1. Managing large blocks of aerial images - Introduction

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Keywords

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1 Abstract

The size of photo-missions increased over the last decade and 10.000s of images in one and the same aerial image block are no longer unusual. Thus new requirements to maintain and control the photogrammetric processing chain raised and software needs to intelligently assist the operator analyzing the data set, to control quality and to document all steps of the automated workflow.

We show an intuitive and powerful solution, a versatile 3D graphical user interface is deeply integrated into the UltraMap AT workflow. This solution enables the operator to identify blunders and weak areas and to display in a color-coded manner all relevant parameters of a project. Beside geometry parameters it is also helpful to visualize the time line of a photo mission. Thus sub-blocks and re-flights are well distinguishable from their color representation in the graphical user interface. We show examples of large blocks of about 30.000 shot positions which have been successfully processed and controlled via this graphical user interface.

Finally, we show how Vexcel Imaging's innovative 3D interface technology is applied to the Digital Surface Model editing tool (DSM Editor). The DSM Editor enables the operator to very efficiently interact with DSM data in a highly intuitive manner.

2 Introduction

UltraMap is the digital workflow product specifically designed and optimized for processing digital aerial images from the UltraCam sensor family. The first version of this software was designed to manage the basic functions of data download and initial image processing. Next came the all-digital photogrammetric workflow in 2008 with the introduction of UltraMap Aerial Triangulation (UltraMap AT). This UltraMap workflow module includes automated tie point matching and the least squares bundle adjustment (utilizing BINGO). Automated radiometric processing, known as the Project-Based Color Balancing (PBCB), provides very powerful radiometric block adjustment and was released shortly after the AT module.

Introduced 2013, UltraMap v3 includes a fully automated processing pipeline for the creation of Digital Surface Models (DSM), the *DSMOrtho* ("true" ortho mosaic based on an automatically generated DSM) as well as the traditional ortho mosaic, which we call a *DTMOrtho* from UltraCam imagery.

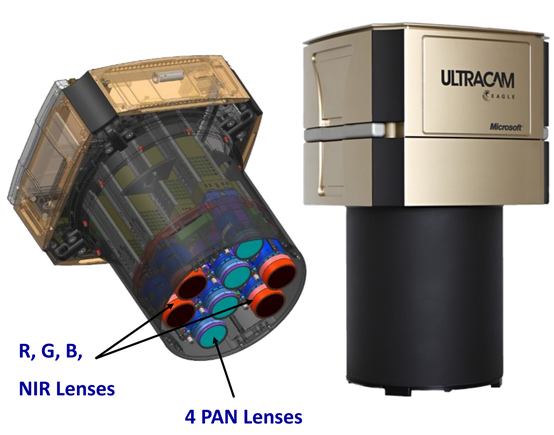
One important design goal of UltraMap is a fluent and intuitive user experience when working with large amounts of UltraCam aerial imagery. For that it was important to simplify the user interface of all workflow tools so that they provide fast and effective user feedback which in turn allows for smooth efficient interaction with large aerial datasets. Utilizing Dragonfly, a Vexcel-Imaging-proprietary technology provides the mechanisms to efficiently display and interact with large aerial blocks of images in a fluent and performant manner.

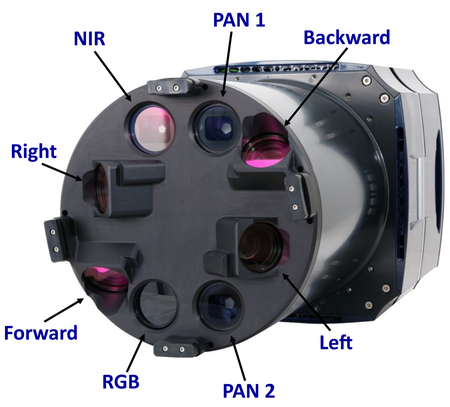
As aerial projects get larger and larger, the next version of UltraMap now allows for even larger blocks of images. The design goal was to comfortably process datasets containing up to 50.000 aerial images and to enable the operator to interact with such large data sets. It allows, for example to zoom and pan into the image data as well as to control and interact with the photogrammetric parameters as the exterior orientation, the quality of the parameters involved and the tools to visualize and to edit these data. In addition to these so-called visual analytics tools we also give a short overview on our DSM editing tool which may indeed add a very specific benefit to the workflow we offer via our UltraMap software package.

3 Data Acquisition

The UltraMap workflow can process any UltraCam data, ranging from the large-format UltraCam Eagle to the medium-sized Hawk and the oblique camera Osprey.

The UltraCam Eagle (right) offers the ultimate in reliability and efficiency for digital aerial photography. With a PAN image footprint of more than 20.000 pixels across the flight strip, and an image capture rate of 1 image in 1.8 seconds, it soars beyond the traditional large-format cameras. The solid-state storage system can be exchanged in flight to meet any storage need.

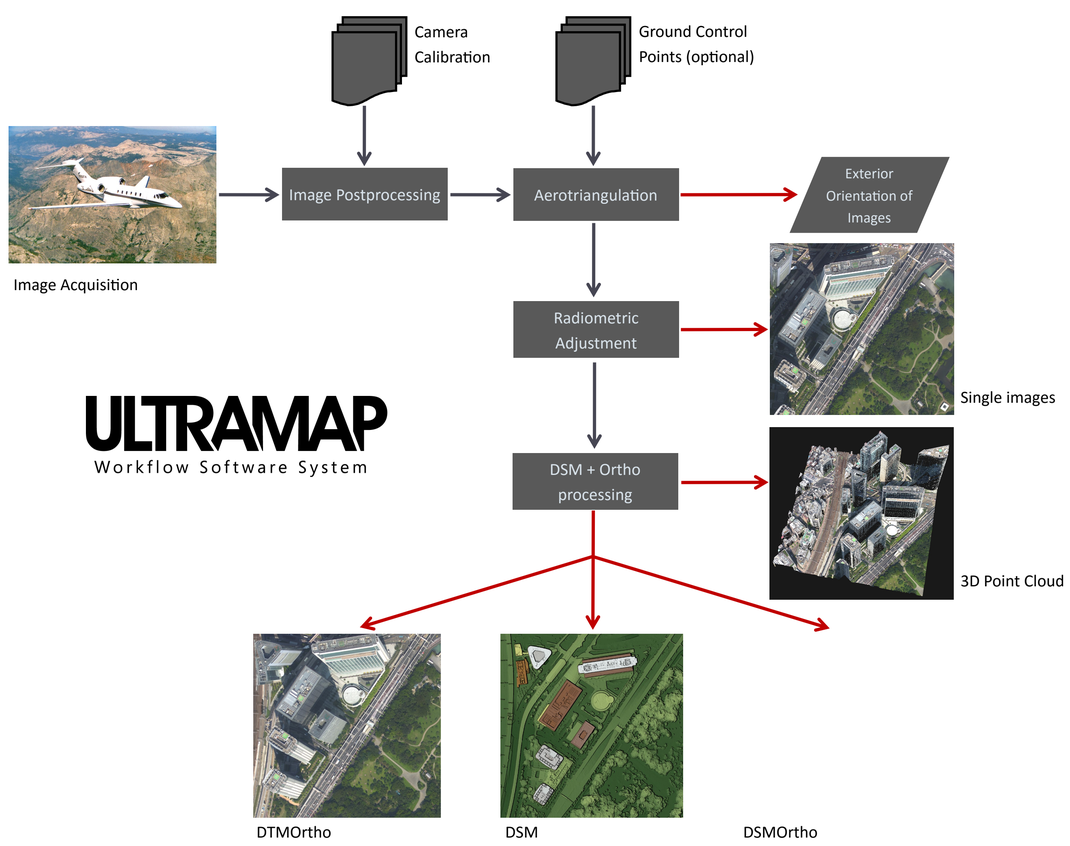




One of the most productive oblique camera systems is the UltraCam Osprey. This camera is based on a concept that offers several new and unique advantages with emphasis on professional photogrammetry and collection productivity. Most important is the metric nadir component which is based on the design of the well-known UltraCam Hawk camera and provides efficiency for conventional ortho mapping at a footprint size of 11674*7514 pixel. Additionally the camera includes oblique camera heads which are looking in the cardinal directions at a 45° off-nadir angle.

4 Processing Workflow

The camera produces images in a raw file format which is postprocessed in Vexcel Imaging's software UltraMap. In the first processing step, the camera calibration and flight metadata are applied to the imagery. Then in the semi-automated aerotriangulation step precise georeferencing is established by using image tie points, ground control points and airborne GPS/IMU for the generation of consistent exterior orientation parameters. In the next step, the images are radiometrically fine-tuned for an appealing visual impression and best fit to any specific application. Further processing leads to a full resolution Digital Surface Model (DSM), pointcloud and orthophoto based on the nadir images.

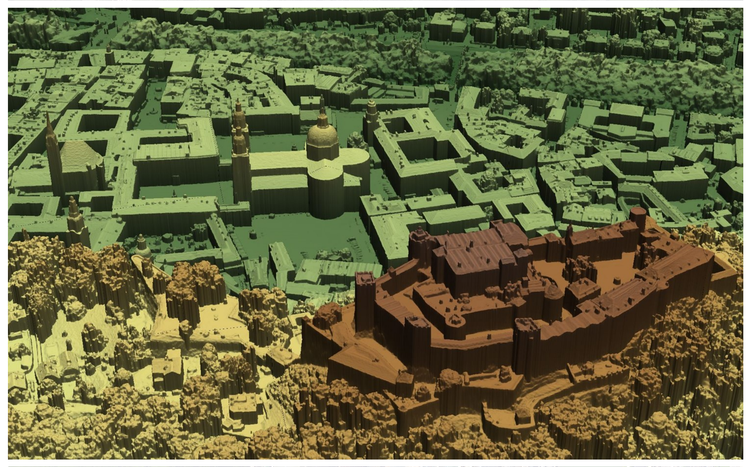


5 Sample data

The workflow allows to export the adjusted imagery plus exterior orientation for georeferenced visualization and analysis. Additionally the DSM, orthophoto and pointcloud can be exported. These datasets can be used for 3D measurements, feature extraction and photo-realistic modelling by adding the oblique images to the 3D objects.

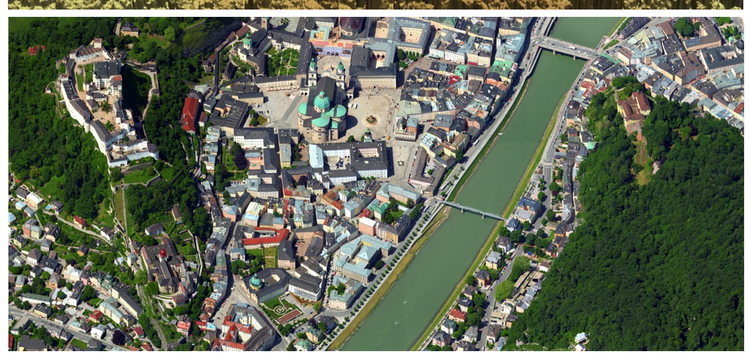
Example:
Flight Mission Salzburg
May 2013
GSD in nadir 10cm
Flight pattern: 75% forward overlap, 65% sideward overlap

Oblique RGB image of castle Hohensalzburg
Viewing direction: East > West



Digital Surface Model resulting from fully automated processing (pixels color coded by height)

GSD of DSM: 10cm (same as input images)



Textured 3D model: DSM is textured with nadir images for pixels on roofs, streets and ground while oblique images are used for facades.

Further Information

For further information and a live demonstration of our products, please visit us at booth #308.