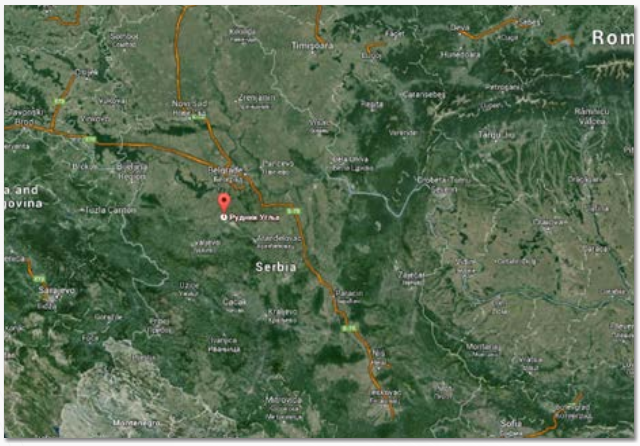
CASE STUDY

Using an eBee drone to assess flood damage at one of Europe's largest mines

When the Serbian government urgently needed to map water damage at the Kolubara lignite pit, it turned to GeoGIS Consultants, whose team used an eBee to provide the client's deliverables in a matter of days

In May 2014, Serbia was hit by massive floods following the heaviest rainfall there since records began. Several rivers broke their banks, completely flooding some of the country's major cities. The overflowing of the river Kolubara also flooded part of the Kolubara Mine Basin, near a small town called Lazarevac, approximately 45 km (28 miles) south of Belgrade.

The Kolubara pit is a huge 9 km^2 (3.5 mi^2) open lignite or 'brown coal' pit, owned by Rudarski basen Kolubara, and part of the estimated 540,000,000 tonnes of estimated lignite reserves in the Kolubara mining fields.



GeoGIS Consultants was employed by Serbia's Ministry of Water Management to supply accurate 2D orthomosaic images and digital terrain models (DTMs) of the flooded section of the mine. These deliverables would then be analysed by the mine's engineers in order to calculate the best method of draining the remaining water from the site.

"The project was concerned with mapping exactly where the river broke its banks and flooded the mine," says Aleksandar Milosavljevic, a geodetic engineer at GeoGIS consultants. "Our client needed to analyse how best to drain this water. Plus, its engineers wanted to plan a new river channel in order to change its direction and prevent such problems happening again in future."

The area the team mapped spanned the lower region of the Kolubara pit and some of the surrounding countryside.

senseFly
a Parrot company

All systems go

The key challenge for the GeoGIS team was one of speed, providing the data the client required as quickly as possible, since the Kolubara pit is of such importance to Serbian industry that it was crucial to minimise downtime.

"Using classical surveying methods such as lidar or total stations for this project, surveying point after point, would have been slow, and therefore expensive, so that was out of the question," Milosavljevic explains, adding that such a terrestrial approach might have taken three on-site teams around two months.

"Satellite images could have been another route," he continues, "but we needed higher data resolution than they offered. Alternatively, we could have tried to scan some areas with our mobile mapping system (MDL Dynascan), but the site contains several inaccessible areas so we would still have had to use some classical surveying equipment. Since time was the crucial factor then, using a drone was the obvious solution."

> "Using classical surveying methods, such as lidar or total stations, would have been slow and expensive, so that was out of the question"

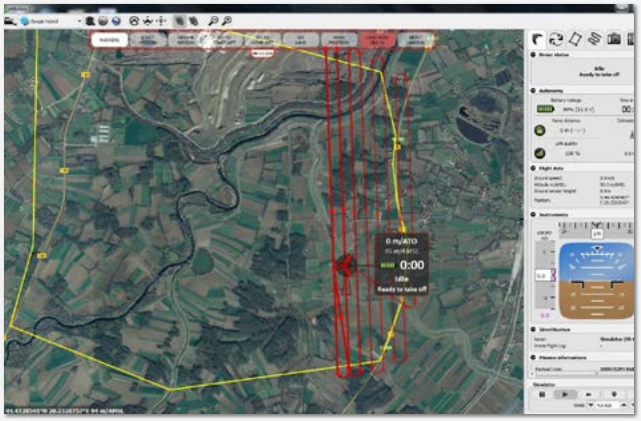
"I first looked into drone technology because we saw it could be used to collect satisfactory data in areas that more commonly-used technologies couldn't reach," says Milosavljevic's colleague, Prof. Tosa Ninkov, the founder of GeoGIS Consultants. "I also realised that a drone could help us reduce costs such as staff accommodation when working outside of Belgrade, by reducing the manpower we needed in the field. I would say our eBee has given us the best return on investment of any surveying tool we own."

Mining methodology

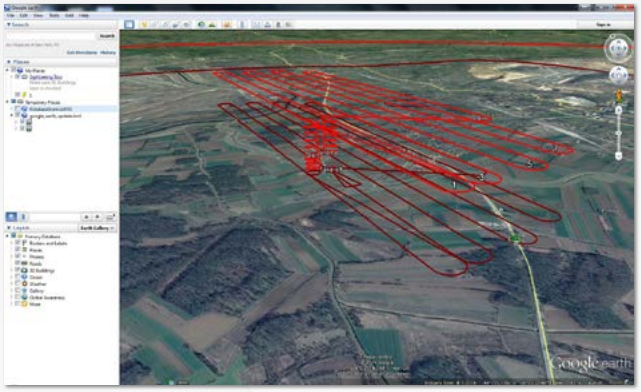
Since much of the area the client wanted to chart was outside the pit itself – to be used as part of its planned river rerouting project – the creation of the drone's flight plans was quick.

"The terrain was pretty flat, so we could plan our flights quickly, in around half an hour, setting a ground resolution in eMotion of 7 cm (2.75 in) per pixel," Milosavljevic says.

What took longer was the setting of ground control points. "We set 15 GCPs for the first three flights, which took place over the eastern part of the site," explains Ninkov, "and just ten on the western side because this area was more difficult to access. We also measured some additional field points using independent GPS receivers and continuous kinematics, which we used to fine-tune the drone's point cloud and DTM elevations using MicroSurvey CAD and ArcGIS."



The project's mission area (yellow), including the team's first flight plan (red). The team's six eBee flights covered approximately 9 km² (3.5 mi²) of terrain in total.



The first flight plan shown in 3D using Google Earth.

A team of three staff then performed six flights in total; two sessions of three flights each. Each flight lasted approximately 33 minutes, with the eBee capturing between 180 and 250 images each time.

"Since the client was very focused on getting their data quickly, we managed to set all the GCPs, plan the flights and fly them all in one day," Milosavljevic says.

Back in the GeoGIS office, the processing of these images was handled – like the flights themselves – in two sessions. The initial processing of the first three flights, for example, took just under two and three-quarter hours, meaning a full processing time for that batch of around 15 hours – from the importing and geo-tagging of images to the generation of the orthomosaic and 3D point cloud in Postflight Terra 3D.

senseFly
a Parrot company

"Since you can't realistically give half a billion points to a client, we then worked to turn this data into simpler CAD drawings, featuring basic entities such as lines, curves and points. For this we used our regular MicroStation software," Milosavljevic explains.

Project workflow

01 Flight planning
02 Setting GCPs
03 Flights
04 Data processing
05 Point cloud filtering/classifying/cleaning/adjusting
06 Point cloud feature extraction & DTM creation
(contours, break lines, objects, spot elevations etc.)
07 Drawing preparation (CAD)

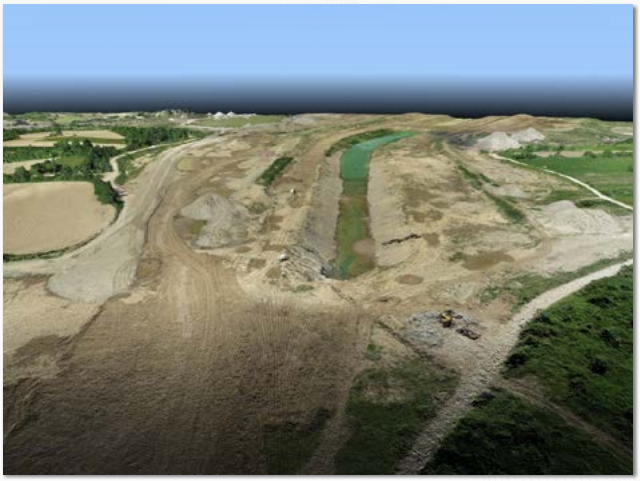
Results

The result? The client received the data products it required within a week and was full of praise for GeoGIS' work. "They were very satisfied, particularly with the data turnaround speed we achieved. We've done a lot of eBee projects since, but this unique flood project was definitely one of the most time-pressured," Milosavljevic concludes.

> "They were very satisfied, particularly with the data turnaround speed we achieved"

The project's resulting orthophoto, created in Postflight Terra 3D.

A section of the project's coloured 3D point cloud showing flood damage in the Kolubara Valley.



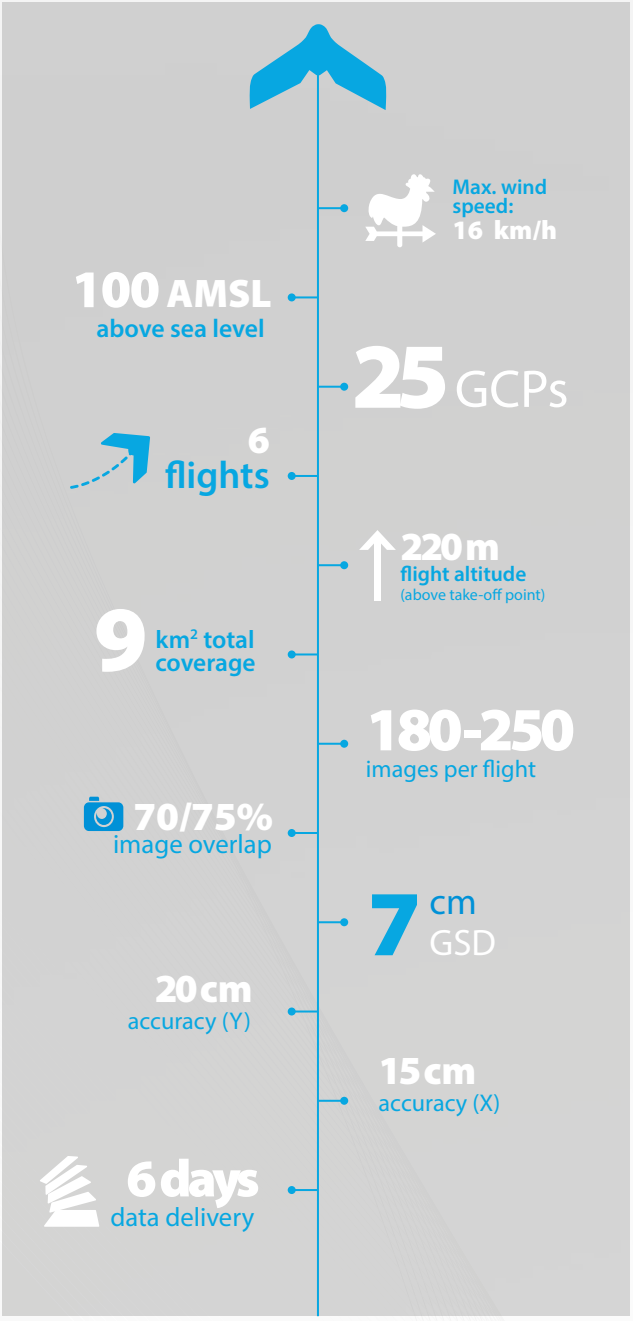
A broader view of the project's half a billion point 3D cloud.

senseFly
a Parrot company

About GeoGIS Consultants

GeoGIS Consultants was founded by Professor Tosa Ninkov in Belgrade, Serbia, in 1997. Originally called WGN-World Geodetic, the company employs 14 engineers who work with external collaborators in Serbia and beyond to offer a wide range of services. These include terrestrial and mobile laser scanning, remote sensing, land consolidation, photogrammetry, digital topography, GIS, bathymetry and more. In addition to owning GeoGIS Consultants, Professor Ninkov also lectures at the University of Novi Sad's Faculty of Science.

PROJECT STATISTICS



Discover eBee:
Learn more at www.sensefly.com/drones/ebee.html

Get the newsletter:
Register for our regular email update at www.sensefly.com

senseFly
a Parrot company