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LAND AIR WATER

Knowing the volume of material in a gravel quarry can be the difference between profit and loss. For Knobel-Bau GmbH, a company in the aggregates sector that manages gravel quarries, concrete factories and tar mixing plants, this information

is critical for business success. That's why the firm relies on the engineering expertise of IngenieurTeam GEO GmbH (formerly known as Ingenieurteam Trenkle GmbH) in Karlsruhe, Germany, to accurately calculate and model its quarries.



Focusing on surveying engineering technologies, IngenieurTeam GEO was contracted to determine the remaining volume in Knobel-Bau's quarries. By creating georeferenced orthophotos and digital terrain models using the Aibotix Aibot X6 unmanned aerial vehicle (UAV), the firm was able to present the current situation in detail and provide an effective inventory reduction plan.

"With this detailed historical overview, our customer can coordinate the extraction processes more precisely," said Martin Schwall, owner and managing director of IngenieurTeam GEO. "This enables the customer to securely plan what to do with the remaining material, based on the most current and accurate information available."

COMBINING TO OVERCOME UNIQUE CHALLENGES

The gravel quarries of Knobel-Bau also include artificial lakes. An expertise of the company, IngenieurTeam GEO uses specially equipped boats for hydrography surveys. What was missing, though, was an aerial view of the entire quarry.

A longtime user of Leica Geosystems levelling and GNSS instruments, IngenieurTeam GEO first became interested in UAV technology when Aibotix became part of the portfolio in 2014. Streamlining surveying components into a fast and efficient process for projects was a key factor in pursuing UAVs for spatial data collection.

"The accuracy of the collected data is important to us, but also the reliability, functionality and quality of all surveying equipment," said Schwall. "We decided to use the Aibotix Aibot X6 UAV for its trusted reputation in the industry. We then trained one of our employees to become a professional pilot, and we've been able to expand our business. Since his training and certification, we not only offer surveying services on land and water but also from the air."

The aerial survey of the extraction site, including its artificial lakes, and the simultaneous hydrographic survey of the water using the special survey boat posed a specific challenge. Essential to this particular project, both tasks had to be precisely coordinated to provide Kobel-Bau with accurate information.

FLYING HIGH, MEASURING LOW

To create the common dataset for the most efficient deliverable, the various survey methods had to be linked, which required technical solutions and the pilot's expertise to generate reliable data. To obtain this, the firm devised an exact flight plan using Aibotix's AiProFlight software. Using an overview map, a waypoint flight plan facilitated precise planning of the autonomously conducted aerial survey.

"The open interfaces of the Aibotix workflow deriving from Aibotix AiProFlight and Agisoft PhotoScan Professional provide us with top quality data with virtually no loss," said Schwall. "We could then easily



combine the aerial and hydrography data seamlessly for one valuable deliverable."

The aerial survey was conducted after determining highly visible and suitable ground points for the georeferencing of the data. With the ability to immediately review the generated data (pictures taken with a high-resolution compact camera) after each flight, the survey quality was quickly validated. The camera, fixed to the free-floating gimbal of the Aibot X6 multi-sensor platform, enables the pilot and others to review the photographic material as soon as the UAV is on the ground. The images are added automatically during the waypoint flight and tagged with GPS coordinates that are generated by the Aibotix AiGeoBox mounted on the camera.

Calculations showed the project would need five flights each lasting six minutes to cover the 55 hectare area. The flight altitude for this kind of topography was established at 90 metres. Due to the wind conditions of the area on the day of the survey, the pilot decided to carry out a total of seven individual flights. As a responsible UAV owner, IngenieurTeam GEO flies the Aibot X6 in conditions of a maximum wind speed of 6 m/s to ensure safety.

Combined with the results from the hydrography survey, IngenieurTeam GEO was able to provide a complete overview of the site and the current situation that Knobel-Bau used to further its business.

"The combination of survey data from the air, from the ground and from the surveying boat has led to an excellent result. The orthophoto, the exact volume calculation and the 3D model of the gravel pit permit prospective planning and accurate assessment of the actual situation," said Bertram Knobel, managing director of Knobel-Bau. "The economic implementation of large-scale projects and the associated results of IngenieurTeam GEO is a decisive advantage in comparison to all conventional and traditional methods."

A GROWING POTENTIAL

Apart from this project, IngenieurTeam GEO uses the Aibot X6 with various sensors mainly for terrain surveys, surface evidence documentation and visualisation tasks, such as animations, simulations and 3D displays. With direct access to point clouds, the firm is accepting more and more complex projects, something it was unable to do in the past. After more than 45 aerial projects and about 350 individual flights, IngenieurTeam GEO continues to be impressed by the data accuracy of its Aibotix Aibot X6 while seeing nothing but positive ROI on its investment.

"Using the Aibot X6 for aerial data generation has allowed us already to reduce our outdoor process times from entire days to hours or even minutes," said Schwall. "We consider the interlinking of different Leica Geosystems technologies and the interaction between software and survey instruments to be the crucial difference to classical surveying methods and commercially available photo drones. This combo make it easy for us to generate data and to provide our customers with essential information."