Innovations in Surveying Education.
Geospatial Digital Engineering: Training of Qualified Specialists and Implementation of Technologies in the Real Sector of Economy

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Keywords: Surveying, Mapping, Computer engineering.

SUMMARY

Geospatial digital engineering is a rapidly growing engineering discipline that focuses on spatial information, incorporating aspects of computer engineering, surveying and mapping.

Experts in this field combine a number of relevant professions such as surveyor, cartographer and unmanned aerial vehicle ground control operator.

As part of the development of the 'Professionals' Championship Movement at the International High Technologies Championship, where the representatives from Ghana, India, Syria and other countries took part, and the Federal Service for State Registration, Cadastre and Cartography (Rosreestr) was the industrial partner, the business community showed great interest and demand in this competence.

SUMMARY (in Russian language)

Геопространственная цифровая инженерия – это быстро развивающаяся инженерная дисциплина, которая фокусируется на пространственной информации, включая в себя аспекты компьютерной инженерии, геодезии и картографии.

Специалисты данной области объединяют ряд актуальных профессий, таких как геодезист, картограф и оператор наземных средств управления беспилотным летательным аппаратом.

В рамках развития Чемпионатного движения «Профессионалы» на Международном Чемпионате высоких технологий, в котором принимали участие представители из Ганы, Индии, Сирии и других стран, а индустриальным партнером был Росреестр, данная компетенция показала большую заинтересованность и востребованность со стороны бизнеса.

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1. INTRODUCTION

Geospatial digital engineering is a rapidly growing engineering discipline that focuses on spatial information, incorporating aspects of computer engineering, surveying and mapping. Experts in this field design, develop and operate systems for collecting and analyzing spatial information about land, oceans, natural resources, and anthropogenic objects and combine a number of relevant professions such as surveyor, cartographer, unmanned aerial vehicle ground control operator. Combining the skills and abilities of these professions allows a specialist to solve new, more complex tasks in real production conditions.
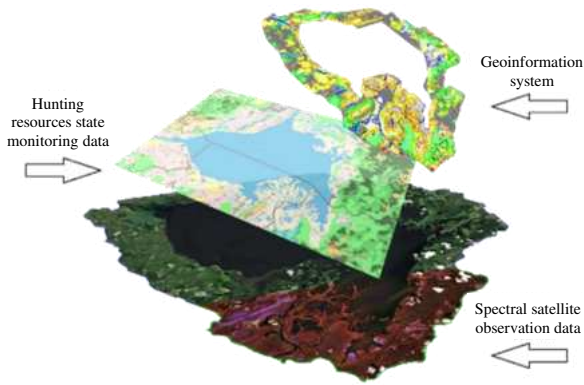
2. GEOSPATIAL ENGINEER

Geospatial engineering includes elements of field engineering and surveying works, as well as modern methods of processing of geospatial data and knowledge in the sphere of geography, geodetic support of construction works, land management and cadastre.

Professional activity of a specialist in the field of geospatial digital engineering implies knowledge and skills to form positioning, navigation and timing support of territories with the help of global navigation satellite systems, to use cartographic works, geoinformation systems, spatial databases, as well as to apply unmanned aerial systems to obtain geospatial data on the Earth's surface.

Modern technologies applied in the professional activity of a specialist in the field of geospatial digital engineering include:
- Earth's remote sensing using unmanned aerial systems and satellite technologies;
- Instrumental geodetic measurements with digital and automated equipment;
- Computer analysis of spatial data, 3D aerospace modeling of terrain, objects and structures for engineering and surveying works.

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Hunting
resources state
monitoring data

Geoinformation
system

Spectral satellite
observation data

If we talk about the final product resulting from the work of a competence engineer, it is a complex geoinformation system that includes a variety of information about natural and anthropogenic objects obtained by means of traditional geodetic measurements, aerial surveying and unmanned aviation.

This product can be used in design and construction of facilities, engineering development of territories, scientific research and land monitoring.

3. COMPETENCE SPECIALIZATIONS

The basic specializations for the competence "Geospatial Digital Engineering" are cartography, land management, aerial photographic geodesy, applied geodesy, operation of unmanned aerial systems, information systems (e.g., in urban planning), construction, environmental management of territories. These basic specializations are represented in more than 180 colleges in 59 cities of Russia.

The purpose of the competence is to consolidate knowledge, skills and abilities to train specialists who meet modern demands and requirements of enterprises, as reflected in professional standards:

- 17.071 Specialist in the operation of unmanned aircraft systems including one or more unmanned aircraft with a maximum take-off weight of 30 kg or less;
- 10.019 Specialist in the field of geodesy;
- 10.020 Specialist in the field of cartography and geoinformatics;

The competence "Geospatial Digital Engineering" was elaborated at Yaroslav-the-Wise Novgorod State University and was introduced into the educational process of a number of higher education training areas related to geography, land management and land cadastre, secondary vocational education specialty **25.02.08 "Operation of Unmanned Aerial Systems"**, as well as in the programs of additional vocational education **"Specialist in the operation of unmanned aircraft systems comprising one or more unmanned aircraft with a maximum take-off weight of 30 kg or less"** and **"Unmanned aircraft systems and satellite technologies"**.

It is obvious that a certain strategy is needed to support the relevance of the knowledge transferred in the training process. This point is realized through research and development works, which are the driver of development. The results obtained during such works (for example, scientific and practical justification of application of the unmanned aerial systems, satellite technologies and GIS in agriculture and nature management) are implemented in educational programs. Students receive in-demand skills, and in some cases this is advanced

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personnel training. For example, transferring competencies to future specialists in the field of precision agriculture, which is entirely based on sophisticated navigation equipment and geospatial information analysis.

Cooperation and training, taking into account the standards of competence "Geospatial Digital Engineering" is also possible for foreign organizations interested in the development of this sphere in their country.

Customers and technological partners are enterprises of construction and agroindustrial complex, oil and energy companies, research and development and other organizations.
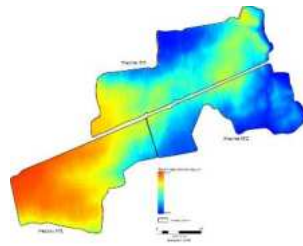
4. RELEVANCE AND DEMAND FOR COMPETENCIES

The global transition to a digital economy is causing a significant increase in the need for spatial data, as well as services and products based on them, in a wide range of applications.

The digital transformation of the spheres of geodesy and cartography is taking place, as well as the transformation of industries that are consumers of spatial data.

Higher, secondary vocational and additional education in the field of geodesy and geoinformation technologies takes this digital transformation into account and approximates its effect.

The greatest demand for spatial data will come from such industries as the electric power industry, housing and utilities sector, financial sector, construction industry, transportation complex, and agriculture. Young professionals will be in great demand in these industries.

As part of the development of the 'Professionals' Championship Movement, this competence was presented at the High Technologies Championship in 10 regions of the Russian Federation, as well as in the Republic of Belarus, with the international final in Veliky Novgorod in September 2023, where representatives from such countries as Ghana, India, Syria and others took part. The final of the Championship was attended by the leadership of the Russian Federation. They noted the importance of developing the system of secondary vocational education.

The main industrial partner of the Championship in the "Geospatial Digital Engineering" competence is Public Law Company "Roskadastr" controlled by the federal executive body

Rosreestr. Also representatives of Geoscan Group of Companies, Ministry of Natural Resources, Forestry and Ecology of the Novgorod Region and other specialized organizations acted as industrial experts.

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BIOGRAPHICAL NOTES

Oleg BARSUKOV:
Professional activities in the Public Law Company 'Roskadastr' branch Information Technology Center 'Roskadastr-Infotech'

2023: Chief Engineer (TeamLead) of the international project of creation CIS Spatial Data Infrastructure Geoportal

2023: Industrial expert in the field of Geospatial Digital Engineering in the High Technology Championship of the All-Russian 'Professionals' Championship Movement

2022: IT infrastructure architect in the project of modernization of the Hardware and Software Complex 'Federal Geodetic Stations Network'

2022: IT infrastructure architect in the projects of scaling up the State Information Systems 'Unified Digital Basemap' and 'Federal Spatial Data Portal'

Education: Higher
Krasnoyarsk State Technical University, engineer. 2001

Evgeny LUKASHIK:
Professional activities in Yaroslav-the-Wise Novgorod State University (NovSU)

2023: Head of the Laboratory of Unmanned Systems and Digital Engineering of NovSU

2022: Lecturer at the Department of Geoecology and Forest Management in NovSU

2021: Head of the Laboratory of Geoinformation Systems at NovSU

Education: Higher
Yaroslav-the-Wise Novgorod State University
Kirov Saint-Petersburg State Forestry University

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