

# **INFLUENCE GEOMETRIC PARAMETERS OF SURVEY ON ACCURACY OF THE CREATION OF THE ORTHOPHOTOMAPS ON COSMIC PHOTOS ICONOS**

Gormash A.V., Dorofeeva T.V., Onkov I.V.  
Limited Liability Company «TRIMM», Russia

Positional accuracy of digital orthophotomap, created on cosmic photos, plays defining role at estimation of the possibility of its use for decision of the topographic and cadastral mapping problems, as well as for formation and renovation of the digital maps and plans. One of the most essential factor influencing on accuracy of the creation of the orthophotomaps on cosmic photos is geometric parameter of the survey namely the corner of the rising the satellite above horizon level. This is connected therewith that the error of the vertical forming of the Digital Terrain Model (DTM) brings about error of the position of the point on orthophotomap on value proportionate to cotangent of the corner of the rising the satellite. It is known that the direction of displacement to within sign of the error of the vertical forming DTM should coincide with the azimuth of the direction on the satellite. Resolvability and quality of the photo depend also on the geometry of the survey. Under inclined survey the distance from satellite to object of the survey is increasing. As a result of this fact occurs increase the size of the platform, covered by one pixel on surface of the Land, secondly inclined ray passes longer way through terrestrial atmosphere that in certain degree reduces radiomimetic characteristics of the inclined photo.

In work were carried out the experimental studies of accuracy of orthophotomaps depending on the corner of the rising the satellite. Studies were executed as a result created orthophotomaps in Perm on cosmic photos ICONOS (Geo Ortho Kit). The photos got as a result of survey with corners of the rise within the range of 60-90 degrees were used for building of the orthophotomap. The ortho-transformation photos was carried out by use DTM and one-twenty five thousandth scale topographic maps in Perm with height of the section of the relief 5 meters. The field anchor of the photos was carried out with use the double-frequency GPS- receivers Trimble 5700 and resting on six points of triangulations geodesic network in city. Photogrammetric processing of the photos and creation of the orthophotomap were carried out by means of software "TALKA" (version 3.5) with use of the coefficient of a rational polynomial (RPS).

Accuracy rating of orthophotomaps was executed on deflections of the square-wave coordinates of the checkpoints which were measured on orthophotomap from coordinates these point. The coordinates of the checkpoints were taken with digitized topographic plane-tables of a one-one five hundredth scale and with a one-one thousandth scale digital maps which were created on material of the air-photographic survey. As the checkpoints were taken corners of the permanent structures which can identify exactly on photo.

Statistical data manipulation was carried out in offer that the measured differences of the coordinates of the checkpoints are an amount three independent errors namely: an intermittent metering error, a hard error depending on coordinates of the checkpoint and an error caused inaccuracy of the heights DTM.

The intermittent errors of differences of the coordinates of the points appear in consequence of errors of recognition checkpoints on photo, quantization errors of the raster, intermittent errors of contours on topographical map and etc.

Inhomogeneity of topographical maps of city is the main reason of appearance of the hard errors depending on coordinates of the checkpoint on the photo. Topographical maps were being created during decades in a variety of organizations from geodetic base often not bound between itself. Preliminary results of accuracy rating of topographic maps of a one-one five hundredth scale by materials GPS-survey allow drawing a conclusion about that this errors can achieve 1-2 meters.

The linear transformation of the measured differences of the coordinates with use the affine model was executed for of exception hard errors. The coefficients of the affine model were estimated on least-squares method.

The iteration algorithm of the processing the measured differences of the coordinates of checkpoints consisted of several stages:

1. The calculation of the main static characteristics of the random and parameters of errors ellipse;
2. The calculation of the residual deviations after affine transformation of the coordinates;
3. The calculation of the main static characteristics and parameters of errors ellipse by remainder;
4. The screening of the data anomalous on criterion  $3.5\sigma$  (return to point 1).

When number of the culling data was equal the zero the Iterations ended.

Ten kits of the measured differences of the coordinates at corners of the rising the satellite within the range of 61-88 degrees had been worked.

The volume of the random depending on presence on given territory of the city of objects of building was ranging within the range of 61-88. The total number of processed data has exceeded thousand.

The analysis of the findings got as a result of processing static characteristics and parameters of errors ellipse allow drawing the following conclusions:

- under greater the corner of the rising the satellite (more than 75 degrees) distribution errors of coordinates has practically circular character (the attitude toward major semiaxis to minor semiaxis not exceed 1.3), the standard root-sum-square error is located within the range of 0.7-0.8 meters;

- under small the corner of the rising the satellite (less 75 degrees) noticeably changes the form of errors ellipse, attitude the major semiaxis to minor semiaxis is located within the range of 1.4-1.7, orientation of the major semiaxis of ellipse coincide with the direction on the satellite within 5 degrees, the standard root-sum-square error increases up to 0.8-1.0 meters;

- outside of dependencies from corner of the rising the satellite minor semiaxis of errors ellipse remains to be constant within 0.6-0.7 m;

- the attitude of the average error to root-sum-square error outside of dependencies from corner of the rising the satellite error is located in interval 1.22-1.26. This is indicative of vicinity of the law of the distribution an intermittent errors of the coordinates of the orthophotomap to normal law.