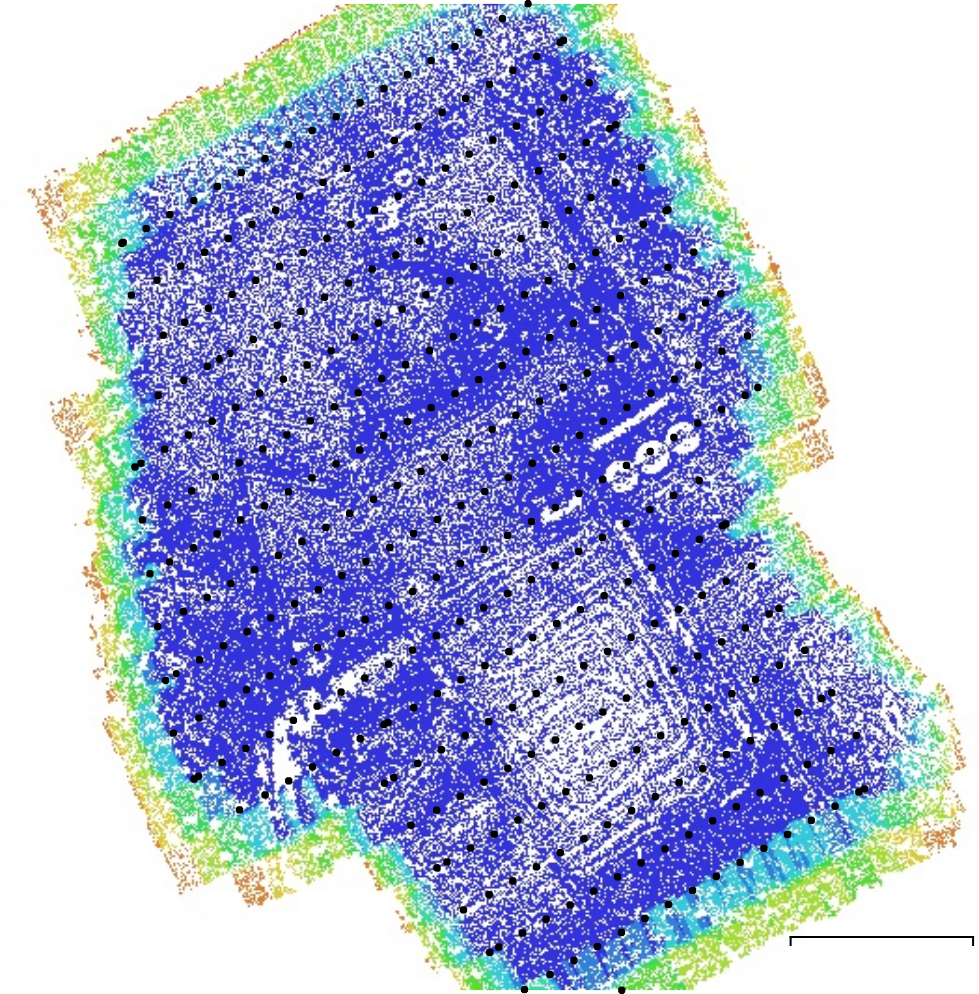
# GCP\_Report

**Report 28 June 2022**



# Survey Data

 > 9



200 m

 9

 8

 7

 6

 5

 4

 3

 2

 1

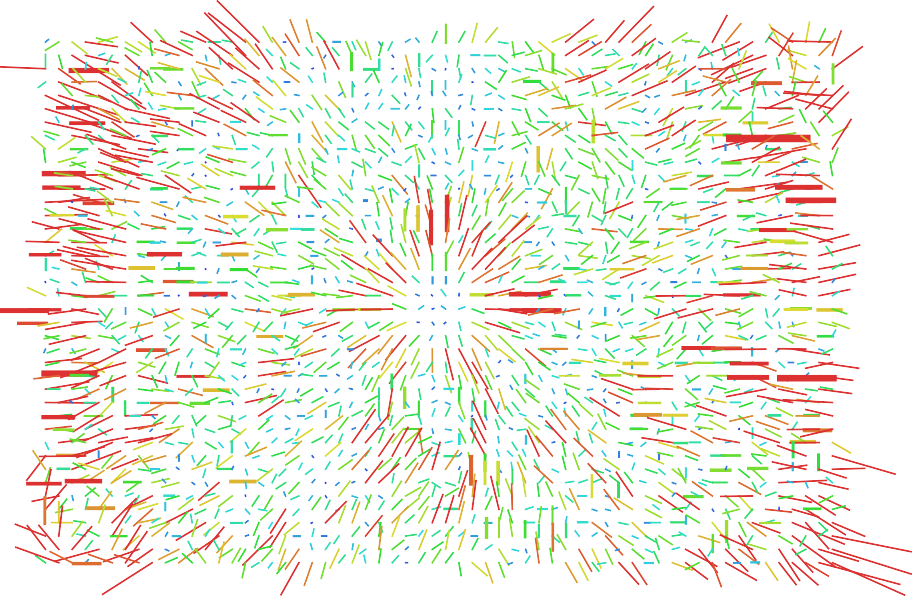
Fig. 1. Camera locations and image overlap.

|  |  |  |  |
| --- | --- | --- | --- |
| Number of images: | 376 | Camera stations: | 376 |
| Flying altitude: | 150 m | Tie points: | 285,128 |
| Ground resolution: | 4.11 cm/pix | Projections: | 1,346,371 |
| Coverage area: | 0.49 km² | Reprojection error: | 1.17 pix |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Camera Model** | **Resolution** | **Focal Length** | **Pixel Size** | **Precalibrated** |
| FC6310S (8.8mm) | 5472 x 3648 | 8.8 mm | 2.41 x 2.41 μm | No |

Table 1. Cameras.

# Camera Calibration



1 pix

Fig. 2. Image residuals for FC6310S (8.8mm).

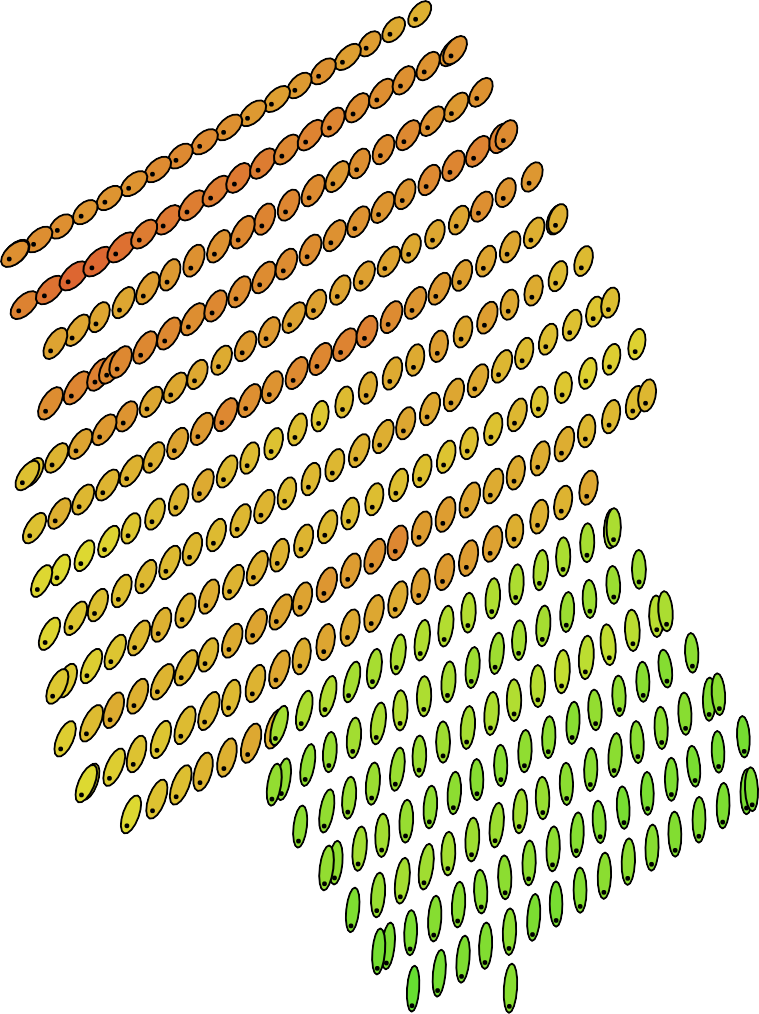
|  |  |  |  |
| --- | --- | --- | --- |
| **FC6310S (8.8mm)** |  | | |
| 376 images |
| Type | Resolution | Focal Length | Pixel Size |
| **Frame** | **5472 x 3648** | **8.8 mm** | **2.41 x 2.41 μm** |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Value** | **Error** | **Cx** | **Cy** | **B1** | **B2** | **K1** | **K2** | **K3** | **P1** | **P2** |
| **F** | **3648** |  |  |  |  |  |  |  |  |  |  |
| **Cx** | **-23.409** | 0.15 | 1.00 | -0.02 | -0.26 | -0.43 | 0.01 | -0.03 | 0.04 | 0.35 | 0.03 |
| **Cy** | **-2.31474** | 0.12 |  | 1.00 | 0.39 | -0.30 | 0.02 | -0.02 | 0.02 | 0.01 | -0.43 |
| **B1** | **-1.47073** | 0.019 |  |  | 1.00 | -0.00 | -0.04 | 0.00 | 0.00 | -0.04 | -0.32 |
| **B2** | **-0.952641** | 0.018 |  |  |  | 1.00 | -0.02 | 0.02 | -0.02 | -0.16 | 0.07 |
| **K1** | **-0.0139603** | 2.8e-05 |  |  |  |  | 1.00 | -0.96 | 0.91 | 0.01 | 0.00 |
| **K2** | **0.00258858** | 8e-05 |  |  |  |  |  | 1.00 | -0.99 | 0.00 | 0.01 |
| **K3** | **0.00583585** | 6.9e-05 |  |  |  |  |  |  | 1.00 | -0.00 | -0.01 |
| **P1** | **-0.00209347** | 2.2e-06 |  |  |  |  |  |  |  | 1.00 | 0.03 |
| **P2** | **-0.0014433** | 2e-06 |  |  |  |  |  |  |  |  | 1.00 |

Table 2. Calibration coefficients and correlation matrix.

# Camera Locations

 10 m



200 m

 8 m

 6 m

 4 m

2 m

0 m

-2 m

 -4 m

 -6 m

 -8 m

 -10 m

x 6

Fig. 3. Camera locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated camera locations are marked with a black dot.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **X error (m)** | **Y error (m)** | **Z error (m)** | **XY error (m)** | **Total error (m)** |
| 1.1334 | 3.82765 | 5.75203 | 3.99193 | 7.00153 |

Table 3. Average camera location error. X - Longitude, Y - Latitude, Z - Altitude.

# Ground Control Points

 2.5 mm  2 mm



Control points

Check points

200 m

GCP15

GCP1

GCP14

GCP2

GCP9

GCP13

GCP3

 1.5 mm  1 mm

0.5 mm 0 mm

-0.5 mm

 -1 mm

 -1.5 mm

 -2 mm

 -2.5 mm

x 2000

Fig. 4. GCP locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated GCP locations are marked with a dot or crossing.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Count** | **X error (cm)** | **Y error (cm)** | **Z error (cm)** | **XY error (cm)** | **Total (cm)** |
| 7 | 0.655577 | 1.19515 | 0.144706 | 1.36315 | 1.37081 |

Table 4. Control points RMSE.

X - Longitude, Y - Latitude, Z - Altitude.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Label** | **X error (cm)** | **Y error (cm)** | **Z error (cm)** | **Total (cm)** | **Image (pix)** |
| GCP1 | -0.268927 | 0.869543 | 0.0937187 | 0.914992 | 0.473 (10) |
| GCP2 | 0.372561 | -2.32387 | 0.0471326 | 2.35402 | 0.835 (10) |
| GCP3 | 1.11684 | -0.264841 | -0.173266 | 1.16082 | 0.558 (10) |
| GCP9 | -0.634555 | 1.30599 | -0.123274 | 1.45721 | 0.554 (10) |
| GCP13 | -1.01235 | -0.253993 | 0.237379 | 1.07038 | 0.527 (10) |
| GCP14 | 0.335421 | 1.28759 | -0.178645 | 1.3425 | 0.747 (10) |
| GCP15 | 0.0999618 | -0.586587 | 0.0457444 | 0.5968 | 0.350 (10) |
| **Total** | **0.655577** | **1.19515** | **0.144706** | **1.37081** | **0.597** |

Table 5. Control points.

X - Longitude, Y - Latitude, Z - Altitude.