

SDI Development in the Russian Federation

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SUMMARY

A reform in the field of spatial data is gathering headway in Russia. Creation of a single agency, which united state institutions responsible for mapping, property rights registration and cadastre acted as a catalyst for this reform.

The first results are already available on the Rosreestr's web-sites - the Public Cadastral Map and various on-line services. There is a project on renovation of maps of different scales, creation of united renewed covering with the Earth Remote Sensing data. This is one of the biggest projects in the world, taking into account the number of features and the scale of transformations.

The report will explain the process of implementation of this project, its tasks and challenges.

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1. INTRODUCTION

The Federal Service for State Registration, Cadastre and Cartography is a body of executive authority, which is responsible for surveying and mapping of the territory of the Russian Federation.

Due to the fact that the total area of Russia is more than 17 million sq. km, solution of this task demands high scientific, technical and production capacities and corresponding budget funds.

It is enough to say, that there are 30 specialized enterprises within Rosreestr, whose staff consists of 8 thousand of skilled specialists.

There is a legally determined list of geodetic and cartographic activities of federal level, being carried out by the Rosreestr's enterprises. The main of them are: creation of a state geodetic network, geodynamic research, creation and updating of state topographic plans and maps, Earth remote sensing and other activities.

2. THE STATE GEODETIC NETWORK (GGS)

The state geodetic network (GGS) of Russia is a complex of geodetic points, located uniformly on the map.

The state geodetic network, created in 1995, unites:

- 26 astrogeodetic points of a space geodetic network in the former USSR territory;
- 131 Doppler geodetic network points;
- 164306 astrogeodetic network points of the 1st and 2nd classes ;
- near 300 thousand points of the 3rd and 4th classes of geodetic crowding networks.

Today in Russia it is established:

- the unified state geodetic coordinate system of 1995 (SC-95), which is for using in geodetic and cartographic works of the Russian Federation since the 1st July 2002;
- the unified geocentric coordinate system (PZ-90) – is used for geodetic supporting of orbital flights and for achieving of navigational tasks.

There are works on creating of a new high efficiency state system for geodetic support of the Russian Federation's territory, based on applying of the space geodesy methods and on using of the global navigational satellite systems: GLONASS and GPS.

The state geodetic network, being created today, includes a geodetic construction of different accuracy classes:

- fundamental astrogeodetic network (FAGC);
- high-accuracy geodetic network (VGS);
- the 1st class satellite geodetic network (SGS-1).

2.1 The fundamental astrogeodetic network (FAGC)

The fundamental astrogeodetic network is on the highest level in the structure of coordinates settling (geodetic positioning) in the country's territory. FAGS establishes a

geocentric coordinates system within the scope of tasks of provision of the basic navigational parameters.

The distance between contiguous FAGS points is 60-1000 km. A spatial location of the points is detected by space geodesy methods in the geocentric coordinates system with the average quadratic inaccuracy, that is not more than $\pm 10-15$ cm, and the average quadratic inaccuracy of the relative positions of FAGS points is not more, than ± 2 cm by the plan position, and ± 3 cm by height.

2.2 The high-accuracy geodetic network (VGS)

The high-accuracy geodetic network is on the second level of the current GGS structure. Fundamental VGS functions are the further dissemination of the geocentric coordinates system in the country's territory and specification of parameters of relative orientation between the geocentric system and the geodetic coordinates system.

VGS is a homogeneous by accuracy, spatial geodetic construction, which consists of the system points removed one from another system points by 150-300 km.

Works on VGS creation in the territory of Russia are completed.

2.3 The 1st class satellite geodetic network (SGS-1)

The 1st class satellite geodetic network is on the third level of the current GGS structure. SGS-1 is a spatial geodetic construction, being created, firstly, in economically developed regions of the country. It consists of an easily accessible points system with the average distance between them about 25-35 km.

This type of networks is created in those regions, where it is necessary.

3. THE STATE FUNDAMENTAL GRAVIMETRIC NETWORK

The state fundamental gravimetric network and the 1st class gravimetric system are the basis for the gravity acceleration determination at any point of the country's territory and it includes more than 1 000 of points, located in the Russian Federation and CIS countries.

The created network of astrogravimetric leveling (AGN), consisting of 2 000 points, and detailed areal gravimetric mapping are the basis for the determination of the quasi-geoid heights.

The whole territory of Russia, water areas of inland seas and a shelf zone of external seas is covered by the detailed areal gravimetric mapping in scale of 1: 1 000 000.

80% of the land territory, a part of sea offshores and the continental shelf are covered with mapping in scale of 1:200 000.

A high-accuracy geometric levelling network of the 1st and the 2nd classes is **the main high-altitude basis (GVO)** of the country. GVO includes 110 the 1st class polygons, whose general length of lines is 115 thousand km, and 850 the 2nd class polygons, whose general length of lines is 340 thousand km. The network of the 1st and the 2nd classes is crowded by the system of the 3rd and the 4th classes levelling lines, which general length is many thousands of kilometres.

The state levelling network extends high-altitude coordinates in the united Baltic heights system of 1977 in the territory of the country.

The current network is characterized by rather high density – in average it is one point to 34 sq. km.

4. TOPOGRAPHY

State topographic plans and maps are created and updated in a digital form.

At this time the territory of the Russian Federation is covered by the topographic plans and maps, consisting of the following data:

- plans in scale of 1:500, 1:1 000 are created for the certain segments of cities, urban type settlements and industrial areas;

- plans in scale of 1:2 000, 1:5000 are created for all the cities, urban type settlements and industrial areas;

- a plan in scale of 1:10 000 is created for all the industrial and agricultural regions, total area of which is 4,5 million sq. km;

- maps in scale of 1:25 000, 1:50 000, 1:100 000, 1:200 000, 1:500 000, 1:1 000 000 are created for the whole territory of the country, whose area is about 17 million sq. km.

These plans and maps are updated on the base of aerophotography materials, space survey, land photography, land survey of current changes, post-construction surveys of newly built projects, as well as ground observation materials and other information. More than 30 enterprises of Rosreestr work for provision of this information.

5. THE FEDERAL CARTOGRAPHIC-GEODETIC FUND (FKGF)

The Federal cartographic-geodetic fund (FKGF) is a constituent part of the State cartographic-geodetic fund of the Russian Federation and represents a complex of geodetic, cartographic, air and space surveying, gravimetric data and materials, which have national and inter-sector (inter-institutional) importance, and are presented in graphic, digital, photographic and other forms and are the subject to constant and continuous keeping.

FKGF materials count more than 52 million units of the keeping.

Main consumers of the materials are public authorities, legal entities and individuals. FKGF issues more than 100 thousand materials and data, most part of which is topographic maps and coordinates of GGS points.

Today a great logistical work on the lifting of restrictions on providing the spatial information, which is kept by the fund, is finishing. It means, that maps, plans, coordinates of geodetic points will be available for all the organizations and citizens on legal basis.

All the spatial information and data of the Federal cartographic-geodetic fund are the most important constituent part of the spatial data infrastructure of the Russian Federation.

At this moment a survey and cartography field is at the stage of the modernization and reformation.

The main goal of the field modernization is to encourage public authorities, local self-government and market entities to increase effectiveness of creation, actualization and usage of mapping and survey activity products, including spatial data. This field should become a part of informational systems as an infrastructural component built on a new organizational-legal and technological platform.

Achievement of this goal requires step-by-step changing of the current management system in this sector and functions of state enterprises, which act in the survey and mapping sphere. Authorities of these institutions should change from the creation of cartographic-

geodetic products to the creation of spatial data and support to functioning of SDI in the Russian Federation.

Main objectives (directions) of modernization are:

- deployment of SDI as a system of an efficient search and provision of spatial data and other cartographic-geodetic products to customers;
- provision of the unified coordinate description of a spatial object;
- division of regulating, producing and controlling functions, as well as division of authorities between public authorities and local self-government in part of field management.

To realize the objectives named above it is necessary:

- to rework substantially the normative legal and normative-technical support of the field functioning;
- to develop scientific and applied researches;
- to develop and implement management methods and technological solutions;
- to create conditions for getting new financial sources;
- to work out effectiveness measures of the proposed solutions;
- to determine the sequence of events for the field modernization.

Main principles of the field modernization are:

- a wide usage and development of current geographic informational, satellite, remote and informational telecommunication technologies;
- acceptance of the spatial data primacy in connection with the cartographic production, which is made from these data;
- the highest possible usage of the existent spatial data, state topographic maps and plans and other cartographic-geodetic information through the creation of metadata and the system of fundamental and basic spatial data;
- unlimited access to the metadata and information about national coordinates basis, to the state and municipal ortho-photo materials, topographic maps and plans and to their source – fundamental and basic spatial data;
- compulsory usage of the national coordinate basis, state and municipal ortho-photo materials, topographic maps and plans, fundamental spatial data and metadata for creating of all kinds of spatial data at the expense of state budget funds;
- informational protection when creating, actualizing, keeping and providing of spatial data;
- comprehensive development and stimulation of market mechanisms for the field development.

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