
Airborne model orientation

Content

Airborne model orientation	1
Content	1
Name:	1
Data:	1
1. Purpose	2
2. Data	2
3. Definition of the Orientations	2
3.1 Interior orientation	2
3.2 Relative orientation	3
3.3 Absolute orientation	3
4. Executing of the processes	3
5. Report	4
6. Attachment - 1 (Technical parameters of the camera VEXCEL UltraCam)	5
7. Attachment – 2 (GCP's allocation)	6
8. Attachment – 3 (Localization of the GCP's)	7

Name:

Data:

1. Purpose

The main purpose of this laboratory is an introduction to orientation processes in photogrammetry, and measurements and calculation on sample data. Students should know the whole work flow of these processes.

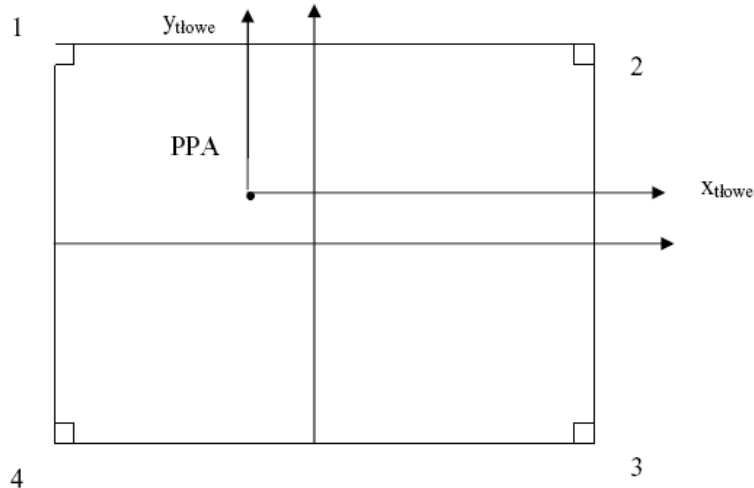
2. Data

The “**stereogram 16497_16498**” made with the use of VEXCEL UltraCam Xp camera. Pixel size : 22 cm, scale 1:36 000, flight high above average ground level - 3550 m, ck =100,50 mm, base relation W/B = 4
Localization of images : \\KLON\VSD\Orientacja\Obrazy_do_o.bezwzglodnej

3. Definition of the Orientations

3.1 Interior orientation

Interior Orientation - is transformation from digital image coordinates (pixel coordinates) to fiducial coordinates. We need minimum 2 points in both coordinates. The first step is measuring (digitizing) the fiducial marks on image to set up the transformation between camera and pixel co-ordinates. This needs to be done once for each image, which we would like to use in further work.



$$\begin{aligned}x_1 &= -\frac{C \cdot s}{2} - x_0 & x_3 &= \frac{C \cdot s}{2} - x_0 \\y_1 &= \frac{R \cdot s}{2} - y_0 & y_3 &= -\frac{R \cdot s}{2} - y_0 \\x_2 &= \frac{C \cdot s}{2} - x_0 & x_4 &= -\frac{C \cdot s}{2} - x_0 \\y_2 &= \frac{R \cdot s}{2} - y_0 & y_4 &= -\frac{R \cdot s}{2} - y_0\end{aligned}$$

Where:

C – number of column;

R – number of rows,

S – size of the matrix pixel in [mm]

X_0, Y_0 - the coordinates of the principal point

3.2 Relative orientation

Within the relative orientation, two images are "connected" by the calculation of model co-ordinates. This is an analytical procedure, as a result of which selected homologous rays of bundles of both stereogram images are brought to intersecting. The choice of homologous rays is connected with the so-called Gruber area.

In terms of geometry, the relative orientation should be understood as bringing to an intersection of all pairs of homologous (unipolar) rays of both bundles through bringing to the intersection of minimum 5 pairs of rays. Due to the lack of redundant observations and, through that, the possibility of committing major errors (wrong identification of homologous points in both images), the number of points subjected to orientation should always be higher than five. In case of measuring one point per each of all Gruber areas, we get one redundant observation, which makes it possible to analyse the obtained ray intersection results.

3.3 Absolute orientation

This is procedure, under which we transform the data from model coordinates to terrain(geodetic). coordinates We perform a spatial transformation.

In order that, we have to measure minimum 3 GPC (Ground Control Points).

4. Executing of the processes

We perform the orientation with the VSD-AGH software. The first step is prepare the project.

In the first orientation we measure (key **i**) fiducial mark, and during adjustment (**F-5**) we expect the error to be less than 0.5 pixels (in analogue photography) and 0 in a digital images.

The next step is the relative orientation. During this process we measure 6 points (in practice 12) in Gruber area (key **h**) and during adjustment (**F-6**) we expect the error (mean y residual parallax on the model) to be less than 0.5 pixels.

Finally, we measure minimum 3 points of terrain. The points are signalised as "white crosses on the ground." We measure them by key **g** and do adjustment by (**F-7**).

When the results are correct (RMS less that 1 pixel), we can start with 3D process.

5. Report

Students should prepare their reports as follows:

- provide a short description of what was the purpose of the class and how we achieved it,
- add as attachment the files: ***or_int.wyn, or_rel.wyn, and or_abs.wyn***
(there are results of each orientation in them)

6. Attachment - 1 (Technical parameters of the camera VEXCEL UltraCam)

Size	columns	67,860 mm	11 310 pixels
	rows	103,860 mm	17 310 pixels
Real Image		-33,91 ; -51,95 mm	33,91 ; 51,95 mm
Pixel size		6,0 μm x 6,0 μm	
Focal length	ck	100,500 mm	+/- 0,002 mm
Principal Point	$X_{\text{ppa}}=X_0$	-0,18 mm	+/- 0,002 mm
	$Y_{\text{ppa}}=Y_0$	0,12 mm	+/- 0,002 mm
Distortion	residual distortion less than 0,002 mm		

Pixel coordinates of the image:

1 (upper left)	0	0
2 (upper right)	11 310	0
3 (lower right)	11 310	-17 310
4 (lower left)	0	17 310

7. Attachment – 2 (GCP's allocation)

GCP's allocation

<i>No of Student</i>	<i>GCP for absolute orientation</i>
1	11, 22, 31, 51, 62
2	11, 22, 41, 51, 62
3	11, 21, 31, 52, 61
4	11, 21, 41, 52, 61
5	11, 21, 31, 52, 62
6	11, 21, 41, 52, 62
7	12, 22, 31, 51, 62
8	12, 22, 41, 51, 61
9	11, 22, 31, 51, 61
10	11, 22, 41, 51, 61
11	12, 21, 31, 51, 62
12	12, 21, 41, 51, 62
13	11, 22, 31, 52, 62
14	11, 22, 41, 52, 62
15	12, 21, 31, 52, 62
16	12, 21, 41, 52, 62

List of GCP coordinates

No pkt.	X	Y	Z
11	588362,84	233372,42	273,14
12	588415,07	233095,84	267,08
21	589429,15	233354,74	241,61
22	589412,71	233133,26	236,25
31	588259,80	231611,96	263,73
41	589504,24	231662,67	228,88
51	588329,96	230292,58	221,51
52	588294,64	229898,60	228,88
61	589536,37	230270,18	222,85
62	589614,11	229881,61	225,53

8. Attachment – 3 (Localization of the GCP's)

