

Creating 3D City Models in a Single Flight



3D urban mapping is required by more cities at a rapid rate. 3D GIS tools are being implemented worldwide by cities transitioning into smart and interconnected metropolises. Since 1970, Aerowest GmbH of Dortmund, Germany has provided acquisition and processing of geospatial data from aerial photographs. Since February 2017 they have operated IGI's UrbanMapper with eight Phase One Industrial 100 megapixel cameras acquiring aerial data for 3D city models in a fast, efficient and cost effective way.

Efficiency in Vertical and Oblique Aerial Photography Collection

In the early 2000s, oblique camera systems were introduced into many diverse aerial imaging applications. System uses include but are not limited to: multi-perspective desktop viewers, visualization of buildings roofs and façades from a 360-degree perspective, realistic texturing of 3D city models, and measurement of building heights in monoplotting mode.



3D Mesh Model - courtesy of Aerowest

Today urban planners and decision makers rely on 3D maps to support a wide variety of initiatives and actions. 3D mapping is used to prepare for changes in city structures, population growth and urban planning, preventative measures for natural and industrial disasters, inhibiting overuse of finite resources, incorporating sustainable practices, and more. City planners therefore require a reliable database that can be easily modified over time in order to gain a holistic look at the urban environment. An immediate advantage of acquiring oblique images is the possibility to view elements that are generally occluded or not visible in the vertical views. The oblique images provide additional viewpoints on objects such as road edges, facades and lower building parts. Classic nadir aerial imaging is accompanied by high resolution oblique images and move classic ortho-photos into 3rd dimension with most detailed 3D point clouds and 3D mesh models.

Aerowest combines both worlds with the newly developed IGI UrbanMapper system, which joins high-resolution nadir and oblique images in one single systems setup. Combining high geometric stability and high quality images allows urban planners zoom into the finest details. Cameras used in the UrbanMapper therefore need to have a high dynamic range to compensate for different light conditions (such as shadowed areas) and a high resolution.

High Performance with Phase One Industrial Medium Format Cameras

IGI's UrbanMapper comprises of 8 Phase One Industrial 100 megapixel cameras that capture multiple perspectives simultaneously with high overlap. The camera system is installed in a gyro-stabilized platform and operated with a IGI's AEROControl GNSS / IMU system. This allows the exact determination of each exposure position and image orientation. This system enables the capturing of large format nadir and oblique aerial imagery in a single flight.

Hans Joachim Benfer, Aerowest CEO explains that the unique aerial sensor system simultaneously captures vertical (nadir) and oblique images with a forward overlap of more than 80% even with highest resolution up to GSD of 2cm.

Four 100MP cameras are installed to form the nadir view, three of which are in RGB configuration to produce a 300 mega pixel image. The fourth nadir camera detects the optional NIR channel.

"Based on the short exposure time and the highly sensitive CMOS sensors we can collect images at the flight altitude of 2,000 m (6,500 feet) with the same or even better image quality as camera systems operated in light aircraft or drones from lower flight altitudes", says Benfer.

"The quality and reliability of Phase One Industrial cameras is outstanding. Due to the high sensitivity of the camera, the IGI UrbanMapper can be operated under poor light conditions and at high aircraft speed while still retaining high-quality image capture. In 2 years we have successfully shot more than 1.2 million images."

- Hans Joachim Benfer, Aerowest CEO.

Generating Online City Models

Each Phase One Industrial camera contains a 100MP CMOS sensor and each lens utilizes innovative RS shutters. A fast capture rate of 0.6 sec per image, and the high performances of Phase One Industrial RS lenses, integrated with an IGI processor, lead to outstanding image quality. The system is able to provide a 2cm Ground Sample Distance (GSD) at 400m flying altitude; 5cm GSD at 1000m flying altitude. A forward overlap of >85% is achievable at 160kn flying speed.



IGI UrbanMapper

About Phase One Industrial

Phase One Industrial is a division of Phase One A/S that researches, develops, and manufactures specialized industrial camera systems and imaging software solutions. The division focuses on specific applications such as aerial mapping and surveying, ground and aerial inspection, agriculture, machine vision and homeland security.



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The UrbanMapper with its eight Phase One 100MP aerial cameras captures a huge amount of data. Processing this data and generating a comprehensive and detailed model out of it takes time. Aerowest uses SURE Aerial software by nFrames GmbH and PHOTOMESH software by Skyline Software Systems Inc. side-by-side to produce textured 3D models of cities. The oriented images can be processed with any matching or photogrammetric software on the market. Even smaller municipalities can now achieve cost effective, high-quality 3D city models as well as orthophotos with an accuracy of two to ten centimeters.

Multi-perspective aerial imaging opens many new opportunities in geodata based applications. Aerial imaging with qualified cameras offers the fastest way to reproduce digital 3D representation of reality for all kinds of planning, surveying or visualization.



3D Representation of Frankfurt – Courtesy of Aerowest

Takeaways

Adding the IGI system with Phase One Industrial cameras enabled Aerowest to:

- achieve a fast method in reproducing digital 3D retransition of reality for all kinds of planning, surveying or visualization.
- provide affordable, cost effective, high-quality 3D city models as well as true ortho-photos.
- accomplish multi-perspective aerial imaging, which opens many new opportunities in geo-data based applications.