

## Summary

Project	May162019
Processed	2019-05-17 08:27:51
Camera Model Name(s)	M100_X3Z_4.1_4000x2250 (RGB)
Average Ground Sampling Distance (GSD)	4.02 cm / 1.58 in
Area Covered	0.194 km <sup>2</sup> / 19.4081 ha / 0.07 sq. mi. / 47.9832 acres
Time for Initial Processing (without report)	01m:57s

## Quality Check

<b>Images</b>	median of 45372 keypoints per image	✓
<b>Dataset</b>	51 out of 51 images calibrated (100%), all images enabled	✓
<b>Camera Optimization</b>	3.78% relative difference between initial and optimized internal camera parameters	✓
<b>Matching</b>	median of 22766 matches per calibrated image	✓
<b>Georeferencing</b>	yes, no 3D GCP	⚠

## Preview

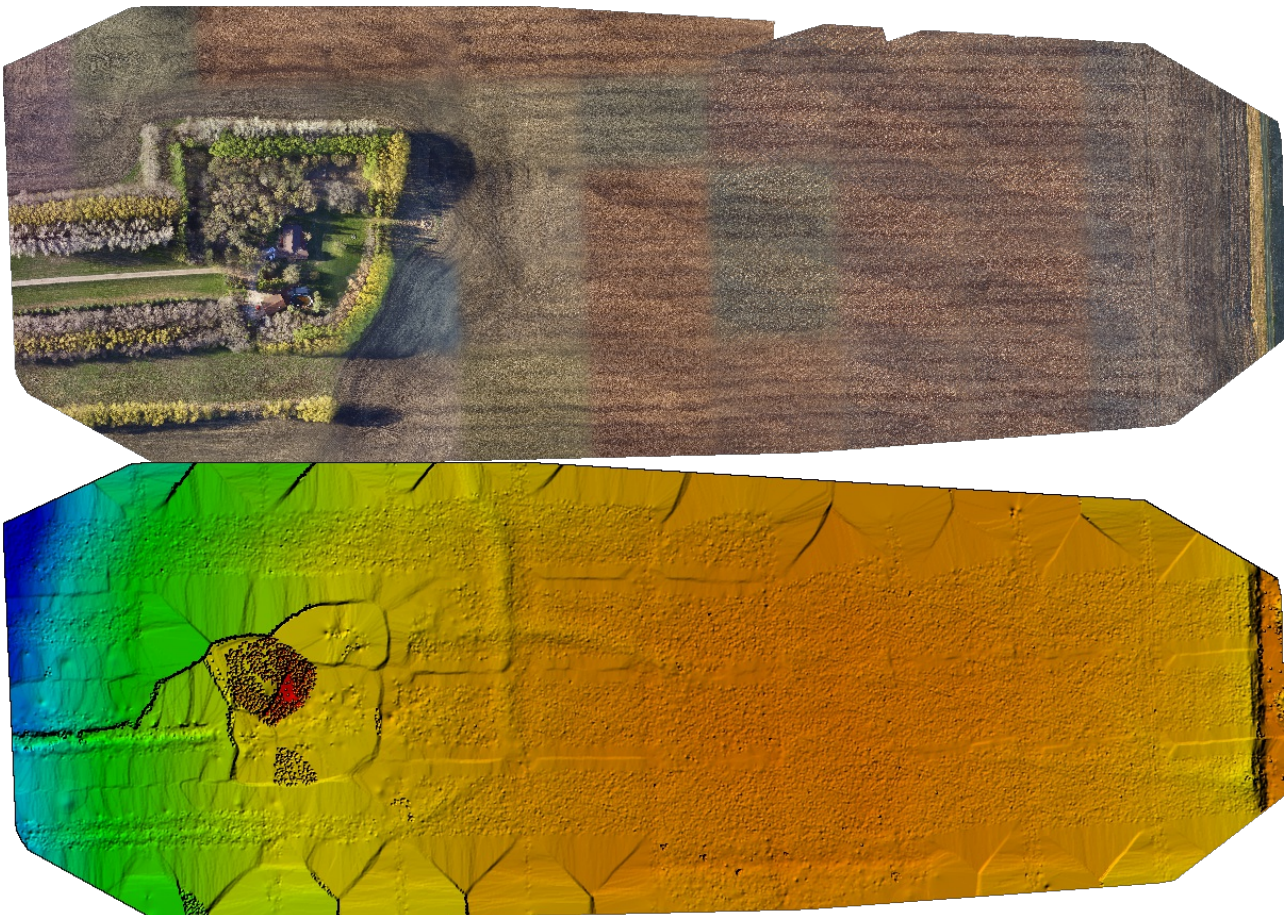


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

# Calibration Details

Number of Calibrated Images	51 out of 51
Number of Geolocated Images	51 out of 51

## Initial Image Positions

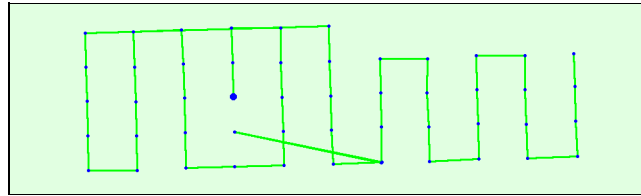


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

## Computed Image/GCPs/Manual Tie Points Positions

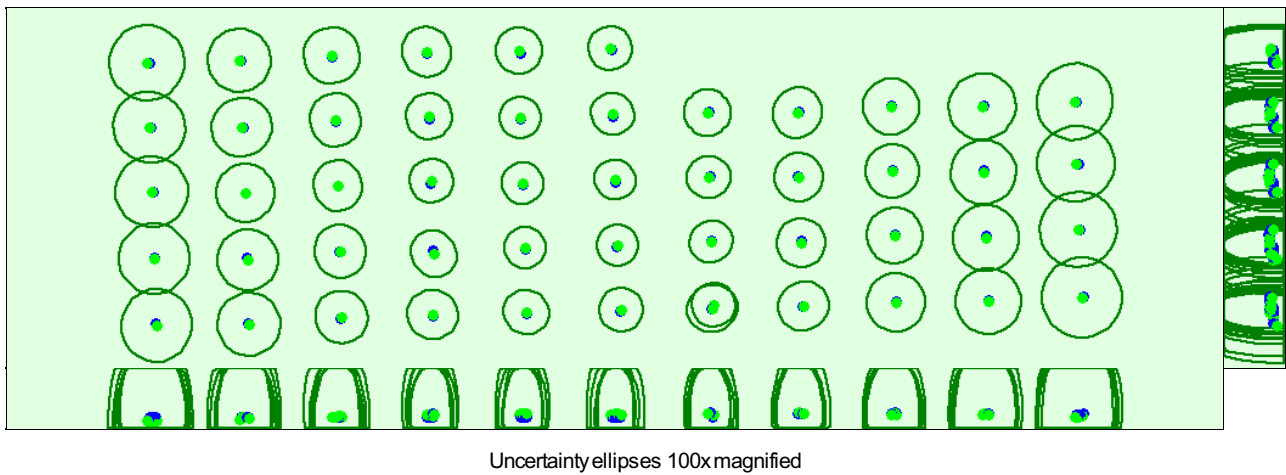


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Dark green ellipses indicate the absolute position uncertainty of the bundle block adjustment result.

## Absolute camera position and orientation uncertainties

	X[m]	Y[m]	Z[m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.233	0.232	0.581	0.255	0.138	0.043
Sigma	0.048	0.049	0.122	0.014	0.035	0.004

## Overlap

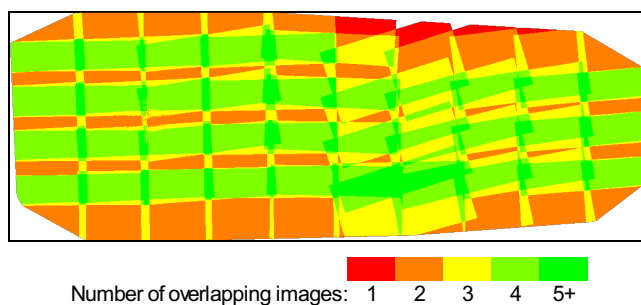



Figure 4: Number of overlapping images computed for each pixel of the orthomosaic. Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint matches is also sufficient for these areas (see Figure 5 for keypoint matches).

# Bundle Block Adjustment Details

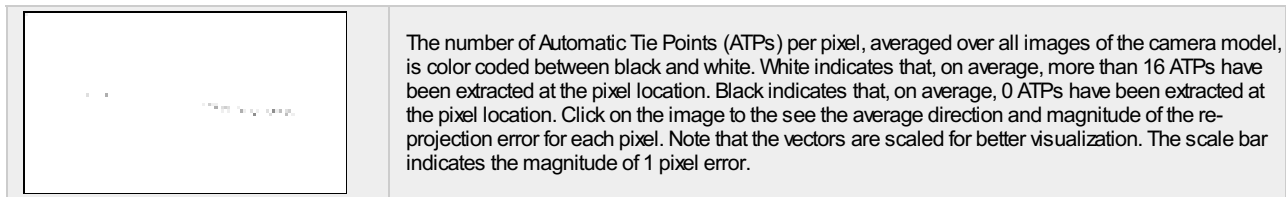
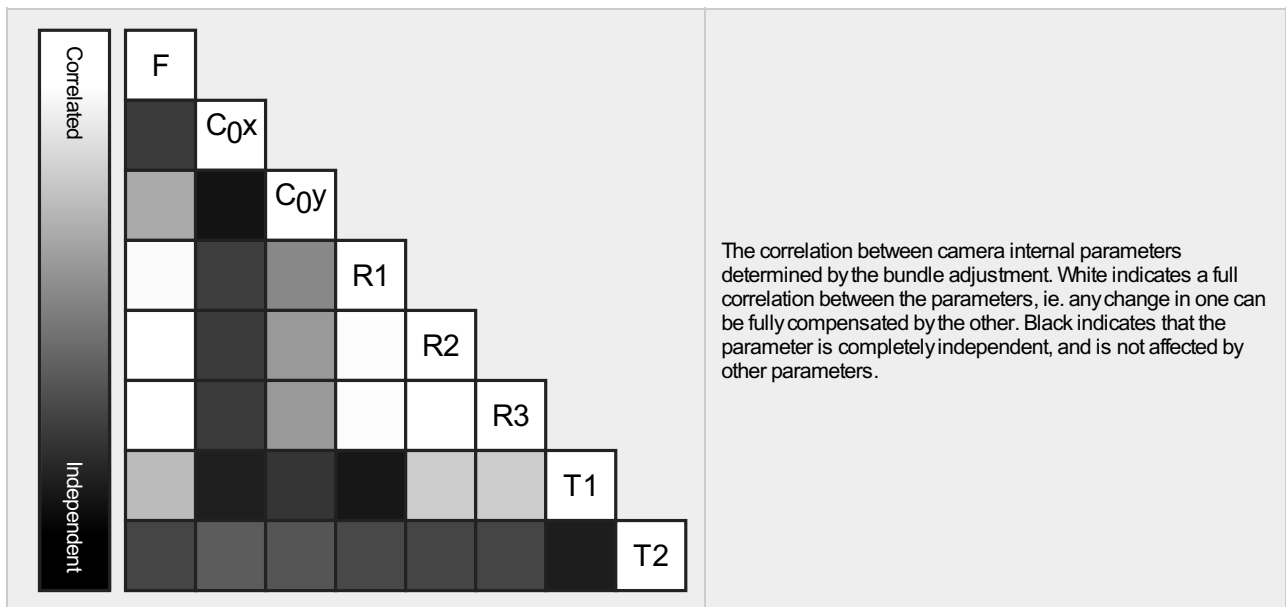
Number of 2D Keypoint Observations for Bundle Block Adjustment	1117343
Number of 3D Points for Bundle Block Adjustment	455250
Mean Reprojection Error [pixels]	0.182

## Internal Camera Parameters

 **M100\_X3Z\_4.1\_4000x2250 (RGB). Sensor Dimensions: 6.523 [mm] x 3.669 [mm]**

EXIF ID: M100\_X3Z\_4.1\_4000x2250

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	2514.285 [pixel] 4.100 [mm]	2000.000 [pixel] 3.261 [mm]	1125.000 [pixel] 1.835 [mm]	0.000	0.000	0.000	0.000	0.000
Optimized Values	2609.335 [pixel] 4.255 [mm]	1996.489 [pixel] 3.256 [mm]	1123.096 [pixel] 1.831 [mm]	0.082	-0.190	0.115	-0.001	0.000
Uncertainties (Sigma)	43.554 [pixel] 0.071 [mm]	0.720 [pixel] 0.001 [mm]	0.585 [pixel] 0.001 [mm]	0.003	0.013	0.012	0.000	0.000



## 2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	45372	22766
Mn	33456	3573
Max	60571	40682
Mean	45954	21909

## 3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	306395
In 3 Images	96994

In 4 Images	46458
In 5 Images	4697
In 6 Images	688
In 7 Images	18

### 2D Keypoint Matches

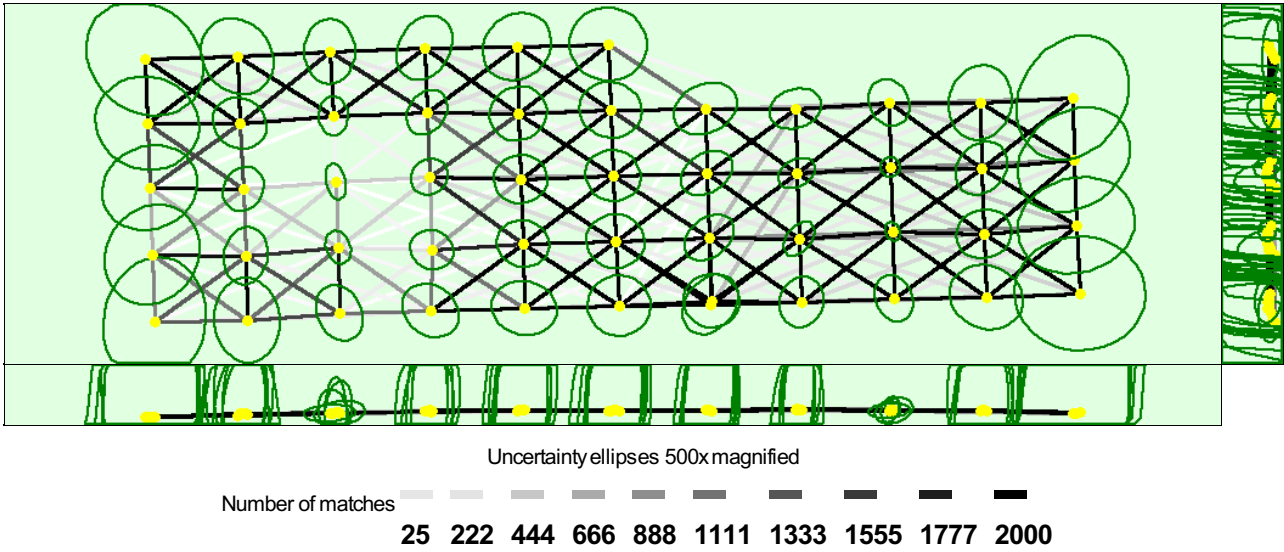


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty of the bundle block adjustment result.

### Relative camera position and orientation uncertainties

	X[m]	Y[m]	Z[m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.051	0.051	0.199	0.043	0.102	0.021
Sigma	0.022	0.021	0.117	0.021	0.062	0.010

## Geolocation Details

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### Absolute Geolocation Variance

Mn Error [m]	Max Error [m]	Geolocation Error X[%]	Geolocation Error Y[%]	Geolocation Error Z[%]
-	-15.00	0.00	0.00	0.00
-15.00	-12.00	0.00	0.00	0.00
-12.00	-9.00	0.00	0.00	0.00
-9.00	-6.00	0.00	0.00	0.00
-6.00	-3.00	0.00	0.00	7.84
-3.00	0.00	50.98	41.18	35.29
0.00	3.00	49.02	58.82	49.02
3.00	6.00	0.00	0.00	7.84
6.00	9.00	0.00	0.00	0.00
9.00	12.00	0.00	0.00	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.00	0.00
<b>Mean [m]</b>		0.000002	0.000002	-0.000016
<b>Sigma [m]</b>		0.743470	1.141287	1.839928
<b>RMS Error [m]</b>		0.743470	1.141287	1.839928

Min Error and Max Error represent geolocation error intervals between -1.5 and 1.5 times the maximum accuracy of all the images. Columns X, Y, Z show the percentage of images with geolocation errors within the predefined error intervals. The geolocation error is the difference between the initial and computed image positions. Note that the image geolocation errors do not correspond to the accuracy of the observed 3D points.

### Relative Geolocation Variance

Relative Geolocation Error	Images X [%]	Images Y [%]	Images Z [%]
[-1.00, 1.00]	100.00	100.00	100.00
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
<b>Mean of Geolocation Accuracy [m]</b>	5.000000	5.000000	10.000000
<b>Sigma of Geolocation Accuracy [m]</b>	0.000000	0.000000	0.000000

Images X, Y, Z represent the percentage of images with a relative geolocation error in X, Y, Z.

## Initial Processing Details

### System Information

Hardware	CPU: Intel(R) Core(TM) i9-8950HK CPU @ 2.90GHz RAM: 32GB GPU: Radeon Pro 560X (Driver: 24.20.11016.8001)
Operating System	Windows 10 Home, 64-bit

### Coordinate Systems

Image Coordinate System	GCS_WGS_1984 (EGM96 Geoid)
Output Coordinate System	WGS_1984_UTM_Zone_14N (EGM96 Geoid)

### Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Full, Image Scale: 1
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: yes
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Alternative Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, yes

## Point Cloud Densification details

### Processing Options

Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Optimal
Minimum Number of Matches	3
3D Textured Mesh Generation	no
LOD	Generated: no
Advanced: Image Groups	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	01m:46s
Time for Point Cloud Classification	30s

Time for 3D Textured Mesh Generation	NA
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## Results

Number of Generated Tiles	1
Number of 3D Densified Points	4207725
Average Density (per m <sup>3</sup> )	51.82

## DSM, Orthomosaic and Index Details

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### Processing Options

DSM and Orthomosaic Resolution	1 x GSD (4.02 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Inverse Distance Weighting Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: yes
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	5 x GSD (4.02 [cm/pixel])
Time for DSM Generation	04m:21s
Time for Orthomosaic Generation	02m:07s
Time for DTM Generation	01m:54s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s