Automation of the materials’ provision and the data from the cartographic and geodetic fund

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Abstract. The main materials and data necessary for the surveyor to conduct topographic and geodetic work include the state geodetic network points and topographic tablets on the survey site. All these data, as well as the aerospace data and other cartographic material, are under the jurisdiction of the Federal Fund (Federal Scientific and Technical Center for Geodesy, Cartography and Spatial Data Infrastructure). This organization is subordinate to the Office of the Russian Federal Register. However, today, when working with the site, there are a number of problems: there are no updates to the cartographic material, coordinates and altitudes for the polygon points of the Fund, the Fund website does not have a common database in open access concerning actual information about the State Geodesy Networks (SGN) points’ state.

Introduction
It is difficult to imagine modern society without digital technologies and the Internet, so one of the most important courses for the state development is the economy digitalization. The national program “Digital Economy of the Russian Federation” was approved on July 28, 2017 No. 1632-r by the Government Order [1]. The program considers the various sectors of the national economy modernization to improve the quality of life and develop the entrepreneurial activity. The program includes several national projects (Fig. 1) designed to: regulate the digital environment of our country as a whole, create a unified information infrastructure and ensure its security, introduce digital theories in all key areas of the economy, train personnel for the Russian economy digitalization, create digital platforms, services for public administration.

Analysis of recent achievements and publications
More and more enterprises are switching to automation of their work, thereby reducing the time of work and improving its quality. In accordance with the national program, the ways to optimize and digitally transform public services are currently being actively developed. So, there are more opportunities with the introduction of personal accounts for legal entities and individuals, digital maps and other interactive information on the government agencies’ services.

It is worth noting here that modern topographic and geodetic production also does not lag behind digitalization in other sectors of the national economy. The services able to use the regulatory documents, data and materials in the geodetic field in the public domain or after quick registration appear.

Currently, the contract and reference terms for geodetic surveys dictate short deadlines to the prospectors [2].
Formulation of goals and statement of tasks
The aim of the study was to analyze the existing procedure for the provision of materials and data from the cartographic and geodetic fund to the users - organizations engaged in geodetic activities. Interactions between the consumers and supporters are an important part of the workflow. As far as this stage is easy, understandable and automated, so much time will be spent on the preparatory process of the contractor.

The main research material
The production of topographic and geodetic works always starts with a study of the materials provided by the customer, as well as the survey area analysis for geodesic and topographic knowledge. According to the paragraph 4.7 [3], the preparatory phase of engineering and geodetic surveys includes the collection and processing of engineering surveys of previous years in the survey area, as well as topographic, geodetic, cartographic, aerial and other materials and data located in state federal, territorial and departmental funds.

Figure 1. The structure of the national program “Digital Economy of the Russian Federation”

The main materials and data necessary for the surveyor to conduct the topographic and geodetic work include the points of the state geodetic network and topographic tablets on the survey site [4]. All these data, as well as aerospace data and other cartographic material are under the jurisdiction of the Federal Fund (Federal Scientific and Technical Center for Geodesy, Cartography and Spatial Data Infrastructure) [5]. The Federal Cartographic and Geodesic Fund is an integral part of the State Cartographic and Geodesic Fund of the Russian Federation and is a combination of national, cross-industry significance geodetic, cartographic, topographic, hydrographic, aerospace, gravimetric materials and data presented in graphic, digital, photographic and other forms and subject to permanent or long-term storage [6]. This organization is subordinate to the Russian Federal Register Office. In addition to these organizations, territorial (local) departments of architecture and urban planning store data on geodetic studies of local significance (coordinates and heights of polygonometry points and the Reference Boundary Network (RBN) points), topographic materials (for example, 1: 2000, 1: 500 scale tablets in paper form and / or in digital). It is also worth noting that the situation regarding the materials and data digitalization in the territorial (local) departments of architecture and urban planning in our country is different. For example, in large settlements, the area of digitized materials is much larger than in small cities and rural settlements. Difficulties arise
especially in those regions where a small number of geodetic points have been preserved, insufficient to ensure the density of points for the implementation of a particular type of geodetic work.

With the digitalization and improvement of the technology, the organizations that own funds of geodetic and cartographic data actively automate the process of obtaining data by the contractors. So, the sites with all the information, a personal account with quick registration, digital and interactive maps, and of course contacts via e-mail and other information are created.

The authors of the article conducted a survey among the geodetic community (surveyor surveyors) on the receipt of the materials and data from the Cartographic and Geodetic Fund (CGF), on the problems and difficulties that arise when interacting with government agencies. The survey was conducted online via email.

Questionnaire “Satisfaction with providing the geodetic source data”

1. Indicate the source of obtaining geodetic knowledge (availability of points, their classes in the work area), topographic knowledge (nomenclature of tablets, as well as the availability of maps and plans if necessary).

2. Indicate the source of the reference data for geodetic work on the site (coordinates and heights of the SGN points, cartographic material).

3. What difficulties do you have in obtaining these materials and data?

4. What recommendations would you give on automation of obtaining the materials and data?

The survey involved 11 people. Based on the analysis and systematization of the data received from the respondents, the difficulties were identified, the recommendations and suggestions were developed to improve the joint work of the performers and fund employees.

As we have already mentioned, according to the government decree, the functions of the fund holder are performed by Federal Scientific and Technical Center for Geodesy, Cartography and Spatial Data Infrastructure (hereinafter referred to as “Fund”). The coordinates and heights of the SGN points in the local coordinate system and the Baltic altitude system, as well as the cartographic material (topographic maps on a scale of 1: 2000-1: 100 000), Earth remote sensing materials, the coordinates and heights of the Fundamental Astronomical and Geodetic Network / High Precision Surveying Network points can be obtained from this fund by sending an application.

Before filling out the application for the necessary data and materials, the surveyor needs to have in his hands a diagram of the survey site with a geodetic (SGN points’ location with their name and accuracy class) and topographic knowledge (for example, the nomenclature of tablets) [7]. Information on geodesic and topographic knowledge can be obtained from the Russian State Register Directorate, after filling out the application of an established form.

Since we are talking about receiving the data from the State Fiscal Fund, this digital service transformation therefore very relevant for geodetic workers.

The digital funds’ transformation does not stand still, it is developing: until recently, there were not those opportunities that an ordinary user has now.

For example, the website of the Federal Spatial Data Fund is quite convenient: on the main page there are “clickable windows” of large size, where it is immediately possible to search for the necessary section (get information about geographical names from the state catalog, go to the federal spatial data fund and others), the fund contains “geodetic, cartographic, topographic, hydrographic, aerospace, gravimetric materials about the territory of the Russian Federation - a total of more than 86 million units of materials and data” [8].

Going through the tabs “Fund - Information about points of state geodetic networks (SGN) - Providing information about points of state geodetic networks (SGN) in local coordinate systems (LCS) - Search for fund materials” we, in fact, get to the section that is of interest for us – an interactive map of the country, which is a visual information system.

The tab “Information about SGN points” shows our country’s regions for which an interactive map with information about SGN points is currently available. Now, the data for all regions of the country are not provided. It should be noted that the coordinates of the SGN points contained in the
Federal Fund are indicated in the local coordinate systems of the constituent entities of the Russian Federation, and this entails some temporary loss of work.

On the tab “Calculation of cost”, it is possible to choose the data or materials (geodetic data, maps, materials of remote sensing of the Earth), to request and immediately see the cost per unit. The conditions for obtaining the necessary data are also indicated. When filing out the applications, the applicants may have questions and difficulties. However, on the Fund’s website, the procedure for filling out the applications is quite accessible and explained in detail, the samples and templates are provided. And, as the survey showed, many surveyors have no difficulty filling out documentation. Assistance in applying - tab “Fund - Information on points of state geodetic networks (SGN) - Providing information on points of state geodetic networks (SGN) in local coordinate systems (LCS) - Instructions, requirements, application form” [9]. Applications can be submitted electronically via e-mail, as well as via personal account.

However, today, when working with the site there are a number of problems:

- while filling the applications through your personal account is not carried out in full;
- for today, there is an acute problem of updating the cartographic material, for example, the maps of the scale 1: 10000 and 1: 25000. If some organizations update the cartographic material of this scale, then they are obliged to transfer it to the Fund. In turn, the Fund, apparently, has difficulties making changes to the existing cards and there is a problem in registering them. These conclusions are made by the implementing organizations, since they are issued obsolete cartographic material, without previous updates on the geodetic surveys’ results;
- the timing of preparatory topographic and geodetic works has been increased, due to the fact that geodetic studies are ordered from the Russian State Register Directorate, and the data (extracts from coordinate and altitude catalogs) in the Fund;
- the Fund does not have any coordinates and heights for polygonometry points. In the section “Preparation of applications for the materials contained in the federal spatial data fund” on the tab “Points of geodetic networks” there is information of only the triangulation points. That is, when surveying in a major city, the base station calibration is possible only from the triangulation points. It is good if there are triangulation points, and they are in good condition. Moreover, their number is sufficient for calibration (according to regulatory requirements), and their coordinates and heights are available in the Fund. And if not? There is a problem with the coordinates and heights of polygonometry points in our country. It is quite serious, because there are such areas as Bryansk, Tula, where there are actually polygon points on the ground, but their coordinates and heights cannot be obtained anywhere, due to lack of information. In such “complicated” regions of the country, fundholders can provide the information on the reference-boundary network points (RBN), and the contractor will be forced to do the topographic and geodetic work from these points, the accuracy of which does not correspond to the points of triangulation and polygonometry. As a result, it may turn out that the survey performed “will not stay” in the coordinates. Or, for example, another situation - the triangulation points may be far from the site of work (city) or their number will not be enough to perform calibration (when performing satellite geodetic measurements), and the polygonometry points are actually available, but their coordinates and heights are nowhere to be officially obtained;
- there is no common database in open access about real information about the SGN points’ state on the Fund’s website: the safety of the center and the external sign, the safety of the point as a whole, although these data should be transmitted by the surveyors to the Fund;
- a large number of SGN points, especially located on the land plots or on the buildings not of the state (municipal) ownership, were lost or damaged, which affected the accuracy of ensuring the solution of many engineering and technical problems for the national economy, science and defense of the country.

Recommendations for improving the provision of materials and data from the cartographic and geodetic fund.
if the data receipt from the cartographic and geodetic fund remains on a contractual basis, it is advisable to adjust the timing for the receipt of these materials by the surveyors. Despite the fact that now the application for the receipt of materials and data from the State Pension Fund is being generated via e-mail and the signature is carried out using the technology of electronic digital signature (EDS), the delivery time is 14-30 days, and before sending was carried out via mail and the time period increased to two three months. This issue is especially relevant if the prospectors do a little work, the term of which, according to the contract, is basically a month;

- replace simplified registration in personal (private) account with the confirmation registration (with attachment of SRO extract, license for the right to carry out the cartographic and geodetic activities);
- automate the payment process: the SGN items are selected, an application and the online calculator calculates are composed in accordance with the standard cost, the total cost of services. There is a possibility to pay in the same place in the “Applications” tab, for example, by entering an electronic wallet;
- to register on the site with the data confirmation of the legal entity or individual entrepreneurship, then it would be possible to form the applications, contract and other documentation by signing with an electronic digital signature;
- it is possible to store order history in personal account;
- it is possible to add a filing function to submit the information about the status of points that were identified as a result of the survey with the ability to upload photos and add comment descriptions via personal account following the example of how surveyors do this on the Geobridge database site [10]. On this site there is a lot of information in Russia about SGN points, about the state in which they are (there are photos), and each registered user gives a comment on this point (either it is lost or is missing, for example, an external sign, and other information).
- It is necessary to consider the possibility of forming a geodetic study online: after selecting the SGN points on a digital map, “select some area (a kind of screenshot) and generate an application”. Today, the Foundation’s website has a convenient search - a digital map, on which, having indicated the necessary parameters (name of the point, accuracy class, subject, municipal district), it is possible to form the knowledge;
- It is necessary to generate brief and easy-to-search information, especially for the beginner surveyors, about what types of surveying work require special permissions and the basic procedure for coordinating the materials received, for example, for aerial photography;
- it is necessary to think about restoring the points of triangulation and polygonometry [11] and develop a strategy and the ways to restore the lost points of the SGN, while there are the ground points from which it is possible to do this.

The main recommendations can be summarized in the diagram shown in Figure 2.
Summary

In the process of working on the material, the client’s path was examined in detail to obtain the data from the cartographic and geodetic fund. The listed paragraphs of the recommendations are more in the form of wishes. Each of them requires the detailed study and communication between the performers and representatives of the fund. However, it is worth talking about it and submitting it for discussion. For the purity of the experiment, the survey is continued with the new respondents’ involvement. It is possible that collectively additional measures will be worked out to improve the provision of materials and data from the cartographic and geodetic fund.

References

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