Plane UAV for mapping a lake area of about 600ha

HOOK, LINE AND SINKER

ANNUAL LAKE DISCHARGES IN THE CZECH REPUBLIC ARE A PRIME TIME TO MEASURE THE LAKE BOTTOMS – IF YOU'RE QUICK ENOUGH. JAKUB KARAS EXPLAINS HOW HE USED A UAV TO HELP CREATE ORTHOPHOTOMAPS AND DTMS OF THE REPUBLIC'S SECOND-LARGEST LAKE IN LESS THAN HALF A DAY

In the Czech Republic, water is discharged from lakes every one or two years in the autumn, because the largest lakes allow people to catch freshwater fish (mainly carp), which Czechs especially love at Christmas. During this discharge, almost the entire bottom of the largest lakes is uncovered, presenting for a few days a unique opportunity to map these areas and compare the rate and amount of silting on the bottom over the next few years.

Using UAVs to take images is the easiest and fastest method of doing this. UAVs can clearly map the bottom of a lake from the air and through photogrammetric methods, the images can be used create a complete digital surface and terrain model of the lake bottom.

We have tested using UAVs in fisheries and water management, to monitor chlorophyll and determine the mass and volume of mud, areas with high silt sedimentation and erosion, and water colour. For our pilot project, conducted in November last year, we used a UAV to create an orthophotomap of the bottom of Bezdrev, the second largest Czech lake (520ha) and the main lake used in the production of Czech fish. The UAV we used was the MaVinci Sirius from Topcon. This has great endurance, can take off from the hand and can be landed manually in a small area. The sensor used was a calibrated Panasonic GX1 camera with fixed focus and 14mm lens.

Mapping of the lake bottom was completed with three planned flights of the UAV in less than three hours of flight time – despite its size, the entire area was mapped in half a day of fieldwork. This is faster and more effective than using terrestrial laser scanners or classic land surveyor methods.

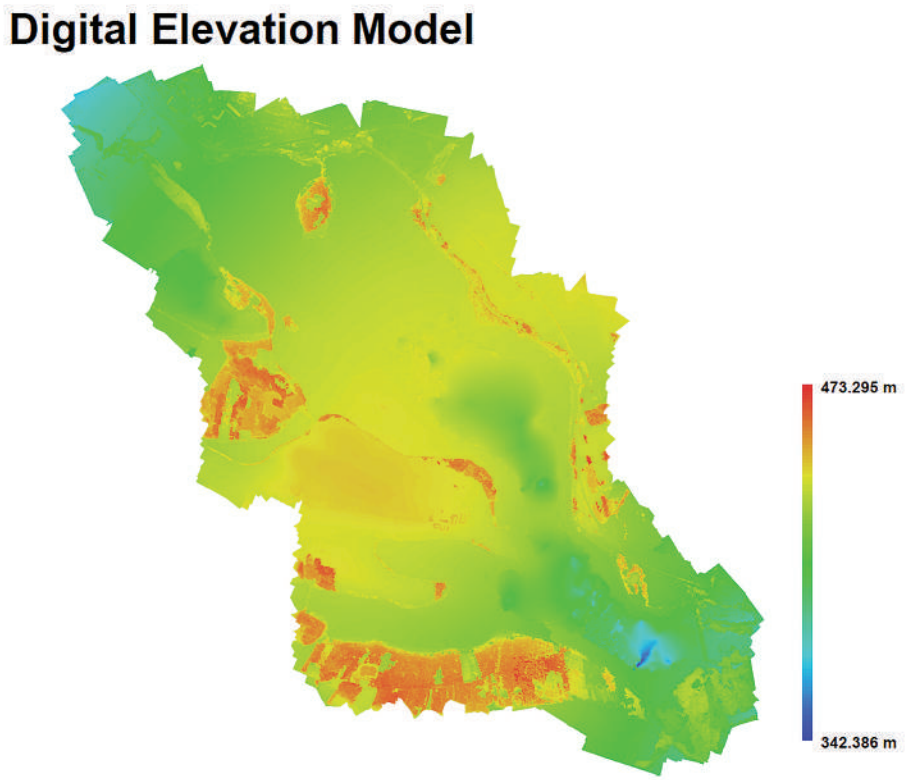
Overall, 640 aerial images were acquired, with 80/60 overlaps and almost two million tie points. Ground control points were located and measured by real-time kinematics and GPS, using a TopCon Hiper GGD with TopSurv SW. Rendering time in the highest quality processing using the Agisoft Photoscan SW with autocorrelation was two days.

Outputs

Among the outputs were an orthophotomap of the bottom of a lake with an image resolution of 5cm, a digital surface model the bottom of lake in point cloud format, as well as aerial photographs of the colour of the water at the dam of lake. From a digital surface model, a 3D model of the entire drained lake was created.

The point cloud had more than 500 million detailed textured points in the Czech coordinate system. Positional error of measurement of points at the bottom was on average about 10cm. This point cloud will be used for volume measurement in future mapping, helping to identify erosion and places with the most mud at the bottom and compute the volume of this mud.

The digital terrain model of the bottom can be used to identify the deepest locations and the location of erosion, and to create hypsometric model or a contoured bottom digital model. Periodic measurements of the bottom from a UAV can be used to compare and



Digital elevation model of the bottom of lake Bezdrev

calculate the extraction needed to dispose of mud in the future.

Upvision, working with the Czech University of South Bohemia, has also tested UAVs to monitor water colour and chlorophyll, identify areas with high silt sedimentation and perform other jobs in water management, where UAVs could help in future. UAV-use in fisheries and water management will definitely increase, because they can be used quickly, responding to current conditions and for different types of aerial monitoring. In addition to identifying the precise terrain model of streams, lakes, ponds and dams, it can effectively be used to monitor the colour of water and chlorophyll, to scare predators and monitor the movement of fish in their environment using a receiver on UAV and transmitters on the fish.

UAV-USE IN FISHERIES AND WATER MANAGEMENT WILL DEFINITELY INCREASE

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Part of the orthophotomap of the bottom of Bezdrev lake

Orthophotomap of the bottom of lake Bezdrev from UAV

Textured point cloud in high resolution