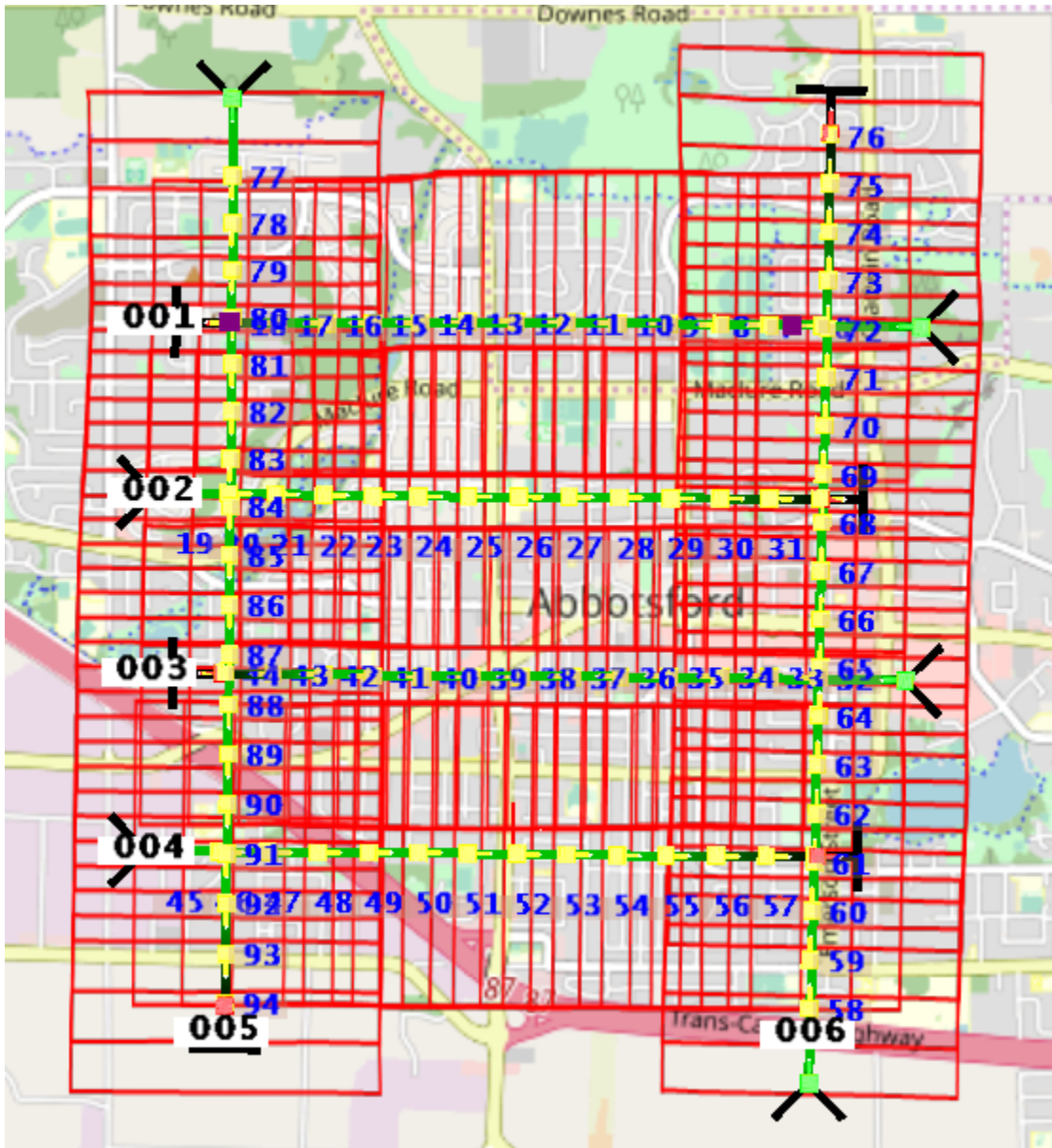Peregrine Aerial Survey 2020 Boresite

DMC III Camera S/N 27542

1. The boresite data was flown on 2/18/2020 using the calibration field located in Abbotsford, British Columbia.

2. Below is the flight pattern flown for the boresite calibration.

3. Processed the GNSS / IMU data through Inertial Explorer version 8.80.2305 using a Differential Solution with 3 CORS stations. The processed trajectory contained additional projects in addition to the boresite calibration field.
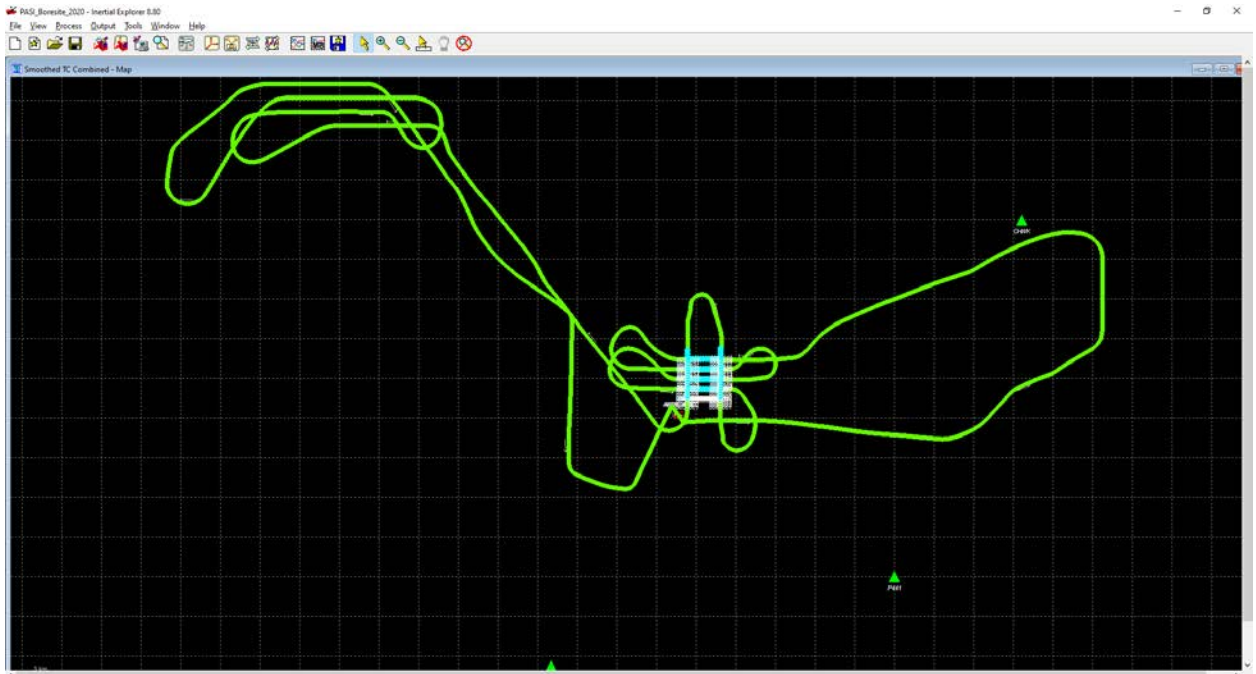
4. The figures below display the estimated position accuracy, estimated attitude accuracy, combined separation of the post processed trajectory. The solution was a Fixed solution in both directions with less than 5 cm position separation between the forward and reverse solutions.
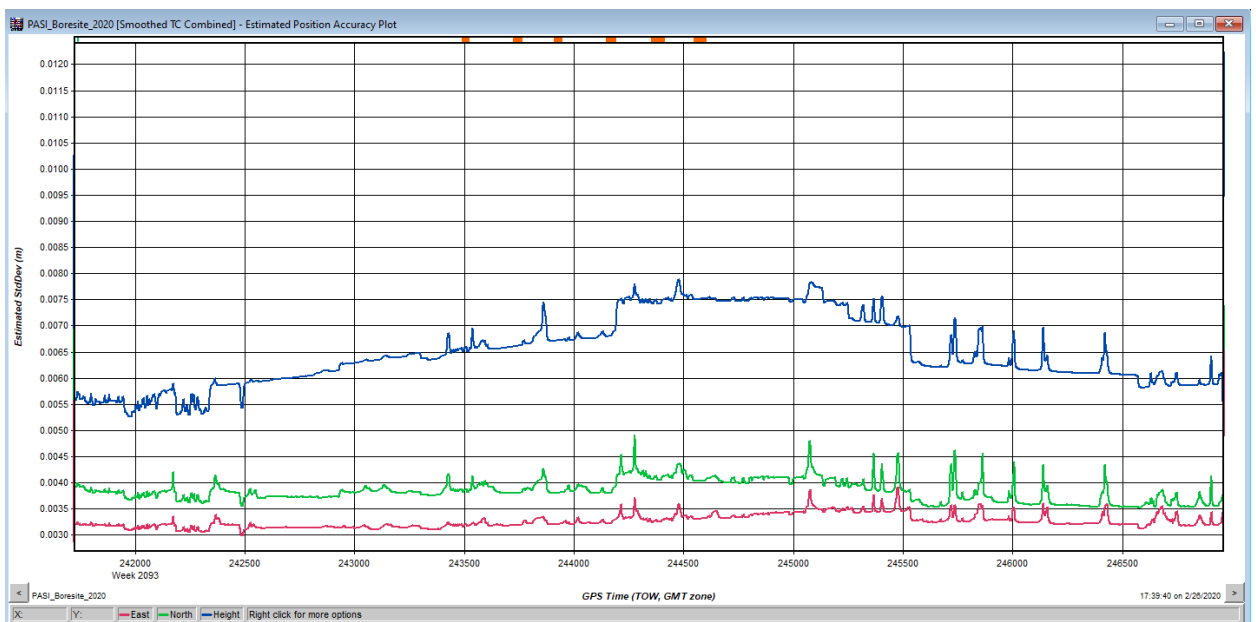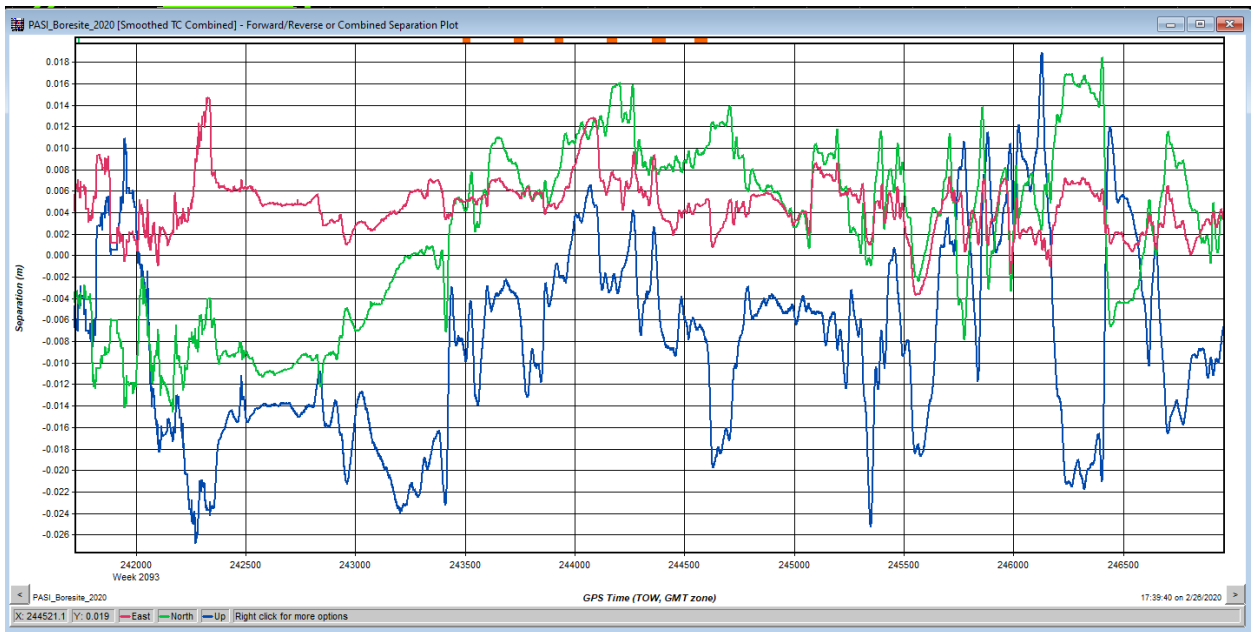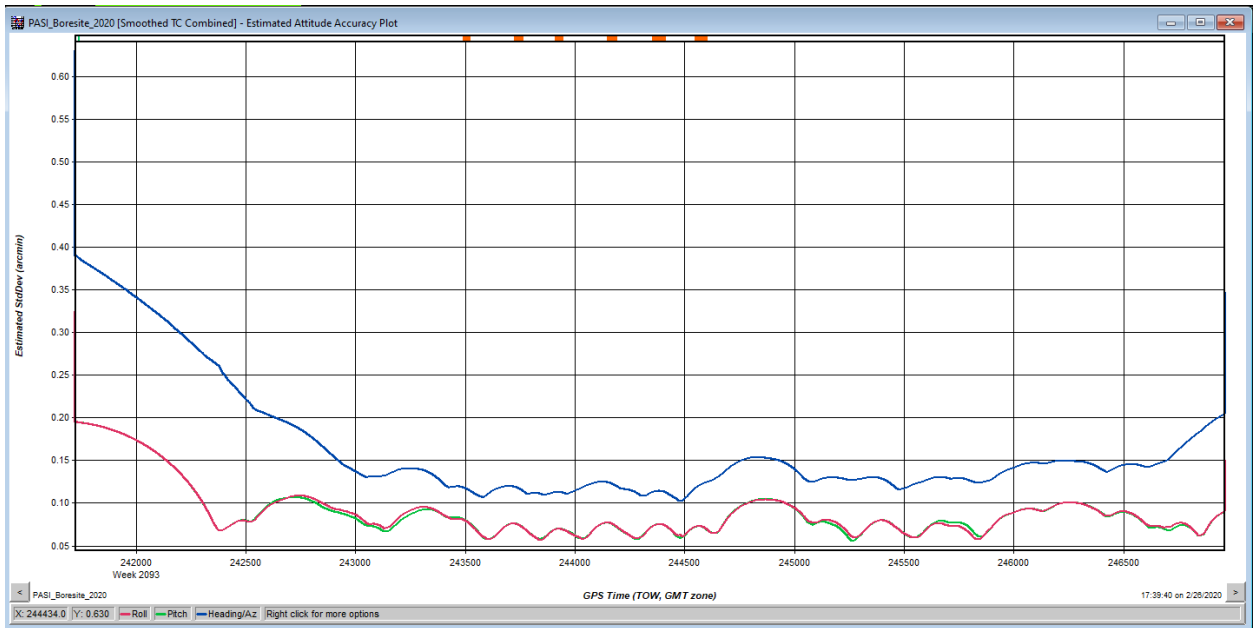
5. An initial Exterior Orientation for the photos in the calibration block was computed in IPASCO+ software, version 2.32 to provide good drives to the ground control points in the ISAT block. For this initial E, no datum shifts or misalignment angles were applied.

6. The Pass / Tie points were all generated using Automated Point Measurement in ISAT with stringent point matching enabled and a 9 x 9 thinning filter applied. All blundered image points, and pass / tie points with residuals greater than 2 ums , single ray points, 2-Ray points in Triple or greater overlap areas were eliminated. The figure below displays the final distribution of the pass / tie points.
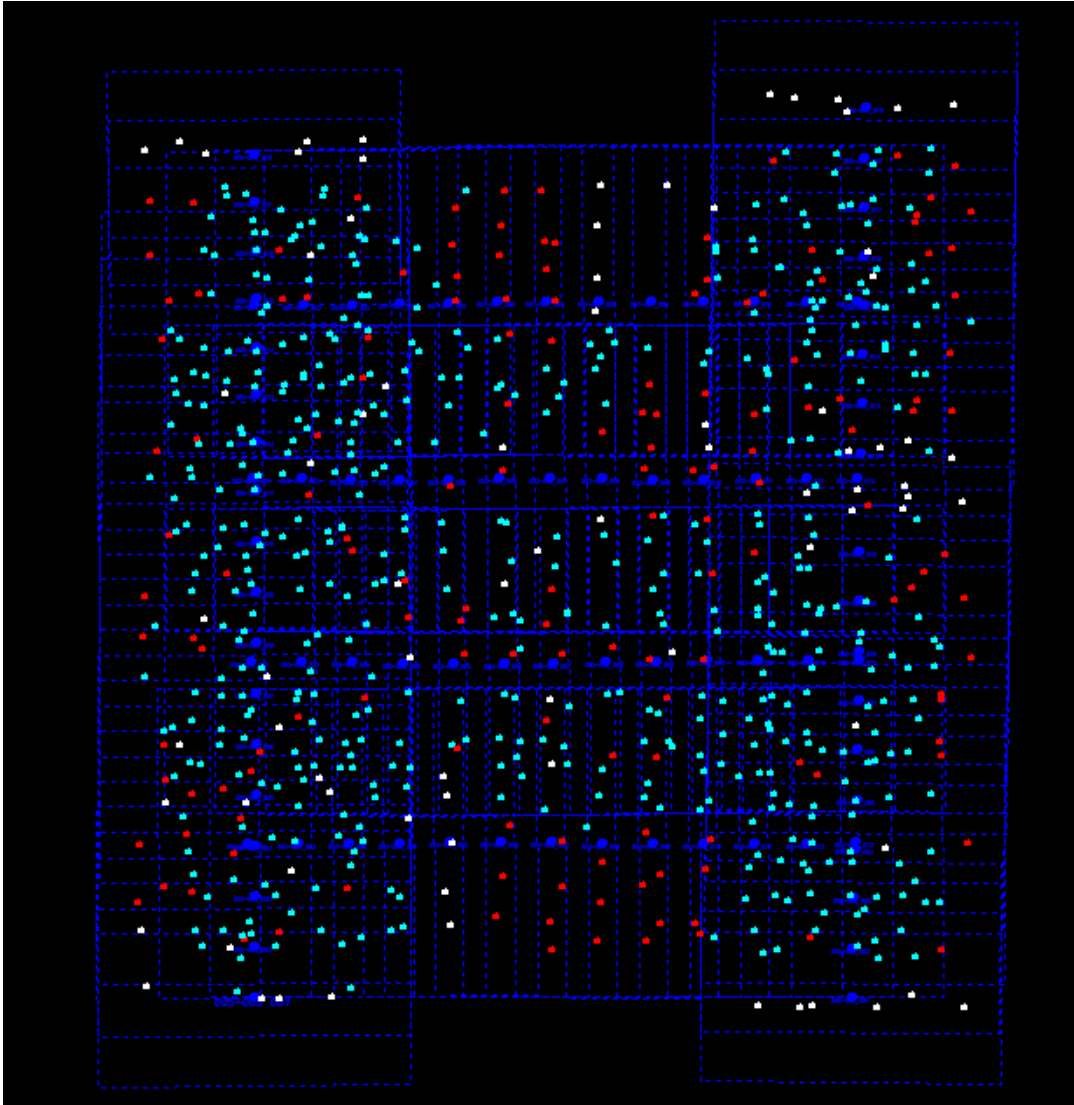
7. The two figures below display the layout of the control and check points in the bundle adjustment. There were 39 control points used and 19 check points. All of the ground control and check points were photo identifiable points.
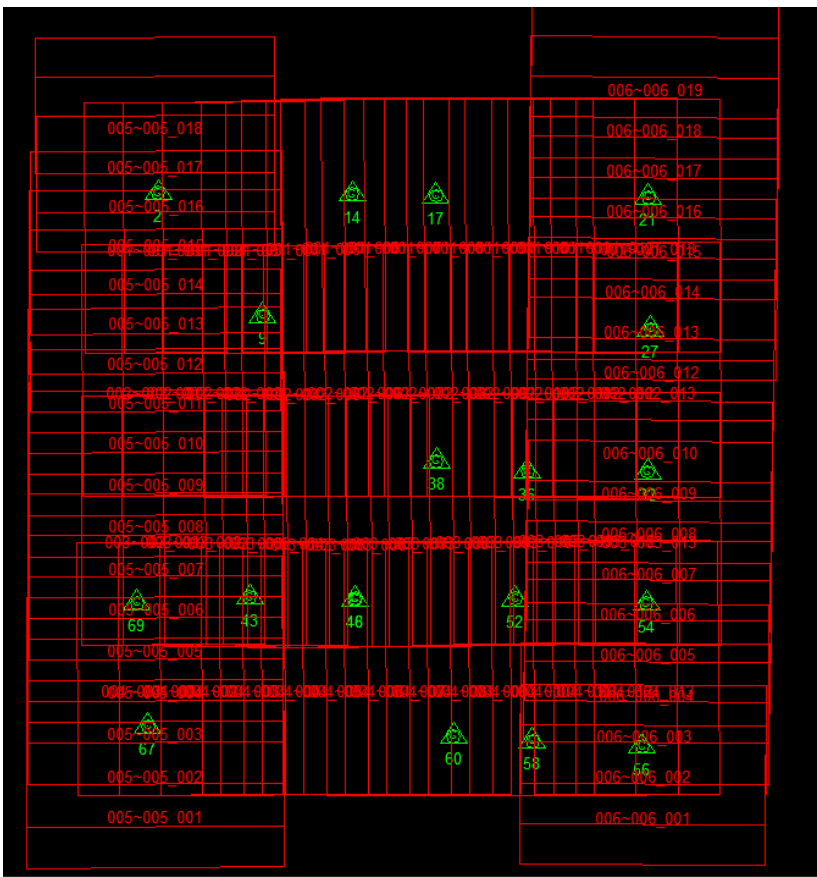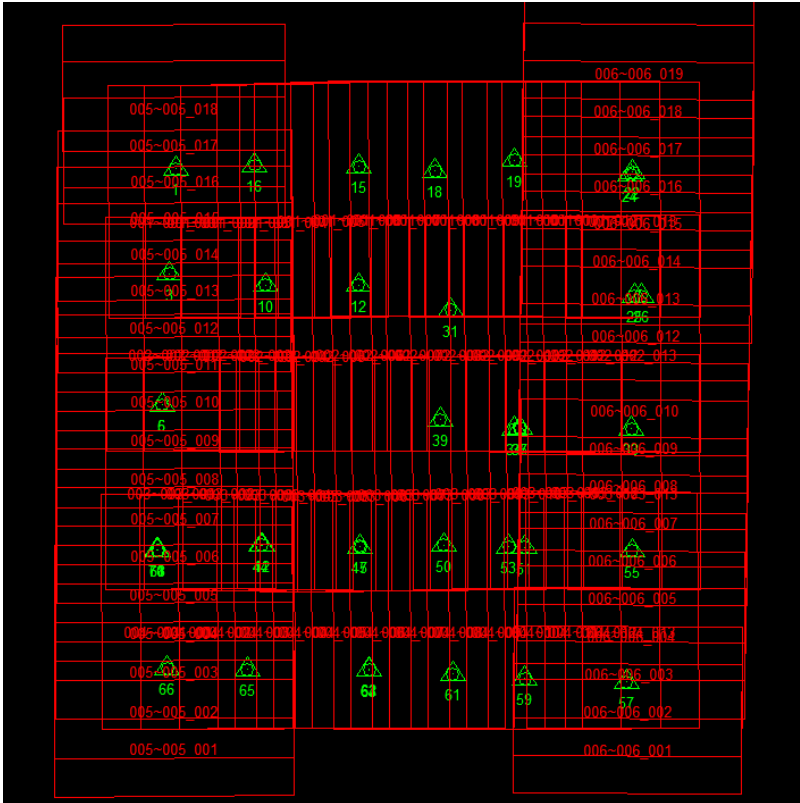
8. An aerial triangulation solution was computed using just the ground control without integrating the GNSS / IMU solution. This was used to compute the misalignment angles and datum shifts for the IMU. The figure below shows the results of this borsite calibration. The calibration was processed using IPASCO+, version 2.32.

9. A new set of Exterior orientation parameters was computed from the GNSS / IMU trajectory using the new boresite misalignment angles and datum shifts. This was imported into the ISAT project and a new absolute bundle adjustment was computed. This adjustment integrated the Exterior orientation generated from the IMU trajectory with the IMU positions weighted at 0.5 meters and the attitude angles weighted at .01 degrees. The ground control was weighted at 0.1 meters. A dynamic shift / drift was computed for the IMU positions on each line. The figures below show the results of the bundle adjustment.

Photo Triangulation Results

Summary Stats | Photo Stats | Object Stats | Point Stats | Exterior Orientation | GPS | INS | Self-Calibration

Parameter	X/Omega	Y/Phi	Z/Kappa
RMS Control	0.031	0.035	0.038
RMS Check	0.024	0.038	0.049
RMS Limits	0.100	0.100	0.100
Max Ground Residual	0.071	0.095	0.114
Residual Limits	0.300	0.300	0.300
Mean Std Dev Object	0.012	0.011	0.035
RMS Photo Position	0.031	0.027	0.021
RMS Photo Attitude	0.001	0.001	0.001
Mean Std Dev Photo Position	0.041	0.039	0.019
Mean Std Dev Photo Attitude	0.002	0.002	0.001

Key Statistics

Sigma: 0.8067 um
RMS Image (x, y): 0.7198, 0.6010 um
Number of iterations: 4
Degrees of Freedom: 5579
Gross Image Blunders: 0
Gross Control Blunders: 0
Image Blunders: 0

Solution Status: Solution Successful.

Current Count

Control Points Used: 39
Check Points Used: 19
Photos Used: 88
Photos Not Used: 0
Image Points Used: 3937

Cameras used: [1].

Camera Id	Lens Di...	Grids
DMC_III	Off	Off

Project Settings

Linear: Meters   Refraction: Off
Angular: Degrees   Curvature: Off

NAD83(CSRS) - Universal Transverse Mercator (m)

Options... Control... Groups... Reports... Exterior Orientation...

Compute Apply Reset Graphics... OK Cancel Help

Photo Triangulation Results

Summary Stats | Photo Stats | Object Stats | Point Stats | Exterior Orientation | GPS | INS | Self-Calibration

Points: (58 Total)

Point Id	Status	Type	Class	VX	VY	VZ	V(XYZ)	Std Dev X	Std Dev Y	Std Dev Z	# Rays	Computed X	Computed Y	Comput
1	Measured	Control	XYZ	0.015	-0.002	-0.011	0.019	0.012	0.011	0.021	5	547277.988	5434799.870	134
3	Measured	Control	XYZ	0.003	-0.001	-0.028	0.028	0.009	0.009	0.017	7	547246.759	5434228.947	106
9	Measured	Check	XYZ	0.045	0.042	-0.028	0.067	0.007	0.007	0.015	12	547812.706	5434177.032	58
10	Measured	Control	XYZ	-0.029	0.065	0.084	0.110	0.007	0.007	0.014	12	547767.197	5434167.372	58
16	Measured	Control	XYZ	0.016	-0.014	-0.028	0.035	0.011	0.010	0.019	6	547708.845	5434820.707	119
12	Measured	Control	XYZ	0.053	0.024	0.005	0.058	0.007	0.007	0.016	6	548274.533	5434168.152	61
14	Measured	Check	XYZ	-0.015	-0.004	-0.019	0.024	0.011	0.013	0.049	3	548267.111	5434790.996	59
15	Measured	Control	XYZ	0.013	-0.044	-0.008	0.046	0.011	0.011	0.024	3	548278.222	5434813.735	58
17	Measured	Check	XYZ	0.012	0.032	-0.004	0.034	0.011	0.013	0.051	3	548692.152	5434783.600	65
18	Measured	Control	XYZ	0.014	0.012	0.006	0.020	0.011	0.011	0.024	3	548691.826	5434787.246	65
31	Measured	Control	XYZ	-0.012	-0.056	-0.030	0.065	0.007	0.007	0.016	8	548775.339	5434032.782	58
19	Measured	Control	XYZ	0.010	-0.064	-0.007	0.065	0.011	0.012	0.024	3	549122.072	5434847.962	60
22	Measured	Control	XYZ	-0.004	-0.010	-0.038	0.040	0.012	0.012	0.022	5	549764.629	5434782.832	63
24	Measured	Control	XYZ	-0.050	0.047	0.094	0.116	0.012	0.012	0.022	5	549752.801	5434768.268	62
25	Measured	Control	XYZ	0.017	-0.006	-0.003	0.018	0.009	0.009	0.018	7	549773.529	5434109.591	54
27	Measured	Check	XYZ	0.016	0.026	-0.085	0.091	0.009	0.010	0.022	7	549778.709	5434108.186	54
26	Measured	Control	XYZ	0.028	-0.022	-0.114	0.119	0.009	0.010	0.018	7	549811.753	5434109.936	54
21	Measured	Check	XYZ	0.008	0.024	0.000	0.025	0.012	0.012	0.035	5	549764.676	5434774.666	63
6	Measured	Control	XYZ	-0.026	0.019	0.005	0.032	0.008	0.008	0.017	8	547203.888	5433517.137	58
5	Measured	Control	XYZ	-0.015	-0.014	-0.002	0.021	0.008	0.008	0.017	8	547204.176	5433517.647	58
38	Measured	Check	XYZ	-0.037	0.032	0.046	0.067	0.007	0.007	0.017	6	548693.285	5433440.992	66
39	Measured	Check	XYZ	0.056	0.028	-0.017	0.065	0.006	0.007	0.015	6	548718.432	5433435.550	66
37	Measured	Control	XYZ	0.059	0.060	0.056	0.101	0.007	0.007	0.014	6	549151.776	5433390.078	64
34	Measured	Control	XYZ	-0.009	-0.003	-0.008	0.012	0.007	0.007	0.014	6	549121.677	5433385.209	64
35	Measured	Control	XYZ	-0.008	0.021	-0.003	0.023	0.007	0.007	0.014	6	549153.980	5433390.277	64
36	Measured	Check	XYZ	-0.043	0.103	0.032	0.116	0.007	0.007	0.016	6	549153.072	5433389.654	64
33	Measured	Control	XYZ	-0.018	0.036	0.086	0.095	0.009	0.009	0.018	4	549758.024	5433385.814	63
32	Measured	Check	XYZ	-0.026	-0.075	0.027	0.084	0.009	0.009	0.021	7	549761.867	5433387.897	63
68	Measured	Control	XYZ	-0.051	-0.061	-0.072	0.108	0.009	0.009	0.017	6	547184.369	5432726.507	63
69	Measured	Control	XYZ	0.009	-0.030	0.001	0.032	0.009	0.009	0.019	8	547177.505	5432726.014	64
70	Measured	Control	XYZ	0.038	-0.024	-0.014	0.047	0.009	0.009	0.016	8	547177.514	5432726.469	64

Withhold Reinstate Delete Headings...

Options... Control... Groups... Reports... Exterior Orientation...

Compute Apply Reset Graphics... OK Cancel Help

Photo Triangulation Results

Strips: (6 Total)

Strip Id	X Shift	X Drift	Y Shift	Y Drift	Z Shift	Z Drift
001	-0.136	0.000	-0.062	-0.004	0.003	-0.001
002	0.217	-0.001	0.103	-0.003	-0.008	-0.002
003	-0.159	0.003	-0.120	-0.001	0.001	0.000
004	0.178	-0.004	0.100	0.002	-0.043	0.000
005	0.165	0.003	-0.180	-0.003	-0.009	-0.001
006	-0.143	0.002	0.192	0.003	0.028	0.000

10. The RMS of the control and check points were as follows with respect to the flown GSD of the project (5 cms).

Control Points:

.62 GSD X
.70 GSD Y
.76 GSD

Check Points:

.48 GSD X
.76 GSD Y
.98 GSD Z