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Earth-Observation Satellites

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CONTENTS

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Maps Are Going Mainstream

A few weeks ago, I caught up with an old friend who has a career in IT, focusing in particular on database administration. On almost each occasion that we have met over the last few years, he would try to better understand this field called 'geospatial'. The questions became routine. "Why are maps not the responsibility of IT? Why is spatial data so different from tabular data? What more does one need from a map aside from occasional directions. After all, I have Google Maps on my phone!" he would say.

Our last encounter was different. "Niall, I finally get it!" he said cheerfully. "Over the past few months, I've been meeting with clients in lots of different industries who are talking about maps - emergency services, farming, local government, banking and retail. It seems like your area is really taking off." After years of futile explaining, this announcement was music to my ears.

Although there are probably numerous reasons why non-GIS professionals are changing their tone on the value of location, the most obvious one perhaps is that the wider public is curious about what more can be done with these mainstream mapping applications. As the 'above encounter' indicates, a range of established industries, which previously had little use for maps, are starting to embrace them as a tool which can be used to help overcome actual operational challenges.

In this edition, therefore, it seems appropriate to celebrate this sea-change by focusing on one of the most essential aspects of the geospatial industry, Earth Observation satellites. These instruments, which collect the imagery that underpins our locational knowledge, is the focus of Gianni Cristian Iannelli's article. In it, he takes us through the key milestones which have taken us to the point of being able to continuously monitor the planet using HD imagery,

HD video and sensor technology. According to Gianni, we are entering into a 'bright age' of Earth Observation.

Perhaps appropriately enough, we also have an article by Nathan Heazlewood on the next phase in the ongoing battle between IT and GIS departments - the lockdown of Master Data in ERPs. Nathan's article reminds us that there are still major spatial awareness-raising challenges for the GIS field. Tim Hayes, meanwhile, continues his exploration of careers in the GIS world - this time focusing on the utilities sector, while Tim Sutton focuses on the open source technology components which can be used to build an OGC standards compliant Spatial Data Infrastructure. Aside from this, we also have an article by Aligned Assets on the use of British Standard addressing management in Africa, a column by Mikael Stern on the continuing 'hammer-mindset' which exists in the Earth Observation industry, and a review of the recent GeoPlace 2018 conference in Birmingham by Jason Poole.

Niall Conway,
Editor of GIS Professional.
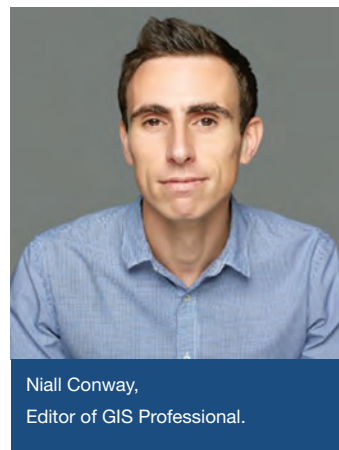
As always, we also have regular contributions from Adena Schutzberg, Katie Decker, and Abigail Page, who recently recently spoke about the UK's Geospatial Commission at last month's GeoBusiness Conference in London.

Finally, I would like to thank all of our readers and advertisers for your continued support.

I hope that you enjoy this edition of GIS Pro!

Regards,

Niall Conway, Editor

UN-GGIM Strengthens Ties with Asian Geospatial Community

According to some updates from members of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), preparations for the World Geospatial Information Congress (jointly organised by the committee's Secretariat and the National Administration of Surveying, Mapping and Geoinformation of China) are well underway. The congress will be hosted in Deqing, China between 19-21 November and it follows on from the Expanded UN-GGIM Bureau Meeting which was held in nearby Zhejiang Province city, Hangzhou in 2015.

Along with the annual plenary meeting of National Representatives from Member States, the event will include a wide range of global and regional meetings, workshops and learning events, side events and meetings. The main focus of the congress will be on strengthening national geospatial information management and systems, and national implementation of the UN's 2030 Agenda for Sustainable Development.

LA Authorities consider Legal Action against Waze

According to a recent article in Govtech, Los Angeles authorities are taking legal action against Waze to stop the trip-planning app routing motorists through residential neighbourhoods in order to avoid traffic on more congested freeways. This recent development represents the latest attempt by governments to control the activities of technology companies which often know more about city traffic than the authorities do.

Waze, a subsidiary of Alphabet (which also owns Google) is a navigational app which uses crowd-sourced traffic information from its users to make trip-planning decisions based on real-time data.

World Bank Warns Mass Movement due to Climate Change

According the Guardian, the World Bank has recently suggested that data will play a significant role in helping governments manage the forced mass movement of tens of millions of people caused as a result of climate change. Among the three actions which government should take such as GHG reductions and the incorporation of climate change migration into their national development after planning: John Roome, a senior director for climate change at the World Bank indicated that governments will need to invest in further data and analysis for use in planning development. The global financial body suggests that up to 140 million people in the developing regions of sub-Saharan Africa, South Asia, and Latin America could be forced to migrate before 2050 unless the effects of climate change are better managed.

OSM Celebrates Record Number of Map Contributors

According to the official OpenStreetMap blog, the collaborative mapping project, which helps power the services of companies such as Foursquare, Snapchat, Strava, Apple, and TomTom, has reached 1 million map contributors. Based on provided statistics, the big increase in the numbers, of contributions to OpenStreetMap has occured over the past 2 years especially. On reaching 7-digit contributor numbers Peter Barth, OSFM board-member said: "At its core, OpenStreetMap is all about humans sharing knowledge about the places they visit, live and work in. Our project is only possible thanks to over a million individuals who generously volunteer their time to help others find their way in the world."

Mapbox Hires Head of Product from Google

Following on from attracting investment of US$164 million last October, the San Francisco-based digital maps startup Mapbox has reportedly hired a lead product manager of Local Search from Google to take over a similar position at the company. The Mapbox system is an amalgamation of 130 data sources which licenses maps to software makers. Its geospatial data currently powers apps owned by the likes of Snap Inc, food delivery service DoorDash and credit card giant MasterCard Inc. According to the new recruit, the emphasis of its neighbouring competitor Google remains on its consumer Maps app, while Mapbox exclusively focuses on developer tools.

SpaceDataHighway Starts Full Copernicus Service

Airbus Space and Defence, a division of Airbus which develops defence and aerospace products and services has started a full Copernicus service on its SpaceDataHighway project, a public–private partnership with ESA (European Space Agency).

According to the Airbus website, "the services offered by the SpaceDataHighway enable users to transfer their data (imagery, video, voice…) from their Earth Observation satellites, UAVs, and multi-mission aircraft by means of optical communication via the EDRS-A and EDRS-C geostationary satellites to receiving ground stations located in Europe." The availability of broadband quality data transmission capabilities in near-real time using high-precision lasers is expected to significantly enable the transfer of large quantities of geospatial data collected by the onboard satellite sensors.

FOAM and OGC to Collaborate?

According to a recent blog-post by FOAM, blockchain-enabled Crypto-spatial Coordinates could become a mainstream feature in the future tech world. The article mentions that FOAM are currently in discussions with the Open Geospatial Consortium (OGC) to establish CSC as the globally recognised interoperable standard for location-specific smart contracts. According to the blog, the OGC offered to present on its vision for a geospatial blockchain standard at their most recent Technical Meeting and the company is currently participating in the ongoing discussion of standards for geospatial distributed ledger.

Snapchat introduced Location & Context Tools for Advertisers

The recent launch of two location-powered advertiser tools by multimedia messaging app Snapchat demonstrates that geospatial data is hitting mainstream businesses. Both tools, Location Categories and Radius Targeting, are designed to help advertisers "reach the right audience, in the right place, at the right time" and follow on from the location enabled Geo-filters, Context Cards, and Snap Map offerings.

Radius Targeting enables advertisers to reach an audience within or outside a given radius of a particular location, while Location Categories enables advertisers to deliver relevant content based on the type of location which they are in. The latter also simplifies the process of using Snap Ads and Filters over specific locations or geo-fences. Considering the recent scandal around Facebook's data privacy, Snapchat has underlined that the protection of users' privacy is of utmost importance to the company. Feature settings note that its location services are optional to users and that the company does not share any location information that can be used to identify specific Snapchatters to advertisers.

Google Maps Adds 'Wheelchair Accessible' Routes to Major Cities

A much-welcome update to the Google Maps system will help disabled people more easily navigate some of the world's largest cities. The updated Google Maps will feature "wheelchair accessible" routes in London, New York, Tokyo, Mexico City, Boston and Sydney. It is hoped that the map will help improve urban inclusiveness for disabled people by displaying details such as elevator and ramp access, transit times, and other useful information.

Mapillary Raises US$15m to Boost Digital Mapping for Self-driving Vehicles

According to Venturebeat, Swedish-based Mapillary, a service for sharing crowd-sourced geo-tagged photos has raised a US$15 million round of strategic investment led by BMW i Ventures. This funding is intended to support the development of an independent mapping data system for autonomous vehicles.

Currently, Mapillary's database of street-level images are analysed and understood using computer vision technology. Their services currently "serve over 22 billion map objects in 190 countries", and they are used by mapping, cities and automotive customers, including partners such as the Volkswagen Group and mapping service HERE.

According to a statement by Uwe Higgen, managing partner of BMW i Ventures: "There is a growing need for an independent provider of street-level imagery and map data, which also acts as a sharing platform among different players... Data sharing is crucial to maintaining accurate maps and to the development of safe autonomous vehicles. Mapillary has made great progress and built technology that will let everyone update maps in a scalable way."

Meanwhile, CEO Jan Erik Solem, who helped start the company in 2013 noted: "The world is still just scratching the surface of autonomous driving, and we know that the demand for a collaborative platform that works across different systems and maps will be steadily growing as autonomous cars hit the streets in increasing numbers."

Boundless Anywhere

Last month, Boundless, the open GIS software company introduced a new offering called Boundless Anywhere, which enables real-time geospatial data collection via iOS and Android mobile devices. The release is focused on meeting an increasing demand for mobile data collection and management in response to the rapid proliferation of smartphones and tablets. Boundless Anywhere extends on the current Boundless Exchange offering and enables users to capture and edit data offline, as well as to update and share geospatial information with other users online.

UK Company Takes Advantage of 'New Space'

A British company is challenging US dominance in the growing Earth Observation industry by taking advantage of the relatively affordable and accessible "New Space" technology to capture and provide HD colour movies of Earth to customers.

The British-made Carbonite-2 satellite, which was built by Surrey Satellite Technology Limited (SSTL) and launched in January, is part of a network of satellites which are operated by Earth-i, a Guilford based analytics firm.

According to BBC news, Carbonite's short clips are the first high-definition, full-colour videos to be delivered from orbit by a commercial satellite on a regular basis, with each sequences having a resolution of one metre. It is expected that this product offering will be popular with customers since video allows for better interpretation and the ability to construct 3D models from the footage. This is especially likely considering the company's future plans to enable high repeat imagery capture - same scene film multiple times.
It is expected that this HD imagery could be of much value to customers in the energy trading industry (e.g. monitoring wind turbine speed), traffic control industry for monitoring congestion, and the military industry for advanced situational awareness capabilities.

Stiff competition continues, however. The announcement about Carbonite was followed by news of an Airbus, Softbank, and Bill Gates-backed satellite project called EarthNow, which plans to launch 500 small satellites to offer video coverage of the world.

GIS Market to Cross US$17.5 Billion by 2023

GLOBAL GIS MARKET, BY COMPONENT, $M (2013 - 2023)

According to a market research report, the GIS market is expected to reach US$17.5 billion by 2023, increasing urbanisation in addition to the surging adoption of GIS solutions in enterprise applications in developing countries is the key factor bolstering the demand for the system. The growth can also be attributed to the implantation of LIDAR technology and increasing availability of spatial data and cloud technology.
On the basis of project size, the GIS market has been categorised into small (less than US$250K), medium (US$250K to US$1 million), and large (more than US$1 million). During the forecast period, the market is expected to register the fastest growth in medium-sized projects. This can be attributed to the increasing expenditure of the defence and healthcare sectors in GIS.
Based on application areas, governments contributed the largest revenue to the GIS market in 2017. Community planning, urban and rural planning, and information extraction on natural calamities are some of major application areas. Although governments in developed countries are the major users of the technology, governments in developing countries too are heavily investing in digital and data-based GIS solutions for urban and rural planning, public health improvement, and optimal utilisation of natural resources. This, in turn, is expected to increase the market penetration of the technology in the coming years.

GetRentr Raises over £500k in Seed Funding Round

Geo-spatial powered property compliance platform GetRentr has raised over £500,000 from a group of strategic investors including Life Ventures, EPIC Private Equity LLP and a number of private individuals.

Founded by Orla Shields, Alex Schembri and Richard Lainchbury, GetRentr uses artificial intelligence to track all UK property licensing regulations and consultations in real time and provides an automated service which enables agents and property managers ensure their property portfolios are always compliant.

The company was selected for the Geovation 2018 cohort for its innovative use of both property data and geospatial mapping. Geovation is an Ordnance Survey Initiative in association with HM Land Registry, which is dedicated to supporting open innovation and collaboration using location and property data.

GetRentr is already working with a number of forward thinking letting agents in the industry and has partnerships in place with major industry players including the National Landlords' Association and others soon to be announced.

The company's mission is to use data and technology to allow agents and landlords to easily comply with regulation, ensuring that the accommodation provided to their tenants is safe and meets required standards. Similarly, through their work GetRentr hope rogue landlords can be exposed, ensuring that no tenant has to live in unsafe, substandard accommodation again.

Commenting on the successful funding round, CEO Orla Shields said: "At GetRentr our vision is to raise the standards of rented accommodation through the innovative use of data and technology, whilst also offering letting agents and landlords significant savings and revenue opportunities by automating complex, error-prone compliance processes. Our pioneering data and technology platform delivers transparency, measurable impact and strong stakeholder returns - things which will set us apart in terms of our ability to recruit the best talent, scale the business globally and enjoy sustainable success.

"This investment comes from an incredible group of investors, who add significant value well beyond their funds, bringing expertise that will help us accelerate market reach and our development roadmap. We are excited to work with these investors, and this additional funding will allow us to bring more features to more markets. This is just the tip of the iceberg in terms of our long-term vision and expansion plans."

Jon Wreth, CEO of LiFE Ventures explained what they found appealing about the team and product, "When we first came across them we had no idea anyone was doing something like this and we were really impressed with what they had developed. We approached Orla who came over to see our office and saw how we do things and met the other tech start-ups we have invested in. We're having major headaches with licensing at the moment and GetRentr can help us solve them and offer a better service to our landlords".

Self-driving Steps up a Gear in California as China Sets Location Testing Rules

Following on from recent crashes involving Telsa and Uber self-driving cars in the United States, Waymo, the self-driving unit of Google parent Alphabet and sibling company of the Google Maps division, has officially applied to the California Department of Motor Vehicles to test autonomous cars without drivers in the state. According to engadget.com, although the new rules allow testing vehicles without steering wheels, foot pedals and mirrors, these applicants will require that remote operators linked to the cars will need to stand by in case of an emergency. Meanwhile, Reuters reports that the Chinese Ministry of Industry of Information Technology has set its own rules for testing self-driving cars, in addition to those announced by the cities of Beijing and Shanghai. The rules specify that all cars must first be tested in non-public zones, road tests can only be on designated streets, and (unlike the requirement on Waymo in California) a qualified driver who is ready to take over control of the vehicle must always be in the driver's seat.

Cadcorp SIS Release Supports More Ordnance Survey Data Formats

The latest service release from Cadcorp SIS now provides full support for various Ordnance Survey data formats including OS MasterMap Greenspace Layer, OS MasterMap Highways Network and OS MasterMap Water Network.

Cadcorp Web Map Layers has been updated as part of the release to include support for Federated Security. It also offers the facility to use the OS Places API in Quick Search and improved feature selection in the application's mobile interface.

The release incorporates a number of bug fixes, software updates and performance enhancements.

Converted Russian Ballistic Missile Launches Sentinel 3-b into Orbit

In April, the European Union successfully launched its latest Sentinel Earth observation spacecraft under the ESA Copernicus programme. The multi-purpose seventh satellite will eventually be cross-calibrated with its identical platform Sentinel-3a (launched in 2016) to make neatly interleaved observations of the planet atmosphere and oceans. In terms of the project's development, Sentinel 3-b is a reflection of a purely international effort. The French-built satellite and British-tested radiometer instruments were launched into orbit onboard a ballistic missile which was converted into a space launch vehicle from Russia's Plesetsk Cosmodrome. Data collected by Sentinel 3-b, like the other satellites under the Copernicus programme, will be made openly available for free use by policymakers, scientists, businesses and the general public.

Big Changes to Google Maps Platform

Tech giant Google has signalled that from 11 June it will introduce pay-as-you-go billing, free support, and Cloud requirement to its Google Maps Platform - the biggest change to its Google Maps business since the platform was opened to developers in June 2005. The recent move means that developers will need a valid API key and a Google Cloud Platform billing account to access the 18 code Google Maps APIs (which are now streamlined into three core products: Maps, Routes, and Places). In particular, this means that the previous Google Maps business standard and premium plans have been consolidated into one pay-as-you-go plan and it is likely to "flush out" many of the of unauthorised or dormant developer accounts which were created using standard Google accounts.

Satellite to Spot Planet-warming Industrial Methane Leaks

An American-based non-profit environmental advocacy group, in partnership with Harvard University and the Smithsonian Astrophysical, has recently announced plans to use a satellite to capture and make public information on major methane leaks from major facilities around the world. The Environmental Defense Fund (EDF) aims to launch a multi-million dollar satellite called MethaneSAT by 2021 and expects that the information can be used by authorities and companies to reduce the methane leaking from oil and gas facilities around the world, which are considered as a major contributor to global warming.

Currently, there is limited reliable, precise, transparent, and regular data on methane leaks. This is particularly the case in less developed parts of the world where this information is limited by technological knowhow and/or a dislike of scrutiny. It is hoped that the satellite data will provide an easy and cost-effective means for the oil and gas industry to plug methane leaks which occur from exploration and production sites, as well as from leaking pipelines.

According to the International Energy Agency (IEA), a large number of gas leaks could be stopped at zero cost, thanks to the cost of the fixes being offset by the value of the gas which is retained by the facilities. It is hoped that this technology will also be used to monitor large methane emission from livestock feedlots.

US Government to Start Charging for Landsat EO Data?

In a move which is likely to upset members of the global scientific research community, the US government is currently considering proposals to charge for access to two widely-used sources of remote-sensing imagery: the aerial-survey programme run by the Department of Agriculture (USDA) and the Landsat satellites operated by the US Geological Survey (USGS). Results from an assessment by a federal advisory committee are due later this year, with fees possibly being introduced as early as 2019 - a rollback to the fee-paying model for the Landsat imagery which ended in 2008. The move follows US President Trump's withdrawal of support for the international climate Paris Accord climate agreement. This is despite efforts by other countries (through the likes of ESA's Copernicus Programme) to make Earth Observation imagery more openly and freely accessible. According to the International Journal of Science: "A USGS survey of Landsat users released in 2013 found that the free distribution of Landsat imagery generates more than US$2 billion of economic benefit annually — dwarfing the programme's current annual budget of roughly US$80 million."
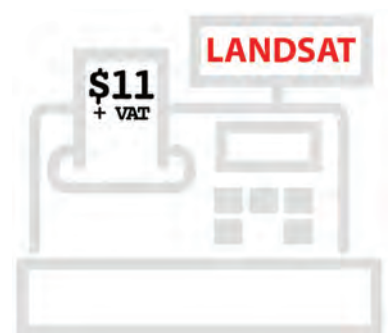
Esri Ireland Eyes Expansion Following €1.6 Million Investment

Paul Synnott, director and country manager, and Eamonn Doyle, CTO, in the refurbished Esri Ireland Dublin offices.

Esri Ireland, the market leader in geographic information services, has announced that it has invested €1.6 million to expand its operations and cater to increasing customer demand. This investment has funded the upgrade of Esri Ireland's Dublin headquarters, the lease of new office space in Northern Ireland, increased headcount and enhancement of the company's technologies and platforms.

Esri's software solutions enable its public and private sector customers to record where things are happening and analyse why, helping them to gain insight and make better decisions. The investment will facilitate the expansion of its service offering, allowing it to provide a range of new services to businesses. This includes the provision of comprehensive managed services.

Esri Ireland employs 75 people, including software engineers, GIS consultants and developers, and sales and marketing professionals. The company has undergone significant growth in the past year, adding 25 new staff, growing revenues by 13% to €7.8 million and taking on 38 new customers. Esri Ireland is targeting further growth again in 2018, forecasting revenues to grow by more than 15% to €9 million.

Esri Ireland has also launched GIS managed services, a secure end-to-end managed service for organisations' GIS environments. This includes the monitoring, management and support of the GIS environment and will enable customers to quickly and easily deploy geography into their business processes and workflow. To ensure effective delivery of this service offering, Esri Ireland has directed investment towards new online platforms and technologies that will enable the company to scale to meet increased demand.

Paul Synnott, director and country manager, Esri Ireland, said: "Accessing and utilising geospatial information helps organisations in every sector to increase efficiency and improve their processes. Esri Ireland has continued to drive awareness of the benefits of GIS, to the point at which it is now seen as a key part of the decision-making process by many organisations."

"We have also launched our innovative new GIS managed services offering which gives our customers access to the knowledge and expertise of our specialist team. This service will allow organisations of all sizes to take advantage of the insights offered by GIS. This investment in our people, platforms and technologies will ensure that we continue to grow and develop while providing our customers with the highest levels of service. We're also looking to spread awareness of the value of geospatial information to new sectors in 2018. This includes working with schools to encourage fresh perspectives from students about how innovative digital mapping can benefit our society." continued Paul Synnott.

Tesla Maps Update

Tesla have announced that the first available 'beta' version of the 'Tesla Maps' is going to be pushed in the software update 2018.12. Naturally, the new navigation system is expected to promise faster routing and more accurate arrival times for its growing number of users. The new system marks a complete overhaul of previous navigation systems and it is likely that the system will use open source modules from companies such as Mapbox and Valhalla.

Google Announces AR Navigation Services

Google has introduced many new features for Google Maps using augmented reality (AR) and computer vision. With regards to AR, they announced a new navigation service, using the camera and GPS of a smartphone to give the user turn-by-turn walking directions.

Google calls this service Visual Positioning System (VPS), referring to the smartphone camera that is used to "recognise" the surroundings. Captured images can subsequently be matched with Google's extensive collection of street view imagery in order to define the user's location. This service will be useful in combination with a series of Yelp-like applications that use machine learning to give users recommendations for restaurants and bars.

Google also has plans for AR using computer vision to identify real-life objects such as buildings and plants. This feature was previously integrated into Google Photos, but will now be released on a number of Android phones so that it works with a smartphone camera. The service can also recognise and copy printed text to a phone. Finally, Google's ARCore SDK for developing AR experiences on smartphones, has been expanded for building multiplayer AR experiences that can be shared across different devices.
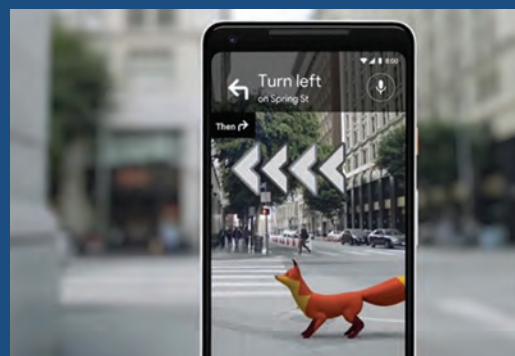
The Bright Era of
Earth Observation Satellites

In helping overcome a wide range of global challenges, the geospatial industry is relying on satellite information to an unprecedented degree. In this article, Italian geospatial solutions developer Gianni Cristian Iannelli, provides a background to the satellite industry and discusses some of the exciting Downstream opportunities which are emerging through it.

Over the past 50 years, advances in satellite technology have contributed to the emergence of the Earth Observation (EO) revolution. The following is an attempt to identify the key milestone events, which have taken the geospatial industry to this data-rich point in time.

The first of these event occurred in July 1972, when a satellite called Landsat-1 was launched into space. This Earth-monitoring Landsat project signalled the beginning of an era in science which was focused on analysing from space the world and all its resources. The first Landsat satellite, which had a spatial resolution of around 70m, opened up a number of new opportunities for end users of the data. Landsat 1 and subsequent satellites enabled the scientific community to develop a range of applications in the fields of agriculture, environmental pollution, hydrology, and mineral resources, which are used to this day.

The next major milestone for the satellite industry occurred in 1986, with the development of the SPOT satellite by the Centre national d'études spatiales (CNES), the French Space Agency. The spatial resolution of this and the following six SPOT satellites range from 20-1.5m, and, today, these satellites enjoy "landmark" status in the EO field thanks to their provision of over 30 years worth of non-stop images of our planet.

The 1990's was a significant time for satellite launches. This period featured a notable set of satellites such as the European ERS-1 (1991), the Japanese JERS-1 (1992), and the Canadian RADARSAT-1

... these satellites enjoy "landmark" status in the EO field...

(1995). Unlike the earlier Landsat and SPOT, these satellites carried a new sensor technology, known as Synthetic Aperture Radar (SAR), which was capable of acquiring radar images with spatial resolutions ranging between 10-100m. The SAR sensor was significant because it offered two notable advantages against optical data (i.e. day-and-night operation capability, and cloud penetration). It is also worth mentioning that RADARSAT-1 outlived its planned life with more than 17 years in operation.

Although RADARSAT was a commercial satellite project, the major milestone in terms of the privatisation of space occurred in 1992, with the incorporation of 'WorldView Imaging Corporation', later renamed 'DigitalGlobe'. In 1999, the company launched IKONOS, the world's first sub-metre resolution imaging satellite. The IKONOS satellite, which was operational until 2015, was significant because it was able to collect panchromatic

IKONOS image acquisition over the city of Venice, Italy (Credits: GeoEye).

Landsat-1 satellite.
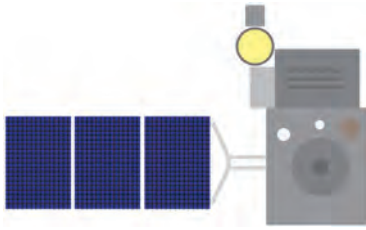
Sentinel 3 satellite.

and multispectral images, at an impressive spatial resolution of 0.80m and 3.2m respectively.

The next major phase in the history of EO was rapid mapping at global-scale - something which was made possible through the MODIS satellite instrument (standing for Moderate Resolution Imaging Spectroradiometer). The instrument was first launched onboard NASA's 'Terra' (1999) and 'Aqua' (2002) satellites. Despite its coarse spatial resolution (from 250m - 1km), the major advantage of MODIS was the possibility to map the entire globe every one to two days; a capability which made it very useful for change analysis applications requiring high revisit times.

The year 2007 marked a significant year for SAR imaging. RADARSAT-2, which was launched by the Canadian Space Agency, by then had an increased spatial resolution of 3m. In addition, the same year, two new sub-metre resolution SAR satellites were launched into orbit. The first of these satellites was TerraSAR-X, which was developed by a public-private partnership between the German Aerospace Center (DLR) and EADS Astrium. The second satellite, which was called 'COSMO-SkyMed-1' (CS-1), meanwhile, was developed by the Italian Space Agency. CS-1 and the three subsequent satellites in the constellation were significant for the EO industry because they had a significantly reduced short-revisit time (less than 12 hours).

In 2014, the European Space Agency (ESA) and EUMETSAT

began launching its own constellation of satellites (called Sentinels) under the Copernicus Programme. The free and accessible remote sensed data shared through the Copernicus services addresses six main thematic areas, including atmosphere, land, marine, climate, security, and emergency. The programme is of significance to the EO industry because it removes the (typically) high data procurement costs from the data acquisition process, and thereby encourages wider commercial use and EO-focused innovation.

Until recently, the development of EO satellites has been restricted to a few national space agencies and sovereign states. The reasons

Until recently EO was restricted to national space agencies and sovereign states.

for this were mainly due to the high complexity and costs of development, deployment, and maintenance of spaceborne EO systems. The last five years, however, has, thanks to reduced barriers to entry, witnessed a number of private actors, investors and venture-capitalists enter the EO-market. This is noticeable - in particular due to the trends in the deployment of small-sized satellites such as 'CubeSats'.

'Skybox Imaging' was one of these private companies, which in 2012 raised around US$91 million of private capital for the purpose of developing and launching a constellation of EO satellites. The significantly reduced size (100kg) and production cost (10 times lower than a common EO-satellite) of these satellites opened up big opportunities for the industry. The first two satellites, named

SkySat-1 and SkySat-2, which were launched in 2013 and 2014 respectively, were important because of their capability to record video footage from space (90 second videos at 1m spatial resolution). Soon after launch, Skybox Imaging was purchased for US$500m by Google, which renamed the company as 'Terra Bella' in 2016.

The SkySat satellites were, however, just the beginning. The recent 'Dove' satellites, for example, which are developed by a US company called Planet Labs, are a mere 10x10x30cm in size and 4kg in weight. If this was not impressive enough, these satellites have a spatial resolution range of between 3-5m. Planet Labs currently have

around 200 satellites in orbit, including 88 cubesats which were launched in one go, and the company has so far managed to acquire EO satellite companies Blackbridge in 2015, and Terra Bella from Google in 2017.

In terms of recent milestones in the EO industry, perhaps the most notable one is the recent acquisition of DigitalGlobe by MDA (MacDonald, Dettwiler and   >
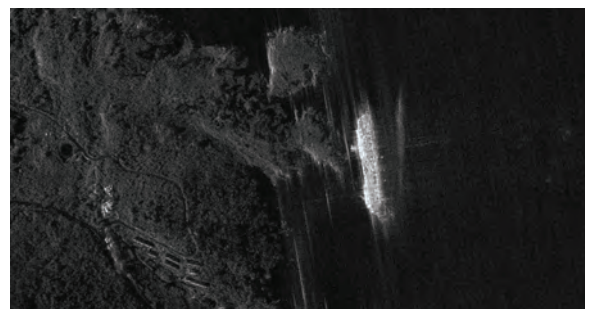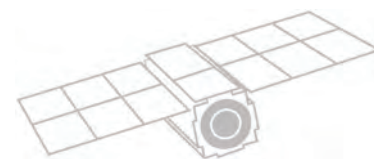

Image of the stranded 'Costa Concordia' shipwreck in 2012 (Credits: Agenzia Spaziale Italiana).

Associates). The US$2.4 billion deal, which represents the biggest acquisition in the Earth imaging market, indicates that the private sector will be a dominant force in the future EO industry. After all, DigitalGlobe recently launched WorldView-4, achieving a pixel size of 0.30m, and has planned two new intraday revisit satellite constellations called 'Scout' and 'World View Legion'.

Aside from the abovementioned companies, the private industry is thriving, particularly in the area of optical and SAR satellites. Some major players include Iceye, Capella Space, Satellogic, Astro Digital, BlackSky, Urthecast, NorthStar, Hera Systems, Axelspace, and Spire. Satellites are becoming as accessible as drones, and it is now even possible to design and buy your satellite components online.

As more and more public and private sector players enter the increasingly crowded EO market, opportunities in the EO industry are shifting to the downstream market. While satellite companies are now using selling points such as spatial resolution, revisit time, spatial extent, sensor, and number of bands in order to differentiate themselves, the real opportunity

Planet Labs 'Dove' satellite

for the geospatial industry lies in the commercialisation of the data collected by satellites. This is demonstrated by the likes of companies such as Orbital Insight and Descartes Labs, which have enabled the development of powerful tailored products and solutions for clients. My view: in the future, it is the companies which harness the significant processing power of cloud-based computing and machine learning technology which will profit the most.

Welcome to the bright era of Earth Observation-satellites!

ABOUT THE AUTHOR

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The Growth Mindset and Learning GIS

If you have not yet run into psychology professor Carol Dweck's thoughts on the importance of "mindset" in education, let me summarise the key idea. She suggests that students who believe that they can get smarter by taking on challenging tasks, even if they should fail to accomplish them, have a "growth mindset." In contrast, she describes students with a "fixed mindset" as believing that intelligence is static and will not change significantly with effort. Students with a fixed mindset see failure as confirmation they do not (and will likely not ever) master the required skill. Dweck argues that students with more of a growth mindset will be more successful in school and life than peers with a fixed mindset.

Much of the research on mindset revolves around K-12 students. The students I work with in Esri's MOOC program are predominantly adults, most of whom have degrees. Esri MOOCs teach core geospatial principles and applications and students try their hands at exercises using, naturally enough, Esri software. Here, I've found evidence of Dweck's mindset idea.

As I write this column, my colleagues and I are three weeks into the first offering of our six-week Cartography MOOC. Based on a survey given during the first week, almost half of our students are using ArcGIS Pro desktop software for the first time. That has provided me with a little laboratory as I help students with installing, licensing and navigating the software. The following is an email which I received in the first two weeks from 'CS', as he worked on a "cookbook" type exercise in which students follow very detailed instructions: *"In Section1, Exercise 3, part 6 h, when I click on the Urban_AreasMA layer symbol to open the Format Polygon Symbol, I get a pane called Layer Properties: Urban Areas_MA but no Format Polygon Symbol. So I am stuck. Can you explain?"*

What CS really wanted, I suspect, was that I tell him what to do to in order to get back on track to finish this exercise. In the interests of the social learning approach which we encourage, I suggested that he post his question (along with a screenshot) to the online course forum. He replied: *"I'd use the forum, but I can't figure out how to post such an image."* Many other students had posted images of their completed maps and situations where they were "stuck." The course FAQ included a question about how to post a screenshot. CS shared an image with me via email. I determined that he was clicking the wrong item in the interface (the name of the layer rather the symbol with which it was rendered) and sent a return screenshot with an arrow indicating where to click. He replied: *"Thank you! It worked. I almost gave up…"* I have mixed feelings about that interaction. I'm glad I could help and I'm glad he did not give up, but wonder what he would have done without my response.

Now, contrast that exchange with one from 'HS'. He explained that he worked a few days a week at another location and wanted to complete the course on a second computer which was available there. *"How should I save work so it's available on the other computer?"*, he asked.

He had tried moving the project himself, but it didn't work. Since ArcGIS projects and project packages are topics which are beyond the scope of the course, I pointed HS to the software documentation. The following was his response the next day: *"I was able to come up with a way, though not elegant, to transfers course files between my desktop and laptop systems; cut and paste the folders the projects and source files are in at each switch of computers."* I was jazzed! HS took on a task that was not part of the course with a bit of guidance and confidence to experiment.

Where do you think CS and HS fall on the "mindset" continuum? Which of these students would you want to work with as a colleague? As per the studies of Carol Dweck, the idea of mindset, based on these teaching interactions, provides a valuable lens through which to explore teaching and learning.

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

BY NATHAN HEAZLEWOOD
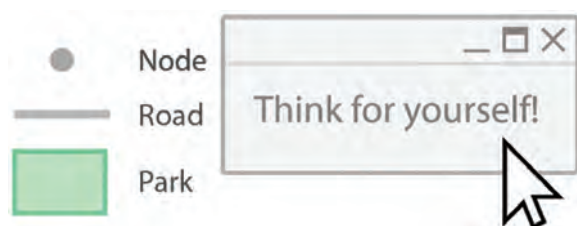
The Battle of Masterdata

GIS Professionals within large corporate organisations sometimes find themselves at odds with 'general IT' management. Some CIOs, IT Managers or Enterprise Architects lack a full understanding of GIS and, as a result, they try to apply rules to GIS that are better suited to other classes of systems, writes **Nathan Heazlewood**.

… 'IT Generals' have issued an order that ALL DATA MUST be 'mastered' in one system…

Over recent years a new area of conflict has opened up, one that threatens to undermine the effectiveness of GIS: the 'IT Generals' have issued an order that ALL DATA MUST be 'mastered' in one system (and that system is generally not GIS). Some organisations are increasingly taking this command to extreme lengths: removing data from GIS systems and restricting the access to that data once it has been transferred somewhere else. It is now time to find ways to stop retreating and counter this attack through improving the understanding and appreciation within 'general IT management' about the capabilities of GIS, about

why data has to be available in certain formats and about the serious collateral damage if access to this data is forbidden.

This battle is particularly prevalent within larger organisations that are implementing 'Enterprise Resource Planning' (ERP) systems. ERP systems were originally designed

to provide one system to carry out functions that are common to almost all organisations, such as purchasing, inventory, sales, marketing, finance and human resources. Often, an ERP will depose multiple legacy systems that only carried out one or two of these functions.

Intelligence reports from the frontline are suggesting that some IT Solution Architects are making statements such as "in a GIS the only thing that you need to hold is the X, Y". In extreme cases, Solution Architects are saying "well, our ERP system has a map so why do we need this GIS stuff?" IT architects can confuse basic digital maps and rudimentary GIS functions

available in some ERP systems with a fully-fledged GIS. The result of such misinformed strategy is that GIS teams are often forced to surrender attribute data that they have traditionally managed over to management within ERP systems, and in some cases, worryingly enough, they are not even permitted to hold a copy of that attribute data within GIS. Instead they get some form of access to that attribute data via an API or other connection, often resulting in limiting the GIS functions that can be used. The result of the above effectively means that GIS teams are operating with 'one hand tied behind their backs'. Not advisable in any battle.

Some data is of legitimate interest to both a GIS and an ERP - the street addresses of clients serves as an obvious example. If the UN was in charge then what should be happening is for one or other system to be designated as the system where data can be created, updated or deleted and for both systems to be able to 'read' the data. Another option is for both systems to be permitted to edit, with a reconciliation process.

Part of the misunderstanding is that ERP systems are often 'transaction' based systems of record that typically deal with easily definable, repeatable and uniform processes. This may include frequent tasks such as taking an order from a new client, implementing an authorisation transfer process when a staff member resigns. Some ERP systems are also being used for tasks related to land, such as valuation of land parcels. Unfortunately, very often the experts tasked with designing

those systems don't understand the strengths or functionality of a GIS that are both less easily defined and not always uniform. This includes tasks such as ad-hoc analysis, scenario based design and analysis, spatial analysis etc.

The importance of this is difficult to justify to people that have a mindset that 'all processes must be designed in advance'. Somehow we need to implant the understanding that one of the main strengths of GIS is the ability to answer ad-hoc questions and to perform previously unimagined analysis.

As an example, one very common use of GIS in 'real' military planning is 'scenario based analysis' i.e. future scenarios that may or may not happen. Like Churchill in his war-room, many military strategists use maps to display the location of ships or units, and then role play multiple different actions that the enemy might make, and what counter-attacks they can make with their own forces and then take into account of other geographic factors. How stretched will our supply lines get? What would happen if it rains tomorrow? Would these roads become unsuitable for tanks?

A civilian example of scenario based analysis is currently occurring where I live in Auckland. A new shipping port needs to be built and 28 possible locations have been compared using GIS to analyse various scenarios. As any GIS professional will understand, that analysis creates a lot of data, much of which will be discarded once a decision has been made. However, in one of those scenarios the 'draft' data will be the starting point for the 'real' data. If all of the records for these 28 scenarios need to be created in another system and then transferred to

GIS, just so that coordinates can be added before analysis is then carried out in another system, then this leads to a lot of unnecessary extra work. A critical element of this is where and how 'object IDs' or unique identifiers are created. This process alone can cause havoc for

... in reality we are all on the same side...

the GIS professional since it can impact versioning and object ID history managed geographically (for example, the relationships between land parcel records when a single land parcel is 'split' to form two new land parcels).

Many spatial analysis queries and processes rely on a combination of spatial functions and 'standard' SQL queries. If the data to perform these functions is restricted or only available using certain limited API connections then a lot of analysis becomes impossible. Even if some form of connection is permitted for GIS to access the attribute data in another system then the performance of spatial queries can still often be painfully slow. For example, if a spatial query is generated in a GIS, and utilises many buffers, and intersects against geospatial data, but also needs to run multiple nested SQL queries against many tables in an external system, then the time taken to execute the query can be many magnitudes greater than the time it would take if the data was structured and held within the GIS. One recommendation is that measurements of tasks like this is some of the ammunition that we need.

The GIS industry needs to get organised to coordinate and respond to the threat posed by 'misinformed' IT managers. The solution is to find ways to educate

general IT management so that they understand the issues outlined above. GIS Professionals need to do things like encouraging more general IT people to attend GIS conferences. Throughout history many wars have been started through miscommunication. Therefore GIS professionals need to do more to learn the language used by our IT brethren. Our industry is heavily out-numbered by the general IT industry, meaning that we must, therefore, push for new peaceful alliances with our IT colleagues, who are, after all, on the same side.

Views expressed do not necessarily reflect the opinion of the author's employers or any 3rd party.

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Career Expectations for the GIS Professional: **Utilities**

This is the final part of three articles pertaining to what to expect as a GIS Professional on a chosen career path. Part 1 focused on what one can expect if they choose a career in government, while, Part 2 focused on what to expect in the private sector.

UTILITIES ARE A DIVERSE ASSORTMENT

There are a wide variety of utilities. At face value there is water, gas, electric, and sewer. But, take a deeper dive, and you will find that utilities present the greatest opportunities for the GIS professional. Water Utilities, for example, include Drinking Water (Potable), Recycled Water, and Irrigation Water used to manage agriculture. Sewer Utilities include Sanitary Sewer and Storm Sewer. Then you have Gas utilities - which type? There are gas transmission utilities and gas distribution utilities. Consider Oil. This is also a utility and consists of Upstream (Source), Midstream (Pipelines), and Downstream (Customer). For Oil, the greatest opportunities for GIS reside in Midstream.

GIS and utilities go hand in hand. They both need each other. In the world of utilities, GIS is not a luxury, it is a necessity from the operational and regulatory standpoints. Whether it is a private or government utility, it offers tremendous growth potential, along with complex challenges, for the GIS Professional.

SO, WHY GIS?

Let's break apart how utilities see GIS as a must have: Every utility has Operators, Maintenance Crews, Heavy Equipment Operators, Electricians, Instrumentation Technicians, Construction Inspectors, and Engineers. Operators are people who turn the valves and monitor the pipelines. They are heavily dependent on map books or GIS-based mobile apps to locate, for example, a specific valve to close or open. Therefore, having the location and key attributes available to them while in the field, such as the number of turns to close a valve is critical. When a water pipe breaks, it can mean the difference between someone's home getting flooded or not; stopping the leak by closing a valve is time critical.

Maintenance crews fix broken equipment. They may not need to use a specific GIS application, but it is common for them to interface with GIS via their computerised maintenance management system (CMMS). Most utilities have, or are likely developing a CMMS which tracks maintenance and work orders done on equipment. It is common for a CMMS to have a GIS map viewer tool embedded inside its software. This provides the user the option to access a map showing the location and work orders associated with a piece of equipment. Heavy Equipment Operators use GIS to find out what is buried below them before they dig up a broken pipe needing repair.

Electricians use GIS to find out where the substations, transformers and electrical manholes are located. This also includes where the cables/wires come from and go to. Instrumentation Technicians need to know where the SCADA (Supervisory Control and Data Acquisition) sensors are located and which assets they monitor. Construction Inspectors need

… in utilities, the best ideas come from the bottom up, not the top down.

to know what utilities are buried where on their project site. Maps and utility field markings, based on GIS, provided to the Construction Inspector before construction begins has a proven track record of saving time, money, and making everyone safer. Engineers use GIS for hydraulic modelling, asset management, and project planning/site selection. Collectively, all these people can be referred to as your customers.

IT'S ABOUT PEOPLE, NOT TECHNOLOGY

Working with such a diverse group of customers presents its own challenges. Each group has their own goals and objectives, some may not necessarily correspond with the other groups. The success of your GIS will depend heavily on your ability to cultivate positive relationships with these customers. If you are a person who has little or no people skills, it is in your best interest to learn these skills. It is people that power the GIS, not

software or servers. Trust is also important. You must gain the trust of these customers. This is done by learning what they do and how they do it. None of this is taught in school or a GIS certificate program - it is learning as you go. To be successful, you must teach yourself more than just GIS software and databases. It is about how the systems within the utility work together, the language/slang used to refer to equipment, and of course the equipment itself. For example, ask yourself how does a Switchgear function? What is a Single-Line Diagram? What is the difference between a Lift Station and Pump Station? What is the difference between a Plug Valve and Gate Valve? If you can master the art of understanding your customer you will exponentially increase your chances of success. The greatest satisfaction you can derive will be witnessing your hard work in action and seeing the results of your efforts as a critical piece to a cost-saving decision or innovative idea.

But, be wary, utilities are not a perfect world for GIS. It is important to understand that from the management side, expect to see mostly Engineers in these roles. This can be an issue for the GIS Professional since the prevailing industry philosophy is that anyone with a degree in engineering is automatically qualified to be a manager. As a result, it is not uncommon that you, the GIS professional, will be supervised by someone who is myopic, obdurate, and antithetical to the unifying philosophy of a GIS. As was mentioned in the previous articles in this series, it will be up to you to educate all individuals in the value GIS can provide to the organisation. This is best achieved by mastering the art of public speaking. It is best to keep an informal strategy that could include lunch n' learn workshops, e-blasts with fantastic updates on GIS, and most importantly, simply walking around and getting to know

your customers (including where they work) by getting into the field and seeing them in action. Maximise your face time with them - such as eating with them in the lunchroom or chatting with them during their breaks. The more they see you,

GIS is one of the few IT-related careers where creativity, holistic thinking, and working with customers predominate.

the better they get to know you, the more they will trust you, and the more likely they will become your biggest supporters. After all, in utilities, the best ideas come from the bottom up, not the top down. Most of these customers may not know what a GIS is, but they do know it makes their jobs easier and safer.

UTILITIES ARE "REAL GIS"
Expect to engage in a wide variety of projects. Utilities is where "real GIS" resides. Almost every task you can expect to engage in is mission critical to the utility. Systems Integration, for example, the joining of GIS to Customer Billing Systems or GIS with Asset Management Systems is vital. GIS provides the ability to instantly notify customers of a power outage or water service interruption. GIS can explain which pipelines or assets are at greater likelihood of failure. Engineering, with the use of GIS for Subsurface Utilities Engineering (SUE), is a process being widely adopted by many utilities. It is the identification, location, and verification of buried utilities in an area at various phases of a project's design before

construction actually begins. The data collected is stored, retrieved and manipulated in GIS. This process, when joined with GIS, has been proven to save thousands, and in some cases millions of dollars on an engineering project.

Hydraulic Models are necessary for the understanding of how a water system is functioning. It answers questions such as, 'How much more demand can the system handle before a new pump station needs to be added?' and 'Does the system have enough reservoir capacity?' These models are built and calibrated using GIS.

DO YOU STILL WANT TO WORK IN GIS?
Knowing more about who works where and salaries are is important also. According to the 2011 URISA GIS Salary Survey, almost 66% of GIS professionals are employed in the government sector. Of this number, 22% work in the public utilities sector. There is no information on the percent of GIS professionals who work in the private utilities sector. But, GIS is equally mission critical to public and private sector utilities. GIS professional salaries are less than those of most other IT sectors. Given the importance of GIS to the organisation, it remains a mystery as to why this appears to be the case. However, do not let this discourage you from starting a GIS career.
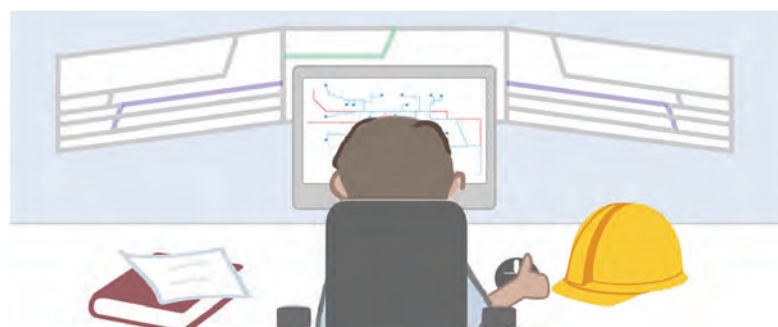
The end has come to the final article in the series. You will notice some common themes in this series: 1) GIS, even after being around for 45+ years, is widely misunderstood; the infernal question of "What is GIS?" will follow you throughout your career; 2) Those who will supervise you will rarely understand, or take interest in, what you actually do; 3) Everyone says they want GIS, everyone says they need GIS, but they consistently fail to dismantle the silos and barriers that are necessary for it to be successful across the entire organisation; 4) Everyone thinks they can "do GIS" - this will be of tremendous annoyance to you as the GIS professional; 5) Expect resistance from the more entrenched IT people within the organisation. After all, GIS is about change and change is very difficult for many decision-makers, particularly in the government sector. It will be up to you to effectively avail yourself of the geo-neophytes among your customers so that they can be useful to your endeavors. Given these realities, you as the GIS professional must choose wisely which areas in the organisation you feel GIS can succeed and disregard those areas where failure is highly likely. This is best achieved by gaining a thorough understanding of every aspect of the organisation you work for.

Do not let the recent paradigm shifts in the GIS profession discourage you. The advent of cloud-based computing, open source GIS, real-time data acquisition, and other innovations, will work to your advantage. One way is that these technological advancements provide you more time to focus on the people you are there to help. Ultimately, this encourages the free flow of ideas and furthers innovation.

GIS can be a rewarding career. It is one of the few IT-related careers where creativity, holistic thinking, artistic visualisation, and working face-to-face with your customers in all environments predominate. You may witness others in the IT profession earning more money than you, however, rest assured that your job is more fun!

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Tim Hayes, MSc, has been a GIS Professional for the past 25 years. He currently holds the position of GIS Manager and supervises a team of three GIS Professionals at a municipal utility. He holds a Bachelor's and Master's Degree in Geography with a Certificate in GIS. His career has spanned all areas, from the private sector, government, and utilities.
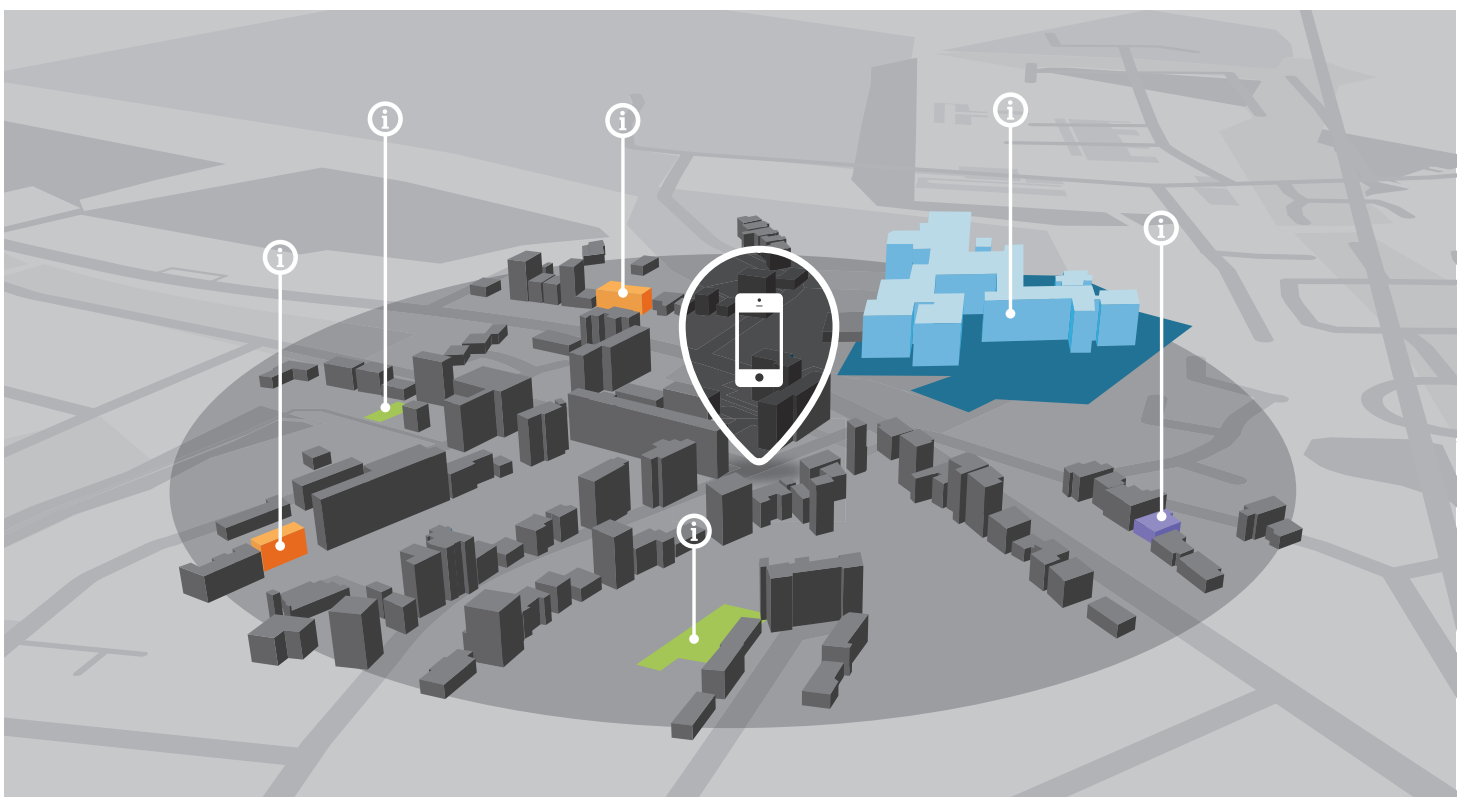
Earth Observation Big Data
- The Hammer Mindset Lacks the Edge

An old adage tells us that if all we have is a hammer, we see every problem as a nail. So for bigger problems we get a bigger hammer...

The European Sentinels generate more than 10TB of free scientific-grade imagery every day. Over the past few years I've heard about truly amazing new approaches to handling output at this scale. These have ranged from bigger storage and faster processors to better fibre and wholesale use of the Cloud. Sounds like Big Data needs a Big Hammer... right?

So here's a thought. **Only a small proportion of commercial satellite data is ever monetised.** Naturally, therefore, we can't afford to treat all data the same way. Considering this fact, are we sure the hammer is up to the job?

Data transport, processing and storage drive costs, especially when talking about huge amounts of data. I mean, why even move data from the ground station if it is impossible to sell? Similarly, processing usually means storing the same data over and over again in multiple versions. This is great if you sell storage.

But let's say you have all these products ready to go. What are the chances you have exactly what any specific customer actually wants? This is a case of "one size fits no one". The Sentinels are great in many ways, but their standard products don't quite work for anyone straight out of the box. So, why the flexibility?

There are other perspectives out there also – what I would cautiously call "smarter" approaches. "Just-in-time" or "lean" methods have been around now for a long time, and they can impact the bottom line in a positive way, both in terms of investment and operational costs:
• Only move the data you really need
• Don't process the data until you need to
• Only process the right data.

I doubt anyone reading this thinks these are controversial ideas. **So why are we stuck in the old paradigm of "move/process/store everything"?** After all, it came down to us from the early days of satellite imaging when the technology gave us no alternative. Today, we have other options. And yes, everyone talks now about processing "on the fly", but typically this is at the end of a chain, only after significant monies have already been handed over to our three old friends - transport, process, and storage of data.

I believe the root of the issue is the misconception that flexibility is expensive. That is, the flexibility to select, process and serve up just the data needed to meet the customer's specific needs. Today, the whole process can be built this way - from the ground station (or even the satellite itself) all the way to the user. And building for flexibility doesn't need to cost any more than a traditional stovepipe. Over the lifetime of a constellation it will pay dividends through operational savings on transport, processing and storage. So I would argue that "smarter" approaches are advantageous, and perhaps even essential, for healthy satellite image businesses. Focus on rapid access and processing of the precise data needed to create exactly the product your customer wants - without spending money and effort on the rest.

Innovative ways to keep CAPEX and OPEX under control sharpen the competitive edge. And I think we can all agree that hammers don't have much of an edge. The technologies are out there, but first we need to change our perspective. **Once we've let go of the hammer, the whole data chain can be lean and flexible.** We won't try to deliver all the data to everyone (or indeed, most of it to no one) - instead we'll deliver the right data to the right people just when they need it.

ABOUT THE AUTHOR
Mikael Stern is the CEO at Spacemetric. To read the original article, go to LinkedIn where it was originally published.

Building an SDI with FOSS

A spatial data infrastructure (SDI) seeks to harmonise users with the provision of data, metadata, software and computational services to provide a productive and flexible environment for working with geospatial data. In an enterprise environment, the development of an SDI constitutes the foundations of the GIS department or group in your organisation. The Open Geospatial Consortium (OGC) provides a number of standards for various elements of an SDI. In this article, we will review the software options provided by the FOSSGIS (Free and Open Source software for Geographical Information Systems) community for developing an OGC standards compliant spatial data infrastructure (SDI). This will provide the foundation for future articles where we will delve into some of the individual projects described below.

Let us start our grand FOSSGIS SDI tour with the basics: The **spatial data repository**. In the previous edition of GIS Pro, we took a look at PostGIS and PostgreSQL via an interview with PostGIS co-founder, Paul Ramsey. For storage of vector data in the enterprise, PostGIS is an excellent choice. It runs on all major platforms (Windows, Linux, MacOS) and provides an enterprise-ready data store for vector data, capable of providing for multiple concurrent users and hosting large volumes of data. PostGIS supports representation of features in both the OGC Simple Feature Specification or as true topology. It also supports representing true curves. Although PostGIS is capable of storing raster data too, it is more usual to use a traditional file system based approach for hosting these larger datasets. For **file based storage**, the venerable GDAL library deserves

a mention as its command line tools allow for various transformation services of raster data, including enabling one to generate hierarchical tile mosaics (TMS) stores from source raster data.

Once you have established a data store, the next consideration is the annotation and publication of this data with standards compliant metadata in a **metadata catalogue**. This is referred to as the catalogue service of the SDI. Typically an SDI should publish data using ISO based institutional standards such as INSPIRE, ISO 19115 etc. made available by the Catalogue Services for the Web (CSW) standard. The flagship product here is GeoNetwork, which provides tools to manage metadata for geospatial data sources, search that metadata and browse the related datasets using a web map viewer. PyCSW (which, along with GeoNetwork, provides a reference implementation for the OGC CSW standard) is a library for publishing and managing CSW-compliant metadata. Platforms such as GeoNode and CKAN provide spatial data storage services, with PyCSW providing catalogue services, to form a spatial content management system, or an SDI in a box.

There is a need to direct users to the data itself after it has been discovered in the catalogue. This functionality is provided by the **spatial data service** component of an SDI. GeoServer, Mapserver and QGIS Server are great examples of FOSSGIS data publishing engines. These spatial data servers make data stored in the spatial data repository available via a number of standards based protocols: The web feature service (WFS) for serving vector feature data, web coverage service (WCS) for serving raster coverages and the web mapping service for publishing ready-to-consume cartographic renderings of one or more datasets.

Users within an SDI environment will often need to transform and manipulate data between data formats, projections and map synonymous attributes between different data sources when merging or importing datasets. In the FOSSGIS world, Proj4 is a key project for the provision of coordinate reference system **transformation services** and is used by many popular GIS tools such as GDAL and QGIS. GDAL (Generic Data Access Library) provides the capability for reading and writing a huge variety of raster and vector (via its OGR sub-system) data formats. It is also used by various commercial GIS applications.

Many SDI implementers will also look to deploy **web-based processing services** via the Web Processing Service (WPS) standard. A WPS can offload resource intensive tasks to a server and away from users' desktops. Additionally it offers a way to have processing take place 'near the data' instead of requiring
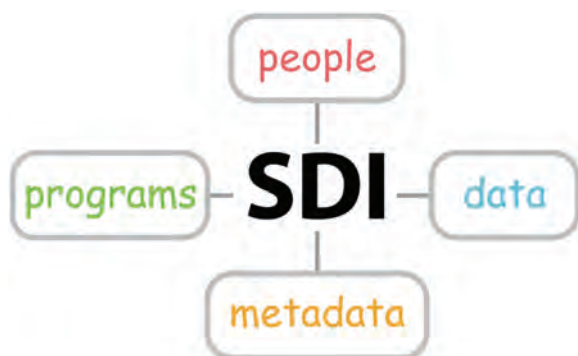
that users retrieve large datasets locally to do analysis. The FOSSGIS community provides some excellent options for WPS: Zoo and PyWPS being notable examples.

With the above elements in place, a key remaining element is to leverage the SDI to provide GIS services to users via desktop and web-based **GIS applications**.

For desktop users, there are a number of mature, feature rich GIS applications. GRASS GIS is one of the oldest GIS projects, commercial or otherwise (over 30 years). GRASS is still under active development and its developers have ensured that the application remains relevant with its rich assortment of analytical tools, topological data model and host of other features. gvSIG and QGIS, although newer projects than GRASS, are both mature applications and also provide mobile applications as sub-projects. They offer a more modern interface than GRASS. QGIS and the Community Edition of gvSIG can interface with GRASS to leverage its analytical capabilities. There are a number of other FOSSGIS desktop GIS applications worth exploring: uDIG and Orfeo Toolbox (OTB) being good examples. uDIG specialises in being a great OGC web services client. OTB is an extremely powerful remote sensing application. The nature of these projects being open source

software means that your desktop GIS choice need not be an all-or-nothing affair. Projects like QGIS also act as a front end to OTB, GRASS and SAGA, giving you a 'best of all worlds' approach.

When users need to discover and **access the SDI via a web browser**, the FOSSGIS community has developed a number of useful applications. Probably most well known are the javascript libraries OpenLayers and Leaflet. The former provides an extremely versatile set of functionality for making richly functional web applications. Leaflet, on the other hand, aspires to be a very lightweight Javascript GIS browser that can be extended via plugins as needed. These are both build-your-own toolkits, though there are a number of ready to run web applications to serve many different use cases.

In almost all cases, **OGC Web Services** are the underpinnings of these applications and the data exchange between applications, so if you have not already done so, it is worth familiarising yourself with the various OGC standards if you intend to build out an SDI. FOSSGIS developers tend to eschew proprietary formats and protocols as they are hard to interoperate with - an SDI should facilitate data exchange between the different components as easily as possible, while also making it easy to open services to the outside world. Open standards

(such as those published by OGC) go a long way to facilitate this.

So, given the whirlwind tour above, you may be wondering "what is missing"? There are still holes in the matrix of tools and applications provided by **OSGeo** (the umbrella project for most of the above-mentioned applications). These holes are most noticeable when you start entering into vertical markets. The more specialised the domain (e.g. mining, civil engineering, natural resource management), the less likely you are to find ready to use schemas, applications and data to incorporate into your SDI. That said it is always worth doing some research before discarding the idea of using a FOSSGIS based stack - you may well find something that fits your needs well. In cases where vertical markets are not well accommodated, many users 'build their own' applications using the numerous FOSSGIS tools, and it is not uncommon to see a number of organisations in a given sector banding together to fund the development of open source tools to support their needs.

If you are interested in finding out more about the options available to you, it is worth attending the annual FOSSGIS user conferences - this year it will be held at the end of August in Dar es Salaam (http://2018.foss4g.org), or take a virtual tour of the projects at http://osgeo.org.

ABOUT THE AUTHOR
Tim Sutton is QGIS project chair and director at Kartoza Pty Ltd. This article represents his personal views and opinions and not those of his employer (Kartoza Pty Ltd.) or the QGIS Project (http://qgis.org).

GeoPlace 2018 –
Data Sharing Vital to Future Success

The recent GeoPlace Annual Conference took place on Thursday 10 May at Edgbaston Cricket Club in Birmingham, UK. Although many topics were discussed throughout the day, talk often circled back to needing one central hub of data that everyone has access to if the industry is going to progress, reports Jason Poole.

In typical conference fashion, the day started with registration, refreshments, and a chance to look round the various stands at the exhibition (and out the window which overlooked the cricket ground). The Welcome talk was delivered an hour later by Nick Chapallaz, Managing Director, GeoPlace who proudly announced that the conference, consisting of 420 delegates, was the largest event to date. This achievement was attributed to the growing addressing sector - with 2.5 billion street and address data records held and 35 million changes being made per year.

THE VALUE OF DATA

The packed main hall where delegates listened to the presentations.

Some 90 days after the Chancellor set-up the Geospatial Commission in his Autumn Budget (consisting of a £40m investment per year for the first two years), William

Priest, Director of the Geospatial Commission, took to the stage to provide an update on his plans for the future. Priest noted that the UK is currently ranked 2nd out of 50 countries for Geospatial readiness and stated the difficulty which the nation faces in maintaining its position, considering the significant advances of other countries. Nevertheless, Priest displayed optimism in the future of the industry which will require further technological investment and increasing the accessibility of accurate geospatial data assets through the removal of unnecessary barriers. He was cautiously optimistic that doing so would see the economy grow by a possible £6-11bn.

Sally Kendall, Head of Street Works Policy and Regulation, Traffic & Technology Division, Department for Transport, used her time on stage to provide an update on Street Manager, a new digital service for planning, management and communication of street and road works. The system, which is designed to minimise and plan for disruption caused by congestion, pothole maintenance, and accidents, uses a single source of open data for all roads, and allows for better network planning. Thanks to it being developed from user research at a very early stage, she was optimistic it could live up to its promise.

Andrew Button, Data Analysis, Manager, Ofcom, spoke about building a complete picture of the UK infrastructure. He thinks linking addresses via a unique property

reference number (UPRN) is the key to success in completing this jigsaw. 65,000 households status are still unknown, which in his words "bugs me", and he plans hopes to improve this and a number of other areas in the future.

USING DATA TO OUR ADVANTAGE

Providing health and care to those who need it costs approximately £3.5bn in the county of Kent. With this being such a huge sector, Dr Abraham P. George, Consultant in Public Health, Kent County Council, in his presentation, called for a linked dataset from GPs, mental health wards, hospitals, social care records, hospices, and more using UPRN. Having access to data such as age, gender, demographics, risk score, and previous health visits will not only help the hundreds of providers cope with the pressures of demand, but also anticipate future demand for a more effective system. He ended with "Right data, right analysis, right structure".

Jai Ghai, Application Manager, Wolverhampton City Council, spoke about developing a central website where any information a citizen would need could be found. He used the quote: "Using data to drive change, delivering improved decision making, efficiencies and performance across the business contributing to increased customer satisfaction", to sum up their mission which will of course require accurate, relevant, and up-to-date data. The system will have a 'cloud first' strategy using Microsoft Azure

with an in-house web service being developed.

With £336m lost through fraud from 75,000+ cases each year, Peter Wilson, Director, Counter Fraud, CIPFA, discussed Fraud Hub - an analytics solution that helps prevent, detect and recover losses from fraud, helping councils optimise their resources for tracking down the lost money and preventing future cases. With councils under continuous financial strain, this could be a game changer.

ROUNDTABLE DISCUSSION
There were 26 roundtables to choose from in the main hall. Table 1 was hosted by Dinesh Thanigasalam, Commercial Director, Aligned Assets, with the theme of 'Closer Working with the Emergency Services', who attempted, within the allowed time, to facilitate discussion around three key questions.

The first discussion focused on the topic of Emergency Services having access to the correct data to find streets and properties as easy as possible. The fire services was used as an example for when a call out is required. They are alerted that someone may be at risk and can find out more information if needed as they have access to council data on citizens. Unfortunately, councils don't have access to fire service data which could help safeguard citizens and staff if made available. One rule for all and one central system was called for. "Wales is using UPRN to de-personalise data. Could this be used in England? There seems to be a lot more barriers in the way." commented one of the participants.

The second question addressed how emergency services can best find non-postal addresses like bridges, lampposts, old mines, or when shop names are used

rather than an address. The idea of a second naming system was brought up where these things could be referenced. Having this would ultimately help community safety as you'll be able to pinpoint otherwise hard to locate locations, but everyone agreed a national consistent system is needed.

BENEFITS OF ACCURATE DATA
After lunch, Mike James & Alistair Calder, Data Architecture, Office for National Statistics, and Juliet Whitworth, Research and Information Manager, Local Government Association, discussed preparations for the 2021 Census. AddressBase Premium is being used to track deliveries, reminders and follow ups of the census. They all spoke of the huge task and challenges ahead, mainly from people living in 'problematic properties' like universities, park homes, caravans, hostels, and houseboats. The process for collecting the required high-accuracy data is their biggest concern - especially since the results will influence subsequent government policy-making. It is not surprising, therefore, that the value of the census to local governments will be an estimated £1.8bn over the next 10 years.

Jon Franklin, Head of Data & Information Strategy, Strategy Group, Valuation Office Agency, used his presentation to explain a flawed understanding of what addresses actually represent, which can undermine their credibility, in the hope that datasets can be used more efficiently. He finished with a few funny addresses, including 'Four Wheel Drive, Rougham' and 'Laughing Snakes, Limpley Stoke'.

After another chance to look round the exhibition, Glenn Dobson, Principal Chair Regional Streets Group and Cathy Coelho, Principal Chair Regional Address

The bustling exhibition where networking took place at various stands.

Group, stated that working as a community in regards to the maintenance of street and address information is essential to the successful delivery of public, private, and emergency services. "This will enhance the lives of people and keep them as safe as possible. Not a bad thing to have on your CV." The presenters feel that they have made huge progress since last year, but finished emphasising the importance of feedback and input to them in progressing forward.

EXEMPLAR AWARDS
The day concluded with the presentation of the Exemplar Award to Mid Sussex District Council for its work using its local address register to underpin a bid for money from the Chancellor's £190m Local Full Fibre Networks Challenge Fund. Other award winners included Ian David, who recently retired from Bridgend County Borough Council, who won the Peer Award; Dacorum Borough Council and Bournemouth Borough Council were announced as winners of the Data Quality and Improvement Award for Addresses 2018 and the Data Quality and Improvement Award for Streets 2018 respectively.

The packed out rooms, buzzing atmosphere and diverse voices made for an interesting day. It's now time to put these ideas into motion!

Using **British Standard Address Management** to Boost the Ghanese Economy

This article outlines two approaches to determining the start and end of a street. The implications of both approaches in terms of complexity, ease of implementation and resultant costs are discussed by address management experts, Aligned Assets.

For many countries, the absence of formal, consistent address management is costing their governments and businesses huge sums of potential income. Without fully defined addresses, there are issues with tax collection, service provision and the efficiency of the emergency services. Considering this, it's somewhat surprising that many cities and rural areas function as well as they do – but clearly at a great cost to individuals, businesses and governments alike.

Address management experts, Aligned Assets, are currently working with partner organisation, Jospong Group, in Ghana to allocate a street name for every street in the country, using their specially adapted SNN International

solution. The solution implements principles from the British Standard for addressing, the World Bank standards for street naming and numbering and conventions from the Universal Postal Union. This is a considerable feat, since over a million streets and 20 million properties in this developing nation require naming and numbering - from sparsely populated rural areas to the densely populated urban towns and cities.

Naturally, the process of introducing street naming systems to countries for the first time is not an easy task and can lead to conflict between logic and practicality. While knowing where a street starts and ends may seem like a straightforward process, in

the 100 or so countries where there is no street-naming convention in place, this can be quite the opposite. Identifying where a street starts and ends defines the geometry of the street.

There are two main approaches that can be taken, each with its own implications – both financial and cultural. The difference is in how street segments are treated in determining the start and end of a street. A street segment is part of a street between two intersections or junctions.

APPROACH 1 - EACH STREET SEGMENT AS A STREET

The first approach is to treat each segment as a street in its own right, giving each one its own name. This is easy to understand, follows an obvious logic, and is relatively easy to derive the street names using an automated algorithm. However, in densely populated urban areas, this will result in the production of an excessive number of street names, leading to both escalating costs for signage and potential resistance from residents and local service providers.

There is however, an advantage to individually defining each segment even if multiple segments are later on going to be treated as one street. Capturing each one as a different object in a GIS or address management system provides some flexibility concerning the naming convention. It also allows data users to assign different

attributes to each separate, yet related, street segment - such as width, surface material, direction of traffic, postcode, etc.

APPROACH 2 - MULTIPLE STREET SEGMENTS IN ONE STREET

Although the address management which treats multiple sequential segments as one street is perhaps the more user-friendly and more preferable method to the majority of countries that already have an established street naming system, the alternative approach will reduce the number of named streets by a factor of three or four, and thereby significantly reduce the costs of signage and create a more manageable data set for a local authority to administer – although it is a much more complex one. For example, exact rules as to where a street starts and ends need to be established to ensure consistency, particularly if this process is to be automated. After all, manual processing is likely to be prohibitive due to the considerable amount of required field and surveying work.

Another important consideration relates to the acceptance of the new names by the citizens and services that will be using the road networks. Any government introducing a universal street naming system should be seeking to maximise early adoption by users by ensuring that the chosen names are both neutral and logical.

In order to assist the Ghanese government, Aligned Assets identified the best approach for naming the million plus streets across the country by applying the two approaches to a sample area of the capital city Accra. As expected, the number of streets generated by allocating a name to every street segment generated significantly more streets than the approach taking sequential segments as one

street. In addition, due to the density of streets in the sample area, the former approach also resulted in very small street segments being treated as streets in their own right - even when they didn't contain any settlements, businesses or services. As mentioned, this would result in unnecessary signage and street maintenance costs. There are around 125,000 street segments in Greater Accra, however if approach two is taken and the segments are combined, it results in around 40,000 streets resulting in a cost reduction of a factor three for street signage.

Dinesh Thanigasalam, Commercial Director for Aligned Assets, told us, 'There really isn't one simple solution. Based on the results of the sample, the logical approach for the densely populated cities is to treat multiple sequential segments as one street, while in the more sparsely populated remote areas of the country, treating each segment as a street in its own right would be more beneficial. We'll then be able to use our SNN International software (an adaptation of our UK Street Naming and Numbering solution) to name the streets and number all the properties. This simple introduction of an address creation and management system will be the foundations on which services can be reliably provided to citizens and income can be generated by businesses and government.'

Aligned Assets developed their UK Street Naming and Numbering software specifically for naming and numbering all the streets and properties in Ghana, and have made it available to the international market. For more information on Aligned Assets' address management solutions both overseas and in the UK, go to www.aligned-assets.co.uk or call 01483 717963.

BY KATIE DECKER

The **Augmented-Reality Solution** That's
Saving the Energy Industry Time and Money

Maintaining assets has always been time-consuming and labour-intensive for the oil business. Whether these assets are underground pipelines or offshore rigs, the resources necessary to monitor them are significant.

Whiting Petroleum Corporation is a major independent exploration and production company, controlling one of the largest acreage positions in the Bakken/Three Forks resources play in the Williston Basin of North Dakota and Montana. Whiting's One Call department in Watford City, North Dakota, is responsible for identifying and protecting underground assets at thousands of well sites and other field locations. Accuracy in identifying hidden assets is critical to the company's success, ensuring that excavators are drilling in the correct site to prevent costly errors and safety hazards. Argis Solutions uses augmented reality (AR) integrated with ArcGIS, a spatial analytics platform, to help Whiting Petroleum save time and millions of dollars and mitigate risk by enabling staff to visualise assets hidden underground.

Field crews used to have to rely on static maps and a time-consuming, faulty process for locating and maintaining the company's assets. On-site field crews would first use an electromagnetic locator or ground-penetrating radar to identify precisely where the assets were buried, marking them on the static map. The locators would then compile a report that would be given to One Call staff. In turn, the One Call department would create the documentation for the excavation crew. This inefficient process left too much room for error, as there was no way to confirm the locations of the assets being marked.

Argis Solutions' cloud-based AR visualisation app, Argis Lens, easily interprets location data. Real-time, real-world renderings of geospatial or other types of data, such as building schematics and component diagrams, can be seen instantly through a mobile device. The app is user-friendly and puts the power of spatial analytics data into the hands of field crews and industry technicians. On-site, workers simply hold their device's camera up to the area where they need to get information about pipelines or other assets, and Argis Lens gives them the most up-to-date data via 3D enhancements to the dynamic image from ArcGIS Online or through ArcGIS Server.

Working with Argis Lens, Whiting Petroleum damage-prevention technicians could not only streamline their asset management process but also improve the accuracy of their data. Now, team members can go out into the field and see their data around them as if they were stepping into an ArcGIS map layer. They have an instant understanding of the location of their underground assets without needing to interpret or analyse the data any further. Once each asset is manually flagged on the ground, the app enables the team to confirm immediately if every asset is marked accurately. With Argis Lens, the One Call report simply requires taking a picture with a mobile device, eliminating manual error-prone work.

The implementation of spatial analytics and the 3D relationships has enabled the Watford City crew to save an average of 30 minutes in locating each asset. So for a company that needs to locate many assets a year, this amounts to significant time and cost savings.

This new process also reduces paperwork, eliminates time-consuming analysis, and provides a higher level of quality assurance. Damage-prevention technicians can now perform their operations more efficiently and effectively while maximising the company's return on investment.

Oil field assets through Argis Solutions' AR mobile visualisation app.

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Advances in Geospatial and Space

As we head towards Brexit in 2019, satellites may be in the headlines for less than positive reasons at the moment. However, what's clear today is the universal acceptance of the value and the critical need for this infrastructure to both our society and economy. Away from the headlines, a number of interesting events over the past month have allowed me to reflect on the relationship between space and traditional geospatial. For many years, the earth observation community has been on the fringes of mainstream geospatial, and in some cases, unfortunately, even viewed as a distinct entity.

Thankfully, space technology has now reached a level of maturity and accessibility which makes it easier and more common for the geospatial analyst to include remote sensing data and associated techniques into both their workflow and toolkit. Advances in the hardware (e.g. Sentinels and Cube Sats), along with that of processing and analysis techniques, have been of key importance. Thanks to reduced barriers to entry into the market to exploit this data, along with the wider availability of open data, there is now much more activity by small businesses in this field. And this rate of activity will only increase as we see bigger investment into new, more efficient methods for serving vast repositories of data. The industry can expect to see faster consumption, stronger utilisation of cloud computing, and greater use of emerging technologies, such as machine learning and AI.

So, what does this mean for the connection between space and in-situ (ground-based) sources of data? During May, I had the pleasure of hearing Barbara Ryan, Secretariat Director of the intergovernmental Group on Earth Observations (GEO), address an audience of data providers at the European Space Agency in Italy. Ryan emphasised the importance of informed and purposeful decision making for our planet. Her vision of a "global earth system" which brings together and co-ordinates the full scope of data is extremely motivating. Her speech also made it clear that initiatives such as the UN Sustainable Development Goals (SDGs) are vital to the success of bringing together a cohesive set of data from all available sources.

While many UK organisations are already embracing this vision in their own implementations, there are still many more collaboration opportunities available to maximise benefits of advances in geospatial and space. In recent weeks, I was delighted to attend a working dinner for UK leaders in Geospatial and Space, in order to explore how this can be achieved. The event, however, was not only about bringing communities together. Since the event was instigated by the National Centre for Geospatial Intelligence (NCGI), there was also a focus on developing a connection with UK defence capabilities.

Abigail Page is Chair of the AGI's Council, which is formed from elected members of the AGI. Its main role is to set the strategic direction for the organisation. www.agi.org.uk

Stuart Martin, CEO of the Satellite Applications Catapult, identified geospatial intelligence as a societal trend, with geospatial forming the link between the physical and the digital world - in which we now spend much of our time. Meanwhile, Brigadier Ben Kite, Commander, Joint Forces Intelligence Group, shared details on the work of the NCGI in terms of delivering information, geospatial intelligence analysis and deployable operations. These three pillars of activity are now being brought together in the UK in a way which is unique in comparison to the rest of the world.

For me, it was really refreshing to hear from leaders about the opportunities to work together on a UK basis, as well to get a sense of the support for closer collaborations - not just in terms of improving day to day efficiencies, but also in terms of positioning the UK as a world leader in this field. The new connections with those of a shared interest, along with the strategic conversations and identification of tangible outcomes from the meeting leaves me with a lot of hope that this, and other initiatives, will play a role in bringing us closer together and allow us to make the most of these opportunities.

The continued message from the majority of those that I meet with is that there is significant opportunity for us right now. There is a real appetite in the UK to be ambitious about what can be delivered in a new and changing landscape – in terms of both technology advancements and policy developments. Will we see the new Geospatial Commission take a holistic view of geospatial in this way? Regardless of the answer to this question, we, as a community, must continue to work together to build these vital collaborations and take maximum value from these developments.

Got an event to list?
Go to www.gis-professional.com/events

GEODATA SCOTLAND 2018
14 June 2018, Glasgow, Scotland
https://vrsk.co/2lURce1

7TH INTERNATIONAL CONFERENCE ON CARTOGRAPHY & GIS
18-23 June 2018, Sozopol, Bulgaria
https://iccgis2018.cartography-gis.com

ESRI USER CONFERENCE 2018
9-13 July 2018, San Diego, USA
www.esri.com/about/events/uc

INTERCARTO-INTERGIS 24 2018
24-28 July 2018, Bonn, Germany
http://intercarto24.net/index.shtml

AFRICAGEO 2018
17-19 September 2018, Johannesburg, South Africa
https://africageo.org.za/

INSPIRE CONFERENCE 2018
18-21 September 2018, Antwerp, Belgium
http://inspire.ec.europa.eu/conference2018

3RD INTERNATIONAL CONFERENCE ON GIS AND REMOTE SENSING
27-28 September 2018, Berlin, Germany
https://bit.ly/2L9BdFU

COASTGIS 2018
27-29 September 2018, Ísafjörður, Iceland
www.uw.is/conferences/coastgis_2018

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