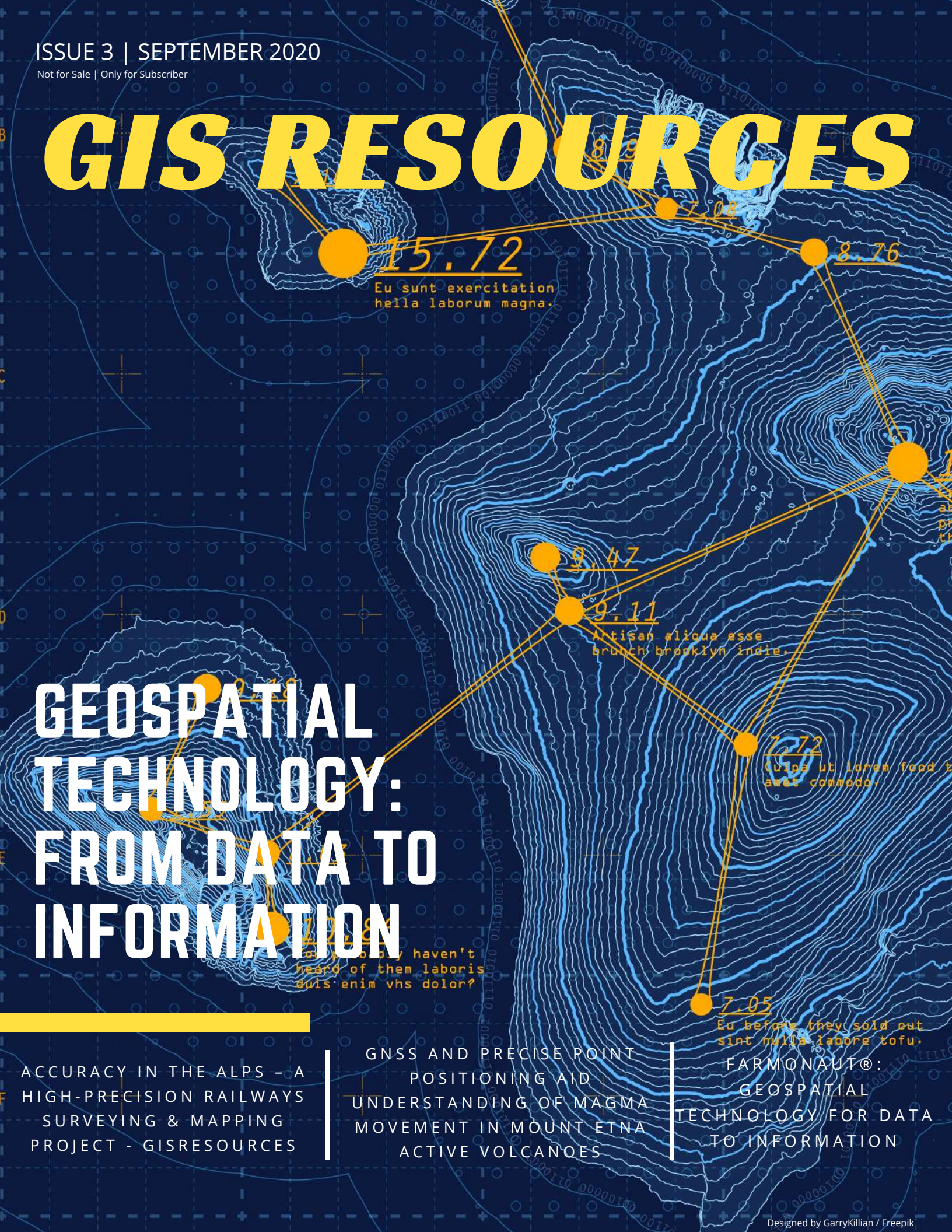
ISSUE 3 | SEPTEMBER 2020
Not for Sale | Only for Subscriber

GIS RESOURCES



GEOSPATIAL TECHNOLOGY: FROM DATA TO INFORMATION

ACCURACY IN THE ALPS – A HIGH-PRECISION RAILWAYS SURVEYING & MAPPING PROJECT - GISRESOURCES

GNSS AND PRECISE POINT POSITIONING AID UNDERSTANDING OF MAGMA MOVEMENT IN MOUNT ETNA ACTIVE VOLCANOES

FARM@NAUT®: GEOSPATIAL TECHNOLOGY FOR DATA TO INFORMATION

Designed by GarryKillian / Freepik

RIEGL AIRBORNE LASER SCANNERS & SYSTEMS

RIEGL WAVEFORM LIDAR TECHNOLOGY for TOPOGRAPHY

CHOOSE THE SCANNER EXACTLY RIGHT FOR YOUR SPECIFIC SURVEYING MISSION!

We are there!
INTERGEO DIGITAL 2020 OCTOBER 13–15

75° FOV
1.5 MHz eff. pulse rate
for UAVs and small aircraft

VUX-240

75° FOV
1.25 MHz eff. pulse rate
for small planes or helicopters

VQ-480 II

75° FOV
1.25 MHz eff. pulse rate
especially for snowy and icy terrain

VQ-580 II

60° FOV
1.33 MHz eff. pulse rate
for customized system configurations

VQ-780 II

58° FOV
forward/backward and nadir look
2.66 MHz eff. pulse rate
dual channel turnkey system for high altitude, large scale mapping

VQ-1560 II

for surveying at low flight altitudes
e.g. powerline, rail track and pipeline inspection

for surveying at mid flight altitudes
e.g. corridor mapping, city modeling, and forestry

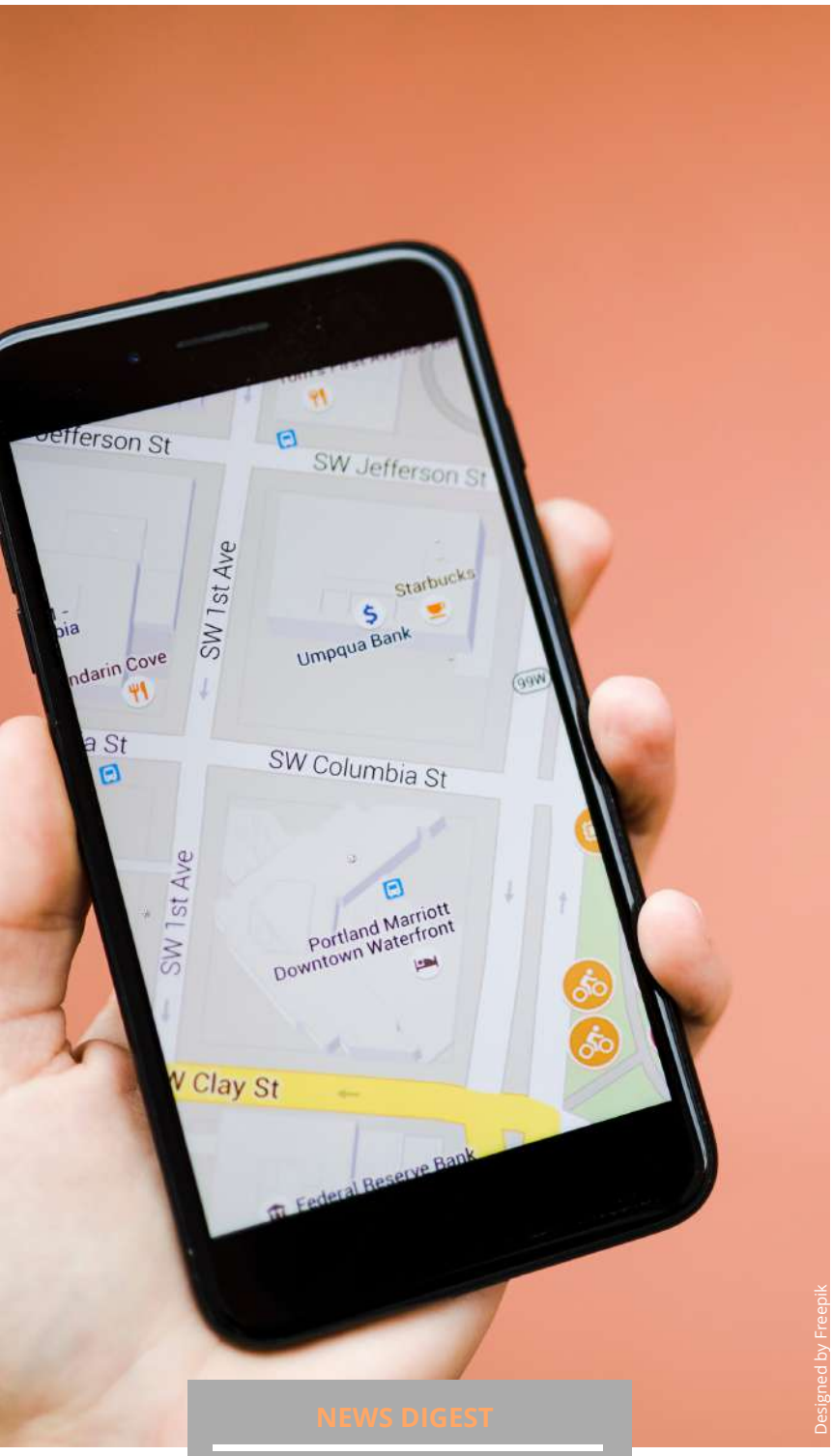
for surveying at high flight altitudes
e.g. ultra-wide area mapping of complex environments

Also explore RIEGL's proven LIDAR sensors for UAVs and for BATHYMETRY www.riegl.com

RIEGL®

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

CONTENTS



Designed by Freepik

executives

Regd. Office
GIS Resources
B-24, Jawahar Vihar, Malik Mau Aima,
Rae Bareli, Uttar Pradesh, India - 229010
Phone: +91 790 010 6154, 911 981 1729
Email: support@gisresources.com
Website: www.gisresources.com

Advertising and Marketing Queries
Email: support@gisresources.com

Designed by natanaelginting / Freepik

editor's note

Anyone who is reading this technical journal would be aware of the terms 'data', 'geospatial data', 'information' and 'geospatial information' and the context in which the terms are being used. In an earlier issue of this technical journal where the need and use of Geospatial Technologies for the planning of a smart city were discussed, it can be easily appreciated that a smart city constantly generates a lot of data like built up area, roads, population, socio-economic indicators, weather, pollution, green cover etc. Left to themselves, the data give vital inputs to the planner who incorporates them in the planning of a smart city. However, when the data is taken together, combined and processed, we arrive at Geospatial information that gives a whole new perspective to the planner or decision maker.

The COVID-19 pandemic is generating huge amounts of Geospatial data. This data is being processed in near real time and on a daily basis to generate Geospatial information that enables planners and decision makers to arrive at best practices to control the spread of the pandemic and to provide succour to the sick.

The above are just a few examples where Geospatial data has generated Geospatial information that has been put to use for planning. Geospatial data spans across many domains, disciplines and times. Geospatial technologies have evolved to a stage where it is just not about data but about getting to understand this data to arrive at information that is vital for planning and sustainable development. The latest Geospatial Technologies include data generation technologies which seamlessly dovetail into powerful hardware and software that is entirely devoted to processing the Geospatial data in order to arrive at vital, critical and timely Geospatial information.

Visualisation techniques have added another dimension to Geospatial Technologies that aid the planner or decision maker in understanding the Geospatial information by visualising the impact of different parameters and time on the Geospatial information. This aids the planner or the decision maker to get a wholistic view and make better sense of the information in order to arrive at the best possible scenarios that will impact human well being and progress.

Every day huge amounts of Geospatial data is being generated. Geospatial technologies and visualisation techniques now harness this data effectively, efficiently and in a timely manner to extract actionable information for a better planning process.

Ashok Prim
Editor

THE PAST IS HERE

Zaragoza Histórica: Historical Cartography on the Web. A Light, Interactive Web Viewer of Historical Maps.

by Miguel Ángel Latre, Francisco J. Lopez-Pellicer, J. Nogueras-Iso and, F. Javier Zarazaga-Soria

Historical photographs can be displayed over the 360-degree view provided by Google Street View in the Zaragoza Histórica web appliation.

Digital publication of historical maps on web application "Zaragoza Histórica".

Introduction

We are result of our own history, and this can be clearly seen in the way human settlements in general (and cities in particular) evolve over time. The historical archives of different public administrations have the originals of the shape and perceived visions of our cities across time, represented in maps of great historic and artistic value.

In some cases, these material resources have been preserved and safeguarded for many years and have served as a basis for very different, interesting and needed research works. It is not until a few years ago when the interest of its use and dissemination to the general citizens has been generated.

About Author

Miguel Latre
Tenured Assistant Professor
Universidad de Zaragoza

Javier Nogueras-Iso
Assistant Professor
Universidad de Zaragoza

Francisco J. Lopez-Pellicer
Tenured Assistant Professor
Universidad de Zaragoza

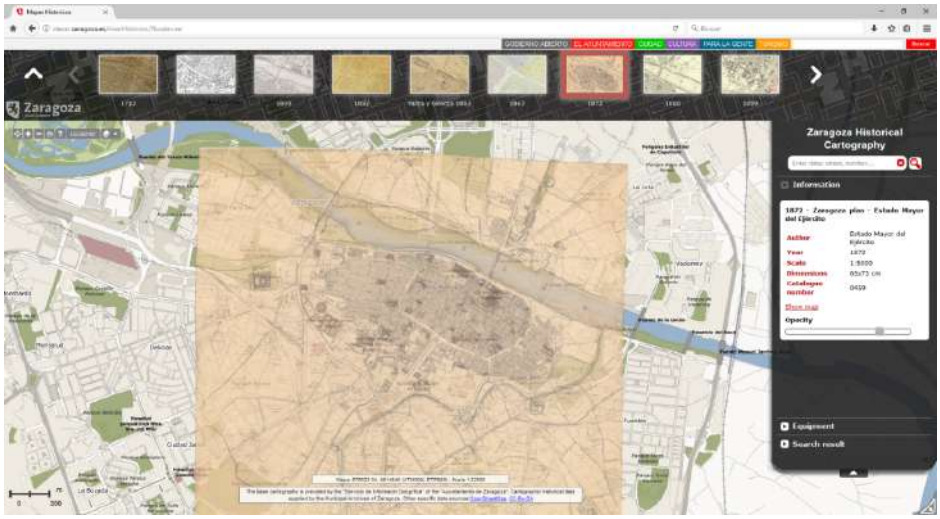
F. Javier Zarazaga-Soria
Assistant Professor
Universidad de Zaragoza

A Web Viewer for Historical Maps

The Advanced Information Systems Lab, in collaboration with GeoSLab, the Office of Participation, Transparency and Open Government of the City Council of Zaragoza and the Municipal Archive, and within the European project ENERGIC OD, has worked in the line of digitally publishing historical plans based on Spatial Data Infrastructures. The result is reflected in a new web application, "Zaragoza Histórica", integrated the portal of the Spatial Data Infrastructure of the City of Zaragoza.

Zaragoza Histórica provides Zaragoza citizens and tourists with a web visualisation tool that combines current cartography with a selection of historical maps from Municipal Archive of Zaragoza.

So far, a collection composed by 19 maps of XVIII, XIX, XX and XXI centuries has been published. Users can select any of the maps and browse them individually by performing the usual actions of zooming in and out, panning, etc. Users are also able to compare any of them with the current cartography by overlapping the maps and setting a transparency level. Each of these maps is provided with detailed information about them (year, author, dimensions, etc.) and a link to the full metadata record in the Municipal Archive.



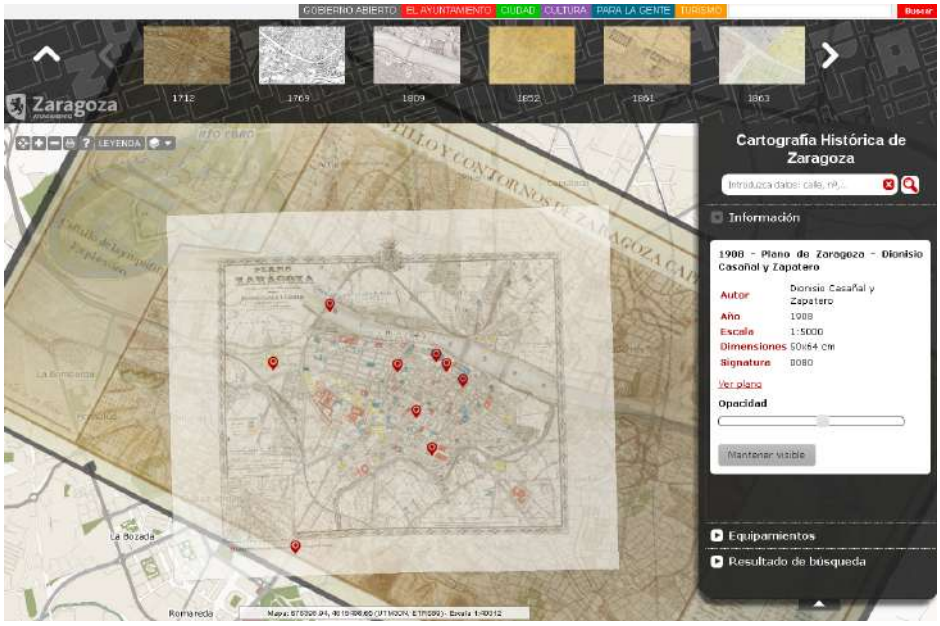


Figure 1 (top) and Figure 2 (bottom): Digital publication of historical maps on web application "Zaragoza Histórica".

Data Processing

Digitisation

The state of historical cartography in its original media (paper), like in the case of any other type of physical document, degrades over time, even with optimal storage and handling conditions when used. A solution to contribute to its preservation is the digitization of this material. This way, besides the original document (of course still to be preserved), there are digital copies that can be consulted without any type of restrictions caused by the need of preservation of the original. These copies must be carefully done, with much respect to

Figure 3: 1 of the 19 Maps of XVIII, XIX, XX and XXI centuries.

the original media. In many cases, specific infrastructures are needed (like large tables, high resolution cameras, tripods, illumination sets, etc.) and high resolution and detail is required so that the digital copy can replace the original document for as many queries as possible.

The Zaragoza Council was already offering many digitised historical documents as open data, with several historical maps among them. The format in which these maps were initially offered (raster files in DjVu format) limited their reuse and exploitation. DjVu is an open file format designed primarily to store scanned documents, very suitable for archiving and long term preservation of digitalised documents but it is not widespread and it does not allow for its contents (maps in our case), to be georeferenced.

In order to be used in the Zaragoza Histórica application, the Council made a selection of 19 of these maps, ranging from 1712 to 2004, which were digitised by the Archive in a more common format (GeoTIFF) and with a higher resolution, needed for allowing zooming in the maps. Due to this the size of each map is much bigger than it was initially expected.

Georeferencing

These digital maps cannot be used directly in any GIS application, as they must be georeferenced first. Transformation to a target coordinate system is the main goal of georeferencing the historical maps. In many cases, map projection, central meridian, scale distortion, survey technique used for the realization of the original historical map are unknown or uncertain, so its georeferencing is usually performed by finding identical points both in the historical map and in reference data sets, and applying an appropriate transformation method to the historical map. Additionally, the portrait and orientation presented in historical maps is sometimes strange to us because it is outside the patterns we are used to: The North upside, the South downwards and the origin of coordinates in the Equator and the Greenwich meridian. As an example, even nowadays, many maps of Seville have the North pointing to the left and maps of Barcelona usually are slightly rotated to accommodate the perfectly orthogonal streets of the Eximple with the vertical and horizontal axis of the map.

So, the assignment of current coordinates to singular points of historical maps leads in many cases to rotations and distortions in the map that must be treated with great care by the software helping in these operations.

In the Zaragoza case, 21 singular points were selected as fixed ground control points (GCPs) and were used in all the maps in the collection. The selected points are current points of interest (POIs) in the city that have not changed throughout the years, as uniformly distributed on the map as possible, like, for instance, the corners of the cathedral or the ancient Muslim palace.

The digitised maps were georeferenced with open-source software (QGIS with the 'Georeferencer GDAL' plugin) using the thin plate spline (TPS) algorithm. This algorithm is appropriate when the maps to be georeferenced present large deformations with respect to the current cartography, as it was the case with the historical maps. It introduces local deformations in the data, but the relative positions of GCPs remain unchanged. As the selected GCPs correspond to current POIs, this will allow to exploit these POIs future developments of the application.

Information on the transformation accuracy of the georeferenced maps was recorded. In particular, averaged error (AE) was calculated for a subset of the collection as the differences between a new set of manually selected control points on georeferenced maps in comparison with reference data sets. Maps belonging to the XVII and early XIX century presented an average error significantly larger (between 15.4 and 31.3 m) with respect to the average of the XX and XXI centuries (around 8 m).

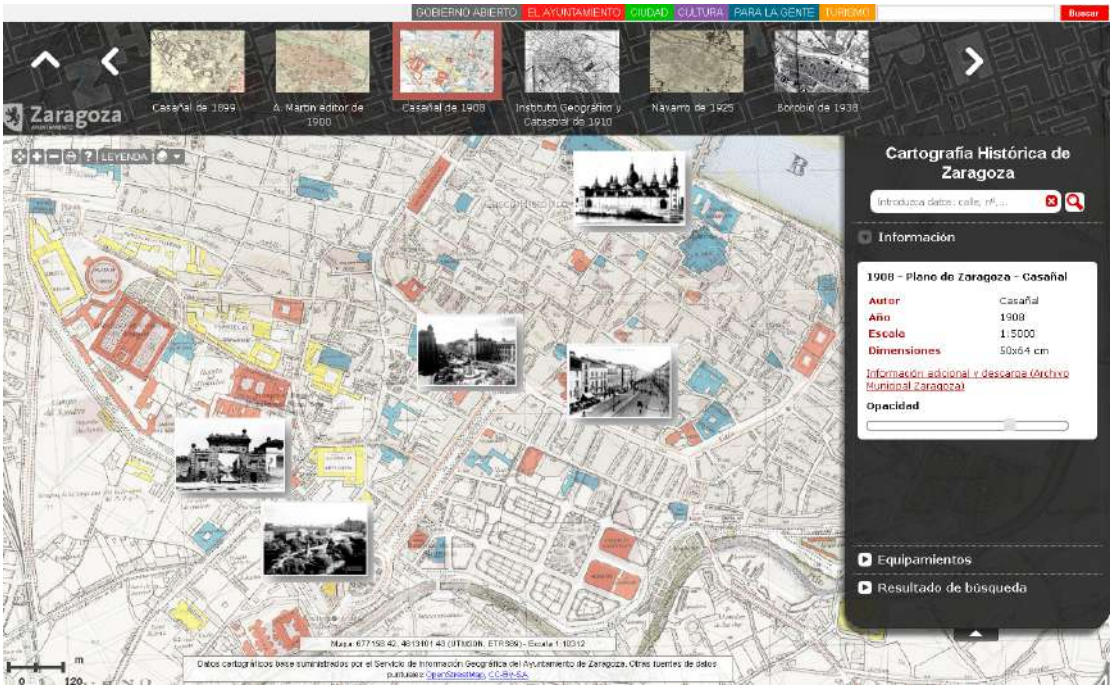


Figure 4: 21 points were selected as fixed GCPs. As the selected GCPs correspond to current POIs, this will allow to exploit these POIs future developments of the application.

Publication

The georeferenced maps were finally published as Open Data through an OGC service offered by the ENERGIC OD's Virtual Hub: the VH provides a Web Map Service interface while internally performs the access to the original data (the historical maps GeoTIFF files) and manages all the cache operations. The WMS allowed, on the one hand, to reduce the development effort of the web front-end of Zaragoza Histórica while, on the other, facilitates the reusability of these data by third parties in the potential development of other applications. Initially, the Web Map Tile Service (WMTS) was the selected interface, due to the fact that reduces bandwidth use and load times.

However, after conducting performance tests with a WMS interface, we concluded that the response times were appropriate enough for an interactive application, so it was finally chosen as the access interface.

The Zaragoza Histórica web application is actually composed of two different elements: the map viewer container and the viewer itself. The container, based in jQuery technology (jQuery 1.8+jQueryUI10), interacts with the map viewer using the façade pattern and implements most of the interface offered to the user, including all the ways to select the data to visualize over the map and advanced functionality such as toponym search.

The map viewer is implemented with a proprietary library developed by Universidad de Zaragoza and based in the Open Source framework OpenLayers 2.12. It provides access to the base cartography and gives all the tools to navigate through the map. By default, it only offers a plain map and the functionality to draw different kinds of data over it in a dynamic way. This feature is used by the container to request and display all the special geographic data made available to the end user.

Future

Several options are considered in order to enrich the application in the future. One of them would be the functionality to portray simultaneously two different historical maps side by side for easily comparing them. Both panels could be synchronized, reacting in the same way to zooming or panning actions from the user. However, the most interesting options to enhance the application involve working with historical photographs of the Municipal Archive or other historical photographs volunteered by the citizens. After being dated and georeferenced, the photographs close in time to a particular historical map could be displayed on top of it. Similarly, these historical photographs could be displayed over the 360-degree view provided by Google Street View.

Additionally, the concept of Zaragoza Histórica application can be easily replicated in other areas, provided the availability of several large-scale historical maps and customised to the corporate image of the archive providing the maps or organisation managing the application.

Further Reading

Mazzetti P, Latre MÁ, Bauer M, Brumana R, Brauman S, Nativi S (2015) "ENERGIC-OD Virtual Hubs: a brokered architecture for facilitating Open Data sharingand use". *eChallengese-2015 Conference*, Vilnius (Lithuania), 25-26 November 2015

Previtali, M., Latre MÁ (2018) "A brokered Virtual Hub approach for the generation of web applications based on historical maps". *Applied Geomatics*, p. 1-20, 2018.

Acknowledgements

The Office of Participation, Transparency and Open Government of the City Council of Zaragoza and the Municipal Archive, POLIMI.

The research leading to the results of this paper is partially funded under the ICT Policy Support Programme (ICT PSP) as part of the Competitiveness and Innovation Framework Programme by the European Community (CIP) GA no. 620400.

Author Correspondence

Authors belong to the Advanced Information Systems Lab at Universidad de Zaragoza and share research interests in the fields of Computer Science linked to Geographic Information Infrastructures. email: *iaaa@unizar.es*

Figure 5: Historical photographs displayed over the 360-degree view provided by Google Street View in web application.

BIRD WATCHING – PRECISE GNSS POSITIONING TO MITIGATE SERIOUS THREAT TO THE ISLAND'S AVIAN POPULATION

A new approach to precise positioning helps solve a century-old problem on an isolated island.

by John Stenmark

Trimble CenterPoint RTX provides precise GNSS positioning to aid in preserving endangered birds on a remote island.

John Houston is not a surveyor. He'd be the first to tell you that. He's not a heavy traveler, either.
So what was he doing on a speck of an island in the South Atlantic Ocean, knee deep in brush and muck while operating a high-accuracy GNSS receiver?

It's all about the birds.

Houston was at work on Gough Island, a British territory roughly 2,700 km (1,700 miles) west of Cape Town, South Africa. First visited by Portuguese explorers early in the 16th century, the tiny landmass covers just 91 sq km (35 sq mi). Due to its lonely location and undisturbed nature, Gough is regarded as one of Earth's least disrupted ecosystems. In 1995, the island was designated as a World Heritage Site by UNESCO (United Nations Scientific, Educational and Cultural Organization).

A prime nesting ground for Atlantic seabirds, Gough Island is home to indigenous birds and invertebrates as well as visiting seals and penguins. Unfortunately, the birds are in trouble. Houston was there to help.

A qualified Structural Engineer, Houston had travelled to Gough from Derry, Northern Ireland. His employer,

About Author

John Stenmark

Writer and Consultant
Email - john@stenmark.us

Taylor & Boyd Consulting Structural and Civil Engineers, was working on a project for the Royal Society for the Protection of Birds (RSPB) to mitigate a serious threat to the island's avian population.

Houston would support the RSPB efforts by gathering topographic and geotechnical information, including mapping with GNSS. But even advanced GNSS has limitations, especially in such a remote location. Faced with a demanding schedule and tight requirements for accuracy, Houston turned to the Trimble CenterPoint RTX positioning service, which enabled him to conduct high-precision real-time GNSS measurements in a challenging and remote environment.

Small Animals, Big Problems

Aside from brief visits by sealing and whaling vessels in the early 19th century, Gough Island has never had notable human habitation. A handful of scientific surveys, including a 1922 visit by famed Antarctic pioneer Ernest Shackelton, established the island as a valuable site for geological biological and ornithological research. Not until the 1950s, when South Africa established a meteorological station, did Gough Island gain a full time—albeit very small - human population. When Houston and a dozen researchers landed in September 2018, the population of Gough Island more than doubled.

While Gough Island has no native mammals, it has plenty of mice, unintentionally carried to the island by the 19th-century ships. The invading mice soon learned to feed on the eggs and chicks of ground-nesting birds, including Tristan albatross, Atlantic petrel, Gough bunting and Gough moorhen. In roughly 150 years on the island, the mice evolved to become 50 percent larger than their forebears. Today they are wreaking havoc on the bird population. Surveys by the RSPB estimate that mice consume roughly two million defenseless eggs and chicks each year. "Albatross lay only one egg each year," Houston said. "If it is lost then they must wait another year for any potential offspring." At the current rate of loss, Gough Island's endangered birds face extinction.

To protect the birds, the RSPB initiated a project to eradicate the mice from Gough Island. The work involves distributing poisoned bait that will attract and kill the voracious rodents. It's not the first time that an entire island has undergone mouse eradication. Similar projects on South Georgia Island and Antipodes Island have successfully removed populations of introduced rodents and restored a more natural balance to bird populations in those sub-Antarctic locations. And in the warmer waters north of Hawaii, Midway Island has also received the anti-rodent treatment.

With the Gough Island eradication project planned to take place in 2020, RSPB began planning for facilities needed to support the work. They received permission to establish temporary infrastructure to house, feed and support the taskforce. Because most of the bait will be spread using helicopters, planning also included landing pads and fuel and maintenance installations. The overall goal is to guide installation of the temporary structures with minimal impact on Gough Island's native flora and fauna.

Houston's job was to collect information on topography and soils for use in planning and design of the temporary facilities. "In addition to the workplaces, we needed to find sites for pens and medical facilities to keep the buntings and moorhens contained so they don't eat the poisoned bait," he said. Houston explained that the island-wide mitigation would be conducted during the southern winter while the other seabirds' migration and feeding patterns took them away from the island.

Precise Mapping in Remote Locations

In order to conduct the design work, Taylor & Boyd needed accurate information on the terrain and existing structures. Adding a surveyor to the team was cost prohibitive, so Houston performed double duty by handling tasks in both surveying and engineering. With only two weeks

Figure 1: John Houston carries the GNSS receiver along a survey line on Gough Island. Cold weather and difficult terrain made days difficult.

to complete his work, RTK GNSS seemed to be an ideal solution for the treeless locale. But Houston's lack of survey experience and the absence of geodetic control or cellular service on the island combined to make RTK unfeasible. Instead, he used a Trimble® R10 GNSS receiver in conjunction with Trimble CenterPoint® RTX correction service. CenterPoint RTX uses a global network of GNSS reference stations combined with satellite communications to enable users to achieve real-time, centimeter-level positioning accuracy, even in the most remote locations in the world.

Using a Trimble TSC3 controller and Trimble Access™ field software with the R10, Houston collected hundreds of 3D points around the project site. He captured the location of existing structures and features, test pits for soil evaluation and ground points for use in topographic modeling. Using the display on the TSC3 he could follow his progress and make sure he covered the necessary ground. In spite of working more than a thousand kilometers from the nearest GNSS reference station, Houston achieved centimeter accuracy on all survey points; typically 3 to 5cm in both the horizontal and vertical components.

A typical workday lasted 10 hours or more. "The weather and terrain made life miserable," Houston recalled. "It's cold and windy and we needed to wear waterproof clothing. The area is overgrown with brush and not easy to walk through. The seabirds often burrowed into the soft peat, and many times the ground collapsed and dropped me into a knee-deep bird burrow."

Even as a self-described "rookie surveyor," Houston quickly learned to operate the GNSS equipment. With CenterPoint RTX operating transparently, he could focus on the engineering aspects of his work. Only on a couple of occasions did he need guidance; he used the island's satellite Internet link to discuss technical questions with Trimble experts. At the end of each day, Houston reviewed data on the controller, planned the next day's work and set up the system batteries for recharging. Aside from cloth tapes used to lay out a rough grid, the R10 was the only survey tool Houston needed. Although he did not establish any formal benchmarks or control points, Houston did capture several hard points on the existing helipad and building foundations. Those markers will be sufficient to serve as reference points for the upcoming work on the island.

A Job Done Well

Houston departed Gough Island with survey data sufficient for the design work ahead. Taylor & Boyd developed 2D contour maps and 3D terrain models of the site, which they shared with RSPB. The society will overlay bird data on the topographic maps and use the information to identify flight paths and nesting areas. Taylor & Boyd will use the maps to set proposed elevations and positions for the temporary structures. The data, which is the first topographical survey ever carried out on the base since it was established in 1963, will also aid the South African government in maintenance and operations of island facilities.

Houston made it clear that he could not have carried out the survey to the required level of accuracy and within the allocated time period without CenterPoint RTX. "It really was invaluable for the success of the project," he said. "If this technology works on Gough Island, then it will work anywhere."

Taking a few moments to reflect on his trip, Houston said the time on the island was well worth the long trip and rugged conditions. The opportunity to see and interact with the birds, seals and penguins left a lasting mark. While he doesn't expect a return trip will be needed, he would jump at the opportunity. "It was a once in a lifetime experience," he concluded. "I would go back in a heartbeat—with warmer clothes."

Figure 2: The TSC3 displayed all the points captured with GNSS. The data were later transferred to CAD software for mapping and design.

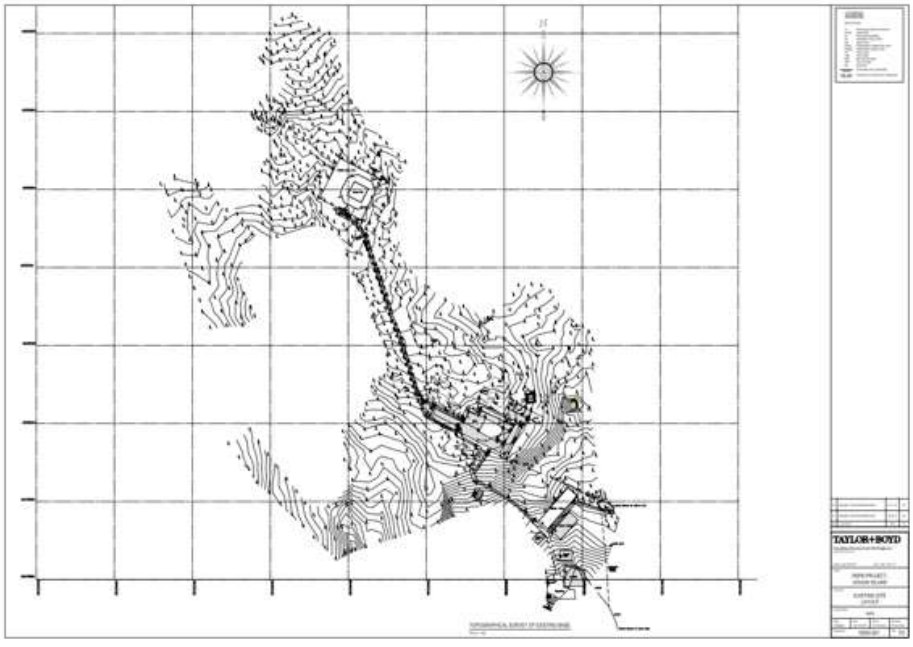
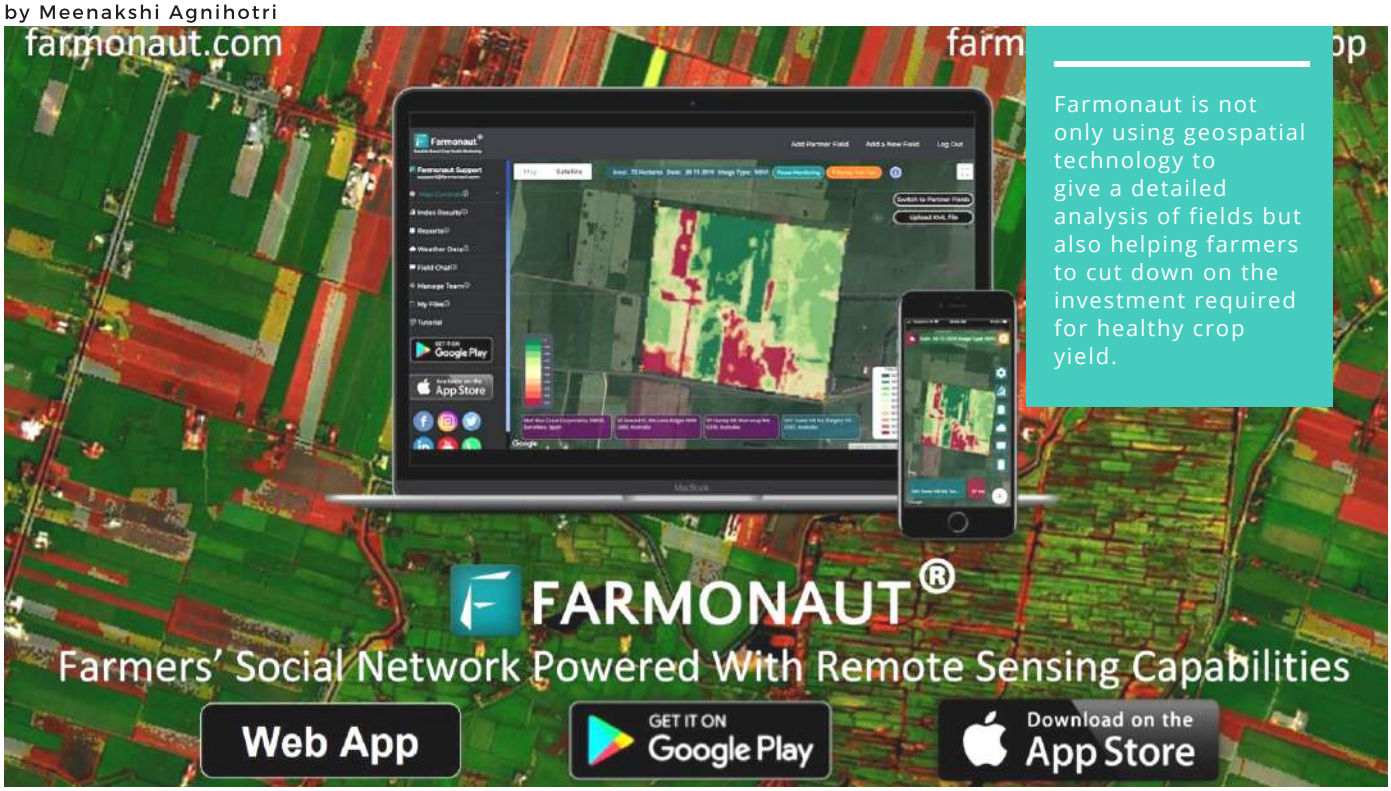


Figure 3: Taylor & Boyd developed a 2D drawing of existing facilities.

FARMONAUT®: GEOSPATIAL TECHNOLOGY FROM DATA TO INFORMATION

The biggest challenge in the Indian agriculture industry is the unawareness and inability to understand the complex technical concepts involved in the analysis. Farmonaut is bridging that very gap of unawareness by providing the farmers with a simpler solution.

by Meenakshi Agnihotri



Farmonaut is not only using geospatial technology to give a detailed analysis of fields but also helping farmers to cut down on the investment required for healthy crop yield.

With the digital revolution in India, there have been numerous technological advancements in the agriculture domain. Tech-savvies have taken up the responsibility to reform the most neglected field by providing our farmers with the most viable solutions. Geospatial technology is an evolving field that includes Geographic Information System (GIS), Remote sensing (RS), and Global positioning system (GPS). Geospatial technology is the need of the hour to ensure exponential growth in the agriculture domain. Farmonaut's Satellite Based Crop Health Monitoring System is built to put satellite technology in the hands of each and every farmer in the most economical way. Farmonaut's main objective is to break the cost barrier and help democratize remote sensing in the farming community by providing an on-the-go always ready platform for field monitoring through satellites. The system is accessible through our web, android as well as iOS apps.

About Author

Meenakshi Agnihotri

Email: *meenakshi.agnihotri22@gmail.com*

Farmonaut enables farmers to monitor their fields remotely through satellites by providing them with a detailed analysis of crop health, vegetation water stress, and soil organic carbon content.

Farmonaut is addressing one of the biggest challenges in the Indian agricultural ecosystem. Remote sensing is a widely used technology to monitor fields across the world, but in India, it couldn't be as popular due to the cost attached to it. Farmonaut has come up with the most cost-effective solution to the issue by helping farmers to identify crop-related issues without compromising on the quality and the depth of the data. Now even for a small farmer (field area less than 5 acre), the cost of 1 month of satellite monitoring is less than what 1 bottle of fertilizer/ chemical costs.

Available in 50+ languages, it is extending features like a social network of more than 10000 farmers, voice text-based plant issue identification, and Government approved farming database as well.

Importance of Remote Sensing in Agriculture (Precision Farming)

The entire agriculture industry has reformed with the incorporation of geospatial technology and the ability of systems converting data into useful information to increase yield.

Decades of research has proven that remote sensing can improve a farmer's productivity tremendously. By observing field changes through specialized sensors from space can reveal field information that is not perceivable through human eye and can help them take preventive actions and manage field related jobs in a much easier way. The easiest way to understand precision agriculture is to think of it as everything that makes the practice of farming more accurate and more defined when it comes to the growing of crops. One of the key components of this farm management approach is the use of information technology and a wide array of items such as GPS guidance, sensors, variable rate technology, GPS-based soil sampling and most importantly a software component to help unify all these components.

It can help us determine everything from what factors may be stressing a crop at a specific point to estimating the amount of moisture in the soil. This kind of data enriches decision-making on the farm.

Farmonaut is not only using geospatial technology to give a detailed analysis of fields but also helping farmers to cut down on the investment required for healthy crop yield. An Indian farmer, on an average, spends between Rs. 41500 (550 USD) to Rs. 332000 (4300 USD) annually on each hectare of arable land. By using highly processed remote sensing results on Farmonaut, a farmer can save approximately 30% of the expense on chemicals, insecticides, pesticides, plant growth regulators, etc.

Data to Information

Some of the concepts most commonly used for the high-level analysis by Farmonaut are NDVI, NDRE, EVI, VARI, SOC and NDWI.

Using the analysis of satellite data provided by Farmonaut in the form of comprehensible information, farmers can -

1. Reduce Chemical/Fertilizer consumption by applying it only at the locations where crop health is not good.
2. Reduce Labour costs by directing the labors only in those field areas where crop health is critical.
3. Reduce irrigation water wastage by applying proper irrigation only in those locations where plant water stress is low.
4. Increase the overall yield.
5. Maintain good nutrient composition post-harvest by getting the soil testing done on the locations where Farmonaut's SOC model has identified the level of soil organic carbon to below.

It can not only reduce and end the use of chemicals on the field but also increase the overall crop yield. It further prevents the deterioration of soil nutrient composition which might happen due to the prolonged usage of chemicals on the land.

Apart from the indices, Farmonaut also provides true color RGB images of the field.

TCI: TCI stands for True color Image. It is basically a raw image of the field captured by the satellite of a particular location completely unaltered. This is not an index image, but a RGB representation of how the field looked like in human perceivable colors upon its last visit.

ETCI: ETCI stands for Enhanced True Color Image. It is basically a TCI image processed by our own systems to enhance the land features which were not so explicitly visible in the raw TCI Image.

Normalized Difference Vegetation Index (NDVI)

NDVI stands for Normalized Difference Vegetation Index and is used as a measure to identify the state of plant health based on the light reflected by the plant at certain frequencies. Though we cannot perceive it with our eyes, everything around us (including plants) reflect wavelengths of light in visible and non-visible spectrum. Taking into account how much amount of a certain wavelength is reflected, we can access the current status of plants.

Case#1: The cotton farm displayed below belongs to one of our Israel based agricultural consultant. This farmland is spread across an area of approximately 15 hectares. The image displayed below is of NDVI index. The recorded satellite data is of 7-Sep-2020. As it is visible from the image, the field is mature and ready for defoliation. Defoliation at the right time helps farmers in maximizing their yield.

Case#2: The field image attached below is of the farmer Harikrushn from Surendranagar, Gujarat (Field Area: 6 Hectares). The image displayed on the map is NDVI captured by the satellite on 15 Feb 2020. In the posted image, as we can see, the top left portion of the field is completely barren, whereas the remaining field is in the yellowish green or green region. This indicates that the crop health of the farmer's field is pretty well. To cross-verify these results farmers can simply open GPS on their smartphones and can navigate through the field using this image.

Normalized Difference Red Edge (NDRE)

Normalized Difference Red Edge (NDRE) is a spectral index that helps in gathering the data at the later stages of a crop when chlorophyll content is relatively higher in the crop.

Case#1: The field displayed in the image below is of NDRE used for crop assessment in the stage of later growth from one of Farmonaut's exclusive farming hubs situated in Saharsa, Bihar. The colormap shows good conditions in the majority of the field. According to the information accessed in the image, the crop would be ready for harvesting in the coming weeks. After harvesting, Soil organic carbon (SOC) content of the bare land is captured to identify locations where SOC content might have gone down. Once locations with low SOC content are identified, a priority soil testing can be done to prepare the field further.

Case#2: The field image attached is of the farmer Paulo o (Ponta Pora - State of Mato Grosso do Sul, 79900-000, Brazil), (Field Area: 47 Hectares). The image displayed on the map is NDRE captured by the satellite. NDVI index is not ideal for the crops in their later stage of growth because in grasses, cereal crops, permanent crops and in certain row crops which are in their later growth stages, chlorophyll content reaches a point at which NDVI reaches a maximum value of 1.0 and hence saturates. Hence, any crop health issue is hard to detect with NDVI until any such problem becomes strong enough to reduce the NDVI value below 1.0. This may happen at a point at which damage has already occurred. By substituting NDVI's red band with NDRE's red edge band we can mitigate this issue of saturation discussed above. So, in conclusion, if the crops of observation are permanent or dense, you should use NDRE right away.

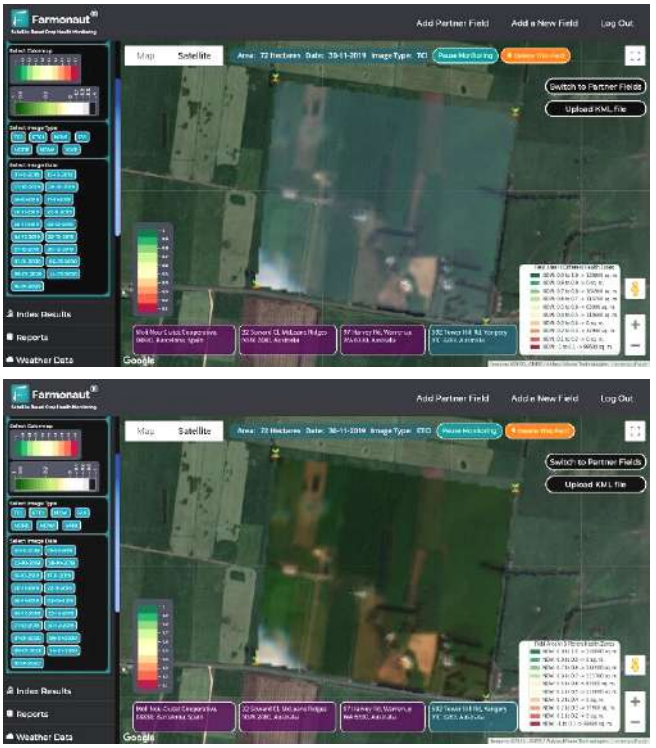


Figure 1 (top) and Figure 2 (bottom): True color image (TCI) and Enchanced true color image (ETCI)

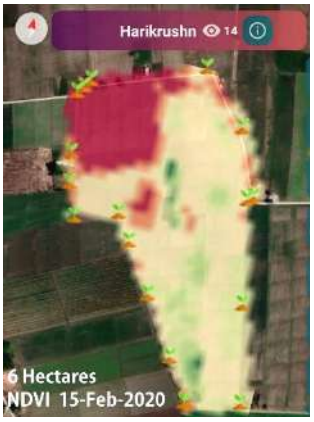


Figure 3 (left) and Figure 4 (right): NDVI values in Case#1 and Case#2 respectively.

Figure 5: NDRE values in Case#2.

Enhanced Vegetation Index (EVI)

EVI is further an optimized index designed to enhance the vegetation signal with improved sensitivity in high biomass regions and improved vegetation monitoring through a decoupling of the canopy background signal and a reduction in

atmosphere influences.

Case#1: These are a few fields added to Farmonaut for satellite monitoring by one of the users from Argentina. Both of these fields (96 Ha and 27 Ha) have maize and are in the early stage of growth. The images are of the EVI index. This is a side-by-side comparison of crop growth. The data is captured in the difference of 10 days by the satellites from 4th August 2020 to 14th August 2020. The data reveals that the crop is growing fine at the majority of the locations. At some locations wherever the EVI index is low, a field visit should be conducted on priority. Cropping needs to be performed again in case the crop has failed to grow at those locations. By having this piece of information, farmers can maximize their yield in the most effective way.

Case#2: The field displayed is of Prashant Amitbhai Hirapra and is approximately of area 4 hectares in Dhoraji taluka and district Rajkot, Gujarat. He has been monitoring blackgram and cotton in the farm. The displayed image is of EVI (Enhanced Vegetation Index). The top portion of the field is used for cotton whereas the bottom portion of the field is used for black gram. As is visible from the image above, the blackgram patch reached its maturity somewhere around 19-June-2020 and was harvested after that. Similarly, we can see that the cotton portion is still growing and is in a healthy state as per the data of 24-July-2020.

Watch video Testimonial:
https://www.youtube.com/watch?v=PJIMuDgZsDg

Case#3: The field displayed is of Ashish Vaishnav and is approximately of area 5 hectares in Dhoraji taluka and district Rajkot, Gujarat. He has been using Farmonaut app since last 2 months and has been monitoring groundnut in the farm. The displayed image is of EVI. The field transformation is visible through June to July which displays that the crop has reached the optimum maturity to be harvested. By having the crop maturity data, farmers can decide precisely when to harvest which region

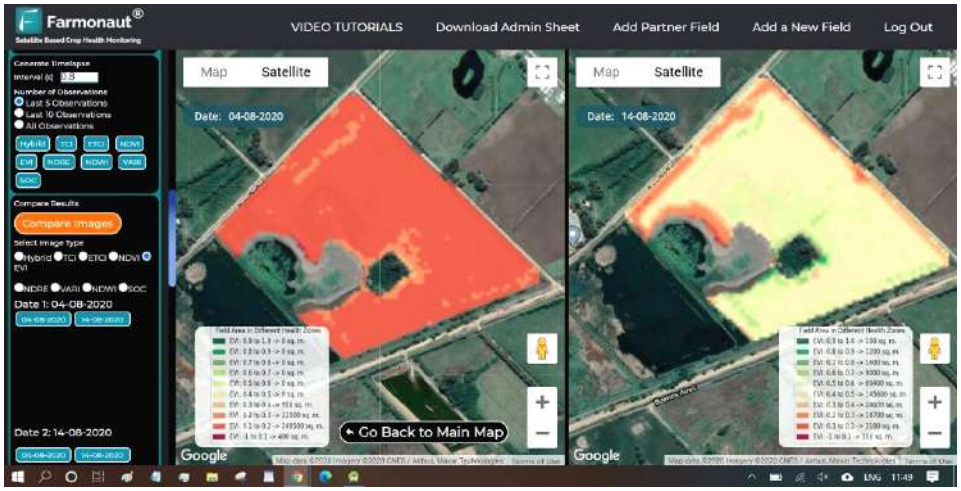


Figure 6: EVI of Case#1 - field added to Farmonaut for satellite monitoring by one of the users from Argentina.

of their field so as to get the maximum yield.

Watch video Testimonial:
https://www.youtube.com/watch?v=fdV20_WLJXA

Normalized Difference Water Index (NDWI)

NDWI stands for Normalized Difference Water Index. NDWI index can help us control irrigation, significantly improving agriculture, especially in areas where meeting the need for water is difficult. The high NDWI values correspond to high plant water content and coating of high plant fraction, whereas the low NDWI values correspond to low vegetation content and cover with low vegetation. NDWI rate will decrease during periods of water stress.

Hence, through NDWI, the early detection of water stress can prevent many of the negative impacts on crops

Case#1: The field image attached is of the farmer Gullapalli Sujatha (Viswamatha farms, Andhra Pradesh, one of the pioneers in Natural Farming in India), (Field Area: 26 Hectares). The image displayed on the map is NDWI (Normalized Difference Water Index) captured by the satellite.

In the posted image, as we can see, the top portion of the field shows pretty good water stress in the vegetation, whereas the remaining field is in the yellowish or red region. This indicates that the farmer needs to pay attention to irrigation in these highlighted regions. To cross-verify these results farmers can simply open GPS on their smartphones and can navigate through the field using this image.

Visible Atmospherically Resistant Index (VARI)

VARI stands for Visible Atmospherically Resistant Index. VARI is minimally resistant to atmospheric effects, allowing vegetation to be estimated in a wide variety of environment. Hence, it is ideally recommended to be used for farm level decision making if TCI and ETCI images show visible atmospheric distortion such as mild clouds or haze above the field.

Case#1: The field image attached is of the farmer Tafuma Fundira (Masvingo,

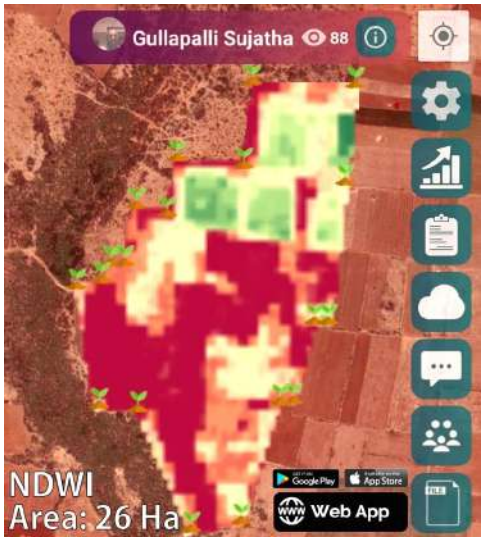


Figure 7: NDWI values in Case#1.

Zimbabwe), (Field Area: 2 Hectares). In the posted image, as we can see, the ETCI image seems to be distorted due to haze and clouds. In such cases vegetation indices like NDVI will not give correct observations. Thus, VARI is used in such cases. As we can see through the VARI image, a majority of the field is growing pretty well, with some barren regions shown in red. To cross-verify these results farmers can simply open GPS on their smartphones and can navigate through the field using this image.

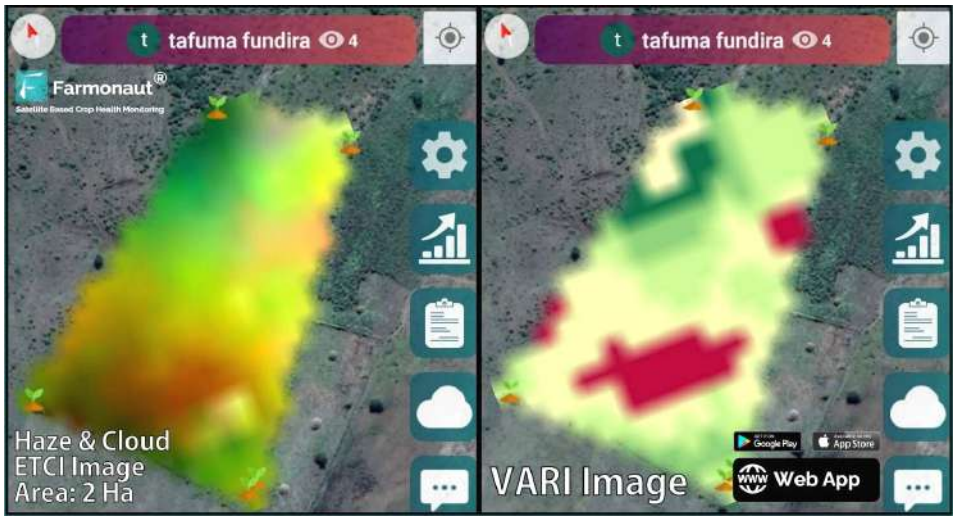


Figure 8: The image displayed on the map is ETCI (Enhanced True Color Image) on the left and VARI (Visible Atmospherically Resistant Index) image on the right.

HYBRID

All the examples cited above are supporting the fact that with the help of technology, data is processed to generate useful information for farmers. The biggest challenge in the Indian agriculture industry is the unawareness and inability to understand the complex technical concepts involved in the analysis. Farmonaut is bridging that very gap of unawareness by providing the farmers with a simpler solution. The field displayed below is entered by one of the farmers from Rattanpura, Rajasthan having cotton, guar, and moong currently under cultivation. The information in the image can be interpreted as follows:

1. (Green) Locations with good crop health and water stress
2. (Orange) Locations with bad crop health
3. (Purple) Locations with bad water stress
4. (White) Locations affected by clouds

Soil Organic Carbon (SOC)

Soil organic carbon is a measurable component of the soil organic matter that indicates the better health and yield of any land once the cultivation process ends. Remote sensing technology plays a vital role in enabling farmers to ensure high SOC content by taking the right measures at the right time and the right place. Farmonaut creates a SOC image with a color map of the percentage of organic matter present in the selected field. The monitored land appears green in the color map if the SOC content is more than 5% and red if the SOC content is less than 1%. Once the locations with lesser SOC levels are identified by Farmonaut, farmers can get the soil testing done on specific regions, and the required nutrients added to the identified land.

Prominent Long-term Example

Some of the prominent players in the agriculture industry have benefitted from the detailed analysis of satellite images provided by Farmonaut.

Viswamatha Farms: Viswamatha Farms are one of the popular names when it comes to natural farming. They had received SAKSHI EXCELLENCE AWARD in FARMING in 2017 for their contributions to natural farming. They majorly cultivate pulses, spices, groundnut, vegetables, and fruits in 26 ha land. Viswamatha Farms has been using Farmonaut's Satellite-Based Crop Health Monitoring System since September 2019.

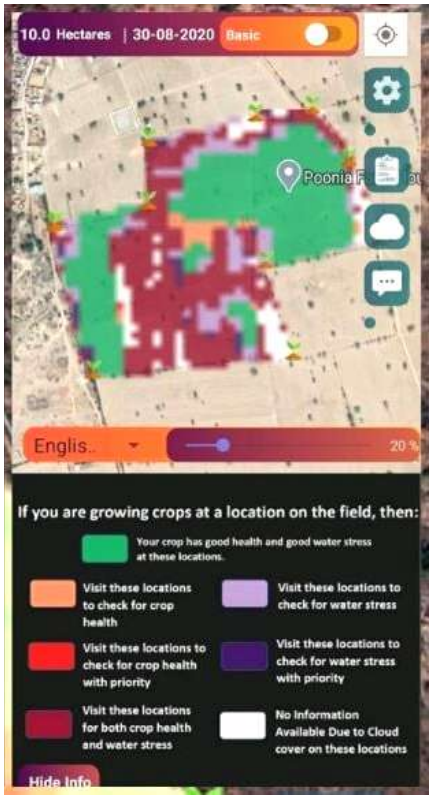


Figure 9: HYBRID - the complete information is collated to represent in a single image.

The farm is a healthy mix of agriculture, horticulture, floriculture and animal husbandary. Apart from their own farms, viswamatha farms has created natural farming farmers group to cater to the

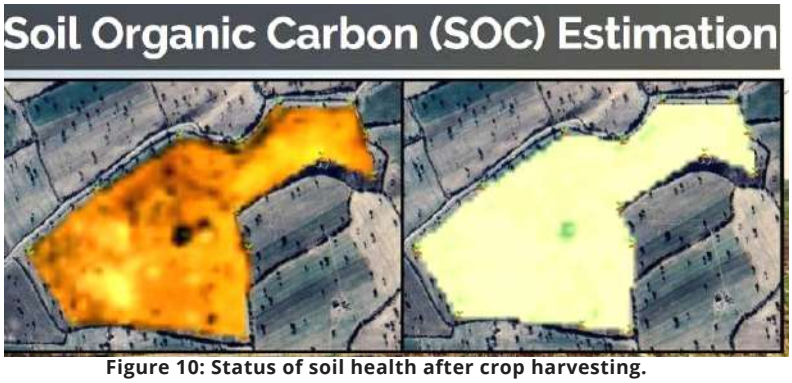


Figure 10: Status of soil health after crop harvesting.

requirement of quality products. Viswamatha farms enrich the soil nutrients by using Jeevamruth which is a fermented microbial culture. It provides nutrients but most importantly acts as catalytic agent that promotes the activities of micro-organism in the soil as well as increases earth worm's activity. During 48 hours of fermentation process the aerobic and anaerobic bacteria present in the cow dung and cow urine multiply as they eat up organic ingradient (pulse flour mixed in the jeevamruth) in the Jeevamruth. A handful of undisturbed soil from the field bunds also added to Jeevamruth as inoculate of native spices of microbes and organism.

Jeevamruth also helps to prevent fungal and bacterial plant diseases.

Insects and pests are managed by using specially prepared mixtures called as neemastram, agniastram, brahastram, dasaparni kashayam. These mixtures involve cow dung, cow urine, Neem leaves, Neem pulp, green chillies and other herbs as required to manage the pests and diseases. Remote sensing in combination with natural farming can do wonders for the agriculture sector. Below are a few examples of the same over the last one year of Farmonaut's working with Viswamatha Farms.

Several Other progressive farms such as Rahua Farm, Mill services, I Support Farming, Organic Foods Market, Agro Drone (Israel) are using the satellite data provided by Farmonaut. Rahua Farms is an agricultural company providing services for agricultural equipment used in sowing. It is currently monitoring more than 760+ hectares of land through Farmonaut.

Conclusion

Agriculture is one of the biggest and most important markets in India. 21% of the total Indian population that is, approximately 200 million lives are dependent on this occupation. To ease the hardships of farmers and enable them to withdraw the maximum benefit out of this domain, Farmonaut is all prepared to experiment further with the different aspects of Geospatial technology and come up with better solutions for the farming community.

With the upcoming advancements, apps like Farmonaut are certainly going to empower the farmers not just in India but across the world.

Figure 11 (left) and Figure 12 (right): (Left) Viswamatha Farms harvested their major crop Red Gram in the month of February, 2020. The image is of the red gram plants in the Viswamatha farms nearly after one month of harvesting. (Right) The image is of the farm nearby to Viswamatha farms which was using the contemporary methods of farming (not natural farming) and also harvested red gram from their field at the same.

Figure 12: The cultivation of the turmeric crop over an area of 1 acre recorded a return of 300 % in the last season.

Figure 13: Due to natural farming and PA (precision agriculture) tools, the crop is healthy with no diseases. Viswanatha Farms is one of the most progressive natural farms in South India.

ACCURACY IN THE ALPS – A HIGH-PRECISION RAILWAYS SURVEYING & MAPPING PROJECT

The project has proved that with the right tools and approach, precise photogrammetry-based maps can be produced for the difficult alpine environment.

by Mary Jo Wagner

Designed for speeds up to 220 km/h, the Kundl-Baumkirchen dual railway crosses the Alps and is the northern connection to the Brenner Base Tunnel.

> Multi-sensor fusion technique has given the confidence to pursue similarly challenging projects

When a Cessna fixed-wing aircraft took off over an Austrian alpine region on an early morning day in August 2016, it ascended carrying two crew, a large format digital camera, a bit of uncertainty and a whole lot of risk.

The plane's mission was part of a project to provide a precise, as-built survey of a narrow 40-kilometer (24-mile) stretch of railway in the Lower Inn Valley east of Innsbruck. Although this wasn't an unusual task for a surveying company, the required accuracy of the project was: 2-cm (0.8-in) horizontal and vertical accuracy for the entire area of interest (AOI).

"Airborne mapping surveys under 5-cm (2-in) accuracy are rare in alpine environments because the mountainous terrain is treacherous and unpredictable," says Klaus Legat, head of the photogrammetry and aerial survey department at Vermessung AVT, a surveying company based in Austria.

"To achieve 2-cm resolution we would have to fly about 500 m above ground within a very narrow air space, making maneuvering tricky. And for this specific railway section, we'd need to supplement the aerial imagery with ground imagery, precise control points and software that could integrate all the data into an

About Author

Mary Jo Wagner

Freelance Writer, Editor
Media Consultant
Vancouver, British Columbia
Email - *mj_wagner@shaw.ca*

accurate, true-to-life map of the AOI. Neither we nor the client had ever taken on such a task before so this would be a proof of concept test to see whether modern surveying techniques could deliver such high accuracy over a large area. It was a risky proposition."

But, it proved to be a successful gamble.

Integrating GNSS technology, aerial imagery and Lidar data, mobile mapping technology and advanced image processing software, AVT proved not only that its multi-sensor, data fusion approach was a solid bet, it's given the company the confidence to pursue similar high-precision alpine mapping projects.

Placing Their Bets

With the Alps in AVT's backyard, mapping and surveying mountainous environments is a natural focus. In fact, AVT has become quite comfortable in the alpine regions, pushing their photogrammetric capabilities to where they routinely provide ground-resolution accuracies of 5 cm or better.

The Lower Inn Valley (LIV) railway project would push them further.

A double-track high-speed main line of the Austrian Federal Railways (ÖBB), the LIV railway is a core part of the Trans-European Transport Networks (TEN-T), a high-performance railroad that will eventually connect southern Italy with northern Europe.

AVT's target was the 40-km section between the Austrian towns of Kundl and Baumkirchen (KB), the first segment of the LIV that opened in November 2012. Designed for speeds up to 220 km/h (124 mph), the KB dual railway crosses the Alps and is the northern connection to the Brenner Base Tunnel, a 64-km-long (40-mile-long) tunnel between Austria and Italy scheduled for operation in 2026.

In 2016, ÖBB Infrastruktur AG issued a tender for a final as-built measurement of the above-ground areas of the new line, the converted sections of the existing line and any objects within 100 m (328 ft) of the tracks themselves. In addition to the 2-cm vertical and horizontal accuracy requirement, ÖBB specified that access to the tracks was prohibited so a purely terrestrial measurement technique wouldn't be possible. There was also another complexity: the tracks were lined by up to 6-m-high (19-ft-high) noise-prevention walls.

"Because we couldn't access the track, we had to choose aero photogrammetry," says Legat. "But the prevention walls and other obstacles would hide many along-track features from the plane's nadir-looking camera. Our approach was to pair an aerial survey with mobile mapping. The aerial data would give us both the railway detail and the area outside the walls, and the mobile mapper would give us the ancillary features not visible from the plane."

Critical to the multi-sensor approach was the ability to integrate diverse data formats into one image processing software to create orthophotos and an orthomosaic. AVT selected Trimble's Inpho Suite, a set of photogrammetry modules for transforming aerial imagery into orthophoto mosaics, point clouds and other 3D datasets.

"Inpho can work with both analog and digital cameras," says Legat. "That flexibility saves us significant data processing time. It also is quite good at triangulating and multi-ray image matching which is the foundation for producing accurate results."

Rolling the Dice

To achieve consistently high accuracy over such a long distance, AVT established both a precise control network and a network of ground control points (GCPs). To minimize atmospheric disturbances, they created the control network through a static observation night survey. Using two permanent base stations near the center of the AOI, crews set out 30 GNSS receivers on pre-determined locations and the units simultaneously collected measurements for 12 hours. The permanent survey established a base network precise to 0.5 cm (0.2 in).

Figure 1: AVT has routinely flown in the alpine to provide ground-resolution accuracies of 5 cm or better. The Lower Inn Valley railway project pushed them to 2-cm accuracies.

For the GCPs, teams painted markers on concrete or other hard surfaces at 2-km (1-mile) intervals around the 40-km area and measured the center points of each with shorter, static observations of about two hours. They set five points at a time and laid out a total of 50 GCPs with a horizontal accuracy of 1 cm (0.4 in).

With the control networks set, AVT could dispatch their flight crew to collect aerial imagery with a ground sample distance of 2 cm. Flying at an altitude of 450 m (1,476 ft) and an average speed of 200 km/h, they covered the entire AOI in two hours. They flew 21 flight paths in an east-west direction and collected 1,300 images with their Vexcel large-format digital camera. The images had a 60 percent overlap.

Per ÖBB's request, they also carried out a second aerial LiDAR mission to produce detailed point clouds for generating digital terrain. Reducing the altitude to 200 m, a crew collected LiDAR data with a point density of 25 points per square meter and a side-overlap of 70 percent.

Completing the data collection was a terrestrial survey using Trimble MX7 mobile imaging system. A vehicle-mounted photogrammetric system, the MX7 is equipped with six 5 megapixel cameras and Trimble Applanix GNSS and inertial geo-referencing modules. The system was mounted on the roof of a van that was placed on a truck-transport wagon which in turn was pulled by a special locomotive of the ÖBB. Maintaining an average driving speed of 50 km/h, the MX7 captured a 30MP panoramic image every 4 m (13 ft) along each of the KB tracks and acquired features such as switching boxes, passenger benches and electrical housings not visible in the aerial photogrammetry. Along the railway there is a 600-m-long (1,698-ft) tunnel which required the AVT team to install six LED headlights to compensate for the low-light conditions to capture features inside the tunnel.

"This was our first experience with the MX7," says Legat. "It not only complimented our aerial campaign and captured the essential ground elements but it performed surprisingly well in the tunnel."

Into the Ortho

After downloading and processing the aerial images and aircraft trajectory data, AVT imported the data as well as the GCPs into the Match-AT georeferencing module of Inpho to automatically triangulate the images. Using an image pyramid process, the software analyzed the 1300 images and pinpointed 15,500 common features or tie points (TPs) across the images, with an average of 200 TPs per image. The precisely surveyed GCPs were measured in the images and the Match-AT module used a bundle-block adjustment process to automatically and precisely orient the imagery. The accuracy of the GCPs in the AT was around 1 cm in planimetry and altimetry.

"The triangulation needed to be done as precisely as possible to ensure we could achieve vertical accuracy," says Legat. "Investing in our ground control was crucial but we also needed image processing software that could deliver the precision. As a long-term user of Inpho, we haven't found any software that can rival Match-AT's triangulation abilities or its intuitiveness."

With the OrthoMaster module, the software automatically orthorectified the individual images with a ground resolution of 2 cm

Figure 2: One of 50 ground control points AVT set out to establish control for the flight.

Figure 3: The Trimble MX7 mobile imaging system was mounted on the roof of a small van and pulled by a special locomotive of the ÖBB. The Trimble MX7 captured ancillary features not visible from the plane.

Switching to Inpho OrthoVista each orthophoto was then stitched together to create a 2D orthomosaic for the whole AOI.

AVT personnel used the Inpho interface to export aerial images into DAT/EM Summit Evolution (DSE) software to create a 3D vector map of railway-related features. The map was customized and finalized in AutoCAD.

In parallel with the aerial mapping, a team processed and georeferenced the MX7 imagery to map objects that couldn't be seen in the aerial images. They first determined the path of the MX7 using the GNSS/INS data recorded during the ride. They manually selected several hundred 3D points that had been determined as multi-ray TPs (aerial GCPs) within Match-AT, and used them to orient the MX7 images to ensure consistency between the aerial and mobile-mapping data. They then extracted and mapped the mobile-mapping objects and exported the results to AutoCAD to produce the finalized 3D vector map showing the layers and symbols defined by ÖBB.

To process the aerial LiDAR data, they extracted approximately 300 horizontal patches, or surface sections, from the data and determined the mean height and standard deviation per patch. They imported this data into Match-AT as vertical-only GCPs with a 2.5 cm standard deviation. The ground points were used to process a digital terrain model and to derive height isolines, which were integrated into the 3D vector map. Both the 2D orthomosaic and 3D vector map were delivered to the ÖBB and AVT's results were given full approval.

This was such a satisfying achievement," says Legat. "The project proved that with the right tools and approach, precise photogrammetry-based maps can be produced for the difficult alpine environment.

More importantly, it has raised the profile of our multi-sensor fusion technique and given us the confidence to pursue similarly challenging projects."

Figure 4 (top) & 5 (bottom): The MX7 captured a 30MP panoramic image every 4 m along each of the tracks and acquired important features such as switching boxes that were not visible in the aerial photogrammetry.

GNSS AND PRECISE POINT POSITIONING AID UNDERSTANDING OF MAGMA MOVEMENT IN MOUNT ETNA ACTIVE VOLCANOES

Researchers on Mount Etna use Trimble CenterPoint RTX for precise GNSS positioning. The work will help improve methods for predicting volcanic eruptions.

by John Stenmark

Pavol Zahorec, Juraj Papčo and Peter Vajda (left to right) collect position and gravity measurements at the Montagnola monitoring station (2600 m a.s.l.) on Mount Etna. Some absolute gravity points were inside buildings on the mountain.

Using GNSS and PPP provides the needed accuracy and is helping scientists understand how changes in topography reflect gravity changes attributable to the magma redistribution.

Italy's Mount Etna is one of the world's most famous and very active - volcanoes. Located on the east coast of Sicily, the mountain's location and frequent eruptions make it a popular tourist destination. Plumes of ash and gas vent from fissures in the mountainsides and lava flows reshape the steep slopes extending from the summit.

While spectacular, Mount Etna's eruptions are also dangerous and worrisome. Eruptions have been recorded over the past 3,500 years and the mountain has been erupting continuously since September 2013. The current eruption, termed "Strombolian activity," produces lava flows and ash emissions that affect the terrain and nearby communities. Activity in July 2019 produced ash clouds that forced temporary closure of nearby airports. Scientists are studying the mountain to improve their ability to anticipate activity and issue warnings and alerts; the recent activity served to emphasize the value of these studies.

About Author

John Stenmark

Writer and Consultant
Email - *john@stenmark.us*

The quantities monitored include surface deformations and spatiotemporal gravity changes. These changes are indicative of magma mobility and pressurization in the mountain's internal plumbing system, which can lead either to unrest or volcanic activity. Simply put - scientists want to know what's going on inside the mountain. They do this by measuring changes of observables on its surface.

In July 2018 researchers from Slovakia (Peter Vajda, Pavol Zahorec and Juraj Papčo) and INGV in Catania (Filippo Greco and Massimo Cantarero) teamed up for a one-week campaign of intense observation. Their objective was to test a new approach to modelling the vertical gradient of gravity (VGG) and applying the deformation-induced topographic effects in interpreting gravity changes in order to improve the ability to predict volcanic unrest or eruption. The task required accurate point positioning and production and use of high-resolution, high-accuracy digital terrain models (DTMs).

While real-time GNSS was the team's first choice to obtain precise positioning in the difficult and sometimes dangerous environments, Mount Etna's terrain and lack of communications presented obstacles to accuracy and productivity. By using precise point positioning (PPP) with satellite-delivered corrections, the researchers produced accurate, reliable data with less time and effort than ground-based RTK GNSS measurements.

Tracking Magma with Gravity

Studying Mount Etna is rugged work. In addition to high altitude and steep terrain, research teams face a constant stream of spewing smoke and gases, unstable ground and explosive eruptions of ash and lava. In spite of the challenges, the Slovak and INGV team view Mount Etna as a research lab in which they can measure and analyze the movement of magma inside the mountain.

The replenishment (or movement) of magma within Mount Etna manifests itself through temporal gravity changes that can be observed on the surface of the volcano. The magma's motion can also deform the mountain's topography. To study these effects, scientists combine gravity data with digital elevation models (DEM) developed from aerial imagery. The team measured in-situ vertical gravity gradients (VGG) at multiple locations on the mountain to verify their numerical method of modelling it. The modelled VGG is used in compiling residual gravity changes that are interpreted in order to track magma mobility.

As the team put it: "We needed to demonstrate that we can successfully predict the VGG in volcanic areas of prominent rugged topography based on modelling the topographic contribution to the VGG using high-resolution high-accuracy digital elevation models (DEM) and eventually local improvements using drone-flown photogrammetry".

For Papčo, a geodesist at Slovak Technical University in Bratislavia, obtaining precise gravimetry called for high-accuracy GNSS positioning. He was especially interested in obtaining accurate heights (elevation) measurement wherever gravity data was collected. But even in such a thoroughly measured site as Mount Etna, precise GNSS measurement is not straightforward.

While Mount Etna is surrounded by geodetic control points, conducting real-time GNSS observations on the mountain proved challenging. Inconsistent cellular service on the mountain made connection to Italy's real-time GNSS network difficult and unreliable. Constraints on radio licensing ruled out conventional RTK.

To ensure reliable GNSS performance, Papčo turned to Trimble® CenterPoint® RTX correction service. CenterPoint RTX uses a global network of GNSS tracking stations and advanced data analysis to enable its subscribers to obtain precise real-time positions nearly anywhere on Earth. With GNSS correction data delivered via communications satellites, CenterPoint RTX users can operate without relying on cellular or radio datalinks.

Figure 1: Juraj Papčo measures a position for topographic mapping high on Mount Etna. Measured points were compared with models created from aerial imagery.

Real-Time GNSS on an Active Volcano

There was a lot of dust, loose rock and gas; it was very, very terrible to breathe" Papčo recalled. "In many places it was quite dangerous and scary. In one location where I wanted to go, the people from INGV said "No, no, don't go there. If something happens there you will completely die." But in spite of the danger there were interesting aspects of sounds and odors. It was fascinating to see how it works and to experience the smell and the life of the volcano."

Papčo used CenterPoint RTX to capture data at 17 locations where gravity data was collected. At each gravity point, he measured additional ground points to provide check data for the elevation models developed from aerial imagery. "Using RTX corrections was very exciting," Papčo said. "On many points, especially on the higher part of the volcano, Internet signals were poor or none at all. Only by using RTX were we were able to collect real-time data."

The project teams used existing aerial imagery to identify the areas where they wanted to measure VGG. They then used RTX to navigate to the locations before collecting real-time and static data on the points. "We had a very good experience with CenterPoint RTX. It performed well in higher elevations and in difficult conditions," Papčo said. "Without RTX, it would have been very difficult and complicated to navigate to the desired points."

For each profile and gravity point, Papčo collected real-time positions as well as roughly 25 minutes of static observation. Some gravity points were located inside buildings or under tree canopy. To produce 3D positions on these points Papčo set intervisible points with GNSS and then used a Trimble M3 total station to measure into the structure or forest. He processed the static data using Trimble Business Center software (TBC) and compared the static results with RTX and previous measurements by INGV.

The data collected using RTX produced vertical accuracy of four to five centimeters. "From my point of view the accuracy was very good," Papčo said. He also imported and processed aerial imagery using the UASMaster module in TBC. The ability to process all the aerial imagery, total station measurements and GNSS data in one software provided an added benefit; Papčo noted that point classification and making transformations into the local coordinate system went smoothly.

Figure 2: Papčo (left) and Pavol Zahorec at work near the edge of the NE Crater. The researchers collected data to analyze movement of magma inside the volcano.

Figure 3: Clouds of gas near Mount Etna's summit made work difficult for the research team.

A Deeper Understanding

The work on Mount Etna revealed that precise information on topography and point positioning is essential to accurate VGG predictions for the purposes of volcano geodesy. Using GNSS and PPP provides the needed accuracy and is helping scientists understand how changes in topography reflect gravity changes attributable to the magma redistribution. The approach will give scientists refined tools to better anticipate and characterize volcanic behavior.

While predicting eruptions of any active volcano remains a challenging science, the work of the multinational Slovak–Italian team provides valuable contributions to understanding volcanoes and anticipating volcanic events. Thanks to their achievements and the work of INGV, the laboratory known as Mount Etna continues to reveal its secrets.

BUSINESS

June 16, 2020 - September 15, 2020

PlanetObserver Release of Updated Global Imagery Basemap

PlanetObserver has released of updated global Imagery basemap. PlanetSAT is an offer aimed at giving access to global and regional imagery basemaps in order to get detailed geographic information at every scale. PlanetObserver has selected best available multi-source data to process the 2020 version of PlanetSAT Global imagery. Our latest Sentinel-2 imagery is from the 2017-2019 time frame and captures 30% of all emerged land including all capital cities and largest urban areas across the world and large regions such as Northern Africa, Middle East and Western Europe. Sentinel-2 is used to update all largest urban areas across the world and all capital cities. Our most recent Landsat 8 images are from the 2013-2018 time span and have been processed to cover 55% of the continents. All our 2020 global mosaic is color-corrected, cloudless, optimized and ready-to-use in different professional format which brings great value to our users. The global satellite imagery product has an impressive resolution of 10 meters and consists in the best solution for an improved user experience.

Seequent Accelerates Cloud-Based Solution to Help Keep World at Work on Major Projects

High-growth geoscience software company Seequent is accelerating the development of its cloud-based solution Seequent Central, enabling organisations to continue work on critical, large-scale, earth, environment and renewable energy projects in the COVID-19 impacted environment. Central works alongside Seequent's other geoscience analysis, modelling and collaborative technologies, to contribute understanding to subsurface geoscience and engineering design solutions. The cloud-based solution allows people in any location to visualise, track and manage geological models created for infrastructure and critical services.

SimActive Software Used for Oil and Gas Seismic Exploration

SimActive has announced that its Correlator3D™ product is being used by Texas-based company Dawson Geophysical for oil and gas seismic exploration. Orthomosaics and elevation models are generated from aerial imagery to aid in planning of seismic surveys. Dawson uses a medium format camera from Phase One to fly over areas of between 20 and 200+ square miles. The collected images are then processed by SimActive software to derive highly accurate geospatial data and identify points of interest. Finally, mappers use the imagery to spot hazards and plan routes in advance. This enables us to be more accurate, time-efficient out in the field, and to produce map products that our whole company can use.

RMSI Appoints Venu Nair as Chief Operating Officer

RMSI has expanded its senior leadership team with the appointment of Venu Nair as Chief Operating Officer (COO). Venu will focus on accelerating the company's efforts towards executing a growth strategy that delivers predictable and sustainable growth. He will lead the overall business, including sales, delivery, and operations with key objective of bringing in operational excellence and client delight. Venu has over 25 years of executive management experience. He has built and grown new businesses across technology sectors.

Bentley Systems Announces Launch of Initial Public Offering

Bentley Systems, Incorporated has announced the launch of the initial public offering of 10,750,000 shares of its Class B common stock. The shares of Class B common stock to be sold in the offering will be sold by existing stockholders of Bentley. The selling stockholders expect to grant the underwriters in the offering a 30-day option to purchase up to an additional 1,610,991 shares of Class B common stock from the selling stockholders. The estimated initial public offering price is between $17.00 and $19.00 per share. Bentley has applied to list its shares on the NASDAQ Global Select Market under the symbol "BSY".

Transerve Technologies Partners with Indian Institute for Human Settlements (IIHS) to aid Tamil Nadu Government in Sanitation Management Mission

Civic Technology firm Transerve Technologies which specializes in Geo-spatial technology has joined hands withIndian Institute for Human Settlements (IIHS) for co-treatment of fecal sludge and septage at Sewage Treatment Plants (STPs) and also stand-alone Fecal Sludge Treatment Plants (FSTPs) to support a cluster of ULBs in Tamil Nadu. IIHS is a lead partner of Technical Support Unit (TSU) which provides advisory support to various Urban Local Bodies in the state of Tamil Nadu by implementing Fecal Sludge and Septage Management (FSSM). Under this agreement, Transerve Technologies will develop a web and mobile based platform using Transerve Online Stack (TOS) to streamline the de-sludging process and will provide technical handholding to maintain and operate the system to IIHS and other state agencies.

Pix4D and SAP in Joint Innovation Project for the 3D Inspection

Pix4D, technology pioneer and market leader in industrial photogrammetry software solutions, has announced that it is starting a joint innovation project with SAP® to open up the market for drone-based, digital 3D inspections for telecommunications companies. SAP, a global leader in ERP (Enterprise Resource Planning) software, has included Pix4D in an SAP Accelerator Program for innovative companies that support the digital transformation of B2B businesses with their software solutions. The collaboration between SAP and Pix4D is principally aimed at the telecommunications industry, where the new Pix4D technology for the inspection of transmission masts with the help of drones, cloud computing and artificial intelligence (AI) is being implemented in the SAP S/4HANA platform and was integrated into the SAP Asset Management. Pix4D plans to expand its collaboration with SAP to develop applications for digital asset management and digital inventory in utilities, mining and construction.

Hexagon Unveils HxGN Smart Census 2020 for Enhanced Citizen Data Collection

Hexagon's Geospatial division has launched HxGN Smart Census 2020, a significant update to its end-to-end population and housing census management solution. The latest release improves digital enumeration by allowing households to complete census questionnaires online or over the telephone, significantly reducing the need for in-person interviews and field-based data collection.

Hexagon Selected for Innovate UK Rail Infrastructure AI Project

Innovate UK has selected Hexagon's Geospatial to conduct a project that will result in faster and higher-precision mapping of railway infrastructure through the use of artificial intelligence. The project is funded by Network Rail, the owner and operator of Great Britain's railway infrastructure, under its R&D portfolio and delivered by Innovate UK through the SBRI competition, Innovation in Automated Survey Processing for Railway Structure Gauging, Phase One. A small group of teams was selected for this effort.The project will enable Network Rail to automatically identify and measure railway structures from LiDAR data, saving valuable time and resources, while also improving planning and operations across the rail network. The current, manual process takes analysts months or even years due to the size of the data and the labor-intensive tasks involved.

Esri and United Nations Create COVID-19 Population Vulnerability Dashboard

Esri has announced its collabration with UNFPA to create the UNFPA COVID-19 Population Vulnerability Dashboard. This new interactive tool will provide public health workers, policy makers, and the general public with access to useful information on populations vulnerable to COVID-19 in order to target preparedness and response and to help save lives.The dashboard highlights population vulnerabilities at the national and subnational levels, using data from the latest Integrated Public Use Microdata Series (IPUMS) census samples for 94 countries. It identifies populations at older ages, including those living alone, and includes risk factors for COVID-19.

Esri Acquires nFrames to Enhance Its 3D Capabilities

Esri has announced the acquisition of nFrames, a technology company that develops SURETM, an industry-leading imagery and lidar 3D surface reconstruction software. This will enable the fusion of imagery with 3D GIS, allowing nFrames and Esri users to seamlessly capture and analyze 3D data from aerial, drone, and ground-based sensors in an automated end-to-end process.SURE scales 3D data creation to large city and countrywide airborne image datasets and projects while giving professional photogrammetry workflows improved precision, speed, and simplicity on premises or in the cloud.

European Investment Bank Provides Funding of €20 million to NavVis as Part of the Investment Plan for Europe

The European Investment Bank (EIB) and NavVis GmbH has announced the signing of a contract which provides financing of €20 million to NavVis GmbH, a global market leader in digital twin technology. NavVis has experienced unprecedented growth and demand for its indoor spatial intelligence solutions, and will further invest in expanding operations to meet the need for technological innovation in the enterprise manufacturing industry. The EU bank's loan is backed by a guarantee from the European Fund for Strategic Investments (EFSI), the heart of the Investment Plan for Europe under which the EIB and the European Commission are working together as strategic partners and the EIB's financing operations are boosting the competitiveness of the European economy.

Leica Geosystems BLK247 Wins Security Industry Association's Best New Product Award

Leica Geosystems, part of Hexagon, has announced its 3D surveillance product, the Leica BLK247, won the Security Industry Association's (SIA) 2020 Best New Product Award. The BLK247 was demonstrated as part of SIA's annual New Product Showcase Awards competition held at this year's virtual ISC West tradeshow. The Leica BLK247 is a first-of-its-kind 3D reality capture sensor for surveillance.

Hexagon Adds End-to-End 3D Security Surveillance Capabilities With the Acquisition of TACTICAWARE

Hexagon AB has announced the acquisition of TACTICAWARE, a provider of LiDAR-based 3D surveillance software used to monitor and protect critical infrastructure and buildings - from powerplants and airports to commercial and residential buildings and more.TACTICAWARE's flagship solution, Accur8vision, is a volumetric (entire space) detection security system offering 3D surveillance. Unlike conventional systems that typically only monitor perimeters, Accur8vision delivers situational awareness of an intruder's exact location, size, speed and movement trajectory - all of which can be visualised within a 3D digital reality of the area under surveillance.

Sony to Announce Release of High-Precision GNSS Receiver LSIs for IoT and Wearable Devices

Sony Corporation has announced the release of High-Precision GNSS Receiver with the industry's lowest power consumption for Dual-Band positioning operation. The receiver intended to be used in LSIs for IoT and wearable devices. The new LSIs support not only the conventional L1 band reception, but also L5 band reception, which is currently being expanded across GNSS constellations, thereby making them capable of dual-band positioning.Sony's original algorithms enable stable, high-precision positioning even under the difficult conditions unique to wearable devices. Also, the use of Sony's original high-frequency analog circuit technology and digital processing technology delivers the industry's lowest power consumption during continuous positioning for dual-band reception operation, at only 9 mW.

GNSS.asia Report on GNSS Market Trends in Asia

GNSS.asia has recently published its first report on GNSS market trends and developments in the Asian market. The report is a must-read for GNSS companies doing business in Asian countries and is planning to do business in Asia.

GIS & EO

June 16, 2020 - September 15, 2020

Global Trends in the Mapping Industry during the Pandemic

The pandemic has brough uncertainties to all businesses and the mapping industry has been no exception. Slowdowns were observed during the first few months of 2020 as lockdowns were gradually enforced in Asia, then Europe, and finally the Americas. As expected, projects were delayed during that initial period as companies were reorganizing their operations to allow for remote work.Once that transition was overcome, a great number of projects resumed, and the geospatial field has been gradually coming back to normal since then. That can be explained by different factors, including for example several governments accelerating infrastructure projects to stimulate the economy.

National GIS-enabled Land Bank System to Boost Investments

The Ministry of Commerce and Industry Government of India, Minister Piyush Goyal said that the Ministry is going to set up a single-window system for clearances and approvals of the industry in the country. The Minister said that the Government has launched a national GIS-enabled land bank which will facilitate the potential investors to locate and identify the land banks from the comfort of the office. The investor can finalize the location of industries without frequent visits to site locations or offices of land-owning agencies. The land bank system will be powered using GIS which will allow real-time information about the availability of industrial land and resources. The national GIS-enabled land bank system is being developed by integrating the Industrial Information System (IIS) with state GIS.Initially, the system has been launched in six states. The system will be improved further to make it an effective, transparent mechanism of land identification as well as procurement.More than 3,300 industrial parks across 31 States/UTs covering about 4,75,000 hectares of land have been mapped on the system. As of now, six States have already given their consent to register and share the data through the portal.

Japanese City Using GIS on iPads for Field Survey

The City of Tamba in Hyogo prefecture, Japan, performs field survey work using a mobile GIS application designed for Apple iPad tablet computers. The application, called Mobile Matilda, is developed by Osaka based GIS solution specialist, Tsukasa Consulting, using the TatukGIS Developer Kernel 11 (for Delphi edition) with the Embarcadero FireMonkey framework. The mobile application compliments desktop and web-based versions of the Matilda software that are enabled with more features. Unlike web applications, Mobile Matilda can operate in a local (off-line) environment. Users can update records in the field for later synchronization to the desktop or server via a secure Wi-Fi or GSM connection, when available.

Mangaluru Smart City is the First Smart City in Karnataka to go Live

Mangaluru Smart City is the first smart city in Karnataka to go live.Mangaluru Smart City already has an Integrated Command and Control Center (ICCC) and using as a war room for the administrators to combat COVID-19 pandemic. The ICCC is the major component of the Mangaluru Smart City project. The Mangaluru Smart City project is expected to have a positive impact on the lives of citizens of Mangaluru. The city is now equipped to handle any disaster through the proven ICCC Infrastructure and its live IoT based applications. The ICCC is equipped with a 24X7 dedicated call center with a helpline No 1077 operationalized for preventing, monitoring and controlling the deadly CORONA virus.

Machine Learning Helps SEGES to Detect 26K Slurry Tanks over Denmark to Assess Ammonia Emission

SEGES detected 26.000 slurry tanks over Denmark in a few hours using Picterra to assess ammonia emission. The method required was a combination of machine learning with existing agricultural GIS-databases. Their choice fell on Picterra, a cloud-based geospatial platform that automates the analysis of satellite and aerial imagery, enabling users to identify objects and patterns (road cracks, damaged roofs, etc.) at scale, anywhere on Earth.

UAE Launches Mission to Mars – Emirates Mars Mission "Hope Probe"

The United Arab Emirates (UAE) has launched its first mission to Mars on June 20, 2020 and becomes the first Arab country to do so. The Emirates Mars Mission "Hope Probe" launched from Japan's Tanegashima Space Center for a seven-month voyage to the red planet, where it will circle and send back information about the air.Emirates Mars Mission "Hope Probe" to Mars is the first Arab Interplanetary Mission to provide a complete picture of the Martian atmosphere and its layers when it reaches the red planet's orbit in 2021. As the rocket accelerated away from the Earth, the solid rocket boosters are expended, followed by jettisoning the fairing once it is no longer needed to protect the Hope Probe from the Earth's atmosphere.

Satellite-Based Crop Health Monitoring System to Help Farmers

Farmonaut started in 2018 with a vision to bridge the technological gap between farmers and strives to bring state-of-the-art technologies in the hands of every farmer. One of such technologies which Farmonaut has brought in the reach of farmers (be it a small scale farmer or a large scale farmer), is the ability to monitor their agriculture fields for crop health and water stress through satellites. Once the field is selected, farmers can access their field data through any platform of their choice (Android, iOS, or the website). Apart from the Satellite-Based Crop Health Monitoring System, Farmonaut provides the following features for use to its farmers too (currently available on the android app).

YellowScan S.A.S. Signs a New Distributor in China

YellowScan, a market leader in UAV LiDAR Solutions, is excited to has announced a new distribution partnership with Beijing MapCore Technology Co. Ltd., a company that has been dedicated to their clients for over 10 years. YellowScan customers will benefit greatly from MapCore Technology's extensive experience in survey and mapping, engineering, construction, GIS, forensics, mining, forestry, water resources and many other sectors throughout China.

Bluesky Laser Maps Quantock Hills to Reveal Archaeological Past

Aerial mapping company Bluesky International is using state of the art, aircraft mounted lasers to create a 3D model of the Quantock Hills in Somerset. As England's first Area of Outstanding Natural Beauty the Quantock Hills has a distinctive character with exceptional beauty and cultural heritage. Commissioned by the Quantock Landscape Partnership Scheme, the high precision terrain mapping project will improve the understanding how people have lived and worked in the area for thousands of years.

HERE Offers Developers and Data Scientists Direct Access to Rich Geospatial Data

Demand for high-quality geospatial data has skyrocketed across industries as the global economy becomes more and more digitized. HERE Technologies has released HERE Data Layers to improve software developer and data scientists' access to the rich cartographic features and attributes captured within an enterprise-grade mapping platform.HERE Data Layers are standalone geospatial representations of the world's road networks, pathways, buildings, structures, places, land use and land cover. They serve as a menu for developers and data scientists to select the datasets needed to power today's location-based functions, applications and customer experiences. The offering consists of customizable high value urban geospatial data sets in GeoJSON format and can be used in a range of use cases from map display, spatial analytics, business intelligence to AI/ML analysis.

Esri Publishes Book on Using Python to Customize ArcGIS Pro

Esri has announced the publication of a new book, Python Scripting for ArcGIS Pro. For experienced ArcGIS Pro users who want to learn Python but lack scripting experience, Python Scripting for ArcGIS Pro takes readers from understanding the difference between programming and scripting to automating tasks in ArcGIS Pro. Readers will learn to accomplish things such as creating a way to easily convert 1,000 shapefiles into feature classes in a geodatabase.

AccuWeather Joins the HERE Marketplace to Increase Distribution and Reach New Segments

HERE Technologies has announced that AccuWeather has joined the HERE Marketplace to sell weather-related information that has several use cases. The HERE Marketplace is a hub for global location data exchange and a means to accelerate data-driven innovation. With AccuWeather, both parties are yielding mutually beneficial results: HERE contributes the platform and qualified business connections while AccuWeather contributes its robust data products. Furthermore, AccuWeather can now leverage HERE's expertise, reputation and global relationships in several industries to accelerate its penetration and growth into these markets.

Bluesky Maps the Peak District National Park in Ultra-High Resolution from the Air

The Peak District National Park Authority has commissioned a brand new ultra-high resolution aerial survey from Bluesky to map land cover and vegetation down to individual species level. Part of the MoorLIFE 2020 project, a €16 million, five-year programme to protect extensive areas of internationally important blanket bog, the Bluesky 6cm resolution imagery and associated height models will also be used to monitor land cover change across the project area, specifically increases in the extent of Sphagnum moss. The Bluesky data will also inform studies into reductions in the dominance of cotton grass, purple moor grass, heather and bare peat, as well as changes in rates of peat accumulation and erosion.

East View Geospatial Partners with AllSource Analysis to Offer Finished Geospatial Intelligence

East View Geospatial (EVG) and AllSource Analysis have established a new partnership to bring forward authoritative geospatial intelligence & analytical products.AllSource Analysis is a provider of geospatial intelligence with a worldwide network of expert analysts and access to the most cutting-edge tools and technologies. This partnership combines EVG's unparalleled data sourcing and production capabilities with the finished geospatial intelligence.

Trimble VRS Now Network Covers More than One Million Square Miles in North America with the Acquisition of MidStates VRS

Trimble has announced that it has acquired MidStates VRS, a network previously owned by Butler Machinery and Frontier Precision. The addition of the network, located in North and South Dakota, increases the footprint of Trimble's VRS Now® GNSS corrections service to cover more than one million sq. miles in North America. The new coverage for the VRS Now subscription service helps users in more places achieve high-accuracy positioning to increase productivity, reduce operational costs and improve safety. The correction service is ideal for professionals in agriculture, geospatial and construction as well as emerging autonomous applications including lane-keeping for passenger vehicles, Vehicle-to-Anything (V2X) position identification and unmanned aerial system guidance. Adding 105,000 square miles of coverage, the acquisition expands Trimble's VRS Now network to be one of the largest in North America—over one million square miles, contributing to Trimble's shift toward a software, services and subscription business emphasis.

Improved Protection Platform Connects Slope Monitoring to Mine Operations

Hexagon is a leader in sensor, software and autonomous solutions. Recognizing the risks miners face, the company now connects systems for safety and radar-based slope stability hazards. The single platform is part of HxGN MineProtect Collision Avoidance System (CAS) 4.6. It means mines can now receive real-time equipment visualization with timely alerts about hazardous areas for people and machinery. Workers and equipment are protected from injurythreatening events by being forewarned of no-go-zones. No-go zones are identified in IDS GeoRadar's IBIS Guardian software, which creates geofenced zones and hazard maps, and is correlated with radar alarms. Guardian's integration with CAS 4.6 and complementary HxGN MineProtect solutions, Personal Alert and Tracking Radar, ensures that alarms are automatically triggered when a no-go zone is approached.

PRODUCT LAUNCH

June 16, 2020 - September 15, 2020

Trimble Announces the Next Evolution of its Flagship GNSS Solution

Trimble has introduced the Trimble R12i GNSS receiver, the latest addition to its Global Navigation Satellite System (GNSS) portfolio. The Trimble R12i incorporates Inertial Measurement Unit (IMU)-based tilt compensation using Trimble TIP™ technology, which enables points to be measured or staked out while the survey rod is tilted, empowering land surveyors to focus on the job at hand and complete work faster and more accurately.

ZEB Go Launches a New Era for Mobile SLAM

There's a smarter way to map and understand spaces, and it's called the ZEB Go. The latest member of the ZEB family has arrived, bringing lower cost SLAM to even more people.In a familiar shell, but with new components and the smartest SLAM, it's already delivering cost effective 3D data for some of the world's largest construction companies.Optimised for use in indoor and underground environments, the ZEB Go lets operators, regardless of experience or technical surveying skill, rapidly create 2D and 3D digital models. Collecting 43,000 points per second with its rotating sensor, accuracy of 1-3cm, and with an IP rating that'll withstand life on a construction site or down a mine, the ZEB Go is renowned for being easy to use and robust.

Locus GIS to Collect Geospatial Data with a Comfort of Your Mobile Phone, Even Without the Need of Internet

The application allows the easy and fast collection and updating of geodata directly in the field, using a phone or tablet running on the Android operating system. Adding to the advantage filed data can be collected even without the need for an Internet connection. Geographic features can be collected as Points, Lines, and Polygons features, all using a mobile phone that captures movement and GPS position. For a more accurate localization, the application uses Bluetooth to connect to an external GPS antenna.

OnPOZ Collect and Cloud Mappings Apps for Geospatial Data Collection

OnPOZ CollectTM is a powerful GIS mapping app that transforms a phone or tablet into a geospatial data collection tool. You will be ready for the field, whether you are completing an inventory assessment, infrastructure inspections, damage reporting, forestry projects or a variety of other project types. OnPOZ Cloud lets you manage your data and monitor field workers from anywhere via your favourite web browser. All projects and field data are synchronized and securely stored in the cloud.

Pointly – Next Level 3D Point Cloud Classification Tool Launched

Supper & Supper has launched Pointly, a SaaS solution allowing to manage and classify 3D point clouds with the help of AI. With Pointly, information from 3D point clouds can be extracted with minimal effort and high accuracy. Pointly enables the user to select large swathes of ground with one click and small objects like street signs with the next. What is important, the point clouds are available in their full resolution without compression.

PCI Geomatics Releases New Features & Full ICEYE SAR Sensor Support in Geomatica Banff

PCI Geomatics has announced the release of new features, and enhancements, as well as full support for data from ICEYE's constellation of SAR satellites. Leading the list of new capabilities and enhancements are: Super Registration, Automated Object-based Classification and InSAR performance boost.

GEO EVENTS

October 13-15, 2020
InterGeo 2020
Berlin
https://www.intergeo.de/intergeo-en/

October 13-15, 2020
InterGeo 2020
Berlin
https://www.intergeo.de/intergeo-en/

November 23-24, 2020
Fair-Congress Geomática Andina 2020
Bogota Colombia
https://geo.sofexamericas.com/

December 1-3, 2020
Commercial UAV Expo Europe
Virtual
https://www.expouav.com/europe/

March 24-25, 2021
Geo Connect Asia 2021
Singapore
https://www.geoconnectasia.com/

April 23-25, 2021
GISTAM 2021
Prague, Czech Republic
http://www.gistam.org/

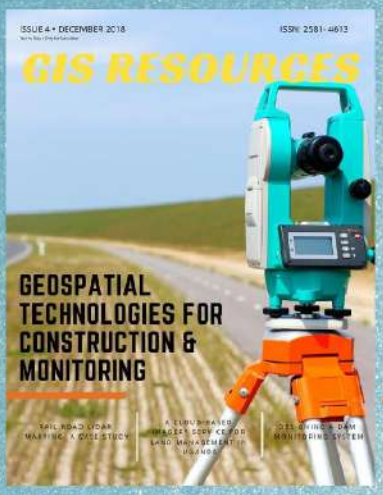
May 19-20, 2021
GEO Business
London, UK
https://www.geobusinessshow.com/

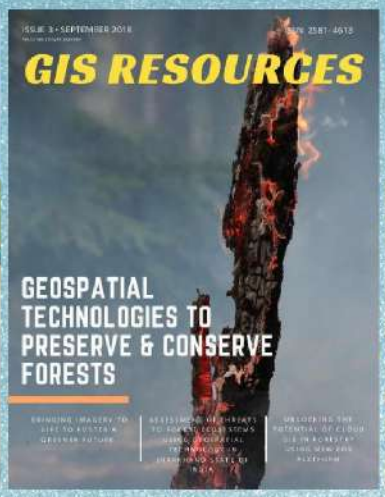
July 4-10, 2021
XXIV ISRPRS Congress
Nice, France
http://www.isprs2020-nice.com/

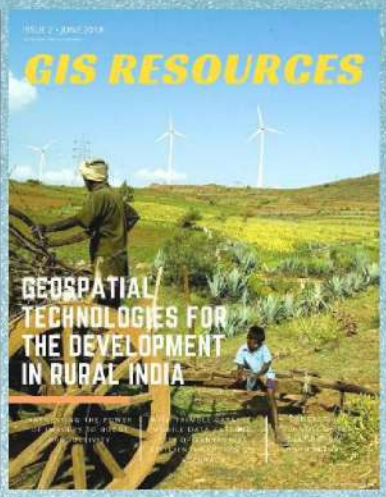
August 24-27, 2021
FME International User Conference 2021
Vancouver, Canada
https://www.safe.com/fmeuc/

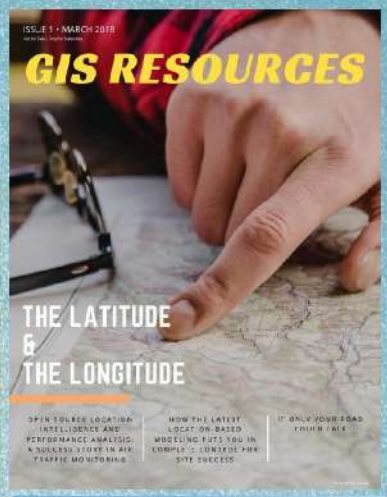
The Next Big Issue

Subscribe to Our Quarterly Magazine and never miss another issue again.









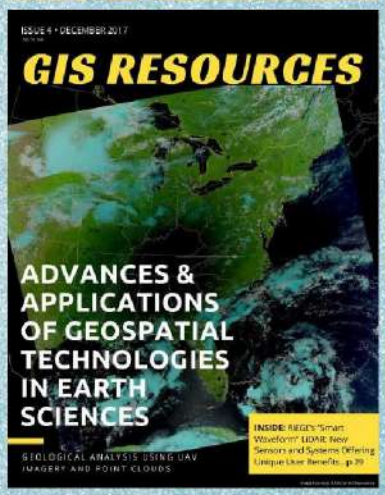
Do you want to **promote** your **product** and **services**?

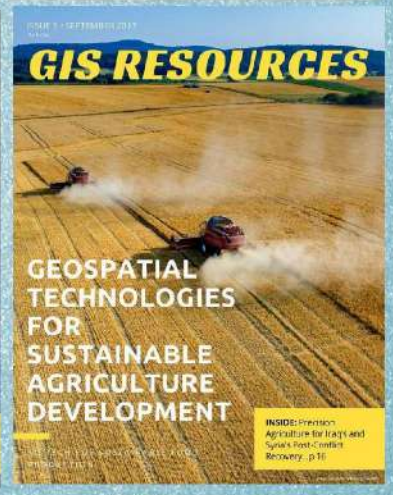
Advertising With Us Works

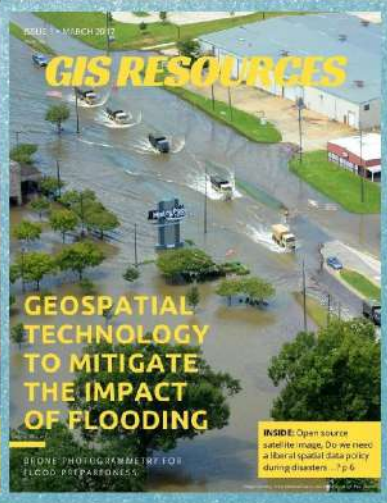
To know more Download

Media Kit

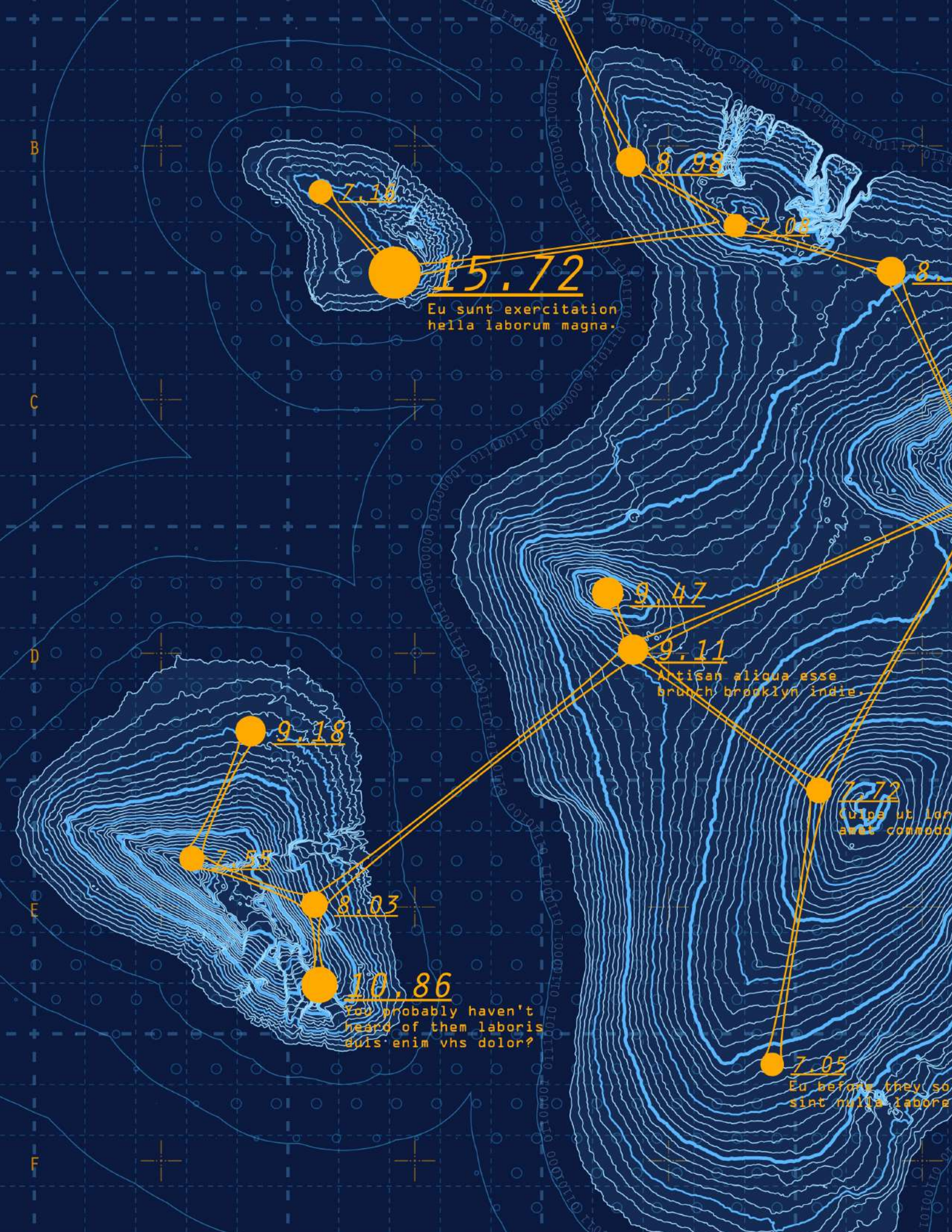
Subscribe Now







For enquiry, write us at support@gisresources.com


B
C
D
E
F
8.98
7.16
7.08
15.72
Eu sunt exercitation
hella laborum magna.
9.47
9.11
Artisan aliqua esse
brunch brooklyn indie.
9.18
7.55
8.03
10.86
You probably haven't
heard of them laboris
duis enim vhs dolor?
7.72
7.05
Eu before they so
sint nulla labore