Quality Report

Generated with Pix4Denterprise version 4.5.6

Important: Click on the different icons for:

Help to analyze the results in the Quality Report

Additional information about the sections

Click here for additional tips to analyze the Quality Report

Summary

Project	Pfe2024
Processed	2024-02-16 16:08:55
Camera Model Name(s)	Phase One IXU-RS-1000 (RGB)
Average Ground Sampling Distance (GSD)	9.50 cm / 3.74 in
Area Covered	104.469 km^2 / 10446.8616 ha / 40.36 sq. mi. / 25828.1186 acres
Time for Initial Processing (without report)	01h:42m:47s

Quality Check

Images	median of 75881 keypoints per image	✓
Dataset	440 out of 440 images calibrated (100%), all images enabled	✓
Camera Optimization	0.03% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 37378.3 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

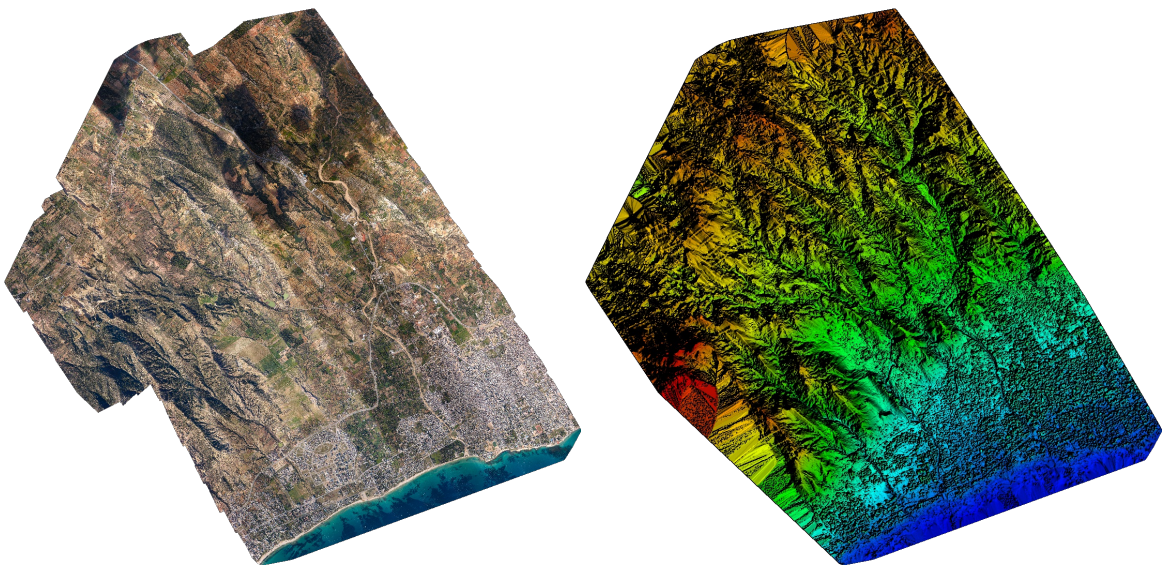


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	440 out of 440
Number of Geolocated Images	439 out of 440

Initial Image Positions

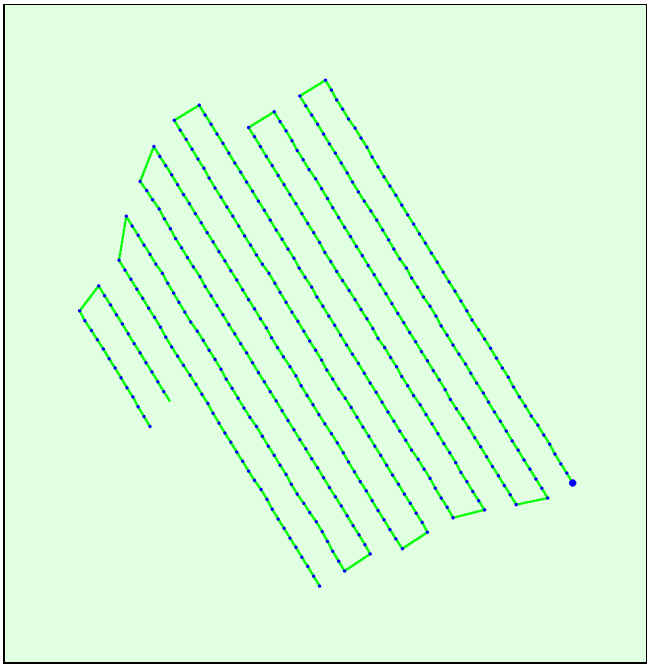
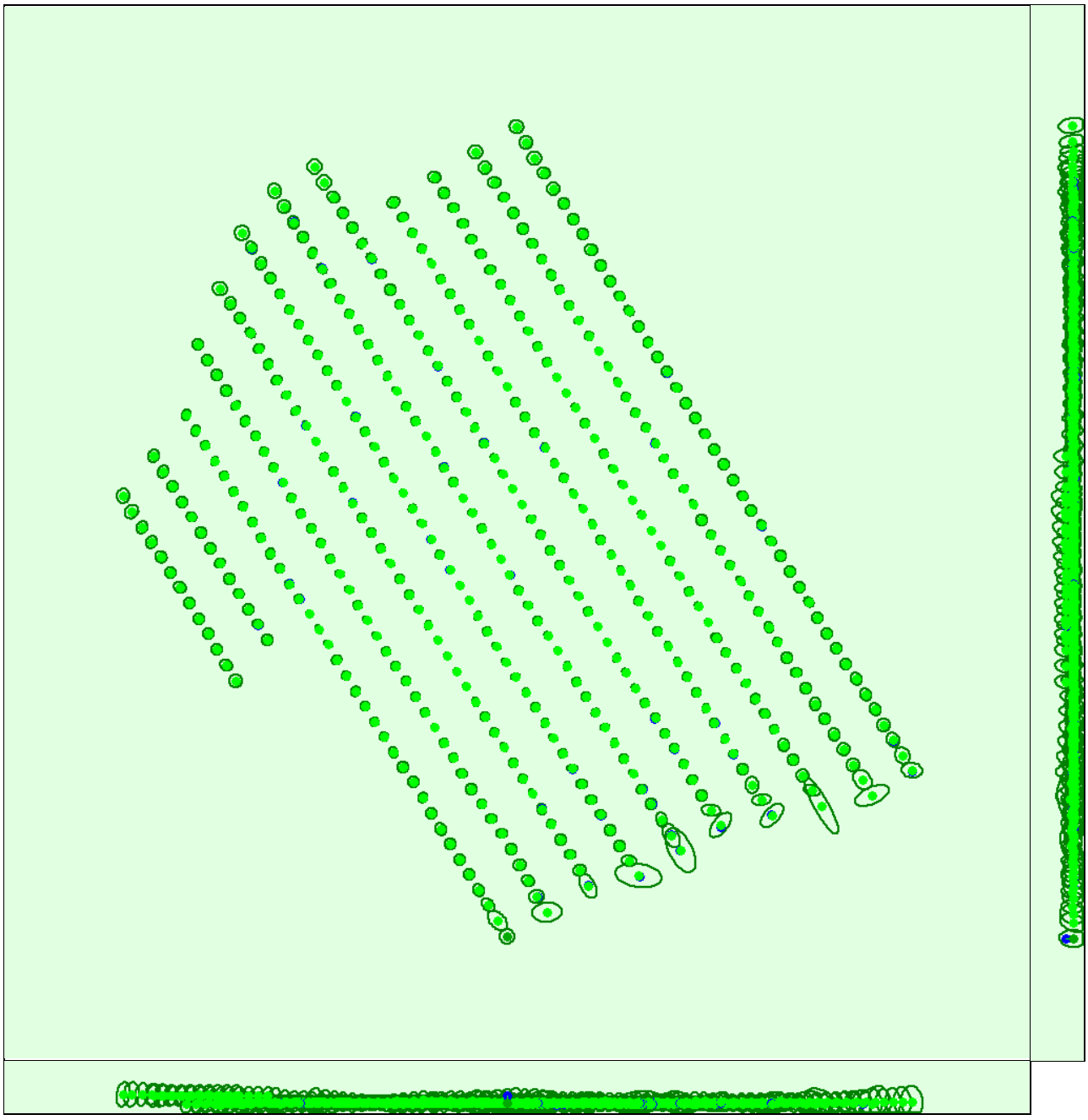


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



Uncertainty ellipses 500x magnified

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	0.165	0.164	0.259	0.008	0.008	0.002
Sigma	0.059	0.063	0.062	0.003	0.003	0.001

Overlap

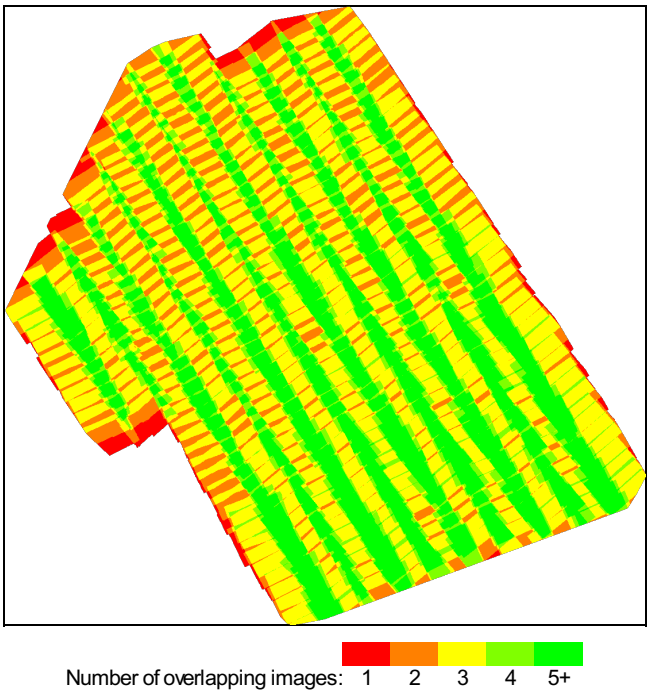


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

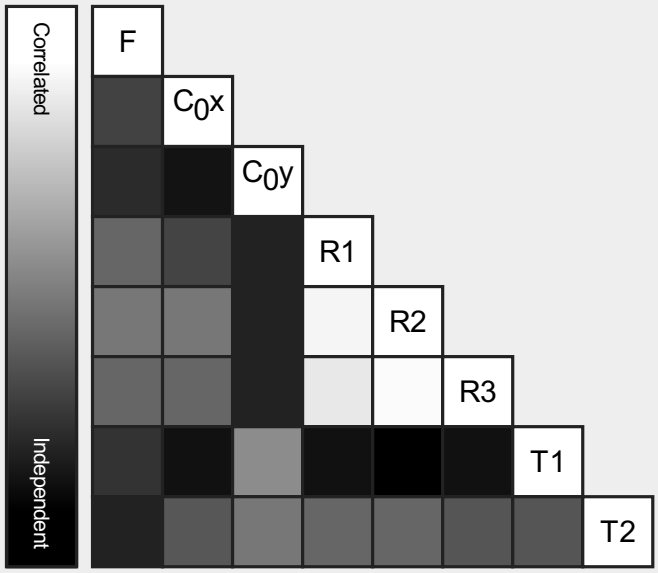
Number of 2D Keypoint Observations for Bundle Block Adjustment	15365436
Number of 3D Points for Bundle Block Adjustment	6438281
Mean Reprojection Error [pixels]	0.079

Internal Camera Parameters

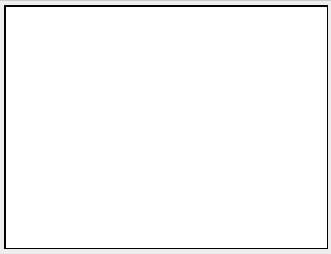
Phase One IXU-RS-1000 (RGB). Sensor Dimensions: 53.397 [mm] x 40.057 [mm]

EXIF ID: _0.0_11608x8708

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	11227.800 [pixel] 51.648 [mm]	5804.000 [pixel] 26.698 [mm]	4354.000 [pixel] 20.028 [mm]	0.000	-0.000	0.000	-0.000	-0.000
Optimized Values	11231.333 [pixel] 51.664 [mm]	5791.433 [pixel] 26.641 [mm]	4346.744 [pixel] 19.995 [mm]	0.000	-0.002	0.002	-0.000	0.000
Uncertainties (Sigma)	2.663 [pixel] 0.012 [mm]	0.361 [pixel] 0.002 [mm]	0.275 [pixel] 0.001 [mm]	0.000	0.000	0.001	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	75881	37378
Min	22188	647
Max	90520	49771
Mean	73356	34921

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4594933
In 3 Images	1442369
In 4 Images	221520
In 5 Images	116506
In 6 Images	60857
In 7 Images	2057
In 8 Images	39

2D Keypoint Matches

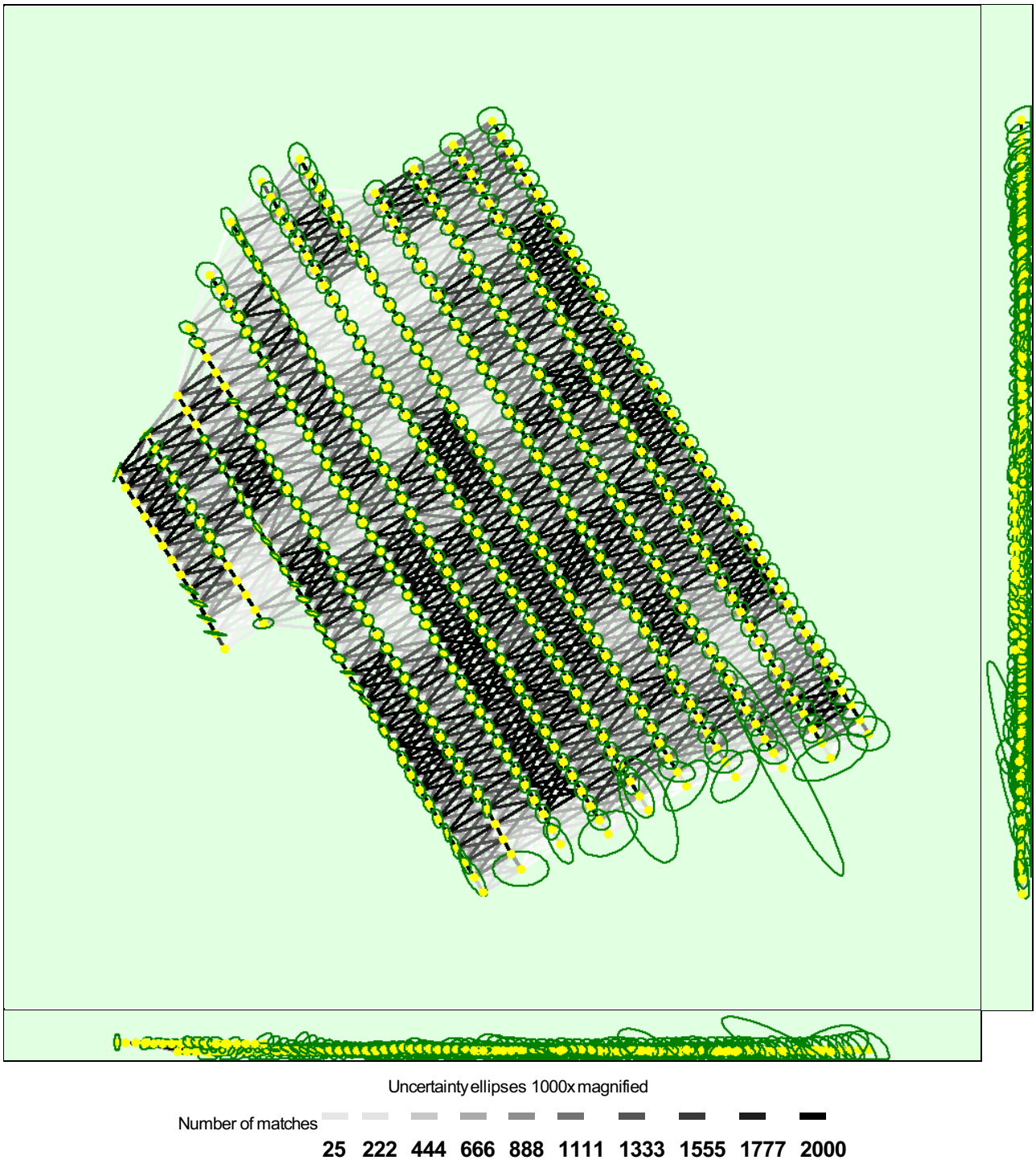


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.136	0.145	0.124	0.007	0.007	nan
Sigma	0.076	0.107	0.057	0.004	0.004	nan

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.23	0.00
-15.00	-12.00	0.00	0.00	0.23
-12.00	-9.00	0.00	0.23	0.00
-9.00	-6.00	0.00	0.23	0.00
-6.00	-3.00	0.23	0.68	0.46
-3.00	0.00	52.74	50.46	46.35
0.00	3.00	45.43	46.35	52.74
3.00	6.00	1.14	1.14	0.23
6.00	9.00	0.00	0.00	0.00
9.00	12.00	0.46	0.68	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		0.054343	-0.046479	-0.037442
Sigma [m]		1.135339	2.037433	0.917676
RMS Error [m]		1.136639	2.037964	0.918440

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]	99.32	98.63	99.77
[-2.00, 2.00]	100.00	99.32	100.00
[-3.00, 3.00]	100.00	99.77	100.00
Mean of Geolocation Accuracy [m]	5.000000	5.000000	10.000000
Sigma of Geolocation Accuracy [m]	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) i5-10300H CPU @ 2.50GHz RAM: 8GB GPU: Intel(R) UHD Graphics (Driver: 27.20.100.9664), NVIDIA GeForce GTX 1650 (Driver: 30.0.15.1272)
Operating System	Windows 10 Pro, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84 (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 32N (EGM96 Geoid)

Processing Options

Detected Template	3D Maps
Keypoints Image Scale	Full, Image Scale: 0.5
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic

Advanced: Calibration	Calibration Method: Standard 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	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: yes
LOD	Generated: no
Advanced: 3D Textured Mesh Settings	Sample Density Divider: 1
Advanced: Image Groups	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	36m:50s
Time for Point Cloud Classification	05m:50s
Time for 3D Textured Mesh Generation	32m:38s

Results

Number of Processed Clusters	147
Number of Generated Tiles	1
Number of 3D Densified Points	21229810
Average Density (per m^3)	2.88

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	5 x GSD (9.5 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Triangulation Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: yes Google Maps Tiles and KML: yes
Grid DSM	Generated: yes, Spacing [cm]: 100
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	10 x GSD (9.5 [cm/pixel])
Contour Lines Generation	Generated: yes Contour Base [m]: 0 Elevation Interval [m]: 5 Resolution [cm]: 100 Minimum Line Size [vertices]: 20
Time for DSM Generation	10m:36s
Time for Orthomosaic Generation	1d:05h:39m:28s
Time for DTM Generation	01h:44m:08s
Time for Contour Lines Generation	09s
Time for Reflectance Map Generation	00s

Time for Index Map Generation	00s