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SMALL FORMAT AERIAL PHOTOGRAPHY

Bernd Hofer
Hofer&Pautz GbR, Buchenalle 18, 48341 Altenberge, Germany
Phone: +4925059377840; Email: hofer@hofer-pautz.de

SUMMARY

With Small Format Aerial Photography, in combination with an ultra light airplane, a low cost and flexible system is given, to perform three dimensional measurements and analysis. Planning and executing the photo survey is done by Hofer & Pautz gbR Germany. Data-processing and model building is realized by the company EFTAS in Münster. Based on the calculated Digital Surface Model and the Orthopicture a multitude of analysis can be performed. These three main parts of this process will be explained in the following abstract.

KEYWORDS: Digital Surface Model (DSM), Orthopicture, Triangulation, Small Format Aerial Photography (SFAP), Triangulated Irregular Network (TIN)

INTRODUCTION

The idea is to offer a relatively low-priced, a spontaneous executable and flexible method to detect the topography. In comparison to traditional methods like the usage of a theodolite or a GPS-Unit in the field, the SFAP accommodates a way to acquire a multiple of data in a significant shorter timeframe. In spite of this, a low-cost method gives many opportunities for high accuracy three dimensional analysis.

MATERIALS AND METHODS

Data Acquisition

Data acquisition will be done with an ultra-light airplane. The advantage of an ultra-light airplane is a low flying altitude, low velocity and low costs. The results are marginal in-motion unsharpness and high resolution. The assembled camera is a Canon EOS 1 Ds Mark II with a resolution of 17 megapixel and a professional calibrated objective lens. With a high accuracy GPS receiver, a Trimble R5 GNSS system, the taken pictures are provided with time stamps and coordinates. Therefore the image centers of every single picture are established with high accuracy. Nano Track from TrackAir is used for survey planning and execution. The following Figure 1 shows a schema of the deployed system.

Figure 1: Deployed system for data acqusition

Data Processing

Processing and georeferencing of the taken photos is realized by the company EFTAS in Münster. Therefore a stereoscopically procedure is used to assign coordinates and heights to every pixel in a photo. The next and final step is to triangulate the surface with an interpolation between the pixel. The results of data processing are a digital Orthopictures and a DSM (s. Figure 2a DSM example and 2b Orthopicture example). Upon the post processing of the GPS data and embedding the reference points in the photos, the accuracy in attitude and height of the models is less than 10 cm.
The resolution of the orthopictures amounts up to 10 cm and of the digital surface models up to 25 cm.

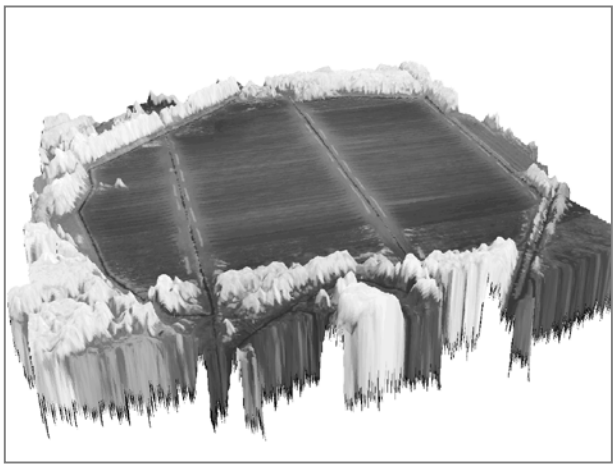
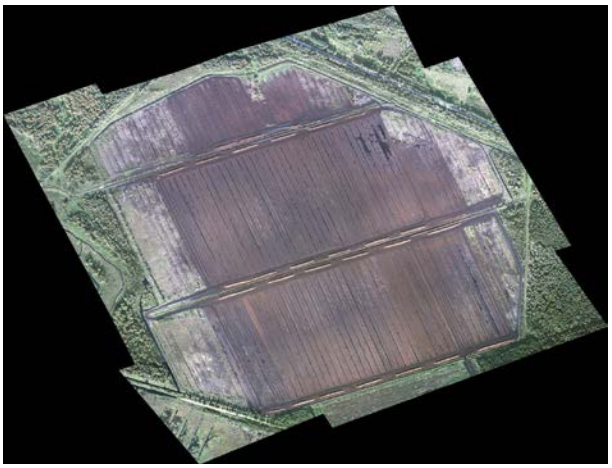


Figure 2a: DSM example



2b: Orthopicture example

3D-Analysis

Analysis with three dimensional data can be performed with a GIS- or CAD- software. As mentioned above, there are two major products for 3D-analysis.

DSM

One of the products is the DSM. For example height modeling, in combination with the stratigraphy, for showing the rest of the mining volume, is useful applications for assembling 3D-analysis. Additional applications can belong to the environment protection. For example rewetting or renaturation plans for peat mining fields which are completely exhausted can be prepared. Figure 3a shows a planning basis for a rewetting project. This basis opens the possibility to plan polder. Another application can be to determine the volume of stockpiles or to progress potential analysis of different scenarios. Figure 3b shows a TIN of a stockpile.

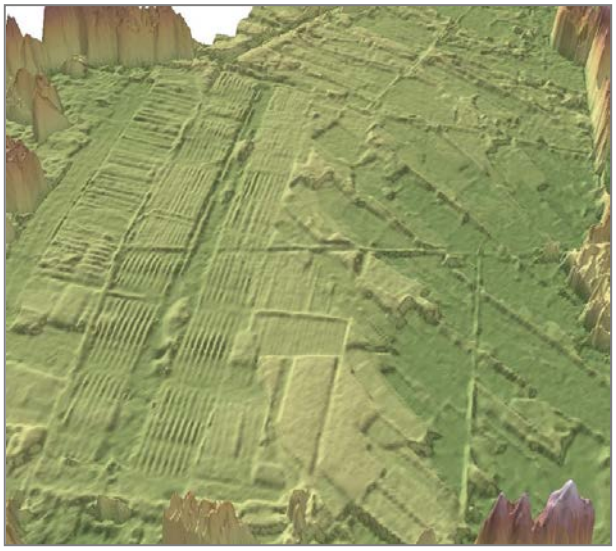
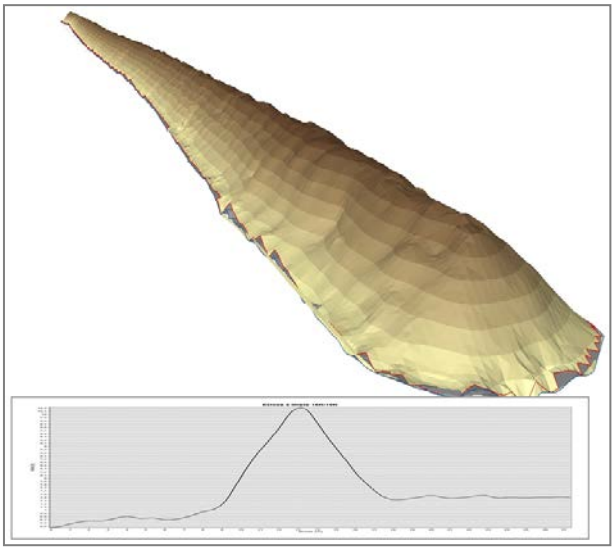


Figure 3a: Planning basis for rewetting projects



3b: TIN of a stockpile

Orthopicture

The conservation of evidences in case of accidents at building sites or wrong plannings are some further interesting application for orthopictures. Furthermore the plant coverage can be analyzed or different location studies can be performed.

CONCLUSION

The SFAP is an effective way to acquire a lot of digital data in a short timeframe with low costs and there is a variety of applications for three dimensional data. The development of this system is leading to more accuracy and more automation. That means that the effort of manpower in processing steps will be reduced in the future and the accuracy and resolution of three dimensional models will increase