoef, ESA's director for the Galileo programme

and navigation-related activities. The next Ariane 5 launches are scheduled for 2017 and 2018. The full system of 24 satellites plus spares is expected to be in place by 2020.



Galileo satellites on dispenser

Challenge will award prizes totalling \$100,000 USD.

Concept Phase: Up to five prizes of \$5,000 each; Prototype Phase: One grand prize of \$75,000. To learn more about the challenge or to register visit <https://herox.com>

APPRENTICESHIP STANDARDS APPROVED

The UK's minister of state for skills has approved an RICS proposal to develop two apprenticeship standards covering geospatial survey technicians and geospatial mapping and science specialists. The announcement enables RICS to press on with development of the standards themselves and with arrangements for their delivery.

BIM SOFTWARE WINS INNOVATION AWARD

3D Repo's innovative work with Balfour Beatty and the Finishes and Interior Sector (FIS) in developing cloud-based software for the construction and infrastructure

industry has been recognised by the Institution of Engineering and Technology (IET). 3D Repo's Bid4Free online platform was highly commended in the information technology category at the recent 2016 IET innovation awards.

In construction, subcontractors repeatedly spend many weeks of effort on tendering. These high multi-party costs are recouped by only those which win contracts. 3D Repo Bid4Free targets this important problem by introducing an innovative cloud-based software as a service (SaaS) 3D BIM platform that aims to reduce the time and therefore cost spent on tendering by providing open source software for the construction industry to build upon.

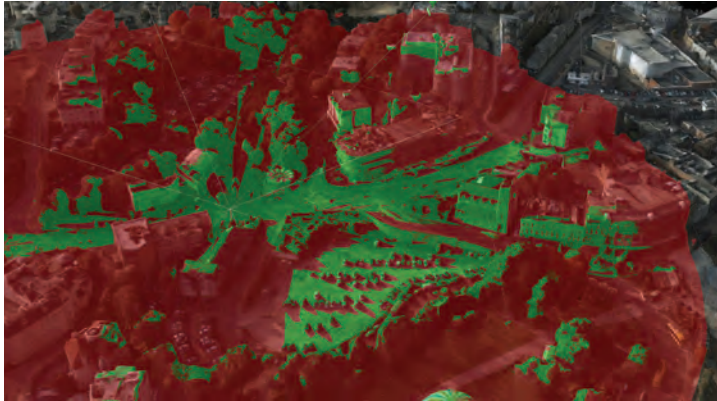
BENTLEY AND TOPCON'S 'CONSTRUCTIONEEER'

Topcon Positioning Group and geospatial software provider, Bentley Systems have

>

DIGITAL TWIN FOR 5G

Ordnance Survey (OS) has been chosen by the UK's Department of Culture, Media & Sport (DCMS) to develop a planning and mapping tool that will be instrumental for the national rollout of 5G technology. It will lead a consortium



3D view-shed analysis of part of Bournemouth

that includes the 5G Innovation Centre and the Met Office, and together they will create a 'digital twin' of the real world, to be used to determine prime locations for radio antennae (access points) necessary to enable the network. The tool will be trialled first in Bournemouth, and if successful it has the potential to be scaled up to cover the rest of the UK, and shared with other countries as they develop their own 5G networks.

Surveying for parts of Bournemouth, which is a test bed for the national rollout of 5G, is already underway and will be used to generate the new model. The intelligent mapping tool trial will support the town's aim to build on its success as Digital Council of the Year 2015 by becoming one of the first places in Britain to have 5G coverage.

The higher frequencies needed for 5g have a shorter range, and so a huge amount of equipment is needed to support the network and make it robust. Industry sources have suggested thousands of sites will be needed to assure widespread national 5G coverage. Different construction materials can markedly reduce the capability for radio signals to travel, and at very high frequencies even raindrops and the leaves of a tree can interfere with the radio signals. To make 5G a success, access points and network equipment must be deployed where the impact of the built and natural environment has minimal effect. Discovering where to best place the equipment required for a national 5G network would be a very time consuming and costly exercise of trial and error, but with the data visualisation tool OS will create, the vast majority of the work could be done from a desk.

announced their joint intentions to connect cloud services for 'constructioneering'. Each company will bring to market cloud-based solution offerings, which include the services of both and provide construction workflows not previously possible. Initially, Bentley will offer its ProjectWise CONNECT Edition so users seamlessly connect with Topcon's MAGNET Enterprise, incorporated with ContextCapture image processing for mass data collection via UAVs.

ARCHAEOLOGISTS OPT FOR LIDAR SURVEY

Devon County Council, supported

by Blackdown Hills area of outstanding natural beauty, has commissioned Bluesky to fly lidar of potentially important archaeological sites in the county for a project funded by Historic England. Using a range of visualisation techniques, the lidar data will be modelled to provide accurate representations of earthwork remains, particularly in woodland areas to provide new information for known monuments and revealing previously unknown sites.

SURVEY4BIM AGM

The annual general meeting of Survey4BIM was held on 6th December at the RICS. Martin

Penney summarised the highlights of a busy and effective year which saw a call to the industry to get engaged through the Big 5 Challenges. This year chairmanship of the cross-industry group has passed from Ian Bush, who has been chairman for the past three years, to Martin Penney. Barry Gleeson will be vice chair. Other posts were announced and, with a few remaining vacancies, Martin Penney asked for other members of the group to get in touch if they are able to get more involved. The group has just started to tackle the Big 5 Accuracy challenge and in January, work will start in earnest on the Interoperability challenge – data coding and standardisation was seen as one of the most urgent issues to tackle.

DRONE TEST CRASHES

The Department for Transport, Civil Aviation Authority (CAA) and the Ministry of Defence are planning to crash drones into passenger jets to test the risks of collisions. With increasing numbers of UAVs in the sky and near-misses reported almost daily, commercial drone company, senseFly has teamed up with Air Navigation Pro to launch Safer Together, which will link up existing navigational technology used generally by aviation pilots and UAV operators to ensure the skies are a safe place for both planes and drones to fly.

Jean-Cristophe Zufferey, CEO of senseFly, adds, "While it's important that we understand the risks of mid-air collisions, it's more important that we find a solution. Currently, drone operators don't have the insight they need to avoid near-misses. This lack of awareness not only risks people's safety, it burdens drone operators with full responsibility for flying safely. Both pilots and UAV operators need two-way, or bi-directional, awareness of one another's flight paths to ensure that drone operators have the insight they need in order to

change, pause or abort a flight and avoid collision”.

IN BRIEF

SCCS has supplied a Leica ScanStation P40 to Greenhatch Group. Commenting, Andrew J Dodson, Greenhatch director said: “The compensator-enabled P40 scanner will complement our existing scanning hardware and allow us to further enhance the accuracy of 3D data delivery for clients in BIM and Revit fields. We wish to thank SCCS for services provided to enable the fast-track provision of this equipment. ”

The Esri UK annual conference returns to the QEII Centre, London, on 16th May 2017. Registration is free of charge at <http://www.esriuk.com/events/ac17>

The 17th annual International Lidar Mapping Forum conference will take place February 13-15, 2017 in Denver, Colorado. The programme will begin with two sessions on Geiger-Mode and Single-Photon LiDAR: what's the difference & why does it matter? The exhibit floor will have more than 60 leading

technology, software and service providers from around the world.

Cyient India Ltd through its wholly owned subsidiary Cyient Europe Ltd, has signed a definitive agreement with Blom AS, Norway, a wholly owned subsidiary of NRC Group ASA, Norway to acquire 100% of the shares of Blom Aerofilms Ltd. Based in Cheddar, Somerset, Blom employs a core team of around 40 people.

FLIR Systems has acquired Point Grey Research for an aggregate purchase price of \$259 million in cash, or an enterprise value of \$256 million excluding Point Grey's closing cash balance. Point Grey is a global leader in the development of advanced visible imaging cameras and solutions.

What3words, the addressing system that creates three unique words for a 3 x 3m triangle anywhere in the world, has launched its services in Poland. The firm has also helped F1 team Manor Racing with their logistics at the 2016 Brazilian Grand Prix, with sponsorship of the company logo on the rear wing of their cars.

EVENTS CALENDAR 2017

Got an event to list? Go to
www.geomatics-world.co.uk/events

DGI Annual Conference

23-25th January 2017, QEII Centre, London, UK
<http://wbresearch.ch/dgigispmeva>

International LiDAR Mapping Forum (ILMF) 2017

13-15th February 2017, Denver, USA
www.lidarmap.org/

Drones 2017: Accident and Investigation

21st February 2017, Cranfield University, UK
<http://events.imeche.org/viewevent?e=6465>

IGTF 2017

12-16th March 2017, Baltimore, USA
<http://conferences.asprs.org/Baltimore-2017/>

SPAR 3D Expo & Conference 2017

3-5th April 2017, Houston, Texas, USA
www.spar3d.com/event/

Internet of Things Applications Europe 2017

10-11th May 2017, Berlin, Germany
www.idtechex.com/internet-of-things-europe/show/en/

Esri UK Annual Conference

16th May 2017, QEII Centre, London, UK
www.esriuk.com/events/ac17

Unmanned Vehicle Technology 2017

17-19th May 2017, Greece
www.unmanned-v.com/

GEO Business 2017

23-24th May 2017, London, UK
<http://geobusinessshow.com/>

FIG Working Week 2017

29th May–2nd June 2017, Helsinki, Finland
www.fig.net/fig2017

Commercial UAV Expo Europe 2017

20-22th June 2017, Belgium
www.expouav.com/europe/

GEOMATICS STUDENTS WIN TSA AWARD

Geographic Information Science students Connor Foxall and Oliver Smith were awarded bursaries at the TSA annual conference last November. The award has been made available to Stage 2 geomatics students at Newcastle University for the past five years. Students are asked to submit a paper on a given subject and this year the essay theme was 'Building for the Future'. Eleven entries were received with the standard being very high.



Adam Bradley presenting the Bursary Awards to Connor Foxhall and Oliver Smith

Where will the next generation of geo surveyors come from, as mega infrastructure projects start in earnest?



James Kavanagh, Director of the RICS Land Group.

Welcome to 2017. I don't think there will be many of you out there who will regret seeing the back of 2016. It's been a year of turmoil, conflict and political wrong-headedness with a very slight sprinkling of hope on the horizon.

RICS Geomatics continues to represent the interests of the geomatics/geospatial surveying profession across a number of fronts. The evening lecture series continues apace with several very well attended lectures (at the time of

press, we are really looking forward to welcoming **Tim Marshall** to RICS on 26th Jan 2017). The Christmas lecture featured the 2016 Michael Barrett award winner **Prof Stig Enemark** HonRICS, who spoke on global land administration issues, fit for purpose survey and his thoughts on a long and varied career. We hope to report on Prof Enemark's lecture in the next issue of GW.

ADVANCED APPRENTICESHIPS

The enabling works for the start of High Speed 2 (HS2) will start in earnest over the festive season (Euston station) and combined with several other mega infrastructure projects such as Heathrow, Thames Tideway, Crossrail 2 – the pressure on our already overstretched geo sector is only set to increase. Just where will the next generation of technician surveyors come from? And just as importantly, how will their training be funded? HM Gov has launched the 'Trailblazer' Apprenticeship initiative. The new apprenticeship levy is due to come into effect from April 2017 and RICS Geomatics has been working hard, along with the wider UK geo industry, to develop geomatics sector specific apprenticeship proposals. We are delighted that the Minister of State for Skills has approved our proposals to develop two apprenticeship standards covering Geospatial Survey Technicians (level 3 – 2 years and linked directly to RICS AssocRICS membership) and Geospatial Mapping and Science Specialists (level 6 – 5 years and linked directly to MRICS). These new apprenticeships should be launched in September 2017 and will allow survey firms to access funding (up to 100% depending on firm size) to support apprentice trainees. This is a very exciting development and a real tribute to the collaborative nature of the working group (RICS, TSA, ICES, major employers, vendors

and educationalists). I will keep you all updated on this important initiative during 2017 (there should also be a workshop at GeoBusiness 2017). More information on the Trailblazers initiative can be found https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/487350/BIS-15-632-apprenticeships-guidance-for-trailblazers-december-2015.pdf

PROPERTY BOUNDARIES BILL

The above Bill has been fully supported and encouraged by RICS Geomatics (boundaries and party walls panel) and successfully had its 2nd reading in the House of Lords (09/12/16). The bill will now enter the committee stages. This is a significant breakthrough on expert determination by an appropriately qualified chartered surveyor for boundary disputes in England and Wales. More on the bill and its progress at <http://services.parliament.uk/bills/2015-16/propertyboundariesresolutionofdisputes.html> The Bill can be downloaded in full from the url above but suffice to say that it concentrates on the resolution of boundaries during a dispute adjudication process, helping to smooth the process, release pressure on the courts and enabling the public to access affordable alternative dispute resolution solutions (with the solution then registered with Land Registry). The proposals are similar to the Party Walls Act, which has enabled development in the UK since the mid 1990's.

This Bill has really raised the profile of Chartered Surveyors within the upper house of parliament and RICS is very grateful to the relentless efforts of Earl John Lytton FRICS.

INTERNATIONAL LAND STANDARDS ILMs

International standards and the collaborative coalitions that have been set up to deliver them have in many ways been the success story of 2016. The latest international standards coalition to gain traction is one focused on land transaction standards and is the minimum requirement to secure land rights and decrease risk in land transfer for internal and external investment. The ILMs coalition has been formally constituted and we are in the process of setting up the standards setting committee, which will be tasked with developing and writing the final standard. ILMs will be present at World Bank 2017 and FIG Helsinki 2017 – more information on this important development @ <http://www.rics.org/uk/footer/international-standards/>

Here's to a sustained and positive 2017!

Last year was memorable for many different reasons. The development and acceptance by the government in the UK of a Survey Apprenticeship was great news after many years of effort. On the more general topic of the Geomatics division name we had a really interesting series of responses, but not nearly enough to represent a decision to change. In any event, the comments and responses were of a varied nature and I thank all of you who contributed. So as a timely reminder, if you do wish to comment or raise an issue with the Geomatics Professional Group, then the choices are either to contact RICS HQ through traditional means, visit the website at <http://www.rics.org/us/about-rics/professional-groups/rics-geomatics-professional-group/> or via the social media channels. If not already signed up you may wish to join these to keep informed.

For 2017 we are going to see an improvement in many of the sectors of our industry. Infrastructure programmes are beginning to award contracts here in the UK and generally, around the globe, the price of resources, natural and manmade, are and will continue to rise. This creates opportunities for surveyors and geospatial professionals to engage and support these activities in order to enable efficient, cost-effective and sustainable development. Sustaining something can be more of a challenge than the initial push to create and develop it; convincing our clients that good coordinates lead to good developments so efficient and cost-effective long-term results are key.

This edition of *Geomatics World* includes a number of articles relating to some of the big technology providers. Technology continues to dominate and influence our profession. The Internet of Things for us is a real opportunity, or the Internet of Spatial Things as I term it. I believe it will be a massive change in how our futures develop. We should all be active and get involved in assessing how to engage with the users who will require new ideas from us on creating the future products and services.

A KEY COMPETENCY

I consider the collection of appropriate quality data, a key competency. It's apparent that the potential for rapid data availability and the distribution of related products, puts pressure on traditional data delivery mechanisms. The ever larger data volumes may not always be accompanied by clear quality indicators or useful quality

related metadata and so our role may become more focused on quality control and checking of data than on the initial use of sensors and survey tools for its collection. To step too far in that direction would be a mistake as it's the initial data collection that often determines its usefulness - and it's not often possible to improve it after capture.

Once collected, more and more of the data is likely to be shared and distributed quickly such that the traditional requirements of map users has gone, to be replaced with an expanded and diversified consumer base with a similar diversity of uses. Mapping agencies think of data as a service now, rather than the physical map as the end product. Planning and recognition of such trends in the collection of data, the use of new and developing data services and their wider distribution, will remain critical components for us to develop and sustain influence.

As mentioned, managing the expectation and demands of our clients may require us to gain new knowledge and new areas of competency such as understanding the rights to access and the rules on data use and sharing. So looking forward, in the world of robotics, automation, data visualisation and the Internet of (Spatial) Things, we too will have to continue to develop as professionals. Our work, our standards and continuing professional development will help us maintain relevance and have a sustained positive impact. Here's to 2017!



Gordon Johnston, Chair of the RICS Geomatics Professional Group. Gordon welcomes your comments and thoughts so please email to the following address geochair.rics@gmail.com

HOW TO ENSURE THAT YOU ALWAYS GET YOUR COPY OF GEOMATICS WORLD

If you receive GW as part of your RICS membership, you must inform the Institution of any change of address. As publishers of GW we cannot change the RICS membership database for you. Call +44 (0)870 333 1600 or log in to the RICS website or write to: RICS Contact Centre, Surveyor Court, Westwood Way, Coventry, CV4 8JE, UK or email contactrics@rics.org Subscribers to GW can call +44 (0)1438 352617 or email: jason.poole@geomares.co.uk

Comments on the collection, meridians and bon mots



Malcolm Draper, Owner of Rentalength

Last issue's report on our visit to Ghent to view the Wright-Draper collection of historic electronic instruments has attracted some interesting comments.

Dr Arthur Allan, who is recovering from a hip replacement, writes: "I am specially pleased to see there the Zeiss Reg Elta 14. **Tony Bancroft** of Huntings gave me one which had not been used for a while. We switched it on in our lab at UCL and to our surprise even

the paper tape reader still worked. It was the first "total Station" to have data recording in the field. But what a massive beast it was. I am sure **Alan Wright** would have been as pleased as no doubt Malcolm was to see it all. I did not see an MRA1 Tellurometer, which we used in Kenya. This beast consumed 8 amps which from 25 APH car battery was a cause of great concern.

... the Zeiss Reg Elta 14... was the first "total Station" to have data recording in the field.

So we had a battery farm laid out in the bush with constant day and night charging. The charger had to be pegged down because it would take a stroll away from its children!

The collection reminds me of a seminar on Gyroscopes that **Dr Thomas** and I organised at Imperial College. When he saw a crowd of different instruments on display he mused, "What a glorious sight. I wonder if they are all talking to each other. Perhaps this applies to the EDM instruments!"

I have assured Arthur that there is an MRA1 and also an AGA 4, both of which were purchased from Swansea University by me.

Jim Smith has also been in touch:

"Just to say a thank you for the mention in the latest Geomatics World re the Exhibition in Ghent. I would have liked to be there but I cannot now leave my wife for long periods at a time."

George Richie of Positioning Resources writes: I read with interest your article on your visit to the Wright-Draper Collection in Belgium. I knew Alan Wright as he had done some field work for us in remote places like Somalia (try doing that now!). He had an amazing way of communicating with the locals who had in most cases very little English. Alan had gone out as the advance party and I followed with other operatives a couple of weeks later, so Alan met us at the airport. Somehow he managed to arrange with the customs for all of our Transit Satellite Systems – 6 in all - to be allowed in as excess baggage, avoiding customs seizures and long delays with many backhanders.

I had heard he was trying to put together a museum for old systems, and I had offered him one of our Magnavox MX1502 Receivers. He had no space and with his passing I had forgotten about it. Do you think that this Receiver would be a useful addition to the Collection? If there is an interest then I would be able to arrange one to be sent."

Thanks George but we have got one.

MERIDIAN MATTERS

Nick Day, who is currently living in Trieste in northern Italy, writes about an interesting discovery:

"Wondered if you've ever seen anything quite like this before? I must have walked past this dozens of times during my months in Trieste, and only just saw it a few days ago on my way back with friends from Thanksgiving Dinner at the American-Italian Club. It's on the meridian line which runs right through the Borsa (the old stock exchange).



Trieste is quite a hub of scientific research, with a couple of major research institutes and the university. There's also a kind of USGS/Geodetic type centre, up on the hill near the town of Prosecco (*Ed: this word will crop up again in this issue of*

GW as astute readers will discover). They run the special pendula in the *Grotta Gigante* cave which I wrote about in GW last year (see September/October 2015 issue)."

QUIZ WINNER

John Harries was the first to respond correctly to last issue's quiz, which asked what does *Le Repère* mean and what was wrong with the restaurant of that name's claimed Lats and Longs? He writes: "I think that at IGN *Le Repère* was known to us as a "benchmark". Possibly to non surveyors as a "landmark". As for the co-ordinates they certainly don't make the grade but possibly the "Grad".

John is also bang on the money about the word benchmark, as indeed the restaurant is a benchmark for food and service in the area. We will try to meet with John in the New Year.

MISCELLANY

We were sad to read of the death of **AA Gill**, the Times' acerbic restaurant critic. Here's a few of his bon mots. *Breakfast is everything. The beginning, the commitment to a new day, a continuing of life.*

Proof that God has a sense of humour – after inventing haute cuisine, he gave it to the French.

Food and pubs go together like frogs and lawnmowers. Spinach is the Kate Moss of vegetables. Goes with everything, boils down to nothing.

You can easily travel from Cardiff to Anglesey without ever stimulating a taste bud.

And this one came to me from someone by email:

"Who says building a border wall won't work? The

Chinese built one over 2,000 years ago and they still don't have any Mexicans." Makes yer'fink, as they say.

Whilst we're playing with words I couldn't resist the following little cartoon

Indians and Africans are resourceful people. Have you been watching David Attenborough's *Planet Earth II*? They put up with a lot of thievery and bare-faced cheek from monkeys. But the Africans seem to suffer worse. How about this pic of a baboon calmly hitching a ride.



*It's one word
George!*

We were also sad to read of the death of Zsa Zsa Gabor. She had some great witticisms, like: "I'm a marvellous housekeeper. Every time I leave a man, I keep his house." And, "How many husbands have I had? You mean apart from my own?"

LEXOPHILIA

A Lexophile is someone with a love of words, especially word games such as: "you can tune a piano, but you can't tuna fish", or "to write with a broken pencil is pointless." A competition to see who can come up with the best examples is held every year in an undisclosed location. Here are some of the entries. This year's winning submission is posted at the very end.

When the smog lifts in Los Angeles U.C.L.A.

The batteries were given out free of charge.

A dentist and a manicurist married. They fought tooth and nail.

When you've seen one shopping centre you've seen a mall.

Police were called to a day-care centre where a three-year-old was resisting a rest.

A bicycle can't stand alone; it is two tired.

When a clock is hungry it goes back four seconds.

The guy who fell onto an upholstery machine is now fully recovered.

He had a photographic memory which was never developed.

And the cream of the wretched crop: Those who get too big for their pants will be exposed in the end.

Smartphone Surveying on construction sites

The use of photogrammetry has increased dramatically within geomatics. Currently, its main use is mapping large open areas such as fields or shorelines using aerial imagery captured from planes or drones. But at the London Bridge Station Redevelopment Project, Costain has been using the technique on a much smaller scale. It has proved useful for applications like the survey of trial holes and excavations in a quick simple way, to minimise survey time and maximise quality reports Costain surveyor Richard Bath.

Compatible with laser scan data For several years, Costain has been producing accurate and detailed 3D survey information covering a developing construction site, using just smartphone imagery and photogrammetry. Regularly, the quality and accuracy of the data produced is compatible with 3D point cloud data from a terrestrial laser scanner (TLS). This means that anyone on site with a smartphone can capture data otherwise achievable only with a laser scanner costing tens of thousands of pounds.

PICKING UP THE BRICKS

At first, basic photogrammetric software was tested to see if the



Figure 1: 3D view of a photogrammetric model of an excavation
(Follow the link to: <https://www.youtube.com/watch?v=wtrpxqEAt9k>)

be replaced with new ones; but planning design constraints dictate that the brickwork on the new and old façades should match.

Before demolition, a detailed laser scan-survey of the existing façade was undertaken, with the objective of modelling each individual brick from the scan data. But meshing of the scan did not highlight the joints between the bricks in enough detail, partly due to noise in the data but also due to the meshing software

effectively bypassing the need for modelling. The photogrammetric survey was able to identify the joints between the bricks effectively and the 3D surface could be overlaid into an existing CAD model and used to identify each brick.

Too many holes, not enough time After this successful application of photogrammetry, other uses for the software were assessed. In particular, Costain adapted their image capture technique for trial holes and excavations.

... responsibility of capturing the survey information can be passed on to the person responsible for each dig...

technique could assist with heritage surveys. The main feature of the new design of London Bridge Station is the expansive concourse running the full width of the station. The existing brick façades at the north and south of the station have been demolished and will

losing detail between the brick joints.

Costain's alternative solution was to use imagery taken using a smartphone to create 3D models of the existing façades using photogrammetric software,

Due to the size and complexity of the London Bridge site, it had been an issue to get a surveyor out to survey any exposed underground services. Trial holes and excavations usually hinder the movement of people and plant on site as well as being a fall risk, so backfilling quickly benefits productivity. On the other hand, there is a network of services under London dating back to the Victorian era; capturing reliable survey

information about them is crucial to working safely. The more knowledge we have of services, the less likely they are to be struck or damaged.

The conflict between these two priorities left open the possibility either that exposed services might not be surveyed before an

limited user input but can take hours, depending on the computer power available.

QUICKER DATA COLLECTION

In many cases, it takes considerably less time to capture 3D data using the workflow described above than to conduct a laser-scan survey.

so as to avoid misinterpreting the data; whereas a photogrammetric model is basically a 3D photograph. The end user is able to see a realistic representation of what's actually there on site and interpret it from the image.

TRAINING

Like any surveying technique, using a smartphone to capture images on a site is not completely foolproof. Without training the final deliverable will be a collection of pictures that can't be used to produce a final model, whether down to a lack of overlap between pictures, out-of-focus imagery or inadequate lighting. In just the same way, if you give an operative a total station, without any training, the only deliverable you will get back is a list of unusable coordinates in the wrong position. The difference is that everyone is familiar with taking photographs, so the training required to ensure that the photographer takes sufficient useful overlapping images builds on familiar experience.

The greatest advantage of photogrammetry for this application and workflow is the potential for complete data capture.

excavation was backfilled or that works might be delayed by a survey. Costain has overcome this conflict by implementing a photogrammetry-based survey technique.

SITE WORKERS COLLECT DATA

Following the simple workflow shown in Figure 2, the responsibility of capturing the survey information can be passed on to the person responsible for each dig, without the need for a surveyor or for dedicated survey equipment.

Steps one and two can be implemented by anyone following five minutes training covering the best way to mark ground control points (GCPs) and the method of taking the photos to ensure the best deliverable. Step three requires a surveyor or anyone with experience in collecting geo-referenced 3D data. The GCP's can be surveyed after the excavation is backfilled provided that they are still visible on the perimeter of the excavation. A minimum of three control points are needed to scale and position the survey, although the more control used, the more reliable the deliverable.

Step four is a highly automated process: uploading the pictures and identifying the GCPs usually takes minimal time, the processing needs

A laser scanner has a single view for each scan so, to cover an area completely, three or four set-ups would be needed to avoid shadows in the data. With each scan taking about ten minutes, the survey could take a total of thirty to forty minutes. Using photogrammetry, photography of the same area takes five to ten minutes, depending on the experience of the person capturing the images.

A total station survey of services in an excavation could be completed in a similar time to a photogrammetric survey but the deliverable would be of lower quality and require more effort to document

Most photogrammetric software packages are created in such a way that they can produce deliverables from as few as ten images. Problems with the photography,

>

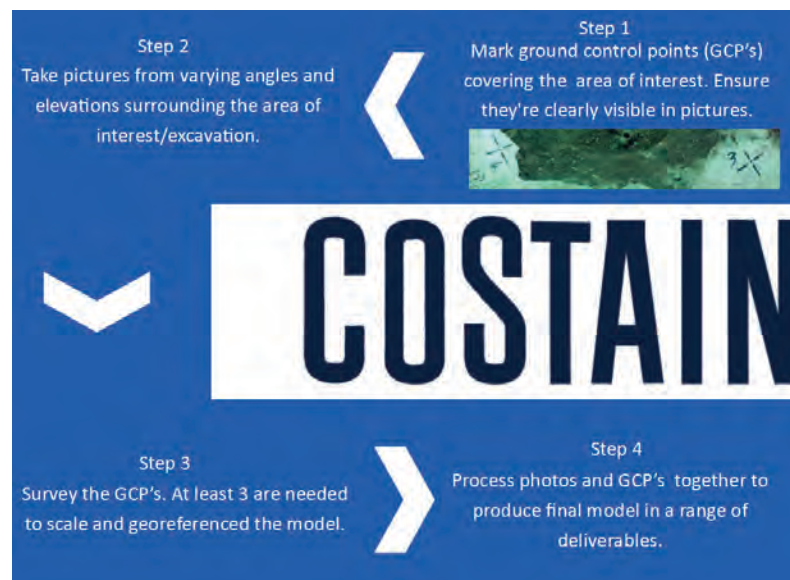


Figure 2: The workflow for photogrammetric survey of excavations



Figure 3: View of a photogrammetric model of a brick arch at London Bridge Station (Follow the link to: <https://www.youtube.com/watch?v=2WXEAebFCao>)

such as missing images, can be identified after processing and the photographer coached to improve his image capture technique.

ACCURACY

The relative accuracy between objects in the 3D model is dependent upon the accuracy with which the

grid is dependent on the position of the GCP's, how clearly they are visible in the photography and how accurately they are surveyed.

The RMS accuracy of site-based photogrammetry is usually sub 10mm compared with a laser-scan survey. This is not accurate enough

...there is a greater appreciation of the data and it is easier and simpler to share and communicate the results.

model has been constructed from the stereo images. The absolute accuracy with respect to the survey

for engineering as-built purposes but is more than accurate enough for underground services surveys.

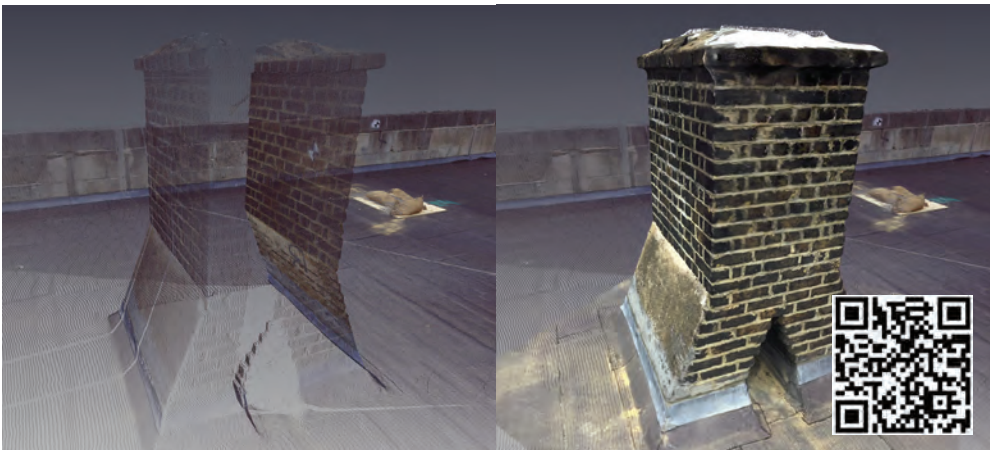


Figure 4: Scanned and photogrammetric view of a pillar on the roof of the former Southeastern railway offices at London Bridge Station

100% DATA COLLECTION

The greatest advantage of photogrammetry is the potential for complete data capture. As an example, if there is one surveyor on site trained to use a scanner then two to three trial holes might get surveyed throughout the day with millimetre accuracy but other excavations on site might be backfilled before the surveyor has a chance to survey them.

Photogrammetric surveys can be completed by anyone with a smartphone, so there's no reason not to have survey information after every dig. This becomes even more useful when validation of existing services information is needed. An empty excavation is nearly as useful as an excavation full of services, as it can prove if the position of services was recorded incorrectly or if they have been removed from the ground. This concept of accuracy is harder to quantify and monitor as there is no way of knowing what underground services have not been surveyed until they are found by an excavator bucket.

SURVEYING THE ARCHES

The uses of photogrammetry extend beyond recording 3D data for excavations and trial holes. By scaling up the same technique used for excavations, large areas of site can be recorded in high detail and with useful accuracy. An example is a survey conducted of the existing brick railway arches at London Bridge. Seven hundred pictures were taken with a smartphone over twenty minutes to produce a deliverable with data inside and on top of the exposed arches with 10mm residuals at the five ground control points across the survey area.

ENHANCING LASER SCANS

Just having a smart phone in your pocket can't fully relinquish the need for a full laser-scan survey in every

instance. However, it is more usually the case that photogrammetry can enhance a laser scan. Figure 4 shows the old Southeastern railway offices on Tooley St, which had to be fully surveyed before they were demolished to make way for the new concourse. A scan was conducted by Costain over the five floors and basement but an issue arose when the roof needed to be surveyed. Brick pillars protruding out of the roof needed to be scanned in enough detail to produce models.

This was a problem as there were few stable places to set up a TLS on the aging roof and due to the shape of the pillars, at least four scans would have been needed to cover all the detail for each of the two pillars, taking at least ten minutes each. As an alternative, a twenty-second video was taken around each pillar and, by extracting the frames from the video and using control points from the laser scan, point clouds could be produced using photogrammetry and overlaid onto the TLS point cloud with an absolute accuracy of about 4-5mm.

QUALITY

The main issue relating to using photogrammetry as a site-based data capture technique is quality. Costain has developed a robust, simple workflow to minimise the chance of an unsuccessful 3D model. Even so, inexperienced users may still capture unsuitable images.

If a conventional survey is being conducted there are regular checks that can be used (check backsight, check level etc.) to make sure the data is accurate and correct. This is not so with photogrammetry: the survey is just a collection of pictures and the quality of the survey information isn't obvious until the pictures are processed and any errors in the survey show up in the 3D deliverable. This can be a problem for people inexperienced in taking images for photogrammetry: there's also a danger that users think photogrammetry is a flawless data capture technique, so errors need to be understood and appreciated.

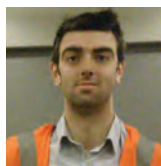
AN INEXPENSIVE SOLUTION

At the London Bridge Redevelopment Project, Costain has been using camera phone imagery and photogrammetry to produce 3D data, which could previously only have been collected using a laser scanner costing £50,000 and a skilled surveyor. This has opened up the possibility for practically anyone to capture information of a developing site and allows for more data to be recorded and processed.

Opening up the responsibility of data capture to more people on site creates a more integrated method of working. Not only is more survey data captured but more individuals on site are aware that data is available, there is greater appreciation of it and it is easier and simpler to share and communicate results.

ABOUT THE AUTHOR

Since graduating from Newcastle University with a degree in Surveying and Mapping Science, Richard Bath has been working for Costain at London Bridge Station Redevelopment Project, where he has been responsible for collecting and processing the laser-scan data needed for the final BIM model. In order to meet the evolving needs of the site, Richard has been focusing on developing other site-based data capture techniques such as photogrammetry.



NEW

RIEGL VQ-1560i

Dual Channel Airborne Mapping System

Waveform Processing LIDAR Solution
for Demanding Airborne Surveying Missions

univerted scan pattern for best point spacing on the ground

multiple time around processing for automatically resolving range ambiguities

forward & backward look for collecting data of vertical structures

World Premiere at
INTERGEO 2016

Turnkey Airborne System
for Demanding Large Scale and
High Altitude Environmental Mapping

Ultra high performance, fully integrated and calibrated airborne laser scanning system offering online waveform processing, full waveform recording, and excellent multiple-target detection capability | up to 2 MHz pulse repetition rate | up to 1,330,000 meas./sec on the ground | offers data acquisition at a wide range of point densities | operating altitude up to 15,500 ft AGL | forward & backward looking capability | automatic Multiple-Time-Around (MTA) processing for up to 20 pulses simultaneously in the air | IMU/GNSS unit and cameras fully integrated | mounting flange for interfacing with typical hatches and stabilized platforms | enables straightforward flight planning for increased flight safety

Visit us at

ILMF 2017
Denver, USA
February 13 - 15, 2017
booth 16 & 19

www.riegl.com

RIEGL LMS GmbH, Austria | RIEGL USA Inc. | RIEGL Japan Ltd. | RIEGL China Ltd.

Geospatial Modelling and Rights to Light

GW reports on last November’s RICS fascinating lecture by Andrew D. Thompson on how geomatics measurement techniques are being used in rights to light cases.

Ever since man first began to live in clusters of buildings with windows there must surely have begun a test of neighbourliness. Don't build too near my property

complex world we have necessarily developed highly sophisticated software tools, legislation, tables and guides to solve these problems.

... can you tell the tolerance of a 3D model just by looking at the paper report?

and don't obscure my view, would have been an early test of relations. In today's highly developed and

Andrew D. Thompson is a chartered surveyor who has specialised in this area. His talk was primarily

to introduce the RICS's latest guidance note Rights of light, 2nd edition, which came into effect on 1st July 2016. The guidance is the result of a working group comprising not only chartered surveyors from across the various professional groups but also lawyers and insurers.

Thompson began with a quote that echoes for our time: In London there were 'bold speculators able to override the rights of the less wealthy'. It was said in 1865 when the capital was expanding rapidly. Plus ça change, as they say.

Band	2 sigma [X,Y]	Accuracy hard detail [Z]	Example survey types/ uses	Approx. legacy plot scale output required to achieve accuracy band	Min. size of feature shown true to scale (not symbolised)
C	+/- 10mm	+/- 5mm	Engineering surveying and setting out, high-accuracy measured building surveying, heritage recording	1:20	10mm
D	+/- 20mm	+/- 10mm	Engineering surveying and setting out, measured building surveys and floorplans, high accuracy topographic surveys	1:50	20mm
E	+/- 50mm	+/- 10mm	Right of light scanned surveys, measured building surveys, topographic surveys, net area surveys, valuation surveys, area registration	1:100	50mm
F	+/- 100mm	+/- 50 mm	Low-accuracy measured building surveys, topographic surveys, high accuracy utility tracing, tree modelling	1:200	100mm
G	+/- 200mm	+/- 50mm	Massing studies from survey, topographic surveys, low accuracy measured building surveys	1:500	200mm
H	+/- 500mm	+/- 125mm	Low-accuracy topographic surveys, massing studies based on national urban area mapping, tree surveys	1:1000	500mm

Above: Rights to light - specification table.

ACCURACY

The new edition links the RICS Guidance in Measured Surveys of Land, Buildings and Utilities, 3rd Edition, 2014, which defines appropriate scales and accuracy for general survey tasks, to the sector's specific needs of geospatial 3D rights of light models. Thompson drew attention to the growing use of laser scanners in this area.

Some developers are attracted to the quick adoption of off-the-shelf general model data captured via aerial survey techniques. By doing this, tolerance of accuracy is being lost. An aerial survey can have a tolerance of ± 500mm, which unless declared would be unknown to an end user of the data.

Thompson challenged the audience: can you tell the tolerance of a 3D model just by looking at the paper report? All you see are pretty computer images; all 3D models are not equal and the difference will now be found in the land survey data

that was used to create the shape. The new guidance therefore has a specification table to help with the communication of the accuracy of the 3D model used in the report.

COMPENSATION

Driven by property values racing ahead of inflation, questions and disputes over rights to light are growing; the sums involved are substantial. Whilst there is legal case law precedent that provides structure for a settlement in the majority of disputes, the market is proving difficult in city centres. The commercial approach requires either a settlement based on development gain or an enhanced direct injury with both elements based on the court's approach to the granting of compensation rather than an injunction.

The Corporation of London was required to step in and use the Planning Powers granted under the former section 237 of the Town & Country Planning Act 1990 to facilitate the development of 22 Bishopsgate, a 62-storey commercial skyscraper planned for construction in London which will stand 278m. This need for private sector developers undertaking major schemes to seek facilitation with local authority help is becoming more common.

The landscape changed on 13th July 2016 as section 203 of the

Housing and Planning Act 2016 came into force replacing the former system. The new section 203 system has a much wider category of potential users. Known as the "specified authority", this allows government departments and bodies with a statutory function, including undertakers such as utilities and nationalised companies like Network Rail to benefit from the powers. The potential source of a helpful partner to offer facilitation powers for major schemes is now wider than local authorities.

Whilst ransom risk is not over for small and medium schemes the logic of a proposed development

being "too big" to be stopped by neighbours does seem to be driving the approach championed by the City of London.

EDUCATION AND QUALIFICATION

In the past becoming a chartered surveyor required specific qualifications and experience; the wrong degree could exclude you from the profession. This view no longer reflects the needs of the current market. The RICS challenge has been to maintain the end quality

of the final designation, whilst opening entry to all in the industry.

Achieving RICS qualification in specialist areas such as rights of light has historically been difficult, however the opening of the APC pathway now has created a route for graduate surveyors wishing to pursue an APC in any environmental area. Thompson explained that the APC now provides a more flexible route to qualification to practice. Even if you don't hold a cognate degree the APC in combination with RICS Training has a route to qualification regardless of your start point so those working in rights of light can still achieve

This need for private sector developers undertaking major schemes to seek facilitation with local authority help is becoming more common.

the designation, Chartered Environmental Surveyor.

Recent APC success story is Gilsen Osman MRICS, Daylight and Sunlight Manager of BLDA Consultancy. Her work in planning, sustainability, natural light and supporting developers in the design phase provided the necessary experience necessary to achieve first AssocRICS and then full MRICS.

Whilst the end experience level required to achieve MRICS has not been lowered, the route to achieve that point is now wide and inclusive. Therefore any capable graduate working in environmental design areas such as rights of light should look again.

Section 203 is based on the approach of section 10 of the 1965 Compulsory Purchase Act, shifting the balance of the negotiation away from a development ransom assessment to the CPO approach under the McCarthy Rules. Thus:

- the cause of the injury must be authorised by statute;
- if the statutory power did not exist, the injury would be actionable;
- the injury must involve physical interference with a right, public or private, which is of benefit to the claimant and which adds value to the claimant's property; and
- the injury must be caused by the 'execution of the works', and not from their subsequent use.

Rights of Light – Illuminated



The guidance document covers a whole host of topics relevant to the subject of Rights of Light (RoL) including methods of assessment, compensation, agreements and insurance. These topics make interesting reading for the unenlightened but generally go beyond the remit of the geomatics professional and are therefore not discussed here.

RIGHT OF LIGHT

A right of light as defined in the professional guidance introduction is *“a private, legally enforceable easement or right to a minimum level of natural illumination. This is through a ‘defined aperture’, usually a window opening, whether conferred by express or implied grant or obtained at common law by a process of long, uninterrupted enjoyment known as ‘prescription’. As with all easements, there is a dominant tenement that enjoys the rights and a servient tenement that is subject to and carries the burden of their existence”*.

Perhaps a simpler definition of the “servient tenement” is the developer’s estate, whilst the dominant tenement is the estate whose “Right of Light” is potentially affected by the development.

Chartered Surveyor Andrew Maltby presents a Geomatics perspective on the RICS Professional Guidance on Rights of Light published in March 2016.

GEOMATICS INPUT

In 2009 and subsequently in 2015, I was invited on to the RoL working group for my geomatics input into what was the first edition and as of March 2016 the second edition of the RICS professional guidance. For my part, the amendments required to the measurement sections 2.7 to 2.10 in the latest revision were minimal – I modestly put this down to the geomatics element being fairly advanced when the first edition was written. In this comparatively short period of time, technology has moved on – laser scanners have got smaller, lighter, faster and infinitely prettier to look at. People need no longer be concerned with having a device resembling a washing machine hooked up to a rugged laptop and huge power supply in order to capture point cloud data. With software developments too, we are now able to build 3D models from point clouds much more efficiently, whilst maintaining the levels of accuracy required. With dedicated software applications to interact with these models and for the analysis too, RoL consultants are able to produce detailed reports, tables and diagrams to convey the definitive results of the study.

The main distinction, with respect to geomatics, between 1st and 2nd editions was the inclusion of Appendices A & B. This was implemented to offer assistance to RoL consultants commissioning measured survey work and makes

reference to the current 3rd Edition of the RICS Guidance Note on Measured surveys of land, buildings and utilities, particularly with regards to accuracy.

SPECIFICATION

The key to a successful RoL survey, as with all surveys, is early collaboration initially in the form of a well written specification. Specifications with respect to those commissioning RoL surveys, whilst being by no means perfect, are now vastly improved – Appendix A of this document offers a specification template and is a new addition to the previous version. This will hopefully go some way to improving and rationalising the commissioning process still further.

LET’S JUST SCAN EVERYTHING

Far be it from me to suggest that a full measured survey is necessarily always going to be required but with the ease and speed of technology it is often prudent to laser scan early on in the process to avoid having to make assumptions that may well prove inconclusive further down the line.

There is a common misconception that all 3D models are created to the same tolerances. Nothing could be further from the truth. You would have had to have been asleep for the last five years to have not been to at least one BIM conference at which people echoed the government’s mandate for the

use of BIM on all public projects. A BIM model and an RoL model, whilst in physical characteristics very similar when you get “under the bonnet”, the difference between parametric objects in the BIM world and solid or 3D faced objects in RoL are very different. Yet we are continually being asked to create an all-encompassing 3D model, which is the answer to everyone’s needs. So the purpose is very important or perhaps I should say “fit for purpose” – whilst the scanning process can be common to all required disciplines, the derived model may not.

FLOOR PLANS

Even when a full measured survey is commissioned some assumptions will need to be made, not least about the geometry of the affected rooms. Access to those rooms is generally not requested for fear of scaremongering and alerting potential claimants to concerns that may not amount to an injury. Invariably, information on room layouts is taken from original construction drawings or planning websites, generally sparse, inaccurate and infrequently in vector format. Covert external scanning of

affected properties, after curtains have been opened, can often help confirm room depths and layouts but I’m sure it’s only a matter of time, Brexit or no Brexit, before human rights lawyers find a way to prevent this data from being used in court.

The scoping plan for the survey, included at the end of Appendix A, is probably one of the most useful documents in relaying the requirements of the RoL consultant’s study to a geomatics surveyor – the working group finally managed to obtain permission to include a plan based on a typical OS extract. Using a simple colour-coded system a well laid out plan is by far the best way to communicate the extents and scope of the study. This allows the RoL consultant to convey the key areas of interest in terms of priority apertures to be tested, masses to be modelled or additional levels to be taken.

In addition to the plan, photography either taken first hand or derived from third-party sources such as Google street view or Bing maps can help convey further the requirements of the scope,

particularly in critical areas not readily apparent to the geomatics surveyor.

Almost without exception RoL projects are incredibly sensitive and demand the utmost discretion. The responsibility for all access arrangements should be clearly defined by the instructing party.

SURVEY COORDINATES AND REFERENCE SYSTEMS

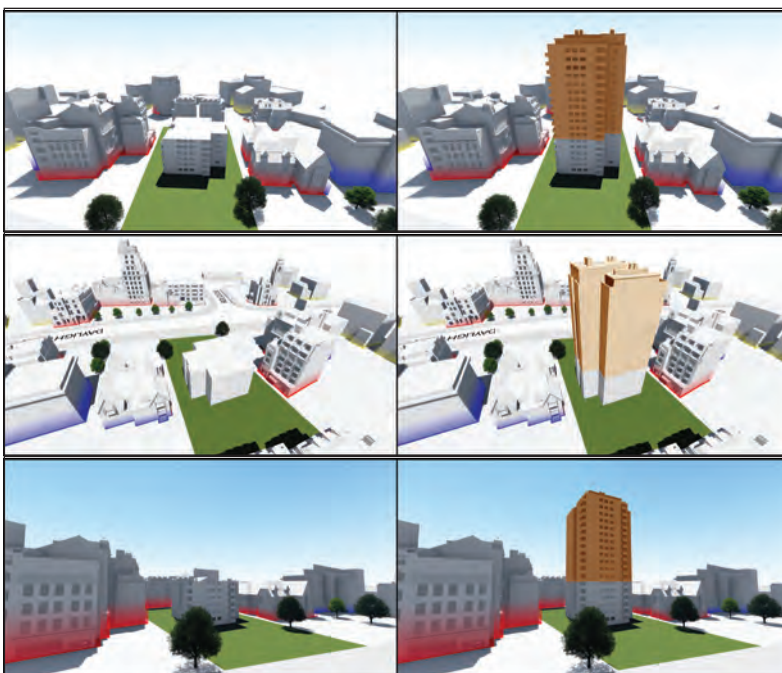
With respect to BIM, all too often a scheme will start with its origin at 0,0,0 which is not particularly helpful when referencing other geo-referenced data sources. With regards to RoL, as with BIM, all modelled data should be related to the OS National Grid reduced to a local scale factor centred on the site. The benefits are that all external mapping resources whether from Land Registry, local authority or context models derived from aerial imagery such as Mastermap, Z-Mapping, Bluesky, Blom, Getmapping, Vertex modelling etc can be referenced seamlessly.

CHECK THE SMALL PRINT. . .

As useful in context and as attractively priced and available as these proprietary models and plans are, I wonder how many RoL consultants actually read the small print. To quote one website delivering this data it states:- “You acknowledge and agree that we do not warrant that the online supply of Website, Content or Services or any internet ordering service will be:

- *Uninterrupted or error free or provide any particular facilities or functions;*
- *free from defects;*
- *free from software viruses;*
- *free of error from computer malfunction, inaccurate processing;*
- *free from corruption of data whilst geo-coding, processing by computer or electronic means or in the course of transmission; or similar*

>



- *You acknowledge and agree that the Services have not been prepared to meet Your or anyone else's individual requirements and it is*
- *Your responsibility to ensure that the Services ordered are suitable for Your (or the End User's) intended purpose."*

CONCLUSION

It appears to be the practice of many RoL consultants to undertake what they call "high level reviews" on behalf of their clients for which they generally use the online sources described above. The reasons given are that such datasets are usually readily available and are cheaper than a "proper" terrestrial 3D laser-scan survey. The problem with this approach is that most 3D models will look similar to the vast

majority of uninitiated end users and, in practice, are very often not subsequently updated with "proper" surveys at a later date when detailed negotiations surrounding compensation are undertaken. Surely any model worthy of being used to undertake detailed calculations needs to be worthy of the sophisticated software programs used to perform the analysis.

The process, cost and timescale of commissioning a full measured survey is not widely understood amongst the majority of RoL consultants and architects, who often get involved at an early stage when "master planning" models are being commissioned primarily to understand the "daylight for planning" impacts, which are significantly different from RoL ones. These models inevitably

get modified, edited and updated with the goal of making them more accurate.

One cannot help but conclude that there needs to be much earlier engagement with geomatics professionals if we are to avoid the idiom of the blind leading the blind when assessing the level of accuracy required for any particular set of circumstances. Historically, Rights of Light has always been considered a "dark art" and often deemed the exclusive province of a select number of experts qualified to advise on these matters. Geomatics professionals have a significant role to play, particularly at the initial client consultation stage, to ensure datasets used are "fit for purpose". To this end, the guidance note is a worthy addition to the process.



technical analysis for.....
daylight & sunlight for planning
rights of light for common law

.....used by 99.8% of specialist consultants

survey.mbs.com



600m range
laser scanner
and robotic
total station
in one...

...**nothing**
else comes
close

AND THEN
THERE WAS
ONE

 **Trimble** **SX10**



www.korecgroup.com

info@korecgroup.com

tel UK: 0345 603 1214 IRE: 01 456 4702

Measured Solutions
Construction | Surveying | Mapping

 **KOREC**[™]

KOREC's Technology Day at Silverstone

Your reporter is more used to visiting Silverstone in the summer, ideally on a bright breezy day. In the depths of winter with no discernible track action and drizzly rain, it is not an inviting place. Nevertheless, the new pits complex has excellent seminar and corporate facilities and was the venue for an interesting KOREC Technology Day.



That telescope is not for looking through!

KOREC's principal supplier, Trimble is now a \$2.5bn global business employing some 8,000 people with its own certified trainer scheme. The day was to learn more about the new indoor mapping system, the SX10 scanning total station and intriguingly, Catalyst – a GNSS data collection app running on a smartphone, which with an external aerial and subscription to an RTK correction service, is capable of cm level positioning.

Introducing the day, KOREC MD **Oliver Brooks** explained that they run scheduled courses throughout the year to help customers understand and use the technology

they supply including Trimble Access, the software used across all their sensor platforms.

They are also getting to grips with one of the industry's regular problems. Brooks said that a total station stolen from a site near Bradford, which thanks to the internal IP address and GNSS, was quickly tracked by the police to a leafy lane where it was found not too much the worse for wear in a ditch. A quick clean and re-calibration and it was as good as new. With password access and real-time tracking, thieving high-end survey equipment really is not a route to riches.

THE NEED PERSISTS EVEN THROUGH CHANGE

Trimble's **Lee Braybrooke** is becoming one of the geospatial industry's futurists and technology gurus. Observing and spotting trends is therefore at the core of his job description. He is a lively and entertaining speaker, reminding us that while technology constantly changes and evolves, needs do not. He cited the video rental company Blockbuster, much of whose income came from fining customers for late returns. In the early 1990s they rejected the opportunity to get involved with a small technology start-up called Netflix. Oh dear!

For our sector, business analysts and trackers Gartner are predicting

a \$1.3 trillion location industry by 2020 together with a fusion of GIS, CAD and BIM. But managing the data generated by all these systems is a growing problem. Braybrooke mentioned that already Crossrail has a knowledge system of over 1 million files. Indeed the data volumes are now so large that fibre, however broad the band, cannot cope. GW recently read reports of Google using an enormous truck stuffed full of hard drives as an easier and quicker way of moving data around from end users to the cloud. Back to the future beckons.

Braybrooke concluded with mention of Microsoft's HoloLens wearable augmented reality headset. Already Trimble is using it with Sketchup to give users virtual walkthroughs of their data. We wait to see whether this will be the next must-have BIM tool so that you can walk the client through the data.

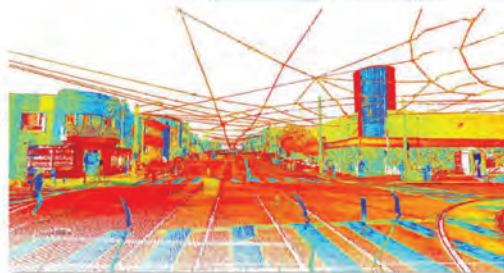
NO EYEPIECE, NO BUTTONS – JUST A CATCH

Six years ago Trimble was the first manufacturer to incorporate laser scanning in a total station and more than 20 years previously their ancestor company Geotronics launched the first robotic total station. The latest development heralds a long forecast future for surveying without eyepieces. Externally the SX10 has only one operable catch or button on it; and that's for the battery housing. Measurement is controlled via a tablet PC controller which displays the image from the coaxial telescope camera.

Apart from having an angular accuracy of 1mm and distance

Key Trimble SX10 System Features

- **Trimble Lightning 3DM** provides combined high-accuracy surveying and true high-speed scanning
- **Enhanced Trimble VISION** imaging system for instrument control and documentation
- **Advanced Autolock tracking** keeps you locked on and working
- **WiFi and long range radios** provide confidence on any site



TRANSFORMING THE WAY THE WORLD WORKS



accuracy of 1mm±1.5ppm in prism mode, the SX10 offers reflectorless distance measurement to 600m (accurate to 2mm ± 1.5mm) and a full dome scanner that can capture point clouds at over 26k per sec. No less than five onboard cameras inform the user or enable tracking, levelling or capturing a panorama in 2.5 mins. All of this is housed in a sleek modern case with IP55 rating and with a working range from -20° to +50°C. Enough for Antarctica or the Saudi desert. But be prepared to think £40k if you're buying.

The key to all this technology working productively lies in the software. It's good to report therefore that point clouds and camera scenes from the SX10 are automatically registered with survey stations, including if scanning is paused for any reason such as battery swaps. Indeed, it marks another change in the way we work: a scene once captured enables the real surveying to be done back in the warm office environment. Hmm. . . are we witnessing the slow end of those rugged outdoor types with eyelids forever half closed searching far horizons and the emergence of a plumper, paler surveyor, like most other office workers?

Onboard the TDC100 tablet the latest version of Trimble's Access software (v2016.10) controls all functions on the SX10. Wi-Fi communication has a range of 100m while long-range radio

space in a day to an accuracy of a centimetre. To give some veracity to these claims, the cart managed to capture Los Angeles' Lax airport in 30 hours – a total of 1.8 million square feet. Impressive.

. . . are we witnessing the slow end of those rugged outdoor types with eyelids forever half closed searching far horizons and the emergence of a plumper, paler surveyor. . . ?

extends this to 800m. Once captured, data moves to Trimble's Business Centre (v.3.8) which can now accept data from competitors Topcon and Leica.

MAPPING THE GREAT INDOORS

Chris Harris introduced TIMMS, Trimble's indoor mapping system for 3D documentation. Essentially this is a cart to be pushed around a building to capture 3D data. Its sensors comprise a laser scanner (supplied by Faro), cameras and PosNav inertial sensors developed by Applanix, one of Trimble's growing portfolio of companies. The whole assemble weighs in at 50kgs and, according to Trimble, can capture up to 25,000 square metres (or 45 rooms per hour) of internal

Getting BIM into the field was the title of another presentation which involved Trimble Connect, a cloud solution. We also learned about Tekla, a suite of CAD and BIM software owned by Trimble. Tekla enables structural calculations, clash detection, planning of temporary works like formwork ahead of concrete pours and quantities take off.

Other technologies on show included senseFly's latest eBee UAVs. The Plus model which includes a camera specially developed for drones and the SQ model which comes with the Parrot Sequoia multi-spectral camera with applications in agriculture and land use.

Modelling a vineyard canopy with UAV Imagery

UAVs have become a popular low-cost and convenient small-scale remote sensing platform for aerial monitoring and survey applications. In Precision Agriculture (PA) they have proved their potential for small-areas, providing data on crops and crop status. Applications have also yielded useful information in viticulture for vineyard managers and small vineyards in both the UK and Switzerland (e.g. Green, 2012a and b; Green and Szymanowski, 2012c and d; Fahrenttrapp et al., 2015).

Precision Viticulture (PV) is based on the existence of spatial and temporal variability within vineyards and is made possible by using four important geospatial technologies: GPS, Remote Sensing; GIS, and digital mapping. PV can be implemented as a cyclical process comprising three steps:

1. **Observation and data collection** through either proximal sensing (physical contact) and/or remote sensing.
2. **Data interpretation and evaluation** processed and analysed using GIS software
3. **Implementation or modification of the vineyard management plans according to the information acquired.**

In this example, two off-the-shelf Ready to Fly (RTF) UAVs, carrying two types of low-cost commercial miniaturised cameras were used to acquire imagery of a small vineyard in Italy, at a number of different spectral wavelengths. The study focused on analysing intra-vineyard variability to provide information about differential management practices with the primary intention

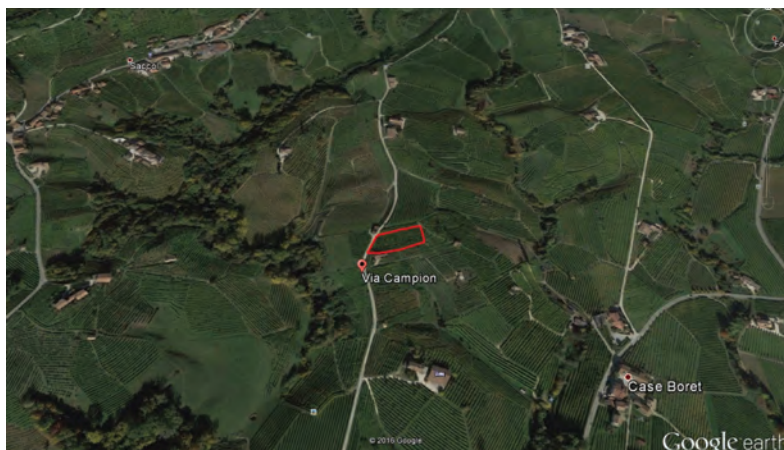


Figure 1 - Map showing the location of the area studied

of increasing awareness about how such technologies can be beneficial to the vineyard manager and potentially lead to change, which may in the longer term reduce costs and/or improve the quality of the wine and increase profits.

STUDY AREA

The study centres on a small area devoted to the production of wine grapes which are the basis of Prosecco di Valdobbiadene, a sparkling wine named after the area where the vines are grown,

namely Prosecco di Conegliano e Valdobbiadene DOCG, which lies in the hilly northern part of Treviso province (North-Eastern Italy). Prosecco is the 44th Italian wine to obtain the Denomination of Origin from the European Union (EU) (Figures 1 and 2).

The study area lies in the village of Santo Stefano di Valdobbiadene (Province of Treviso) at a latitude of 45.89° N and a longitude of 12.02° E and covers around 1950m². The vineyard surveyed is 8ha in total and



Figure 2 - The vineyard

NO.	UAV	GIMBAL	CAMERA	COMMENTS
1	DJI Phantom 2	Zenmuse H3-3D	GoPro Hero 3+ Silver Edition	IGotU geotagger was attached to the UAV
2	3D Robotics IRIS +	Tarot 2D	Mapir Survey 2 - NDVI model	NA

Table 1 – UAV and sensor equipment used in the study

is scattered over several different locations with plot sizes ranging

(Normalised Difference Vegetation Index) camera - sensitive to both

In order to geo-reference the imagery, four Ground Control Point (GCP) markers were placed across the area studied.

from 3ha to 0.02ha.

The vineyard is characterized by a mixture of deep soils with a high clay content, and shallower soils made up of sand and marlstone. The presence of different soils associated with areas of varying slopes and aspects (gentler in Conegliano and steeper in Valdobbiadene) has led to the definition of a number of micro-zones. Location near the Alps and the coast provides a stable, mild climate, with a yearly mean temperature of 12.3°C and a constant breeze that dries the grapes after the rain. Annual rainfall is around 1250mm with heavy showers in the summer. Altitude ranges from 100-500m above sea level (asl) with a good daily thermal range and the hills, stretching from east to west allow the southern facing slope to be planted with vines. Management practices are traditional manual labour and there is currently no digital record keeping.

Red (650nm) and Infrared (850nm) wavelengths - was used to capture images containing information about the health and status of the vines. A total of 1263 RGB images and 202 Red-NIR images were acquired. As the DJI Phantom 2 does not store telemetry data a small GPS logger (IgotU) (see Table 1) was attached to one of the legs in order to record the spatial coordinates after which the log file was downloaded and used to geo-tag the images (Figures 3a, b, c).



Figure 4 - A yellow plastic wrap used as a Ground Control Point (GCP)

In order to geo-reference the imagery, four Ground Control Point (GCP) markers were placed across the area studied. The markers consisted of three yellow, non-reflecting, pieces of plastic placed on top of vine trellis posts with an additional GCP at the corner of a building (Figure 4).

Image pre-processing assigned a coordinate to each image, as neither the GoPro or the MapIR cameras are GPS enabled, and therefore do not assign a spatial location to the photographs. The geotagged images were then sorted to allow choice of the best for processing. The images were subsequently geo-coded using two different software packages:

1. The images collected with GoPro camera were synchronised initially with TripPC software provided by

EQUIPMENT

Details of the UAV and sensor equipment used are shown in Table 1.

The GoPro Hero camera was used to capture standard colour (RGB) imagery, whilst the MapIR NDVI



Figure 3 – UAV Platforms (DJI Phantom 2 and 3D Robotics Iris+/GoPro Hero 3 and MapIR)

>

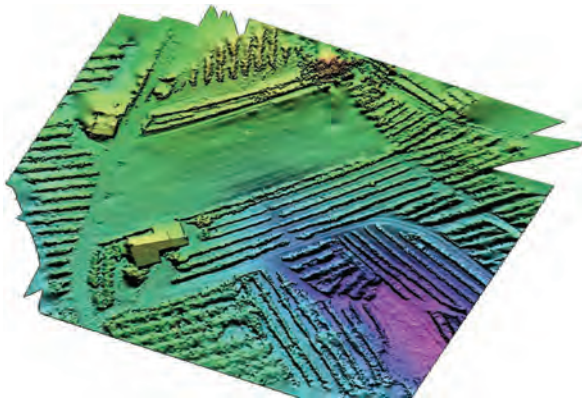


Figure 5 - Digital Terrain Model (DTM) of the area studied

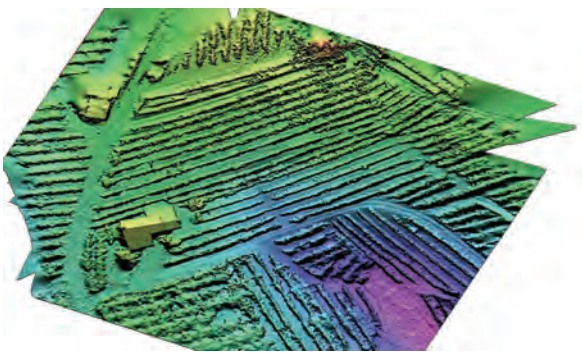
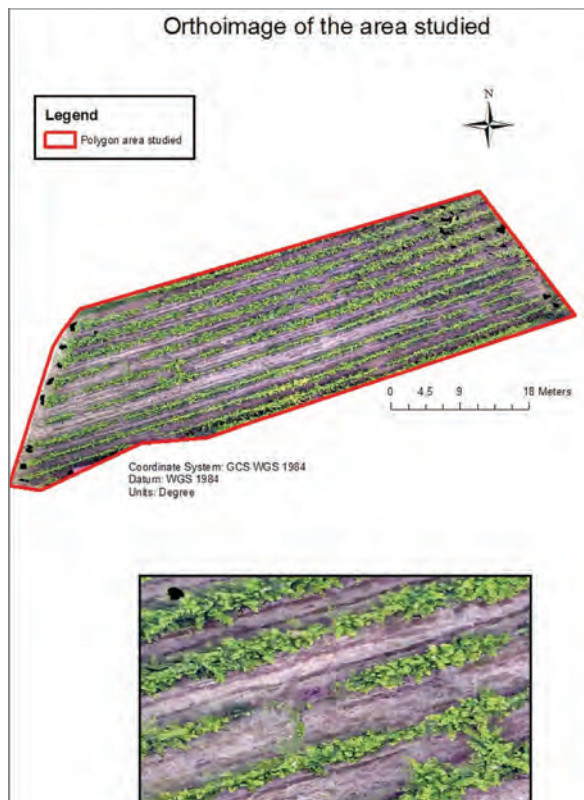


Figure 6 - Digital Surface Model (DSM) of the area studied



Figures 7a above and 7b right show ortho-images of the study area from RGB images.

- IgotU GPS logger (<http://www.igotu.com>)
- The images acquired with MapLR camera were geotagged using Mission Planner, free software provided with the 3DR Iris+, which uses a three-step process to pair the images with the flight GPS coordinates.

Building a 3D model of a vineyard using Structure from Motion (SfM) Structure from Motion (SfM) is a photogrammetric technique in which a number of RGB images taken from different positions are overlapped in order to recreate a 3D model of physical objects. The points created have 3-D values (X, Y and Z coordinates) to create a “point cloud” to which colour information is then added (Mathews, 2013).

Geotagged images were input to Agisoft Photoscan software (www.agisoft.com) for processing into a point cloud. Subsequently, a Digital Surface Model (DSM) and a Digital Terrain Model (DTM) were rasterised from the dense point cloud. The last step was to construct a high-resolution orthomosaic from the source photos and the DSM. The DTM and DSM were also used to derive a DDM (Digital Difference Model) representing only the vineyard canopy using **Equation 1** (**Figures 5, 6, 7a & 7b**):

Equation 1: $DDM = DSM - DTM$

INFORMATION LAYERS

A Topographic Wetness Index (TWI) map was also computed using the Topographic Index tools (<http://www.arcgis.com/home/item.html?id=b13b3b40fa3c43d4a23a1a09c5fe96b9>) in ESRI's ArcGIS software. This index was calculated according to **Equation 2:**

Equation 2: $TWI = \ln(FA+1) / (\tan((S)3.141593/180))$ where: **FA** is the **Flow Accumulation** and **S** is the **Slope** degree

Knowledge of the TWI is very important in viticulture as it is highly correlated with soil depth, organic matter content, phosphorous content and percentage of silt. The DTM also serves as a base raster layer from which to calculate a solar map that expresses insolation at a certain location. The tool used for this computation was Area Solar Radiation (Esri ArcGIS Spatial Analyst Extension: <http://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/an-overview-of-the-solar-radiation-tools.htm>). Using data from between April and October, the output was a group of raster maps where each image pixel contained a value representing the insolation (Whm^{-2}).



The orthomosaic generated from the RGB images was used to separate the vineyard canopy from the ground using Trimble eCognition developer software. In eCognition (www.ecognition.com) the RGB orthoimage was first segmented and pixels were grouped according to criteria of scale and colour. Multi-resolution segmentation allows one to obtain homogeneous vectors from an image. The segmented layer was then classified using the nearest-neighbour algorithm in order to separate the vineyard's canopy from the ground and classification was based on colour and texture. The nearest-neighbour classification allows one to get samples from the feature classes and to define a "positive" class (in this case the vineyard's canopy) and a "negative" class (the ground). The class "canopy" was then exported as in ArcGIS for visualisation.

SUMMARY AND CONCLUSIONS

The importance of spatial variability in vineyards is often underestimated due to the lack of affordable tools to acquire and quantify the information as well as the expertise to process and interpret the information. The information acquired from this project shows how off-the-shelf hardware and software - in the form of UAVs and softcopy photogrammetry and image processing software - can successfully be used to create a 3D model of a vineyard and additionally, useful layers of information to support decision-making by the vineyard manager.

In this example, low-cost equipment demonstrated how affordable tools can successfully be used to gather data in order to enhance knowledge about a complex environment such as a vineyard.

Being able to acquire a DTM and derivatives such as the solar radiation layer has important

agronomic implications. For example, when replanting a vineyard, an agricultural implement such as a grade-leveller, guided by a laser, could be used to modify the slope of the vineyard and in turn to

still quite expensive and also require specialist expertise to use, analyse and interpret the results. Ideally RTK GPS enabled UAVs, e.g. using a Navspark (www.navspark.com.tw) or Piksi (www.swiftnav.com/

. . . a photogrammetric technique in which a number of RGB images taken from different position are overlapped in order to recreate a 3D model of physical objects.

enhance the solar radiation captured by the plants. This could help to optimize under-performing areas by improving the photosynthetic activity of the plants and possibly increase the sugar content of the grapes.

Whilst UAV and sensor hardware are now both more affordable and relatively easy to use, aside from some of the freely available apps and open source software, softcopy photogrammetry and image processing software are both

piksi.html) unit would also help to improve the locational accuracy of the imagery and the resulting layers of information.

ABOUT THE AUTHORS

Luca Zanchetta and David R. Green¹ 1UCEMM, Department of Geography and Environment, School of Geosciences, University of Aberdeen, Scotland, UK. d.r.green@abdn.ac.uk | www.abdn.ac.uk/research/ucemm

REFERENCES

- Fahrentrapp J., Hafele M., Schumacher P., Gomez C., Green D., 2015. Identifying Physiological Differences in Highly Fragmented Vineyards Using NIR/RGB UAV Photography. **Proceedings** of GIESCO 2015. pp. 660-663.
- Green, D.R., 2012a. Geospatial Tools and Techniques for Vineyard Management in the 21st Century. In, **Geography of Wine: Studies in Viticulture and Wine**. Chapter 13. Percy H. Dougherty (Ed.). Springer. 255p
- Green, D.R., 2012b. Grape Expectations - Digital Data in the Vineyard. **GIS Professional**. Issue No 46. June 2012. pp. 16-19.
- Green, D.R., and Szymanowski, M., 2012a. Monitoring, mapping and modelling the vine and vineyard: collecting, characterising and analysing spatio-temporal data in a small vineyard. **Proceedings** of Ninth International Vitivinicultural Terroir Congress 2012 (ITC2012). 25-29 June 2012, France. 12p.
- Green, D.R., and Szymanowski, M., 2012b. Grape Expectations: 'Terroir' Explained – Collecting, Characterising and Analysing Spatio-Temporal Data in a Small Vineyard. **GIS Professional**. Issue No. 48. October 2012. pp. 16-19.
- Mathews, A.J., and Jensen, J.L.R., 2013. Visualizing and Quantifying Vineyard Canopy LAI Using an Unmanned Aerial Vehicle (UAV) Collected High Density Structure from Motion Point Cloud. **Remote Sensing**. 2013, 5(5), 2164-2183

Topcon's Elite show at Olympic Park

GW recently saw how Topcon's Elite software suite integrated with the company's latest hardware. The venue was next to the structural steel eyesore, or elegant sculpture, depending on your point of view, known by the snappy title of the AcelorMittal Orbit. Reaching it involves a hard trek from Stratford Station through the temptations of the Westfield shopping centre, paying close attention to easily missed signs.



FC5000 and Hybrid GNSS

In the September/October issue of GW we reported on Topcon's new suite of integrated hardware and software aimed at survey professionals. Last November we had the opportunity of hearing in more detail what this suite can do from Topcon's **Peter Roberts** and **Mark Billingsley**, senior trainer for the company's geospatial and construction division.

In an era when clients expect to give surveyors the CAD design drawing so that they can take it to site for setting out, Roberts has a vision of elevating the site surveyor from peg basher to site data manager through software. So let's see how Topcon's solution can help that process along.

As previously reported, Elite relies on Topcon's MAGNET enterprise software, now in version 4.0. The current hardware line-up for Elite includes the new GT series of total stations, a six model range with ultrasonic motors, bright colour touch displays and integrated cellular modems; the Hybrid GNSS, a 452-channel receiver that weighs just 1kg and can be used as a network rover or base station; and the FC5000 controller, a rugged tablet running Windows 10 with a 4g SIM card. Topcon has also introduced a tilt function for their detail pole (up to 15° out of vertical will be corrected).

MAGNET, described as a cloud solution for the enterprise, is the way that Topcon connects the field with the office environment. With a cellular link and Wi-fi between the field elements, transferring data should be a breeze. Mark Billingsley regards the system in the same way as an iPhone: you take a photo and instantly it goes to the iCloud, enabling anyone with permission to view it in their browser. "It's a three-way communication – field, cloud, office. It gives simultaneous access to a data file to anyone working anywhere in the world with an internet connection."

Demonstrating the system, Billingsley showed how a user's access is defined by a specific email address. Uploading is simple and follows similar principles to Dropbox. Files are set up for each project: clicking on a project immediately syncs the user with that project, enabling data to be transferred. The survey itself can be viewed, checked and overlaid on background imagery or mapping. Once uploaded, the system can send an SMS message to others in the project loop. It is also possible for users to see who else is currently online. A "chat" message appears on the controller, rather than a personal mobile, which may be switched off.

Like most solutions these days MAGNET Office is very much icon driven through a series of apps. Billingsley regards it as "the glue that brings the hardware and software together". Core apps are the Data Manager and Map, which georeferences the survey. "What MAGNET gives you", he

says, “is reporting and visualisation of the survey.” Data is viewed in a spreadsheet environment. The reporting functionality also includes productivity, enabling managers to see how productive the survey crew were by identifying points over time, distance and the sequence in which they were captured. You are being watched!

Once in the cloud, the raw data can be processed and checked for integrity before going into a CAD file (Bentley or Autodesk). Observations are identified by whether they came from GNSS or optical readings.

The Roads app which Billingsley demoed, is a comprehensive design tool that includes plan, profile and cross-section views plus

intersections, sub-grades, cut & fill volume comparisons and even 3D fly-through simulations. From there the survey can be smoothed, kerbs added, cross-sections created at defined intervals. Once finished, the file can be sent to a client, back to the field for setting out or to a machine control system.

Topcon uses their own unique file format across all the company’s platforms. Known as TP3, it enables data as diverse as localisation, GPS calibration, a road, points indeed any entity which goes in a design file, to be incorporated within one file. It is used across Topcon’s portfolio of apps – topo, mass data collection, UAVs, static scanning, drainage, railway design, BIM visualisation and more.



Eyesore or sculpture?

Geo-matching.com

The world’s largest product database for **surveying, navigation and machine guidance**



**Offshore
Renewables**



Hydrography



**Habitat
Mapping**



Oil & Gas



**Land
Surveying**



**Precision
Agriculture**



Mining



Infrastructure



Cadastre



**Cultural
Heritage**



Forestry



Construction

Add your products to Geo-matching.com by registering online today!
www.Geo-matching.com

**JOIN
US!**

Mobile Mapping chez Leica

Leica Geosystems mobile mapping day featured the UK release of two new pieces of equipment and a refresh of two others. The day at Milton Keynes was a mix of indoor presentations and outdoor demonstrations, reports Richard Groom.

Leica ProScan is a new three-wheeled trolley-based scanning system with a P40 scanner, which can be used indoors or outdoors. Position fixing is by total station tracking and IMU both indoors and outdoors. For outdoor work there is in addition a GNSS receiver. What makes this system special is that, when controlled using total-station tracking, it can achieve a point-cloud accuracy of 5mm, which means that it can compete with static scanning and is potentially much more productive in certain situations. Example applications include measurement of asphalt courses during road construction and survey of large relatively open areas without steps – like factories.

RAIL TROLLIES

SiTrack:One is a rail trolley system. It carries a P40 scanner, 1000Hz IMU, spheres for self calibration, an optional GNSS and two laser odometers, which measure distance along the track. The system can also be fitted with pairs of lasers (DMI's) for each rail that measure the rail shape, and therefore rail wear, precisely. The system comes with a suite of software for field operation, data processing and analysis. Alan Barrow has been given the task of assessing SiTrack:One with the intention of getting it approved for use on Network Rail. This is work in progress, but he was able to give an insight into the tests. He has chosen a length of London Overground between Gospel Oak and Barking,



which has recently been surveyed by ABA Surveying. The test involved surveying the same length of track as surveyed using the SiTrack trolley with two Amberg trolleys and a rail shoe observation at all 10m markers. He is making use of observations to permanent survey control, installed at 200m intervals, to assess the control needs for a SiTrack workflow. The hope is that the DMIs will improve the accuracy of chainage – a problem with mechanical odometers, which slip on the track. Because it is possible to reverse-engineer the trajectory of the trolley, it could encourage rail engineers to order as-built surveys – a key aspect of BIM. Will this be a second generation trolley? We wait to see.

VEHICLE SCANNING

The Pegasus:Two and Pegasus Backpack systems have both been refreshed. Leica has sold three Pegasus:Two systems in the UK and claims that it is still the most accurate on the market when used with the Z+F scanner. Users who already have a P40 scanner can mount it on Pegasus and there is a version that uses Velodyne scanners. And for those who just want to take imagery, there is a camera-only version. The Pegasus:Two only carries one scanner but the reasoning for this seems logical: the roads are now so congested that you need more than one pass to survey a motorway and,

by observing using different scanner configurations and in different directions you achieve denser point clouds and data redundancy and greater chance of avoiding obstructions. The point cloud can also be constrained using ground control points, which can control in plan, height or 3D. For the future, Leica is looking at adding external sensors and a second Z+F scanner – for rail applications only. Pegasus:Stream is a Pegasus:Two combined with a ground penetrating radar array towed behind the vehicle. It collects GPR data as well as observing point clouds. Utilities up to 4m deep can be surveyed, depending on ground conditions. There's also a pavement camera, for collecting data on pavement defects.

SCANNING ON THE HOOF

The Leica Pegasus:Backpack carries two Velodyne scanners: one for point cloud data collection and a second for position-fixing using SLAM, the simultaneous localization and mapping algorithm, when working indoors. There is a GNSS receiver for position-fixing outside and both inside and outside position fixing is aided by an IMU. The quoted accuracy of outdoor point clouds is 35mm (2.5 σ) and for indoor point clouds is 50mm (2.5 σ). The cameras can be used for photogrammetric observations. It is possible to include control points in the post processing of the data.

From cricket, a citrus sculpture to a 40-foot deep bubble cave

Honouring Australia's sporting heroes and the surveyors whose work enabled a vast irrigation project as well as creating a sculpture of 100,000 oranges! There's also space for a tour of the deep. . .

Brush Farm Historical Society had me as their guest speaker on the two great maps of the 1830s created by two of our greatest colonial surveyors, Sir Thomas Mitchell and his nemesis Robert Dixon. The society holds their meetings in the house built by William Blaxland in the 1820's after he, Lawson and Wentworth succeeded in finding a route over the Blue Mountains to Sydney's west in 1813.

RIVERINA RECONNOITRE

A brilliant Topp Tour of Australia's food bowl took us through Boorowa and Borellan (birthplace of our tennis great Evonne Goolagong Cawley and home to the large tennis racquet in her honour). Our final destination was to an area of southern NSW not possible without the surveyors responsible for the accurate levelling and planning needed to facilitate an irrigation project as vast as the Murrumbidgee Irrigation Area (MIA), named after the river injecting the major quantity of water for the scheme's viability.

After a period of troubling drought the region was threatened by floodwaters rising after heavy downpours in surrounding areas. However, we were in Griffith to see the first showing of the citrus sculptures made from over 100,000 oranges (and the same number of rubber bands!) in one of only two places in the world where such an exhibition is mounted. The other is held in the little town of Menton on the French Riviera using lemons.

Staying in Leeton, which together with Griffith was designed by Walter Burley Griffin, the winner of the competition to plan our capital city Canberra, we went to Whitton, Binalong, Darlington Point, Narrandera, Grong Grong, Aria Park historic town and Young. Altina Wildlife Park saw us escorted through the reserve by Clydesdale horse-drawn wagon to get up very close to their many inhabitants including white lions, wild dogs, bison, giraffes, rhinoceroses, zebras, maned wolves, hyenas, bantengs and the very endangered bongo antelope. I tell you I'd hate to be at a buffet meal with the wild dogs – they make short work of whatever is tossed in their general direction in a wild frenzy of feasting.

ANMM TURNS 25

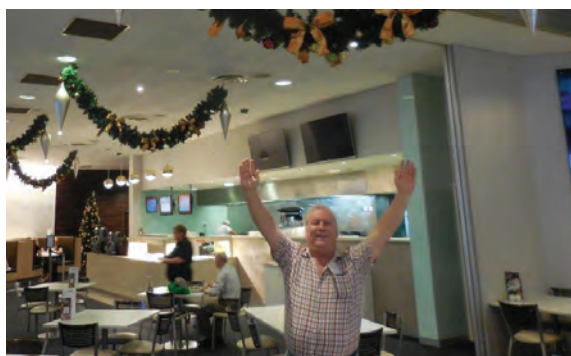
My favourite museum, the Australian National Maritime Museum of which I am a founding member, celebrated its silver anniversary with a dinner attended by over 200 guests, 39 of whom had been with them since day one in 1991. Fabulous speaker David Mearns told us of some of the iconic wrecks which his deep-sea diving team had identified such as HMS Hood as well as the boat that sank it, The Bismarck along with a book release about his 2008 discovery of HMAS Sydney lying at 2468m (8097ft) off the coast of Western Australia since it went down losing all 645 crew in November 1941 only five days after they had found the German ship HSK Kormoran involved in the mutual sinking not far away. His team Blue Water Recoveries Ltd has the Guinness World Record for such a mission at 5762m (18,904ft) to locate the German blockade runner Rio Grande from WWII.

CHRISTMAS CRUISING

Starting the festive season with a cruise around one of our great bays Port Hacking (named after First Fleeter Henry Hacking and near Cronulla Beach) is a great way to get into the mood for the New Year with a Topp Tour on the MV Gunnamatta. Going past an area where there is a 12 metre (40 feet) deep bubble cave highly praised by the legendary Jacques Cousteau made us realize how well regarded our waterways are worldwide. A very Happy and safe New Year to all GW & DUC readers for 2017.



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.



Brocky's festive plumb bobs. Photo collage of ANMM's 25th anniversary dinner.

Jonathan Davy FRICS - the face of Walker Ladd

A dedicated chartered land surveyor who specialised in boundary disputes and who became the face of renowned Bristol based firm, Walker Ladd.

Over the years Jonathan Davy inspired many young land surveyors, whether he was their boss at Walker Ladd, the local RICS branch chairman, or their APC councillor or mentor. For those colleagues who worked at Walker Ladd, many experienced at first-hand the range and ability of a remarkable chartered land surveyor who secured an impressive catalogue of wide-ranging projects; from the McLaren F1 centre, to the Severn Tunnel, Heathrow T5 and even working in the remote wilderness of the Falkland Islands. Whatever the project was, Jonathan either led the work in his inimitable style and to the highest standards of professionalism, or mentored and supported those young surveyors who were tasked with often the most extraordinary survey work. Part of his legacy are those grateful surveyors, many of whom he started on the right path and who now enjoy their own successful survey practice.

Jonathan was born in Orrel and initially educated at Westbourne Prep School, Sheffield. He completed his schooling at St Bees School, Cumberland and Deer Park Comprehensive in Cirencester before heading to N.E. London Polytechnic to complete his Diploma in Land Survey in 1976. After taking his RICS finals exams in 1977 he worked for six months in Australia, where his father had settled, enjoying a

period with the Melbourne Public Works Department and a further six months' travel.

On his return to the UK he settled in Bristol and started work under Don Walker and Rex Ladd at their firm Walker Ladd & Co. He worked briefly with both Longdin & Browning and MJ Rees in his early career, before taking over as managing partner of Walker Ladd when founder Don Walker retired. The firm went from strength to strength and was purchased by Atkins in 1999 to form the core of their Survey and Mapping department. Jonathan enjoyed six years as an associate director within this large multidisciplinary consultancy, before departing in 2005 to re-form Walker Ladd as a smaller practice, focusing on his expert witness work and boundary dispute surveys. Despite being diagnosed with a brain tumour in 1999, Jonathan continued to enjoy work and was never hindered by

his illness. It was only in the last three months of his life that he finally stopped site work in order to relax and spend more time with his family.

Jonathan married Caroline in 1979 and they had four wonderful boys. Whilst at school he played squash to county level and was always in a team wherever he lived. He loved all sport in particular rugby, surfing and sailing. His other love was music and Jonathan played guitar throughout his life enjoying folk music and playing at various clubs in Bristol where he also sang with two choirs. He loved travelling, socialising and was always on one committee or another, or as chair of a school, club or professional organisation. Jonathan was a dedicated proud father who valued his family life above all else and is survived by Caroline, their four boys and one granddaughter.

Jonathan Edward Davy: Born 20th September 1955, died 20th August 2016.



How do you apply the UK constitution, if you know what it is?

In a fairly recent book (2009, *The New British Constitution* by Vernon Bogdanor, Hart publishing, Oxford) the author considers how the Constitution has changed since 1997. Crucially he states: 'Nevertheless, the radicalism of the reforms should not be under-estimated, nor the challenge they offer to traditional assumptions about the constitution. These assumptions, in particular the principle of the sovereignty of Parliament, have been crucially and, almost certainly, permanently undermined.'

An earlier book (1999, *Constitutional Futures: A History of the Next Ten Years*, Edited by Robert Hazell OUP, Oxford) is prescient about the Royal prerogative in that Hazell says: '... the shadowy and confusing notions of the Crown and the Royal prerogative, which are still important sources of ministerial power (to make treaties, . . .) will gradually be replaced in the language and reasoning of the courts by sharper concepts of State and the executive. This will both reflect the reality of greater judicial control, but in turn make them more susceptible to further judicial control.'

That is enough of textbooks. Enter Gina Miller and her application for judicial review on the issue of: 'Does the Government have power to give notice pursuant to Article 50 of the Treaty on European Union of the United Kingdom's intention to withdraw from the European Union, without an Act of Parliament providing prior authorisation to do so?'

The Court of Appeal stated that an Act of Parliament was needed. The Government, that is the executive, appealed to the UK Supreme Court. Unusually all eleven of the Supreme Court judges sat (the presiding judge, Lord Neuberger happens to be a past recipient of the RICS Michael Barrett award). Between 5 and 8 December 2016 the following case was heard: R (on the application of Miller and another) (Respondents) v Secretary of State for Exiting the European Union (Appellant) Case ID: UKSC 2016/0196.

The Attorney General had three points:

1. The foreign affairs prerogative is a contemporary necessity and essential for the effective conduct of public business.
2. The prerogative operates as part of a dualist system, including in the EU context. (In a dualist system a treaty ratified by the Government does not alter the laws of the state unless and until it is incorporated

into national law by legislation. This is a constitutional requirement: until incorporating legislation is enacted, the national courts have no power to enforce treaty rights and obligations either on behalf of the Government or a private individual).

3. Parliament understands the constitutional function of the prerogative and where it chooses to limit them it does so specifically.

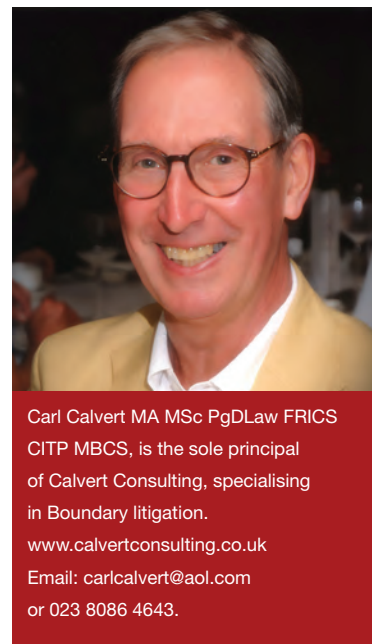
Lord Pannick QC for the appellant, Gina Miller, had seven points three of which are given below:

1. The Referendum is not under consideration. It is the scope of the prerogative power which is the issue.
2. Submissions as to why the prerogative power to enter into or renege from treaties cannot validly be exercised so as to nullify statutory rights or obligations, far less, a new constitutional order which Parliament has created.
3. In any event, in the light of the purpose and the content of the 1972 Act, Parliament did not intend that what it had created could be nullified by a minister exercising the prerogative.

IT'S ALL ABOUT THE RULE OF LAW

Of course, the obvious question is what are prerogative powers? In a report by the House of Commons in 2009 (SN/PC/03861) the opening paragraph, paraphrased somewhat, is as follows. Originally prerogative powers were exercised by the reigning monarch. The distinction has emerged between the monarch acting on his or her own capacity, and the powers possessed by the Monarch as head of state. In modern times, Government Ministers exercise the majority of the prerogative powers either in their own right or through the advice they provide to The Queen, which she is bound constitutionally to follow. There have been calls to reform prerogative powers, chiefly because they are exercised without any parliamentary authority.

The problem facing the Supreme Court is not Brexit or not, but, in my opinion a far more important issue of the rule of law. And, by the time you read this the Supreme Court will almost certainly have given their judgement.



Carl Calvert MA MSc PgDLaw FRICS
CITP MBCS, is the sole principal
of Calvert Consulting, specialising
in Boundary litigation.
www.calvertconsulting.co.uk
Email: carlcalvert@aol.com
or 023 8086 4643.



Leica's BLK360 weighs in at 2kg and is sub \$16k.

SCANNER REVOLUTION

Leica Geosystems has announced a miniaturised 3D imaging laser scanner offering 4mm accuracy for an amazing \$16k. The product was revealed at Autodesk University 2016 and will be bundled with Autodesk's ReCap 360 Pro and the new ReCap 360 Pro app for iPad, so you will have to factor in software and iPad costs to the package.

The BLK360 captures full-colour panoramic images overlaid on a high accuracy point cloud. One-button operation offers a simple user experience via an iPad to capture the world around you with high-resolution 3D panoramic images. Other features include a 60 metre measurement range for full dome scan that takes only 3 minutes. It also comes with infrared sensors for thermal imaging and cameras to produce spherical imaging with HDR support and LED flash.

Using the ReCap Pro 360 mobile app, the BLK360 streams image and point cloud data to an iPad. The app filters and registers scan data in real-time. After capture, ReCap 360 Pro enables point cloud data to be transferred to CAD, BIM, VR and AR applications. The integration of BLK360 and Autodesk software is expected to dramatically streamline the reality capture process thereby opening this technology to non-surveying individuals.

BLK360 & Autodesk ReCap 360 Pro Bundle will be available to order in March 2017 and will be sold online through Autodesk's distribution network. The anticipated bundle suggested retail price is \$15,990/€15,000, which includes scanner, case, battery, charger and an annual subscription to ReCap 360 Pro.

2MHZ AIRBORNE SCANNER

RIEGL has introduced an ultra high performance, fully integrated and calibrated dual-channel airborne mapping system RIEGL VQ-1560i. Based on the company's waveform processing LiDAR technology, the system is capable of online waveform processing as well as full or smart waveform recording, resulting in unsurpassed information content on each single target.

The new VQ-1560i provides a laser pulse repetition rate of up to 2MHz resulting in more than 1.3 million measurements per second on the ground. It operates at varying flight altitudes up to 15,500 ft with a wide range of point densities. The system is ideally suited for aerial survey of ultra wide areas as well as complex

urban environments. The scanner has a unique forward/backward looking capability enabling data capture from multiple angles.

FALCON 8+ SYSTEM FOR NORTH AMERICA

Topcon Positioning Group has announced the Intel Falcon 8+ System, a patented V-shaped eight-rotor UAV for the US and Canada markets. The new generation Falcon features the triple redundant AscTec Trinity autopilot and has full electronic system redundancy. It also includes the Intel Cockpit ground control and the Intel Powerpack smart battery system.

Eduardo Falcon, executive vice president and general manager

for the Topcon GeoPositioning Solutions Group says, "It offers the best performance and weight-to-payload ratio in the entire market, as well as the highest stability in harsh conditions, easily exchangeable and deeply integrated payloads, best-in-class safety and high-precision GNSS."

XCAM AND XMAP WORKING TOGETHER

GeoXphere is a new UK-based company that launched last year with the support of US airborne hardware manufacturer WaldoAir and aerial survey and solutions provider Getmapping, UK. The aim is to bring the airborne survey sensor, XCAM, together with adaptable cloud-based GIS services for the benefit of partner survey companies around the world. WaldoAir's XCAM and XMAP, a cloud GIS in use by Getmapping, are offered to exclusive market and territory partners on a subscription basis.

Chris Mewse, managing director of GeoXphere commented on the positive feedback received at Intergeo. The company's new team had a very busy week and were overwhelmed by the reaction to the XCAM and Cloud GIS, Mewse said: It's being seen by many survey companies as a disruptive technology that can give them a competitive edge against traditional operators of large format cameras and even UAVs. By utilising a camera system that attaches to any aircraft without survey modification, they can rapidly expand their offering and win more work. They can then upload the results into their Cloud GIS portal and deliver the data directly to the end client.

GeoXphere have already signed up exclusive market partners in East Africa, North West Europe and South East Asia where the cameras and GIS are being utilised for a variety of projects. The XCAM range of RGB, near infrared and

thermal cameras are showing great results in sectors such as powerline management, mining, agriculture and municipalities.

SIMACTIVE RUNS IN CLOUD

Photogrammetry software developer SimActive has announced that processing in the cloud is now officially supported by Correlator3D. Users can subscribe to an online computing service, such as Amazon EC2, and run Correlator3D on a virtual machine.

Correlator3D is a patented end-to-end photogrammetry software for the generation of high-quality geospatial data from satellite and aerial imagery, including UAVs. The main advantage of processing in the cloud is the capability to use multiple licenses as required. It permits an on-demand deployment of the software on several processing machines, without any computer hardware. The new option allows customers to continuously adjust their processing power, said Louis Simard, CTO of SimActive.

CARDINAL SUPPORTS UAS IMAGERY

Cardinal Systems has introduced VrUAS to its Vr Mapping software. The company provides mapping software for the handling of digital spatial data and is the developer and provider of the Vr Mapping software suite. Vr Mapping supports the use of UAS imagery and while much of this falls within the parameters of existing, time-tested photogrammetric applications, other newer applications assist with the process. These include applications such as camera calibration and digital surface model (DSM) generation.

Included in the full Vr Mapping VrUAS bundle is the ability to perform aerial triangulation (automatic tie point and bundle adjustment), create digital surface models, and produce

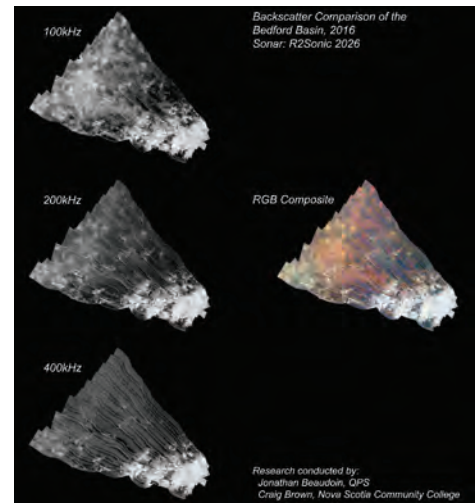
MULTISPECTRAL MULTIBEAM

R2Sonic, LLC has developed MultiSpectral Mode, which enables collection of backscatter data at multiple frequencies in a single pass with a single system. Hitherto users of Multibeam Echosounders (MBES) with the capability to measure acoustic backscatter intensity across the survey swath, have collected data limited to a single chosen frequency. As a result, traditional backscatter is typically displayed as a monochrome or single colour image, representing a single data point for each bottom location.

In contrast, multispectral data is collected at several widely spaced frequencies, providing an additional dimension of information compared to simple single frequency intensity. Multispectral backscatter combines several single frequency backscatter measurements to create a final comparative result. A multispectral backscatter mosaic can be generated as an RGB composite image with each colour representing backscatter intensity at a different frequency.

Multispectral backscatter is an active area of research showing promising results. Potential uses include efficient mapping of seafloor characteristics, bottom type discrimination and feature identification as well as habitat mapping for environmental applications.

Read more about recent research conducted in the Bedford Basin using the Sonic 2026 and the MultiSpectral Mode at <http://www.r2sonic.com/news.php>.



Backscatter comparison of imagery captured in MultiSpectral mode from the Bedford Basin survey by the Sonic 2026 multibeam

orthomosaics. The VrTwo and VrThree Modules allow for true 3D viewing, vector collection and editing from stereo images and point clouds. The modular design of the software allows for compatibility with other processing packages, allowing Vr Mapping to continue a project started using another software.

SCANFLY MOBILE MAPPING

3D Target, an Italian manufacturer, is launching a new Scanfly product. Scanfly is a turnkey solution for 3D Lidar mapping, specifically designed for UAVs. The Scanfly can also be installed on any other type of vehicle (aerial, terrestrial and marine).

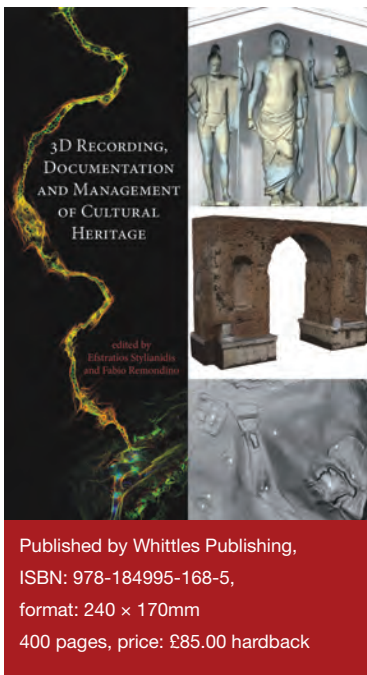
An optional panoramic camera allows photographic documentation of surroundings. A backpack option will be available

soon. SLAM algorithms aid the integrated IMU (INS+GNNS) to achieve the best accuracy even with satellite outage. The point cloud is available in most common formats or for smart processing, 3DT proprietary software.

The basic system features include the Velodyne VLP-16 Lite scanner, accurate survey-grade IMU (INS+GNNS), double antenna – double receiver RTK GPS/Glonass, integrated board for control, data capture and synchronisation, and smart-processing Lidar software for Lidar/GPS/IMU fusion. Additional options are a 5MPx global shutter camera and a high-resolution panoramic camera.

**Launching a new product or service?
– Make sure you email editor@geomares.co.uk**

3D Recording, Documentation and Management of Cultural Heritage



At a time when the world's tangible cultural heritage is subject to an unprecedented variety of natural and anthropic threats, fortuitously there has never been more innovative technologies available in the conservator's toolbox to help document and manage it for future generations. This in itself, however, presents more challenges than solutions to the modern day professional. For example, how best to record data (photogrammetry or laser scanning) and how best to manage it (GIS or BIM?) for any particular cultural heritage project? This work helps guide us through the basics of documentation, via non-complex explanations of modern-day techniques, the application of which are demonstrated by numerous case studies.

The first thing you notice on picking up this textbook is its high quality production; advertised as "liberally illustrated, full colour throughout", it feels as if almost every one of its glossy pages is adorned by either a simply beautiful cultural heritage image or a refined technical drawing. Pleasingly, the high quality of the publication doesn't end with its presentation! Indeed, the editors, Efstratios Stylianidis and Fabio Remondino, have called upon no less than a further 11 highly respected international figures from the world of CIPA Heritage Documentation (see <http://cipa.icomos.org/>) to produce a reference text that rightly claims to be of value to "anyone involved with the application of such techniques to recording heritage".

The book is logically structured, with an introduction to current trends leading into a review of conservation techniques that includes many rich examples from around the globe. A relatively short chapter on management tools focuses on the role of both GIS and BIM, noting that they are both "simply a non-geometric database connected to a geometric database: therefore there is no reason, from a theoretical point of view, to talk about two different technologies". A comprehensive review on the basics of photography follows, logically sequenced ahead of the most equation-heavy chapter of the book on image-based modelling techniques.

A chapter on range-based techniques covers both terrestrial and airborne laser scanning, before the book concludes with a short overview of the burgeoning use of unmanned aerial vehicles (UAVs) in the sector.

One of the issues of any multi-author textbook of this kind is the inevitable differences in style and level of detail that can arise, even though chapter authors were presumably provided with a standard original brief. The seven chapters comprising the book are all logically connected, and for the most part they are also generally self-contained. Whilst this in itself can lead to a little redundancy in the overall content, this is generally healthy and it means that differences in writing style – compounded here a little, perhaps, by the multi-national author line-up – is not a significant issue.

More of a frustration to readers, however, might be the imbalance in the length and detail of various chapters. Chapter 4 on basics of photography, for example, accounts for nearly one third (125 pages) of the entire volume, whilst Chapter 7 on UAVs warrants a somewhat meagre 13 pages. Certainly, Chapter 4 will be one that will be referred back to time after time (and not necessarily only by those interested in photographing cultural heritage objects) whilst Chapter 7, at the admittance of the editors, does little more than introduce UAVs and highlight current problems and research challenges. Whilst this is doubtless a reflection of the two topic's varying levels of maturity, the concluding Chapter 7 does leave a somewhat open-ended feel to the text. Then again, with technologies and tools developing apace and increasingly heterogeneously, perhaps that is the intention. It should also be noted that the chapters all include individual reference lists for those who want to delve deeper into any particular subject.

The book should grace the bookshelf of any professional working in cultural heritage. Despite the criticism, it is evident that all chapters have been written by authors with real passion for their subject, as well as a vast wealth of experience; all have value. Any reader looking for a reference text on a particular aspect of cultural heritage documentation or management might want to flick through the pages to affirm its true worth to them before departing with their hard-earned £85. That single caveat notwithstanding, the book is highly recommended.

Reviewer: Jon Mills, Newcastle University



www.appsincadd.co.uk

Applications in CADD Ltd.
Surveying - Mapping
Modelling - Design

Complete 30 days free trial,
 no restrictions
 Discounts for multiple systems



t: +44 (0)1509 504501 f: +44(0)1509 600079 e: enquiries@appsincadd.co.uk
 21 Britannia Street Shepshed Leicestershire LE12 9AE United Kingdom

GW Classified Services

To advertise your company's expertise in the next issue, contact Sharon Robson on +44 (0)1438 352617 or sharon.robson@geomares.co.uk



Software for Land Survey Terrain Modelling Design Volumes

dtmsoftware.com



SonarMite Echo Sounder



www.ohmex.com



MBS Survey Software Ltd
 The trusted name in survey software

Still using pencil and paper?

020 3176 0984 | survey.mbs.com

Want to advertise with us? Call +44 (0)1438 352617 or email sharon.robson@geomares.co.uk

Next issue: March/April 2017 Copy date: 16th February

ADVERTISERS' INDEX

Geo Business	p. 04
Geo-matching	p. 31
J C White	p. 39
Korec	p. 23
Leica Geosystems	p. 06
MBS	p. 22
Riegl	p. 17
SCCS	Inside front cover
Survey Review	p. 39
Topcon	Back cover

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.surveymagazine.org. Orders and requests for inspection copies should be sent to: subscriptions@tandf.co.uk.

November/December 2016 Contents

- A new ZTD model based on permanent ground-based GNSS-ZTD data
- A solution to RPCs of satellite imagery with variant integration time
- Outlier detection by using fault detection and isolation techniques in geodetic networks
- A new quality validation of global digital elevation models freely available in China
- Distributed texture-based land cover classification algorithm using hidden Markov model for multispectral data
- The relation between structured cultural heritages and condominium towards 3D cadastre
- Alternative methods for teaching cadastre and remote sensing
- A mixed weighted least squares and weighted total least squares adjustment method and its geodetic applications



J.C. White Geomatics Limited

J.C. White Geomatics is a medium-sized land surveying practice with an unrivalled reputation, built on over 30 years' experience of providing a cost-effective, efficient and accurate solution to any surveying project.

A highly professional approach to carrying out surveys linked to an understanding of clients requirements married with the need to produce useable data to a high cartographic standard has been the bedrock of our growth and forms the core principle for our future.

Boundary Surveyor

As a Company we have always been involved in Boundary related surveys from preparing transfer plans to boundary investigation to disputes and in 2012 we took on an extremely experienced Surveyor specialising in this aspect of work.

Over the last 4 years the amount of this type of work has significantly increased and as such we are looking for a Boundary Surveyor to be based at our office near Hythe, Kent and be part of an extremely busy boundary section.

Main Tasks

- Carry out broad range of boundary related surveys
- Process survey information and generate final data to be issued to clients
- Liaise with clients

Attributes

- Minimum of HND qualification in Land Surveying
- Minimum of 5 years post qualification boundary survey experience
- Self-motivated, resourceful & ability to problem solve
- Preferably a working knowledge of Land Registry documentation
- IT literate with survey processing and CAD

Benefits

- Salary commensurate with experience
- Vehicle
- Pension

A skills assessment will take place at interview.

Further information on our Company can be found on our website www.jcwhite.co.uk

Please apply with your CV and a covering letter either via email jan@jcwhite.co.uk or post to: Mrs Jan Turrell, J.C. White Geomatics Ltd, Shrine Barn, Sandling Road, Postling, Nr. Hythe, Kent, CT21 4HE

Closing date: 28th February 2017



INTRODUCING

THE ELITE SURVEY SUITE



HIPER HR
ADVANCED CONNECTIVITY



FC-5000
COMPACT POWER



MAGNET 4
ALL ACCESS



GT SERIES
SUPERSONIC SPEED

MULTIPLE TECHNOLOGIES, ONE POWERFUL SOLUTION

Our new combination of products and services make your jobs faster, easier, and more profitable. Get the industry-leading solutions that can take your surveying to ELITE levels.