Quality Report

Pix4D

(!) Important: Click on the different icons for:

(?) Help to analyze the results in the Quality Report

(i) Additional information about the sections

(♡) Click here for additional tips to analyze the Quality Report

Summary (i)

Project	Project-2020-08-11
Processed	2020-08-11 16:12:42
Camera Model Name(s)	Anafi_4.0_5344x4016 (RGB)
Average Ground Sampling Distance (GSD)	1.25 cm / 0.49 in
Area Covered	0.002 km^2 / 0.2441 ha / 0.00 sq. mi. / 0.6036 acres
Time for Initial Processing (without report)	28s

Quality Check (i)

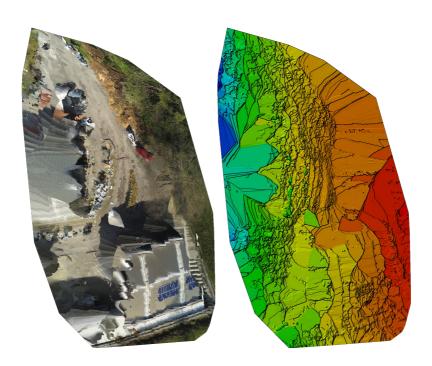| (?) **Images**	median of 50860 keypoints per image	✓
(?) **Dataset**	8 out of 8 images calibrated (100%), all images enabled	✓
(?) **Camera Optimization**	6.16% relative difference between initial and optimized internal camera parameters	⚠
(?) **Matching**	median of 10482 matches per calibrated image	✓
(?) **Georeferencing**	yes, no 3D GCP	⚠

(?) Preview (i)

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

Calibration Details

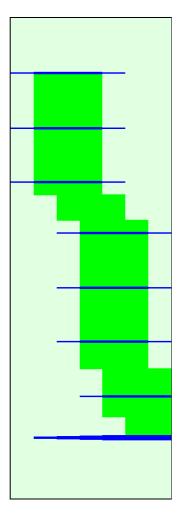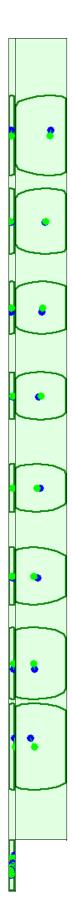|	
Number of Calibrated Images	8 out of 8
Number of Geolocated Images	8 out of 8

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 5x 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	0.390	0.438	0.674	1.773	2.242	1.801

Sigma	0.059	0.095	0.115	0.024	0.006	0.018

? Overlap   ℹ

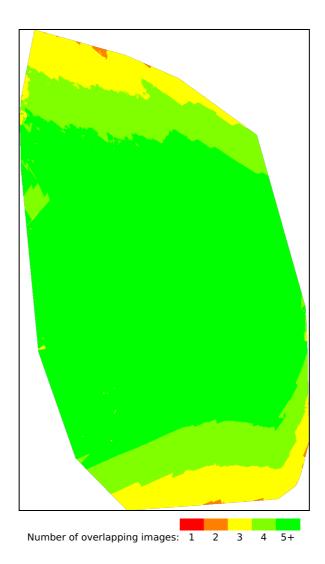Number of overlapping images: 1 2 3 4 5+

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   ℹ

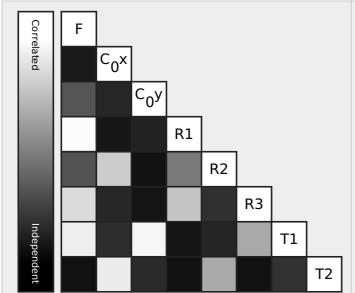|	
Number of 2D Keypoint Observations for Bundle Block Adjustment	84856
Number of 3D Points for Bundle Block Adjustment	34838
Mean Reprojection Error [pixels]	0.226

? Internal Camera Parameters

⊟ Anafi_4.0_5344x4016 (RGB). Sensor Dimensions: 5.985 [mm] x 4.498 [mm]   ℹ
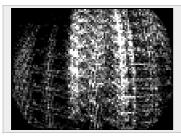
EXIF ID: Anafi_4.0_5344x4016

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3634.470 [pixel] 4.071 [mm]	2662.230 [pixel] 2.982 [mm]	1976.860 [pixel] 2.214 [mm]	-0.249	0.020	0.012	0.000	0.001
Optimized Values	3410.419 [pixel] 3.820 [mm]	2658.697 [pixel] 2.978 [mm]	1966.275 [pixel] 2.202 [mm]	-0.220	0.009	0.014	0.001	0.000

Uncertainties (Sigma)	225.429 [pixel] 0.252 [mm]	27.855 [pixel] 0.031 [mm]	41.647 [pixel] 0.047 [mm]	0.030	0.007	0.007	0.002	0.001

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	50860	10482
Min	40901	8987
Max	69178	13007
Mean	52126	10607

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	25698
In 3 Images	5674
In 4 Images	1971
In 5 Images	784
In 6 Images	410
In 7 Images	234
In 8 Images	67

2D Keypoint Matches

Uncertainty ellipses 500x magnified

Number of matches

| 25 | 222 | 444 | 666 | 888 | 1111 | 1333 | 1555 | 1777 | 2000 |

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	0.002	0.003	0.002	0.138	0.131	0.097
Sigma	0.001	0.001	0.000	0.009	0.003	0.008

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-1.29	0.00	0.00	0.00
-1.29	-1.03	0.00	0.00	0.00
-1.03	-0.77	0.00	0.00	0.00
-0.77	-0.52	0.00	0.00	0.00
-0.52	-0.26	0.00	25.00	12.50
-0.26	0.00	37.50	50.00	37.50
0.00	0.26	62.50	0.00	37.50
0.26	0.52	0.00	12.50	12.50
0.52	0.77	0.00	12.50	0.00
0.77	1.03	0.00	0.00	0.00
1.03	1.29	0.00	0.00	0.00
1.29	-	0.00	0.00	0.00
Mean [m]		0.000165	-0.001937	-0.005330
Sigma [m]		0.024072	0.305578	0.175988
RMS Error [m]		0.024072	0.305584	0.176069

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	87.50	100.00
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	0.472349	0.472349	0.798750
Sigma of Geolocation Accuracy [m]	0.020899	0.020899	0.056444

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

Geolocation Orientational Variance	RMS [degree]
Omega	149.869
Phi	57.113
Kappa	166.183

Geolocation RMS error of the orientation angles given by the difference between the initial and computed image orientation angles.

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Xeon(R) Platinum 8124M CPU @ 3.00GHz RAM: 69GB GPU: no info (Driver: unknown)
Operating System	Linux 5.3.0-1032-aws x86_64

Coordinate Systems

Image Coordinate System	WGS 84 (EGM 96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 33N (EGM 96 Geoid)

Processing Options

Detected Template	🗄 3D Maps
Keypoints Image Scale	Full, Image Scale: 1
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: no
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	20s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	41s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	1284931
Average Density (per m^3)	994.86

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (1.25 [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 GeoTIFF Without Transparency: no Google Maps Tiles and KML: no
Time for DSM Generation	14s
Time for Orthomosaic Generation	43s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s