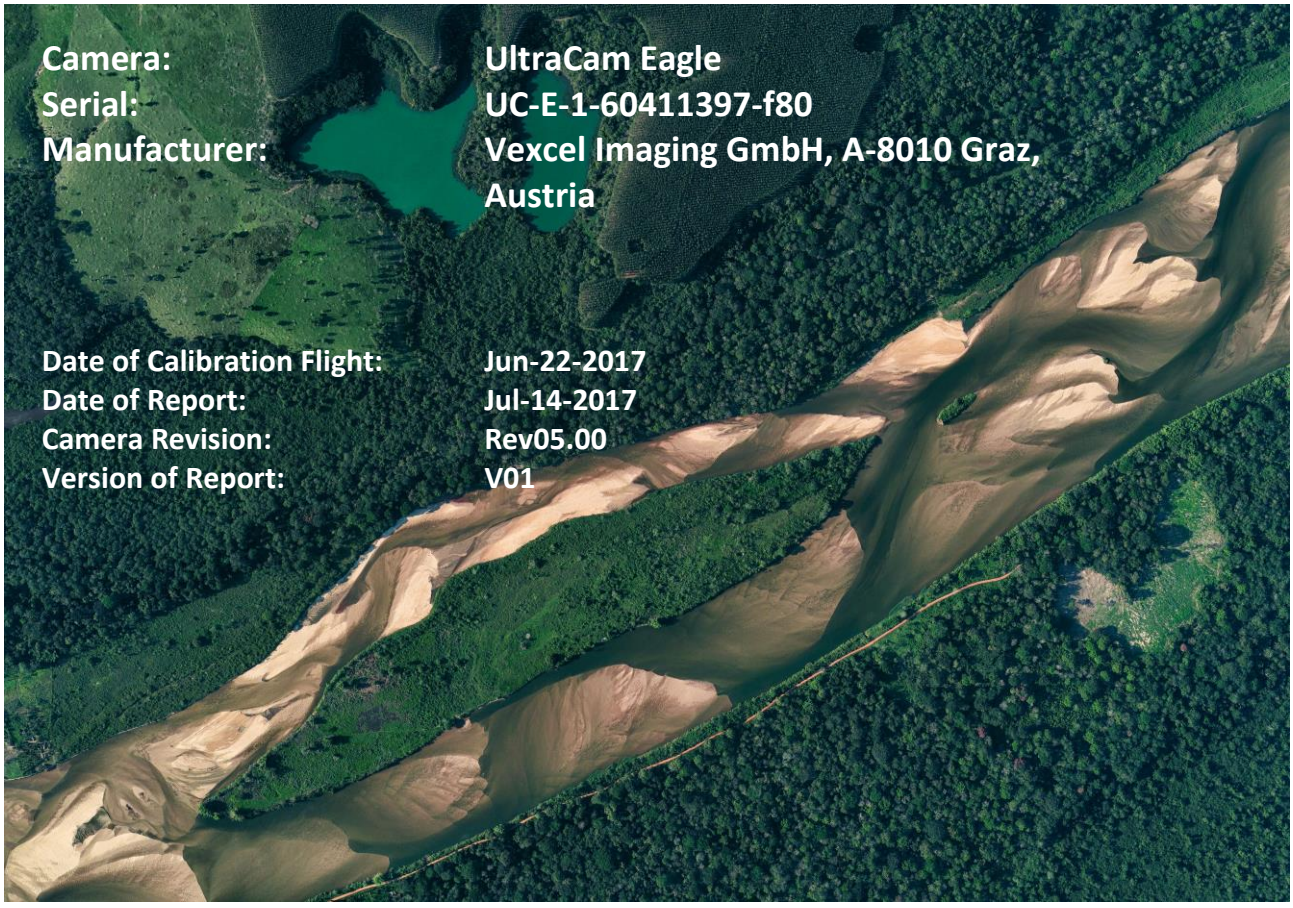
VEXCEL
IMAGING

ULTRACAM

Field Calibration Report



Camera:	**UltraCam Eagle**
Serial:	**UC-E-1-60411397-f80**
Manufacturer:	**Vexcel Imaging GmbH, A-8010 Graz, Austria**
Date of Calibration Flight:	**Jun-22-2017**
Date of Report:	**Jul-14-2017**
Camera Revision:	**Rev05.00**
Version of Report:	**V01**

Bahia, Brasil 2013

Photo on page 1 courtesy of Hiparc Geotecnologia, Brasil

www.hiparc.com

UltraCam Lp, GSD25 cm, RGB

Calibration Procedure

The purpose of the Field Calibration is a verification of the camera status and calibration and consists of three major steps:

1. Test flight performed by customer
2. Processing of images and aerotriangulation (AT) by Vexcel Imaging GmbH
3. Analysis of AT results by Vexcel Imaging GmbH

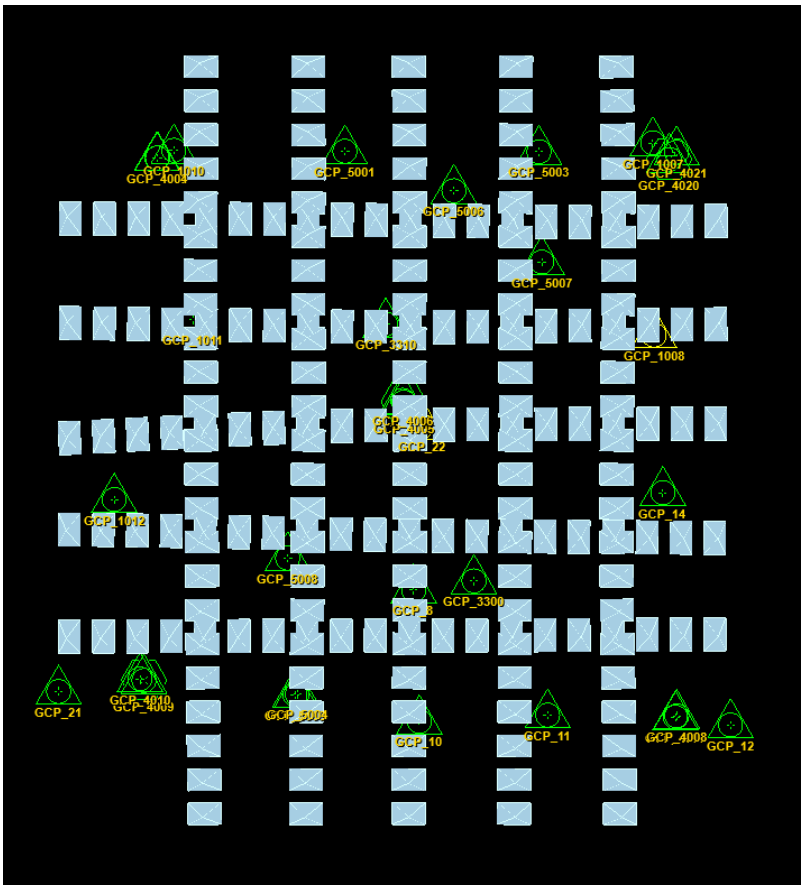
Available Data

Test flight at customer's test site:

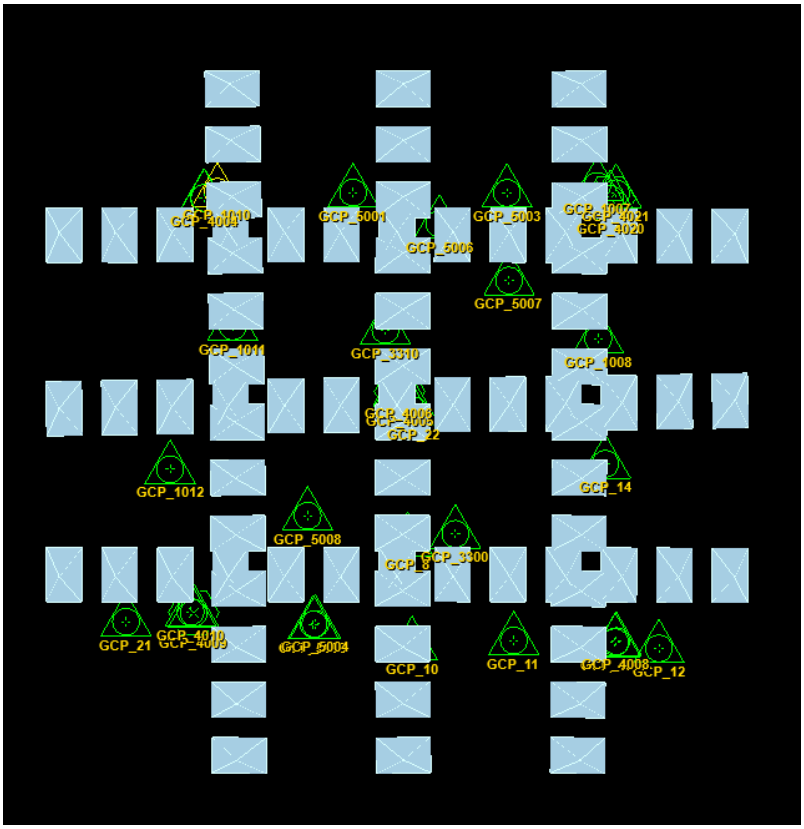
- Date of flight: 22/06/2017
- Number of images: 293 (total)
- Flying heights: 1500 m (GSD 10 cm)
  3000 m (GSD 20 cm)
- Number of images: 215 (GSD 10 cm)
  78 (GSD 20 cm)
- Ground Control Points: 31 (3 were used as check points)
- Postprocessed GPS/IMU: available

Flight lines look very well done and show good overlap and image quality.

- **Flight at 1500 m (GSD 10 cm):**



- **Flight at 3000 m (GSD 20 cm):**



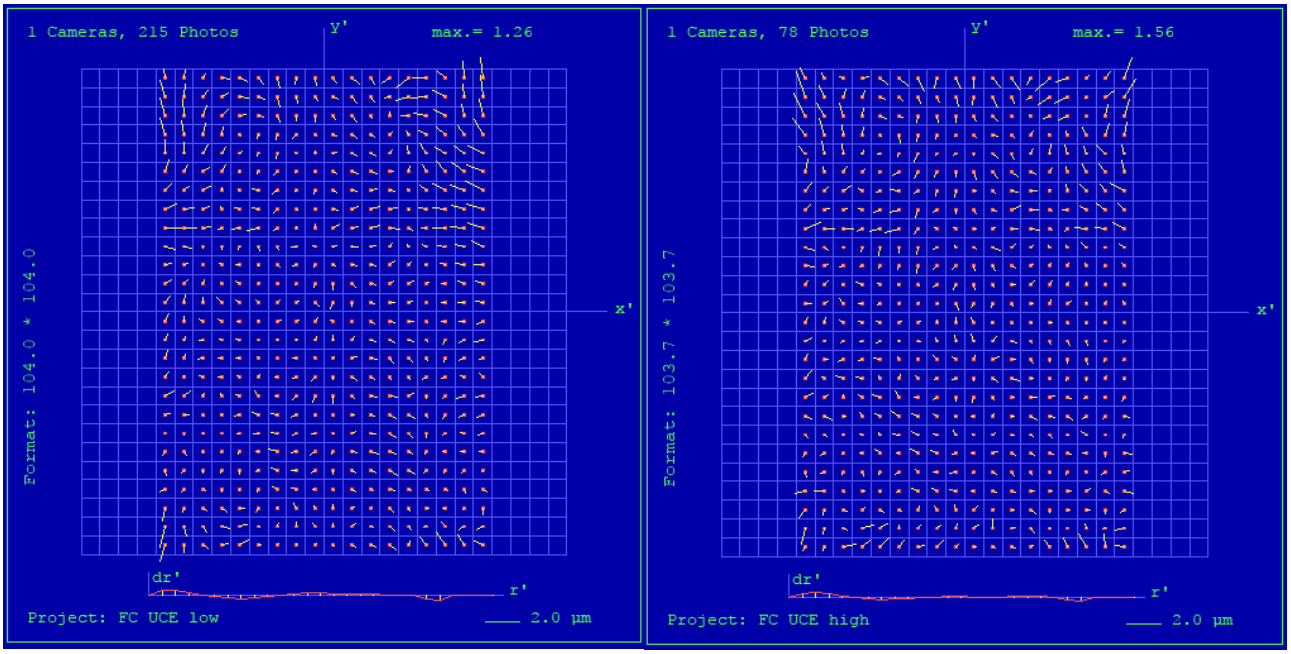
Results

The data was processed in UltraMap v4.2 by Vexcel Imaging GmbH (Process to Lvl02, Automated Tie Point Collection, Bundle Adjustment and Analysis).

The results of the Bundle Adjustment are shown in the table below.

	Flight m (GSD cm)	Flight m (GSD cm)
Sigma 0	1.30	1.26
Mean photo scale	1: 19303	1: 38555
RMS object points X/Y/Z	19/19/59 mm	32/34/108 mm
RMS check points X/Y/Z	29/17/35 mm	13/37/77 mm
RMS control points X/Y/Z	11/11/17 mm	14/14/23 mm

The remaining residuals in the image of the camera are shown in the plots below.



ULTRACAM

Geometric Specifications

Camera:	**UltraCam Eagle**
Serial:	**UC-E-1-60411397-f80**
Panchromatic Camera:	**ck = 79.800 mm**
Multispectral Camera:	**ck = 79.800 mm**
PPA Information:	**X: 0.000 mm**
	Y: 0.000 mm

Panchromatic Camera

Large Format Panchromatic Output Image

Image Format	long track cross track	68.016mm 104.052mm	13080pixel 20010pixel
Image Extent		(-34.01, -52.02)mm	(34.01, 52.02)mm
Pixel Size		5.200µm*5.200µm	
Focal Length	ck	79.800mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	0.000mm	± 0.002mm
Lens Distortion	Remaining Distortion less than 0.002mm		

Multispectral Camera

Medium Format Multispectral Output Image (Upscaled to panchromatic image format)

Image Format	long track cross track	68.016mm 104.052mm	4360pixel 6670pixel
Image Extent		(-34.01, -52.02)mm	(34.01, 52.02)mm
Pixel Size		15.600µm*15.600µm	
Focal Length	ck	79.800mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	0.000mm	± 0.002mm
Lens Distortion	Remaining Distortion less than 0.002mm		

Conclusion

The tables and plots above show acceptable results for the processing with the camera calibration. The calibration was verified with two datasets of the same test area acquired at different altitudes. The remaining distortions in the image are within an acceptable range.

This equipment is operating within specification as defined by Vexcel Imaging GmbH.

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