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GEOSPATIAL WORLD

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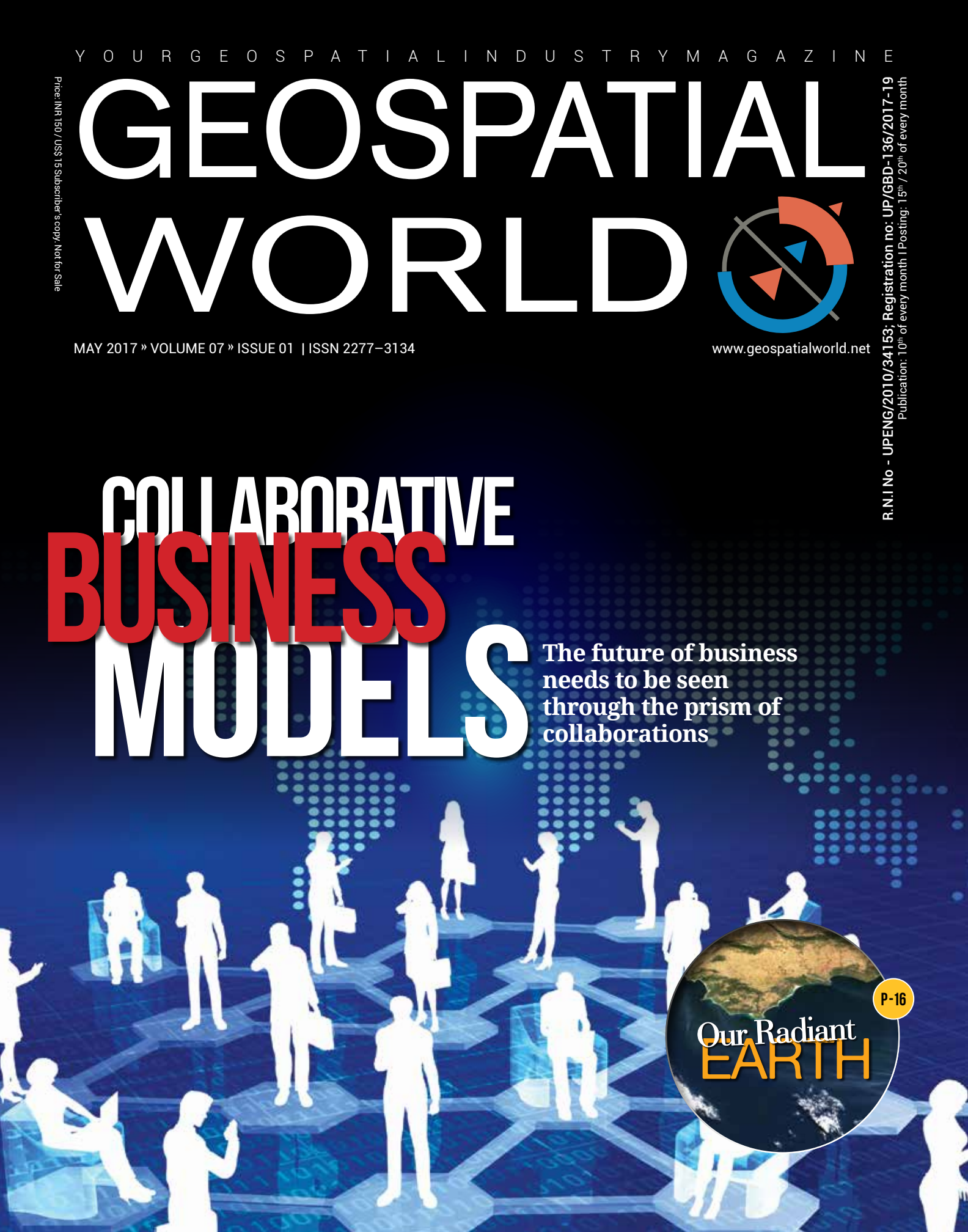
COLLABORATIVE BUSINESS MODELS

The future of business needs to be seen through the prism of collaborations



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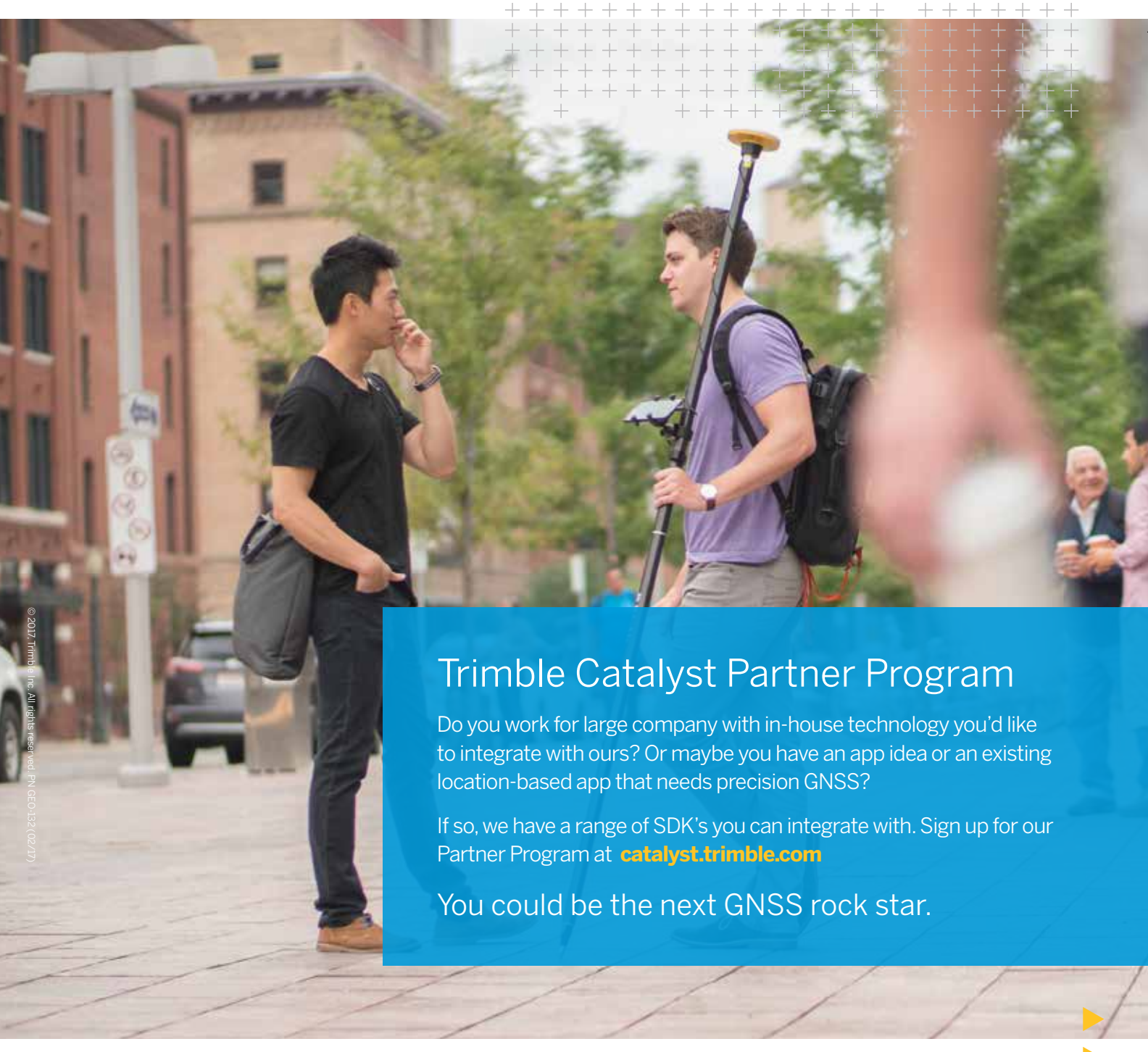
Our Radiant EARTH



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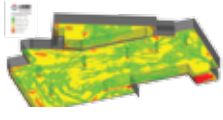

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ACHIEVING LOCATION *NIRVANA* BY MEANS OF COLLABORATION!

Prof. Arup Dasgupta
Managing Editor,
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The world has ceased to exist in silos. The universal key that has opened the old silos is information. There was a time when information was the source of power and pelf, to be guarded and sequestered. The only way this could be done was through creation of silos and the principle of 'need to know'. This worked well as long as the silo was self-sufficient but with progress it became necessary to garner more information from other sources to remain competitive.

For long we have talked of convergence of technologies. For example, power distribution developed techniques of SCADA for managing assets but lacked the information on physical location of these assets on a common platform. SCADA with GIS overcame these lacunae. Now, we have BIM and GIS, ERP and GIS, and BI and GIS. In each case the geospatial component is provided by GIS, while the domain information is provided by the concerned expert systems. Perhaps the biggest example of convergence and collaboration is C4ISR. However, these examples are limited to the technologies used.

Another process is mergers and acquisitions. For example, Google Earth, which we are so familiar with, started as an earth viewer by a venture called Keyhole, which Google acquired in 2005 as it saw the value of location in their core business of searching huge data sources. Similarly, we have seen mergers of GIS and imaging companies as these technologies complement each other.

An examination of these trends brings out the fact that the spatial component, or 'where', has become an essential part of any activity. This is why we see a surge in imaging and mapping and the integration of this data in spatial information systems which service many other operational systems. While governments and large organizations can make this a part of their activities, middle-level organizations, which cannot afford to set up their own departments, tend to buy these functionalities as services. Last but not least, the public has become 'where'-savvy, thanks to Google and its clones, the availability of cheap GPS-equipped smartphones with apps which fall under the rubric of LBS.

Indeed, initiatives like Smart Cities, Green Buildings, and Sustainable Development all need the sharing of data, processes and applications and collaboration between different players. Many of these applications will need data on the go like self-driving cars. The transition from raw data to meaningful action will transcend human intervention. It will not be enough to know where but what is to be done and how. Thus, a long-term weather pattern may indicate a chance of drought, which can set in motion specific actions for water conservation like rationing and reduction of non-essential usage.

Will power of sharing and collaborative business models lead to location *nirvana*? *The Economist* raises an interesting issue stating that data, not oil, is the most valuable resource. It is seen that the Internet based companies like Alphabet (Google's parent company), Amazon, Apple, Facebook and Microsoft have grabbed a major share of the data economy racking up US$25 billion in net profits in the first quarter of 2017. So are we seeing a resurgence of mega corporations and monopolies related to data? Domination by a few mega data giants is potentially dangerous but indiscriminate data sharing could also threaten privacy as we can see in the current *Aadhar* controversy in India. There has to be a golden mean.

Thought leadership is typically a hard concept to define. But in a broad-spectrum, it means individuals with the ability to aggregate followers around ideas to educate, influence and inspire. They generously commit their time, energy, and resources. They actively participate in knowledge exchanges. They go the extra mile to both identify and fill the gaps. Lastly, they both challenge others to think big and empower them to follow through.

In this background, Geospatial Media and Communications is thrilled to announce its new **Global Advisory Board**, comprising of eminent thought leaders who are making a significant difference to the geospatial industry as well as global economy and society with their vision and acumen across different segments of the geospatial value chain. The Global Advisory Board members will strengthen the vision, mission, values and principles of Geospatial Media and Communications, which have

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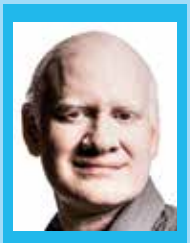

SANDEEP SINGHAL
Senior Director, Cloud Storage, Google, USA

been evolving along with the changing fabric and scope of the geospatial industry. Their diverse professional insights and personal commitment towards the larger objectives of Geospatial Media and Communications will be instrumental in shaping and supervising its business directions and dimensions. The Global Advisory Board is for two years — 2017 to 2019 — and the members are:

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DigitalGlobe Q1 revenue up 19.6% buoyed by growth in US govt business

DigitalGlobe in its first quarter result shows a surge in the company's revenue by 19.6% at $209.7 million. It has also shown a significant growth in revenues from the US government orders by 25.4% at $28 million.

Due to its ongoing merger process with MDA, DigitalGlobe has not provided details of the earnings call but has provided supplementary information on its Website. The result also shows a growth of 9.7% in DigitalGlobe's commercial revenue, soaring at $6.3 million, as demand for capacity on WorldView-4 fuelled due to 8.7% increase in DAP revenue. "We delivered a strong start to 2017 with solid revenue growth across all of our major customer groups," said Jeffrey R. Tarr, CEO, DigitalGlobe. "We have delivered double-digit growth in our commercial business. We will continue to focus on the execution of our strategy while satisfying all closing conditions for our upcoming combination with MDA," added Tarr.

Hexagon Q1 earnings up 9%; MSC Software acquisition process over

Hexagon has reported a 9% increase in operating earnings at $190.15 mn (174.5 mn euros) in its first quarter results. It shows net earnings of $151.34 mn (138.9 mn euros); whereas the per share earnings increased by 9% to $ 0.41 (0.38 euros).

The company has also registered a rise in net sales by 7% at $ 847.81 mn (778.1 mn euro). The report mentions the acquisition of Hexagon's MSC Software at a purchase price of $834 million on a cash and debt free basis, and the company will be consolidated as of April 26, 2017."It's full speed ahead for Hexagon in 2017! We're pleased with the results in Q1, reporting strong growth in our manufacturing, construction and positioning portfolios and good profit development in all divisions," said Ola Rollen, CEO, Hexagon. "We announced the acquisition of MSC in direct support of our smart connected factory strategy and launched a group-wide cost savings program to further accelerate our margin expansion." he added.

MDA Q1 revenue dips; but positive on US market prospects

Canada-based MacDonald, Dettwiler and Associates (MDA) has reported a 12.1% loss in revenue at $494.3 million in first quarter 2017 as compared to $562.4 million in the first quarter last year.

The decrease in revenue was primarily due to the lower level of order activity in the geostationary communications satellite industry over the last two years, said a statement from the company. This was partially offset by higher revenue from the emerging markets sector in the Surveillance and Intelligence segment, which includes the US government space and defense markets. The company also continued to invest in the required infrastructure to pursue its US government access plan resulting in operating EBITDA of $89.2 million for the first quarter of 2017. Net earnings under IFRS for the Q1 2017 were $5.9 million, down from $40.7 million in Q1 2016. Net earnings were impacted by the inclusion and variability of certain large, non-operational items, particularly restructuring costs and incremental legal and other professional fees related to the acquisition of DigitalGlobe.

Trimble Q1 revenue soars by 5%; will focus more on profitability, says CEO

Trimble has registered 5% increase in revenue at $613.9 million for the first quarter 2017. The company had reported revenue of $585.5 million in Q1 2016. Of late, Trimble has made changes to the reporting of its segment financial results in order to reflect the company's customer base adequately. Its Buildings and Infrastructure revenue has also increased by 8% at $188.1 million and Resources and Utilities revenue is up by 5% at $119.9 million. However, Geospatial revenue is down by 2% at $149.8 million.

During the first quarter, Trimble repurchased approximately 0.5 million shares of its common stock for $14.2 million. Approximately $116 million remains under the current share repurchase authorization as of the end of the first quarter.

"We continued to demonstrate progression in the first quarter, with accelerating revenue growth and significant margin improvement," said Steven W. Berglund, President and CEO, Trimble. "Our outlook for the remainder of the year anticipates continuing year-on-year improvement in both revenue and profitability," he added.

SpaceX launches recycled rocket

Elon Musk's company is breaking new grounds every day.

By Sanskriti Shukla

On March 31, SpaceX opened a new chapter in space technologies. The Falcon 9 rocket that launched the SES-10 commercial communications satellite from NASA's historic Kennedy Space Center launchpad in Florida is the same rocket SpaceX used to send a Dragon spacecraft on a commercial resupply mission to the International Space Station in April last year. After the launch, the recycled Falcon 9 successfully came back on Earth, possibly to be used at some future point once again.

SpaceX has been performing these landings for a while now, continuing its rebound from an explosion last summer that grounded the company for the last four months of 2016.

Reusing rockets has been the foundation of the company's business model, which is centered on driving down the cost of accessing space. The whole point is to eventually create a fleet of reusable rockets that can fly multiple missions to orbit and come back home. Reusing rockets will help in decreasing the cost of launching them into space, allowing governments, private players, and common man have more access to orbit.

The drill continues... SpaceX launched a top-secret spy satellite for the US government at 7:15 a.m. ET, and then successfully landed the booster for recycling. The unmanned Falcon 9 rocket lifted off from Cape Canaveral in Florida. The launch was SpaceX's fifth this year.

Falcon 9 is a two-stage rocket designed and manufactured by SpaceX for the reliable and safe transport of satellites and the Dragon spacecraft into orbit. As the first rocket completely developed in the 21st century, Falcon 9 was designed from the ground up for maximum reliability. Falcon 9's simple two-stage configuration minimizes the number of separation events — and with nine first-stage engines; it can safely complete its mission even in the event of an engine shutdown.

Needless to say, SpaceX has further refined its ability to deliver objects into space and then land its reusable rockets. It was SpaceX's first mission for the National Reconnaissance Office. No details have been given out about the newly launched NRO satellite. SpaceX aims to return most of its boosters for reuse.

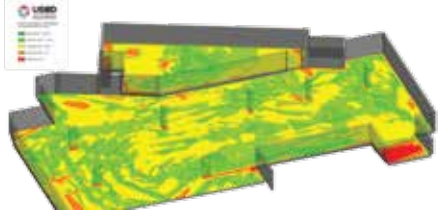
With the launch of 1st recycled rocket – Falcon 9, SpaceX made a historic leap

DJI AND HASSELBLAD'S DRONE PLATFORM FOR PRECISE AERIAL IMAGING

DJI and Hasselblad have introduced a 100MP integrated drone imaging platform. The DJI Matrice 600 Pro drone, the Ronin-MX gimbal and the Hasselblad H6D-100c camera combine each company's unparalleled technological expertise to create an unprecedented tool for precise, detailed and accurate aerial imaging. The flight platform for the combination is the DJI Matrice 600 Pro drone, an advanced and adaptable six-rotor flight platform equipped with the powerful Lightbridge 2 transmission system, a dustproof propulsion system and six Intelligent Flight Batteries. The Hasselblad H6D-100c camera is a triumph of camera technology, with a large 53.4 mm x 40.0 mm sensor that offers outstanding detail, color reproduction and tonal range even in poor lighting conditions using the HC and HCD lens family. The camera mounts on the drone through the Ronin-MX three-axis stabilized gimbal.

FEATURES

- Professional drone users can continuously control camera operations in flight using the DJI GO app, in order to provide rich imagery for landscape and fine-art photography, robust data for surveying and mapmaking, and endless possibilities for future professional endeavors.
- Centimeter-level enhanced accuracy over typical barometer, compass and GPS systems makes it ideal for exacting commercial, industrial and scientific applications.



FARO'S POINTSENSE 18.0 SUITE CREATES MORE VALUE FOR CONSTRUCTION AND ARCHITECTURE

Faro has introduced the PointSense 18.0 Suite, a bundle of industry specific plug-ins for AutoCAD and Revit, designed to accelerate the evaluation and processing of laser scan data. It includes intelligent feature extraction, for design and scan to BIM, as well as deformation analysis tools for QA/QC assessment.

The suite includes: PointSense basic/Pro for AutoCAD; PointSense Building for AutoCAD; PointSense Heritage for AutoCAD; PointSense Plant for AutoCAD and PointSense for Revit. All tools are compatible with the 2015 - 2018 releases of AutoCAD and Revit.

FEATURES

- PointSense 18.0 for Revit is the first software platform to incorporate Levels of Accuracy as defined USBID standards. This enhanced analysis tool is designed to enable users to more confidently validate the accuracy of the as-built model compared to the relevant point Cloud
- The improvement in scan navigation functionality was driven by direct user feedback, supports greater efficiency and assures that the user is able to get to a result faster than ever before

TOPCON INTRODUCES GNSS RECEIVER BOARDS WITH EXPANDED CONSTELLATION TRACKING

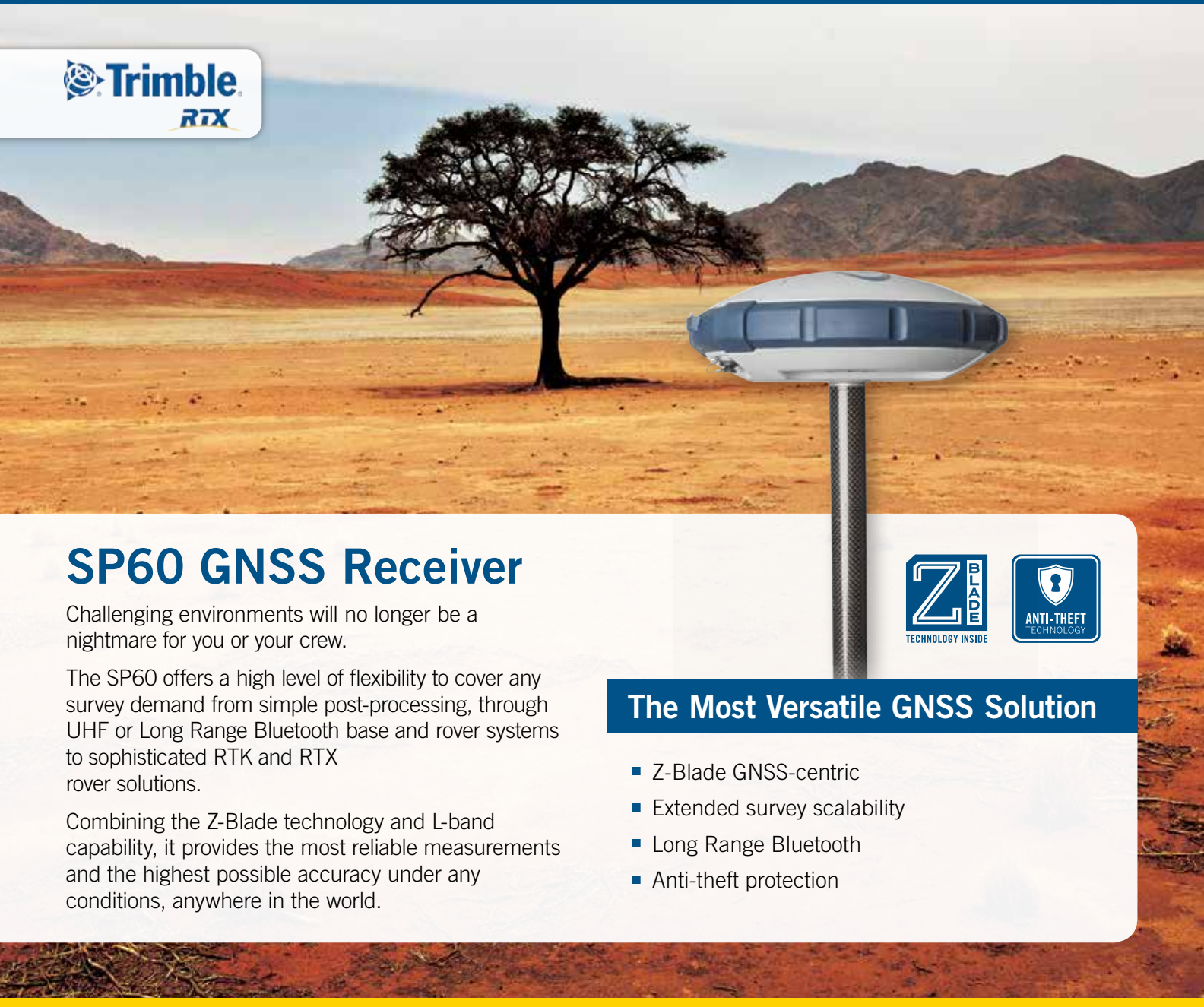
Topcon Positioning Group has announced the launch of two new full constellation GNSS receivers for the original equipment manufacturer (OEM) market. The new B111 and B125 boards are designed for use with a broad range of positioning applications.

The boards utilize the GPS, GLONASS, BeiDou and Galileo constellations with the B111 tracking signals in the L1 and L2 frequency band, while the B125 adds signals in the L5 band. Both boards are designed to provide scalable positioning from sub-meter DGPS positioning to sub-centimeter RTK positioning. The dual frequency B111 board has very low power consumption and flexible communication interfaces, making it easy for OEMs to integrate the compact board into any precise positioning application, reducing their time to market. The B125 board offers Ethernet connectivity for options for advanced OEM integration.

FEATURES

- The new boards both include 226-channel Vanguard Technology with Universal Tracking Channels, for reliable 'all-in-view' and 'future-proof' tracking
- The addition of BeiDou and Galileo constellation tracking along with GPS, GLONASS, SBAS and QZSS functionality ensures the boards provide the best performance available.

Wherever You Are



SP60 GNSS Receiver

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The SP60 offers a high level of flexibility to cover any survey demand from simple post-processing, through UHF or Long Range Bluetooth base and rover systems to sophisticated RTK and RTX rover solutions.

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EVERYTHING has a LOCATION

Mladen Stojic, President, Hexagon Geospatial, firmly believes that open data help supports downstream economies that can use data to facilitate better and smarter decision making.

What are the key drivers boosting the global Cloud market?

As organizations are accumulating and working with more data, they need more cost-effective solutions to manage it. This does not necessarily mean within the existing IT infrastructure but effectively moving that data to the Cloud, and then leveraging streaming technologies and data access technology with some other new Cloud capabilities in the market. The total cost of ownership is effectively going down because the content does not have to be managed in house; it could be managed as a hosted service and ultimately connected in order to get that content and use it with an applications and solutions.

What role do you see for geospatial in Big Data analytics?

In terms of geospatial, everything has a location. If we look at the perfect union of Cloud and IoT in geospatial, we now have the ability to basically understand how things change and the ability to connect dynamic sensor feeds, whether they are traffic video surveillance or weather sensors or capturing information about noise pollution or air quality. All of these sensors are now collecting massive amounts of data and this can then be connected to a geoprocessing service so that insights about analytics of the data can be gathered and delivered in a way of dashboard or different VI tools. So, it is the perfect union of Cloud with IoT or analytics — all coming together once again under the assumption that everything has a location.

What role do you think social media is playing in geospatial?

Social media is seeing a lot of activity in the areas of public safety and security. In some of our solutions we have the ability to connect to social media feeds as they relate to incoming information regarding an event. Having access to it or connecting a pipe of that information into a system

gives us the ability to understand what is happening in real time. Being able to sift through feeds in an intelligent way enables you to extract the necessary pieces of information that is critical to feeding other downstream process for running analysis or determining where to deploy emergency responders in the time of need. All of that really comes together on social media because crowds are collecting data and ultimately feeding through social media.

How can such unstructured data be curated to yield stable patterns?

All this data need to be tied to a location and I think that is the precondition to success. Without location it is ultimately very difficult to do downstream analytics or any geoprocessing analysis on the data. So, the first step is to geo code or to tag some of these unstructured data and then allow it to be available so that you can catalog all these inputs and ultimately gain access to those inputs in a geoprocessing service or an analytical service. And then fuse this content in some sort of analysis model and ultimately deliver additional insights.

Data privacy has been a very burning issue of late, especially with regards to location. How do we keep a balance between privacy and security?

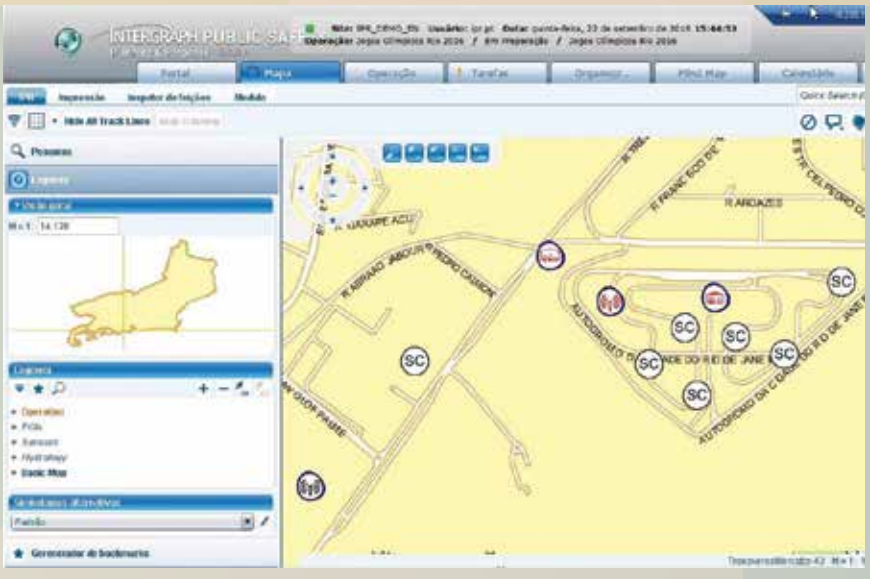
It is a very important topic and one that varies by region. In Europe I have seen

> If you allow opportunity, not fear, to drive your decision making, good things will happen

a trend and a call for open data. But then you get the same agencies or same countries calling for open data getting upset on privacy issues when, say, Google is driving around with a mobile device capturing street-level imagery of a neighborhood of a city. Data is just data … it could be image data, mapping data, 3D data … it could be used for great benefit, and there is a huge opportunity in being able to leverage data. I am a firm believer that open data help supports downstream economies that can use data to facilitate better and smarter decision making.

Closed data is certainly being driven from the perspective that if that data gets into the wrong hand then it could be used for whole variety of unpleasant purposes. If individuals want to get access to the data they will find ways to get access to it. But there are much greater opportunities when you have open data as opposed to not having it open. If you allow opportunity to drive your decision making, good things will happen. If you allow fear to drive your decision making processes, it limits not only the geospatial economy but also the opportunity of what can be done with open data in the society, particularly at the state or local levels. I am of the belief that open data is really good and supports citizen engagements, and also opens up the industry to much broader use of not only geospatial services but also applications.

Every case is unique. You have to look at the interest of each country and then the interest and safety of its citizens, and decide on what is your priority. Do you compromise privacy? It is a tough topic. Even organizations like Apple have their terms and conditions. When they collect data about a given individual's location, Apple has every right to not to disclose the information to the government. But, again the government can go through its legal processes to hand over that data. It is a sensitive issue. When it comes to an overall security of the general public, I am a fan of protecting the general public.

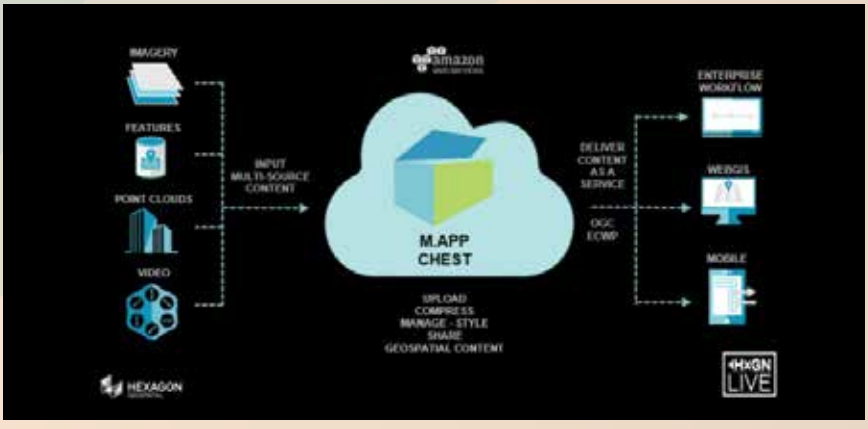


Intergraph Planning & Response is an application for emergency operations centers and mobile command staff to manage major events.

About AI effecting geospatial and visa-versa, how do you think geospatial can encourage and empower some of these areas?

Geospatial is still unique to the fact that the data is coming from satellite sensors, radars, and mobile sensors. In order to fully leverage the power of that content you have to know about the sensor, and know about the metadata of that sensor. Without that knowledge you can still extract information from the sensor but it is not powerful; especially, in productive modelling, where you look at the trends and changes overtime — which is where deep learning and AI can have a very profound impact.

We have to leverage the sensor metadata, and to understand the physics associated with how data is collected. Having that knowledge facilitates even more and better information extraction through AI and also more predictive analytics with deep learning. The opportunity is immense but we have just started scratching the surface. We are beginning to see a number of start-ups coming up that are focussing on very surgical solutions in terms of solving specific problems with the synthesis and the fusion of multi-source content — imagery, point Clouds, GIS databases, CAT databases, or BIM. When you start fusing these sensors together in obvious data inputs, we have the opportunity to use very smart algorithms to get even more insight or more information for all the inputs. That is where AI and deep learning can have an insightful impact on the industry.



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- when it has to be **right**

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Our Radiant EARTH

NASA/Landsat: San Francisco Bay

Some of the top philanthropists and professionals in the world have come together to support an open geospatial data platform that is being seen as an answer to the global development community's call for better access to EO data for greater insight into critical challenges facing our planet.

By Anusuya Datta

There are around 1,400 satellites orbiting Earth and this number could more than double over the next five years as satellites become smaller, lighter, cheaper and easier to launch. Advances in launch technologies and peripheral infrastructure have also led to a phenomenon that is fast coming to be known as 'democratization of space'. The world is now flooded with data that is difficult, if not impossible, to discover, let alone analyze.

Now, some of the most influential billionaire philanthropists in the world have joined hands to support a powerful digital platform to harness the plethora of data gathered from satellites each day, and make it freely available for humanitarian and environmental causes. Bill and Melinda Gates have joined forces with e-Bay founder Pierre Omidyar, to fund Radiant.Earth, which is envisioned to be a repository and archive of earth observation imagery. Jeff Bezos's Amazon Web Services is providing Cloud credits to build the platform.

"We wanted to harness this unique moment in time to put this data, as well as the cutting edge analytical tools that are available, to work for the betterment of humanity," says **Anne Hale Miglarese, Founder and CEO, Radiant.Earth.**

The project plans to work with leading geospatial and development experts from around the world as it seeks to more effectively deliver open earth imagery, tools, and strategies to meet some of the most urgent challenges in the world. The offerings will be open, free of charge and in simple formats that do not require specific expertise to understand.

The effort was officially launched in late February 2017 at the Thought Leaders Summit hosted by the Bill & Melinda Gates Foundation. "We are incredibly lucky to have the support of the Gates Foundation and Omidyar Network, which allowed us to convene 113 geospatial and global development experts from around the world to contribute to Radiant.Earth's strategy going forward," adds Miglarese. Since the Summit, Radiant.Earth has awarded software development contracts to two firms — Azavea and Vizzuality — to build the technology platform, which will formally be launched in July.

NASA/MODIS: South Africa.
Winds sent smoke from a bush fire near Mossel Bay, South Africa's Western Cape Province, streaming over the Atlantic Ocean.

Miglarese knows what she is talking about for she has extensive experience both in public and private sectors in dealing with geospatial technologies. Prior to Radiant.Earth, she served as President and CEO of Fugro Earth Data, as the President and CEO of PlanetiQ, and Principal Director at Booz Allen Hamilton. She had also worked for the National Oceanic and Atmospheric Administration, the South Carolina (SC) Water Resources Commission and the SC Department of Natural Resources.

"In the summer of 2015 through the spring of 2016, I worked with Kass Green of KGA Inc. and Peter Rabley of Omidyar Network to review the market opportunity and develop the basic mission and business functions of Radiant.Earth," she recalls. Green and Rabley both have years of experience on the intersection of using geospatial data to solve global challenges, and they all shared the same vision.

In defining Radiant.Earth, the team realized three key things: first, open data is not good enough — it must be discoverable, accessible and useful to a very diverse group of users, some sophisticated, some new users. Second, there are similar needs across the global development community and an entity such as Radiant.Earth can help amplify those needs. Third, there is so much change going on in the remote sensing sector right now that such an entity is needed to help guide and connect users worldwide to earth imagery, geospatial data, and analytical resources.

"We are now seeing an ever increasing volume and variety of geospatial data with the recent disruption in the manufacturing and delivery of small satellites, the management of small satellites as software assets, planned redundancy and obsolescence, and an acceptance of a higher failure rate of the hardware," explains **Peter Rabley, Venture Partner, Omidyar Network.**

And these image data are not just optical, but include radar, non-visible spectra, etc. If these datasets can be unlocked by making them easy to use and more accessible, their usage will explode. For example, moving Landsat to Amazon Web Services made the data easier to access and use, which resulted in a significant increase of monthly traffic.

Why Radiant.Earth and why now?

Satellite imagery is rich in data and can be used for many applications. In areas where access to data is limited, is expensive, and in some cases dangerous to procure, satellite imagery offers a powerful resource for transparency, accountability, and fact-based advocacy.

"Radiant.Earth is important because it has the wherewithal and mission to make these new troves of data accessible at a scale never before seen." That one simple statement from **Jed Sundwall, Open Data Lead, Amazon Web Services,** captures the essence of Radiant.Earth.

It is neutral, user-driven and inclusive. A key element here is recognition of similar needs across the diverse global development communities, while also responding to various levels of sophisticated users who can help find new solutions to global problems.

"The time is right, the technology has matured, and the costs are down," Miglarese

THE VISION IS TO ALIGN AND CONNECT IMAGERY ASSETS

PETER RABLEY
Venture Partner,
Omidyar Network

It is said that you are one of the visionaries behind the initiative. What inspired you to get involved?

As a long-time user of satellite imagery, its applicability for planning, analysis and policy and advocacy has always been clear to me. This is particularly true in emerging economies where good, up-to-date, and accurate geospatial data is largely non-existent.

We are now seeing an ever-increasing volume and variety of geospatial data, with the recent disruption in the manufacturing and delivery of small satellites — as a result of alternative sources of financing such as venture capital, the management of small satellites as software assets, planned redundancy and obsolescence, and an acceptance of a higher failure rate of the hardware. These image data are not just optical but include radar, non-visible spectra, etc. With this increased volume and variety, comes the potential for it to be harder to discover and use these phenomenal datasets.

If we can truly unlock these datasets by making them easy to use and more accessible, we find that their usage explodes. For example, Landsat moving to Amazon Web Services that made the data easier to access and use, saw a significant increase in monthly traffic as a result. Radiant.Earth's vision is to align and connect imagery assets — both commercial and public — and make it easy to explore and consume, acting as an ultimate set of connective tissues. In addition, Radiant.Earth can address the need for a community that embraces all types of users — government, commercial, defense, community and humanitarian groups — to openly share their data, knowledge and tools, as well as act as a convener and a trusted association.

What is Omidyar Network's involvement in Radiant.Earth?

Omidyar Network can provide capital in two ways: as commercial venture funding through our LLC, or as grant funding through our foundation. Radiant.Earth is being provided with grant funding through our foundation. We also provide assistance to the board and management in the areas of marketing and communications, research, and human capital.

With our partner the Gates Foundation, we believe making these types of data easily available has great use for the work we do in empowering individuals and providing them with opportunity to improve their lives. Between the two foundations, we have committed to multiple millions of USDs over the initial three years.

explains. "At the same time, our climate is changing rapidly, causing and amplifying global problems such as food security, health, and many more. We believe the solutions to the serious problems across the globe will be enhanced by using geospatial data and technologies," she elaborates.

The time is right to focus on supporting the global development community. "Radiant.Earth will provide access to data that is not presently exposed via registries and available on the Internet. We will also work to build plugins and APIs to data and services that is already in a Cloud ecosystem," she adds.

Between Gates Foundation and Omidyar Network, Radiant.Earth has millions of dollars committed over the initial three years. It received support from the Foundation and Omidyar Network in large part because these two world-class organizations realize the fundamental importance of imagery and data in fueling their mission and grantees' work.

For instance, since Gates Foundation does most of its work in developing countries, one of the challenges it has faced is lack of sophisticated users of satellite imagery in those regions due to their poor technical infrastructure and training. It now plans to take every opportunity to connect potential users to the Radiant.Earth platform, states **Vincent Seaman, Sr. Program Officer, Bill & Melinda Gates Foundation.**

Agrees Rabley, "As a long-time user of satellite imagery, its applicability for planning, analysis, and policy and advocacy has always been clear to me. This is particularly true in emerging economies where good, up-to-date, and accurate geospatial data is largely non-existent."

As part of its philanthropy projects, Omidyar Network provides funding to allow partners to use geospatial data for their work. This includes investees like Suyo, Landmapp, Duke University/Indian Institute of Management-Bangalore, and Indian Institute for Human Settlements. Its approach is based around its investees, research, and media and communications. It plans to follow the same pattern for Radiant.Earth.

The core team: (Third from left) Anne Hale Miglarese, CEO, Radiant.Earth with (L to R) Louisa Nakanuku-Diggs, Marketing and Communications Associate; Dan Lopez, Chief Technology Officer; and Anthony Burn, Director – Community Engagement.

The funders are leaving the details about how the platform would be set up and run to be determined by Radiant.Earth's management and users. "We are comfortable knowing that there is an experienced and dedicated team behind Radiant.Earth that will deliver the features and access all users want and value. We are also confident that they will work with other organizations to provide access and enhancement, and not redo what others have and are doing," says Rabley.

Similarly, Seaman clarifies that the Foundation's role will be limited to financial support only, as it does not have the technical expertise or bandwidth to advise the grantee in other matters. "We will provide financial support for the term of the grant period of three years. Additional financial support will be determined based upon the progress and impact of the platform," he adds.

Amazon's involvement in Radiant.Earth is providing the Cloud platform. "We have given Radiant.Earth a grant of AWS promotional credits to help them get started building their platform," states Sundwall.

Along with the Cloud infrastructure, Radiant.Earth also gains access to a vibrant ecosystem of AWS potential users. A large and growing community of startups, enterprises, government agencies, and academic researchers already use AWS to analyze geospatial data, and that community is incredibly collaborative; so Radiant.Earth is already benefiting from open source tools that other users have created to work with geospatial data on AWS. "Simultaneously, that community is going to benefit tremendously from the data that Radiant.Earth

THE PROJECT IS AN EXAMPLE OF OUR OVERALL MISSION OF PUBLIC GOOD

VINCENT SEAMAN
Sr. Program Officer
Gates Foundation

Why did the Gates Foundation think of getting involved in a venture like this?

The Foundation invests in work that supports specific program strategies such as, eradication of polio, malaria and, to a lesser degree, work that supports our overall mission and/or represents a 'public good'. The Radiant.Earth project is an example of the latter. While it does not provide direct benefit to any of the Foundation's priority areas, it is viewed as a public good that can potentially provide value to the global development and global health communities. The idea for the Radiant.Earth platform did not originate at the Foundation; rather we were approached by the grantee and Omidyar who made a successful bid for funding this work.

Why it is critical to have an open sat imagery for non-profit across the world?

We already have public access to satellite imagery through Google Earth, Bing maps, and other services. However, these resources are limited to viewing imagery and have only basic tools for the user. The US government makes available a large number of imagery-related products, but accessing them requires a moderate level of technical expertise and knowledge of what is available, and where to look. Many institutional users have purchased high-resolution satellite imagery that is licensed to share with non-profit groups, and sometimes the public. There is also a growing body of aerial imagery captured by airplanes and drones that the owners are willing to share. But in all of these cases there is not a convenient vehicle to do so. The Radiant.Earth platform offers a 'one-stop- shop' for imagery of all kinds, and will include an array of analytical and visualization tools that can be accessed by users at all levels.

What are your views about open data? How can this humongous amount of data be opened up for innovation?

The Foundation strongly supports the concept of open data, and we make every effort to provide public access to data that is collected through our grants. This is one of the main reasons we are supporting this project. Innovation will occur as a natural consequence if the project is successful. 'Geospatial' is just an aspect of all data – everything happens somewhere, and the 'where' is the geospatial part. When data has a geospatial component, it is like adding another dimension, which in most cases greatly enhances its value and allows for more sophisticated analyses. We are using geospatial data successfully in the fight to eradicate polio and malaria, support routine immunization and public health strengthening, provide information to small share-holder farmers about crop yields and productivity, and many other areas.

will make available on the Cloud," Sundwall explains.

Who is the target audience?

The answer is in Miglarese's definition of Radiant.Earth's mission: "To connect people globally to earth imagery, geospatial data, tools, knowledge, and solutions to meet the world's most critical challenges."

While it is anticipated that Radiant.Earth will serve a broad cross section of users to include individuals, academics, educators, governments and the commercial sector, the main focus will be on providing the greatest support to the organizations that are working on humanitarian, global and international development issues, and expand collaboration and capacity building among the community worldwide. This includes making their valuable resources go further by providing the technology platform as a back-end utility to their existing resources; and to enhance their professional development through Radiant.Earth's capacity development initiatives, which includes thought leadership activities.

As Rabley also points out, the vision is to align and connect imagery assets (both commercial and public) and make it easy to explore and consume. In addition, the platform can address the need for a community that embraces all types of users — government, commercial, defense, community and humanitarian groups, for instance — to openly share their data, knowledge and tools, as well as act as a convener and a trusted association.

Radiant.Earth will not create products to directly solve the global problems specifically, but will work through users to support their efforts. Organizations like Direct Relief, Catholic Relief Services, Care, among others, are on the front line with a mission to solve the societal and environmental problems worldwide. "Hundreds of these organizations across the globe are using geospatial technology daily to deliver their mission programs. Our desire is to support those organizations by providing a back-end infrastructure to quickly discover

and use the best data they can for their application," Miglarese explains.

The platform is expected to foster more informed decision-making about Earth's resources and encourage the creation of more open source technologies and innovation that can help solve humanity's most pressing issues. "Our efforts initially will be to support partners that are working on global health, property rights, data-driven reporting, agriculture, urban development, government transparency, conservation and climate change. The possibilities are endless. We hope that customers who use the technology platform will bring this data to their unique interest and I hope there are many applications in the future," she adds.

While its programs will be global, there will be a focused approach on the underdeveloped and developing countries, predominantly in the Global South. "At the end of the day, my sincere hope is that we can raise the technical and policy literacy of the global development community regardless of what or whose data or software they use," she says. Radiant.Earth is also mulling the possibilities of working with regional centers and other technology providers to develop a solution through time.

What makes it different from others?

The European Space Agency (ESA) is hosting the Sentinel data online and doing an excellent job. Landsat data is free. And there are initiatives like Group on Earth Observations (GEO). So what makes Radiant.Earth different and what value does it bring to the table?

"The advances with the Sentinel program are superior to anything we have seen before in civil government observations, and we are developing an agreement with the ESA at present. However, the Landsat data are hosted and supported online by several commercial companies. In addition, if you want the Landsat data from United States Geological Survey (USGS), you will have to go through a cumbersome online FTP process," elaborates Miglarese. Radiant.Earth will ease the effort by allowing a person to view and analyze the data within the same environment, and without having to download it locally.

Further, as was seen in the USA recently, federal agencies don't always have the resources to post and expose the observation data; and those financial resources change with administrations. It is therefore imperative to have a neutral location to store data that can be counted on regardless of the environmental or societal issue. Radiant.Earth's promise is to deliver the abundance of earth imagery and tools to a non-space — and in many cases non-technical — audience. "We want to build upon all the good work that's been done by space agencies and others, but also take it a step further by reaching new users that may not know these resources even exist," she elaborates.

As for GEO, Radiant.Earth thinks they are complementary to each other. "GEO is an intergovernmental organization, focused primarily on coordinating government data and policy for the delivery, integration, and use of that data to meet numerous societal needs. The need for Radiant.Earth comes from users in the global development community for better access to earth imagery and data to fuel greater analysis and insights into the challenges we are faced with across the globe," Miglarese explains, while adding that the team was honored to have Dr Barbara Ryan attend the February summit to ensure that the two teams were aligned and not duplicating any of their activities.

Where Radiant.Earth differs from GEO is the way the former plans to focus its capacity development and technology use on the global development community. What also sets Radiant.Earth apart is how it will provide open source photogrammetry and tools to analyze the data. Equally important will be the provision of plugins for commercial software companies to allow their users to work within our environment, using their commercial software and open APIs for developers to create their own innovations. Apart from the data, the analytical tools will be free.

Once the platform is launched, the team will develop a schedule to begin releasing information over the next year, and will build off other efforts underway or recently completed.

Another interesting thing is the capacity development that it plans to focus on. "We want to develop and strengthen the knowledge, skills and aptitudes of the global development community to use geospatial data for greater analytical insights," she adds. Radiant.Earth's capacity-building programs, which again will be a free service, will be focused on overarching thought leadership and regular publications

Radiant.Earth is an effort to organize and make discoverable already existing open data with a focus on supporting global development applications.

THE PLATFORM WILL ALSO PROMOTE CREATION OF OPEN SOURCE TOOLS

JED SUNDWALL
Open Data Lead
Amazon Web Services

What difference do you think Radiant.Earth brings to the market?

What we have done with Landsat on AWS and the datasets listed on Earth on AWS have shown people what all is possible when you make earth observation data available in the Cloud. By making data available in a public Cloud environment, Radiant.Earth is allowing everyone to use whatever tools they want to analyze the data, which will enable much more innovation. This will promote the creation of open source tools, and enable the creation of proprietary tools too. The important thing is that it gives data users complete flexibility over how they choose to analyze the data.

What do you think is the value of geospatial data for the world?

It is incalculable. This data can be used to provide crop insurance, monitor land use policies, ensure land rights, and enable research and growth in dozens of other fields. For example, when AWS launched the Landsat dataset, we were amazed by the level of interest in the data from around the world — within six months of launch, we had received more than half a billion requests, which supports just how valuable the data is. Just a few of the ways Cloud-based geospatial data has made an impact include enabling a start-up to deliver cutting edge agricultural analysis to farmers and empowering researchers to monitor global deforestation. Essentially, making this data easier to access is going to allow us to know a lot more about our world and make better decisions to protect human wellbeing and our natural resources.

How can open data encourage innovation?

Opening up data does not magically solve problems or create start-ups. Organizations sometimes make the mistake of launching an open data portal thinking their job is done. The first thing you need to think about when trying to open up data for innovation is, if there is a real demand for insights you can get from the data. You have to think beyond simple "wouldn't it be cool if...?" questions, and think about actual problems that can be solved with the data, and who will benefit from cost savings as those problems are solved. As far as opening humongous amounts of data is concerned, that can only be done in Cloud. Earlier, if you wanted to share 100TB of data, you would need 100TB of storage space, and then you would need to figure out how to get a copy of that data. Then, you would also need the computer power to run analysis on it. This severely limited the number of potential users and the innovation that could take place. When data is staged for analysis in the Cloud, anyone can analyze it without needing to download or store their own copy. The Cloud grants equal access to data. Putting data on the Cloud really democratizes access to the data.

around the latest in research and development, the imagery and geospatial services market analytics, creating awareness of the value and use of GIS and open data by promoting best practice use-case analysis, sponsoring summits, roundtables and hackathons on specific issues, and more. It also hopes to develop a fellowship program in 2018.

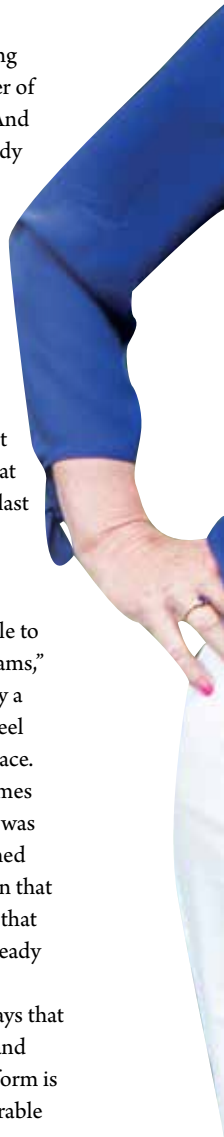
What's going forward?

A great platform needs a great marketing effort to reach out to maximum number of people in the global user community. And Radiant.Earth is on the job. It has already finalized its marketing programs and approach, recognizing that community development is just as important as any technology it will provide.

The team is also moving forward with strategic communications on the market and policy issues that are of particular concern to the development community. While these plans have not been finalized, Miglarese anticipates that this content could start coming by the last quarter of 2017.

"I am confident that we will work through already existing organizations like NetHope and ICT4D as an example to create awareness and deliver our programs," she explains. Radiant.Earth will employ a network of network approach to flywheel its programs into the broader marketplace. Miglarese feels one of the major outcomes of the Leadership Summit in February was the connections that the team established with the community. "Their recognition that Radiant.Earth is needed, and knowing that many organizations and people stand ready to help validates our mission."

Miglarese is categorical when she says that Radiant.Earth builds upon the public and commercial business models. The platform is an effort to organize and make discoverable already existing open data with a focus on supporting global development applications, she sums up.



Anusuya Datta
Executive Editor
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RADIANT.EARTH LEVERAGES PUBLIC AND COMMERCIAL BUSINESS MODELS

How does Radiant.Earth plan to open up geospatial data for positive global impact?

The value of geospatial data has not been adequately documented outside of the defense and intelligence applications. Traditionally, it has been too difficult and expensive to deploy this technology inside of resource-constrained organizations. However, the potential value is tremendous because the vast majority of these problems are clearly place based, and their solutions are rooted in some part on the analysis and consideration of physical and cultural geography. With the advances in technology, the wealth of data coming from satellites and drones, and the dramatic advances in machine learning, we believe the time is now to focus our efforts on supporting the global development community. Radiant.Earth will provide access to data that is not currently exposed via registries and available on the Internet. We will also work to build plugins and APIs to data and services that is already in a Cloud ecosystem.

There are multiple sources of data — some private, some national, and each have their own data policies. How will all this data be shared keeping in mind the diverse policy and regulatory environments?

There is a lot of great commercial imagery in the market, and we want to see those companies grow and prosper. It is their activities and risk taking that is driving large portions of the innovation in the market place — including the government sector. The same is true of the commercial software and analytics companies. Radiant.Earth is not a statement about a commercial business model. Radiant.Earth is an effort to organize and make discoverable already existing open data with a focus on supporting global development applications.

Data licensing is a big topic. How do you plan to address that?

Open data and data licensing is a complex topic and one that is not well understood by geospatial practitioners. Radiant.Earth will develop programs and thought leadership publications specifically topics such as — What's in a license? What do those clauses mean? How should you approach negotiating them?

We are developing our schedule to begin releasing this information over the next year and will build off of other efforts underway or recently completed such as the UNGGIM analysis of this topic, among others.

What is the commercial proposition of this venture?

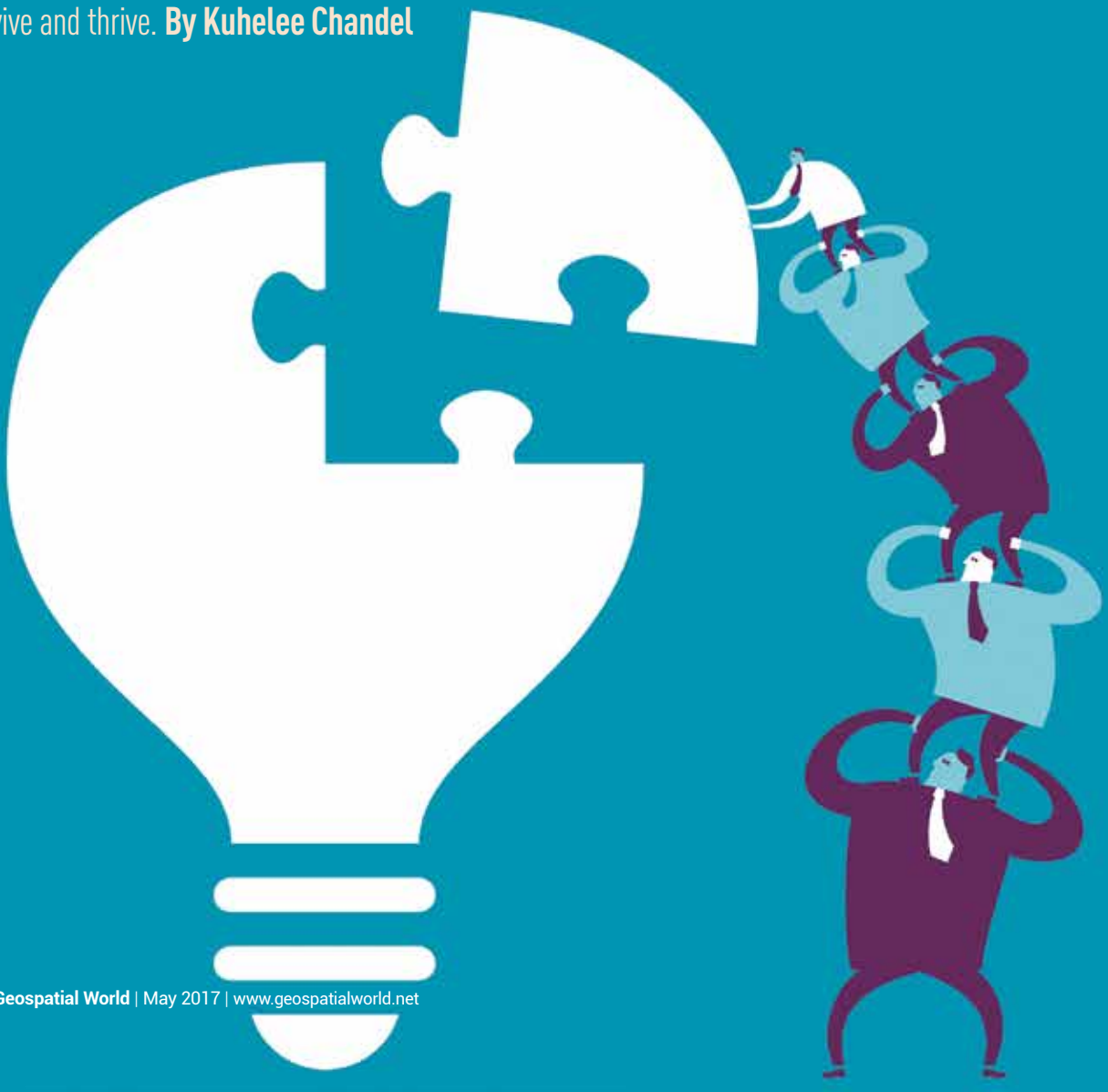
We have received generous support from Omidyar Network and the Bill & Melinda Gates Foundation to date, but will look to supplement their contributions with donations from other philanthropic efforts whose missions Radiant.Earth aligns with and can directly support. We are also in the process of developing a business model that will generate some revenue for our operations in the longer term to ensure sustainability.

However, just as important as their funding, the recognition that these leading and highly respected professionals in the development arena need and want a better approach accessing and applying open imagery and data is incredibly valuable. Both organizations make substantial investments in imagery and geospatial tools — well beyond their monetary support for Radiant.Earth — and the fact that they want improvement and change adds great credibility to what we are doing.

ANNE HALE MIGLARESE
Founder & CEO
Radiant.Earth

COLLABORATION IS THE NEW INNOVATION

As the 'where' element becomes an indispensable element of businesses, driving our thinking, problem solving and decision-making capabilities, geospatial industry must adopt new collaborative models to survive and thrive. **By Kuhelee Chandel**



Apple, Uber, Amazon, LinkedIn, Facebook, AirBnb, Microsoft, Ola, TripAdvisor, Twitter, Booking.com, Quikr, Financial Times, Flipkart and many more companies…Wondering what is the connect here?
"Location, Location, Location!"

Today, spatial information is critical to a much wider range of applications than ever before. Spatial context is now seen uncovering new trends, relationships and other business insights. While smartphones, PDAs and wearables bring the Web to any location, the context of usage turns into the main point, and the knowledge of the location becomes fundamental. Citizens have become the biggest group of consumers as well as producers and enablers of location data. Juniper Research reports that the number of location-aware apps is expected to triple by 2019. With more consumers fast embracing location into their everyday lives, businesses are fast trying to keep up.

"Location has always been vital to making sense of the dynamic world around us and geography, according to the study of spatial relationships between components of the world," says **Mladen Stojic, President, Hexagon Geospatial.**

The 'where' element has become an indispensable element of businesses, driving our thinking, problem solving and decision-making capabilities.

Location intelligence is more than just a map with dots on it. For instance, empowering clients with purchasing knowledge at the front door of commercial shops and sharing price comparisons on customers' smart phones is feeding the retail industry's individual and aggregate customer profiles for increased sales efficiencies through Big Data analytics. Traditionally, geospatial had been cubby-holed enormously, and this kind of 'spatial intelligence' was the responsibility of highly compartmentalized and specialized geospatial industry players and their users. However, evolution of technology and transformation of the industry as a whole has democratized both the access to and the insights within and throughout the organizations employing them.

Naturally, this is creating new business models. As new companies threaten to disrupt the market with innovative products and solutions, traditional geospatial companies are going for collaborations with each other or with mainstream IT companies to survive the competition. Then there are a host of major mainstream companies like SAP, Microsoft, IBM or Oracle, and automobile, infrastructure or utility firms that have shown interest in location, with geospatial capabilities being integrated into all kinds of systems and they are no longer separate industries.

> "LOCATION INTELLIGENCE IS BEING ADOPTED BY COMPANIES LOOKING TO PROVIDE AN UNPARALLELED EXPERIENCE TO CUSTOMERS REGARDLESS OF THE INDUSTRY OR SERVICE THAT IS BEING OFFERED. I EXPECT TO SEE THIS TREND ONLY INCREASE WITH SOPHISTICATION OF IOT AND AI CAPABILITIES"

MANISH CHOUDHARY
Senior Vice President, Global Innovation & Managing Director, Pitney Bowes

> "BUSINESSES ARE SEEKING TO MAKE USE OF WHAT WE IN THE GEOSPATIAL INDUSTRY HAVE ALWAYS KNOWN — EVERYTHING HAS A LOCATION. AND THIS MAKES IT A VERY POWERFUL TIME TO BE IN THE GEOSPATIAL INDUSTRY"

MLADEN STOJIC
President, Hexagon Geospatial

But where did this all begin?

According to **Marc Melviez, Group CEO and Director, Luciad,** "Google Maps, Google Earth and the increase in mobile devices have caused the masses to start thinking in terms of 'where' for many aspects of daily life. The trend picked up quickly."

Agrees **Clint Brown, Director, Product Engineering, Esri** when he says a little over a decade ago, consumer mapping exploded onto the Web with tools like Google Maps and just a few years ago map-based apps became one of the most popular categories to download onto amount phones.

Today, awareness about geospatial technology and its applications across businesses and industries is on a continuous rise. Naturally, this is encouraging several traditionally 'non-geospatial' companies to engage in both spatial data capture and consumption, primarily as an enabler for their own products and services.

Over the past few years, the term 'spatial enablement' has become a trending jargon and there is a phenomenal expansion of applications and enterprises that have been labelled disruptive in terms of capitalizing on spatial components. Spatial enablement — or the ability to add location to almost all existing information — unlocks the wealth of existing knowledge about social, economic and environmental matters, playing a vital role in understanding and addressing the many challenges we face in an increasingly complex and interconnected world.

Manish Choudhary, Senior Vice President, Global Innovation & Managing Director, Pitney Bowes, emphasizes that geospatial and location technologies are now present across a number of industries, including retail, transportation, government and banking. He gives an example of the banking sector using geo-data to identify areas with high population density, Internet penetration, smartphone users to set-up ATMs, branch and sales

> WHEN WE LOOK AT A NON-GEOSPATIAL ACROSS THE INDUSTRIES WE SERVE THERE IS SCOPE FOR COLLABORATION AT ALL LEVELS. THERE ARE ALWAYS NEW PARTNERSHIPS FORMING IN EFFORTS TO FIND NEW WAYS TO ADDRESS OPPORTUNITIES THAT ARISE IN THE MARKET "

RON BISIO
Vice President, Trimble Geospatial

employee allocation, and other banking services. Governments across the world are also using earth observation, spatial analytics and other geospatial technologies in fields of urban development and planning. Be it choosing the perfect location for setting up a new hospital, or logistics and resource planning for agriculture or disaster management, data and geographic information has become a core focus. This has led to stakeholders evolve fluid strategies with important decision points, thus altering the course of these strategies from time to time. This trend is expected to continue as technology evolves making capture and application of spatial data more and more cost effective.

It is exactly how, Stojic sees it: "Businesses are seeking to make use of what we in the geospatial industry have always known: everything has a location." He feels this makes it a very powerful time to be in the geospatial industry for the industry has the capability to shape the potential across a diverse set of different industries. However, he also goes on to pose a relevant question, "How do we make this streamlined and as simple as possible for non-traditional businesses to build their individual geospatial applications?"

What is driving mainstreaming of geospatial?

"The trend is being driven by the need to own the geospatial data." says **Asif Khan, Founder, Location based Marketing Association (LBMA).** That the value of the geospatial business is growing is clearly evident by the interest shown in this field by an increasing number of non-geospatial companies, including mainstream IT companies. In a small phase of time characterized by the speed of transformation, enabled by emerging technologies and a considerable continuity in industries and markets, it has always been observed that the most innovative businesses and organizations start to develop a new collaboration system that goes beyond the open innovation. It is about developing collaboration and synergies between businesses belonging to different industry verticals to produce new products, services and processes.

As a result of this collaboration, both 'non-geospatial' as well as 'geospatial' companies, which belong to two very distant segments, are moving into territories hitherto unexplored. The collaboration between two good ideas multiplies the result, and ultimately the value of the end solution increases manifold as a result of combination of technologies, applications or services.

As Melviez predicts, "The trend of increased geospatial information and the creators of geospatial information will only continue to increase and intensify." He also envisages more and more information to be shared using geospatial metaphors, and feels that the 'map' would conquer part of the screen real estate currently used by spreadsheets. This in turn is expected to drive a need to acquire knowledge, know-how, techniques and applications to manage geospatial information.

So where is this heading?

Location undoubtedly is becoming fundamental to all decision making. Quite interestingly, Khan describes location data as the 'cookie' for the physical world. Why so? Because, much in the way that cookies are used for tracking people online, location data has the potential to enable tracking of people across their entire day journey. From home to work to lunch to shopping to entertainment and back to home again. Interesting, eh!?

Ron Bisio, Vice President, Trimble Geospatial, aptly explains: "Spatial data is becoming ubiquitous across both our personal and professional lives. From tracking the location of a business asset, to paying rent, to finding the closest coffee shop on the smart phone, even if we are not aware, spatial context is already a fundamental element in most of our decision making." Industries are looking at geospatial information to gather more accurate data and to increase connectivity. There is an opportunity around location that extends beyond targeting customers. One major driver for this is the marketing/advertising sector wanting to leverage real-time geo data to engage and understand 'where' their customers are and 'where' they will potentially be going. Location intelligence platforms can help businesses, especially e-commerce, to gather invaluable information about their customers are along with actionable visual insights to deliver personalized offers and communications, sometimes even on a real-time basis.

As location becomes all pervasive and spatial enablement befalls the need of the hour, non-traditional players are gradually becoming an integral part of the geospatial industry. This trend is definitely transforming the business models of major geospatial players as users begin to think about GIS capabilities as part of their enterprise systems with various classes of users. For example, in the past

The importance of location has led to stakeholders evolve fluid strategies with important decision points, thus altering the course of these strategies from time to time

few years Esri's ArcGIS platform has moved from desktop product, which professional users would buy per seat or as shared sets, to one where work is orchestrated across many apps, desktops and servers along with the Cloud. Today, spatial analytics is reaching not only desktop using analysts but also the field workers who use custom GIS apps as well as the end users across every field. In turn these users are also creating valuable information products and maps that are intended to reach consumers through apps on their smart phones, other portable devices, crowdsourcing and story maps. This is enabling real people to mine actionable, useful information out of the ever changing pile of data available in the real world.

Stojic has an interesting observation to make — because traditional maps were too expensive, modern maps were designed to be multi-taskers. And instead of communicating, our maps began complicating information. According to him, the map of the future is a Smart M.App — the revolutionary technology offers a platform that lets customers build their own dynamic information service. They are designed to be used to provide information about a specific business problem.

The pace at which collaborations between various technologies enabling location analytics is happening is remarkable. The bigger players of the geospatial industry are trying to make applications and information more public in order to encourage collaborations and partnerships. Technology innovation and increasing access to information have triggered endless business opportunities which are leading to mainstreaming of these technologies while compelling businesses to align, re-align and consolidate.

Is this driving acquisition of geospatial companies?

Uber and AirBnB are classic examples of further disruption to the disruptive agents as a function of spatial enablement. "If you take location out of Uber, you take them out of business. Uber uses data to predict traffic patterns, estimate near accurate wait-time for taxis and re-route to the fastest possible route to the destination, to give users a seamless travel experience from point A to B," as Choudhary puts it.

From planning their entry into new markets, to improving customer service capabilities, the use of location technologies will be key to success. Uber isn't the only company using location intelligence to keep its customers happy, every time someone make an online purchase on Amazon, ebay or any e-commerce website, a lot of work goes on behind the scene to identify the most optimal delivery process, calculate landing costs for shipping, analyzing courier services available near the location, to get the order delivered as quickly and seamlessly as possible. This trend will only increase with sophistication of IoT and AI capabilities.

Non-geospatial companies are discovering that 'spatial' is not as easy as they had thought. It is one thing to use your own personal GPS application on a smartphone and absolutely another thing to design a logistics application that optimizes delivery times by taking real-time factors into account. After realizing it is more complicated than anticipated, these non-traditional players start to hunt for talent, then discover such talent is scarce! Finally they realize that building resilient systems would take way too long and would also involve a lot of risk. So, what is the solution? 'Buy' is

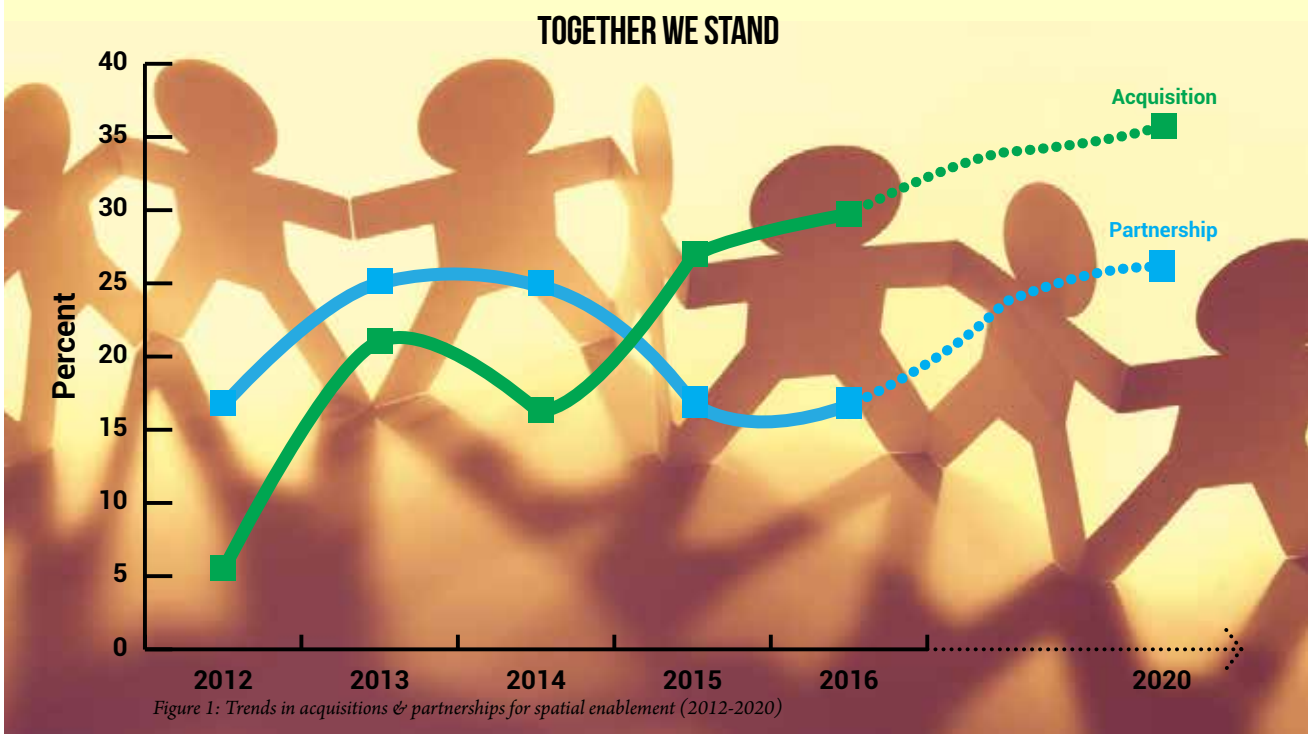


Figure 1: Trends in acquisitions & partnerships for spatial enablement (2012-2020)

Source: Global Geospatial Industry Outlook 2017

MAJOR ACQUISITIONS IN LOCATION SPACE

- **2016:** Apple secretly acquired a Finnish company Indoor.io to help it map indoor spaces to help it map indoor spaces.
- **2016:** Apple acquired Flyby Media, a start-up that developed technology for mapping spaces using smart-phones.

- **2015:** Uber teamed up with TomTom to provide navigation map on the driver's side, suggests a concerted effort to develop native navigation, mapping & location services.
- **2016:** Uber's acquired AI startup Geometric Intelligence, reinventing itself into a tech giant and leader in the AI field, while aggressively trying to prove that it's no longer just a ride-sharing platform.

- **2016:** Google acquired Urban Engines, location-based analytics start-up that aims to help cities and companies better understand urban mobility.

- **2015:** Flipkart, the Indian e-commerce giant, acquired a minority stake in the digital mapping company, MapmyIndia, in order to strengthen its logistics and customer analytics.

- **2016:** TripAdvisor, the travel planning and booking company, acquired Citymaps to improve customer travel experience, working around the fact 'Travelling is all about location'.
- **2015:** TripAdvisor acquired ZeTrip the start-up which stands behind the travel-journaling app Rove which works by creating a record of a traveller's behaviour using GPS coordinates and blending it which photos, notes and other content.

- Intel has invested heavily in computer vision and drones in recent times and as part of that vision, they acquired of Movidius, a start-up that manufacturer computer vision chips for the likes of DJI and the Google Tango project.

- In **2015**, the automobile consortium acquired HERE, digital mapping and location business to secure long term availability of independent and value creating platform for cloud-based maps.

- FT acquired GIS Planning, for location analytics for business intelligence and marketing opportunities

Infographic: Pradeep Chauhan

> "LOCATION DATA IS THE 'COOKIE' FOR THE PHYSICAL WORLD. BECAUSE, MUCH IN THE WAY THAT COOKIES ARE USED FOR TRACKING PEOPLE ONLINE; LOCATION DATA HAS THE POTENTIAL TO ENABLE TRACKING OF PEOPLE ACROSS THEIR ENTIRE DAY JOURNEY"

ASIF KHAN
Founder, Location Based Marketing Association

better than 'make' and this come in the form of acquisitions!

Majority of collaborations happening between the non-spatial and spatial industries are in terms of acquisitions of small-scale geospatial or location-based companies by the 'non-geospatial' players for their spatial enablement. This is also substantiated in the Global Geospatial Industry Outlook, 2017 Edition, by Geospatial Media and Communications, where trends traced around acquisitions and partnerships for spatial enablement through 2012 till 2016 (as seen in the Figure 1) show a conspicuous rise in such acquisitions.

So, is there a scope for partnerships?

Experts feel this is a possibility in the near future. One suggested model could be of traditional geospatial companies seeking out emerging location datasets gathered by non-geospatial companies to explore partnerships, licensing and investments before outright acquisitions. With the exponential value addition of geospatial in other industries, enterprises are seizing new opportunities around customer loyalty and supply chain efficiency with the help of collaboration with location intelligence companies. Companies have begun to understand the

customer value that can be derived from geospatial information as they strive to differentiate themselves from their competitors. By combining their expertise with geospatial capabilities, businesses increase their overall value and this would be more so if they opt for a partnership model and not just acquiring certain small scale location service providers.

Another interesting trend seen today is that the already well-established geospatial companies are collaborating within themselves, instead of competing with each other. Some major mergers like the Topcon-Sokkia merger portray that where the market environment for the two companies is highly competitive and the merger of two companies is to maintain the edge in the increasingly competitive worldwide market. In more buoyant times, companies usually complement each other to make the collaboration worthwhile. On the same line, Choudhary talks about Pitney Bowes exhibiting partnerships with a number of technology companies, like a strategic alliance with GE which deals with embedment of location intelligence. It also has a number of technology partners such as IBM, Ernst & Young, GE Digital, Microsoft, Salesforce, Okta and Apigee.

Contrary to the belief that this is making the field smaller, the geospatial industry envisions the increasing interest in location intelligence as a great opportunity. "We recognize that while we have extensive expertise in the geospatial market, there are companies out there who understand their own individual industry and local markets, and large companies like Hexagon are leveraging the brand recognition to establish mutually beneficial partnerships with large, multinational companies," says Stojic.

As interest levels about location strategy increases and organizations develop their own in-house capabilities, they are doing so only by leveraging on the existing geospatial information, products, services and solutions which is good news for the existing players. This is leading to a more expansive adoption and growth in the use and knowledge of geospatial industry. While there are some businesses which are looking at developing in-house capabilities for analyzing location-based data, this is also resulting in the explosion of the market. This growth is further catalyzed by factors like high Internet penetration, mobile usage, increasing deployment of IoT-based solutions etc.

Choudhary feels that in-house location-based capabilities are only a reflection of this growth and

leads to an increased acceptance of location intelligence tools. Bisio agrees to this when he says that the more ubiquitous spatial data becomes, the greater the business opportunity. "Across the industries we serve there is scope for collaboration at all levels. There are always new partnerships forming in efforts to find new ways to address opportunities that arise in the market. This is true both for manufacturers and for the service providers to whom we sell." He thinks, in the instance of a non-geospatial company acquiring a geospatial/location-based company for their spatial enablement, only highlights the increasingly important role spatial data is playing across most market segments as companies try to evolve their own products and services, or in some cases establish brand new categories. Public examples include recent acquisitions of various spatial technologies by both Uber and Intel.

Rather interestingly, Brown shares that business GIS is growing rapidly at close to 100% annually, and in terms of logistics, major companies are saving on the order of $0.5 billion each year by applying GIS. This growth is not occurring in a vacuum, but rather in concert with their other existing IT systems. Other IT companies with longer term plans and visions recognize this synergy, value, and opportunities from working together (vs. competing) with the geospatial community. While there are evidences of numerous in-house projects failing for geospatial is lot more complicated than imagined, the need and demand for spatial enablement continues.

"It's more like the tech industry and GIS community are coming of age. The technology platforms involved in spatial analytics have advanced to the point that there are more exciting opportunities to be achieved through collaboration and information sharing," Brown says, while pointing to the fact that modern GIS has always been about participation, sharing, and collaboration. Since the early days of the technology, people realized that to be success ful they would need data and technical capabilities from other sources beyond their immediate workgroups and organizations. People quickly recognized the need for data sharing and technology integration. Open GIS and data sharing gained traction early and quite rapidly across the GIS community, and these ideals continue to be a critical aspect in implementation of GIS capabilities. Modern Web and Cloud computing have accelerated what is possible in collaborative computing environments.

> MORE AND MORE INFORMATION WILL BE SHARED USING GEOSPATIAL METAPHORS. AS A RESULT, MORE AND MORE COMPANIES WILL NEED TO ACQUIRE KNOWLEDGE, KNOW-HOW, TECHNIQUES AND APPLICATIONS TO MANAGE GEOSPATIAL INFORMATION "

MARC MELVIEZ
Group CEO and Director, Luciad

> IT'S MORE LIKE THE TECH INDUSTRY AND GIS COMMUNITY ARE COMING OF AGE. THE TECHNOLOGY PLATFORMS INVOLVED IN SPATIAL ANALYTICS HAVE ADVANCED TO THE POINT THAT THERE ARE MORE EXCITING OPPORTUNITIES TO BE ACHIEVED THROUGH COLLABORATION AND INFORMATION SHARING"

CLINT BROWN
Director, Product Engineering, Esri

There is another side to this story that Stojic very rightly brings into light through hard-hitting questions that the geospatial industry needs to ask itself — Why are these businesses developing their in-house capabilities? Are the traditional packages too hard to use or too comprehensive? Is the learning curve too complicated? What really drives this need?

One obvious reason could be that the traditional geospatial offerings are not really catering to the needs of these non-traditional players. For years, business-critical technology providers have been innovating and creating user-friendly, targeted applications that provide timely, at-a-glance dashboard views of their businesses. Why shouldn't they expect the same from location-based information? Each business has unique needs, and they want to get answers to their business questions without too much overhead. Customized solutions should empower businesses to combine their industry acumen with the industry-leading technology from build targeted applications that address their particular needs.

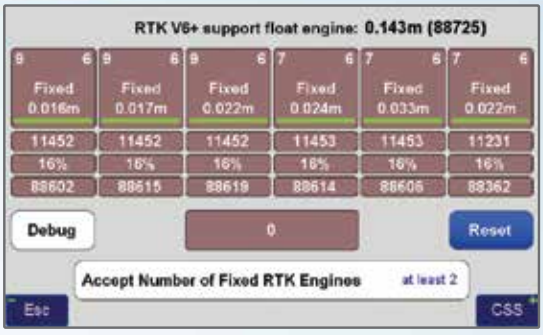
When a new dataset is acquired, there should not be weeks-long waiting period for the answers. They should plug in the new data and get an updated answer. This is the essence of dynamic geospatial information services. New data, new insights, no waiting!

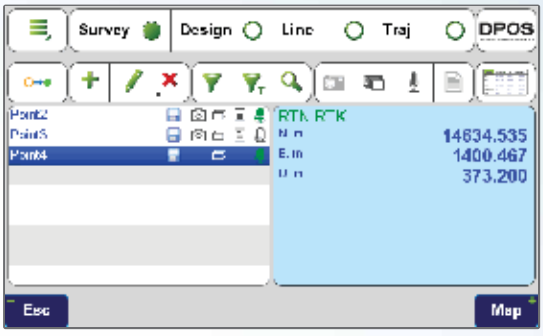
Collaborative partnerships, particularly the technology driven ones, have a colossal transformative influence. What is more exhilarating is that these innovative collaboration processes are having a cumulative effect, increasing resources that would lead to further competitive advantages. Even a small edge, compounded over time proves to be decisive. This definitely makes it an exciting time to be in the geospatial market, because there is an explosion in the awareness of the importance of location data. More and more people are coming to see the powerful communication outlet that maps provide and geospatial is poised to empower them to take geospatial technology to levels we have never been able to reach before.

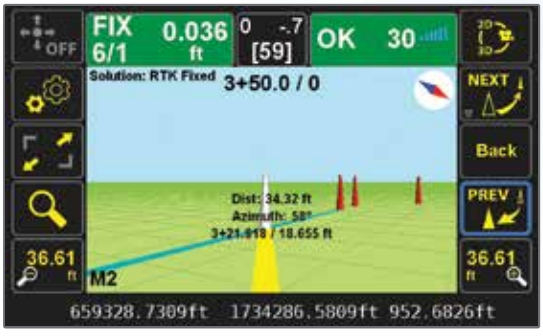
Kuhelee Chandel
Senior Research Analyst
kuhelee@geospatialmedia.net

TRIUMPH-LS and J-Field

Hands free operation







J-Field is the embedded application program of TRIUMPH-LS. It has the following unique features for each point surveyed:

- Six parallel RTK engines to maximize solution availability.
- Automatic Engines Resets, verification and validation strategy.
- Several graphical and numerical confidence reports and documentation.
- Voice-to-text conversion for hands free operation and documentation.
- Lift & Tilt and automatic shots for hands free operation
- Visual Stakeout (Virtual Reality)
- “DPOS it” or “Reverse Shift it” features. The most advanced RTK verification.
- Photogrammetry and angle measurements with embedded cameras.
- Automatic or manual photo documentation.
- Automatic screen shots documentation.
- Audio files for documentation.
- Automatic tilt correction.
- Comprehensive HTML and PDF reports
- Comprehensive codes, tags and drawing tools.
- Over 3,000 Coordinate Systems.
- Automatic and free software update via Internet.

J-Tip

J-Pod

J-Pack

J-Shield

Front

Works Where Others Can't
Goes Where Others Won't

Why Javad? Because it works where nothing else will and it has abilities and features that nothing else does.

I got some ridiculous 'fixes' today in some horrible situations. Reset receiver, moved around, etc. Tried to get a bad fix but had a hard time doing it.

The LS has increased our productivity 2:1

Using licensed professionals for development has been a brilliant idea. Tip of the hat to the programmers and designers that put the original box together it appears to me that they knew where they were going with this years ago.

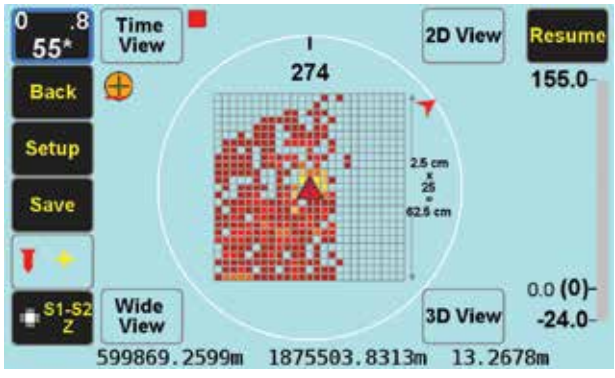
FL

Since I got the Javad system, I go places NEVER BEFORE possible, and WITH confidence, because, the quality checks are there.

J-Tip
Integrated Magnetic Locator

$850

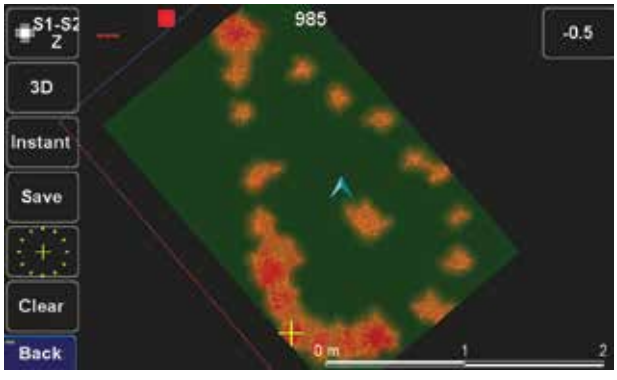
TRIUMPH-LS tags coordinates with magnetic values, It also guides you to top of the item to survey it.

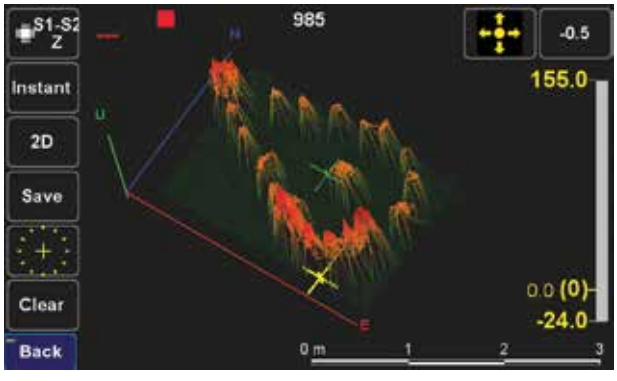


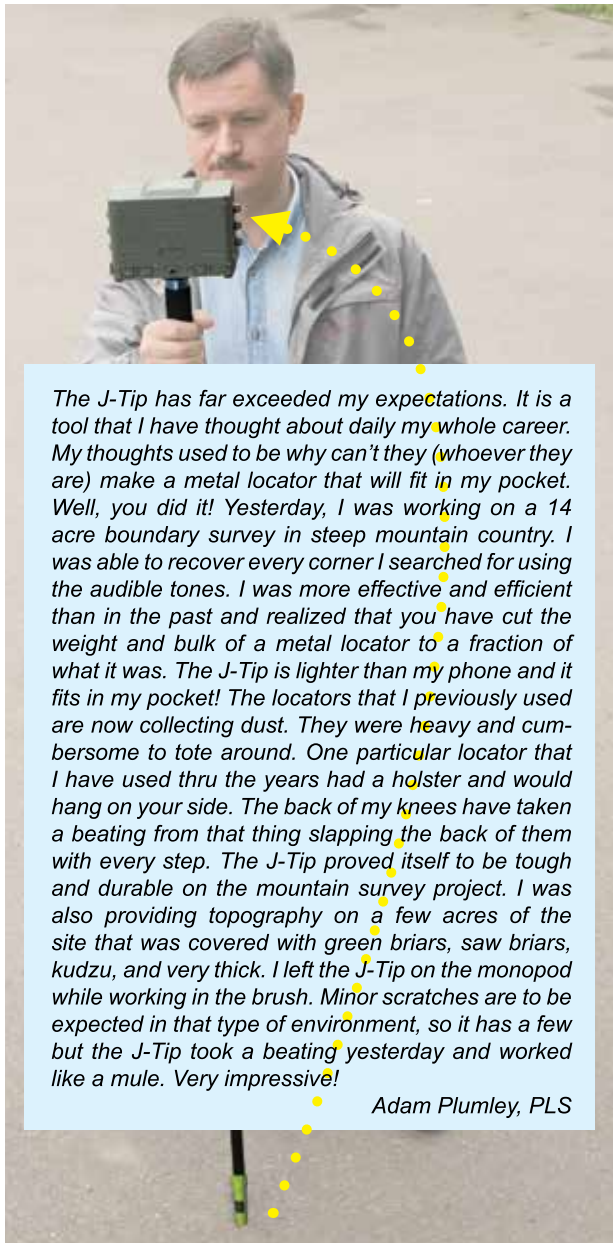
The Mag View focuses only on the mag object with the highest mag value.

The audio and graphical bar on the right side show the magnitude of the magnetic object.

In “Setup” you can select the cell size and the size of the field you want to scan.







The J-Tip has far exceeded my expectations. It is a tool that I have thought about daily my whole career. My thoughts used to be why can’t they (whoever they are) make a metal locator that will fit in my pocket. Well, you did it! Yesterday, I was working on a 14 acre boundary survey in steep mountain country. I was able to recover every corner I searched for using the audible tones. I was more effective and efficient than in the past and realized that you have cut the weight and bulk of a metal locator to a fraction of what it was. The J-Tip is lighter than my phone and it fits in my pocket! The locators that I previously used are now collecting dust. They were heavy and cumbersome to tote around. One particular locator that I have used thru the years had a holster and would hang on your side. The back of my knees have taken a beating from that thing slapping the back of them with every step. The J-Tip proved itself to be tough and durable on the mountain survey project. I was also providing topography on a few acres of the site that was covered with green briars, saw briars, kudzu, and very thick. I left the J-Tip on the monopod while working in the brush. Minor scratches are to be expected in that type of environment, so it has a few but the J-Tip took a beating yesterday and worked like a mule. Very impressive!

Adam Plumley, PLS

2D and 3D views of the field show the magnetic objects that have been scanned.

Zooming the 2D and 3D screens can show the shape of the magnetic objects under the ground.

For many sophisticated features of the J-Tip see its Users Manual in www.javad.com

J-Pod

A rugged Transformer-Pod

$850

Monopod, 8 and 40 sec level vials, compass, Accessory hooks.

Connect legs on demand to make bipod or tripod.

+ Bipod.

+Tripod.

Monopod >>> to + Bipod >>> to + Tripod… On demand.

Rugged, Light, Compact, Easy to level.

* Detachable landing and resting pads.
* Mace grips (concrete, asphalt, bricks, soil)

Travel mode.

Inside bag.

The most stable tripod.
It will never collapse, even on wet glass.

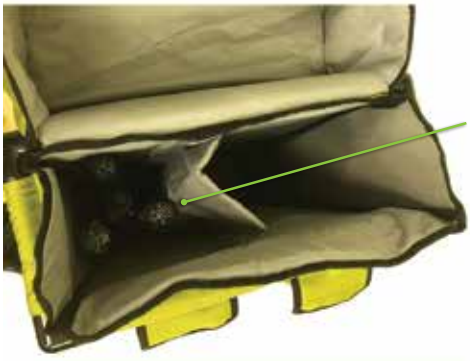
Think of it as a rugged Transformer-Pod,
We call it **J-Pod.**

J-Pack

Nice and convenient survey bag

$290

It was not our job... You asked for it - we did it!



J-Pod

Landing Pads

Javad.....Bravo!!!!

The J-Pack is nicest bag I have ever seen for surveying. I especially like the pocket in the back and all of the places to tie down equipment and stuff.

Adam Plumley, PLS

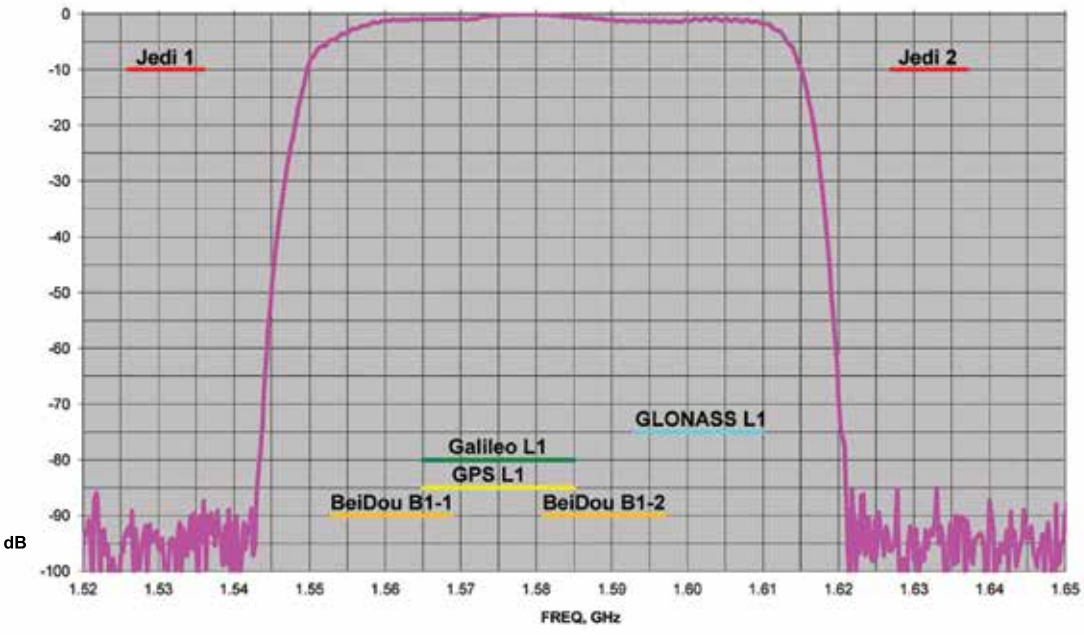
Ship date - January 2017

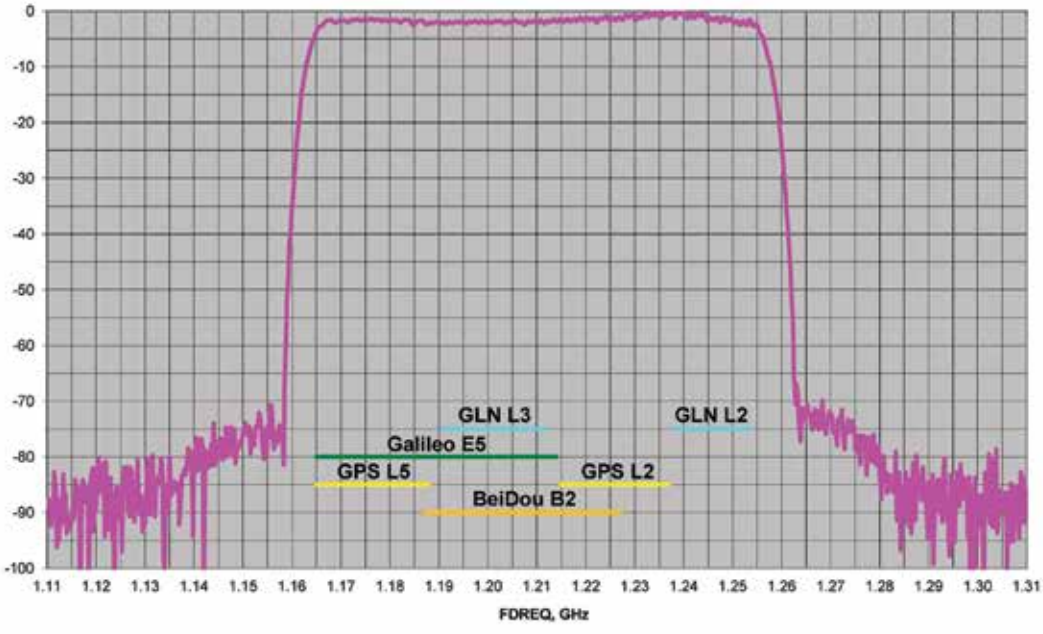
See full video “J-Pack & J-Tip in Use” www.javad.com

J-Shield

In case the **Jedi** returns

$450





J-Shield of TRIUMPH-LS
protecting all GNSS Bands.

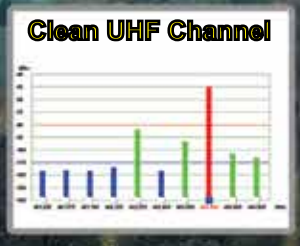
J-Field
Software Features

I used “Beast Mode” on a small project yesterday and all I can say is WOW!!!! Did Javad and Red Bull team up to enhance RTK or did my system drink hypercaffeinated coffee when I wasn’t looking? Amazing accomplishment/development Javad. I can’t imagine using any other GPS equipment.

I surveyed 20 acres today and never used the total station.

The only bitching now is for the crew that has to take out the Hyper V.

DPOSit
Data Processing Online Service



REVERSE
SHIFT<<it

Thank you for the most awesome set of equipment I have had the pleasure of running in my 41 years of surveying. I am having the most fun I have ever had!

TRIUMPH-1M

864 channel chip, equipped with the internal 4G/ LTE/3G card, easy accessible microSD and microSIM cards, includes “Lift & Tilt” technology.

TRIUMPH-2

Total 216 channels: all-in-view (GPS L1/L2, GLONASS L1/L2, SBAS L1) integrated receiver.

The one and the only Digital Radio Transceiver in the world!

Unique adaptive digital signal processing, which has benefits: the full UHF frequency range and all channel bandwidths worldwide • the best sensitivity, dynamic range, and the highest radio link data throughput • embedded interference scanner and analyzer • compatibility with another protocols. Cable free Bluetooth connectivity with GNSS receivers and Internet RTN/VRS access via embedded LAN, Wi-Fi, and 3.5G

And all this with competitive prices!

HPT435BT/HPT135BT/HPT225BT*

$2,710

35 W UHF/VHF Transceiver

HPT404BT/HPT104BT/HPT204BT*

$1,640

4 W UHF/VHF Transceiver

HPT401BT/HPT101BT/HPT201BT*

$2,040

1 W UHF/VHF with internal battery

L-Band/Beacon*

$1,550

Receivers for multiple applications

JLink 3G LTE BAT*

$2,735

Web-interface Wi-Fi, Ethernet, 3.5 G, UHF/VHF/FH915, internal battery

OEM Solutions

$840

902-928, 360-470, 225-255, 138-174 MHz

*Power, data cables and antenna are included.

CREATING CHANGE THROUGH COLLABORATION

Collaborative innovation is transforming geospatial workflow and industry, finds the Global Geospatial Industry Outlook 2017.

By Jyotsana Chuchra and Akshithha KP

The technology industry is always in flux. Frequent new products and category innovation define and redefine the sector's constantly shifting landscape, affecting the makeup of hardware, software and data companies themselves. This volatility is manifested by massive shifts in relationships and sudden clash of cultures courtesy mergers, acquisitions, partnerships and divestitures.

Acquisitions and partnerships

Acquisitions and partnerships — the two pillars of a business growth strategy are those organizational activities, which give a company access to external resources, but they differ in many ways. Acquisitions deals are competitive, based on market prices but are risky. Partnerships and alliances are cooperative, negotiated and not so risky. Companies habitually deploy acquisitions to increase scale or cut costs, and use partnerships to enter new markets, customer segments and regions. Technology never stands still, it keeps advancing. The growing value of geospatial business is clearly evidenced by the flurry of mergers and acquisitions happening in the domain.

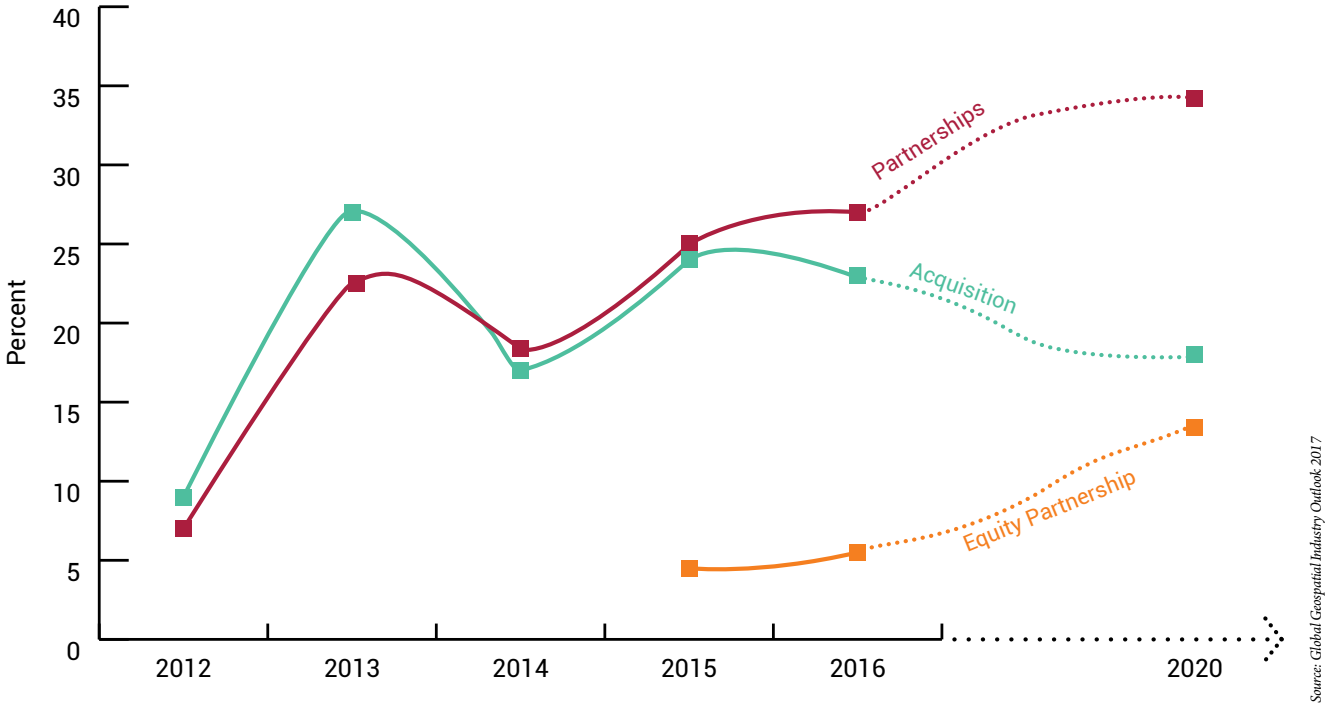
The year of change

2013 was the peak year for partnerships and acquisitions. It was the year when 'one-stop-shop' solution was the driver of the industry. It started with the Hexagon–Intergraph deal that is considered as the most significant acquisition ever in the geospatial domain. The event had tremendous impact on the existing alignment and the prevailing partnership networks of the industry, which affected everybody in the geospatial technology business in one way or the other. This resulted in a wave of changes, where eventually many of the geospatial players started aligning themselves with other large players, amalgamating their distinct spheres of influence and expanding their product portfolio. Also, around this time, the companies started talking in big way about comprehensive and integrated solutions for end users. Many companies were actively either partnering with or acquiring another to move toward the goal. Meanwhile, large enterprises were also motivating geospatial and IT companies to get together and integrate their offerings from data acquisition and data management to IT integration and finally delivering valuable solutions. All these factors coalesced to gear the industry for various inward and outward acquisitions and partnerships.

Acquisitions deals are competitive, based on market prices but are risky. Partnerships and alliances are cooperative, negotiated and not so risky. Companies habitually deploy acquisitions to increase scale or cut costs, and use partnerships to enter new markets, customer segments and regions

Partnerships leading over the acquisitions

After a great turmoil of both acquisitions and partnerships in the year 2013, there was a shift in the scenario post 2013. Understanding the fact that acquisitions strategies



Graph 1: Trends in acquisitions and partnerships in the geospatial industry (2012-2020)

were a costly affair and only few can sustain it for long timeframe, the partnerships strategies started taking a lead over acquisitions (Refer Graph 1)

Bulk of companies were working towards strategic partnerships. This trend was increasing because it delivered access to new markets or customers, accelerated new product development cycles, and improved a company's competitive positioning in a cost-effective manner. Partnerships help companies to expand their capabilities without the added step of creating those capabilities in-house or increasing business risks by carrying extra cost or assets on the balance sheet. Companies, therefore, perform more efficiently and adapt more quickly than they could have on their own.

Partnerships help companies to expand their capabilities without the added step of creating those capabilities inhouse or increasing business risks by carrying extra costs or assets on the balance sheet. Companies, therefore, perform more efficiently than they could have on their own

Trending towards equity partnerships

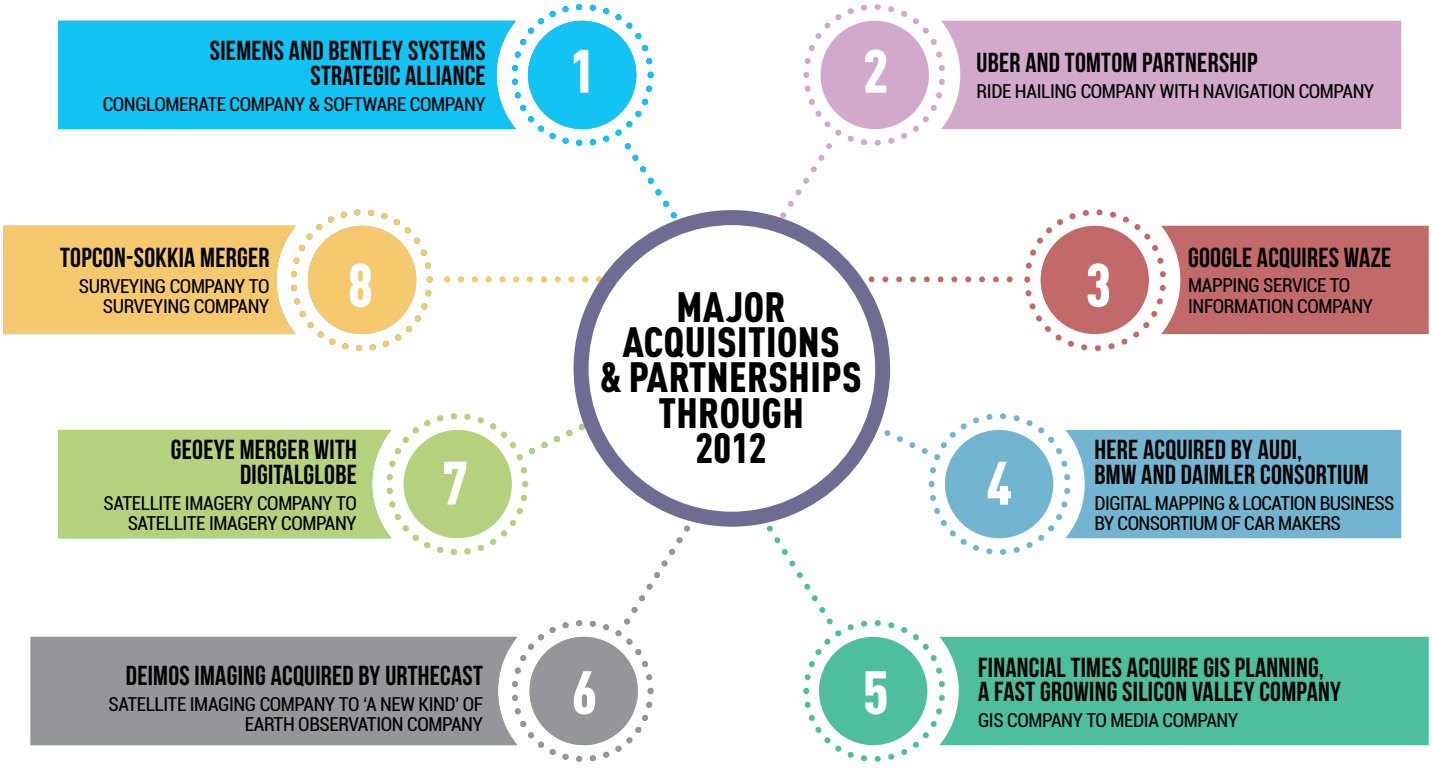
A new trend, which started off late in the partnership arena, has termed as equity partnership. It reflects the partners' ownership interest in the business. One of the great examples is the deal between Siemens and Bentley Systems, wherein the former acquired secondary shares of the latter's common stock to advance infrastructure project delivery. Similarly, Flipkart acquired a stake in MapmyIndia to sharpen its logistics capabilities.

Why partnerships and acquisitions?

Partnerships and acquisitions are significant aspects of a modern business strategy. The reasons range form delivering competitive advantages, economies of scale, and economies of scope, international expansion, vertical integration and access to unique assets. Of these, the most common today is perhaps the drive to deliver a complete solution. Over time, we can see acquisitions and partnerships moving through a number of 'waves' from a strategy point of view in order to pursue 'system integration and solutions'. The different waves in the value added collaborative business are discussed in the Figure1.

Determinants for partnerships and acquisitions

Partnerships and acquisitions are no longer exceptions for most of the firms — they are



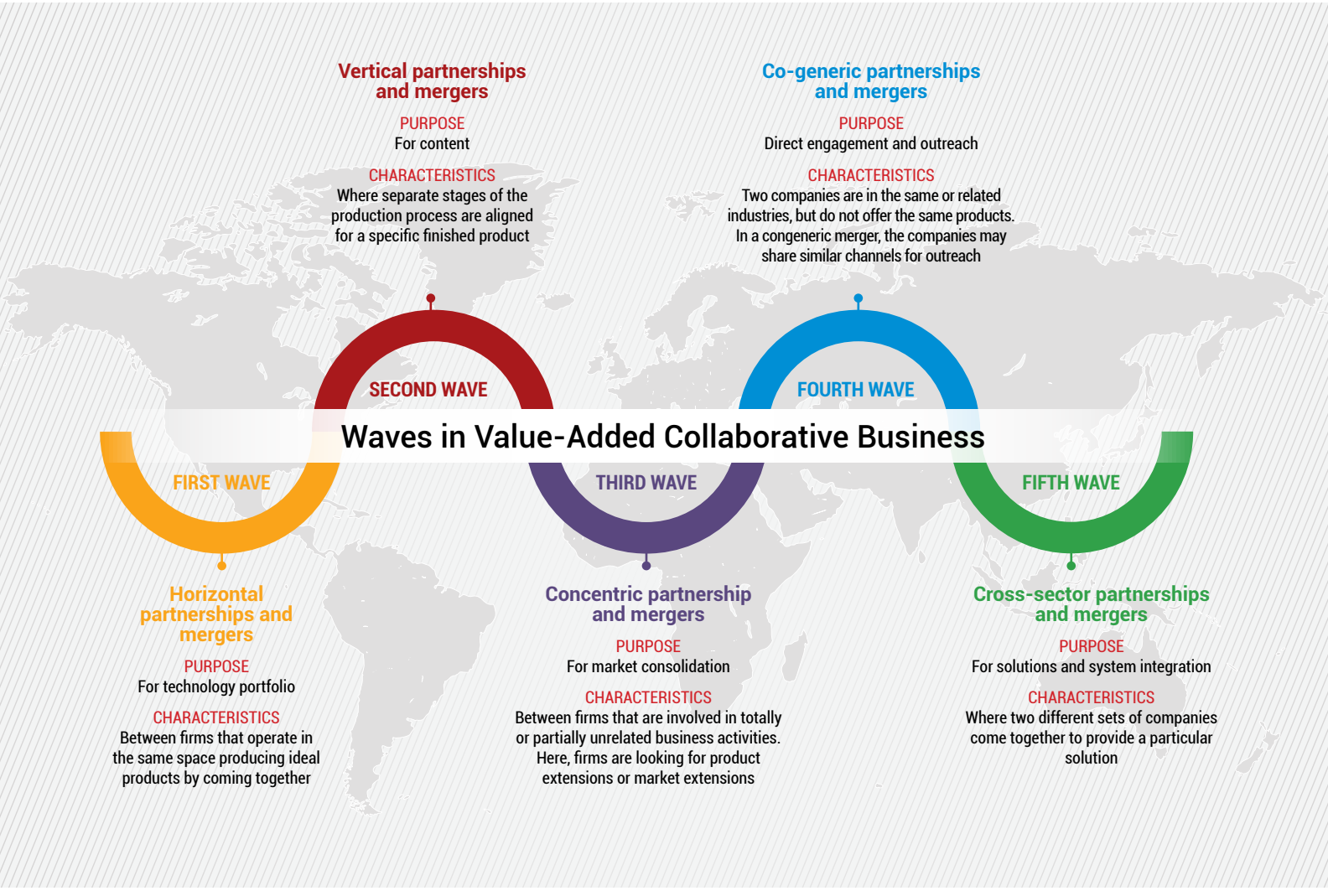


Figure1: Waves in value-added collaborative business

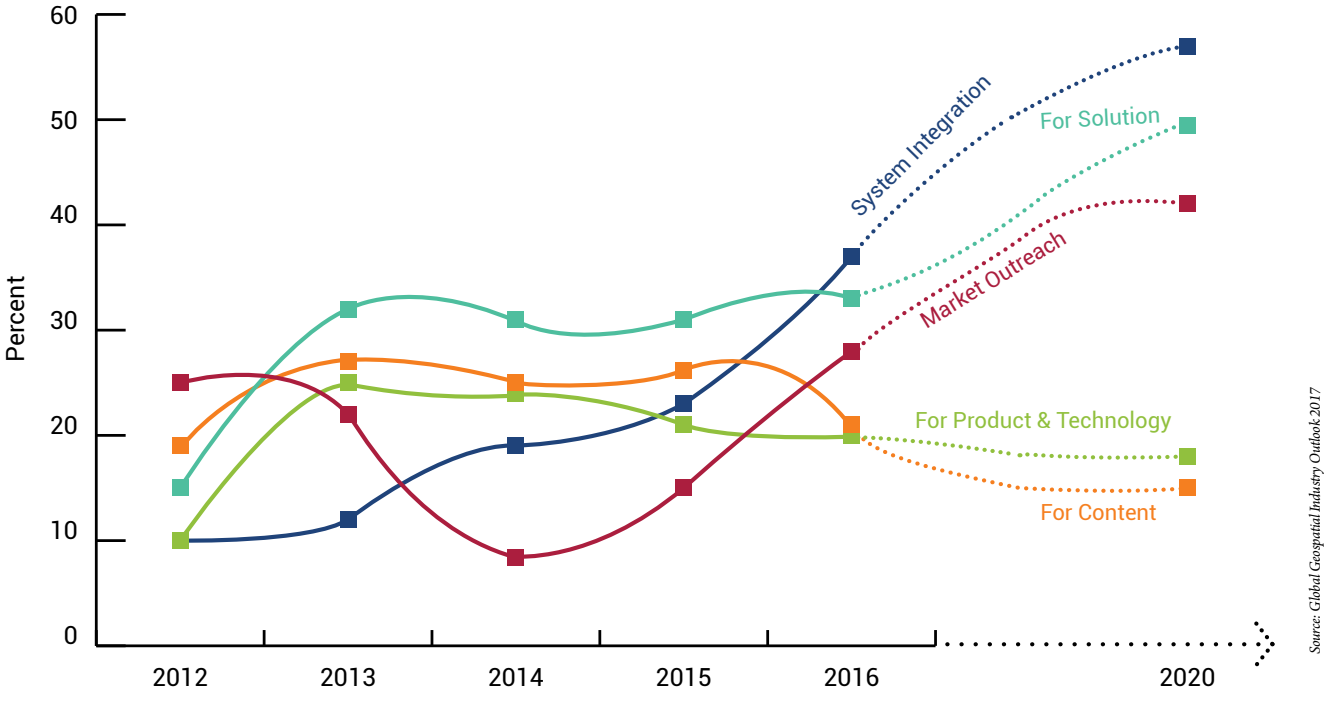
becoming central for gaining competitive advantage. The value these contribute to the firm and the society depends on certain determining factors. The factors determining the partnerships and acquisitions in geospatial industry are different trends, which have been observed with these determinants which are shown in graph 2 and graph 3 in the following pages.

Partnerships

Content is the king in the geospatial space. The various partnerships and acquisitions have taken place for delivering applications and solutions with usable insights and information which all require content. Some of the major partnerships which happened for generating content are: Hexagon Geospatial partnered with content providers like Airbus Defence and Space, and HERE. This enabled the company to find and access geospatial content that drives the application Cloud-based M.App exchange platform. Second in line was the partnership between Esri and MapmyIndia, which gave its users an interface for collaboration and sharing a complete geospatial management experience. The partnership, which provided its user, the power of mapping and location intelligence even in the most remote locations was between DigitalGlobe and Trimble.

The scenario is now seen shifting where most of the product companies are creating their own content and these kings of partnerships for content are expected to stabilize soon. The situation demands the convergence of product and content because in today's scenario the hardware and the software are content-ready.

Following the change are the emerging trends of the solution-centric approach and enterprise orientation that have triggered a transformation in the existing business practices and policies of geospatial companies. The industry has realized the required degree of integration or convergence for integrated systems and developing a solution centric workflow environment. It requires acquisition of technologies, integration of processes, and embedding of workflows,



Graph 2: Determinants of partnerships in geospatial industry (2012-2020)

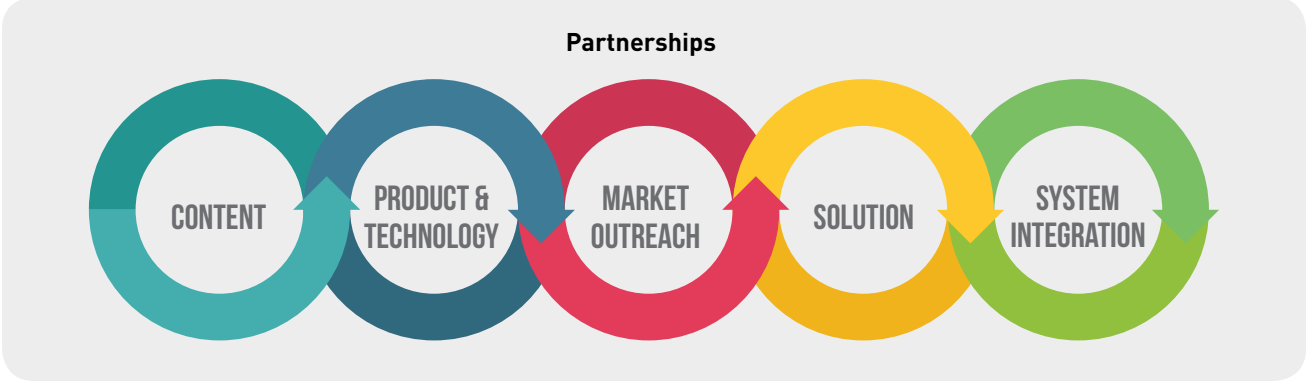
which is possible with a structural reorganization of the existing ecosystem.

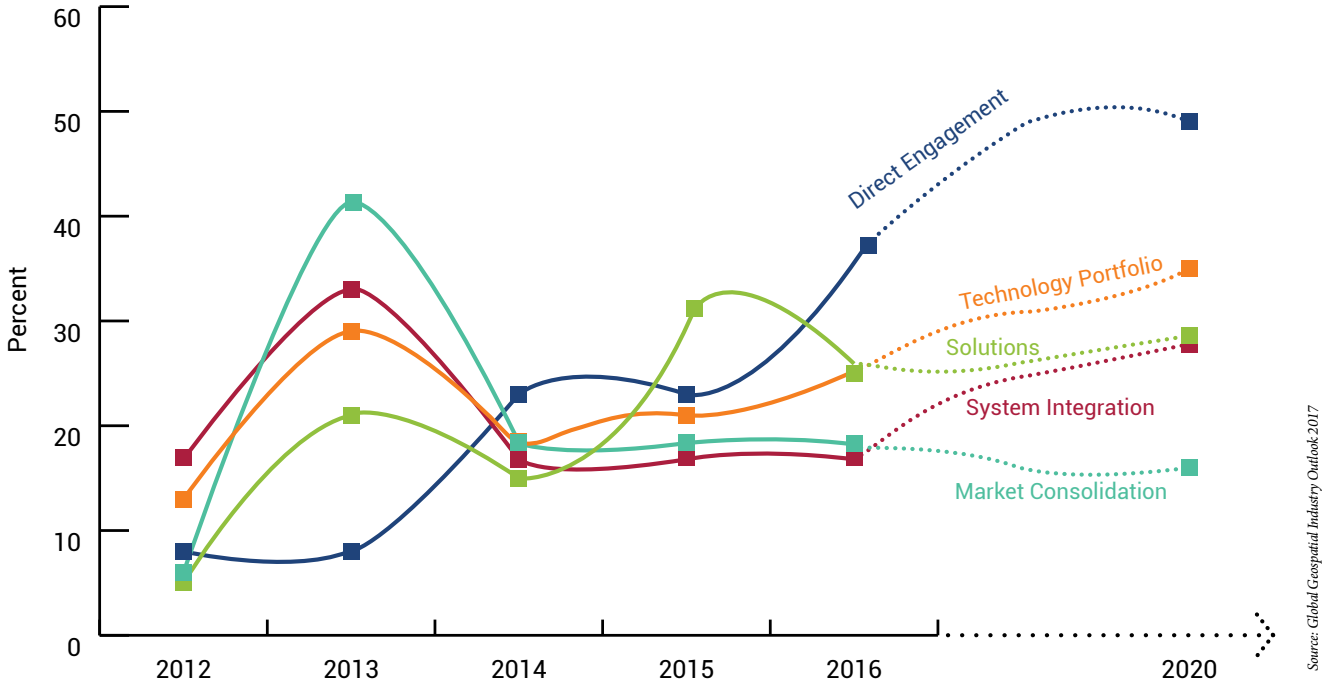
Partnerships for system integration or solution are growing, though at differential rate compared to acquisitions, wherein they are almost stabilizing. Companies are finding it more cost competitive to partner for extending integrating systems and providing solutions to the users, rather than amalgamating the entire new technology portfolio in their systems. This system integration and solution-oriented collaboration is driven by an established geospatial player who wants to venture into a specific market, but doesn't have the domain knowledge edge. And finally, there are partnerships between equals for competitive advantage.

Market outreach has been an influencing factor for partnerships. The company planning to expand into different markets joins hand with the company already operating in that segment. The network gives both companies a wider customer base practically overnight.

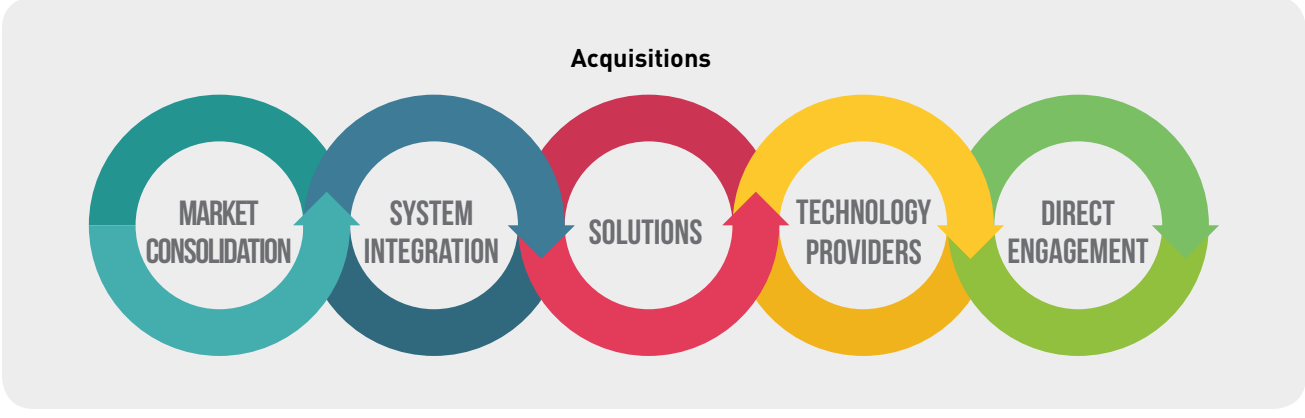
Acquisitions

Direct engagement has been one of the chief reasons behind acquisitions. By buying out one of its suppliers or





Graph 3: Driving factors of acquisition in geospatial industry (2012-2020)



distributors, a business can eliminate a certain level of cost. When Topcon acquired one of its significant European dealers GEOTOP, the move not only enabled Topcon to save on margins that the supplier was previously adding to its costs, but also enabled the parent company to have direct engagements with the market. In the software space, emergence of Cloud has enabled companies to reach directly to the customer. These all-direct engagements have affected the revenue model of distributors who now need to move up the value chain.

Market consolidation has seen a downside with the acquisitions, as a large premium is usually required to convince the target company's shareholders to accept the offer. Acquiring a unique technology platform would enhance the capabilities of the company and produce better results. The acquisition of GeoEye by DigitalGlobe or that of Sokkia by Topcon was for market consolidation, wherein the acquirer aimed to eliminate future competition and gain a larger market share in its product market.

These trends have given way to new business models and workflow efficiency creating more demand. This has been the driving factor as industry readily adapts to the new technologies, applications and business models.

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FINDING THE RIGHT FIT

Partnerships between academia and industry are nothing new, but only with the right strategy, enterprises will be able to prosper. **By Arup Dasgupta**

Academia and industry share a symbiotic relationship. Academia produces graduates who are absorbed by industry. Research work in universities are taken up by the industry and turned into products and services. Industry on the other hand looks to academia for solutions to their concerns. It would like universities to tailor their courses to turn out graduates whose skill-set are aligned to industry requirements. Often new research topics arise out of interaction between the duos which benefit both academia and industry.

Industry expectations

Academia expectations

Industry should frankly and honestly talk with academia based on logical thinking and scientific background

The latter therefore funds focused research in universities which they can operationalize. This may include setting up laboratories, designating industry chairs, and providing guest faculty and placement opportunities. Geospatial industry entails all these facilitators and more because it is a multi-disciplinary field which requires geographers, computer scientists, environmental scientists, social scientists, and domain and management experts.

Industry Outlook

Addressing this issue, **Rajesh C. Mathur, Advisor, Esri India**, says, "Availability of high caliber GIS manpower will be one of the critical success factors for meeting several challenges." He lists these as

reengineering of business processes and workflows and GIS awareness amongst decision makers. Mathur goes on to add, "Skills required include leadership which involves the appreciation of the value of location as key information parameter and at the executive level a willingness to reengineer existing business processes and workflows. At the technology level, there is a need for solution architects, database analysts, developers with domain knowledge and expertise on contemporary geospatial technology. Last but not least, project management skills top the skill-set." Industry can participate in collaboration with academia through Train the Trainer programmes, course curriculum review, internship for students, technology updates, support in establishing laboratories and research projects.

Han Wensink, Chairman, NEVASCO — a consortium of 18 Dutch SMEs also feels that there is a need to organize collaboration with academia and its stakeholders. "The industry would be able to create together with academia long-term sustainable consortia to organize funding and develop new products and services," he says.

Prof. Michael Goodchild
Emeritus Professor of Geography, University of California

"The best ideas in the world often fail in the marketplace because it is so difficult for small entities to reach a sufficiently large set of potential adopters"

Prof. Shunji Murai
Founder, Asian Association of Remote Sensing

"Collaboration should be based on friendly manner with industry. Discussion should be based on equal partnership"

Venkatesh Raghavan, President, OSGeo Foundation pitches for the co-creation of knowledge by academia and industry -based on open source and open data. Some of the steps he recommends are: establishing research and teaching opportunities in 'Open Geospatial Science', building global open access teaching and research infrastructure, providing worldwide learning platforms and training opportunities and establishing collaborations between academia, government and industry around Open Geospatial Science and Education. "OSGeo has set up 114 laboratories worldwide and majority of the mentors are from industry. In terms of collaboration models, an academia-industry collaboration either can lead, depending on the budget commitment. Ways for industry to engage with academia can include idea or hackathons, publish, certification, summer-of-research for young professionals, more summer-of-code for students, etc." explains Raghavan.

An erudite stance

"Academia can be an excellent source of new ideas, when workshops or specialist meetings organized by academics bring together experts to discuss the state-of-the-art and potential research agendas, and such meetings are open to industry. Second, collaboration between academia and industry can ensure that training programs include curricula that meet the needs of industry. Finally, industry is often willing to sponsor academic research that is more 'blue skies' and futuristic than the kinds of in-house research that industry supports," says **Prof. Michael Goodchild, Emeritus Professor of Geography, University of California.** He also feels that such collaboration is best realized through interpersonal relationships between individuals.

On the other hand **Prof. Shunji Murai, Founder, Asian Association of Remote Sensing,** feels that "The leader should be a person who has ability of management experience and marketing sense with innovative motivation and positive thinking,

Han Wensink
Chairman, NEVASCO

"The industry would be able to create together with academia long-term sustainable consortia to organize funding and develop new products and services"

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"Ways for industry to engage with academia can include idea or hackathons, publish, certification, summer-of-research for young professionals"

Large corporations with extensive sales networks are often reluctant to pursue and promote new ideas. Instead, progress in the geospatial industry is often made by large corporations taking over small startups and absorbing their ideas. Unfortunately this process is often slower than one might like

which academic scientists sometimes have not enough. Industry should be the CEO while academia should be the CTO."

Financial matters can often become sticking points in any collaboration. On the question of, 'who pays', Goodchild thinks, "Student internships and short-term residence of industry representatives in universities could be a win-win situation for both parties as the costs are minimal compared to the benefits." Other than financial aspects, Murai stresses, "Industry should frankly and honestly talk with academia based on logical thinking and scientific background, which would be helpful to close engagement with academia."

Do academicians tend to be dismissive of commercialization of their research work? Goodchild feels this is an individual issue because "Many academics have little to no contact with the industry, and remain deeply suspicious of industry's motives and behaviors. Others create contacts through former students or through chance contacts with industry representatives. In this the academic activities like seminars and training can play a major role."

Murai is dismissive of academicians without financial or accounting understanding, "collaboration should be based on friendly manner with industry. Discussion should be based on equal partnership."

Surprisingly Goodchild has quite low expectations, though he value links with industry very highly. "True cooperation," he says, "in which both sides engage fully and equally, is very difficult, because academic and industrial behaviors and motives are so different." Murai has a word of caution, "Cooperative research should be basically result or achievement oriented with limited deadline. However, industry should provide very clear purpose and goal which is challenging but feasible."

On innovation transitioning from academia to industry, both Goodchild and Murai feel that industry is low on the growth curve but opportunities exist and resistance is being overcome slowly. Goodchild expresses caution for new innovators entering the marketplace, "the best ideas in the world often fail in the marketplace because it is so difficult for small entities to reach a sufficiently large set of potential adopters. Large corporations with extensive sales networks are often reluctant to pursue and promote new ideas. Instead, progress in the geospatial industry is often made by large corporations taking over small startups and absorbing their ideas. Unfortunately this process is often slower than one might like". He continues that innovations must be implemented and demonstrated successfully before it can be marketed.

Geospatial technology today has made its way across diverse industries. New demands for geospatial-enabled solutions are continuously emerging, creating business opportunities. With the right strategy, enterprises that orient their business towards scalable innovations will be able to prosper in this fast-transforming world of technology.

Prof. Arup Dasgupta
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SIGNS OF TRANSFORMATION

A collaboration and a printer are saving lives in a small South African province. **By Manoj Joshi**

"Remote.challenged.poor"

These are perhaps the three most common words one encounters when reading about African health systems. The health and well being of most of the Africans remain plagued by a relentless burden of infectious diseases, persisting social disparities and inadequate human resources to provide care for a growing population. Additionally, millions of people live in informal settlements without reliable address.

KwaNdengezi is one such province of South Africa. The province has a high incidence of health issues including HIV, AIDS, TB and childhood malnutrition. HIV infection amongst pregnant women is at 37%, which is 10% above the national average. It has a population of around 54,000 people and its 11,000 homes range from solid brick buildings to self-built shacks. KwaNdengezi has an extremely chaotic layout — finding a specific location, or telling someone where one lives, almost impossible. The majority of the criss-crossing networks of roads

The what3words address-printing machine

have no official names, and there are no signages. This inability to define a location of — homes, businesses and properties — means people are essentially invisible to the system. They struggle to access basic services, amenities and receive medical care.

However, an NGO — Gateway Health Institute — is committed to provide healthcare and community services in disadvantaged areas. Gateway Health runs programs to deliver medicine, supply emergency transport for women in labor, and identify hot spots for human rights abuses. But without proper addresses, many of these programs struggle. Not having a proper addressing system can be very challenging and can take almost a full day for an ambulances to reach a person in need. Having to navigate via word-of-mouth, without local landmarks or sign posts, medical experts are left with an almost impossible task of finding patients quickly. It is like finding a needle in a haystack.

Enter what3words

Three word addresses proved to be an ideal solution for KwaNdengezi. A location reference system based on a global grid of 57 trillion 3 x 3m squares, the what3words addressing system works on the system where each square has a pre-assigned, fixed and unique three word address.

"People make errors — lots of errors — and errors are easy to make and hard to spot when it comes to long alphanumeric codes. what3words is optimized to recognize and correct mistakes by both the sender and receiver," explains **Giles Rhys Jones, CMO, what3words.**

The addressing system is simple and easy to communicate than GPS, and more accurate than street addressing and much quicker to roll out than other geo-coding or addressing projects.

A local resident of KwaNdengezi with his three word address

Jones further adds, "We remove words that sound similar (e.g. sale and sail), and have shuffled similar sounding three word locations as far away from each other as possible, so it's obvious if you have made a mistake. The AutoSuggest system helps you identify any mistakes by suggesting the similar sounding location closer to you than the one that may be 400 miles away."

The three word addresses cover every part of the township, including homes, community centers and facilities like water pumps; and each square has a pre-assigned and fixed address. As each address is just three words, it is easy to remember, and simple to communicate. A problem that once seemed insurmountable can be solved using the three simple words address.

A community connected

Dr Coenie Louw, Director, Gateway Health and his team of 11 local field workers are helping the residents of KwaNdengezi to discover their addresses through the what3words mobile app, which can be used anywhere, without the need for a data connection. It is free to download, and the small file size means that it works even on the most basic smartphones. "In this work, a team of 11 local young people are working with us that are employed with Gateway Health. Our team has worked with Dr Louw to train these people to help residents discover and use their three-word addresses," explains Jones.

Furthermore, the team has taken a big leap by using a portable address-printing machine. "They are our advocates within the community as they intuitively understand how better addressing can help improve their quality of life. They help to explain the value and ease of use of three word addresses," says Jones. Built as a collaboration with what3words, the colorful cart prints three-word addresses onto eye-catching and durable signs that residents can display on the outside of their houses. Using a tablet to display an aerial map of the township, the resident identifies their house, and simply zooms in until they can see which square of the grid their front door sits in. A three-word address sign is then printed on the spot for the resident.

As each address is just three words, it is easy to remember, and simple to communicate. A problem that once seemed unsurmountable can be solved using the three simple words address

By means of these addresses residents are registered in a database, creating a medical and community record for the first time. Above all, this is not a temporary solution, or a gimmick, these addresses will never change. People in KwaNdengezi can now communicate their locations and get access to various government welfare schemes.

Thembinkosi Lesley Dladla, KZN EMRS Paramedic in KwaNdengezi says, "The system of what3words is going to make our lives so much easier. We will be able to get to our patients in time. It is good to know we are able to do the right thing."

The what3words system is gradually becoming more engrained in the KwaNdengezi community. Gateway Health is identifying the three-word addresses of critical community assets including local government centres, medical facilities and clean water pumps. These are also being given printed signs, and will be listed on a detailed community map, helping the community to locate essential services and improve the standard of living. "hope.change.enabled" is the new address for which KwaNdengezi has already sought for!

"We are pioneers — this township is where it's going to start and then spread all over the country. I am very proud to be a part of this new project," sums up **Vusani Mbanjwa, Ward Councillor**.

Manoj Joshi
Sub Editor
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PUTTING A SQUARE PEG INTO A ROUND HOLE

BY JOHN STENMARK

How geospatial solutions and virtual construction reduce risk and control costs

It's hard enough to build a complex 12-story industrial structure. Try putting one into a deep, concrete-lined hole. Twice.

That's the challenge facing Abe Torres and his colleagues at PC Construction. When the job is finished they will have helped solve a problem more than two hundred years old.

PC Construction is working on a project at the Washington, D.C. Water Authority (DC Water) Blue Plains Advanced Wastewater Treatment plant. The work is part of an effort to prevent release of untreated effluent that can result from heavy rain. Like many older cities in the U.S., Washington's sewer system collects sanitary sewage and storm water into common pipes that carry water to a treatment plant. When heavy rains occur, the runoff exceeds the system's treatment capacity. These events, called combined sewer overflows, result in the release of untreated effluent into area rivers.

DC Water is constructing a series of massive tunnels to collect and store sanitary sewage and storm runoff. The tunnels terminate at the Blue Plains Plant. There, the joint venture of PC Construction (PC) and CDM Smith has a design-build contract on the tunnel dewatering pump station (TDPS) and related facilities that will lift the water from the tunnels and deliver it to the treatment systems.

The tunnel that arrives at the Blue Plains plant is 23 feet (7 m) in diameter and roughly 170 feet (52 m)

>>> Installation of large components (the pipe is 13 feet in diameter) relied on precise measurements and accurate modeling. Scans of shaft walls captured beam pockets and keyways for future floors.

ADVERTORIAL

below the surface. It connects to a pair of vertical circular concrete shafts 132 feet (40 m) in diameter. Within these shafts, PC is constructing the massive piping, pumps and equipment that make up the tunnel dewatering pump station (TDPS).

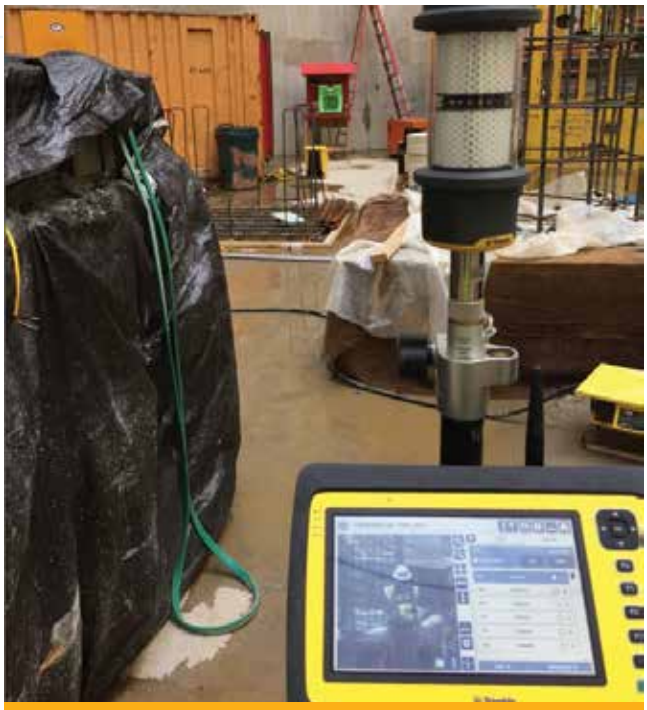
Torres describes the project as placing a 12-story industrial facility with seven levels of steel, mechanical and electrical components into a deep, round hole. The design and construction of such a large, complex facility is a prime opportunity to leverage building information modeling (BIM). By combining BIM with spatial technologies in the field, PC is achieving cutting-edge efficiency and significant cost savings.

3D Modeling Meets the Physical World

When Torres arrived on the project, another firm had already completed construction on the two shafts. The shafts' concrete liners included beam pockets and keyways to support the new structures. PC needed to verify the dimensions and locations of these and other elements and compare them to the 3D model of the concrete structure that they would build into the shaft. 3D scanning would be a fast, cost-effective approach.

Using a Trimble® TX5 scanner, PC crews scanned the first shaft and produced 16 individual datasets. Torres used Trimble RealWorks software to process the data and create a single point cloud. He could merge the scanning data with the 3D design model of the pump station. Next, engineers determined a best fit to place the structure in the shaft. "We had to turn it a little bit, not much, and it came together pretty good," Torres said. "With the exact dimensions in hand, we figured out that we could prefabricate our beams and steel. Crews can do much of the assembly outside and then slide it into the hole and put it in place."

»» Design and construction of such a large, complex facility is a prime opportunity to leverage BIM. By combining BIM with spatial technologies in the field, PC is achieving cutting-edge efficiency and significant cost savings



»» A PC surveyor is shown on the Yuma display. The surveyor is seen from the total station mounted on a bracket on the shaft wall (above the red ladder.)

The second shaft came with more challenges. Scanning revealed that the concrete liner was out of plumb in places and that the design would need some adjustments. "Our rebar was going to be too long and we needed to redesign it," Torres explained. "Had we ordered rebar according to the original design, there was no way it would fit. Doing the scan and checking it against the model saved us a bunch of money."

Checking the models and feeding up-to-date information to construction crews is a continuous process. Matt Harraka, a virtual design construction manager for CDM Smith, said that engineers and designers use a broad range of software tools to develop structural, architectural, MEP (mechanical, electrical and plumbing) and grading designs. Harraka brings the designs together in large model viewer systems such as Navisworks or Trimble Business Center software.

PC uses Trimble Connect to manage and share design and construction documents with field engineers and subcontractors. As design changes occur, Torres uses Tekla software to manage the model and check for fit or clashes before placing updated files onto the Trimble Connect server. Then the data goes to handheld field controllers for layout.

On the site, survey crews PC crews use Trimble Access™ software for all the surveying work and control. Engineers and tradesmen use Trimble Field Link software and total stations for layout inside the shaft. They all can use visual layout techniques, in which the robotic total station automatically places a laser dot at the precise location of a fixture or attachment point.

Keeping and using an accurate model is an essential part of project efficiency and quality control. Any design changes can be checked against existing conditions before going to the field or fabricator. The extensive checking helps to prevent errors and costly rework. Cloud-based file sharing ensures that everyone is using the same correct and up-to-date plans. Everything in the pump station—from concrete structures down to ductwork, conduits and individual anchor bolts—goes through the modeling and review processes. "If it's not in the model, then it's not going to be laid out in the field," Torres said.

»» Any design changes can be checked against existing conditions before going to the field or fabricator. The extensive checking helps to prevent errors and costly rework

MOVING FROM MODEL TO REALITY

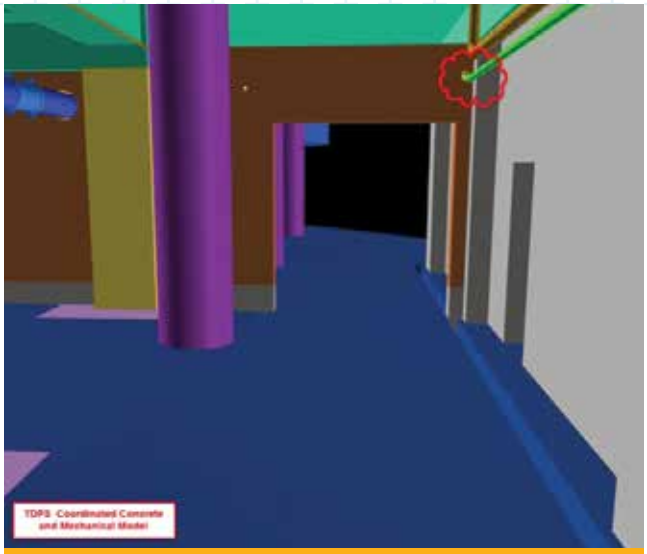
When Abe Torres joined PC Construction (PC) in 2008, he arrived with ideas and experience on ways to improve the company's performance. With contracts totaling roughly $500 million annually, PC's clients include water and wastewater treatment plants and large infrastructure, which are Torres's area of interest. Torres, who holds the intriguing job title of "Senior Virtual Construction Engineer," saw the potential to use a blend of spatial technologies in PC's design and construction processes.

"In the past it was common to see a lot of rework," Torres recalled. "A design that works on paper can produce some expensive surprises on the construction site. What we're trying to do is to use technology and leverage computerized design and BIM in wastewater treatment plants." The effort gave rise to a new department at PC focused on virtual construction, which blends 3D design and modeling with field measurement, layout and quality control. The ability of the model to adapt to reality has delivered some big benefits at Blue Plains.

While it's common for engineers to produce 3D models for their designs, the models aren't static, explains Matt Harraka, a virtual design construction manager for CDM Smith, PC's joint venture partner at the Blue Plains site. It's Harraka's job to carry the model from the design phase into construction. In the process, he juggles dozens of different file formats for structural components, MEP (mechanical, electrical and plumbing) designers, architects and civil engineers. Harraka needs to ensure that the model is kept up to date as construction progresses

"If you don't update the model past the design phase then there's no real use for it other than seeing what it was like at the end of design," Harraka said. "In order to use it during the construction phase, you need to keep the model current in relation to what's actually going to be installed. So that means that as shop drawings and fabrication notes come in, the model needs to reflect what will be installed. If not then you can't build accurately."

>>> The view from the prism pole during layout. The display guides the user to the correct location. Brackets on the shaft walls hold prisms for control points. The total station is visible above the workers to the left of the prism pole.



>>> A model detail reveals a clash between a pipe and opening in a wall. By detecting problems before installation, engineers can avoid most errors and rework.

>>> The lower levels of the pumping station model. The pipe opening on the lower level is 13 feet (4 m) in diameter.

Preventing Problems

The work at Blue Plains to date has gone well. "Using the model is one of the best things that could happen to us," Torres said. "We modeled all the concrete inside the structure, all the anchor bolts and steel pipe supports as well."

The ability to measure and plan in detail delivers big benefits. One example is the installation of a large header pipe that will deliver water from the tunnel to the pumping equipment. Fabricated in sections, the steel header is 13 feet (4 m) in diameter and runs the width of the shaft. PC needed to rent a special crane to handle the pipe. "We had just two days to put everything together," Torres said. "We needed to put the pipe on its supports at the correct elevation, so we had to shoot inverts on the pipe supports. We worked with zero tolerance. The pipe is so big and heavy that had we needed to move it then it would probably break all the anchor bolts, which would be a disastrous setback. Everything was thoroughly planned, checked and re-checked." The rigorous measurement and checking enabled installation to move smoothly and according to plan.

PC Construction Chief Engineer Ron Ellison said that's not an unusual result. "It makes it so much better to be able to see something in 3D in the office before it gets to the field. That's our biggest benefit, to catch and eliminate mistakes in the office before they get to the field."

PRIVATE SPACE INDUSTRY HAS THE TRUMP CARD

There is no doubt about thing, and Trump's statements are suggestive of things to come — that commercial space will enjoy a larger role with NASA in the future. Space after all remains one the last of the government-restricted sectors. **By Anusuya Datta**

The private industry is buoyed by President Trump's efforts to boost commercial space activities. The NASA Transition Act signed by President Trump on March 21, 2017 is an important piece of legislation that opens up huge opportunities for the private commercial space industry, feel some players.

"The Act provides robust support for public-private partnerships which will benefit NASA while bolstering private sector innovation and domestic job creation," spells out **Mike Gold, VP, Washington Operations, SSL**. Via the NASA Transition Act, the groundwork has been laid to leverage additional public-private partnerships to accomplish increasingly ambitious activities and missions, he adds.

"The pace of technology innovation and infrastructure development within the emerging commercial smallsat industry is tremendous. We support all efforts on the part of our government — and NASA in particular — to leverage this to meet their broader mission," says **Jason Andrews, Founder and CEO, Spaceflight Industries**.

The Act authorizes NASA's activities and sets general funding levels in categories that add up to a total of US $19.508 billion for fiscal 2017. In its budget estimates released the week before, the White House proposed NASA spending at US $19.1 billion in fiscal

2018. Now Congress will formulate a detailed spending plan, and the Act is expected to provide guidance for the agency's activities going forward.

Specific examples of the Act's support for public-private partnerships includes language directing NASA to leverage commercial satellite servicing capabilities, which have the potential to enhance satellite operations and value while lowering overall costs. The space agency's focus on human exploration of planets and establishing a human presence there will also offer much better opportunities for the aerospace industries in the US.

The Act also directs NASA to build future spacecraft in a manner that is compatible with servicing missions. For instance, as Gold points out, SSL is currently working with NASA on the Restore-L program which will demonstrate the ability of a robotic spacecraft to refuel a satellite in Low Earth Orbit (LEO). Restore-L is a critical mission to demonstrate satellite servicing capacity for use by NASA, the private sector, as well as the Department of Defense and the Intelligence Community.

Andrews, whose Spaceflight works with NASA through its launch services business, is hopeful that the agency will continue to fund small satellite innovations that leads to future launch services. He is also optimistic that the Act will encourage NASA to use streamlined contracting mechanisms such as the General Services Administration for these new services.

Courtesy: NASA/Bill Ingalls

The Act also supports the transition of LEO human spaceflight operations from the government to the private sector. Specifically, the Act asks NASA to explore the concept of adding a node to the International Space Station (ISS) that will allow multiple private sector companies to dock commercial habitats to the ISS.

"Man-rated rockets and space vehicles will be far more profitable than just rockets and satellites. SpaceX Dragon is to get man-rated. A manned mission to Mars will create huge opportunities for industry. During the Moon Race the US thought out of the box and came up with a two-vehicle system, the Capsule and the lander which itself was in two parts — the lander and the return capsule. Mars may result in some such out-of-the-box thinking and industry will love it," says a geospatial industry expert and former ISRO official on the condition of anonymity.

From the earth observation perspective, **Barbara Ryan, Secretariat Director of the intergovernmental Group on Earth Observations (GEO), Geneva**, feels this is a great opportunity that the private industry can most certainly take advantage of and opens up newer arenas for users too.

Mike Gold
VP, Washington Operations, SSL

"The Act provides robust support for public-private partnerships which will benefit NASA while bolstering private sector innovation and domestic job creation"

The Act directs NASA to build future spacecraft in a manner that is compatible with servicing missions. For instance, SSL is currently working with NASA on the Restore-L program which will demonstrate the ability of a robotic spacecraft to refuel a satellite in Low Earth Orbit (LEO)

The Restore-L satellite servicing mission in LEO.

Courtesy: SSL

For instance, the Societal Benefit Areas (SBAs) — Biodiversity and Ecosystem Sustainability, Disaster Resilience, Energy and Mineral Resources Management, Food Security and Sustainable Agriculture, Infrastructure and Transport Management, Public Health Surveillance, Sustainable Urban Development, and Water Resources Management — around which the Global Earth Observation System of Systems (GEOSS) project is exerting its efforts, are currently using both space-based and *in situ* observations. "One can see that many of these issues touch every person every day. From a GEO perspective, our primary interests are three-fold — to ensure that EO inform environmental and policy decisions; to ensure coordinated, comprehensive and sustained Earth observations; and to ensure that data collected with public money is broadly and openly available. While each of these conditions can certainly be met with private providers, many of the current business models preclude this from occurring," Ryan adds.

Interestingly, SpaceX Founder and CEO Elon Musk seemed anything but happy. In reply to Recode co-founder Kara Swisher tweet saying "Somewhere @elonmusk is smiling", Musk tweeted back saying: "I am not. This bill changes almost nothing about what NASA is doing. Existing programs stay in place and there is no added funding for Mars."

He continued, "Perhaps there will be some future bill that makes a difference for Mars, but this is not it."

Other space experts like **Scott Pace, Director - Space Policy Institute, Elliott School of International Affairs, George Washington University** tend to agree with this assessment. "I don't see the Act as making any major new commitments to commercial activities. It just continues on-going efforts," says Pace.

While Pace thinks it is too soon to tell which course the new administration may take, he points out that there are numerous companies that are already seeking to offer commercial cargo services to the Moon (e.g., Astrobotic, Moon Express) and on-orbit research platforms (e.g., Nanoracks, Bigelow Aerospace). Firms that can serve privately driven markets, as opposed to being dependent on government purchases, will tend to have cost and innovation advantages, he adds. There are larger forces driving commercial development, particularly in GPS, GIS, and small satellite constellations, while other emerging activities are still reliant on slower moving government acquisitions.

A large section of space experts thinks that NASA should focus on climbing up the value chain instead of having a finger in every pie. "This is nothing but moving forward with positive spirit to lead NASA into next generations. Let NASA use the money for building next-generation of R&D capabilities and possibilities and allow private sector to take care of commercialization," says an industry expert while requesting not to be named.

Agrees Andrews, "It is appropriate that, as commercial industries mature, NASA focuses

Jason Andrews
Founder and CEO Spaceflight Industries

"We are excited to see NASA's renewed commitment to purchasing commercial crew and cargo logistics services, and hope that they can expand new programs to procure earth science, earth observation and other LEO-based services"

their unique talents and resources on the final frontier of exploration and discovery."

What is the NASA Transition Act?

"It is the first NASA Authorization Act since the 2010 Act, which ran out in 2013, and thus represents a signal of stability and support by the Congress for NASA. President Trump's choice to have Oval Office signing ceremony with the Act's primary authors and supporters, from both parties, was also a welcome sign of support," says Pace.

The first such authorization passed by Congress in more than six years authorizes the development and execution of a long-range plan for deep space human exploration; invests in robust science, technology and aeronautics portfolios; and endorses the agency's successful efforts to nurture a new commercial market that will boost the US economy and create more jobs.

Interestingly, on papers the new Act keeps NASA mostly on the same course it has been on since the last authorization act in 2010, and could be seen as mainly a way of grounding NASA during the administration change following Trump's takeover.

However, what is to be noted is Trump's words after signing the Act into law. While placing a lot of emphasis on the commercial space industry, the President spelt out that the bill will allow NASA to continue working with the private sector. "This bill will make sure that NASA's most important and effective programs are sustained and orders NASA to continue… transitioning activities to the commercial sector where we have seen great progress… So the commercial and the private sector will get to use these facilities, and I hope they are going to be paying us a lot of money, because they're going to make great progress," he said.

Further, Trump highlighted NASA's Commercial Crew Program, the partnership with private industry to facilitate the development of a US commercial crew space transportation capability with the goal of achieving safe, reliable and cost-effective access to and from the ISS and LEO.

"We are excited to see NASA's renewed commitment to purchasing commercial crew and cargo logistics services, and hope that they can expand or initiate new programs to procure earth science, earth observation and other LEO-based services," says Andrews.

National Space Council

It seems likely that more details will emerge once the National Space Council (NSC) is resurrected and gets in place. The NSC was last active in 1989-1993, during the George H.W. Bush Presidency and was scrapped when Bill Clinton took over. Before that it had existed in some form or the other starting in 1958, when NASA was created. Now, under Vice President Mike Pence's leadership, the NSC, which is expected to be announced via an Executive Order soon, will provide guidance on NASA's future policies.

A large section of space experts thinks that NASA should focus on climbing up the value chain instead of having a finger in every pie

Scott Pace
Director - Space Policy Institute, Elliott School of International Affairs, George Washington University

"I don't see the Act as making any major new commitments to commercial activities. It just continues on-going efforts"

"The President will be taking action to relaunch the National Space Council, and he has asked me to chair that, as Vice Presidents have in the past," Pence said after signing of the Act. "We are going to be bringing together the best and the brightest from NASA and also in the private sector."

While the NSC was scrapped earlier because it was seen as being too much of top-down approach, it is now felt a central coordination agency is required given the rise of the commercial sector. In the recent years, NASA has been heavily partnering with the private sector — through companies like Boeing, Bigelow Aerospace, SpaceX, Orbital ATK, and many others — to hand off LEO operations so it can focus on deep space exploration. But commercialization of LEO can be possible only if the private sector is able to make a profit and the industry thinks the key to that is deregulation.

Even the National Oceanic and Atmospheric Administration (NOAA), and defense agencies like the Defense Advanced Research Projects Agency (DARPA) have keen on public-private partnerships. A centralized NSC could facilitate the process better by re-evaluating regulatory framework in a way that bolsters

the private sector, in addition to aiding in international collaborations.

Giving up on Earth Sciences?

This is the tricky part. From the NASA Transition Act and the proposed budget of the space agency, it looks like NASA is moving away from studying Earth while focusing on deep space explorations. NASA's budget for Earth Sciences in 2017 is about $2 billion out of the $19 billion total and proposes a $100-million cut for its Earth Science division, or 5% of the program's annual budget.

While Trump detractors believe this is just reflecting the President's much publicized scepticism about Climate Change, Pace sees the proposed budget as rebalancing science spending to prioritize deep space exploration and the decadal science recommendations of the National Academies of Science.

Barbara Ryan
Secretariat Director
Group on Earth Observations (GEO)

> "Space is still an expensive venture, and no one country or organization has the requisite resources to deliver space-based observations across all spectrums that are required to address the range of issues for which these observations can contribute. The role of space agencies both private and public is essential, and will continue to be so"

Courtesy: Jim Watson/AFP/Getty Images

Vice President Mike Pence will head the National Space Council.

In the face of NASA ceding the LEO space to private players, questions also arise if it is also leaving the Earth Sciences space to focus on other areas. While NASA remains the only agency capable of studying the entire planet and its changing patterns, the revolution in the EO satellite industry, particularly in the face of proliferating small satellite business, has seen interesting developments in recent times.

As Andrews says, the EO industry is undergoing a commercial revolution. In the very near future all organizations — government or commercial — will be able to acquire commercial data in every spectrum to observe the planet. "We hope that the government regulatory agencies that oversee this domain continue to streamline their processes to support this revolution."

Disagrees Pace, who feels Earth Science missions are government driven. While commercial partnerships can create opportunities for more innovative contracting to government, true commercialization requires finding sources of private demand. "Many areas of space activity are already open to commercial development, but being open to development does not mean that all activities will be economically viable or sustainable."

The former ISRO official sees opportunities for other national space agencies in this. "NASA operates many satellites for Earth Sciences which are not within the operating parameters of industry, for example, geodetic satellites. I do not see industry taking on these kinds of studies where there is little scope of profit. If NASA withdraws I see a major opportunity for ISRO to enter this space."

More than ISRO, however, many experts see this opening up great opportunities for ESA, particularly once its ambitious Copernicus mission in fully place.

However, Ryan, whose GEO has always relied on a suite of governments and organizations delivering Earth observations, explains: "Space is still an expensive venture, and no one country or organization has the requisite resources to deliver space-based observations across the spatial, temporal and spectral resolutions that are required to address the range of issues for which these observations can contribute. The role of space agencies — both private and public — is essential, and will continue to be so."

There is, however, no doubt on one thing, and Trump's statements are suggestive of things to come — that commercial space will enjoy a larger role with NASA in the future. Space after all remains one the last of the government-restricted sectors.

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THE CHALLENGE

Upgrading legacy mapping service to support mobile devices and improve performance

BCC offers customers access to an online mapping service, eBIMAP (Brisbane's Integrated Map of Assets and Property). Feedback on the original system suggested improvements were needed in availability, performance and device-independent access, which management saw as an opportunity to take advantage of the Cloud. BCC realised it needed to:

- Use Web-based mapping technology to provide up-to-date geospatial data
- Create a fully responsive online service that can be accessed from any device
- Increase customer confidence that the service is easily accessible and maintains integrity
- Provide a user-friendly platform with enhanced functionality including analysis and reporting

THE SOLUTION

Cloud-hosted mapping technology

AAM designed, developed and deployed the Web application, eBIMAP2, on GEOCIRRUS, AAM's geospatial Cloud platform. BCC customers can access asset and property information on any device — desktops, tablets and smartphones — using the eBIMAP2 Web viewer, that:

- Is compatible with all recognised Web browsers
- Provides search criteria including address, lot and plan number, and postcode
- Includes base maps and aerial imagery from 1946 and current-day
- Offers analysis tools such as spatial buffering, report generation and attribute queries
- Allows high-quality printing from A4 to A0 formats
- Gives greater control over mapping layers and layer transparency
- Provides coordinate readouts in various formats

THE RESULTS

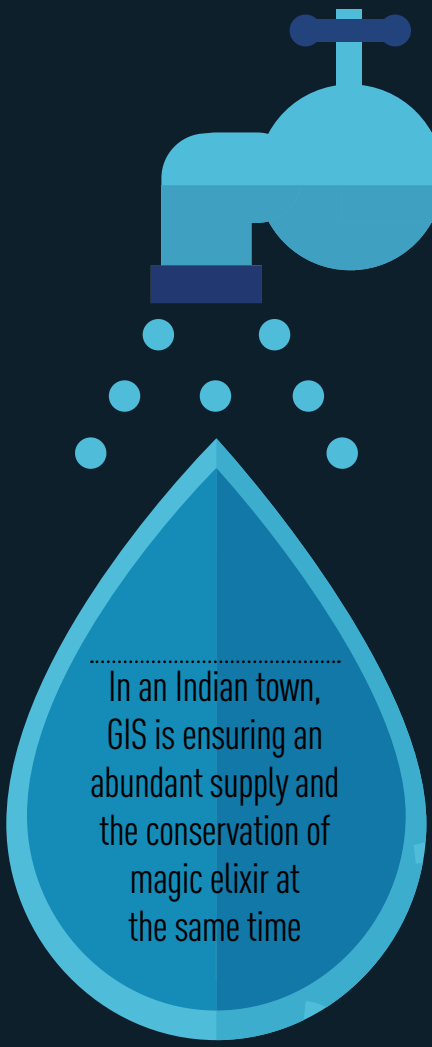
Improved user satisfaction and increased accessibility

Under AAM's management, eBIMAP2 is regularly updated to ensure currency and veracity. The new Cloud-based mapping service has experienced increased uptake as it:

- Improves customer satisfaction through confidence in the information provided
- Provides a comprehensive and easy-to-use online mapping service with high availability
- Increases user accessibility through Cloud-based infrastructure and device independence, accessible anywhere, anytime and on most devices

Using eBIMAP2, customers can easily access accurate and up-to-date asset and property information

TAPPING THE FLOW OF WATER



In an Indian town, GIS is ensuring an abundant supply and the conservation of magic elixir at the same time

Providing sufficient water of appropriate quantity has been one of the most pressing issues in the Indian sub-continent. Poor water supply is normally a surrogate for huge volumes of water being lost through leaks, not being invoiced to customers and irregular water supply. It also seriously affects the financial viability of water utilities through lost revenues and increased operational costs. Bhadravati town of Chandrapur district in Maharashtra is no different from other Indian cities, where lack and loss of water is mundane.

Under the given situations, Bhadravati Municipal Council took the challenge to ensure water supply system inaccuracies are overcome. Bhadravati Municipal Council drove the mission under the Maharashtra Sujal Nirmal Abhiyan Program. The tender for Water Supply Reforms was bagged by the GIS and engineering solutions provider — ADCC Infocad Ltd.

What was required

The mandate was to establish a proper water distribution network and a system for measuring non-revenue water (NRW). Educating the people about surveys, billing systems, and water meters was crucial as it also aimed to identify non-registered connections (NRC) and installing authorized metering system. ADCC intended at obtaining valid, reliable and credible data of water supply as a whole and in further course, the apt measures to ensure smooth water supply.

Modus operandi

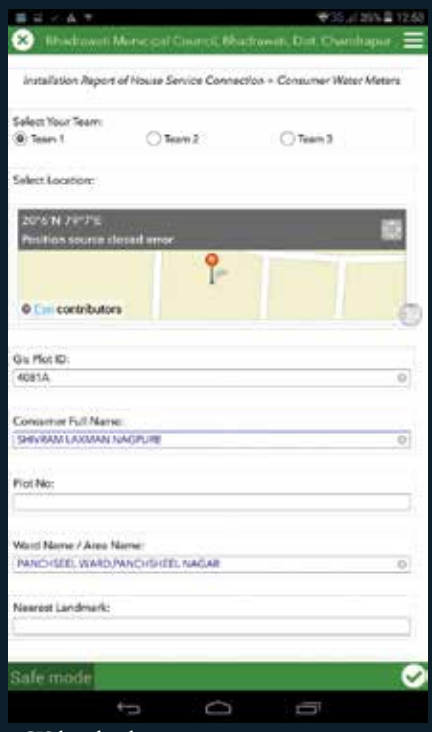
ADCC strategically carried out the project in three phases — the first phase covered the survey analysis. Population survey, bifurcation of institutional data, details of water resources, consumption of water by different beneficiaries, and identifying non-registered connections was done right from the scratch. The mapping activity took place in AutoCAD map software to create attribute tables, similarly data integration in ESRI ArcGIS software to produce thematic maps for decision making.

To understand how infrastructure would behave as a system, react to operational strategies, and how it should grow as population and demands increase, hydraulic modelling was done and GIS-based Bentley's WaterGEMS was deployed for the purpose. By means of

> "When something new is introduced people don't accept it; they are rigid and reluctant. We need to make them understand the advantages of accepting change, accepting new technology and how the acceptance will improve their living."

VINOD JADHAV | Chief Officer, Bhadravati Municipal Council

Thematic map of Bhadravati



GIS-based real-time monitoring

Advantage ADCC

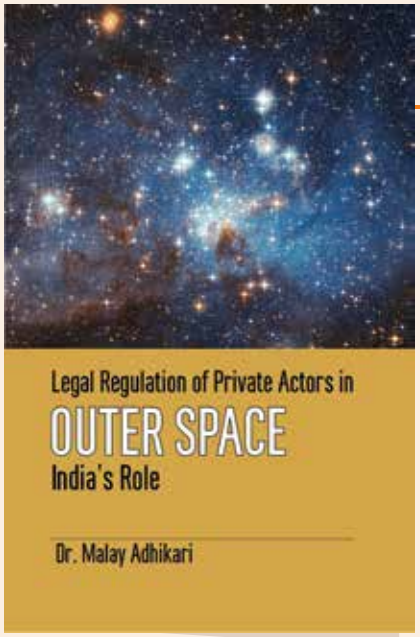
- → The entire GIS database related to water supply is in one place and can be updated at any point of time. All the consumers are now uniquely numbered and same reference can be used for further monitoring work
- → Thematic maps and GIS data prepared with this project can help to take necessary decisions at higher authority-levels and for other schemes like sewerage, railways, land authority, etc.
- → A sustainable and a centralized water supply network has been designed for next 30 years
- → Increase in demand for water meters, which in return has increased the revenue
- → Control over leakages and water wastage

hydraulic modelling, ADCC could recognize the optimization of existing infrastructure (storages, transmission and distribution network) in the areas where there was no water supply to cater the demand of future population, demarcation and modelling of proposed pipeline networks. This also led to minimization of operation and maintenance cost.

Creating a water supply scheme augmentation, involving meter and service connection, and NRW reduction was the second phase. Consumers were provided temper-proof water meters; the charge is in proportion for the actual amount of water used. Every consumer has been given a unique GIS ID, which carries all the details of the consumer. This GIS-based customized real-time monitoring tool, encouraged the conversion of NRC into authorized ones. House service connection was provided to each house as it ensured 100% leak -proof capacity saving enormous quantity of water; thus, decreasing the NRW.

Taking the water supply system to the next level ADCC is planning for phase three, which comprises of smart water network management, smart water billing system, SCADA, and 24x7 water supply operations. ADCC has also proposed an app, which will help in maintaining transparency. It includes all the consumer details and materials used for metering system and photo of the place where the meters were installed.

> "ADCC was successful in initiating the complete project and while doing so, it also made sure that it created highest awareness and trained people in learning the GIS-based processes and applications. ADCC ensured Education, Information & Communication to be passed to the councils and locals of Bhadravati."
>
> **ANIL DHANORKAR** | President, Bhadravati Municipal Council



Legal Regulation of Private Actors in Outer Space — India's Role

Book Review By

Prof. Arup Dasgupta

Author

Dr Malay Adhikari

Legal Regulation of Private Actors in Outer Space, India's Role by **Dr Malay Adhikari** is an interesting piece of work on an emerging topic. Outer Space activities in India have been so far restricted to a few organizations wholly in the government sector or in academia. Private entrepreneurs are emerging in this virgin field. Most people have heard or read about Team Indus, which has been selected among other international contestants by Google to create a Moon Rover. There are many others who may not have grabbed such headlines but form the vanguard of a small band of space enthusiasts, who are seeking to make a mark in Space supported by Angel financiers. In fact, these are India's budding Elon Musks.

One of the key problems faced by this group is the lack of policies and regulations. Our bureaucrats and politicians have not anticipated a scenario where Indian entrepreneurs dream of space as an achievable frontier. In this context, Dr Adhikari's book is a must read. The book examines the adequacy of existing space treaties and principles for the regulation of activities of the private sector in outer space and the extent to which such actors will be allowed to perform under these principles and treaties. The possibility of an international voluntary code of conduct among private actors is also explored. The impact of national space policies and in particular the regulations with India rounds off the treatise.

Beginning with an analysis of the history of space regulations that incidentally includes a recounting of the Indian Astronomical studies starting from Ancient India, the first chapter covers these efforts in other countries as well and the situation in the pre and post UNCOPUOS periods as well as developments outside the UN framework. Chapter 2 introduces the private actors in outer space, their role and relationship with their respective governments. The chapter ends with an introduction to the Indian private operators. Chapter 3 deals with the legal issues relating to sovereignty, national security, IPR, liabilities, arbitration, safety, environmental protection, ethics, CSR and financing. The regulatory issues are covered in chapters 4 and 5. While chapter 4 addresses the rest of the world, chapter 5 is devoted to the Indian situation. Chapter 6 sums up the situation and makes some recommendations. These recommendations cover issues that are bothering the nascent Indian space industry, like a roadmap encouraging private investment, a policy on space launchers and launchings and a firm navigation policy. The chapter also suggests that the Indian policy could well be the seed to create similar policies in its immediate neighborhood and that India could consider leading the evolution of an International Code of Conduct for Commercial Space Activities.

The book is a valuable reference as it brings within its covers a comprehensive coverage of international and national laws, policies and regulations. The only drawback is that the New Delhi-based K W Publishers has been very lax in the editing of the text resulting in many spelling and grammatical errors.

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