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MAGAZINE FOR GEOSPATIAL TECHNOLOGIES

EN

SOLUTIONS

Cobra Consultants aids to park renovation with dedicated mapping

TRENDWATCHER

Going beyond the entertainment : Using Unmanned Aerial Systems for Public Safety

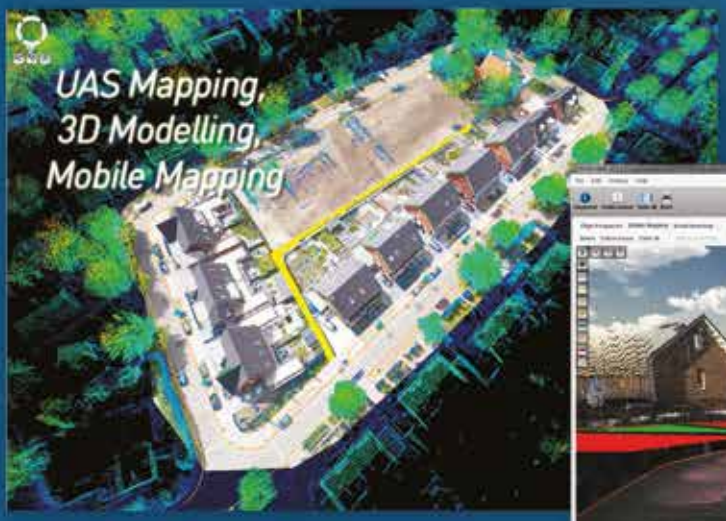
INNOVATION

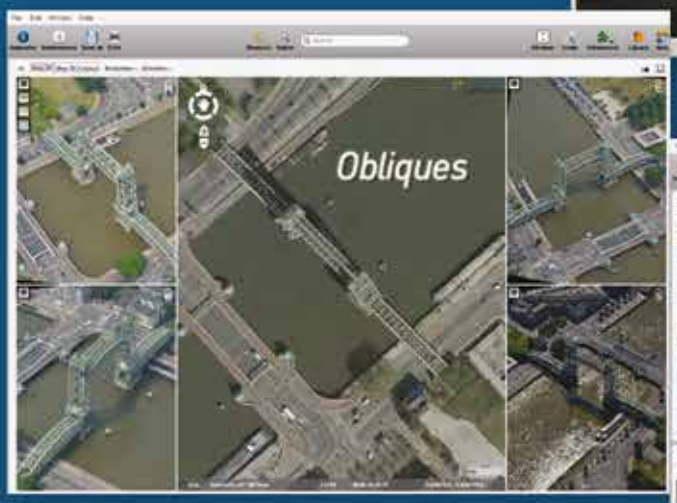
Bridging The Gap
Disruptive and Gamechanging: how maps are made tomorrow

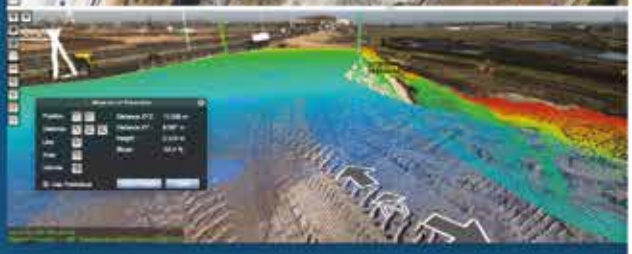
SPOTLIGHT

City of Antalya maps Publicity Signs

ORBIT MAPPING SOLUTIONS. Bridging the Gap.







CONTENTS

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EDITORIAL

Dear reader,

"Bridging the Gap between Airborne and Mobile Mapping" has been our vision and mission for quite some years now. It has been our guide in the way we design, develop and integrate our software portfolio. With several decades of airborne and terrestrial photogrammetry behind us, these last few years have brought the rise of exiting new fields of technology and applications that in depth are all based on the same foundations as photogrammetry. And we embraced them all.

This magazine again presents paramount applications of Mobile Mapping, a domain in which Orbit GT's software is leading the world. Low-altitude precision mapping has become very mature indeed as UAS Mapping proves to be game-changing for safety and contingency planning. And with the entry of Oblique aerial imagery, Orbit GT solutions present a comprehensive set of tools to visualize the world from the air to ground level.

Enjoy !

Peter Bonne

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BRIDGING THE GAP

DISRUPTIVE AND GAMECHANGING : HOW MAPS ARE MADE TOMORROW

Vision and Technology

For the last 3 decades, the introduction of digital captation technologies in the mapping business has changed all aspects of mapping. With the coming of age of computer technology, map drawings were replaced by digital maps and software with interactive update capabilities took the place of draftsmen. Orbit GT has forfronted this change since the late 70's.

Digital camera's brought the replacement of analog film for the production of orthophoto's, creating a new standard reference basemap, while the introduction of laser technology revolutionized surveying. Today, mapping couldn't live without it anymore.

Yet the basics of mapmaking didn't change that much: only the instruments have been updated. The optical theodolite became the digital total station, but the surveyor's job remained exactly the same. His notebook was replaced by a digital one, and the drawn result became a CAD or GIS dataset.

The major advantages came from what happens next: once data was gathered digitally, one could do so much more

with it than was ever possible in the analogue age : databases were populated, silos of data became integrated, georeferenced or linked to geospatial features, data was merged for analysis, statistics and many more highly valuable purposes.

Today's disruptive era

Where the largest chuck of the work has always been the initial captation of data, be it aerial or terrestrial, the truly disruptive evolution is the dramatic increase in capacity and simultaneous huge drop in production cost for the captation of raw data. This led and still leads to much faster lifecycles and data updates.

The introduction of Lidar technology and mass IT infrastructures leads to a mapping cycle in which the captation of data is no longer equal to the identification or qualification of it. Captation is now performed in masses, whereas identification and qualification are moved from the field into the office. As such, photogrammetry showed the way even a long time ago, by collecting raw image data by plane and extracting features in the office using optics and mechanics.

At Orbit GT, we understand that tomorrows mapping industry needs full support of these new captation techniques and the maximal exploitation of its rich and versatile data. Whereas aerial lidar is maturing in dedicated domains for the last decade, and terrestrial laser scanners collect more data than ever before, it is mobile mapping and drone-based mapping that are truly the biggest innovators today.

Hence Orbit GT's makes big efforts in creating the world's most extensive and integrated portfolio in software solutions to embrace and exploit these vast volumes of rich data and create new and added values to its collectors, owners and users.

Serving the world

It is Orbit GT's strong belief that this new data will become omnipresent as did the orthophoto in the last 2 decades. Especially the 360 degree panoramic streetlevel imagery is a very human way to explore the environment, hence a natural user tool to identify, extract and qualify objects and items that are seen in these images. Orbit GT is the only provider of software solutions that supports any camera, allows versatile use and integrates this imagery into each and every workflow.

Second to that, the huge point clouds collected by lidar scanners provide an instant view of reality from any viewpoint in a way that has never been seen before until a few years ago. Today still in hands of specialists, Orbit GT makes this data accessible and usable for everyone through low-threshold and high performance desktop applications up to online, mobile and integrated consultancy tools.

A different technology evolution brought the availability of unmanned aerial vehicles or drones. A toy since years, slowly becoming a professional instrument carrying a useful payload such as video or still image camera. Orbit GT as experimented with drones since 2007 as the first devices equipped with GPS and IMU offered the prerequisites for a truly mapping device. A UAS Mapping system was born, now being a proven and reliable technology for ad hoc, fast, high-resolution and high-precision mapping resulting in both imagery as height information, and extendable with a growing range of sensors such as thermal cameras and lidar.

Data and Workflow Integration

Both mobile mapping and uas mapping deliver instant result and bring a representation of reality into the office near to immediate. Identification, classification and processing are now embedded in a daily workflow with a growing range of automated tools. Fortunately, Orbit GT offers integrated tools to use all sources in a single environment : traditional 2D mapping, streetlevel imagery, 3D point clouds, UAS maps and models, aerial photography either in stereo or obliques; it all comes nicely together.

Limitless Applications

Bringing together the various new techniques of data collection and sources of data into traditional 2D and 3D GIS and CAD environments delivers immense new possibilities. Wheras today, many of these new technologies are parked in silos for processing and stand-alone use, Orbit GT believes strongly that integration is key to create a new generation of applications only limited by man's imagination.

CITY OF ANTALYA, TURKEY : 45000 ADVERTISING SIGNS, 750 KM ROAD NETWORK, IN ONLY 2 MONTHS

"IT MAY SOUND IMPOSSIBLE BUT IT'S NOT. THANKS TO ORBIT SOLUTIONS"

HAKAN ERKAHVECI , PROJECT MANAGER

Antalya, a pearl of Turkish Riviera is the 3rd most visited city of the world with dynamic economy, tourism, modern urban life and historical sites. But this growing development brings problems with its dynamism. Antalya Metropolitan Municipality determined that current status of the advertisement sign database and tax declarations, did not reveal the real status. AMM decided to solve this problem with modern techniques. In order to do so, AMM decided to work with Geomobis Mobile Information Systems, a leading mobile mapping company in Turkey and Orbit GT's Turkish reseller. "Geomobis aimed to show in this project the advantages of using modern mobile mapping techniques to both administrative authorities and as well as the general public; a project which is a first in its field in Turkey creating an advertising sign inventory and integration into the municipality database." said Hakan Erkahveci, Project Manager .

Large Project, Limited Time

1st November 2012, Geomobis started the project with collecting mobile mapping data of all main transportation roads, and the financial, touristic and historical districts of Antalya. The Topcon IP-S2 mobile mapping system was used for the project, a system that integrates 3 laser scanners, Ladybug III 360° spherical camera, GPS, IMU and DMI. Approximately 750 km road network was scanned with this mobile mapping system in just 2 weeks and the process phase started with arrivals of

View of popular Konyaalti Beach of Antalya.

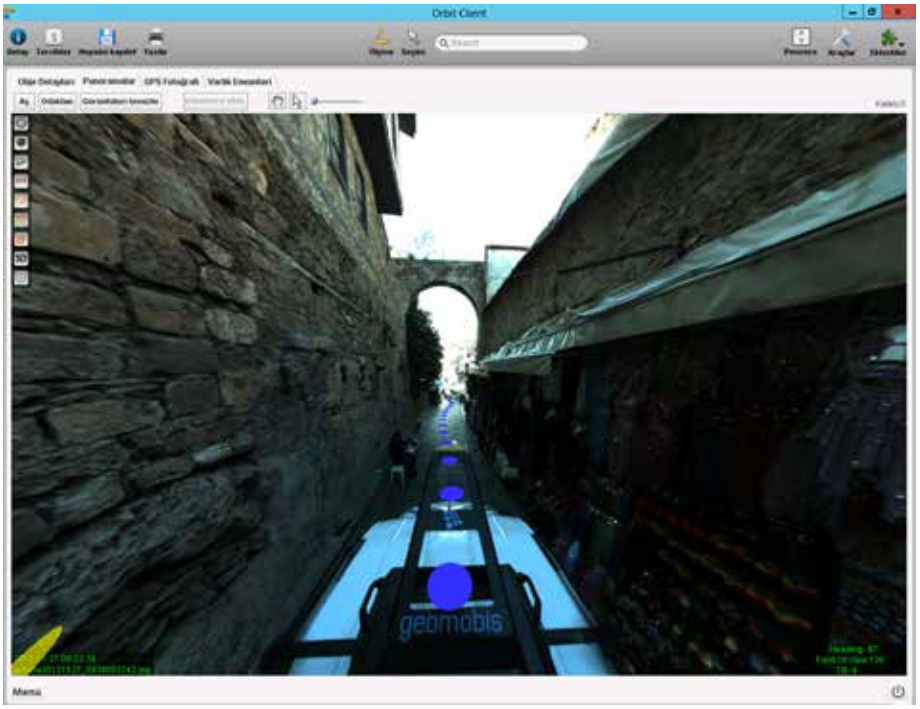
the first data from Antalya to Geomobis' technical office in Istanbul. Due to its massive volume, data was transferred physically day by day. Highly accurate GPS and IMU eased the processing of the data. After the process phase, the data was imported into the Orbit Mobile Mapping software where it was used to extract the advertising signs into a database.

Hakan Erkahveci, Project Manager expresses one of the most important reasons of using Orbit : "Normally, it's very hard to manage and store this size of mobile mapping data but Orbit's dedicated Multi-Resolution Point Cloud storage technique makes it very easy to view and use LiDAR data and its performance speed rules out long loading times which are important if you work in a tight schedule." As soon as the first mobile mapping data was imported into Orbit, technical staff of Geomobis started to measure advertising signs from Panoramas. Orbit's integration with different spatial datasets and mobile mapping data in the same environment, especially vector overlays on panoramas, allows operators to create the inventory easily by simple measurement actions, reducing user mistakes.

It's not always that easy

In perfect conditions, the hardware collection phase and feature extraction phase work nicely. But there were some practical issues to be faced due to the system and outer environment. Although laser scanners modelled the entire environment in narrow streets of historical old town of Antalya, it wasn't enough to measure advertising signs located on high levels of buildings or where LiDAR scanning was blocked by other objects. On top of that, because of Antalya's Mediterranean climate is like a hot summer in almost all seasons, light bursts composed in some panoramas made operators' work difficult.

Signs on high levelled buildings measured from two panoramas using triangulation.



Narrow roads of Antalya's Old City.

How were these problems solved?

Orbit Asset Inventory user friendly measuring tools allows users to measure in a good accuracy where no point cloud is available. This technique is called 'Triangulation': the user can measure easily using two panoramas by selecting the same points of an object. The visualisation of the triangulation lines makes it easy for the user to pinpoint the same points in two different panoramas. In addition, such technique avoids clicking errors which lead to a better registration as mean values are calculated on-the-fly. This is very important in relation to an issue as delicate as taxes.

Results

Consequently, this important and leading mobile mapping project was finished by 1st January 2013 in only two months by 3 Engineers, 10 Operators , 3 Field engineers and some support of Orbit GT. 45000 advertising signs were measured and integrated into the Antalya Metropolitan Municipality's database. Before the project started, the quantity of registered signs were just around 15000. When relying on conventional surveying techniques, it is obvious to see that updating and integrating this volume of data is near to impossible.

Hence, the municipality detected a tax evasion valuing multiple times the cost for this project and decided to publish the panoramic imagery to public, using the integration solutions of Geomobis and Orbit GT. This successful project inspires other Turkish administrative authorities in having interest to use mobile mapping technology in different aspects.

ABOUT GEOMOBIS MOBILE INFORMATION SYSTEMS

Geomobis is Turkey's leading brand in the mobile mapping sector. It was established in 2010 as sub brand of Ersel Mapping Company which is established in 2001. Since then, Geomobis realized many mobile mapping projects, applications and GIS projects among which 3D City Information Systems, Automation Systems for Internal use of local authorities and municipalities in co-operation with Orbit GT. Geomobis and Ersel Mapping Company are located in Istanbul.

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COBRA 3D ENVIRONMENT SCAN OF PARK OOSTERBEEK IN THE HAGUE, THE NETHERLANDS

COBRA CONSULTANTS AIDS TO PARK RENOVATION WITH DEDICATED MAPPING

Cobra Consultants are renowned for their innovative initiatives in the specialized domains of nature conservation, with a specialization in trees . They brought innovations such as the tree tensile test to measure the stability of trees, the level camera for inspection of the tree crown, the 'tree risk' tool to calculate the tree safety and the 3D environment scanner for imaging and mapping of the exterior. And innovation keeps going on. With the help of Orbit software, new developments enter the Cobra 360+ platform, with a growing amount of very useful tools.

A Short History

The park Oosterbeek in The Hague is an estate on the territory of the Wassenaar municipality, since 1953 owned by the municipality of The Hague. The Oosterbeek estate originated in the 17th century. Jonathan van den Luchtenburch, board and superintendent-general of the count's domains in North Holland, bought a farmhouse in 1629 between estate Clingendael and the Haagse Bos. He built a house surrounded by a ditch, stables and a garden house were constructed and he planted an open forest. Opposite to the house a pond with an island were created.

A part of the former estate Oosterbeek received a building destination in 1995 and in 2000, near the A44 motorway , the NEBO nursing home was constructed along with some senior housing. The remaining park is now a protected monument and a bird sanctuary.

During the past centuries, many seedlings in the park become mature trees. Little remained from the original design with its openness and sightlines.

An Innovative Approach

Plans were made for a major renovation of Oosterbeek. However, there was no inventory of trees, no maps, no characteristics known. The city department needed such inventory, mapped and documented with characteristics such as tree type and size, before renovation could take place.

To meet this city demand, traditional surveying techniques proved inefficient, expensive, and finally not delivering the required set of data.

Cobra's expertise, know-how and innovations in these matters brought the solution it required.

Cobra's 3D environment scanner is mounted on a quad motorbike to easily reach to every corner of the area. The park was mapped using panoramic imagery and laser scanning. Using Orbit's Asset Inventory solution, all trees were registered and documented in a database. Final results are made accessible through the Cobra Map Viewer equipped with Orbit's Publisher showing the panoramic imagery. The scan and inventory by Cobra will form the basis for the renovation and replanning of paths.

The Action Plan

Cobra presented an action plan based on the list of requirements set out by the municipality. This plan can be summarized by the following four phases.

The 3D environment scan

The first phase is to collect image and point cloud data throughout the park. The scanner registers the environment at a rate of 40 000 points per second and a panorama image is shot every 3 meters during the drive through the park. Cobra mounted a Topcon IP-S2 system on a 4 wheel drive quad so that each part of the site is made accessible for this capturing process. This results in thousands of images and millions of points.

Extractions

The collected data is post processed to optimize positional accuracy, then loaded into the Orbit Asset Inventory software. Cobra specialists register every tree as a point object, measured in the heart of the trunk base at ground level. These registrations automatically contain x - , y - and z-coordinates , and have a deviation of less than 20 cm.

Adding Basic Characteristics

Cobra designed a set of tree characteristics called a 'tree passport' one of which is associated with each tree. Some characteristics are derived from the extraction process. Others need to be checked in the field.

So Cobra used their online 360+ Map Viewer service, showing the trees and their passport on reference basemaps such as an orthophoto and soil data. Using the inventory tool, Cobra specialists entered the park to inspect all trees and complete these characteristics :

- tree species
- height
- crown diameter
- trunk diameter

Tree Safety Control

At the same time, the field inspectors were required to assemble safety related characteristics :

- tree condition
- defects
- life expectancy
- maintenance condition
- maintenance measures

Cobra's Map Viewer shows all trees as mapped by the 3D environment scan.

Point cloud overlayed on the panoramic image

Result

Tree positions, with their passport as attributes, were delivered to the municipality as a simple SHP file. This allowed the landscape architects to integrate the results in their workflow and start making the renovation plans. During the execution of the project, Cobra's 360+ Map Viewer and Orbit's Publisher proved to be powerful communication tools, not only between all professionally involved, but also towards citizens.

Finally, this whole project could be completed for an amazing low price.

Baseline situation and progress reports

The Orbit MM Publisher is ideal for capturing a baseline situation before beginning renovation work . For example, when damage is detected, the panoramic photos can be consulted to determine whether it was already present before the beginning of the renovation. Heights and dimensions of trees are easy to retrieve which helps the renovation workers.

By making multiple 3D environment scans during the execution of the renovation project, a 4D presentation of the project is created as the subsequent panoramas are displayed on a timeline.

Cobra 360 + Map Viewer

The Cobra 360+ Map Viewer was developed by GeoNovation with whom Cobra intensively cooperates . The Map Viewer shows and edits project information. It has proven to be an almost indispensable tool in project communication. The Orbit Mobile Mapping Publisher, displaying the panoramic imagery, is seamlessly integrated in the viewer retaining all the functionality.

ABOUT COBRA CONSULTANTS

For all Cobra Consultants, maintenance and support for green and especially the trees in public spaces is of core interest. Cobra performs tree investigations, develops policy and management plans for the administration of public and green spaces, conducts ecological surveys, maps the environment and brings it indoors, and gives legal advice. Cobra consists out of the following branches:

- Cobra tree consultants bv
- Cobra plan consultants bv
- Cobra eco consultants bv
- Cobra geo consultants bv
- Cobra green lawyers

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The 3D environment scanner at the center of Park Oosterbeek

GOING BEYOND THE ENTERTAINMENT : USING UNMANNED AERIAL SYSTEMS FOR PUBLIC SAFETY

ORBIT GT MAPS THE WORLDMUSIC FESTIVAL DRANOUTER ON BEHALF OF THE BELGIAN POLICE FORCES

Contingency planning based on UAS maps

One of the major shortcomings when it comes to contingency planning at the currently popular summer festivals are up-to-date, high precision maps. Given the huge difference that exists between a summer event ready-for-the-public and the festival terrain in normal days, there is a considerable uncertainty for public safety planning. Every year festivals are reinventing themselves by placing fancier decors, huger tents and better equipped camp sites. Major transformations are happening on the scene in the final days before the actual start of the festival. Having access to critical planning information is however indispensable for each public safety worker. From the operational tasks through the decision support systems, all jobs need accurate maps in preparation, planning, briefing, emergency cases, analyses, etcetera.

While sketches or point & line maps measured by land surveyors can fill this gap, aerial data taken with Unmanned Aerial Systems or UAS are a far better overall solution. Low altitude aerial maps enclose much richer data than single vector layers and handling can be finished in no time. However unmanned aerial systems represent a relatively new and as yet undefined market in this world of safety planning. Most important reason is of course caused by safety airspace regulations but nevertheless also the negative

connotations of the word 'drone' feed the reluctance towards these promising unmanned systems.

Looking further than the battlefield, Orbit GeoSpatial Technologies have been conducting for a number of years now highly targeted turnkey projects involving the mapping application of civil UASs, concentrating on quality, accuracy and reliability. Although it is often suggested like any takeoff of a UAS system ends in satisfying mapping results, there is a big difference between an eye in the sky and the map making process of these aerial imagery. To fill this gap, Orbit GeoSpatial Technologies has decided some years ago – based on the 50 years of experience in standard aerial photogrammetry – to invest into the software working-out of civil UAS systems which are suitable for accurate data captation and reliable in 'real-time' safety planning procedures, thereby taking into account that the mapping processes remain integrated in the user-friendly Orbit planning tools.

As a confident customer the Belgian police zone PZ Arro Ieper asked Orbit GT to make such a high precision map right before the actual takeoff of the Dranouter Festival. Dranouter is a three-day festival that takes place during the summer months and in average welcomes about 60 000 visitors. A huge organization in which the local police needs to ensure safety. In what follows, we run through the process and discuss the way in which we practice this critical step in the safety procedure at the Dranouter event site.

Preparing: legal aspects and terms of reference

Regarding the solution part, we had different stages to pass starting with getting flight permission at the site to support the Police Forces in a legal way and be able to fly in a safe airspace environment. Although we could stick to the idea that there are too much rules these days anyway, regarding airspace safety one never can be safe enough. Based on the standard procedures that need to be completed in Belgium to get a case-license, we easily got our permission based on the detailed workout of our flight plan in the Orbit UAS Mapping software and the official documents generated about

the emergency procedures of the MD4-1000 UAS system.

Preflight process: planning the flight in a GIS environment

In a joint meeting the police forces informed us about the actual delivery they require in their safety procedures: an orthophoto with 2-3 cm pixelresolution the evening before the start of the festival on which the final location of tents, paved paths, fences, and many if not all decoration can be seen and potential or required doorways and safety exits can be measured. Based on this idea, we worked out the Orbit UAS Mapping project starting with generating an appropriate flight plan for this job.

Using the preflight planning of Orbit UAS Mapping software, a flight plan was easily drafted based on GIS reference materials and created by activating some essential mapping tools available in the software. The software calculates the required waypoints and commands to create a full mono or stereo image coverage of the event site. Just by drawing the area on a reference map of your choice, indicating the main flight axis, and confirming some parameters such as flying height, speed settings, mounted camera, home position, and so on, the MD4-1000 flight plan is created and ready for flight.

For this Dranouter mapping, we planned to use the Sony Nex-7 light weighted digital camera with an average focal of 19mm. The flying height was set on 125m above ground level. This resulted in a ground sample distance of 2.5 cm. Other settings were 3,5m/s horizontal speed, 2,5m/s vertical ascending and 0,5m/s descending speed. The image coverage was fixed on an 80-60 percent overlap for semi-true orthocreation. After generating the flight plan, we checked all final parameters and settings on the results report, confirmed the flight

settings, and saved the flight plan ready for later use.

PREFLIGHT DETAILS	
flight time	32:08:00
Surface covered	6.94ha
# photos	186
# strips	7
# flights	1
coverage/hour	12.96

Flight process: extreme reliable and automated flight with all terrain takeoff and landing

Based on a UAS experience of more than 6 years, Orbit GT worked out a professional UAS Mapping solution. Based on the idea that a fast and easy preflight planning needs to be combined with a professional and reliable UAS system, the outstanding Microdrones MD4-1000 is brought together with the photogrammetric mapping experiences of Orbit GT. Putting the MD4-1000 to work for mapping purposes shows some remarkable advantages. The extreme flight time (up to 88 minutes) and quadcopter principle leads to a universal operational reliability. A quadcopter has the advantage that it can take off on all terrain and fly with minimal energy waste according generated coordinates or waypoints. Furthermore the low speed of the system generates the possibility of high accurate, maximum brightness and precise images. And last but not least the reliability and proven professionalism of emergency procedures on board of the MD4-1000 are invaluable in these kinds of safety procedures.

For the Dranouter 2013 event, the MD4-1000 system of Microdrones was fed with the flight plan and prepared for takeoff. Within a few minutes, the system was initialized automatically

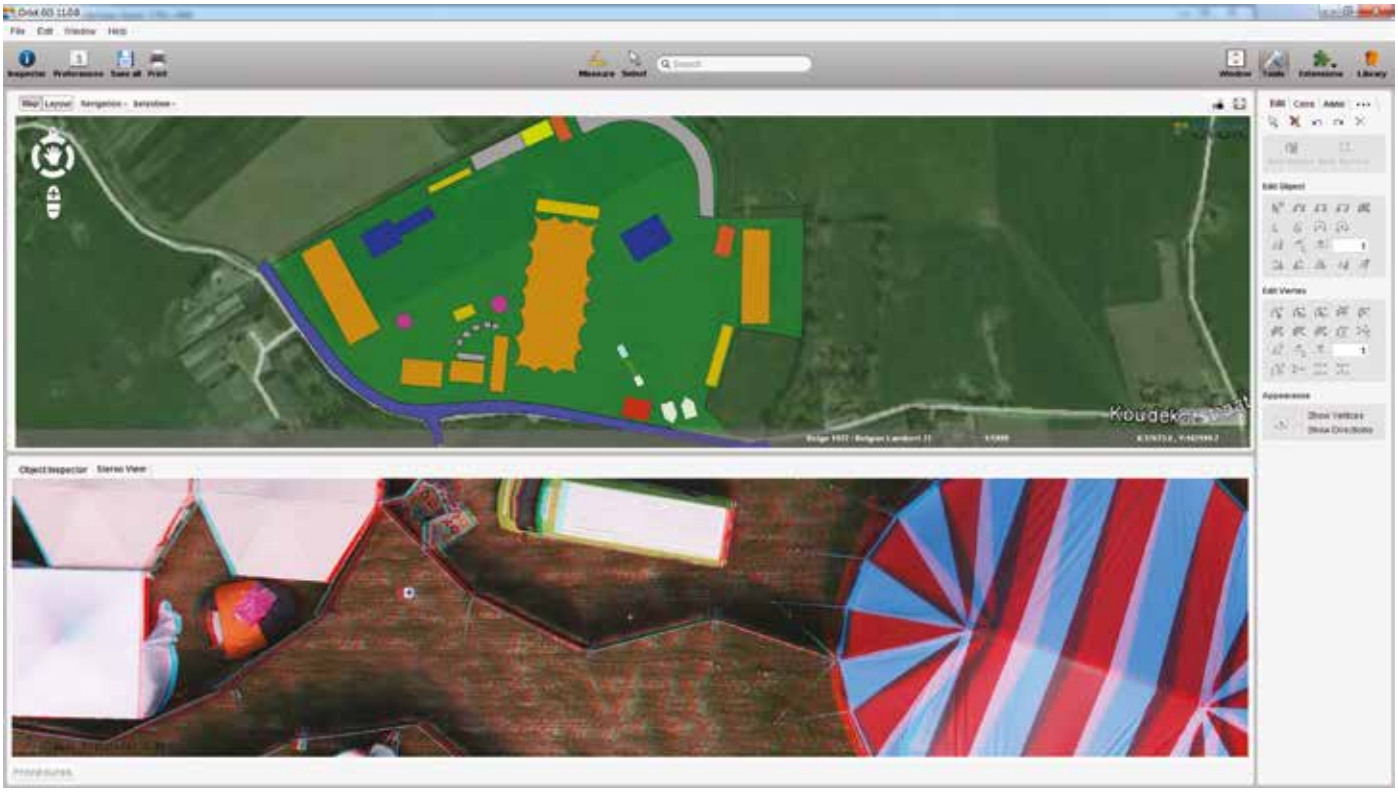
checking flight plan distance, battery capacity, rotor functionality, GPS satellites reception, and a limitless list of sensors. Ready for takeoff, after fixing some ground control points on the terrain for high accuracy. Flight time was around 30 minutes. Weather conditions were optimal.

Postflight process: automated high precision 3D map creation in a stereo GIS environment

An automated post-processing of the operated flight is easily done by calling the postflight module of Orbit UAS Mapping software. First, the UAS data importer feeds the mapping project with the necessary basic data coming from the planning and flight data. Hereafter an automated triangulation based on several point detection and matching techniques with automated blunder detection successfully completes the bundle block adjustment. The DSM and ortho are finally made on different scales which allows the safety planner to map in the extensive 2D or 3D-stereo Orbit UAS Mapping environment ready for import in the Orbit GT's safety or contingency planning software. From here on the safety workers could use, for the first time, an accurate and actual map of the festival terrain.

Orbit UAS Mapping provides fast and round-trip solution for pre- and post-flight tasks for immediate and accurate UAS Mapping jobs. This case would not have provided the required results without it.

POSTFLIGHT DETAILS	
# photos	191
% stereo overlap	87.33
% strip overlap	44.50
# stereo models	184
# strip models	465
GSD	2.54cm
surface covered	14,32
Average flying height	123,5



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