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GeoCom16: why location matters in data analytics

The value of GIS in Big Data to empower
River habitat monitoring by UAV
Removing the barriers from open data
Powering utilities with social media

EO data more accessible as investment rises
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The future of open data publishing

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GIS: a blueprint for gender equality

What made a GIS event different from other IT events was the large proportion of female delegates. So why, asks Esri's **Sarah Lewin**?

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A new portal to the world's most comprehensive collection of Earth Observation data is available, reports **Katherine Anderson**.

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Global Citizen Award for British Academic

An important body has made rare award to a leading GI expert whose career in GI and town planning has spanned nearly 60 years.

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The value of GIS in big data

The common operational picture is ideal for municipal authorities, says **Varun Adibhatla** of ARGO Labs. It helps implement equitable decisions.

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Why location matters in data analytics

AGI GeoCom16 featured a refreshed format with invited speakers in the home of geography. The editor reports from a stimulating day.

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River habitat monitoring with UAVs

The use of UAV's and associated technologies, off-the-shelf photographic and thermal sensors for river monitoring and mapping.

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The 2016 Geoforum Lecture

Held in the august surroundings of the RICS, **David Henderson** spoke on Ordnance Survey GB's move from mapper to collaborator.

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COVER: AGI GeoCom16 was held in the historic headquarters of the Royal Geographical Society. It featured a slate of invited speakers to address the topic of why location matters in data analytics. Turn to page 20 for the full report.

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welcome. . .
to the December 2016 issue of *GIS Professional*. . .

GeoCom grabs the headlines

The AGI's decision to change the format of the annual GeoCom conference from residential to a one-day event with invited speakers seems to have worked. Several of the presentations were outstanding. Big Data author **Timandra Harkness** set the scene very well, grabbing everyone's attention with a big data example drawn from the Ice Age!

Dr **Catherine Mulligan** also gave some headline-grabbing stats. If it's not appeared on your horizon yet, Blockchain computing is sure to arrive soon. It's a way of ensuring security for online transactions and is set to play a role in securing the Internet of Things. Currently its main use has been to secure Bitcoin transactions and is already consuming as much electricity as Ireland.

From developing risk-free navigation for drones, to relieving hunger, to green corridors and the underground, GeoCom16 was an event to really set you thinking. It was also rather grand to be at Britain's home of geography, the Royal Geographical Society, whose director general Dr **Rita Gardner** was on hand to kick-start proceedings. You can read our full report, starting page 20.

Staying with Big Data, **Varun Adibhatla** of ARGO Labs argues that there are benefits for local government by combining GIS and big data collected through low-cost street sensors and viewed through the platform of a common operational picture. This is collaborative technology and can only help break down walls and silos within government. Soon artificial intelligence will become significant. But, in the words of the old song, there could be trouble ahead. To quote a leading pundit, "In a field where reality testing is difficult under the best of circumstances, wherein authenticity can be assumed, an AI takeover may prove undetectable". Read more on page 18.

This issue (the last in the current form) sees the launch of a new column under the working title of "the elevator pitch". To reiterate for those unaware: you have a brilliant geospatial idea to take your organisation forward; you have just a few minutes in the lift with the CEO to convince him or her. What do you say? The idea is to be as concise and convincing as possible. The first in the series comes via Esri's start-up programme and it's all about an energy company using GIS and social media.

A visitor to GeoCom16, who last attended such an event say 20 years ago might notice quite a change in the audience. Today there are far more women in GI. Esri UK's **Sarah Lewin** comments on this phenomenon on page 15. The good news for the girls is that we're reaching equilibrium in the geo workplace, but there are currently more girls than boys on GIS courses.

It is now six years since the UK's data.gov platform was launched and four since the UK Government set out its vision for a data-based future of openness and transparency. While there are plenty of datasets available and being used, their use in high value authoritative applications is patchy. We're still a long way from realising those promised multi-billion pound benefits. The future, barriers to use and solutions are examined in detail by **Ed Corkery** and **Steven Ramage** (page 11).

We are delighted to honour Prof **Ian Masser** in this issue (page 17) who has received the rare GSDI Global Citizen award from the Global Spatial Data Infrastructure Association. *GISPro* congratulates Emeritus Professor Masser on this well deserved recognition, which celebrates a remarkable academic career spanning geography, town planning, GIS and INSPIRE with an underlying thread of spatial data infrastructures.

This column is all too brief. I had wanted to tell you all about *Connectography* and its advocate **Parag Khanna** but you'll need to Google him. Trust me, this guy is on to something. I'll try and tell you more in the next issue when I've finished reading his book.

Enjoy this issue. We shall return in the new year with a refreshed design. Stay safe and enjoy the seasonal break.

With all good wishes.

Stephen Booth, Editor



This is collaborative technology and can only help break down walls and silos within government.



Tree map saves time



A detailed 3D map of trees is helping Lichfield Council assess planning enquiries by providing immediate insight into the impact on trees of planning applications. The data comes from Bluesky's National Tree Map, which identifies the location, height and canopy cover of more than 280 million trees nationwide, complementing other map layers like aerial photography.

"We have been using the Bluesky National Tree Map data. . . it has become a resource on which many officers have come to depend," says Gareth Thomas, the council's corporate GI manager. The data enables the exact location of trees and their proximity to other features or assets in order to make decisions about the tree's future maintenance and conservation. For trees already afforded some protection, through Tree Preservation Orders (TPOs), for example, the Bluesky data is being used in considering planning applications and even potential prosecutions in the cathedral city.

Users in the council are also accessing the data for emergency planning and response, where the number and location of trees may have an impact, such as falling on essential infrastructure in extreme weather conditions or forest fires. The National Tree Map data is also helping to monitor and understand potential increases or decreases in tree numbers in an area which is home to the National Memorial Arboretum.

Bournemouth is 5g guinea pig

In the UK, the mapping agency Ordnance Survey has been chosen by the government to develop a planning-and-mapping tool for the national rollout of 5G technology, the next generation of wireless comms needed to bring internet-connected devices into everyday life.

OS will lead a consortium, which includes the Met Office and the University of Surrey, to build a 'digital twin' of the real

world to be used to identify prime locations for radio antennae. To be trialled in Bournemouth, a test bed for the national rollout of 5G, if successful the tool 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.

The project will link spectrum and meteorological data in a highly accurate digital model of the real world, with

added attributes and intelligence. Networked sensors and beacons will depend on seamless access to a 5G network with higher frequencies and significant increases in bandwidth, which these devices demand. However, higher frequencies 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 with higher frequencies to assure widespread national 5G coverage.

Higher frequencies also mean much larger amounts of data can be sent and received than at current mobile frequencies. This is important for meeting the increasing demand for bandwidth brought about by the growth of the Internet, and it is vital to the future success of new tech concepts, including Smart Cities, the Internet of Things (IoT) and driverless vehicles.

An issue with the rollout of a 5G network is that details like 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 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 place antennae using the data visualisation tool, the vast majority of the work could be done from a desk.

Welcoming the planning tool, Professor **Rahim Tafazoli**, director of the University of Surrey's 5G Innovation Centre, said "The consortium has world class and highly complementary expertise. Meanwhile, the Met Office says that weather can

degrade performance of networks at higher frequency bands, adding that their expertise in both numerical weather prediction and remote sensing of the atmosphere can contribute to realistic high-resolution weather scenarios and associated impacts on signal transmission.

HOT needs your help

Humanitarian OpenStreetMap Team (HOT), which featured in the April 2016 edition of *GISPro*, is a global online community of volunteer humanitarians applying the principles of open source and open data to create and provide free, detailed and up-to-date maps for NGOs and local communities fostering economic development, enhancing disaster preparedness and engaged in emergency relief.

HOT and its partners need your help with several of its mapping projects. All mapping projects can found on the OSM Tasking Manager: tasks.hotosm.org

The OSM Tasking Manager introduces mapping projects, explains what needs mapping and divides mapping projects into small mappable squares. Right now, you could help map Maputo, the capital of Mozambique, to help MSF develop strategies to fight TB and HIV/AIDS in the city (task 2337), Cité Soleil, Haiti, to help Concern Worldwide and the local community mitigate against risks of conflict and disaster (task 2320) and Blantyre, Malawi, to help the American Red Cross combat measles in the city (task 2304).

In other news, December sees the launch of HOT's second annual crowd-funding campaign. The focus this year is raising funds to support the direct needs of volunteer-led HOT/OpenStreetMap projects across the globe. Further

details will be posted on hotosm.org in the coming days.

For more regular updates on HOT, follow HOT on Twitter ([HOTOSM_ID](https://twitter.com/HOTOSM_ID)), join HOT on Facebook and subscribe to the HOT newsletter by submitting your email address at the bottom of hotosm.org

Council collects extra £320,000 from data matching

A current hot topic in UK local authorities is a consultation from the Department for Communities and Local Government on 'Self-sufficient local government: 100% business rates retention'. Whether or not the proposal goes ahead, business rates are an important source of funding for LAs and the very highest collection rate is a priority.

Bath and North East Somerset Council decided to review its processes around business rate collection and its existing sources of intelligence for new potential rateable properties by integrating information from planning, building control and licensing with the business rates department. By using the Unique Property Reference Number (UPRN) of every individual piece of land and property in the council, it revealed an additional £320,000 of business rates within the first six months.

The council's **Steve de Bruin** explains: "From analysing our internal processes, I noted that although planning applications for business premises were put on the council website, they were not joined with the business rates team. It was clear that we needed a mechanism to enable the departments to work better together". By using the UPRNs held in both databases, the systems were brought together for easy access, viewing and

analysing. The system also demonstrated other aspects which could flag a change in rateable values such as businesses that had expanded.

Warrington to centralises GIS

Cadcorp's mapping software has been chosen by a UK north-west council to modernise a range of services. Following a competitive tender, Warrington Borough Council awarded the contract to the British software developer to centralise its GIS, enabling the council to better target services and customers able to use the system to pin-point issues and report them online. Cadcorp's technology will replace the current intranet based GIS solution and the public facing internet solution, to provide consistency between the internal and external user.

Microsoft move for Esri

Esri is collaborating with Microsoft on MS Power BI and Azure to make geospatial analytics available to a broader audience. ArcGIS will be integrated into the business intelligence Power BI analytics allowing enterprise users to create dashboards, reports, and data visualizations through a cloud-based service. Currently with more than five million subscribers, Power BI will be able to leverage integrated data and geospatial analytics, including interactive basemaps, US demographics and secure access to organizational data.

In addition, ArcGIS Pro can be part of the virtual desktop in the Azure cloud platform in a desktop as a service (DaaS) configuration as part of a growing collection of integrated cloud services. ArcGIS Pro as a service on Azure enables GIS users to visualize, edit, and analyze geographic data in both 2D and 3D, as well as share work

with others.

John Doyle, director, Microsoft Power BI, adds "When armed with a strong geographic understanding, Power BI users can make informed location-based business insights for everything from allocating resources to the best places to start a new business."

Esri has also announced a similar cooperation with IBM users and developers by making GIS data and technology available in IBM's cloud.

Council links data with UPRNs

Salford City Council is introducing an 'Intelligent Information Provision' concept aimed at linking data in its existing systems to give people better digital access. The move is underpinned and connected by the Unique Property Reference Number (UPRN) from the corporate address dataset and will give the council better insight into customer needs.

The council's CRM and its profiling product in the city's contact centres provides information on where customers live, the type of calls and how and when they make them. Staff use a profiling database, which categorises residents in many ways such as by demographics, abilities, age, skills, employment status etc. It is a detailed product with around 60 different profile types. The data in these two datasets is now linked through the UPRN and the types of contacts are shown alongside the customer's profile and location. The council will use this combined data to push the right information to customers through the website to encourage more self-service through on-line transactions.

John Gibbons, Authority Address Custodian said; "The

system is designed around residents' skills and needs. . . It means that information can be delivered much quicker to self-sufficient customers who are able to access council services at a time that suits them. It's 'quicker, easier and better' (our delivery aim) for residents to get services through the website".

Quality of service charter

As spatial data infrastructure (SDI) now plays a critical role in the smooth functioning of contemporary society, the Open Geospatial Consortium is launching a charter for a proposed Quality of Service and Experience (QoSE). OGC believes that despite their critical nature, SDIs may suffer from sub-optimal configuration, malfunctioning hardware, or other factors that ultimately affect the accessibility of that data. The closely related fields of Quality of Service (QoS) and Quality of Experience (QoE) deal with estimating, reporting, and improving the experienced quality of communication between distributed systems to inform the SDI users of the suitability of the service for the users' needs.

OGC's QoSE domain working group will provide a forum for discussing the evaluation of the QoS and QoE of an SDI as whole, and, when appropriate, propose corrections and enhancements to the existing OGC standards (or externally governed standards) and guidance to make it easier to improve the experienced quality of Spatial Data Services. The draft charter for the QoSE DWG is available for download from <https://portal.opengeospatial.org/files/71360>

Drone test crashes

The Department for Transport,

Graduates and students snapped up



The RGU graduates and students with John Hanson (front left), owner of IDS, and Program Manager Colin Dawson (front right)

A Scottish company providing operational reporting to the upstream oil and gas industry has snapped up five Robert Gordon University graduates and current students to more than double its current team. Independent Data Services' Colin Dawson explains: "In being an RGU graduate and current student myself, I know first-hand the skills and experience that RGU graduates bring to the table. Most have experience in oil and gas or at least some exposure to the challenges that exist in the technology sector in this market, which is key to what we do at IDS. The employment market across Aberdeen is awash with data managers, and ITIL (Information Technology Infrastructure Library) qualified service delivery managers, but it lacks data scientists and product visionaries".

The Aberdeen University's culture provides in-depth knowledge of the subject and also prompts students to develop innovative & disruptive solutions. Senior lecturer at RGU's School of Computing Science and Digital Media, Dr Ines Arana, adds: "The school places great emphasis on the industry focus of its undergraduate and postgraduate courses, benefiting from a panel of industrialists whose opinion is sought to ensure the currency, desirability and demand of the courses' content".

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 being 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 by general 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".

Cyber threat may go physical

With many cyber security experts wary that smart city technologies are being adopted faster than the technology needed to protect them, a survey has revealed that 88% of state and local government IT professionals are concerned about cyber attacks targeting critical systems such as transport infrastructure or waste water treatment. The survey, by IT security specialists Tripwire, also found that over 80% believe such an attack could cause physical damage. "As we use more and more technology to innovate around the management of cities and their infrastructure, we also create new attack surfaces that can be exploited," said Tim Erlin, director of IT security and risk strategy for Tripwire.

Arizona opts for 1Spatial Technology

Cambridge UK based 1Spatial has won a contract to supply its 1Integrate product to Arizona's Department of Transport where it will be used to validate the state's road network. The move will enable the DoT to automatically quality assure the information it receives from the combination of fifteen counties and seventeen public-safety answering points (PSAPs) by validating it against a set of pre-defined business rules. They will also be able to match new data submissions against the current version of the road network to identify changes in geometry and other attributes and apply the changes.

GEO Business 2017: over 70% space sold

After the most successful GEO Business show to date, with over 2,200 visitors from a staggering 50 countries, organisers Diversified have

announced that over 70% of the exhibit space for 2017 has already been booked. Show director, Caroline Hobden, adds: "The overwhelming response to the third GEO Business has been phenomenal, both in feedback from exhibitors and visitors and also in the response to launching stand sales. Past exhibitors were given just two weeks to rebook their stand. The majority confirmed straight away and since then, new requests have been flooding in, leaving no doubt that GEO Business 2017 will sell out well in advance."

Feedback from this year's event was overwhelmingly positive with 95% of exhibitors and 99% of visitors surveyed rating the show as excellent or good. Atkins' Gavin Malyon commented: "A growing 'must attend' event on the Geospatial map, a great mix of hardware, software and technical papers/information under a single roof. Looking forward to next year already." Whilst Richard Birch of C&C Baseline Architectural, said: "We left inspired and excited about the potential improvements to our business practices and have since invested in some of the hard and software available at the show" and Jon Bylo of Fugro Geoservices, summarised the show as: "The best showcase for geomatics and geospatial business in the UK."

Call to improve status

The International Society for Photogrammetry and Remote Sensing (ISPRS) has called for proposals by 1st January 2017 to support funding of scientific and other initiatives to further improve its international status. For 2017, the ISPRS Council is making up to Sfr. 40,000 available to support new scientific initiatives. The maximum funding assigned to any one project will be Sfr.

10,000 per annum. Projects should commence on 1st February 2017 and typically last up to 12 months. More at www.isprs.org/documents/orange-book/app9.aspx

IN BRIEF

Esri is continuing its long-standing support of Code for America by sponsoring the 2016 Code for America Summit, which brings together leaders in the civic technology community to discuss the new ways technology tools can innovate services that government agencies offer.

Diversified Communications, the organiser behind the GEO Business event, have announced it will launch a commercial drone expo and conference in Brussels in June, 2017 based on the same format as its North American event. **Lisa Murray**, director of commercial UAV Expo, made the announcement during her welcoming remarks at Commercial UAV Expo in Las Vegas.

PEOPLE

Top honour for Masser

Professor **Ian Masser** has received the Global Citizen Award from the Global Spatial Data Infrastructure Association. A rather astonished Masser commented, "This is the greatest moment in my life. I couldn't believe my ears when I heard the news!" The rarely made award came at the association's conference in Taipei, Taiwan. *GISPro* congratulates Ian Masser, a regular contributor to our columns.

Fellow professionals have added their congratulations on the award. Dr **Muki Haklay** said, "his contribution to the area of geographic information management and research in

Europe and international is highly important and long standing. The evidence to his vision is in the continued activities of AGILE, EUROGI and GSDI and the importance of his academic and practical work in this area."

Dr **Suchith Anand** added: "Well deserved. Congratulations on behalf of the GeoForAll and the Open Source Geospatial Foundation on your excellent achievement and contributions to the geospatial community over the years."

Meanwhile, former AGI CEO **Chris Holcroft** expressed his delight at the award and said, "Ian was a leading light in the development and comprehension of national and international SDIs. Indeed, he played an important role in the AGI's understanding and activity and communication with regard to INSPIRE. I'm sure that all who worked with Ian will be extremely pleased to see his international work and career celebrated like this."

For a full report and a review of Prof Masser's career, which marks a lifetime achievement in GI, turn to page 17.

Ramage to support GEO

Steven Ramage was recently appointed to head stakeholder engagement and external relations for the Group on Earth Observations (GEO) to provide access to and sharing of open Earth observations data. Commenting, GEO secretariat director **Barbara Ryan** said: "We are really pleased that Steven has joined the team, he brings significant experience working across our community, having worked extensively across both the private and public sectors. His visibility and network in the international arena will help us achieve a number of our goals, he has already chaired our first ever commercial sector panel at

our annual Plenary event and it was a great success."

Canada, Ghana, Japan, Jamaica, Kenya, Singapore, the UK and US have all invested in open data portals. Many of their datasets are available on the GEOSS Portal; for example, more than 20,000 data records from <http://data.gov.uk> are now live and discoverable. However, government engagement in GEO goes beyond data sharing and, alongside Defra and the UK Space Agency, the National Centre for Earth Observation (NCEO) is working to increase visibility of GEO to the UK Earth Observation community.

Gardels Medal for Tillman

Stan Tillman has received the Open Geospatial Consortium's prestigious Kenneth D. Gardels Award. The annual award goes to individuals who have made an outstanding contribution to advance OGC's vision of GI fully integrated into the world's information systems.

As the primary representative in OGC of Hexagon Geospatial's Intergraph, Tillman has worked tirelessly to foster communication and build constructive partnerships within the Technical and Planning Committees, as well as with those working outside of OGC activities. He has contributed his expertise to numerous Working Groups, and the Technical Committee as a whole, and has shown great leadership in collaboration.

Hexagon Geospatial president **Mladen Stojic** said, "Stan exemplifies many of the values that define Hexagon Geospatial. He is professional, innovative, and entrepreneurial. He is focused on the customer, engaged with them and their needs, and seeks to deliver the best solution to them. Those who have worked with Stan know that he brings all of those values to his contributions at the OGC."

The Gardels Award is the OGC's highest honour to Consortium member representatives. It is given annually in memory of Kenneth Gardels, a founding director of OGC and OGC's former director of academic programs. Gardels coined the term "Open GIS," and devoted his life to the humane and democratic uses of GIS technology. He died at the age of 44 in 1999.

Bass joins Bluesky

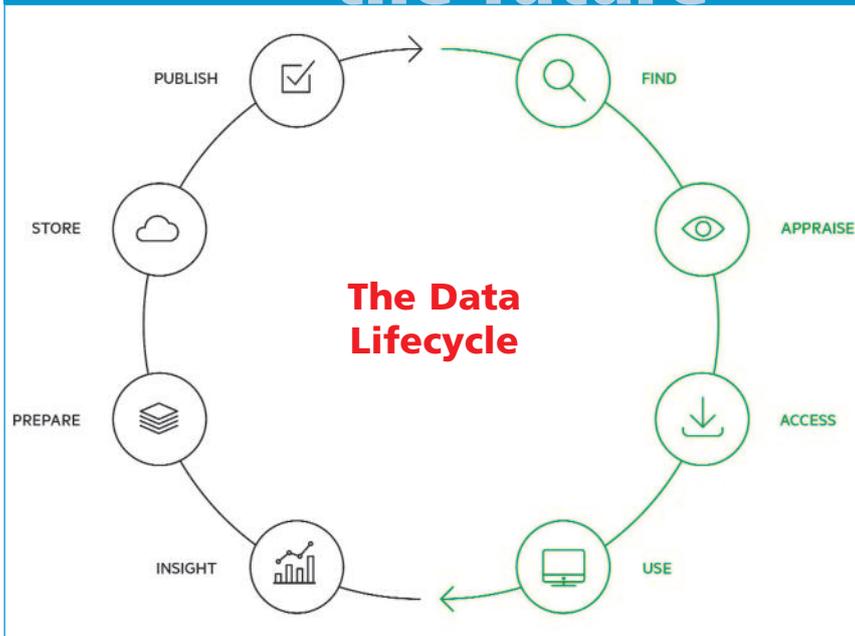


Aerial mapping company Bluesky has recruited **Kate Bass** to boost its expanding commercial team. Bass, who takes on the role of sales executive, holds master's degrees in both GIS and Criminology and has studied in the UK, Europe and the US. She previously worked as the first crime analyst in the Maricopa County Sheriff's Office in Arizona.

Bass will be responsible for promoting the use of Bluesky's expanding portfolio of geographic data solutions, including aerial photography, 3D height models, LiDAR, the unique National Tree Map and thermal surveys.

"Kate brings an international flair to the sales team, as well as first-hand experience in selecting and using geographic data within a testing real-world environment," commented **Ralph Coleman**, sales director at Bluesky International.

OPEN DATA: the future



A LOT CAN HAPPEN IN FOUR YEARS. In 2012, the UK Government published its Open Data White Paper, which laid out a vision for greater openness and transparency across the public sector. Crucially, the

From 'getting it out there' to 'getting it used.'

So, what's the problem? Well, the thing is—and this might sound counter-intuitive—the goal of the open data movement was never just “release more data.” The actual goal was to see a sharp increase in high-value use of authoritative data, across civil society, industry and government itself. And getting data used is hard. While the open data project has been successful in getting more open data on the Internet, it has struggled in generating the levels of use required to realise its initial vision (we'll talk about why this is the case later on).

This is not specific to the UK: every open government data project in the world has found it difficult to bridge the gap between 'getting the data out there' and 'getting it used.' While there are some great open data case studies, these are still relatively isolated. It is fair to say therefore that we haven't yet realised the full, transformative potential of open government data.

The particular case of geospatial This is particularly the case with geospatial data, which has the greatest potential to transform our society and

The future of open data publishing

The rise of open government data since 2012 has presented many opportunities for the UK. But there remain barriers to use and still much to do in improving both delivery and application, argue the authors, **Ed Corkery** and **Steven Ramage**. In this article they examine the real world workflows of potential users, contrast them with government agencies and offer some solutions.

White Paper was accompanied by strategy papers from each government department, providing concrete details on their commitments to release more authoritative data for reuse.

The vision for open data spelled out in the White Paper was a grand one indeed. Open data, the Paper stated, had the potential to realise economic benefits of £33 billion per year, as well as to make government more transparent and accountable to the public. In sum, open data had the capacity to transform government, society and the economy of the UK.

Four years on, the open government data project is widely seen as something of a success. This is especially the case in the UK, which has consistently topped the annual Open Data Barometer rankings. More concretely, there has indeed been a sharp increase in the amount of authoritative data released by government for free and open reuse. While it hasn't always been smooth sailing, open data publishing is gradually becoming business as usual in the UK. As was shown in the Open Data Institute's recent International Open Data Conference, this is increasingly the case globally too. And with the rise of the Open Government Partnership, more and more governments are beginning to make strong open data commitments.

economy, but has also the greatest barriers to high-value use. Geospatial professionals know these barriers all too well, particularly the low-level data wrangling tasks, such as sourcing and translating spatial datasets published across a range of government websites. These rudimentary, somewhat painful tasks have, unfortunately, become part of the job.

But what about those who lack geospatial training and software? What about the multitude of architects, engineers, analysts, designers, draftsmen, researchers and more, all those involved in the projects that determine how we understand and shape our planet? For these folks, the process of accessing and using data can be truly daunting. Indeed, lacking specialist software and training, simply finding, downloading and appraising large and complex geospatial datasets from a variety of sources and translating them into the formats they need—such as DWG, or geospatial PDFs—is nearly impossible.

For the open government data project to realise its potential, we need to find a way to reduce these barriers. Otherwise, industry, government and civil society will continue to bear the heavy transaction costs of accessing and using authoritative geospatial data.



... the potential to realise economic benefits of £33 billion per year, as well as to make government more transparent and accountable...



The workflows of data users To tackle this problem, we need to go back to basics, and examine the real-world workflows people are using to find and access data. This sounds like a complex task, given the sheer diversity of potential users. But for our purposes, we can simplify the geospatial data workflow into four general steps:

FIND APPRAISE ACCESS USE

The aim, for government agencies publishing open data, is to reduce the bottlenecks and pain-points at each of these steps. These pain-points include:

FIND: Data is scattered across a multitude of servers, catalogues and portals.

APPRAISE: Data needs to be downloaded in its entirety and imported into a specialist application before users can tell if it's useful for their project.

ACCESS: Data is made available in specialist formats that require training or expensive applications to translate and combine.

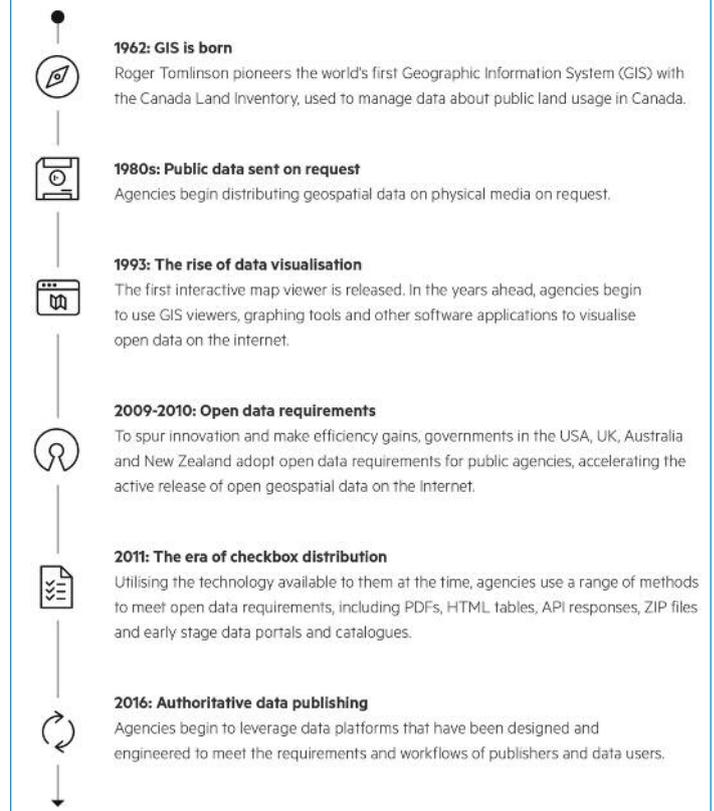
USE: Data lacks OGC web services and APIs to enable the creation of new products and services.

As you can imagine, these are difficult problems to solve: geospatial data is sourced from various local and national government agencies; it can be large in size and complex; and the industry uses a range of open and proprietary file formats that can be hard to translate and combine. To make this even more difficult, whatever solution public agencies adopt needs to be designed for both geospatial and non-geospatial professionals.

Authoritative data publishing Now for the good news: We have, over the last few years, witnessed an explosion in new geospatial applications. Enabled by more affordable and secure cloud storage, increasingly sophisticated web browsers and powerful open source tools, a range of companies are radically expanding the reach of the geospatial industry. Organisations like Mapbox and Carto, for example, have made it easy for developers to edit and customise maps for popular applications, as well as to generate visualisations and location intelligence. And a range of other organisations are providing open data catalogues and portals, including Esri, Socrata and CKAN.

These new technologies have been accompanied by exciting, increasingly affordable developments in the profession itself, including BIM, UAVs, LiDAR and the increasing amount of geospatial data from the social sciences and humanities. The work of international bodies, such as the Open Geospatial Consortium and the ISO TC211, have produced open geospatial standards that have provided the foundation for global geospatial interoperability.

The GIS timeline



The same transformation has occurred in the world of open data publishing, where we can see the rise of new data platforms that have been specifically engineered to address the pain-points and bottlenecks for data re-users. One such platform, from Koordinates, has been developed alongside New Zealand government agencies, including Land Information New Zealand, and hosts a range of international public datasets—including over 7,000 from New Zealand and 12,000 public data layers from the USA.

These new platforms enable government agencies to move beyond 'getting it out there' to we might call authoritative data publishing—publishing primarily geared to generating far greater levels of high-value reuse.

The solution So what does this look like? Let's return to the data user workflow we introduced earlier on:

FIND Users need to be able to search across all of the UK's open geospatial data in one place. At the same time, agencies need to be able to publish on their own custom, branded websites. The ideal solution here is to ensure that data published on the site of Agency A simultaneously appears alongside data published on the site of Agency B, and vice versa, and so on, for every government agency in the UK. This expands the user-base for each agency, and also increases the value of the data to users, who can layer data from multiple sources together in their browser.



Users need to be able to search across all of the UK's open geospatial data in one place.



OPEN DATA: the future

APPRAISE Users need to be able to preview, layer and perform simple spatial queries in their browser – before they download any data. A great deal of the waste in the existing system comes from not knowing exactly what data you’re getting until after it’s downloaded and imported to your application.

ACCESS Geospatial data can be truly massive, so users need to be able to crop multiple data layers to a specific extent. They also need to be able to export to their own specific file format, including non-GIS formats like DWG and geospatial PDF—regardless of the file format in which it was published.

USE More technical users need spatial query APIs and, for geospatial professionals, OGC compliant WFS and WMTS web services, to enable access to the latest data version and build new products and services on open government data.

Taken together, this new workflow enables all users to get the data they need, without leaving their browser or subscribing to expensive and complicated software.

What this means for government agencies

Of course, this won’t entirely solve the problem of open data reuse. Alongside the workflows of data users, we have the publishing workflows of government agencies themselves. At the moment, these workflows are highly variable, depending on the size and nature of each organisation. But here, too, we see a range of pain-points and bottlenecks that can be partially streamlined with a specifically engineered data platform.

Import Agencies need to be able to add data directly from their internal data sources, and automate regular updates via API. They also need data to be cleaned and verified on import, to ensure users don’t experience errors.

Store At the platform-level, agencies need their data automatically SEO-optimised, and stored in such a way that it can be previewed and repackaged on-the-fly for data users.

Publish At the site-level, agencies need their own branded site, with built-in licensing, metadata and granular access controls.

Insights Before publishing more open data, agencies need rich analytics to understand user behaviour and make informed investment decisions.

Taken together, this leads to an integrated lifecycle of open data, where agencies see higher levels of reuse, and users see more releases of open data.

The future work of geospatial professionals

The geospatial sector has always had a communications problem. It can be hard to explain to

friends, family, students — and, occasionally, managers — exactly what geospatial professionals do. Too often, we end up radically simplifying the profession, and under-selling the value we provide. After all, how many geospatial professionals have, after several frustrating attempts to explain spatial, resort to the dreaded ‘we do maps’?

Some of this is unavoidable. The vocabulary we use is peculiar, and the software we rely on is expensive and, though extremely powerful, dauntingly complex. But surely some of the problem is because we have unnecessarily large barriers to the basic tasks of accessing, previewing and using geospatial data.

We need to continue to remove these barriers. Simply put, you shouldn’t need to be a GIS professional to access and use open data—especially open data from government agencies, which is so fundamental to our society, economy and environmental. That’s the easy stuff. Spatial analysis, project delivery and customer engagement—that’s the hard stuff, and that’s the stuff that provides greater value to our clients.

Open government data is here to stay. And as data publishing practices evolve, the geospatial sector will find an increasing number of people understanding geospatial data; and, as a result, understanding how the geospatial sector can add value. This promises to be just one part of the transformation that occurs when authoritative geospatial data is made both open and re-useable for everyone.

About the authors



Ed Corkery is CEO and co-founder of Koordinates. Ed is a firm advocate for the potential of open and shared geospatial data to transform our society, economy and environment.



Steven Ramage is head of global stakeholder relations at the Group on Earth Observations (GEO) advocating open EO data and good practice. He is also a member of the GiSPRO Editorial Board and a contributing editor.



...how many geospatial professionals have, after several frustrating attempts to explain spatial, resort to...‘we do maps’?





Adena Schutzberg has worked in geospatial technologies for more than 25 years. She is a member of the Esri Education Team.

I RECEIVED AN E-MAIL A FEW WEEKS ago from a potential Esri Massive Open Online Course (MOOC) student. He wanted to know why he had to wait until the start date to begin the course. "Why," he asked, "can't we start whenever we want?"

It's a great question and I thought a bit before answering. My basic answer was that we were trying to create a learning community. A MOOC I took on educational technology introduced me to the idea that a learning community has:

- diverse members
- shared goals
- regular meetings
- knowledge sharing

Our MOOCs create a time and place for all those things to happen. The time is a four to six week period and the place is an online learning management system. While students can simply plough through the material without interacting with anyone else, I'd argue more is learned and it's more fun to learn with others. By opening up new lessons once a week, we encourage students to help each other and learn together as they tackle the same material at the same time.

collaborative learning, exploration, and map creation using mapping tools and technologies." There are chapters all over the world or you can start your own.

Avid Geo (<http://avidgeo.com>) - This is my local geospatial group lead by one fellow at a Boston GIS company. The group has formal and informal gatherings and got behind the bid to bring FOSS4G to Boston.

Reddit (<http://reddit.com/r/gis>) - This is a great online learning community. The tricky part here is that the participants need to manage the "regular meetings" part. I drop by a few times a week and nearly always learn something. I contribute, but not that often.

University of Cincinnati GIS Learning Community - "The goal of the community is to create a user-driven forum for novice and expert practitioners alike to come together and discuss tools, resources and solutions to questions, as well as to explore new projects that develop as researchers consider the spatial aspects of their data."

GIS Gang - This is a very special learning community headed by a sixth grade teacher at a private middle school in Michigan. After some professional

Finding your geospatial learning community

MOOCs are in the news on this side of the ocean. *GISPro* first highlighted these online learning communities in the August 2016 issue and Oxford University recently announced a MOOC in Economics (<http://www.bbc.co.uk/news/education-37975359>). In her regular column, **Adena Schutzberg** examines how they work and suggests some sources for those keen to update their skills.

Unconference sessions as learning communities

I'm involved with another learning community at Esri. I volunteered (or was volunteered, I don't really recall) to lead the "Self-organized Sessions" at the Esri Education GIS Conference. "Self-organized Sessions" are a few hours for attendees, rather than the conference hosts, to decide on topics and to explore them. It's another way we enable a learning community. I found this great quote on Twitter from an attendee about this sort of session: "There is no expert in the room. The expert is the room."

Are you in a geospatial learning community? Should you be?

How often do you put yourself into a learning community related to your work in geospatial technology? Have you taken a course? Have you participated in an event that offers peer learning rather than individuals (experts) dropping pearls of wisdom in front of PowerPoint slides? If not, there are number of existing communities to explore.

Maptime (<http://maptime.io/>) - "Our mission is to open the doors of cartographic possibility to anyone interested by creating a time and space for

development to learn about GIS, the teacher invited students to join her, before school, to learn about maps and mapping. There were ups and downs and some chaos, but also lots of learning.

What makes a learning community thrive?

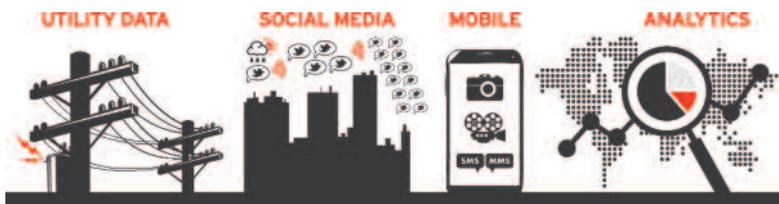
I've watched many geospatial learning communities (both online and face to face) come and go. What do those that survive have in common? I'd offer these best practices:

- Energetic leaders who pass the torch - the founders of MapTime stepped down when they felt burnt out.
- Core of active participants - the leader(s) depend on others to keep the group active. At Reddit, devoted volunteer community moderators keep the peace and clear out spam.
- Focus on the topic- Learning communities that get too broad can't retain shared goals.
- Distance from commercial interests - Learning communities should be fundamentally about learning, not selling.

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...great quote... from an attendee about this sort of session: "There is no expert in the room. The expert is the room."

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Data from utilities and crowdsourced social media information are analyzed to make better, faster decisions.

DATA CAPABLE IS A STARTUP THAT BUILDS and delivers software-as-a-service (SaaS) solutions tailored for the utility industry. Its flagship product, UtiliSocial, is a social engagement platform that provides utilities with real-time aggregate outage reports, customer sentiment feedback, weather event data, situational awareness, logistics support, and analytics. When the City of Seattle, Washington, asked for help in developing proactive communication software that could integrate with the city utility provider's existing outage management system (OMS), DataCapable presented a cloud-hosted solution paired with Esri's geographic information system (GIS) technology.

Agile adaptation Empowered with Esri's GeoEnrichment service and ArcGIS Online, the DataCapable UtiliSocial platform gives Seattle City Light the ability to harvest social media data and generate powerful visualizations while engaging with customers. The platform combs social media channels such as Twitter for specific terms and topics related to the utility, and when someone comments about these, staff get real-time notifications so that they can act fast.

The data is mapped and presented on a dashboard, showing when and where customers engage with the utility. DataCapable's platform also displays other collected information such as demographics, consumer behavior statistics, natural environment datasets, surrounding utility information, and sensor data. Utility communications personnel are able to view and analyze this information and interact with customers via UtiliSocial. Information filters into the utility's OMS to help speed response. Staff can also see how weather events are impacting surrounding utilities and predict how these storms may impact their territory.

Powering modern utilities with social media

In the first of a new series of elevator pitch type columns, **Kurt Daradics**, Esri startup program manager, introduces a start-up company that's delivering SaaS solutions to utility companies enabling them to see how customers are reacting on social media.

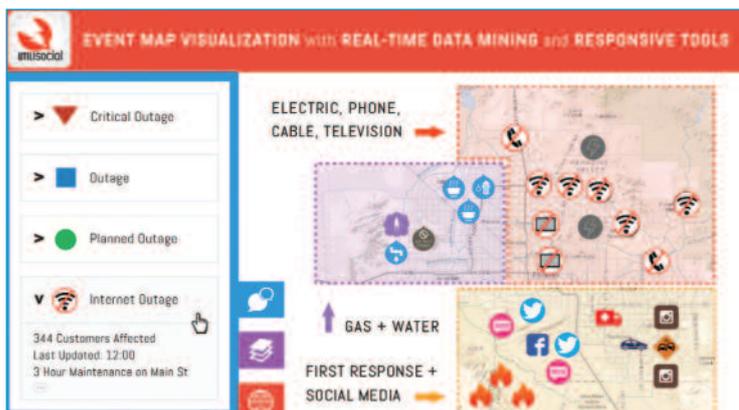
A changing city Seattle City Light is the public electric utility which has been providing Seattle with power for over 100 years. The utility serves approximately 415,000 customers, making it the tenth-largest public power system in the US. Seattle City Light has recently been investigating new technology in order to connect with the modern customer and improve reliability. Customers' preferences, their technology use, and their relationships with the utility are highly diverse and evolving every day. Enhancing modern customer relationships requires a strong understanding of how the utility wants to communicate—especially during power outages, for instance. To improve two-way communication, the company needed a real-time solution to stay on top of grid events and customer concerns.

Real-time response When customers turn to social media to report something like a power outage, Seattle City Light has the tools to respond in an informed way and can address the issue faster. Utilities can now visualize outage data, customer communications, and imagery from the field in one place and in real time. Weather information helps the utility create predictive models of when outages will likely occur so that staff can notify customers in areas with a high potential of being affected.

The advantages of this innovation don't end at simply improving response time. Analyzing and understanding customer communication over the long term can generate non-traditional datasets for utilities to use as a historical baseline for all kinds of solutions. With this valuable information, utilities can evaluate present-day events in comparison to previous outages and in combination with asset locations and other Esri visualizations. Staff can create maps, scenes, apps, layers, analytics, and data and share them with existing enterprise datasets. By analyzing all data—both traditional and nontraditional—utilities like Seattle City Light can better understand customers' key concerns and drive faster outage response.

• For more information, Kurt_Daradics@esri.com or visit www.esri.com/startups

Below: DataCapable's UtiliSocial platform uses social media to show where power outages are occurring on a map.





Sarah Lewin: 'equilibrium in the near future'.

WE HAVE BECOME USED TO SEEING NEWS stories on the lack of women in IT with the general consensus being that on average only 17 per cent of IT workers are female). Yet, at the Esri UK User Conference, it was almost double that. In fact, drilling down further into the list of attendees shows that almost half (45 per cent) of GIS Analysts and just over half (52 per cent) of GIS Technicians were female.

At a tipping point More interesting perhaps is that this trend is expected to continue as the next generation of GIS workers graduate into full time employment. Some 64 per cent of the 98 GIS students in attendance were female; meaning that gender neutrality may even go past equilibrium in the near future.

GIS is taking up the reins and providing a blueprint for success. GIS is now on the national curriculum and through the investments we are making into Esri UK's CSR initiative, GIS technology is now being used in some 140 universities across the UK on a range of courses including architecture, biology and geography. The amount of students being exposed to what can be accomplished with GIS is increasing month by month and is why so many graduates of each gender are coming up through the ranks of education establishments interested in exploring a career in the sector.

Whilst we won't truly break the glass ceiling for some time yet it is encouraging to see that, over the past five years, half of those joining our graduate programme have been female; so the move towards a balance has begun.

GIS: the Blueprint towards gender neutrality in IT

London recently played host to over 3,000 GIS professionals. What made it different from many other IT events was the large proportion of female industry experts in attendance, making it arguably, says **Sarah Lewin** head of pre-sales and tech research at Esri UK, the most gender-neutral IT event the industry has ever seen.

The reasons behind the trend are open to conjecture. Some point to the fact that, by its very nature, the GIS industry doesn't employ traditional geeky techie people but rather leans towards mathematicians and geographers.

Breaking up the old boys' club I think what is also making GIS so appealing to both sexes is that the technology is intuitive and can be applied to so many different industries. As such, GIS is an ideal route into the wider technology arena; as a data scientist said about the GIS industry: "it is a way to break into the old boys' club".

When I studied my GIS master's degree at Edinburgh University some 16 years ago, less than a third of students on the course were girls. On beginning my career I found that it was equally male dominated, though as the User Conference showed, it is far more balanced today. But there is more progress to be made before we see a more gender neutral senior management line-up in the boardroom, as it is still stilted towards the top. I'm hopeful that the trend we are seeing from graduates will address this balance in the coming years.

Looking to the future It is heartening to see so many initiatives now looking to get children as young as five into coding from an early age. Without such a paradigm shift there is an impending skills gap on the horizon, not just in technology but in other industries such as engineering, which won't be filled by men, so the focus needs to widen.

From the Frontline Isabel Allen, GIS manager at Crossrail 2

I used to be a big fan of Channel 4's Time Team, where in each episode the specialists carrying out an archaeological dig used various survey technologies and maps, although at the time I didn't realise it was being powered by GIS.

After studying geography and business management at University College of London and becoming exposed to GIS technology, I transferred to a specialised GIS course at the University of Portsmouth. Being dyslexic, I loved the visual element to GIS, and became fascinated by the various applications of the technology. After graduating, I got a GIS job at Transport for London, maintaining the property asset register. Since then, I have moved to head up the GIS team for Crossrail 2 and am currently creating a consultation map through ArcGIS Online for the next round of consultation.

I believe that GIS has a high proportion of females because of the visual element of the technology. Women are generally good at taking the more techie aspects of GIS and distilling it down, acting as a bridge between the techies and the technophobes within the business.

Women in general are exploring a wider range of roles than ever before, with GIS undoubtedly leading the way. At the Esri UK conference earlier this year, I found it really inspiring to attend so many talks and demos from females at the forefront of the GIS marketplace. My hope would be to see these talks being done in schools to encourage the next generation of young women.

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It is heartening to see so many initiatives now looking to get children as young as five into coding...

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EARTH OBSERVATION: opportunities



Private Sector Panel at the GEO XIII Plenary. L to R, Steven Ramage, GEO Secretariat; Olga Gershenzon, RBC Signals; Jeanne Foust, Esri; Geoff Sawyer, EARSC; Rob Postma, Airbus Group; Xu Liping, Space View Technology; Sanjay Kumar, Geospatial Media and Communications.

THE MARKET AND APPLICATION for Earth Observation data is set to rise in the coming years as an increasing volume of new data becomes available. At the annual GEO meeting in St Petersburg participants also addressed how best to advance GEO initiatives linked to the Sustainable Development Goals and, for the first time, to engage with the commercial sector through a plenary panel session.

Government investments in satellite and in situ Earth observations make up around 65 percent of total cost.

observations more widely available and meaningful, for the benefit of humanity.

The Plenary meeting was held for the first time in the Commonwealth of Independent States (CIS) Region. Co-host **Alexander Frolov**, Head of Roshydromet said: "We express our pleasure at the success of the GEO-XIII Plenary due to strong cooperation between the GEO community, Roshydromet and Roscosmos. Numerous side events organized by members and PO's clearly

EO data: more accessible and investments to rise

The Portal to the world's most comprehensive collection of Earth observation data, the Global Earth Observation System of Systems (GEOSS) got a new look and feel with the launch of version 2.0 at the Group on Earth Observation's (GEO's) annual gathering in St Petersburg, Russia, 9-10 November 2016, reports **Katherine Anderson**.

Companies not only contribute in terms of hardware; they also stimulate provision of services. The EO commercial data market was estimated at \$1.6 bn in 2014 and is set to rise, almost in line with the incremental curve of increase of data availability.

"Open data not only maximizes tax-payers' money in government infrastructure, it promotes economic growth, education and capacity building." said GEO secretariat director, **Barbara Ryan**. "GEO wants to bring all sides of the conversation together so that data is broadly and openly available, free to the user and can be used to create value-added products and services to benefit society."

The 13th GEO Plenary Meeting convened representatives from GEO's 103 member governments and 106 Participating Organizations (POs). New members announced at the Plenary were Uruguay, United Arab Emirates and Mongolia. Among new PO's approved in 2016 are the European Association of Remote Sensing Companies; the Humanitarian OpenStreetMap Team; the Integrated Carbon Observation System; the Sahara and Sahel Observatory; and the World Health Organization.

The Plenary opened with a message from the International Space Station. In the video message, the cosmonauts observed it is easy to understand the interconnected nature of the planet. Space technologies help to understand Earth's complicated processes and problems. Humankind is facing global challenges today, and international cooperation plays a crucial role in tackling these issues. The work of GEO makes Earth

demonstrate the constantly evolving influence of GEO as an intergovernmental body."

Philemon Mjwara, director-general, department of science and technology, Republic of South Africa and chair of the session, reiterated the benefits of having access to EO data as an "enabling resource that allows us to begin addressing the water-food-energy nexus. . . as a stepping stone to clearly understanding how the Earth's systems work, and ultimately realizing GEOSS".

The GEO community exchanged updates on activities relating to the GEO work programme, which streamlines governments' and organizations' efforts to coordinate and share Earth observation in the most useful way possible to decision makers.

Citizen GEOSS, an EC-funded project, presented applications such as My Sky at Night to investigate the effect of light technology on night sky brightness; My Seasons with phenology information; iAtmos mobile weather data crowdsourcing and City Focus, an app showing distances to services in Milan.

An open data community event looked at the economic benefits of data sharing and explored how such policies are valuable to generate growth and jobs through downstream services. Challenges as GEO continues to develop data sharing principles include a lack of common data formats, a need to educate policy makers on the importance of data policy and a need for regional advocacy of data sharing policy. Read more about GEO from the blog Observations:

http://www.earthobservations.org/geo_blog_obs.php?id=192



The EO commercial data market was estimated at \$1.6 bn in 2014 and is set to rise





Emeritus Professor Ian Masser.

'THIS IS THE GREATEST MOMENT IN MY LIFE' said Emeritus Professor **Ian Masser** upon receiving the news that he was to receive, the GSDI Global Citizen award. The award, which is only made very occasionally, recognizes someone who has provided exemplary thought leadership and substantive worldwide contributions in promoting informed and responsible use of geographic information and geospatial technologies for the benefit of society and who has fostered SDI developments that support sustainable social, economic, and environmental systems integrated from local to global scales. Prof Masser is only the fourth such person to receive the award.

Masser received the award during the Association's conference in Taipei, Taiwan on December 2nd 2016. His acceptance speech entitled 'Looking back on SDI developments with an eye to the future' drew upon his experiences in the last thirty years and reconsidered the four "Brave New GIS Worlds" scenarios put forward in

information restricting access to the more powerful; *Big Brother* in which surveillance and control by fully integrated omniscient systems pervade all aspects of life; and *Beyond GIS* in which public domain information contributes to greater democratisation and grassroots empowerment.

Updated in 2016 by the authors, they correctly anticipated the miniaturisation, memory and computing speed of all kinds of electronic devices possible today and predicted the emergence of transnational media conglomerates integrating telecommunications, cable and computer companies. An aspect which they acknowledge they did not anticipate has been the explosive growth volunteered geographic information (VGI) or the diffusion of GPS enabled mobile phones.

One of the most significant projects that Masser identifies is the EU's INSPIRE initiative to create an SDI for the EC – 'an infrastructure built on those of

British academic wins Global Citizen Award

The Global Spatial Data Infrastructure Association has made a rare award to a leading GI expert whose career in GI and town planning has spanned nearly 60 years.

1996 with particular reference to the diffusion of SDIs and the impact of technology and the development of the GIS industry.

His speech touched on the seminal Chorley report of 1987, which provided the impetus in the UK for the development of GIS and encouraged interest from research bodies at the same time as similar initiatives in the US and Australia. He identified President Clinton's significant executive order of 1994 'Coordinating Geographic Data

Acquisition and Access: the National Spatial Data Infrastructure' which set out defined time limits for each of the initial stages of the national SDI.

In 1996, Masser in collaboration with **Michael Wegener**, published the influential paper, 'Brave New GIS Worlds'. It explored contrasting scenarios likely over the next 20 years through perceptions of the impact of GIS on society in different countries. It developed four scenarios of GIS diffusion: *Trend* – characterised by incremental diffusion of GIS along the lines experienced in the recent past; *Market* – based on the commodification of

28 different countries in 24 languages by a truly democratic process. . . a role model not only in relation to the developments of SDI but more generally to the formulation of public policy at the European level' (**Max Craglia** 2014). Masser has commented in detail on the progress of this project in *GiSPro* (February 2015 and August 2016).

Looking ahead, he is critical that many national SDI initiatives still abide by the principle, 'one size fits all', and envision a relatively uniform product. His view is that as most database maintenance is carried out at local level, national SDI strategies should drive regional ones, and regional SDI strategies drive local ones. He believes that the small elite of spatially aware professionals in geography, land administration and environmental science, must develop SDIs to provide an enabling platform in a transparent manner to serve the majority of society who are not spatially aware.

Emeritus Professor Ian Masser

Educated in geography and town planning at Liverpool University, he has held senior positions at the University of Liverpool, the State University of Utrecht, the University of Sheffield and the University of Twente in the Netherlands. Nearly half his time was spent in Sheffield where he was Professor of Town Regional Planning at for nearly 20 years. During a career that spans more than sixty years, Ian has visited more than fifty countries in all five continents. Born in York and, like a true Yorkshireman, he notes with some pleasure that most of the costs of his travels were born by government bodies and universities.

About the GSDI Association



The Global Spatial Data Infrastructure (GSDI) Association was formed in 2004 as an inclusive networking organization of academic and research institutions, government agencies, commercial geomatics firms, national and regional GI associations and individuals. Its purpose is to promote international cooperation and collaboration in support of local, national and international spatial data infrastructure (SDI) research and implementations to help nations better address social, economic, and environmental issues of pressing importance, including sustainable development. It has 38 Organisational Members from 20 countries and over 400 individual members from 55 countries with a high concentration in developing nations.

GSDI is involved in SDI capacity building in the less developed world through a small grants programme with the US Urban and Regional Information Association's GIS Corps volunteers as well as SDI focused workshops and seminars offered by members globally, and SDI-related GSDI projects co-funded by the Association and implemented by its members.

value of GIS in Big Data & AI



Data Collection using the Street Quality Identification Device (SQUID) to digitize Street inspections and deliver equitable and cost-saving street maintenance.

I FIRST ENCOUNTERED GIS WHILE studying geocollaborative decision-making for crisis management over a decade ago. Back then, GIS seemed like an obscure field and its software was

COP. This is a concept that originated in the military and relies heavily on a GIS to allow many stakeholders to make decisions using a common platform. Simply put, a COP offers a “bird’s-eye view” of an information landscape.

The COP is an ideal use-case for many GIS platforms used in data-intensive and collaborative environments. The COP is “first and foremost, a visual representation of relevant information characterizing a situation.” (USJFCOM, 2008) It represents a centralization of information to allow shared understanding. This definition has many similarities with the ethos of the professional GIS community. The COP is an ideal sense-making tool to help decision makers avoid being overwhelmed by the fire-hose effect that big data usually has.

A distinguished software developer writes that “software development is fundamentally about making decisions” and so I argue that geographically situated software development should focus on decision making that much more because location, navigation and spatial thinking are unique elements of higher order cognition.

ARGO Labs focuses on the common operational picture in municipal settings. Our Street Quality Identification Device or SQUID project uses low-cost sensors to collect thousands of images of streets, combines it with ride quality data, and presents this

The value of GIS in big data and AI to empower civic decision makers

The common operational picture is the ideal use case for municipal authorities, argues **Varun Adibhatla** of ARGO Labs. It helps implement equitable decision making by combining data from many sources.

used by only a select few who could install it and navigate the different menus and sub-menus to produce actionable results.

A lot has changed since then. When I re-entered graduate school a few years back to study cities using data at NYU’s Center for Urban Science and Progress, I re-discovered GIS. Except this time, almost everything was on the web and the cloud. Platforms such as CartoDB, Tableau and RESTful methods have exponentially improved usability and made GIS accessible to masses of non-native technology users.

The ability to rapidly create accurate, functional and customizable data-driven narratives is a powerful skill that is actively shaping decision-making at various levels of government. GIS, I argue, is an enabling medium for this.

The common operational picture A concept that I have found helpful to bridge the worlds of urban operations, public policy and GIS development is the Common Operational Picture or

data on a map to allow different stakeholders to make proactive and cost-saving decisions for citywide street maintenance.

The COP, I argue, is also useful to implement equitable decision-making. Creating a GIS powered COP lowers barriers to create shared goals and manufactures common ground; a vital need in contested and bureaucratic settings. GIS therefore is, vital to reduce the frictions between the source of data and when decisions are made.

Complimentary artificial intelligence **Walter Kirn**, an accomplished writer says this about Artificial Intelligence. “In a field where reality testing is difficult under the best of circumstances, wherein authenticity can be assumed, an AI takeover may prove undetectable”. The hope and hype of AI to automate decision-making in difficult information environments is a powerful signal guiding technology development and adoption. Yet, there is evidence to suggest that in such settings, AI is better applied to compliment

“

... to allow different stakeholders to make proactive and cost-saving decisions for citywide street maintenance.

”

value of GIS in Big Data & AI

rather than substitute human decisions. Again GIS through the COP lens offers many solutions.

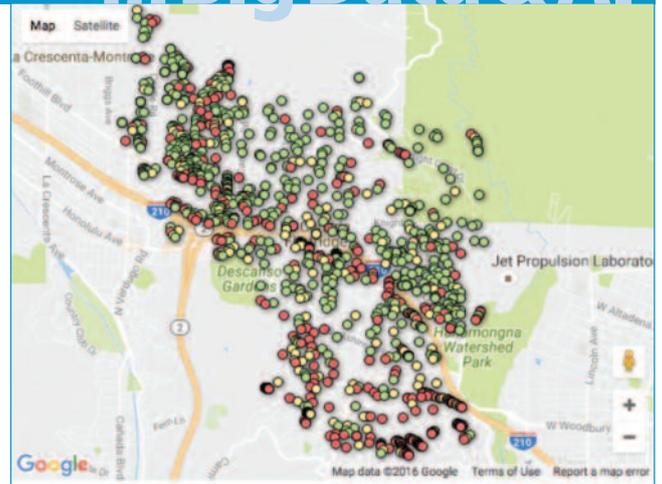
Our work with the California Data Collaborative combines earth observations and satellite imagery with computer vision techniques to classify irrigable and landscaped areas, a key missing data point for CA water managers. We are actively working to carefully combine advanced analysis with decision-making tools in municipal contexts to identify potential efficiencies that, not only assist better delivery of critical public services, but also help guide informed and fair policy-making.

To conclude, some of this may just seem like a re-branding of well-understood GIS concepts. We at ARGO Labs believe that it is important to translate entrenched vocabularies or technical jargon from one world (GIS) to another (public policy, planning and municipal operations). To this end, the Common Operational Picture is useful to organize collective energies around generating shared understanding and empowering decision makers. The GIS community has overcome many technical and organizational challenges around geographical data which if abstracted can be helpful to un-tangle similar yet obscure challenges in the public domain.

About the author

Varun Adibhatla is the executive director of ARGO Labs, a startup non-profit based in New York City that works with municipal managers to rapidly prototype scalable urban solutions across device, data and decision-making. He holds Master's Degrees in Information Science and Applied Urban Informatics from Penn State University and New York University.

Right & below: Using freely available earth observation data and computer vision to estimate lawn counts in California.



Varun Adibhatla

What are you wishing for this Christmas?

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GeoCom16 location & analytics



WE LIVE IN AN AGE OF CONSTANT CHANGE and churn so this year's AGI conference was no exception. A major departure from past formats of two or more days of presentations and keynotes, today's uber-busy world needed something sharper, quicker, more attention grabbing. A one-day event at the home of geography, the Royal Geographical Society, attracted nearly two hundred to hear 12 invited speakers talk about location and data analytics. The audience seemed different; yes, the usual faces and greybeards were there but new faces too were in abundance. It looked as though it was going to work.

A brief but welcoming introduction from the RGS's director general, Dr **Rita Gardner** CBE set the scene. These are exciting times for geographers, she said. Graduates in the discipline are amongst the lowest without a job. On our topic for the day, Dr Gardner highlighted a growing world population: 2 billion more by 2050 and the likelihood of 150 million climate change refugees. We will need those new techniques of data analytics.

to think it was wolf kills. The winning total was 57 or for the binary minded, 111001.

Fifty seven may well have been big data back in the Ice Age when man's mathematical skills may not have extended to 57 but fast forward to the 21st century and CERN where, when the super collider is fired up, 40Mb or more of data is captured in a second. Phew! We needed something a bit more on the human scale.

Harkness turned to some interesting analytics of the routes and pick-up points for New York taxis. Where were the most lucrative points for the drivers? A fascinating 3D graphic presented the points (appropriately) as skyscrapers of varying heights. Further data from the cabs tried to find where the best customers came from, based on their tips. But that rather falls over because often the tip is in cash and the data doesn't get recorded, other than by citizen snappers capturing poor-tipping celebs. Therefore, 'don't be fooled that all the data is in there' she cautioned.

Harkness turned to tracking mass cycle rides. The Dawn-to-Dusk ride around North Wales seems about as gruelling a ride as this writer could imagine in a 24-hour

Why location matters in data analytics

AGI GeoCom 2016 boasted a new format, new speakers and a new venue.

Stephen Booth reports.

Does size matter? To get us focused on the day ahead, which was blocked out in sessions of three or four speakers, up first was **Timandra Harkness**, author and broadcaster. Her book "Big Data: does size matter?" has been something of a best-seller, even if it is, as she conceded, No 1 in a very small category. Ms Harkness is a lively and engaging speaker with just the right examples to get our attention and thinking. She traced the beginnings of big data to two wolf shin bones dating from around 30,000 years ago when two hunters kept a tally of something with cuts across the bones. Why, nobody knows for sure but Harkness likes

period. But it does produce some big data from the cyclists with suitable sensors. She told a beautiful tale of a cyclist in San Francisco, a city of rectangular blocks, who recorded his ride on a map so that it spelt out "I love you Emily". Needless to say, Emily was delighted and they lived happily ever after. . ?

Blockchain: the future of transactions? So we were beginning to learn and understand what big data is. The next speaker had something far more complex for us to get our heads around. According to Dr **Catherine Mulligan**, Blockchain technology is

Right, Dr Rita Gardner 'exciting times for geographers'.

Far right, Timandra Harkness - from wolf bones to CERN's 40Mb a sec.



the way we're going to manage transactions in the future. Think Bitcoins as an early example, described as "distributed ledger technology" relying on synchronised data in multiple locations to secure transactions. It is held up as a way of preventing fraud. Think land and property transactions. Georgia is already opting for the technology which provides "immutable" records of transactions; others including Sweden and Ghana may soon follow.

So what precisely is it? 'The best way to view Blockchain is as a platform', says Dr Mulligan., 'upon which applications can be built'. Its use can be way beyond financial services – 'it's a new way to manage data'. However, it raises some interesting issues around identity. There is currently research around using Blockchain to validate ownership of your identity, something which the Sustainable Development Goals set as the right of every person on the planet to own. How that will square with the big data it will generate and the big IT companies managing it, remains to be seen.

Another area for its application will surely be the Internet of Things, where provenance, anti-tampering and attestation of data all play a role. It is here that the role of GIS and location services will play a key role in securing the IoT and the services built upon them.

Incidentally, Blockchain and Bitcoin is not only big data but big computing. Dr Mulligan told us that already Bitcoin transactions are using more electricity than the whole of Ireland!

Green corridors of plenty It was time to talk about mapping, something we all understand. **Aranca Munoz-Criado** is an architect and urban planner. She has also attracted the attention of **Jack Dangermond** and Esri to provide maps of green spaces to create a green infrastructure map for the whole of North America.

Her thesis is that we all need green space to enhance our quality of life but as towns and cities

develop rapidly into surrounding countryside we need to preserve corridors of green space; better to allocate the green space ahead of construction. She describes it as 'a new conservation approach for the 21st century' and which she has applied in planning for Valencia in her native Spain. The city now has green corridors to the sea, green regeneration of old industrial sites and protection for wetlands and farming within urban areas.

Q&A Brief questioning following the session centred around truth and how can we trust data to be clear and transparent? Dr Mulligan was asked where Blockchain was on the famous Gartner Curve; with people struggling to understand exactly what it was; were we in "the trough of despair?" A good name for a heavy metal band, thought Timandra Harkness.

Safety standard for drones It would be an odd conference without drones wheeling their way on to the agenda. GeoCom16 was no exception and **Ed Leon Klinger** was there fresh from Ordnance Survey's Geovation Hub to tell us all about how big data, driven by risk analysis, will lead to safer drone flights. This is needed by insurers, who currently can charge more than the cost of the drone.

Drone use is predicted to be a \$127 billion industry by 2020 (one can't help thinking that if you take the military and playful consumers out of that you will be left with a much smaller sum), nevertheless, sales of



Above, question time for Session 1 speakers.



Blockchain. . . relying on synchronised data in multiple locations to secure transactions.



From left to right, Ed Leon Klinger - safer drone flights.

Dr Katherine Royse - a role for geology in Smart Cities.

Andy Hamflett - unlocking data for charities with GEO4GOOD.



... a super-computer from which the data never stops growing. Data volumes are so big that downloading to a desktop for analysis is fast becoming impractical.



drones alone are predicted to be \$5bn by then.

The challenge is to reduce risk in real time. Klinger's start-up, Flock is aiming to develop a platform for drone operators driven by data from many sources – mapping, weather, traffic, etc – where users will log in to plan their flight based on real-time data (and presumably updated as the flight proceeds) using Software-as-a-Service technology. Flock's vision is to create a global de facto safety standard for drone operation.

His promises of Uber vertical take-off taxi drones 30 years hence will need a change to the laws of gravity and possible shrinkage of the (currently growing) human body. Terrestrial autonomous vehicles are more likely.

Smart Cities and Geology The April 2016 issue of this magazine published an article on the development of a ground information model as part of BIM. Dr **Catherine Royse** of the British Geological Survey posed the question, is there a role for geological data in the Smart Cities Agenda. To which the answer must be a resounding, yes.

Cities both in the UK and the rest of the world continue to attract a huge influx of people, yet often have to cope with flooding and water contamination so it is essential that we adopt a more holistic view of the sub surface. In the capital, construction works regularly overrun, usually due to unforeseen ground conditions. While drilling into the underground can result in... well, drilling into the London Underground, as at least one event involving the Piccadilly Line records.

Dr Royse noted that London's underground railways do not extend very far south of the river. Having tunnelled under the Thames they often opt for over-ground routes; the reason is that north of the river tunnelling is in near perfect clay, whereas in the south wet gravels and sands hamper tunnellers.

The problem with geology is data, or rather its absence. 'Only 18% of ground data from recent infrastructure projects can be used', said Dr Royse. 'We need a standard for underground data'. She highlighted the ASK project in Glasgow where data was in a standard format, the key to usefulness. There are opportunities ahead for ground source heat pumps if we

have the data through initiatives like GIRP – ground instability risk profiles. There is therefore a role for geology; the sub surface is vitally important otherwise there will be nasty surprises ahead.

Location unlocks value Using data science to help charities was **Andy Hamflett's** presentation. He believes that location is vital to unlocking data use in this sector. His primary interest is in combating hunger. Backed by the Trussel Trust, which works to alleviate hunger and poverty in the UK, he's been getting local communities with food banks to track where visitors are coming from. An intense heat map of charity activities around Old Street Station in the City of London revealed alarming levels within what looked like less than a 1 mile radius.

This approach of using captured data can also work in the not-for-profit sector. He cited the Dallas Museum of Arts, where they decided to go for free admission provided you give your personal data (which they can use and trade). Attendance is reportedly up by 30%. The app **charitymiles.org** tracks personal movement via a smartphone; such data is valuable and could even be piggy-backed on to Pokémon Go players.

Hamilton also looked at tracking illegal fishing around the globe through the not-for-profit Geo4GooD initiative. Driven by GNSS data, a world map revealed an awful lot of it going on.

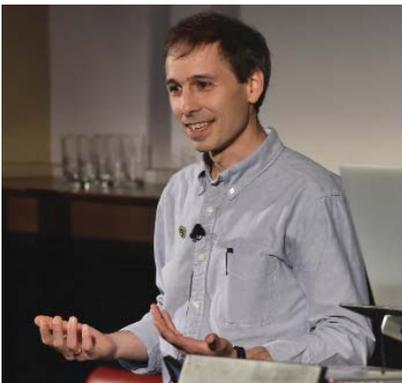
Q&A Questions were around the value in interoperability and application of data. BGS's Dr Royse said that they gained from engaging with people who asked, 'how do we interpret it?'

The conference might have benefited from a session around digital licensing. A lawyer in the audience argued that just because data is free, it doesn't mean you can't licence it, especially for enterprise applications. There is also a new data protection bill on its way. Meanwhile, **Graham Voles** said there are serious problems in dealing with large corporations where start-ups are looking for legacy data.

The Snappy Seven Following lunch and a chance to look around the exhibition of sponsors, it was time for four "Lightning Presentations" of seven minutes each, chaired by **John Alderson** of Informed Solutions. First was **Patrick Bell**, information systems leader at British Geological Survey, who spoke on 'taking the pulse of the UK's underground'. There is now real-time monitoring of environmental phenomena through boreholes. Funded by NERC, a £31m package is helping keep an eye on fracking around Fylde and the Vale of Pickering shale gas sites to check for water quality, seismicity, radon and soil gases. Data is available free online.

The next speaker really was a departure from what we're used at a geo event. **Doug Specht** is a researcher and lecturer in communication geography

Below left, The Met Office's Dr Alberto Arribas 'the data never stops growing'. Below right, Prof Jacqui Taylor, 'Big Data has bred hords of unicorns!'



at the University of Westminster. His philosophical presentation was about the 'ugly untruths of data'. He took us back to a day in 1910 when the author and socialite **Virginia Woolf** wrote, after seeing an exhibition of impressionist painters, that "today human nature has changed".

What had attracted Woolf's keen eye and that of our speaker, was Cezanne's numerous "non finito" canvases. Hitherto, painters had tried to portray reality by painting near perfect representations of the world. The form behind those brilliant dabs of Cezanne's vivid colours on a white canvass could still be recognised as the Mont St Victoire, which he'd painted again and again in his search for some kind of reality. For Specht, the interesting aspect was what he'd left out. Like **John Berger's** "Ways of Seeing" in relation to a painting, an absence is a map. Plenty to ruminate on there.

Crispin Hoult has a PhD in Geomatics from the University of Newcastle upon Tyne. He posed the questions, Cartography, is the end nigh? A map is something that's been curated, according to Hoult. But today there are so many ways we can capture reality. However, it still requires continuous survey for the real world to be in the background.

James Milner is a software developer who works with start-ups at Ordnance Survey's Geovation Hub. The hub is an incubator for those with a geospatial or location-based idea for an app. The balance of technology is shifting according to Milner, so that by 2020 it will be 50:50 between mobile and online. 'We've never been in a better position to take advantage of technology, with new tools and data services available. But the user experience matters', he says. He urged us to look closely and consider how, for instance, Uber operates compared to traditional GIS.

Q&A Questioning after this session was perhaps more searching than the speakers had expected. With the UK in the top five digital nations in the world, how could we as a community benefit, asked Dr **Vanessa Lawrence**? Answers were far from clear or concise.

Weather man and his super computer The final session of the day heard two very different speakers. Dr **Alberto Arribas** is from the Met Office's Informatics Lab (<http://www.informaticslab.co.uk/>) and acknowledged that 'we operate outside the Met Office structure'. He described the government agency as 'a big technology company'. They have a super-computer from which the data never stops growing. Data volumes are so big that downloading to a desktop for analysis is fast becoming impractical. The answer is Jade, an environment accessed via a desktop to handle large amounts of data where analysts can look for a phenomenon in a subset of the data, or maybe downscale it.

They also have an immersive VR app where you can wander – literally - through 3D clouds, observing the weather as it changes in different layers; and all on a



tablet. Like so many clever scientists left to play with technology Dr Arribas predicted the next big disruptive technology: the Amazon Echo. If you haven't clocked it yet, Google it or pop into John Lewis. It's a smart bot that will stream voice information and music upon your verbal command, provided you subscribe to Amazon's Alexa service. Alas, most of the services available in the US are not available in the UK. I now understand disruptive technology, basically technology that will annoy me.

Beyond Web 2.0 The final speaker, Prof **Jacqui Taylor**, spoke about mapping the future towards the Internet of Things. She argues that as we move to a future where 80% of the world's population are connected, Big Data and the IoT will take us beyond web 2.0; it will require us to understand new ways of communicating with customers and clients. However, she doesn't believe in "Big Data" – 'it's just a term used by technologists; it has bred a herd of unicorns!'

Prof Taylor has had a variety of careers since she first qualified as an aerospace engineer. She has also been a wholesale energy specialist and a web entrepreneur. Currently she runs Flying Binary Ltd (subtitle, changing the world with data), a company involved in data analytics and open data, which has advised government through the ministerial advisory group on open data.

Rounding up the day, which seemed to pass incredibly quickly, **Rollo Home** said 'the disruption drivers are forcing us to think differently. We have to work out our place in this brave new world'.

The day concluded with AGI awards made by chairman **David Henderson** to **Simon Wheeler** for exceptional service to the association and to **Jamie Justham** for career achievement. Geodrinks followed.



Above left, Simon Wheeler receives his award from AGI Chair David Henderson. Above right, Jamie Justham steps forward to receive his Lifetime Achievement Award.

We've never been in a better position to take advantage of technology...

UAVs river habitat monitoring



Figure 1 – The River Muick Study Site.

UAVS ARE EXCELLENT PLATFORMS for environmental data collection. Both fixed-wing and multi-rotors are potentially useful airborne platforms for a range of environmental remote sensing applications, including expensive high-end specialist solutions and much cheaper off-the-shelf options. They are ideal where aerial coverage requirements are small, flying expertise is limited, and the operating budget is relatively small. With advances in battery technology, navigational controls, and payload capacities, many of the smaller UAVs are now capable of utilising a range of miniaturised sensors to collect aerial

provide an exploratory understanding of the morphological habitat and thermal threshold zones of salmonids in a highland river in Scotland, UK.

Study area The River Muick is a montane upstream tributary to the River Dee, near Ballater, Deeside. It is approximately 70km from the mouth of the River Dee and water is sourced from Loch Muick (Figure 1). The Muick is a well-known spawning ground for salmonid species and therefore a habitat for the early life phase of alevins and parr that hatch there. The river has a gravel bottom and is typical and ideal as a salmonid habitat, displaying a high heterogeneity of depths that include pools, riffles and runs with fast flowing water.

The study site selected – a small stretch of the river – was ideal for test flights of a UAV, being a largely open area with few obstructions and few overhanging trees, as well as being easily accessible both on foot and by car. The river is also relatively shallow making it easy to cross from one side to the other for in-situ ground truth data collection.

River habitat monitoring and mapping with a UAV

Authors, **Ryan Peck, David R. Green, Chris N. Gibbin** and **Matt Greig**, examine the use of small low and medium-cost UAV platforms, associated technologies, and several off-the-shelf photographic and thermal sensors currently available for applications such as river monitoring and mapping.

photographic data, video footage, multispectral, thermal and hyperspectral imagery, as well as lidar.

With the aid of specialist digital image processing software, the aerial data and imagery acquired can now be processed into products like orthophotos and orthomosaics, Digital Elevation Models (DEM), and subsequently analysed and interpreted to generate useful information for input to GIS and environmental modelling software.

This project utilises a combination of both UAV thermal and airborne remote-sensing technology to

UAV equipment and image acquisition A number of different UAV platforms and digital cameras were used to collect the aerial data. Test flights of the study site were first conducted using a standard DJI Phantom 1 UAV with a GoPro Hero 3+ Black Edition digital camera (11Mpx) to collect colour (RGB) aerial photography; and a modified DJI Phantom 2 equipped with a FLIR Vue thermal camera and data capture module on a fixed tilting mount to determine the suitability of a small thermal camera for collecting thermal imagery of the river (Figure 2).



Figure 2 – The DJI Phantom 2 and FLIR Vue Thermal Camera.



Figure 3 - The DJI S900 Hexacopter.

Higher resolution vertical colour aerial photography was subsequently collected using a Panasonic GH4 DSLR camera with a polarising filter (to reduce glare from the water surface). The camera was mounted on a DJI S900 hexacopter UAV with a Zenmuse GH4 gimbal; it also captured vertical thermal imagery using a TeAx Technology ThermalCapture FLIR Tau 2 324 camera with a 13mm lens. The radiometry-enabled thermal camera core (thermalcapture.com) was mounted on a custom-made fixed plate (Figure 3). Three thermal and one aerial photographic flights were flown at an altitude of approximately 20m.

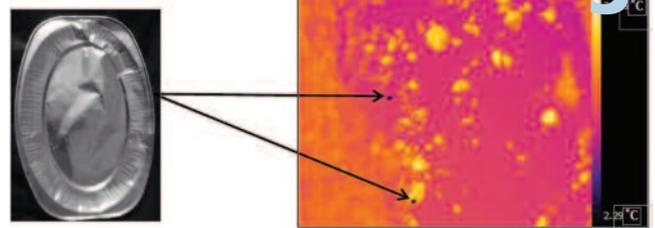
Whilst natural and man-made features can be used for ground-control, to permit accurate geo-location and geo-referencing of all of the imagery, a number of small aluminium foil trays were placed in the study area as GCPs (Ground Control Points) as they are easily detected in thermal imagery due to their high reflectance of thermal radiation (Hartman et al., 2012) (Figure 4).

Thermal overflights were also paired with coincident in-situ manual collection of surface water temperatures using a HANNA HI 9025 pH meter with a temperature sensor placed along transects across the river and recorded using the free Ordnance Survey (OS) Fieldtrip GB mobile App (fieldtripgb.blogs.edina.ac.uk/). Water depth measurements were also taken at random points along transects in the shallow water with the aid of a metre rule and a mobile GPS unit to calibrate a bathymetric model of the river (Figure 5).

Image pre-processing and orthomosaic creation

Over 8,000 images (including Flir semi-video frames) were quality checked for evidence of blurring, view angle (e.g. taking into account the fixed mounting of the thermal camera) with manual removal of unwanted frames to reduce the processing time and overall quality of the final product. Both GoPro and Panasonic GH4 photographs were carefully selected for input to Pix4D softcopy photogrammetric software

Figure 4 – Using Aluminium Baking Trays as Thermal Ground Control Points (GCPs).



in order to create the colour orthomosaics.

For the thermal imagery, two additional steps were required for pre-processing. As the images were originally captured in semi-video frames at nine frames per second and stored as TMC files, they could only be viewed using ThermoViewer software (thermalcapture.com/thermoviewer/) to view the temperatures for each pixel and to adjust the colour band display. As before, the files all required careful examination in order to select the most appropriate images based on quality. The image frames were then exported as radiometric JPEG files and transferred to GeoSetter software (www.geosetter.de/en/) to facilitate geo-tagging of each thermal image for the Pix4D software. Subsequently, it was possible to undertake image matching, mosaicing, optimising and merging of the thermal imagery. The results were normalised seamless thermal orthomosaics ready for georeferencing (Figure 6).

Bathymetry To model river bathymetry it was first necessary to identify the submerged and non-submerged zones of the river using brightness values taken from the red and green bands of the Panasonic GH4 RGB imagery. This was done using image classification techniques to identify the brightness of the wet/dry border and wet/dry zone. Secondly, the absorption rate coefficient was derived from a linear regression of water depth and brightness in each image band. This was then used to calibrate a depth-brightness model using the Beer-Lambert Law (Equation 1 - light attenuation through a water column by absorption) (Carbonneau, et al., 2006). Equation 1. The Beer-Lambert Law: $I_{OUT} = I_{IN}e^{-CX}$ where:

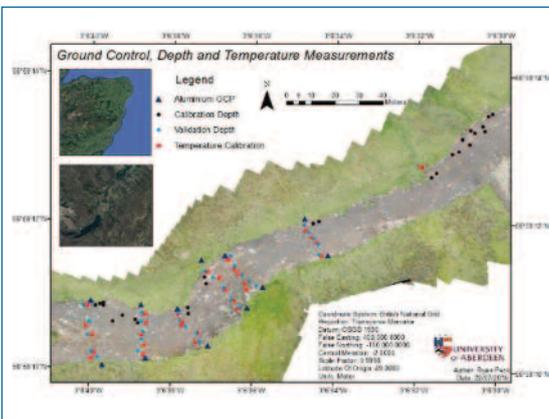


Figure 5 – Ground-Truth Data Sampling Locations at the Study Site using the OS Fieldtrip GB App.

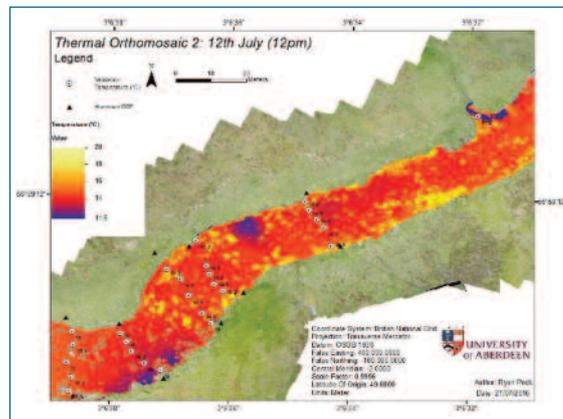


Figure 6 – A Thermal Orthomosaic.

UAVs river habitat monitoring

Figure 7 – River Bathymetry Derived after Correction for Illumination

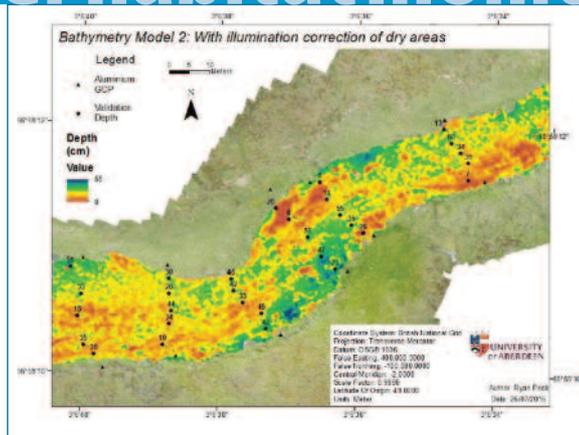
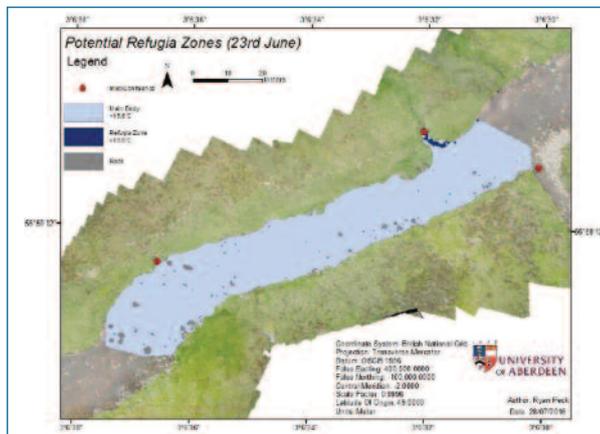


Figure 8 – Map Identifying Potential Refugia Zones in the River



I_N = the incoming light intensity
 C = the rate of absorption
 X = thickness (depth and turbidity) of the transparent medium (water) and: I_{OUT} is the light intensity at depth after travelling through the transparent medium.

Three assumptions were made before the depth-brightness relationship and bathymetry were calculated:

1. The river bed is homogenous and does not distort the radiance values
2. Red and green band wavelengths are 650nm and 500nm respectively
3. The light absorption coefficient in the water column is the same across the study site

The model was used to predict depths and then compared to measured depths for validation (Figure 7).

Potential spatial distribution and refugia zones of salmonids To identify the potential spatial distributions of salmonids in a river it was important to consider the optimal depths at which they are found. General guidelines for the spatial distribution and thermal tolerances were based on the available literature to estimate habitat range and refugia zones in the River Muick. Refugia zones were based on the temperature thresholds of salmonids and the definition of refugia as: “a semi-separate water body that is at least three degrees lower than the main body

temperature” (Kurylyk et. al 2014). Using this information the expected distribution and habitat zones were identified (Figure 8).

Conclusions The preliminary work with the UAVs and photographic and thermal sensors shows that both thermal and bathymetric surfaces can quickly be derived from UAV data and imagery. The project provided an opportunity to gain greater insight into the availability of salmonid habitat in a river. Mapping the bathymetry of the river helped to explore the possible spatial distributions of salmonid populations and potential redd sites (the hollows where the fish spawn) in the river. Similarly the thermal data showed that temperatures could be modelled to a high level of accuracy.

References

- Carbonneau, P., Lane, S. & Bergeron, N., 2006. Feature based image-processing methods applied to bathymetric measurements from airborne remote sensing in fluvial environments. *Earth Surface Processes and Landforms*, Band 31, pp. 1413-1423.
- Hartmann, W., Tilch, S., Eisenbeiss, H. & Schindler, K., 2012. Determination of the UAV position by automatic processing of thermal images. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Band 39, pp. 111-116.

Kurylyk, B., MacQuarrie, K. & Linnansaari, T., 2014. Preserving, augmenting, and creating cold-water thermal refugia in rivers: concepts derived from research on the Miramichi River, New Brunswick (Canada). *Ecology*, 8(6), pp. 1095-1108.

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...both thermal and bathymetric surfaces can quickly be derived from UAV data and imagery.





**David Henderson,
OSGB's director of
products and
innovation.**

"WE ARE IN THE COOLEST AND SEXIEST industry on the planet!" So began David Henderson, Ordnance Survey GB director giving the annual Geoforum Lecture at RICS hq last November. In fact so cool that he took the audience "back from the future". A future expressed by Gartner in a whole raft of

directly back to the origins of OS. Mapping was required by the security services for the G20 summit at Excel and for the Olympics, with the organisation tasked to map a great many more features in the proximity of the venues than is usual in large-scale mapping. And so Roy's map of Kent has evolved into 'situational awareness' and the OS role in ensuring that command and control have the information and geospatial tools they need to make quick decisions.

Location unlocks value in other's data In the coming world of the Internet of Things (IoT), driven by a proliferation of sensors which all collect data, location unlocks value in other people's data. Henderson explained that they now had to build for mobile first. He spoke on the competitive advantage of data analytics and how new solutions will drop the GI tag "Modelling the future, not mapping the past is where the money lies" he argues.

Moving to open data, Henderson believes that "Open" is enabling social good and is an economic

Geoforum Lecture: OSGB's journey from mapper to collaborator

In a wide-ranging talk to geospatial professionals from across the various institutions and societies, **David Henderson**, director of products and innovation at Ordnance Survey marked out the future for Britain's mapping agency as a content provider in a world where analytics, predictive modelling and real-time data hold sway.

statistics, for example: by 2020 100 million people will be shopping in virtual reality, indeed 30% of sessions will be done without a screen.

This was a wide ranging lecture that touched on many aspects of geospatial and how Ordnance Survey was changing from mapping to becoming a cross-industry collaborator and location enabler in a world of big data.

Super use Henderson viewed the development of OS in terms of 'super use cases'. The first of these was the need to defend against invasion – its *raison d'être* at the end of the 18th century. This developed into a need to map to manage the land, to secure tenure and for taxation. Then from the 1930s into a formal programme of map maintenance. He described two phases of digital mapping: the first driven by the utilities industry as super user and a second phase by GIS applications. Today we have moved "beyond the map", where OS data becomes linked to data held by others, which can be shared and exchanged, promoted by open data and open innovation.

One of the current super use cases relates

stimulator. "It brings in a whole new community of users and a broader range of stakeholders." OS now has 14 open products which are maintained and whose users they engage with. They are also a strategic member of the Open Geospatial Consortium, the only one outside the US.

Geospatial has become mainstream, evidenced by Pokemon's need for accurate global spatial data infrastructure and Ordnance Survey Ireland releasing a dataset designed for use with Minecraft. Cool and sexy indeed.

RWOM creates smart frameworks Ordnance Survey GB's latest highway datasets (see also the November/December issue of GW News) have been developed around real-world object modelling (RWOM) by collecting a much higher level of topographic data than hitherto. "It's a smart location framework" says Henderson and is part of "equipping the nation to make its next move".

Henderson cautioned that there will still be demand for geospatial data to be used for search, analyse and navigate applications. But the future will be real time, real world data, machine to

“

... Roy's map of Kent has evolved into 'situational awareness'...

”

UK Geoforum Lecture



Ultimately, OS will become a 'content and services' business. . .



machine interaction and predictive modelling. On the latter point he drew an analogy with weather forecasting, which used only to be accurate for recording the past, and was therefore not of much value. But now it is predicting with some reliability several days in advance: a service which can be used to make decisions upon which millions of pounds rest.

Cloud hosting of data and software will take over from local hosting: In the future predicts Henderson, "we will never download anything". There will also be new data types – not expressly spatial.

Henderson is closely involved with UN-GGIM and made the point that OS is playing a leading role in this organisation as a means of bringing together various disciplines (statistics, mapping, land administration and remote sensing) along with different nations each with widely varying capacities for the digital future.

Stimulate to innovate Open source software is something that the OS has embraced as user and as contributor. Half of the organisation's products have been available as open data since 2010 but he stressed the importance of keeping it authoritative but you have to stimulate people to innovate,

which is where Geovation comes in, with its annual challenge and the hub in Clerkenwell, London. Standards are crucial to making all this work and OS demonstrates its commitment as the only strategic member of the OGC outside the USA.

Ultimately, OS will become a 'content and services' business Henderson predicts, but that means as spatial content provider for others to use.

An interesting point made by Henderson that has only emerged recently is the concept of the computer system as a digital robot. If it is doing what a person formerly did, such as processing a hotel booking via the internet, then that is an apt description. Perhaps surveyors have been employing robots to do their sums all these years!

Questioned on the changing skill-set of surveyors and geomatics professionals, he said that OS has most difficulty in finding geospatial data scientists and urged his audience to learn about data science, predictive modelling and to get into the heart of analytics and machine data.



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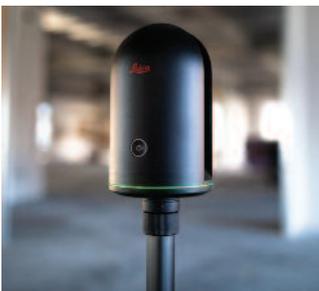
Multispectral drone for agriculture

senseFly has announced the fixed-wing eBee SQ, an agricultural UAV system using the Parrot Sequoia multispectral camera, which can cover up to ten times more ground than smaller quadcopter drones. The Parrot Sequoia camera captures data across four spectral bands (near-infrared, red-edge, red and green) plus visible RGB imagery during just one flight. The system's software includes in addition to eMotion Ag, a complimentary three-month licence of MicaSense Atlas and a complimentary one-month licence of Pix4Dmapper Ag/Pro.

Camera crane to capture BIM data

Pix4D, a Swiss developer of drone mapping software has launched a crane-mounted camera system that automatically collects site data and produces professional 2D orthomosaic maps and 3D models for surveying and analysis. The system has been developed in collaboration with the German crane manufacturer Liebherr. The developers believe it will significantly change the way construction professionals monitor sites and follow the BIM process. To learn more, please visit: <https://pix4d.com/product/crane-camera/>

Leica's \$16k mini 360° scanner



The Autodesk University event last month in Las Vegas saw a surprise announcement from Leica Geosystems with the launch of the

BLK360 3D laser scanner. The tiny device, weighing just 2 kgs, has a range of 60m for a full 360° dome scan. In appearance, the technology is hidden within a beautiful all-black bell-shaped case (reminiscent of a T2 theodolite carrying case!), with one button control to switch on, thereafter control by phone, iPad etc.. The real surprise is a price tag of just \$16k. . . but data goes directly to Autodesk Recap (free sub for a year) so it's essentially a scan-to-BIM tool. Watch this space.

IN BRIEF

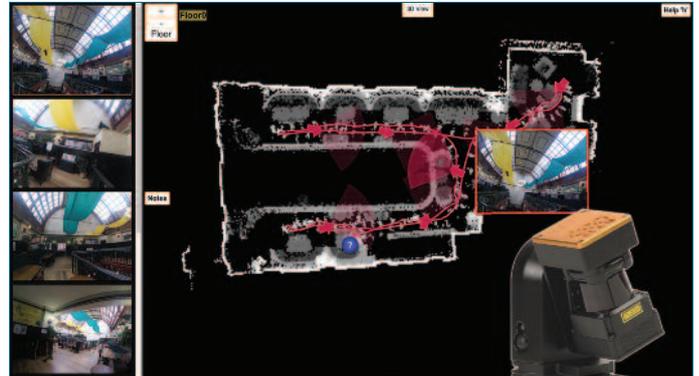
Handheld has a major upgrade to its IP65-rated Algiz 10X tablet computer with new screen technology and improved GPS/GLONASS functionality. The unit now comes with a 10.1" HD projective ultra-bright capacitive touch-screen with the ability to operate in both glove and rain modes.

Chinese company Hi-Target has launched the QPad X5 high-precision rugged tablet designed for harsh fieldwork with an IP 67 rating. Connected to a high-accuracy GNSS module, the device can achieve 2cm accuracy RTK performance.

LandWorks Inc has improved its Web AutoMapper online service, which translates land legal descriptions into GIS-ready map polygons. The update features a new interface, including a job detail web-page that lets you review and edit polygons before you buy. In the US, property polygons can now be mapped against the USLandGrid's national land base, with the option of buying land grid townships containing the mapped property.

Blue Marble Geographics has released version 18 of its Global Mapper, a low-cost GIS

Imagery now from ZEB-REVO



GeoSLAM has unveiled ZEB-CAM, a new add-on option for the ZEB-REVO mobile indoor mapping system which allows imagery to be captured simultaneously along with scan data. With an integrated inertial sensor, ZEB-CAM utilises optical flow technology to accurately synchronise the acquired imagery to the point cloud data.

GeoSLAM's Mark Reid says that several customers have asked for further contextual information to best utilise the resulting point cloud. "ZEB-CAM therefore makes interrogation and feature extraction from ZEB-REVO data simpler than ever."

Meanwhile, Ric Durrant, GeoSLAM's CTO adds, "We did not want to overcomplicate the ZEB-CAM and needed to keep the overall system compact, light and simple to operate. The modular approach adopted with ZEB-CAM means that it can be quickly attached or detached depending on the application. Keeping things simple is harder than it looks but the results speak for themselves."

application combining access to over 250 data formats with advanced spatial analysis tools. The release introduces a new

layout and a complete overhaul of the 3D display engine offering dynamic, full range rendering of LiDAR and terrain data.



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Geospatial World Forum 2017
23-25th January 2017, Hyderabad, India
<http://geospatialworldforum.org/>

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

FEBRUARY 2017

Drones Oman 2017
27-28th February 2017, Oman
www.dronesomanevent.com/

MARCH 2017

2nd Big Data & CEM World Show 2017
1-2nd March 2017, Indonesia
www.bigtechnology.com/indonesia2016/

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

APRIL 2017

AAG Annual Meeting 2017
5-9th April 2017, Boston, USA
www.aag.org/annualmeeting

International Conference on Geographical Information Systems 2017
27-28th April 2017, Porto Gaia, Portugal
www.gistam.org

MAY 2017

Esri UK Annual Conference 2017
16th May 2017, QEII, London, UK
www.esriuk.com/events/ac17/registration

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

AGI Foresight Report 2020



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The Report highlights five key themes that are of relevance, not only to the GI industry, but to anyone with a vested interest in how technology and information will change our world and businesses in the next five years. These five themes - Open, Big Data, BIM and Future Cities, Innovative Technologies and Policy - form the backbone of our Report, bringing together papers from experts across industries and disciplines.

They show that the GI community can, and must, play a big part in helping us to understand and maximise benefits from these areas, and meet head on the challenges and opportunities the next five years will bring.

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