

Creation of digital topographic-geodetic software for land use purposes using PHOTOMOD system

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For effective management of GAZPROM Company and its affiliates real estate as well as for operational considering of legislative changing, connecting with putting into effect of Russian Federation Land Law on 25.10.2001, it is necessary to obtain reliable information about rights on land pieces, using for gas industry real estate.

That is why, the land inventory for oil-gas industry objects as well as for documents preparation for State Cadastre and land rights registration is needed. The most important part of this work is topographic-geodetic basis for land use works, i.e. preparing of digital topographic maps and cadastre plans of different scales.

The suggested technology of remotely sensed data use was checked in our organization in the project: "Land inventory for the real estate objects of "Medvezhje" gas field in Nadim region of Yamalo-Nenecky District". The customer was Landuse Committee of Yamalo-Nenecky District.

Area of licensed region is 662 km². Survey scale – 1:15,000, camera fame size – 18x18 cm, focus=99.865, number of survey areas – 2, strips number – 5, inter-images overlap – 60%, inter-strip overlap – 30%, film type – KODAK 1200 dpi.

Survey referencing in scale 1:15,000 was executed in September-October 2001 using GPS technology with system TRIMBLE 4600 in static mode. Assigned accuracy – 0,20 m. Number of XYZ ground control points – 114.

Field interpretation was done in November-December 2001 for digital topographic map updating in 1:25,000 scale and further using it as a basis of inventory plan of "Medvezhje" gas field, and for creating the topographic basis of inventory plans of area objects in 1:2,000 scale.

Photogrammetric works were done using digital photogrammetric station PHOTOMOD 3.0, for producing of digital ortho-mapping in 1:10,000 scale and executing of stereo-topographical survey in 1:2,000 scale.

Films were scanned using polygraphic scanner UMAX PowerLook III with resolution 1200 dpi. Blocks were adjusted in PHOTOMOD AT module. Considering the configuration of airborne survey strips and ground control points location 5 blocks were set for adjusting, including 23 strips and 348 stereopairs.

Blocks features:

Block # 1: strips – 3, stereopairs – 31, GCP – 12, tie points – 470

Block # 2: strips – 4, stereopairs – 89, GCP – 19, tie points – 1229

Block # 3: strips – 4, stereopairs – 76, GCP – 19, tie points – 1128

Block # 4: strips – 6, stereopairs – 69, GCP – 26, tie points – 1147

Block # 5: strips – 6, stereopairs – 83, GCP – 13, tie points – 1301

Block #1 area – 62,16 km², blocks # 2, 3, 4, 5 area – 599,9 km².

After the adjustment the residual average coordinates errors on ground control points were for blocks: 0.397, 0.302, 0.185; with scale accuracy 1:2,000.

Digital ortho-maps in 1:10,000 scale were created in PHOTOMOD DTM module. TIN was built using adaptive model with regular grid, contour lines step - 2,5 m. There were produced 5 ortho-maps in MapInfo format, and they were used for digital topographic map updating in scale 1:25,000. The map will serve as a basis of inventory plan of linear objects of the gas field.

Area objects cadastre plans were produced using contours stereo-processing in PHOTOMOD StereoDraw module and field interpretation data. Thus the entire inventory works including inventory mapmaking, calculating of land parcels areas, producing of total land use table of gas field “Medvezhje” and other documents were done at the earliest possible date.

In 2002 the cadastre works on “Medvezhje” license parcel were continued. In technical specification announced the mapping accuracy requirements increased. Executed works included: repeated scanning of film negatives with resolution 1800 dpi, then aerial triangulation and blocks re-adjustment. The average adjustment errors were the following: 0.219,0.194,0.197 that allows to consider the stereo-model accuracy as for 1:1,000 scale.

In order to obtain reliable and more accurate DTM the TIN was built using vectors obtained during the stereo-topographical survey. The resulting orthomaps and DEM satisfied the accuracy requirements of 1:2,000 scale.

Stereomodel with scale accuracy 1:1,000 and digital orthophotoplans in 1:2,000 scale allow to make land use inventory works, mapping and land parcels description with accuracy required for determination of parcels boundaries corners coordinates and parcels areas.

The materials produced proved to be important due to the land use schemes designing, where maximal variations is needed to consider. For this purpose it is necessary to have digital topographic map of the object territory in common coordinate system and accurate enough. Now such works on the object are going on.

Besides using the air-borne materials, направлением в работе нашего предприятия является using of digital ortho-rectified space images for inventory purpose, particularly for linear-stretched objects inventory for example: roads, power lines, etc. That is why we have a strong cooperation with space data suppliers - "Sovinformsputnik" and GeoSpectrum.

One more direction of our work is developing and intending the technology of digital topographical mapmaking for projecting and reconstruction of the roads of I-IV category using remote sensing data.