

## **INPHO GmbH – Ready for the Future**

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### **ABSTRACT**

INPHO GmbH is a full system provider for digital photogrammetry and terrain modeling. The paper is summarizing ongoing developments and is touching briefly the change of ownership in the company, which was announced in Feb. 2007.

### **1. INTRODUCTION**

INPHO GmbH is a successful supplier of complete systems and individual software components for the GIS and mapping market, with special emphasis on spatial imaging and terrain modeling. It currently appears to us, that the mapping market splits into two major trends. The hottest topic in the industry is about providing all kind of geospatial imagery, gathered by various sensors for numerous web portals, whereas mapping or engineering projects, in the classical meaning, are getting somehow lower attraction, at least when looking into the news ticker. For the first category of projects, features like costs, speed and percentage of coverage of a certain area are most important, while for the second category features like accuracy, reliability and quality of the data as well as a certain warranty for the work performed still needs to be addressed at a high priority. The challenge for INPHO GmbH will be to fulfill the needs for both types of projects, in order to play a major role in a world of continuing globalization.

### **2. INPHO GMBH NOW OWNED BY TRIMBLE NAVIGATION LIMITED**

In February 2007, a press release announced the acquisition of INPHO GmbH by Trimble Navigation Limited. Trimble is a major player in the geomatics market, employing about 3.400 people worldwide and having achieved revenues of about US\$ 940 million back in 2006. All businesses of Trimble share the mission of enhancing productivity and profitability of various customers through location-based solutions, mainly all kind of GPS based technology, surveying equipment and LiDAR scanning devices as well as related software solutions. These technologies are used in ng various kinds of applications, like engineering and construction including surveying, utilities, mobile resources management, precision agriculture, etc.. INPHO, well known for its excellent technology and expertise about handling georeferenced imagery and subsequent information extraction, will act as a center for photogrammetry and greatly extends the product portfolio of Trimble for the applications mentioned above.

### 3. MAJOR NEWS ABOUT INPHO PRODUCTS

#### 3.1. Enhancement of sensor support with the INPHO product line

##### 3.1.1. Frame sensors

Over the last years, INPHO has mainly been focusing on processing imagery based on frame sensors. Cameras using frame sensors are still the most commonly used units for the photogrammetric market. Especially, if we don't consider the large format cameras only, but also the medium format cameras, which are now available by various manufacturers.. In the following, just a few out of a long list are mentioned as examples:

- DMC from Intergraph
- UltraCamD and UltraCamX from Mircosoft Photogrammetry
- DSS camera system from Applanix
- film based cameras from Leica and Zeiss

INPHO has spent efforts in handling the geometry of digital camera sensor at the best. According to our experience, which we achieved while working with our customers, it is worth or sometimes even a must to use self-calibration during aerial triangulation. Including these procedures, the results can be improved considerably, in some cases it reduces the sigma naught of block adjustment to about 30% - 50%.

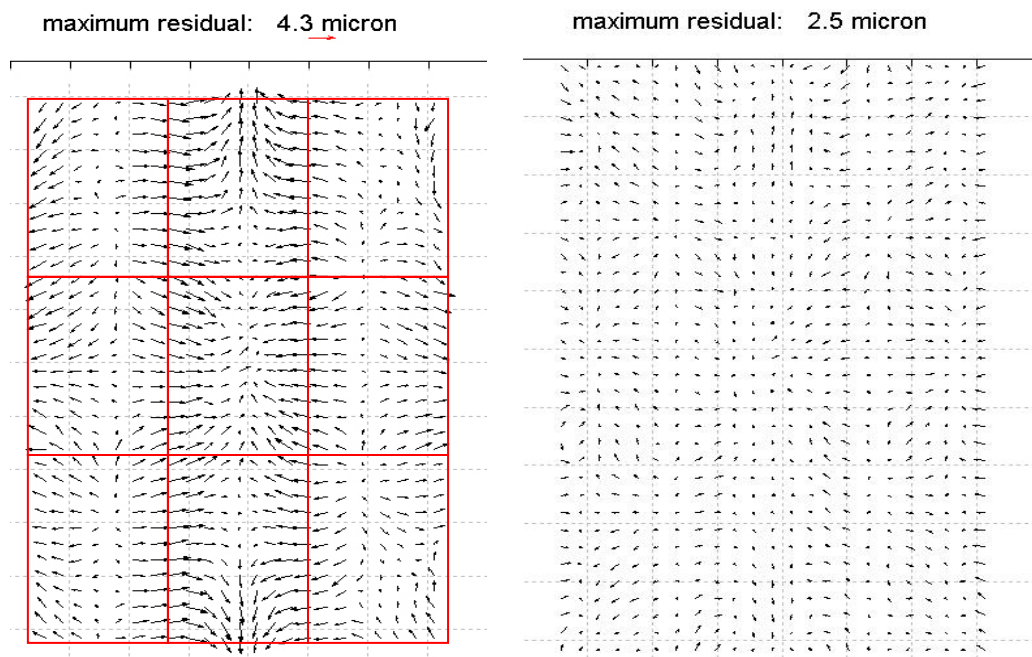


Figure 1: Distortions detected by using self-calibration with MATCH-AT

It is very important to mention, that the results of the automated aerial triangulation with MATCH-AT including the self-calibration are applied in all steps of INPHO's photogrammetric workflow, i.e. during DTM extraction with MATCH-T, during orthorectification with OrthoMaster as well as during data collection out of stereo models with Summit Evolution or DTMaster stereo. The self-calibration parameters are applied by means of a dense correction grid, which is a very flexible approach, as it is easy adoptable, if there is once a need to use other modeling approaches for the

image plane. The “on-the-fly” grid correction method avoids resampling of the original imagery, which is time-consuming and needs additional disk space, not forgetting to mention a potential mix-up of various sets of similar imagery.

### 3.1.2. Pushbroom sensors

The upcoming release of INPHO’s photogrammetric system will now fully support the processing of pushbroom cameras, like:

- ADS40 series from Leica Geosystems
- JAS150 from Jena-Optronik

The main characteristics of the new aerial triangulation module for pushbroom sensors are:

- A new easy to use measurement tool for tie and control points
- Only few interactive tie points needed for strip connection
- Different adjustment modes are available: trajectory calibration, to adjust kinematic parameters and to allow the trajectory offset, including the a-priori sensor/navigation offset

The first ADS40 projects processed with the new digital aerial triangulation module are showing nice results, e.g. INPHO has also processed the EuroSDR testblock Vaihingen. (ADS40, 6 flight lines, 0.18m GSD). By using the trajectory and offset mode, the mean residuals at 12 checkpoints are 0.05m (XY) and 0.07m (Z), which is an excellent result, compared to others, who have been running the same test data set!



Figure 2: DTM generated by MATCH-T

### 3.2. Progress in DTM Generation with MATCH-T

MATCH-T is INPHO’s fully automated DTM generation software, which is successfully on the market for years. It is supporting all kind of sensors, like frame cameras, as well as airborne and spaceborne pushbroom sensors.

Due to the increasing demand of orthophoto generation, the generation of high quality DTMs (Digital Terrain Models) is one important step in the whole process chain. There is also an increasing demand for generating Digital Surface Models (DSM). The photogrammetric block configurations for such projects differ significantly from standard 60/20 overlap setup, especially when flying with digital frame cameras. Projects with 60/60 or even higher overlap are beneficial, for some requirements necessary. Therefore a much higher number of images are available covering the same location on the ground. The new MATCH-T is using now all of these images in the automatic point measurement procedure. Self evident, not all rays will contribute due to a weak geometrical constraint. Some other techniques have been included, like improved noise filtering, to

increase the quality of the generated points. In case of pushbroom sensor cameras, images from all views (nadir, forward, backward) can be used.

The improvements can be summarized as:

- Higher quality of the DTM points
- Increased number of DTM points, if needed
- Point quality suited for building modeling
- Need for manual interactive editing highly reduced

### 3.3. Introduction of Distributed Processing for Orthophoto generation

Similar to the Olympic Games, the slogan for photogrammetric projects nowadays is ‘faster’ and ‘bigger’, which requires new methods and tools for processing. Fortunately, the rapid development in computer hardware helps a lot in managing the heavy processing work load. Modern workstations are available with dual- or quad-core CPUs or multiple processors configurations at reasonable prices.

INPHO leverages the increase of computing power in the orthophoto rectification process by offering a distributed processing environment for OrthoMaster based on Condor<sup>®</sup>. Condor<sup>®</sup> is a package of software tools enabling increasing computing throughput using multiple or distributed processors.

The overall increase of throughput is dependent on the number of CPUs available and used in the network, but also on other components of the IT infrastructure as well, like network speed, file server and storage setup.

Offering a solution for distributed processing for orthophoto rectification is the first initial step. Other modules, like MATCH-T etc, will follow with upcoming software releases.

## 4. CONCLUSION

INPHO is continuously further developing its product line in order to meet the needs of existing and prospect customers. That product line is supporting all important space and airborne sensors currently available on the market. Being part of the Trimble group, INPHO has now access to additional infrastructure and additional sales channels to approach customer in all corners of world.

[www.inpho.de](http://www.inpho.de)

[www.trimble.com](http://www.trimble.com)

[www.applanix.com](http://www.applanix.com)

[www.cs.wisc.edu/condor](http://www.cs.wisc.edu/condor)



Figure 3: MATCH-T point cloud