orbit

MAGAZINE FOR SMART 3D MAPPING

CONTENT

TRENDWATCHER

SPOTLIGHT

SOLUTIONS

COLOPHON

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EDITORIAL

Dear Reader,

For sure everyone looks at the bright future that the idea of Smart Cities represents. Being an expression that covers many different concepts and ideas, there's one element that brings it all together : the need for 3D Mapping.

Yes, there's no Smart City without Smart 3D Mapping. Cities and governments need to manage their space and territory, be it with ever more smart assets and instruments to monitor, plan and optimize their operations. All this to result in a more resilient and sustainable way of living.

Each one working in the geospatial industry has a part in this future, be it as surveyor, drone operator, constructor, contractor, engineer, transport and utility corporation and governmental organization.

As Orbit GT, we see it to be our task to provide for the software tools to build this fundament of the Smart City, by helping to properly collect, process, optimize and disclose 3D Mapping content with the ultimate goal of improving the way society manages its environment and cities.

Our portfolio equally addresses to countless people involved in the many phases and tasks to improve the quality of our infrastructure, public services and policies, as well as optimizing workflows for numerous corporations working with 3D spatial content. The stories included in this magazine are a lively representation hereof, and I hope they are inspirational for many readers.

We invite you warmly to join us in this journey.

Enjoy !

Peter Bonne

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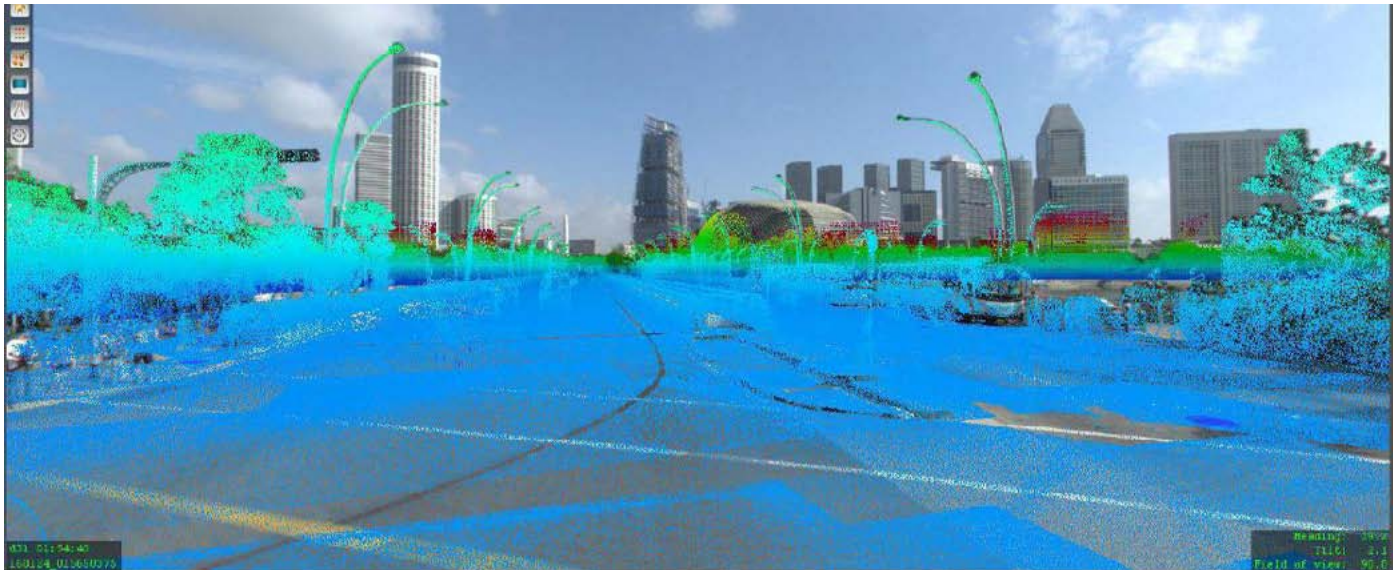
SINGAPORE SMART NATION EMBRACES 3D LAND MANAGEMENT

AS PART OF SINGAPORE'S QUEST TO BE A SMART NATION, THE SINGAPORE LAND AUTHORITY (SLA) EMBARKED ON A 3D NATIONAL MAPPING INITIATIVE IN 2014. THE INITIATIVE INVOLVES MAPPING THE ISLAND NATION OF SINGAPORE VIA AIRBORNE LASER SCANNING, ALONG WITH AERIAL IMAGERIES AND MOBILE LASER SCANNING & IMAGING. ORBIT TECHNOLOGY WAS USED TO MANAGE THE CONTENTS OF THE DOWNSTREAM MOBILE LASER SCANNED AND IMAGED DATA. THE EASE OF USE AND THE INTERACTION OF THESE HIGH-QUALITY DATASETS WITH ORBIT TOOLS HAVE OPENED UP MANY POSSIBILITIES FOR STAKEHOLDERS WITHIN THE GOVERNMENTAL AGENCIES TO EFFICIENTLY MANAGE FEATURES AND ASSETS OF INTEREST. ORBIT GT IS PROUD TO PLAY A PART IN SINGAPORE'S SMART NATION QUEST.

Overlay extracted objects on spherical view and reference map



A Singapore skyline in spherical view with point cloud overlay

Introduction

The Singapore Land Authority (SLA) is a statutory board formed in June 2001, which manages Singapore's land resources. Its vision: managing the country's limited land to create unlimited space. SLA is thus dedicated to optimising land resources for the economic and social development of Singapore. As Singapore is a small island nation, land needs to be managed in the most efficient way. This can be achieved by creating space above and below ground.

When spaces are created above and below ground, 2D maps are no longer adequate to fully represent the real-world GIS information in Singapore. The airspace and subterranean spaces are all being overlapped together with the ground level, making it hard to visualise and represent them on a map.

In 2014, SLA embarked on a journey to create a Singapore Advanced Map (SAM) by mapping the whole island nation of Singapore with 3D Geospatial Data through the 3D National Mapping project. This is part of the Smart Nation initiative led by the Smart Nation and Digital Government Office, Singapore. The aim? Improving the lives of citizens, creating more opportunities and building stronger communities by harnessing technology and gathering insights from data to the fullest.

3D National Mapping

The demand for 3D map data is increasing, as 3D data can assist in land development planning, management of underground utilities and infrastructure, flood management, urban airflow analysis, solar potential studies and many other applications.

There are some factors to consider when defining the methodology to collect 3D data. They are: accuracy, level of detail, reliability, area coverage, data format and appearance. In the traditional method of collecting GIS data, it is possible to just perform a 3D topology around Singapore, but the level of detail and appearance will not be adequate for the creation of 3D models; the physical appearance will not match the real-world appearance. By using and exploring advanced mapping technologies, it was clear that 3D laser scanning with imagery is the best available solution that addresses the considerations for collecting 3D data.

The 3D National Mapping initiative aims to create and maintain an accurate national 3D map that is developed once and used by many. The main objectives are to have high-resolution data in order to meet the requirements of most government agencies, to have an open standard data exchange format for interoperability and data sharing, to have a common, authoritative 3D base map to support collaboration among agencies and to create a workflow for continuous maintenance to ensure currency of data.

The 3D National Mapping Project is carried out in two phases. Phase one is to capture and create an Orthophoto map of Singapore and to capture the digital terrain and digital surface data of Singapore. Phase two is to collect road and street data as furniture to supplement the data collected in the first phase of the project.

To achieve the goal for phase one, airborne laser scanning and imagery equipment was used. Two twin-engine aircrafts were mobilised, and one set of equipment mounted on each aircraft. The aircrafts were pre-programmed with the flight path data and were launched to capture both vertical and oblique images. They simultaneously performed 3D laser scanning. The whole data collection exercise was

completed in 40 days. Collected 3D data was then processed and put to use to create the Digital Surface Model (DSM) and Digital Terrain Model (DTM). The images were also used to create an Orthophoto of the whole of Singapore. The vertical and oblique images paired with the point cloud data were used to create 3D building models. This data also serves as a base to create the overall framework of the Singapore Advanced Map.

The second phase of the 3D National Mapping project involved a comprehensive mobile mapping project. This was carried out by a mobile mapping laser scanner with a panoramic camera mounted on a vehicle.
This way, ground-based laser scanning and a 360° panoramic imagery dataset was collected on approximately 6,000 km of roads in Singapore. This exercise captured all road and street features such as trees, fire hydrants, traffic lights, lampposts, etc. This mobile mapping 3D data enriches the airborne 3D data with fine detail, at the same time verifying the accuracy of all the building models.

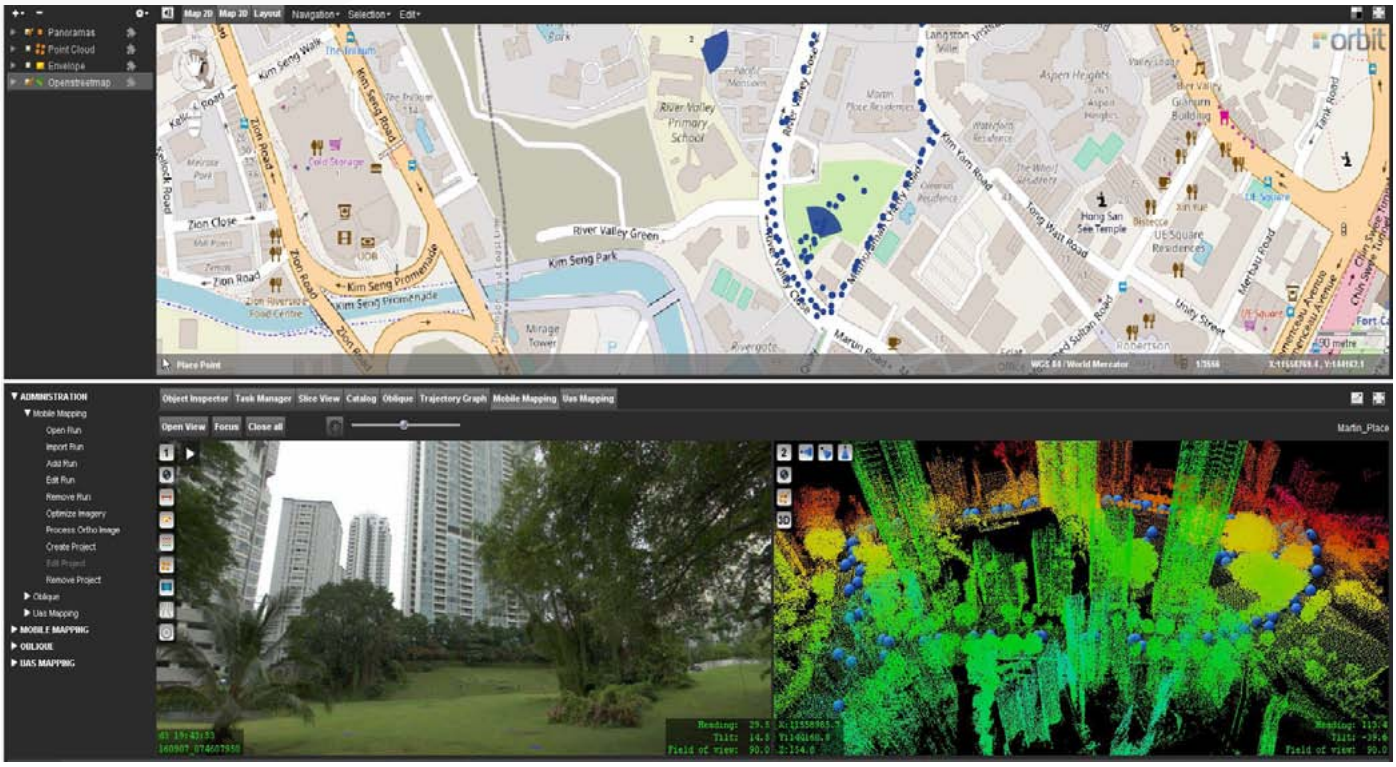
Orbit GT Smart City Solutions

When the data sets are collected and being processed, the question of how to combine all of them to verify and view them together comes in. The data sets are huge and the point cloud processing software available could not handle their size. They become useable when they are pieced together and can have features extracted from the data.

GPS Lands Singapore, an Orbit GT partner, approached SLA with a solution that allows SLA to piece all their data sets together in a single platform, where they can view and verify the data that was collected and processed.

This is made possible with the Orbit's 3DM Content Manager, which allows the processed pointcloud data and panoramic images to be imported as runs. All the imported runs can be loaded together for viewing as a whole. This is where the data sets can be verified in a large overall scale to check for any mismatched data. The pointcloud data also shows the accuracy of the orthophoto map created from the airborne imagery when overlayed as the base map in the 3DM Content Manager.

The features available within the 3DM Content Manager enable SLA to manage the data sets at ease by grouping the data and loading them separately when required. For example, the mobile mapping data of northern Singapore is made up of



Orbit 3DM Content Manager

several point cloud data sets. In the 3DM Content Manager, these data sets can be imported as runs and added into a project to be grouped together. In this way, data can be managed easily, and according to the user's requirements.

A critical component of the 3D National Mapping initiative is data sharing with stakeholders. The main stakeholders come from across governmental agencies, research institutes and other parties of interest. The next step is to be able to extract the 3D features from the GIS data. The Orbit 3DM Feature Extraction is the next tool to be used by SLA to perform feature extraction from their 3D data. In land management and administration, the exact details on the ground provide crucial information for the government to plan and make decisions. Being able to view rich data captured in 3D without having to be physically on the ground is an efficient allocation of resources.

In a particular example of collaboration with government agencies, tree features across Singapore are being extracted as points, with the attributes or coordinates and height. This information allows relevant agencies to manage the greenery of Singapore, to provide high-resolution information for carbon accounting and also to identify the location and estimate number of trees on State Land.

There are also other use cases where features such as lampposts, curb lines and manholes are extracted to perform verification of the existing GIS data of other agencies, as part of their asset inventory management. Exact coordinates of the data and accurate measurement can be done without having to go on the ground for GIS data collection.

By identifying the features on the ground, extracting and exporting those features allows them to be shown on a map at a single glance. This information can be exported and shared with different government agencies, using GIS data to provide them with visibility of their assets. Without having 3D geospatial data, the extracted features can be overlaid in 2D form as the data can be exported in various available formats which can be used immediately with 2D GIS data.

Moving forward

In Singapore's quest to become a Smart Nation, SLA continues to explore advanced GIS technologies to build and enhance the Singapore Advanced Map. As a plan to move forward on sharing data with various government agencies, SLA is engaging the Orbit 3D Mapping Cloud solution for publishing the 3D data. This enables agencies to benefit from the 3D GIS data for their own use cases.

ABOUT THE AUTHOR

Johnson Ang is the Project Manager in GPS Lands (Singapore). He has 10 years of experience working in the land survey industry.

Originally from the IT industry, Mr Johnson's subsequent experience with GPS Lands, has allowed him to integrate knowledge from the land survey industry with IT knowledge, and implement advanced GIS solutions.

His team specializes in GPS infrastructure system setup and customization and also Orbit GT solution setup.

ABOUT GPS LANDS (SINGAPORE)

GPS Lands (Singapore) was incorporated in 1999. The company's primary purpose is to carry out sales, service, training and support for Trimble GPS. Over the years, GPS Lands had evolved from a traditional GPS equipment selling company into a provider and consultant of technologically leading geospatial solutions. GPS Lands achieved this by keeping up with emerging market trends and staying in the forefront of geospatial technologies. GPS Lands strives to explore new technology and innovate to provide comprehensive geospatial solutions.

"We will continue to invest in equipping our team to be the best for the sole interests of our valued customers, who have placed their trust in us and supported us all these years." Gerry Ong (Founder & Managing Director – GPS Lands). www.gpslands.com

BRINGING 3D MAPPING TO THE PEOPLE OF KUWAIT

IN COLLABORATION WITH MENA3D, THE PUBLIC AUTHORITY FOR CIVIL INFORMATION (PACI) OF KUWAIT IS IMPLEMENTING A MOBILE MAPPING SOLUTION TO PROVIDE 3D PANORAMIC MAP DATA FOR 'KUWAIT FINDER' SERVICES.

THE PUBLIC AUTHORITY FOR CIVIL INFORMATION (PACI) OF THE STATE OF KUWAIT HAS PURCHASED A MOBILE MAPPING HARDWARE AND SOFTWARE SOLUTION FROM MENA3D. PACI WILL USE IT TO IMPLEMENT A REALISTIC 3D COUNTRY MAP INTO 'KUWAIT FINDER', A PRE-EXISTING PUBLIC-SERVICE WEB AND MOBILE APPLICATION, AND INTO OTHER GIS SERVICES OFFERED BY PACI TO GOVERNMENTAL AND PRIVATE ORGANISATIONS. THE MAPPING EFFORT IS PART OF KUWAIT'S OVERALL STRATEGY GOAL OF 'PROVIDING GIS AS A GOVERNMENT SERVICE'.

Kuwait's 3D Mapping team

Orbit 3DM Publisher for webhosting

A unique address system

When it comes to getting directions for a planned journey, all of us nowadays rely on online applications. However, in Kuwait, these mapping applications are only useful on the street and POIs. Buildings and houses are not available. And yet, these missing address details are very crucial, as the way of using address information in Kuwait is different than in other countries. People include these details in how they communicate address data to each other.

In the past, people in Kuwait struggled to find a specific building. The Public Authority for Civil Information (PACI) intervened, inventing an address system that is unique in the world: it gives every resident, establishment and even building and flat a unique ID. All IDs are linked together so that every resident can be associated with his or her residence and every business can be linked to its establishment. PACI provides these address data via 'Kuwait Finder', a free public mobile and web-based service, and via different APIs and interfaces for both the private and governmental sector.

Kuwait finder

The 'Kuwait Finder' application for the public, governmental and private sectors is currently used by more than 650,000 people in Kuwait, with more than 1,200,000 hits per day. To develop the services even further, PACI released a new version of 'Kuwait Finder' back in March 2018. Its added functionality, a panoramic street view, was well received by the user community. PACI now intends to also provide a full 3D map service for the country, which will allow users to see the streets of Kuwait in realistic 3D panoramic view.

To provide such a high-definition map for the State of Kuwait, PACI evaluated different solutions from various vendors in terms of their usability features. In this case, the primary requirement was the possibility to use the solution for both Mobile Mapping as well as for terrestrial scanning applications. The software should be able to host numerous concurrent users to ensure an excellent user experience.

Mena3D

Since PACI is always looking for and evaluating the best technologies that meet its requirements, it reviewed several LiDAR technology and solution providers. PACI eventually selected Mena3D, which analysed PACI's requirements and suggested a state-of-the-art technology solution which is currently on the market and which addresses PACI's needs 100%.

Mena3D provided the RIEGL VZ-400i laser scanner with the Mobile Mapping Feature VMZ in combination with the Orbit 3DM Content Manager, Orbit 3DM Feature Extraction & Orbit 3DM Publisher software.
The innovative laser scanner offers the perfect combination of a new processing architecture, including internet connectivity, with the latest LiDAR technology. Dual processing platforms enable a real-time data flow. Thanks to its integrated orientation sensor, this scanner's up to 1200 kHz pulse repetition rate can be perfectly utilised in the State of Kuwait. Moreover, it offers very high precision, a wide field of view (100° x 360°) as well as a range of up to 800 m, with 5 mm accuracy.

The Hybrid Mobile Laser Mapping System enables the combination of static and kinematic data acquisition and lowers the mobilisation cost. This way, city modelling is simplified, thanks to easy mounting, a flexible setup and a user-friendly workflow. These features

are absolutely helpful for the creation of high-resolution pictures of Kuwait, getting a high-quality street view.

The appropriate software

Of course, every hardware needs the appropriate software. Orbit 3DM Content Manager, Orbit 3DM Feature Extraction & Orbit 3DM Publisher software fit the application perfectly. They offer limitless imagery and point clouds which allow the management of every single run and the bundling of raw data into manageable projects. This way, all 3D data is optimised for performance. Manual, semi-manual and automated measurements can easily be performed thanks to the intelligent Feature Extraction solutions.

Furthermore, it can be embedded and integrated in any host so that everyone can access the mobile mapping content from within their workflow. Finally, the 3DM Publisher software enables every single citizen of Kuwait to access the 3D mapping data thanks to the availability of unlimited volumes of planar/panoramic imagery. With the help of the 3DM Publisher, 3D data can be published from local servers and shared over the internet to web browsers, mobile devices, embedded viewers and integrations in enterprise or customer workflows. The shared 3D mapping data is easily accessible within the 'Kuwait Finder' web and mobile applications. But who will operate it?

Young Kuwaiti GIS specialists

PACI has assigned a dedicated group of young Kuwaiti GIS specialists who will be responsible to capture, process, and analyse the data, using the hardware and software provided. This group underwent intensive training in handling the entire workflow. PACI had a very strong and important message: **"It is very important for us to empower our Kuwaiti national youth with the knowledge and expertise about this new technology to the level at which they become a national reference in this high tech"**.

PACI has provided all the support needed in order to achieve this. In March 2018, Mena3D supplied and installed the equipment and trained the PACI personnel on hardware and software. Moreover, Mena3D is providing after-sales support for this extraordinary project. "During the training at PACI, we have noticed our client's broad expertise in terms of surveying and we are very optimistic about the project outcome", says Dr.-Eng. Khaled El Nabbout, General Manager at Mena3D. "The first results are very promising. We are planning to launch these within a couple of months", explains Maher Abdel Karim, GIS Consultant at PACI.

Mobile Mapping system mounted on vehicle (Source: PACI)

ABOUT PACI

The Public Authority for Civil Information (PACI) is responsible for the registration of people, addresses and establishments in the State of Kuwait.

The main objectives of its civil information system therefore are: the registration of individuals' data; the creation of a unified identity, including facts like name, nationality and address; and the allocation of a unified civil number for everyone.

Further objectives are the establishment of a unified National Bank for civil information, including the provision of information for government agencies, institutions and every single person in Kuwait

RIEGL VMZ VZ-400i Mobile Mapping system in Kuwait (Source: PACI)

ABOUT MENA3D

As a leading company on 3D measurement, Mena3D offers complete 3D measurement and geospatial solutions for a broad range of applications.

Mena3D's strength is the knowledge in 3D technologies and expertise in the 3D market development, especially in the Middle East and North Africa.

Mena3D is a Europe-based company with headquarters in Germany and several offices in the MENA region.

MUNICIPALITY OF DONOSTIA/SAN SEBASTIÁN, PIONEER IN MOBILE MAPPING FOR CITIZENS

OPEN GOVERNMENT AND TRANSPARENCY ARE THE KEY COMPONENTS OF A MODERN MUNICIPAL STRATEGY. WITH THESE CORE PRINCIPLES IN MIND, THE CITY COUNCIL OF DONOSTIA/SAN SEBASTIÁN DECIDED TO EMBED ORBIT 3DM PUBLISHER IN ITS WEB ENVIRONMENT, IN ORDER TO PROVIDE ITS CITIZENS WITH THE MOST ACCURATE AND UP-TO-DATE MAPS OF THE CITY.

History

In compliance with the European INSPIRE directive, the City of Donostia/San Sebastián is the competent authority to generate, organize, manage and share municipal geographic information. For this reason, the City Council has been in charge of the management and maintenance of the Municipal Base Cartography (MBC) since the year 2000.

This MBC, as a representation of the municipal territory, is produced mainly with traditional topographic techniques and is able to represent the buildings, walls, sidewalks, signs, street furniture and a long etc. of our city with accuracy down to the centimeter. From the beginning, it was a priority of this municipality to share and publish externally all geospatial information, so it would be available to different user profiles.

As a result of that broad scope, a Web Viewer and a public download portal were developed.

At present, the MBC of Donostia/San Sebastián is used not only by municipal services but also by external users. At City Council level, the data is used by Urban Planning, Works and Projects, Environment, Municipal Guard, the Fire Brigade, etc.

Donostia Oinez powered by Orbit 3DM Publisher

Externally, it is used by the Cadaster and Territorial Planning offices of the Region of Gipuzkoa, as well as by engineering and architecture firms, other professionals and citizens. In all cases, the MBC fulfills the expectations of a multipurpose, updated and accurate cartographic service.

Mobile Mapping in Donostia/ San Sebastián

In 2012, the City of Donostia/San Sebastián tested a new technology, called Mobile Mapping, in several of its districts. Thousands of photographs were taken, and millions of points were measured in order to support its cartographic service and asset management. The technique was used in different scenarios, such as Projects and Works, Construction, Maintenance, Emergencies, Traffic, Security, Asset Management, Tourism, Urban Planning, etc.

In 2016, the City Council chose Geograma to carry out the Mobile Mapping survey of the complete city, with almost 400 km of road street network.

Once the municipality had access to a powerful source of geospatial information, the next phase of the project, finished at the beginning of 2018, focused on providing the Mobile Mapping data to the citizens. This new web environment, called **Donostia Oinez**, is embedded with the **Orbit GT** software technology, specifically the platform **Orbit 3DM Publisher.**

The new web application of the municipality makes use of this mobile terrestrial technology to provide more than 115.000 panoramas and over 3,5 million of measured cloud points, that can be downloaded and reused by both citizens and professionals.

"This new generation of embedded tools reinforces the commitment of the City Council to open government and transparency: we make available to all citizens the information we generate in our everyday life" said **Ibón Ramos**, Director of the Municipal Information Unit at Donostia/San Sebastián.

With the use of **Donostia Oinez** based on Orbit technology, users gain access to an ecosystem that not long ago would have been unthinkable!
Private companies that work in facades are able to quote their services with higher accuracy, without the need for complicated measurements in situ, reducing resources and increasing security.

Citizens are able to measure both surfaces and heights, distances from their house to containers, heights of trees in front of their windows... allowing them to complain about certain situations. Municipal services – the fire department, for instance – can measure the height of buildings to foresee the infrastructure and materials needed in case of emergencies. They can both quantify and qualify the existing obstacles on any street, helping them to select the emergency vehicle that will get them to the location.

ABOUT THE AUTHORS

Juan Miguel Álvarez, Geoinformation Manager at Geograma and project leader; and Ibón Ramos, Director of the Municipal Information Unit of the Municipality of Donostia/San Sebastián and lead project manager.

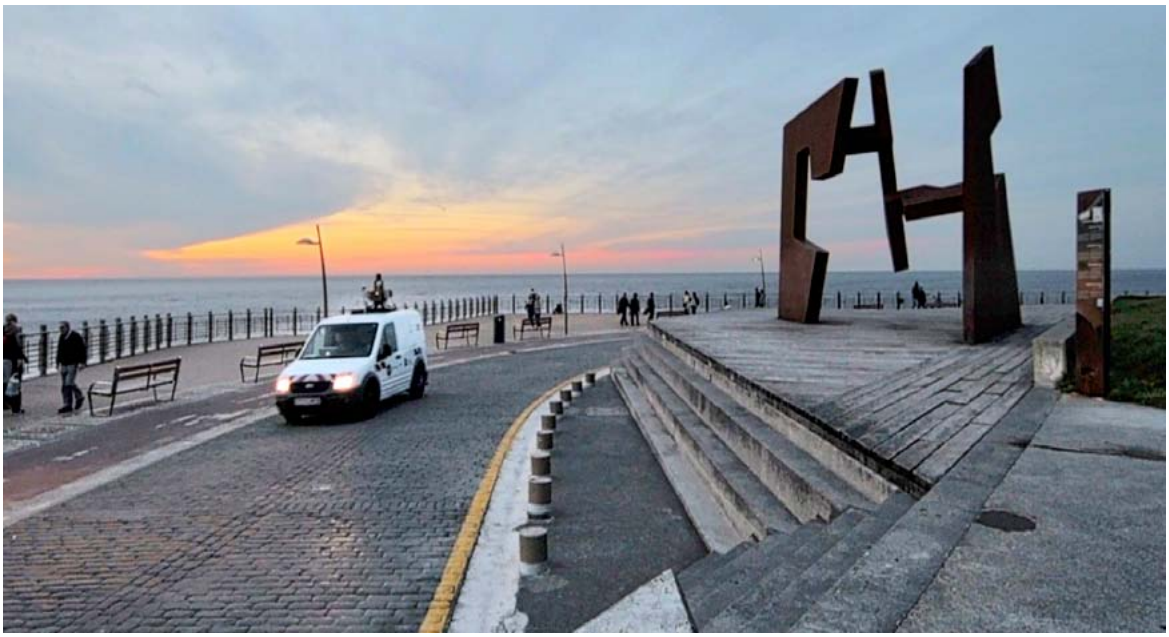
ABOUT GEOGRAMA

Geograma is a Spanish company founded in 1998, specialized in providing geoinformation solutions and services to both public and private customers. The company has relevant references in digital mapping through Mobile Mapping technologies and maintenance of reference cartography to different bodies of the Spanish Public Administration.

Geograma's services are: field data collection services, geoinformation projects, development of geosolutions, consultancy, cloud geoservices and licensing of geospatial tools and data. The skills of the company cover the whole cycle of the geographical data, which provides a different perspective to ensure the success of the projects. Geograma works with a team of 35 GIS consultants.

Donostia Oinez links

Viewer: http://www.donostia.eus/DonostiaOinez/Donostia/index.html
YouTube (English subtitles): https://www.youtube.com/watch?v=_pqKVh5I_14
Local TV Media: https://www.eitb.eus/es/noticias/sociedad/videos/detalle/5314337/donostia-oinez



Donostia Oinez, the new viewer of the Municipality

MANAGING STREET-SIDE TREES IN SOUTH KOREA

THIS PROJECT IS TO CONSTRUCT A SYSTEM FOR STREET TREE MAINTENANCE THAT WILL SYSTEMATICALLY PERFORM TASKS RELATED TO STREET TREE GROWTH, REPELLING INSECT ATTACKS, STATISTICS FOR URBAN PLANNING AND MORE. INITIATED IN JUNE 2018 BY THE LOCAL GOVERNMENT OF HAMAN CITY IN KYUNGNAM PROVINCE, SOUTH KOREA, COMPLETION IS DUE BY NOVEMBER 2018.

A Street Trees Maintenance Database

In 2006, the South Korean government launched a measure to promote 'The planting and maintenance of street trees'. Each local government has since been participating in the street trees planting project. However, the project was not properly organized, so a the consortium in which C2L Equipment is participating is now trying to optimize it – starting with the case of Haman city. This local government-sized project is planned to expand nationwide.

Operations

A basic element in this 'Street Trees Maintenance' project, C2L Equipment builds a location-based street tree database. We are using our own Mobile Mapping System (MMS), Nebula_LP, for field surveys. This MMS consists of a panoramic camera (Ladybug 5+, FLIR), LiDAR (HDL-32, Velodyne) and INS (POS LV210, Applanix).

The local government has decided to use MMS for collecting street tree data because MMS is the most efficient tool for street tree data acquisition. It actually took only two weeks with 2 persons to collect all the MMS data in Haman city. The site is a 200 km long local road in Haman city. There are about 20,000 street trees along the road.

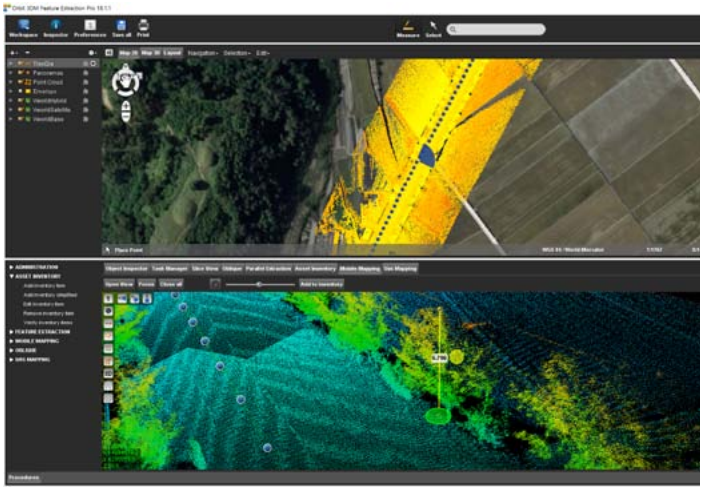
From the 3D Mapping content acquired using MMS, we extracted all relevant data for each tree: species, height, breast height etc. The panoramic image is used to distinguish the species of trees and this image data will be converged with point cloud data to finetune other inventory elements.

This new data will be converged with the existing, old-version maintenance files and documents to produce an up-to-date Street Trees Maintenance database. This post-processing work requires three persons for three months. The data survey by MMS was designed in advance using 3DM Content Manager and all the measurement data was extracted using Orbit 3DM Feature Extraction.

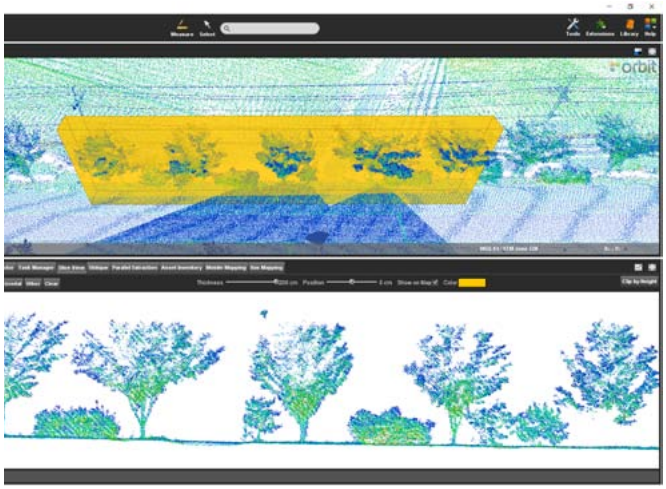
Conclusion

The meaning of this project is very important since this is an exemplary case to build a multiple geospatial information database in local government by using MMS and its postprocessing Software, Orbit, very precisely in a short period of time. Success in providing good results , the needs and demand for MMS and Orbit S/W in the geospatial information database market will increase dramatically. We are confident that quite a large number of local governments will follow the same technique as setup in this project.

Written by Bratt Lee, CEO
C2L Equipment, South Korea



Measurements of Tree attributes in Orbit 3DM Feature Extraction Pro



Using the Point Cloud Slice tool to separate trees from the surroundings in Orbit 3DM Feature Extraction Pro

LA MATANZA, ARGENTINA, OPTIMIZES PUBLIC ADVERTIZING USING MOBILE MAPPING

"THE SURVEY AND IDENTIFICATION OF PUBLIC ADVERTIZEMENT SPACE FOR THE CALCULATION OF THE ADVERTISING RIGHTS OF LA MATANZA ALLOWS THE CITY TO QUANTIFY AND TYPIFY ALL THE INSTALLATIONS AND/OR ADVERTISING ELEMENTS THROUGH WHICH THE ECONOMIC ACTIVITY OF A CERTAIN SOCIAL ACTOR IS DEVELOPED AND MATERIALIZED ACCORDING TO THE ORDINANCE TARIFF 2017 FOR THE ADVERTISING RIGHTS OF THE MUNICIPALITY OF LA MATANZA.

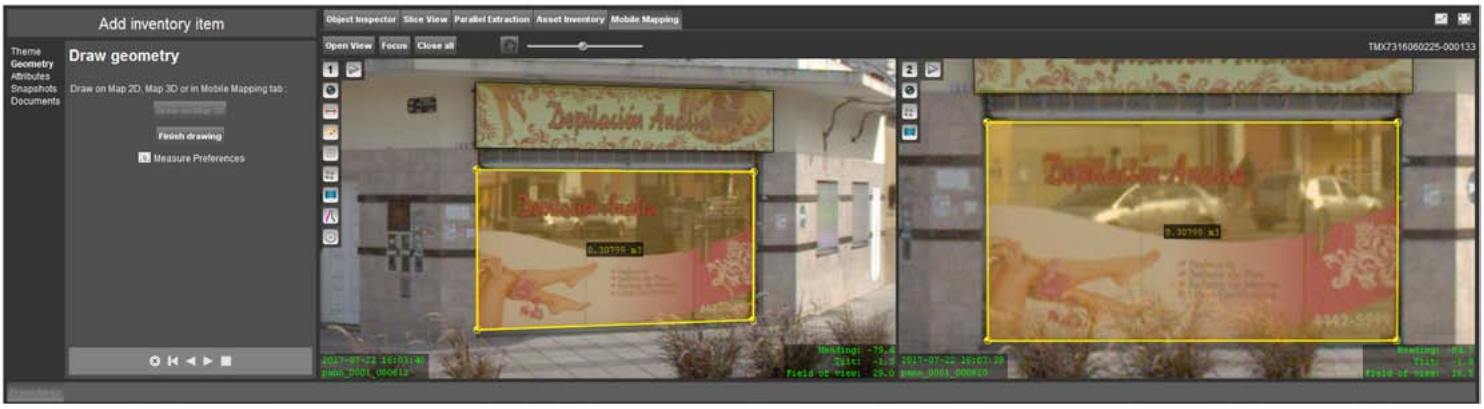
THE COMMERCIAL MARKET IS ONE OF THE KEY AXES IN THE ECONOMIC DEVELOPMENT OF A COUNTRY, REGION OR CITY. PUBLIC AND PRIVATE SECTOR INSTITUTIONS MUST ENSURE THE PROTECTION AND IMPROVEMENT OF THE VALUES OF THE URBAN LANDSCAPE AND ITS IMAGE."
- IRINA LONGO.

A Taxable Advertizements Database

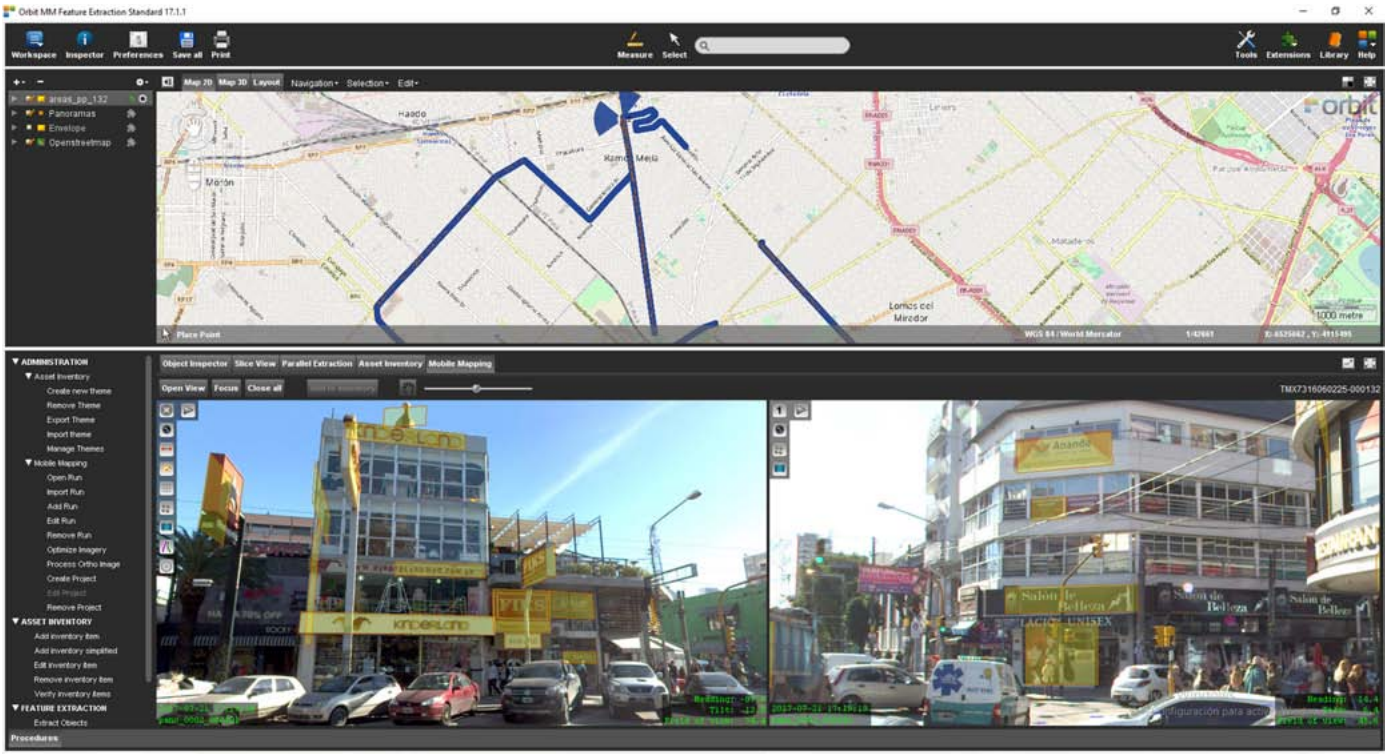
The Municipality of La Matanza hired Genmap S.A. for a 360° survey of its main avenues. The aim was to identify and measure all advertising elements present on public roads. The fundamental purpose of this project was to complete and update the database used to tax public advertising. On this database and from subsequent processes, lists of posters obtained by the survey were linked to the alphanumeric database that prepares the payment forms. As a result of this process, a very important number of posters that were not declared were added to the database – thus providing an economical justification for the cost of the survey.

Additionally, the database obtained with Mobile Mapping allows the detection and geopositioning of all the elements of the equipment and street furniture that are found along the public road. It also allows for the verification of the quantity and state of health of all the trees, semaphores, lighting poles, aerial poles and cables, state of the road and sidewalks, among other traits that can be captured and categorized. The software tools used for this project were equally provided to the municipality, along with 'on-the-job' training, which will allow us to maintain and obtain new information from future surveys.

Applying Mobile Mapping technology, Genmap, Authorized Reseller of Orbit GT, surveyed the main streets and avenues of the municipality of La Matanza, Province of Buenos Aires,



Advertizement panel shown in 2 subsequent images in Orbit 3DM Feature Extraction



Many advertizements on buildings along the trajectory in Orbit 3DM Feature Extraction

Argentina. This project enabled the municipality of La Matanza to optimize the income from Advertising Rights as one of the fundamental tasks that guarantee economic sustainability and the principle of equity towards the taxpayers of the municipality.

Project Execution

In July 2017, the municipality of La Matanza began to investigate new techniques for capturing data on public roads in order to improve collection of municipal taxes.

There has been a boom of modern technologies that allow the capture of spherical images in 360 degrees with equipment mounted on cars. This complies with the requirements for surveying the public environment. In the particular case of our municipality, this technology allowed us to extract the elements of interest (facilities and/or advertising elements).

The municipality requested Genmap to survey 80 km of the avenues and streets of greater commercial interest using Mobile Mapping technology. The aim was to extract all the advertising posted. In all, a total 120 km was surveyed between 21 and 28 July 2017.

The increase in the number of kilometres surveyed by Genmap with respect to what was requested by the municipality of La Matanza was due to the fact that some streets within the project are two-way (round-trip) or wide-margin streets, for which the company suggested us to capture both sides of the road for more detail.

The company used a Trimble MX-7 for mobile mapping georeferencing images and trajectories. Orbit 3DM Feature Extraction was used to visualize, extract and measure the taxable items.

This software enabled the creation of two models or layers of data (templates): one for all the advertising elements that could be drawn as polygons, another for all the elements without associated geometric interpretation.

The name of each data model is composed of: the name of the street surveyed, the number of the mission or project captured in the field and established in the equipment's controller software (at the time of field survey), and the type of geometry awarded to the object to be captured (point or polygon), being as follows:

- Street_mission_Polygon
- Street_mission_ Point

For example: Varela_137_poligono; Varela_137_point.

The fields that make up each data model are exactly the same. The differentiating parameter was the type of geometry captured on the images (point or polygon). The created attributes were named in the following way:

- **Categories**: Type of advertising element (Marquee, Structure, Billboard, Column, Signboard, Screen projection, etc...)
- **Sub-categories**: subtype of advertising element (Simple, Illuminated, Luminous, Animated).
- **Face**: number of sides or equal faces of the advertising element.
- **Area**: calculated automatically by the software.

This dataset allowed the end users to choose the option that corresponded to the point or vectorized polygon on the advertising element according to its characteristics.

In addition, it also allowed us to classify all the installations and/or publicity elements that make up the public road of the avenues and streets surveyed.

ABOUT THE AUTHOR

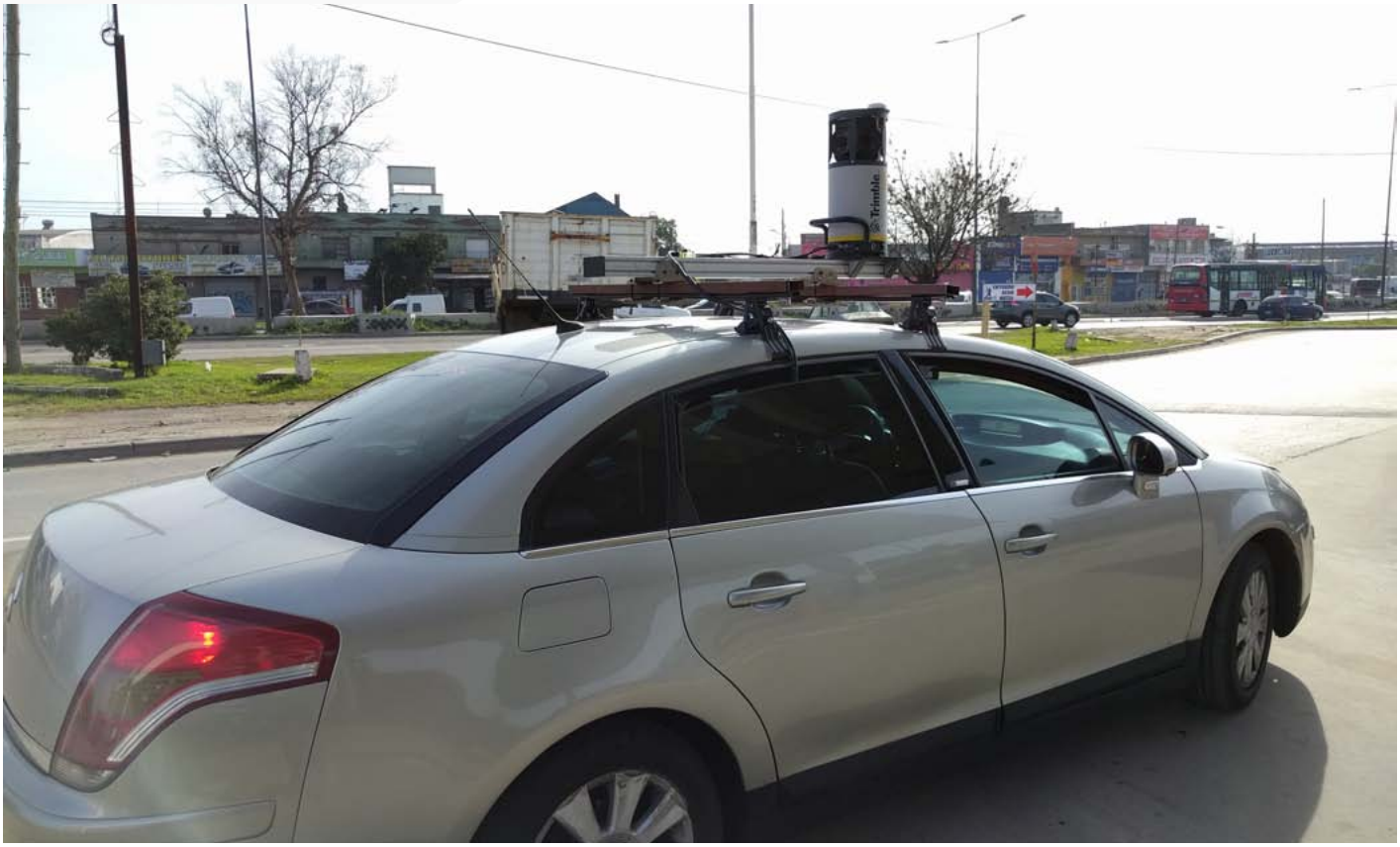
Irina Longo is a Public Accountant, graduated in 2009 in Argentina. She is Coordinator of the Advertising and Propaganda Department of the municipality of La Matanza.

ABOUT GENMAP

Genmap is an Argentine company and a pioneer in geographic information services. It generates three-dimensional virtual realities based on photogrammetric techniques and serves both the public and private sectors. Genmap is a 'map factory' that provides current data to recreate change scenarios.

It was founded in 2003 by two engineers, who have a recognized track record in the geomatics industry via their participation in large-scale projects at a national and international level. Genmap is prepared to address the Spatial Literacy paradigm, which means understanding and making effective use of spatial data.

3D Mapping using Trimble MX7



VISTA 360: THE DIGITAL TRANSFORMATION OF STREET MANAGEMENT IN COSTA RICA

ONE OF THE MOST IMPORTANT TASKS OF MUNICIPALITIES IS MANAGING THEIR TERRITORY. THIS TASK IS A DAILY CHALLENGE, BECAUSE THERE ARE MANY VARIABLES: THE MAINTENANCE OF STREETS, SIDEWALKS, PIPING, SIGNAGE, TRADE, EDUCATION, HOUSING AND FACTORIES. NOT TO MENTION THE CONSTANT SEARCH FOR A BALANCE BETWEEN THE QUALITY OF LIFE OF CITIZENS AND A RESPONSIBILITY FOR THE ENVIRONMENT.

Geotecnologias

Efficient management requires that we know all relevant variables. In the case of municipal management, the vast majority of these variables are out on the street. It has always been a challenge, not just to take daily measurements in order to take effective actions, but also to properly record these measurements. In order to have historical records of decision-making, as a basis for learning and planning for the future.

Geotecnologias recently developed a solution that measures multiple variables in the urban environment and distributes this data to various departments within the municipality. Thus improving the management of tax collection, road maintenance and repair, and the analysis of both housing stock and commercial premises.

Vista 360

We call it: Vista 360
This solution is based on three pillars and leading technologies:

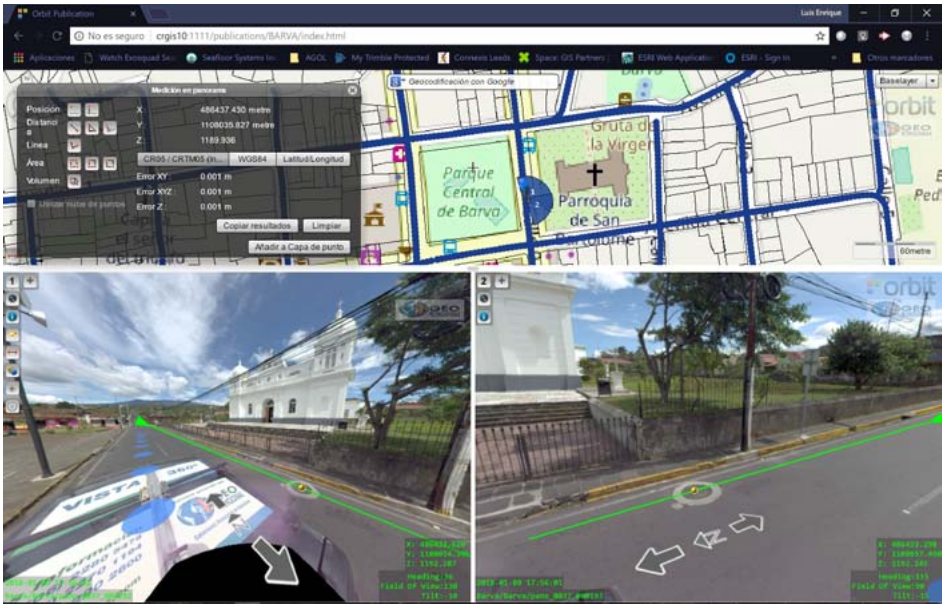
- A 360-degree lifting system – model Mx7 Trimble brand;
- A publishing and measurement system – Orbit 3DM Publisher;
- The Esri ArcGIS geographic information system.

By using Vista 360 when surveying the road network in a district and publishing it in 3DM Publisher, the municipality has a record of the route. Furthermore, it can make a series of measurements in order to validate that municipal taxes are calculated properly.

The system similarly allows to record and publish each journey made and to show the changes and improvements in the road network and the municipal environment.

At the same time, Vista 360 generates significant cost savings. Since pre-inspection and work planning are done in the office, Vista 360 reduces the need for field inspections, enabling the municipality to limit the dispatching of crews and equipment to the necessary minimum.

Vista 360 offers both the municipality and its citizens a record of their environment that enables them to make the best decisions on community issues.



Vista 360 using 3DM Publisher and its image-only measurement capabilities

ABOUT THE AUTHOR

Luis Araya is the commercial manager of Geotecnologias, Costa Rica, dedicated to work together with customers and find solutions to their problems.

ABOUT GEOTECNOLOGIAS

Geotecnologias is Trimble, Esri and Orbit GT dealer operational in Costa Rica, Nicaragua and Guatemala providing the region with top notch geospatial solutions.

MOBILE MAPPING TO IMPROVE WATER UTILITY SERVICES IN COCHABAMBA, BOLIVIA

GEOSPATIAL INFORMATION IS CRUCIAL TO PROPERLY MANAGE COMPANIES WHOSE ASSETS ARE FULLY DEPLOYED ON THE FIELD, AS IN THE CASE OF A WATER UTILITY. IN MOST CASES, GATHERING THIS DATA, WHICH IDEALLY SHOULD BE ACCURATE AND UP TO DATE, IS DELEGATED TO 'SOME TIME IN THE FUTURE'. THE FACT THAT UNTIL RECENTLY OBTAINING DATA IN THE FIELD WAS A RISKY, COSTLY AND TIME-CONSUMING TASK MAY EXPLAIN WHY IT WAS ALWAYS PUSHED FORWARD.

AMIDST THESE AND OTHER CONSTRAINTS/OBJECTIONS, CIVIS NEEDED TO PROVE THE ADVANTAGES OF USING MODERN MOBILE MAPPING TECHNOLOGIES TO HELP A WATER UTILITY COMPANY TO BUILD ITS GEOSPATIAL INFORMATION DATABASE, ALMOST FROM SCRATCH.

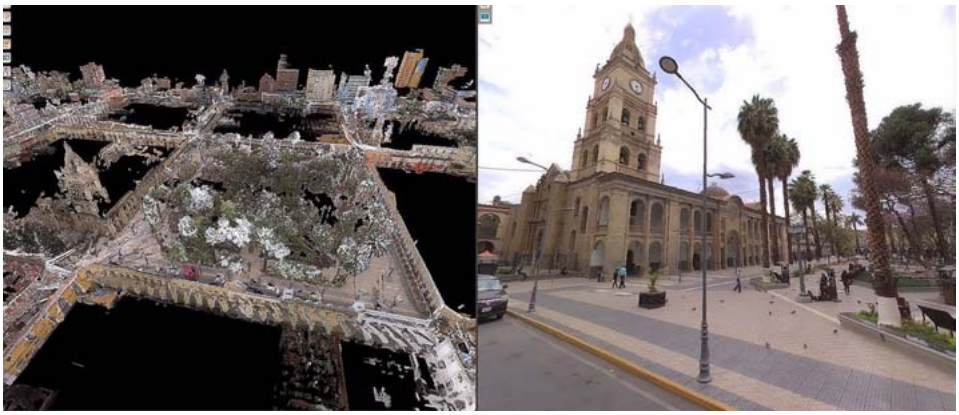
Water War

The world is running out of fresh water. The continuous depletion of water sources (reservoirs, underground, etc.) caused by climate change, amongst other variables, has turned the spotlight onto water utility management, which must ensure the supply of water to a growing population. A decrease in supply coupled with an increase in demand seems to be the name of the game in the water world for the years to come.

SEMAPA, a water utility company located in the city of Cochabamba (Bolivia), is no stranger to this phenomenon. It is charged with supplying water to some 1.000.000 inhabitants, but due to scarcity of water and funds, it can only reach two thirds of the target population. Leaving the rest, mainly in the poorest neighbourhoods, to find a water supply solution by themselves. This is achieved at a higher price and with water of dubious purity from trucks and also with self-managed little water cooperatives.

Cochabamba is known worldwide for the famous 2002 'Guerra del Agua' (Water War), a conflict that erupted in response to an increase in local water rates, following the privatization of the municipal water utility. The private consortium that won the contract, which was dominated by the United States-based Bechtel Corporation, had doubled and tripled water rates.

What looked like just another conflict among many others in Bolivia, ended rather violently. The national government declared martial law in Cochabamba, the third-largest city in Bolivia. A good part of the population was in the streets, battling police and soldiers. Finally, the price increase was fully revoked, the consortium's 40-year contract annulled and, unfortunately, many people were wounded and a seventeen-year-old student died. It is being said since then that the protesters **won the war but lost the water.**



Cochabamba's main square in 3D and spherical views, within Orbit 3DM Feature Extraction

Challenges

Since the end of this conflict, water has been incorporated as a human right in Bolivia's Constitution, and it became a thorny issue whenever any increase in water rates is discussed. As a matter of fact, water rates are heavily regulated and none of the water utilities in the country has the right to modify them without central government consent. Besides, the water rate structure is designed to subsidize water-access to anyone, no matter their income level.

Spherical picture of location with good urban infrastructure

Area with very deficient urban infrastructure. The water barrels in front of the house are used to receive water from water trucks, two times per week

Though right from a social standpoint, perspective looks complicated – to say the least – from the water utility investment needs.

In the past decade, SEMAPA has been compelled to prioritize its investments, mostly in the expansion of its water and wastewater pipe network. Leaving aside the investments needed in systems to efficiently manage and maintain these networks and the whole infrastructure in general.
As an illustration of this situation, their commercial system was running on Novell, an operating system that was discontinued over 20 years ago. They also had some outdated and incomplete spatial information running on isolated PCs, using an open-source GIS.

In this context, they decided that the time to invest in intangible solutions and systems had come, such that the entire organization will modernize its operations. Towards this end, they launched a competitive bidding to find a company that brings to the table a viable solution to update, visualize, manage and measure their field assets and pipe network information, knowing that:

- they had serious budgetary restrictions;
- assets and pipe network were stretched out over an area covering around 3.000 hectares;
- the starting point was an outdated and most probably inconsistent database about field infrastructure.

Solution

To submit a bid, we needed to devise a solution that, whilst satisfying these constraints, should also prove to be cost- and time-effective. We knew that – without a unified platform on which geospatial information pertaining to the different assets (pipelines, valves, pumps, reservoirs, service connections, water meters, etc.) could be loaded, distributed, updated and/or consumed – **all efforts would have ended with the same current analogue problems but in a digital format.**

Data capturing

By experience, we were aware that Mobile Mapping technology could speed up geospatial data capture and production, and that LiDAR point clouds integrated with 360° high-resolution imagery would provide the functionality and feel of reality on the desktop. This would speed up adoption by users with limited IT knowledge and experience, which in the end would be one of the project success keys.

We decided that data acquisition would require the combination of high-resolution images and 3D point clouds to allow detailed observations, feature extraction and measurements. At this point, the outline of our plan was :
1. to start a mobile mapping data collection, incorporating 360o imagery and LiDAR point cloud; and
2. to integrate mobile mapping deliverables into their open-source GIS.

Data processing

Given that the data production side of the equation was already solved, we needed to find the platform to integrate and manage the data, knowing that this platform should at least allow them:

1. to publish mobile mapping data through a web browser for browsing imagery, point cloud, performing detailed measurements and basic feature extraction;
2. to merge with their GIS, and probably also allow to load other sources of information, such as satellite imagery and eventually orthophotos;

3. to use geoidal heights;
4. to deliver all the content in Spanish;
5. to have the possibility to access information through mobile devices;
6. to shorten their learning curve, so they can quickly start using the delivery products and incorporate them into their own workflow;
7. to work seamlessly on computers with very low computing power and within an intranet.

To satisfy this 'wish list', we headed straight in one direction, as all these requirements could be met by the Orbit GT portfolio. And, more specifically, Orbit 3DM Content Manager and Orbit 3DM Publisher, as we will explain below.

Eventually, with all the pieces of the puzzle in place, we submitted our bid, hoping that both scope, schedule and cost would satisfy the client. They did, and we were awarded the contract.

Implementation stage

We started data capture using a Topcon IP-S2 hardware system. The target area covered the whole spectrum of urban development. Starting from areas with first-class urban infrastructure, to areas with a non-existent or fully underdeveloped urban infrastructure, and some others in between.

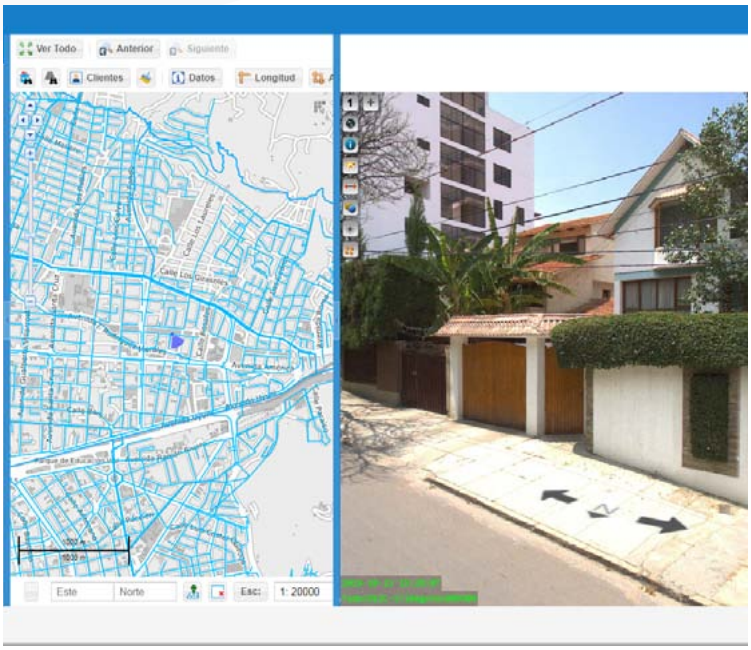
The first one was covered at a brisk pace. The in-between zone presented some challenges, mainly due to the placement of overhead telecommunication cables and advertising billboards at elevations far below of what is allowed. This forced us to stop the car many times per hour, in order to avoid not only cutting these cables, but also damaging our equipment.

As for the third area, it was a daily nightmare, with all kind of complications due to topography (slopes up to 50%), nonexistence of streets and very aggressive residents, many of whom thought we were there either for tax- or home property-related issues. Representing about 30% of the project area, this third area took us more than 60% of the data collection time.

The data collected was pre-processed and imported into Orbit 3DM Content Manager, with which we organized the captured 3D data. 3DM Content Manager gave us the necessary tools to clean up multiple passes and LiDAR point cloud data noise, as well as to optimize image quality and make the necessary adjustments required to optimize data for performance before sharing it. Finally, we exported the data set to Orbit 3DM Publisher. As with all the Orbit solutions, these processes ran smoothly and timely.

Our final task was to integrate Orbit 3DM Publisher into their GIS, which we did by using Orbit SDK. Their GIS is a web-based application using PostGis, Geoserver and PostgreSQL. All these are open-source solutions. Not only because of budgetary considerations, but also because public institutions in Bolivia are mandated to migrate to this kind of platform. The integration allowed them to work in only one system, avoiding the annoying and time-consuming task of jumping between two systems all day long, which turns out to be a deterrent that limits the use of a system.

The integration improved user's adoption bringing mobile mapping into what was already a familiar environment to them. Moreover, it facilitated the editing and update of their GIS layers, using imagery and point cloud coordinates. This way their



Integration Orbit SDK + Open Source GIS

Water meters' inventory

goal of having an accurate an updated geospatial information can now finally be met.

Results

In the end, we were able to gather up to 500.000 images, each in an 8,000-by-4,000-pixel resolution, totalling a volume of 3TB. When adding the LiDAR data, the total data volume is about 21 TB of imagery and point cloud data.

Orbit 3DM Publisher has proven to be the ideal solution to share and manage all those terabytes of information effortlessly, easily combining imagery, point cloud, vector and raster data. The client can access a georeferenced LiDAR point cloud and 360o imagery data sets in a web-based environment, without noticing delays due to the huge amount of information that is going back and forth.

Before the project implementation, in the event of a service interruption, quick access to water and wastewater pipeline network data – as well as the ability to locate, diagnose, and respond to the failure – was a challenge. Currently, this information turns out to be at just a few clicks of time and distance away. Thus allowing the staff to focus on the problem's solution rather than on collecting information needed to solve the interruption.

Orbit 3DM Publisher has become an indispensable tool for planning different tasks and field interventions, enabling workers to connect and collaborate in a timely and thoughtful way. More people from different areas within the organization are involved. Together they can analyse the situation and find solutions to different problems in a fraction of the time and cost they needed before the implementation. They can run countless spatial data derivatives and field reality interpretation capabilities as well as measurements of distances, areas and even volumes. Thus facilitating decision-making processes across the entire organization.

Street level content adds value to many other tasks throughout the company. This way they are also improving workflows on quite different domains. For instance, feasibility studies and technical specification definition of water and waste-water pipe network extension jobs.

As for the commercial side of the organization, they can identify inaccuracies on users' categorization (e.g. between residential and commercial). This has a great impact on the water rates that they are allowed to charge to every one of the users. This could translate in an annual revenue growth of at least 7%.

It also has become an effective and objective communication tool with the user base and is avoiding a lot of interpretation conflicts regarding the user's category.

Identifying Private and Commercial users using spherical imagery in Orbit 3DM Publisher

ABOUT THE AUTHOR

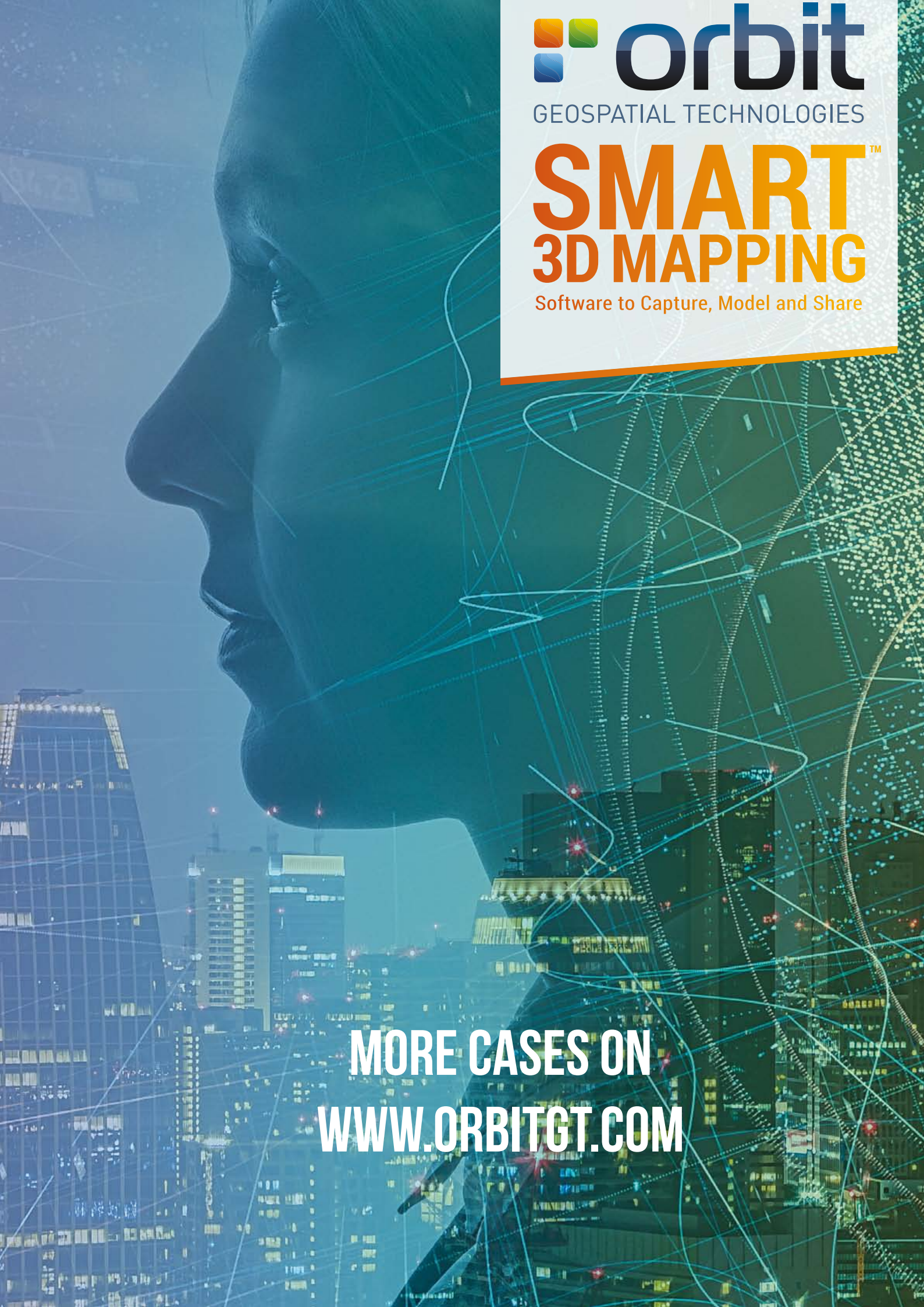
Fernando Terrazas, CIVIS's COO, has extensive experience working in the geomatics industry, being one of its leading experts in Bolivia. He has also worked in other countries, including Brazil, Paraguay, Peru, Colombia, Panama, Honduras and Mexico. Fernando was in charge of the project discussed in this article.

He has been working in CIVIS group for nearly 15 years and has extensive experience leading system development teams. Over the last years, he has become a specialist in the development and integration of open-source systems with a GIS component into enterprise-wide systems.

ABOUT CIVIS

CIVIS Bolivia is a leading geospatial company and Orbit GT's Bolivian reseller. Using mobile mapping technologies, CIVIS has covered around 15.000 km of streets in different cities in Bolivia for municipal and utilities clients. In Bolivia CIVIS has extensive experience working with aerial photography, DTMs, DTEs, orthophotos, 3D cartography production as well as geomatics systems development. We have also worked in Brazil, Peru and Mexico.

Located in Cochabamba, Bolivia, CIVIS services clients throughout Latin America.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