Quality Report

Generated with Pix4Dmapper Pro version 3.1.22

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	
Processed	2017-02-01 09:02:45
Camera Model Name(s)	FC300S_3.6_4000x3000 (RGB)
Average Ground Sampling Distance (GSD)	2.31 cm / 0.91 in
Area Covered	0.2422 km^2 / 24.2225 ha / 0.0936 sq. mi. / 59.886 acres

Quality Check

Images	median of 63182 keypoints per image	✓
Dataset	810 out of 814 images calibrated (99%), all images enabled	✓
Camera Optimization	1.71% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 14524.8 matches per calibrated image	✓
Georeferencing	yes, 9 GCPs (9 3D), mean RMS error = 0.202 ft	⚠

Preview

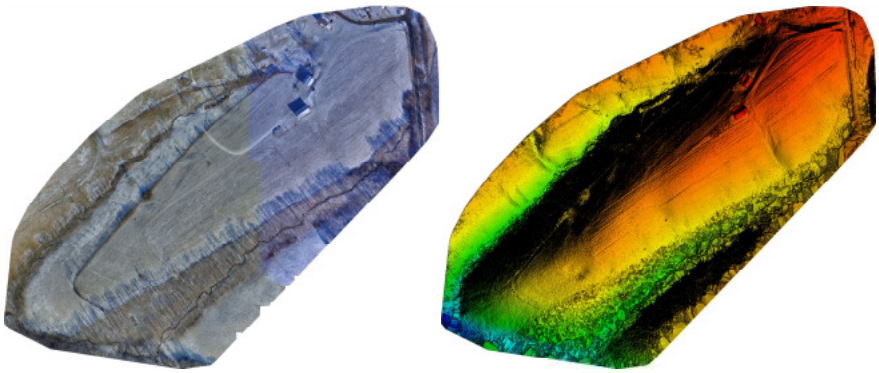

Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	810 out of 814
Number of Geolocated Images	814 out of 814

Initial Image Positions

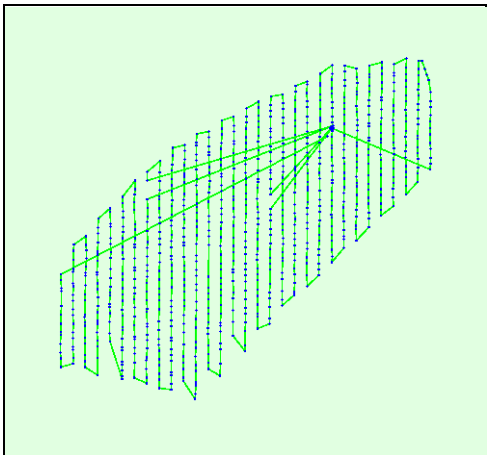

Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions

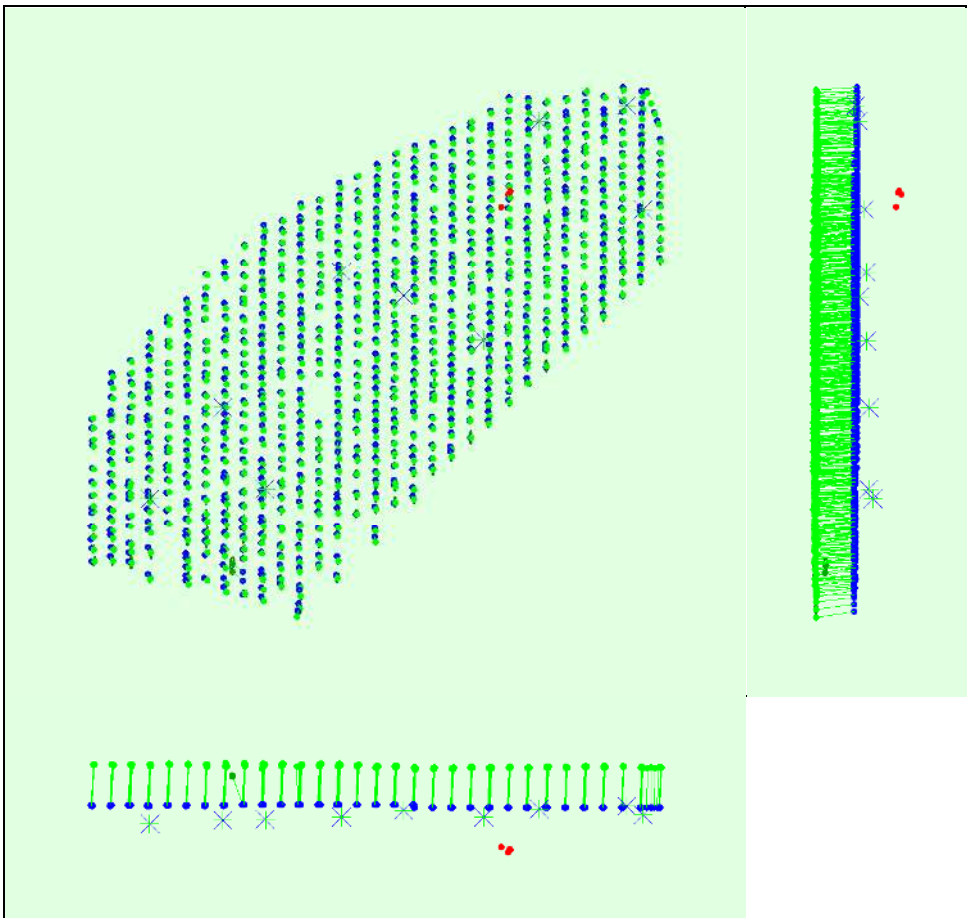

Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled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

Absolute camera position and orientation uncertainties

	X [ft]	Y [ft]	Z [ft]	Omega [degree]	Phi [degree]	Kappa [degree]	Camera Displacement X [ft]	Camera Displacement Y [ft]	Camera Displacement Z [ft]
Mean	0.200	0.931	0.178	0.307	0.055	0.039	0.097	0.104	0.604
Sigma	0.109	0.387	0.094	0.134	0.029	0.023	0.073	0.081	0.245

Overlap

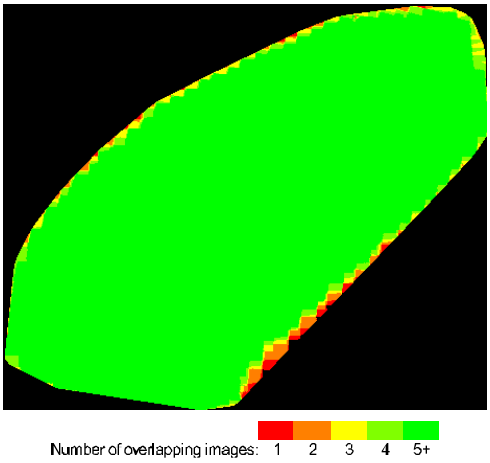

Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	11349508
Number of 3D Points for Bundle Block Adjustment	3514738
Mean Reprojection Error [pixels]	0.155

Internal Camera Parameters

FC300S_3.6_4000x3000 (RGB). Sensor Dimensions: 6.317 [mm] x 4.738 [mm]

EXIF ID: FC300S_3.6_4000x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	2285.722 [pixel] 3.610 [mm]	2000.006 [pixel] 3.159 [mm]	1500.003 [pixel] 2.369 [mm]	-0.132	0.111	-0.016	0.000	0.000
Optimized Values	2324.920 [pixel] 3.672 [mm]	1998.637 [pixel] 3.157 [mm]	1461.050 [pixel] 2.308 [mm]	-0.001	-0.013	0.021	-0.001	0.000
Uncertainties (Sigma)	0.729 [pixel] 0.001 [mm]	0.397 [pixel] 0.001 [mm]	0.531 [pixel] 0.001 [mm]	0.000	0.001	0.001	0.000	0.000

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.

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	63182	14525
Min	46092	503
Max	79197	31505
Mean	62661	14012

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	2176416
In 3 Images	638990
In 4 Images	259960
In 5 Images	128038
In 6 Images	72542
In 7 Images	43586
In 8 Images	30262
In 9 Images	23846
In 10 Images	19613
In 11 Images	16585

In 12 Images	14588
In 13 Images	12403
In 14 Images	10773
In 15 Images	9521
In 16 Images	8549
In 17 Images	7758
In 18 Images	6890
In 19 Images	6094
In 20 Images	5048
In 21 Images	4156
In 22 Images	3443
In 23 Images	2769
In 24 Images	2400
In 25 Images	1909
In 26 Images	1637
In 27 Images	1383
In 28 Images	1112
In 29 Images	1045
In 30 Images	826
In 31 Images	665
In 32 Images	540
In 33 Images	406
In 34 Images	303
In 35 Images	240
In 36 Images	167
In 37 Images	116
In 38 Images	63
In 39 Images	47
In 40 Images	24
In 41 Images	16
In 42 Images	8
In 43 Images	1

2D Keypoint Matches

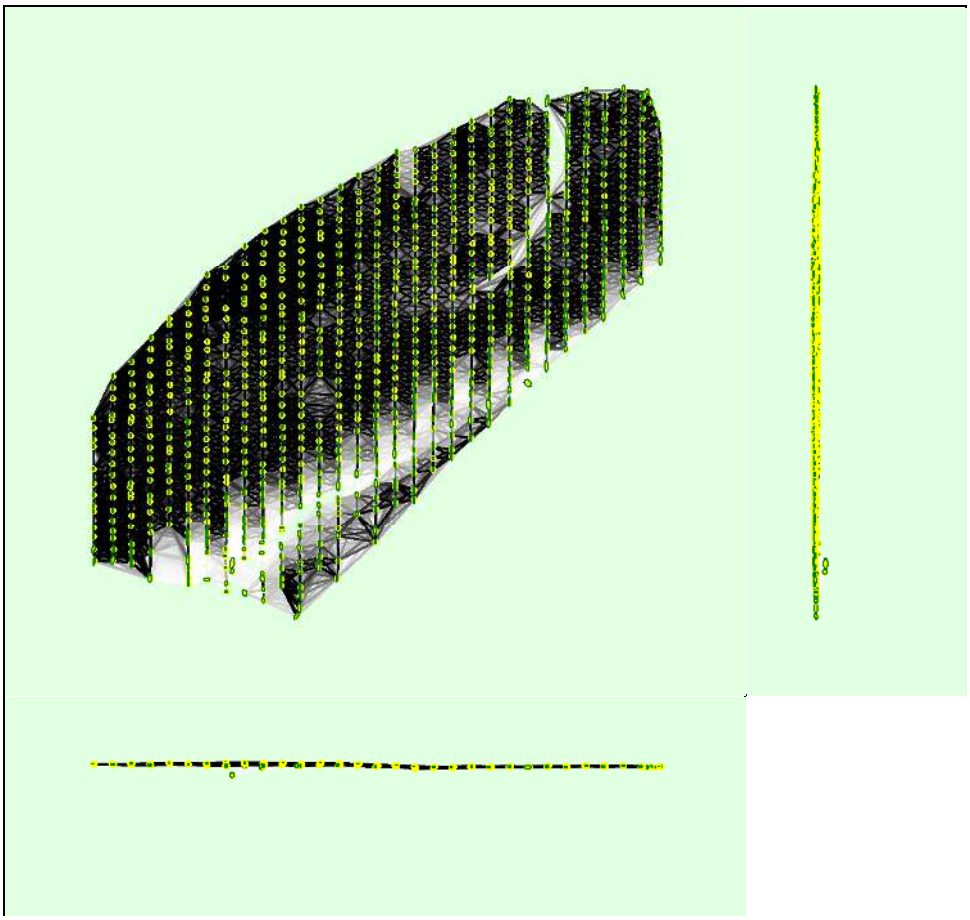

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty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

Relative camera position and orientation uncertainties

	X [ft]	Y [ft]	Z [ft]	Omega [degree]	Phi [degree]	Kappa [degree]	Camera Displacement X [ft]	Camera Displacement Y [ft]	Camera Displacement Z [ft]
Mean	0.259	0.935	0.148	0.313	0.053	0.048	0.120	0.128	0.614
Sigma	0.115	0.376	0.098	0.135	0.032	0.023	0.069	0.074	0.244

Geolocation Details

Ground Control Points

GCP Name	Accuracy XY/Z [ft]	Error X [ft]	Error Y [ft]	Error Z [ft]	Projection Error [pixel]	Verified/Marked
CP1 (3D)	0.020/ 0.020	-0.001	0.007	0.143	0.818	4 / 4
CP2 (3D)	0.020/ 0.020	-0.004	0.001	0.010	0.486	4 / 4
CP3 (3D)	0.020/ 0.020	0.019	0.094	-0.456	0.299	3 / 3
CP5 (3D)	0.020/ 0.020	0.006	0.012	0.140	0.743	3 / 3
CP7 (3D)	0.020/ 0.020	-0.196	-0.104	0.767	0.673	3 / 3
CP8 (3D)	0.020/ 0.020	0.246	-0.193	-0.036	0.268	3 / 3
CP9 (3D)	0.020/ 0.020	-0.217	0.238	-0.483	0.338	4 / 4
CP10 (3D)	0.020/ 0.020	0.198	-0.081	-0.043	0.782	3 / 3
CP12 (3D)	0.020/ 0.020	-0.001	-0.037	-0.115	1.541	4 / 4
Mean [ft]		0.005692	-0.007187	-0.007966		
Sigma [ft]		0.143434	0.116015	0.347270		
RMS Error [ft]		0.143547	0.116238	0.347361		

0 out of 3 check points have been labeled as inaccurate.

Check Point Name	Accuracy XY/Z [ft]	Error X [ft]	Error Y [ft]	Error Z [ft]	Projection Error [pixel]	Verified/Marked
CP4	0.0200/0.0200	-0.1236	0.0123	-0.4997	1.1663	3 / 3
CP6	0.0200/0.0200	0.4132	-0.6126	0.4274	0.9148	3 / 3
CP11	0.0200/0.0200	-0.2362	-0.3074	0.1376	1.1115	3 / 3
Mean [ft]		0.017791	-0.302551	0.021783		
Sigma [ft]		0.283322	0.255114	0.387243		
RMS Error [ft]		0.283880	0.395753	0.387855		

Localisation accuracy per GCP and mean errors in the three coordinate directions. The last column counts the number of calibrated images where the GCP has been automatically verified vs. manually marked.

Absolute Geolocation Variance

Min Error [ft]	Max Error [ft]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.25	0.00
-15.00	-12.00	0.00	2.60	0.00
-12.00	-9.00	0.00	8.54	0.00
-9.00	-6.00	0.00	10.64	0.74
-6.00	-3.00	6.56	11.01	19.55
-3.00	0.00	26.49	16.58	33.79
0.00	3.00	66.46	17.33	28.22
3.00	6.00	0.50	10.89	12.62
6.00	9.00	0.00	11.01	2.72
9.00	12.00	0.00	9.16	2.10
12.00	15.00	0.00	1.98	0.25
15.00	-	0.00	0.00	0.00
Mean [ft]		-4.789476	8.533703	-132.641396
Sigma [ft]		1.478070	6.752168	3.432272
RMS Error [ft]		5.012361	10.881905	132.685796

Min Error and Max Error represent geolocation error intervalsbetween -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.

Geolocation Bias	X	Y	Z
Translation [ft]	-4.789413	8.533736	-132.641567

Bias between image initial and computed geolocation given in output coordinate system.

Relative Geolocation Variance

Relative Geolocation Error	Images X [%]	Images Y [%]	Images Z [%]
[-1.00, 1.00]	99.26	49.38	98.14
[-2.00, 2.00]	100.00	84.41	100.00
[-3.00, 3.00]	100.00	99.75	100.00
Mean of Geolocation Accuracy [ft]	5.000000	5.000000	10.000000
Sigma of Geolocation Accuracy [ft]	0.000000	0.000000	0.000000

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

Geolocation Orientational Variance	RMS [degree]
Omega	0.823
Phi	1.458
Kappa	5.596

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

Rolling Shutter Statistics

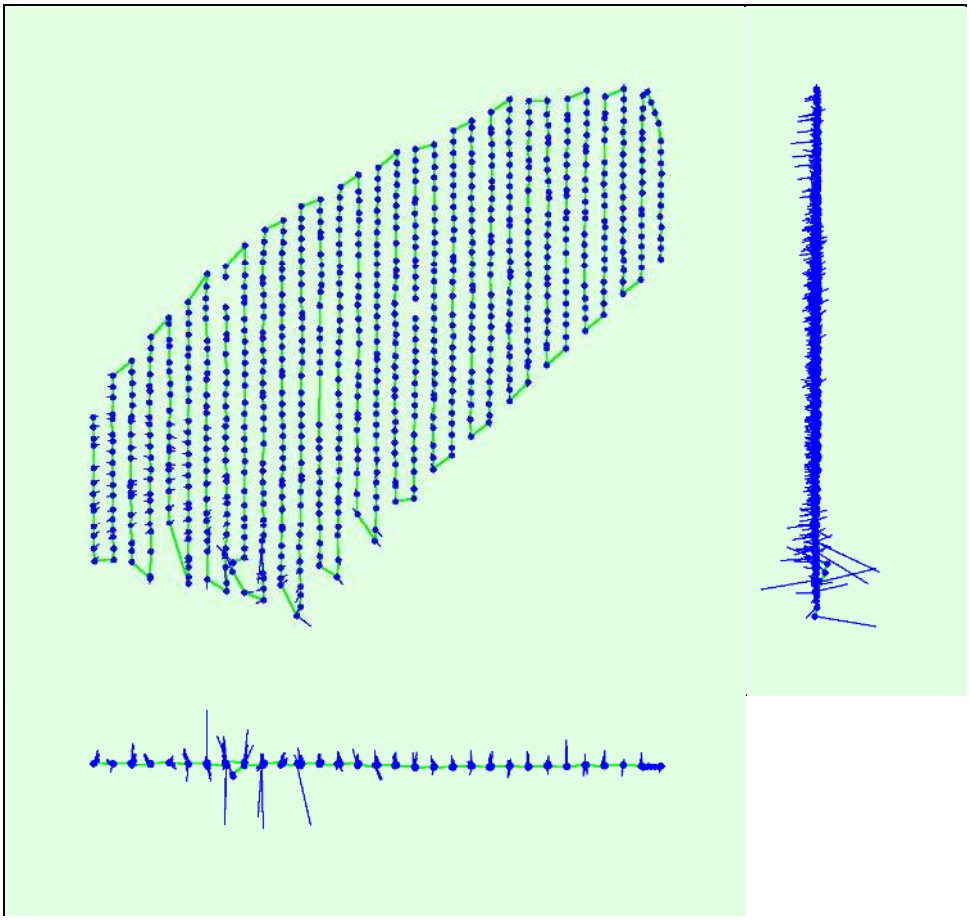

Figure 6: Camera movement estimated by the rolling shutter camera model. The green line follows the computed image positions. The blue dots represent the camera position at the start of the exposure. The blue lines represent the camera motion during the rolling shutter readout, re-scaled by a project dependant scaling factor for better visibility.

Median Camera Speed	14.6811 [ft/s]
Median Camera Displacement During Sensor Readout)	1.2753 [ft]
Median Rolling Shutter Readout Time	86.6484 [ms]

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Core(TM) i7-3610QM CPU @ 2.30GHz RAM: 28GB GPU: NVIDIA Quadro K3000M (Driver: 10.18.13.5442), RDPDD Chained DD (Driver: unknown), RDP Encoder Mirror Driver (Driver: unknown), RDP Reflector Display Driver (Driver: unknown)
Operating System	Windows 7 Professional, 64-bit

Coordinate Systems

Image Coordinate System	WGS84 (egm96)
Ground Control Point (GCP) Coordinate System	NAD_1983_StatePlane_Kentucky_North_FIPS_1601_Feet (egm96)
Output Coordinate System	NAD_1983_StatePlane_Kentucky_North_FIPS_1601_Feet (egm96)

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, no Bundle Adjustment: Classic