

# Quality Report



Generated with PIX4Dmapper version 4.8.4



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Additional information about the sections



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## Summary



Project	LANGLEY FLIGHT
Processed	2024-03-29 11:02:36
Camera Model Name(s)	ILCE-7RM4A_0.0_9504x6336 (RGB)
Average Ground Sampling Distance (GSD)	2.36 cm / 0.93 in
Area Covered	2.073 km <sup>2</sup> / 207.2713 ha / 0.80 sq. mi. / 512.4437 acres

## Quality Check



Images	median of 26523 keypoints per image	
Dataset	1456 out of 1456 images calibrated (100%), all images enabled	
Camera Optimization	23.5% relative difference between initial and optimized internal camera parameters	
Matching	median of 15282.4 matches per calibrated image	
Georeferencing	yes, 8 GCPs (8 3D), mean RMS error = 95.463 US survey foot	

## Preview

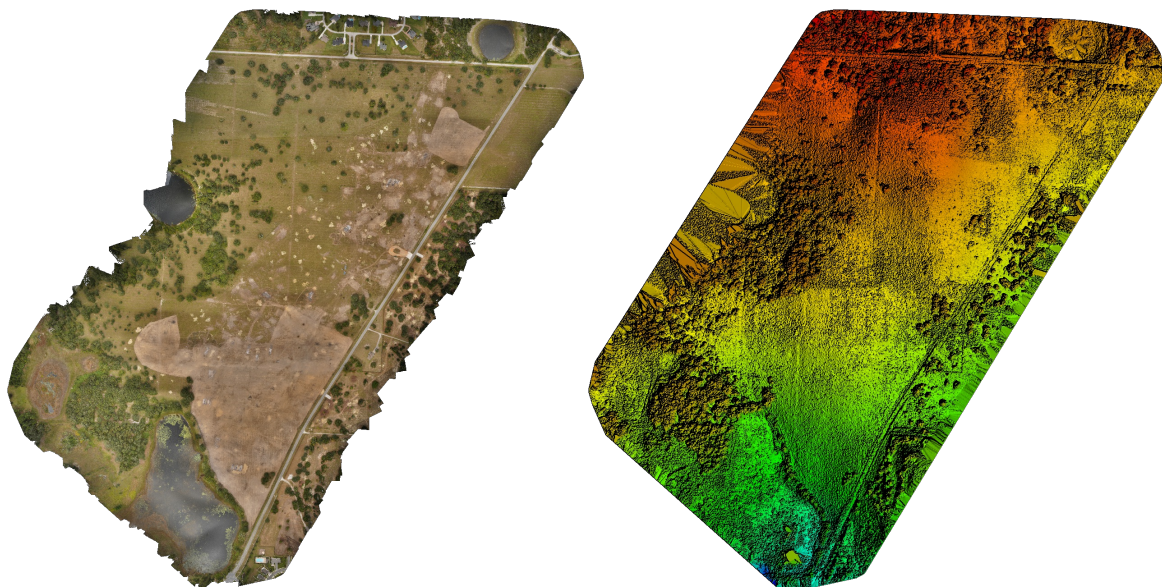


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

## Calibration Details



Number of Calibrated Images	1456 out of 1456
Number of Geolocated Images	1456 out of 1456

### ? Initial Image Positions

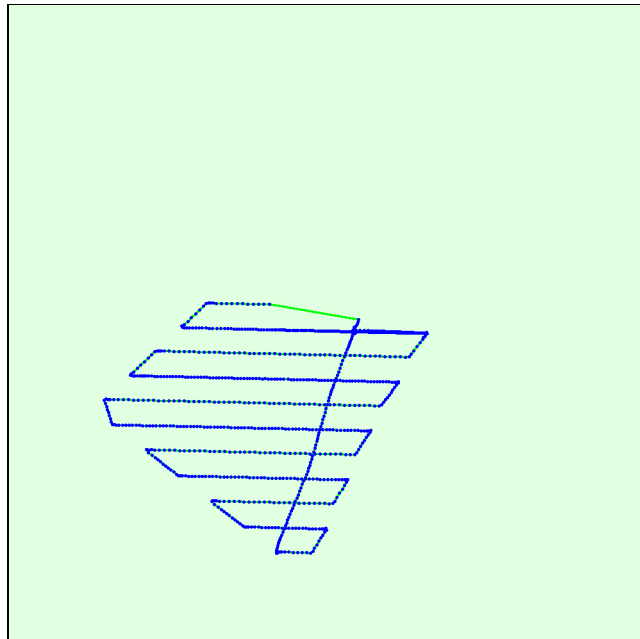
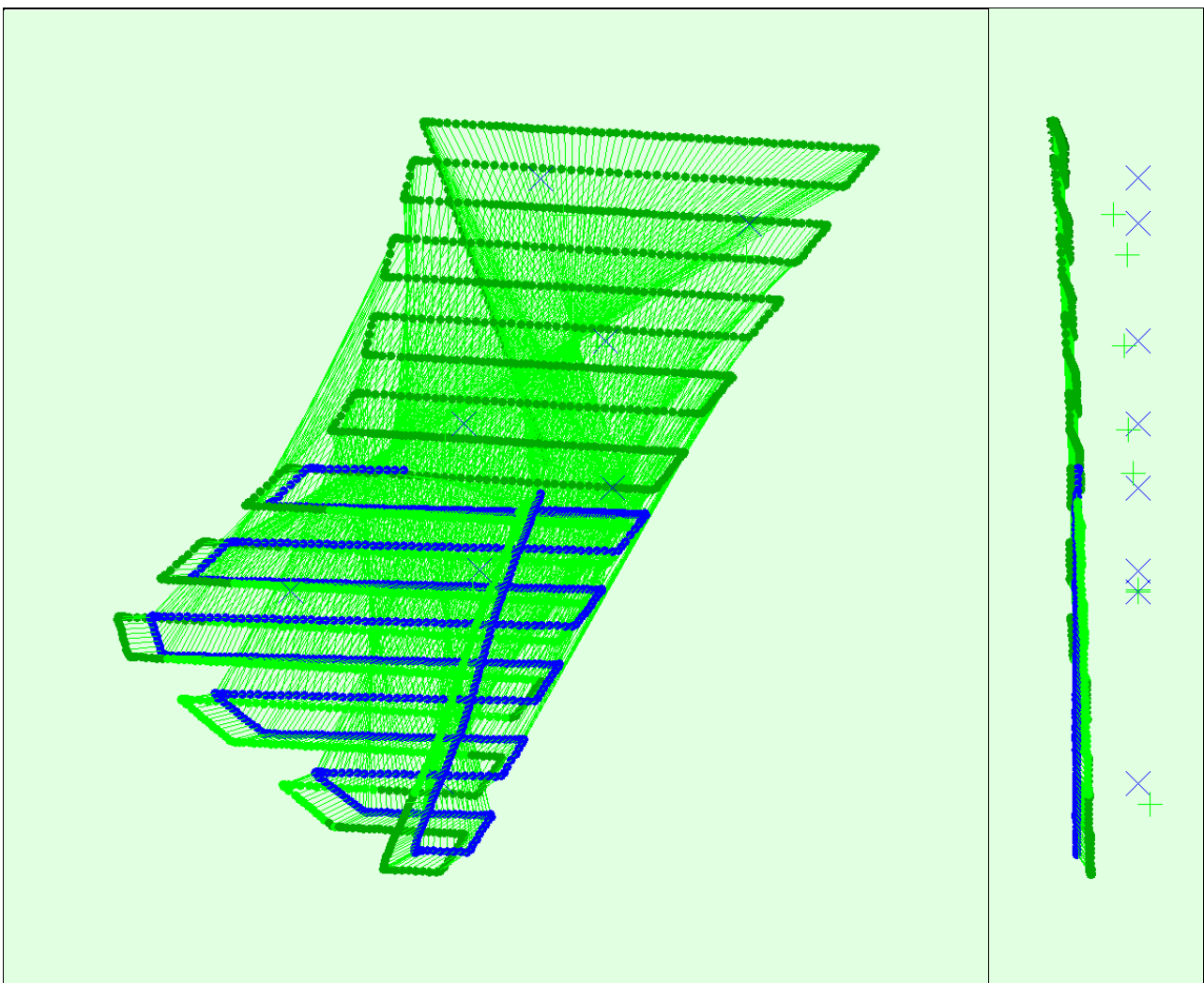
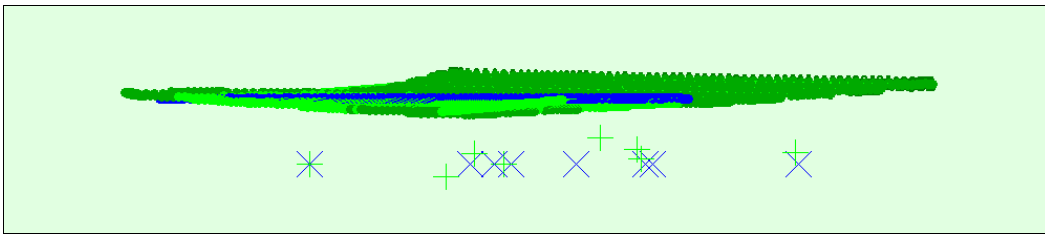


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

### ? Computed Image/GCPs/Manual Tie Points Positions





Uncertainty ellipses 10x 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 [US survey foot]	Y [US survey foot]	Z [US survey foot]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.751	0.804	1.734	0.056	0.051	0.021
Sigma	0.318	0.314	0.894	0.006	0.006	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).

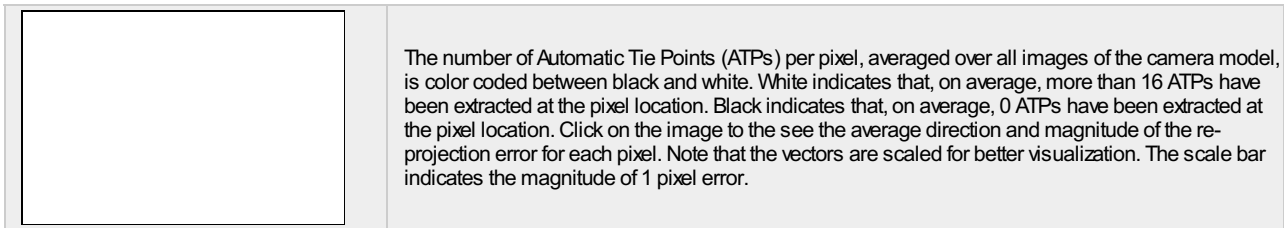
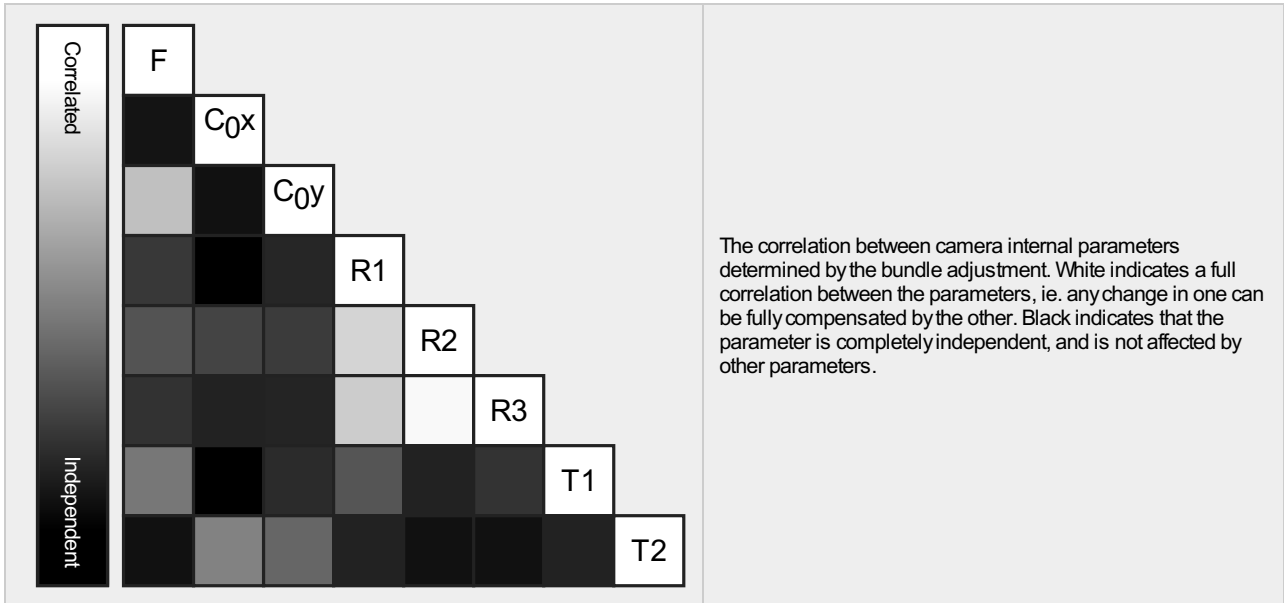
## Bundle Block Adjustment Details

Number of 2D Keypoint Observations for Bundle Block Adjustment	23492981
Number of 3D Points for Bundle Block Adjustment	6357331
Mean Reprojection Error [pixels]	0.232

### ? Internal Camera Parameters

📷 ILCE-7RM4A\_0.0\_9504x6336 (RGB). Sensor Dimensions: 25.400 [mm] x 16.933 [mm]

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	7483.464 [pixel] 20.000 [mm]	4752.000 [pixel] 12.700 [mm]	3168.000 [pixel] 8.467 [mm]	0.000	0.000	0.000	0.000	0.000
Optimized Values	5724.118 [pixel] 15.298 [mm]	4731.335 [pixel] 12.645 [mm]	3171.745 [pixel] 8.477 [mm]	-0.070	0.061	-0.014	0.000	0.000
Uncertainties (Sigma)	0.691 [pixel] 0.002 [mm]	0.098 [pixel] 0.000 [mm]	0.147 [pixel] 0.000 [mm]	0.000	0.000	0.000	0.000	0.000



### 2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	26523	15282
Mn	20011	4199
Max	68992	31639
Mean	30449	16135

### 3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	3571851
In 3 Images	1080878
In 4 Images	528456
In 5 Images	314784
In 6 Images	209857
In 7 Images	146343
In 8 Images	100037
In 9 Images	71804
In 10 Images	52655
In 11 Images	40699
In 12 Images	32678
In 13 Images	26842
In 14 Images	22291

In 15 Images	18645
In 16 Images	16537
In 17 Images	13879
In 18 Images	12458
In 19 Images	10810
In 20 Images	9549
In 21 Images	8442
In 22 Images	7360
In 23 Images	6447
In 24 Images	5625
In 25 Images	5075
In 26 Images	4717
In 27 Images	4075
In 28 Images	3625
In 29 Images	3292
In 30 Images	2860
In 31 Images	2650
In 32 Images	2156
In 33 Images	2054
In 34 Images	1747
In 35 Images	1620
In 36 Images	1396
In 37 Images	1288
In 38 Images	1068
In 39 Images	1008
In 40 Images	882
In 41 Images	851
In 42 Images	770
In 43 Images	695
In 44 Images	584
In 45 Images	524
In 46 Images	476
In 47 Images	454
In 48 Images	371
In 49 Images	332
In 50 Images	298
In 51 Images	299
In 52 Images	296
In 53 Images	252
In 54 Images	231
In 55 Images	226
In 56 Images	237
In 57 Images	215
In 58 Images	177
In 59 Images	184
In 60 Images	149
In 61 Images	152
In 62 Images	125
In 63 Images	114
In 64 Images	91
In 65 Images	113
In 66 Images	98
In 67 Images	92
In 68 Images	77
In 69 Images	61
In 70 Images	70
In 71 Images	74
In 72 Images	63
In 73 Images	56

In 74 Images	29
In 75 Images	16
In 76 Images	13
In 77 Images	4
In 78 Images	9
In 79 Images	5
In 80 Images	4
In 81 Images	3
In 82 Images	1

## ? 2D Keypoint Matches

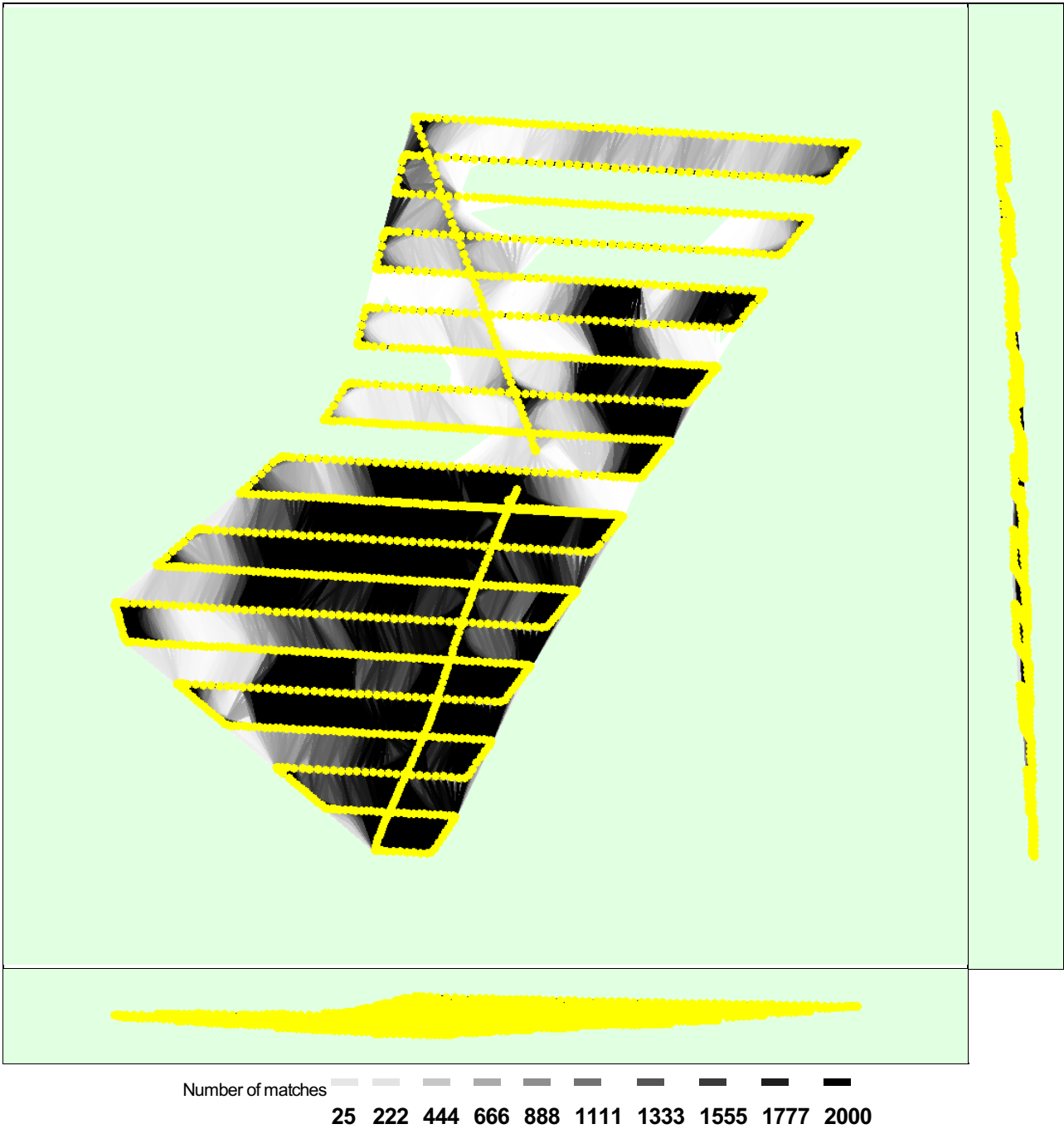


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

## Geolocation Details



## Ground Control Points



GCP Name	Accuracy XY/Z [US survey foot]	Error X [US survey foot]	Error Y [US survey foot]	Error Z [US survey foot]	Projection Error [pixel]	Verified/Marked
10007 (3D)	0.020/0.020	166.007	150.771	85.720	1.134	15 / 15
10003 (3D)	0.020/0.020	48.956	134.718	-4.427	1.114	10 / 10
10000 (3D)	0.020/0.020	-167.427	268.374	-179.822	0.736	10 / 10
10001 (3D)	0.020/0.020	25.228	226.438	-79.729	0.948	14 / 14
10002 (3D)	0.020/0.020	54.972	31.439	-103.305	0.972	11 / 11
10004 (3D)	0.020/0.020	141.464	40.314	-71.967	0.750	12 / 12
10005 (3D)	0.020/0.020	78.756	-107.491	-39.968	0.772	12 / 12
10006 (3D)	0.020/0.020	-0.002	-0.002	-0.002	1.024	16 / 16
<b>Mean [US survey foot]</b>		43.494158	93.070055	-49.187296		
<b>Sigma [US survey foot]</b>		95.345256	116.753535	74.291182		
<b>RMS Error [US survey foot]</b>		104.797231	149.309823	89.098652		

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 [US survey foot]	Max Error [US survey foot]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-49.21	22.16	1.37	1.03
-49.21	-39.37	7.90	4.81	3.61
-39.37	-29.53	5.67	6.53	7.22
-29.53	-19.68	6.19	7.22	8.08
-19.68	-9.84	6.19	11.17	13.75
-9.84	0.00	4.81	12.54	14.95
0.00	9.84	4.98	11.86	15.29
9.84	19.69	6.01	11.68	8.93
19.69	29.53	6.87	14.60	10.14
29.53	39.37	6.01	8.93	7.73
39.37	49.21	4.30	7.04	6.70
49.21	-	18.90	2.23	2.58
<b>Mean [US survey foot]</b>		149.466163	72.330978	28.631141
<b>Sigma [US survey foot]</b>		51.647588	26.215893	25.300494
<b>RMS Error [US survey foot]</b>		158.137937	76.935320	38.208078

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.

Geolocation Bias	X	Y	Z
Translation [US survey foot]	153.139384	68.032267	26.672800

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]	18.38	40.89	77.15
[-2.00, 2.00]	39.18	74.91	100.00
[-3.00, 3.00]	58.93	96.39	100.00
<b>Mean of Geolocation Accuracy [US survey foot]</b>	16.404167	16.404167	32.808333

<b>Sigma of Geolocation Accuracy [US survey foot]</b>	0.000002	0.000002	0.000005
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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: 13th Gen Intel(R) Core(TM) i9-13900KS RAM: 192GB GPU: NVIDIA GeForce RTX 4070 (Driver: 31.0.15.5123)
Operating System	Windows 11, 64-bit

### Coordinate Systems

Image Coordinate System	WGS 84 (EGM96 Geoid)
Ground Control Point (GCP) Coordinate System	NAD83(2011) / Florida East (ftUS) (-88.924ft)
Output Coordinate System	NAD83(2011) / Florida East (ftUS) (-88.924ft)

### Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Full, Image Scale: 0.5
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: Standard Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, no

## 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	03h:43m:04s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	NA

### Results

Number of Generated Tiles	14
Number of 3D Densified Points	464362991
Average Density (per US survey foot <sup>3</sup> )	5.65



# DSM, Orthomosaic and Index Details



## Processing Options



DSM and Orthomosaic Resolution	1 x GSD (2.36 [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	01h:12m:10s
Time for Orthomosaic Generation	02h:55m:36s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s