

# **Day 7 (Survey 2)**

**Processing Report  
13 February 2018**



# Survey Data

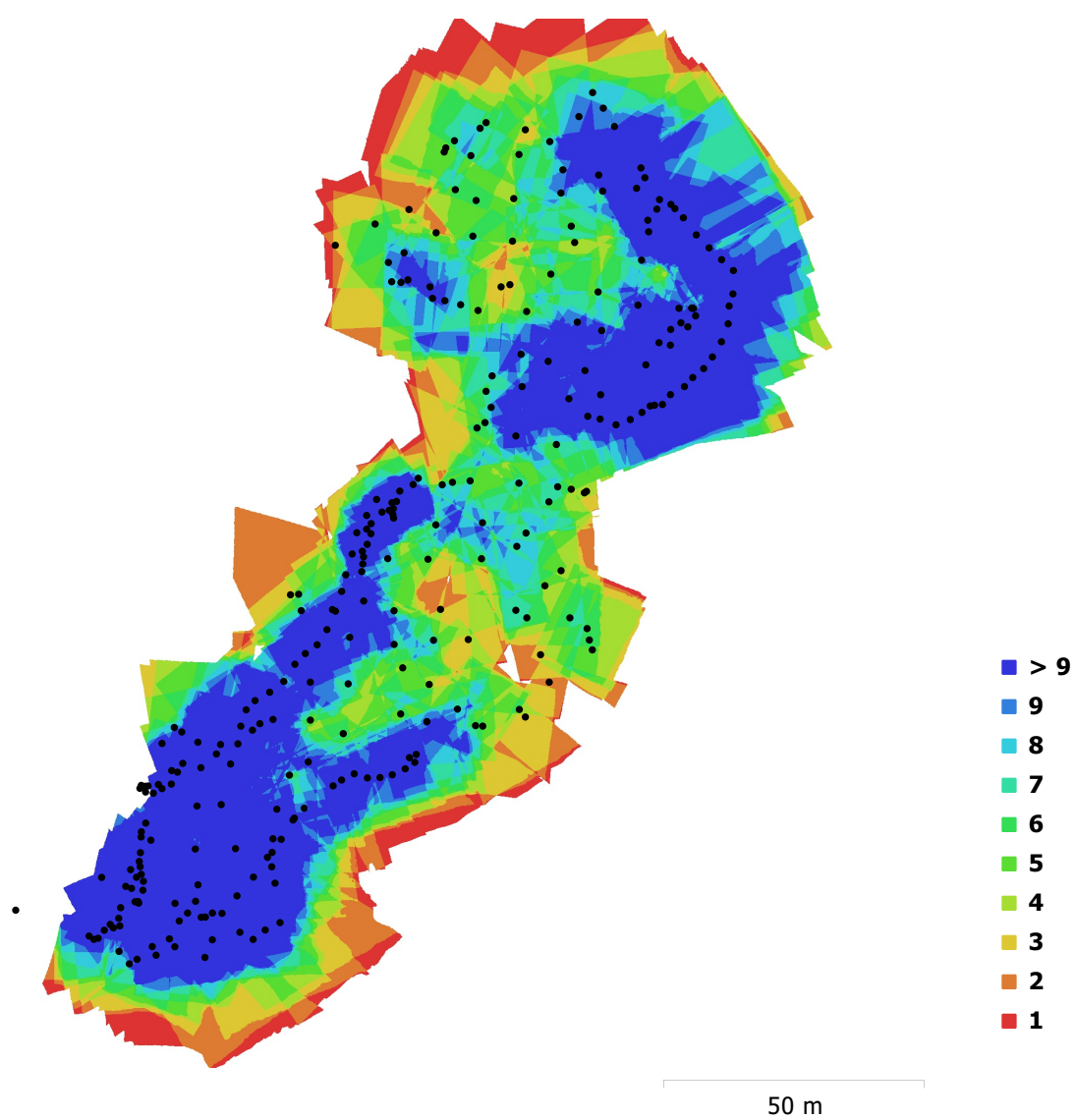


Fig. 1. Camera locations and image overlap.

Number of images:	298	Camera stations:	287
Flying altitude:	18.1 m	Tie points:	819,098
Ground resolution:	5.21 mm/pix	Projections:	2,184,711
Coverage area:	0.0138 km <sup>2</sup>	Reprojection error:	0.91 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
Canon PowerShot D30 (5 mm)	4000 x 3000	5 mm	1.55 x 1.55 µm	No

Table 1. Cameras.

# Camera Calibration

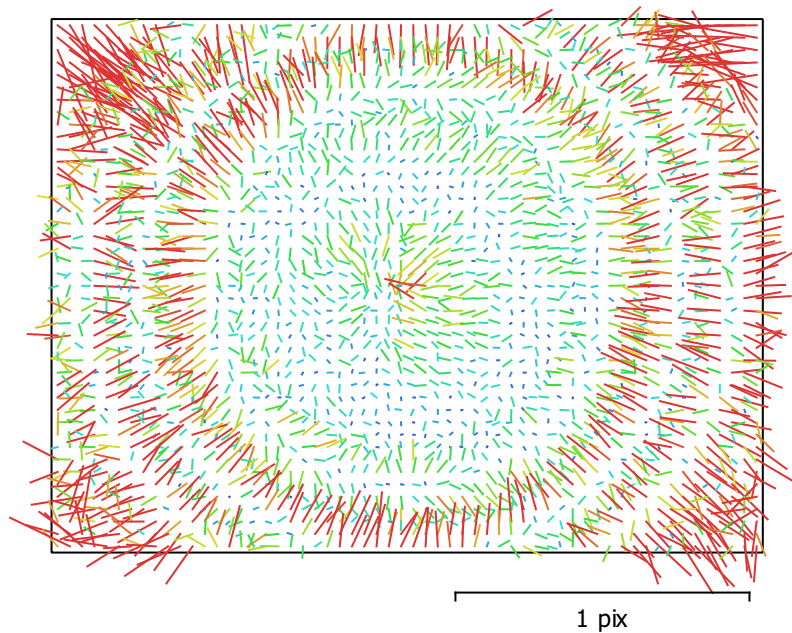


Fig. 2. Image residuals for Canon PowerShot D30 (5 mm).

## Canon PowerShot D30 (5 mm)

298 images

Type  
**Frame**

Resolution  
**4000 x 3000**

Focal Length  
**5 mm**

Pixel Size  
**1.55 x 1.55  $\mu\text{m}$**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	P1	P2
<b>F</b>	<b>3291.46</b>	0.1	1.00	-0.18	-0.06	0.09	-0.15	0.07	0.07	-0.06	-0.11	0.01
<b>Cx</b>	<b>-31.9629</b>	0.071		1.00	0.03	0.08	0.14	-0.03	0.00	-0.00	0.81	0.02
<b>Cy</b>	<b>1.70773</b>	0.067			1.00	-0.17	0.11	0.01	-0.01	0.01	0.03	0.80
<b>B1</b>	<b>-1.38809</b>	0.014				1.00	-0.04	0.01	-0.03	0.03	-0.05	-0.05
<b>B2</b>	<b>0.104723</b>	0.014					1.00	0.02	-0.02	0.02	0.02	-0.08
<b>K1</b>	<b>0.00302047</b>	5.4e-05						1.00	-0.93	0.87	-0.04	-0.01
<b>K2</b>	<b>-0.0147195</b>	0.00023							1.00	-0.98	0.00	0.00
<b>K3</b>	<b>0.00591995</b>	0.0003								1.00	-0.00	0.00
<b>P1</b>	<b>-0.00374929</b>	5.5e-06									1.00	0.01
<b>P2</b>	<b>-0.0011377</b>	4.8e-06										1.00

Table 2. Calibration coefficients and correlation matrix.

# Ground Control Points

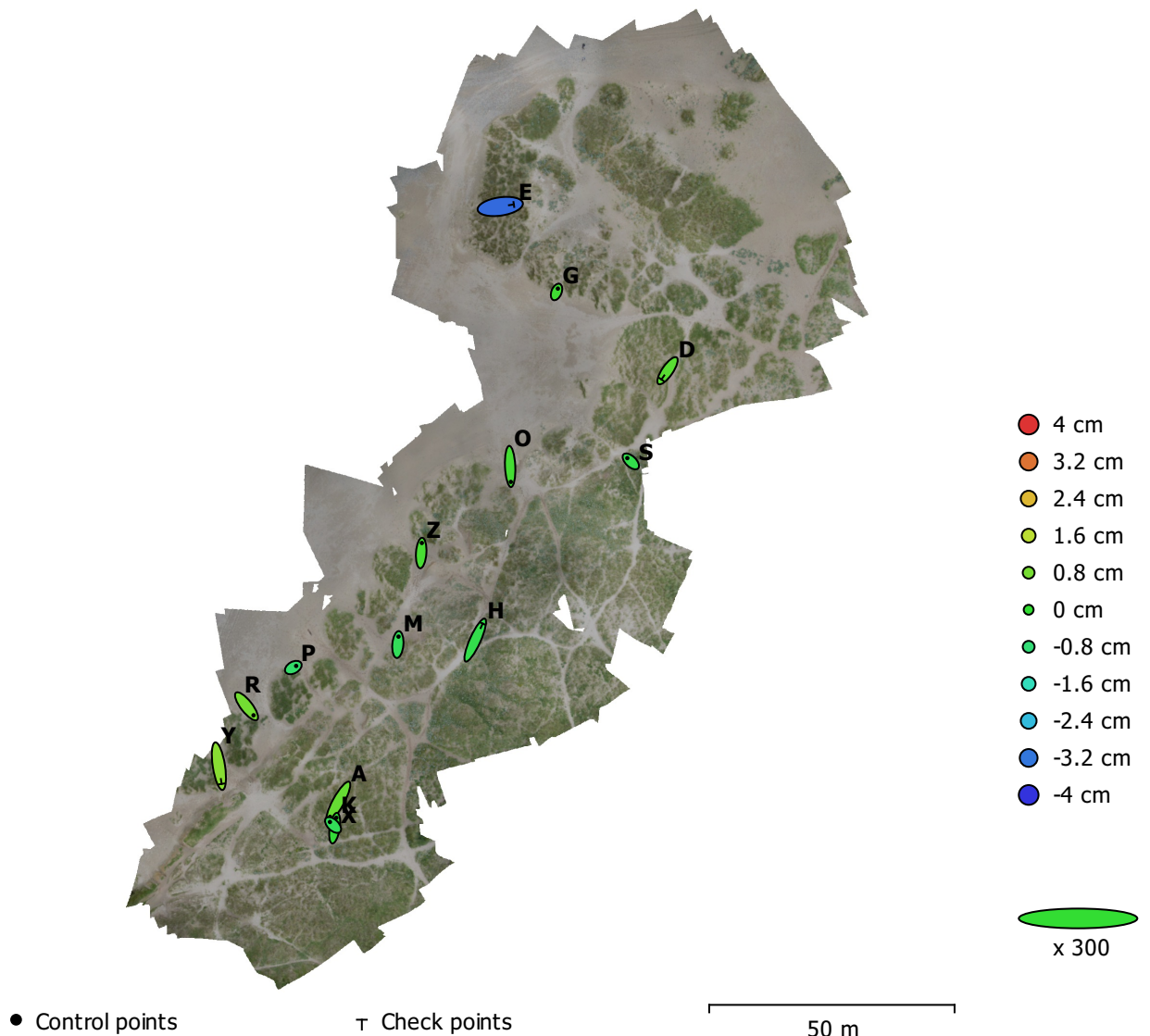


Fig. 3. GCP locations and error estimates.

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)
10	0.530832	1.25371	0.44003	1.36146	1.4308

Table 3. Control points RMSE.

X - Easting, Y - Northing, Z - Altitude.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
4	1.14617	1.75806	1.78344	2.09868	2.75411

Table 4. Check points RMSE.

X - Easting, Y - Northing, Z - Altitude.

<b>Label</b>	<b>X error (cm)</b>	<b>Y error (cm)</b>	<b>Z error (cm)</b>	<b>Total (cm)</b>	<b>Image (pix)</b>
Z	0.0890405	1.36501	0.222941	1.38596	0.529 (16)
M	0.0887304	1.07675	-0.48812	1.18555	0.526 (9)
P	0.387269	0.21898	-0.671327	0.805363	0.446 (6)
R	0.952563	-1.22008	0.719306	1.70686	0.392 (11)
O	0.0912239	-2.10231	0.16655	2.11087	0.535 (8)
A	-1.11638	-2.04337	0.571341	2.39752	0.882 (17)
K	0.223874	1.40887	-0.0535979	1.42756	0.613 (18)
X	-0.427673	0.411495	-0.454801	0.747714	0.564 (18)
G	0.183539	0.457546	0.112829	0.505733	0.569 (6)
S	-0.47258	0.447236	-0.321873	0.725916	0.103 (4)
<b>Total</b>	<b>0.530832</b>	<b>1.25371</b>	<b>0.44003</b>	<b>1.4308</b>	<b>0.594</b>

Table 5. Control points.  
X - Easting, Y - Northing, Z - Altitude.

<b>Label</b>	<b>X error (cm)</b>	<b>Y error (cm)</b>	<b>Z error (cm)</b>	<b>Total (cm)</b>	<b>Image (pix)</b>
Y	0.371833	-2.41316	0.953075	2.62106	0.632 (21)
H	1.01465	2.24576	-0.335715	2.4871	0.542 (5)
D	-0.822169	-1.19286	0.417623	1.50774	0.741 (12)
E	1.8469	0.27081	-3.39518	3.87448	0.676 (4)
<b>Total</b>	<b>1.14617</b>	<b>1.75806</b>	<b>1.78344</b>	<b>2.75411</b>	<b>0.660</b>

Table 6. Check points.  
X - Easting, Y - Northing, Z - Altitude.

# Digital Elevation Model

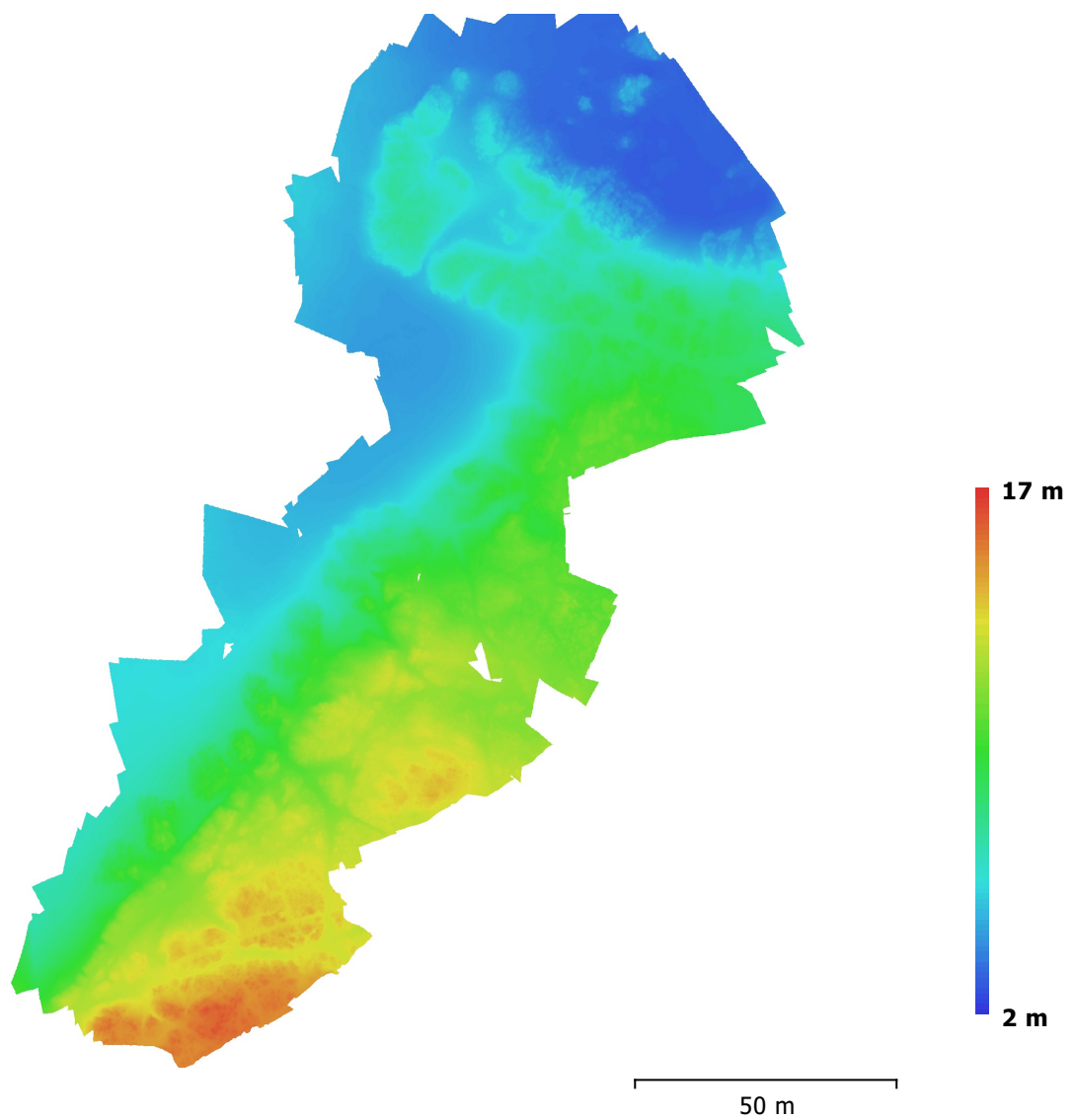


Fig. 4. Reconstructed digital elevation model.

Resolution: 1.04 cm/pix  
Point density: 92 points/cm<sup>2</sup>

# Processing Parameters

## General

Cameras	298
Aligned cameras	287
Markers	14
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Rotation angles	Yaw, Pitch, Roll

## Point Cloud

Points	819,098 of 916,493
RMS reprojection error	0.140989 (0.909653 pix)
Max reprojection error	0.587212 (41.1404 pix)
Mean key point size	5.95078 pix
Effective overlap	2.75146

### Alignment parameters

Accuracy	High
Generic preselection	Yes
Reference preselection	Yes
Key point limit	100,000
Tie point limit	0
Adaptive camera model fitting	Yes
Matching time	1 hours 0 minutes
Alignment time	8 minutes 17 seconds

### Optimization parameters

Parameters	f, b1, b2, cx, cy, k1-k3, p1, p2
Fit rolling shutter	No
Optimization time	15 seconds

## Dense Point Cloud

Points	129,471,939
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### Reconstruction parameters

Quality	High
Depth filtering	Aggressive
Depth maps generation time	3 hours 9 minutes
Dense cloud generation time	1 hours 1 minutes

## Model

Faces	8,569,457
Vertices	4,292,311
Texture	4,096 x 4,096, uint8

### Reconstruction parameters

Surface type	Height field
Source data	Dense
Interpolation	Enabled
Quality	High
Depth filtering	Aggressive
Face count	8,631,462
Processing time	12 minutes 26 seconds

### Texturing parameters

Mapping mode	Orthophoto
Blending mode	Mosaic
Texture size	4,096 x 4,096
Enable color correction	No
Enable hole filling	Yes
UV mapping time	2 minutes 53 seconds
Blending time	7 minutes 23 seconds

## DEM

Size	24,536 x 28,941
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)

### Reconstruction parameters

Source data	Dense cloud
Interpolation	Enabled
Processing time	21 minutes 27 seconds
<b>Orthomosaic</b>	
Size	31,552 x 38,626
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Channels	3, uint8
<b>Reconstruction parameters</b>	
Blending mode	Mosaic
Surface	Mesh
Enable color correction	No
Enable hole filling	Yes
Processing time	31 minutes 50 seconds
<b>Software</b>	
Version	1.3.2 build 4205
Platform	Windows 64