



Cartography in Ukraine

The national report of Ukraine (2015 – 2019)

18th General Assembly of International Cartographic Association
Tokio, Japan, 15th of July 2019

1. 1. Activities at the International Cartographic Association

Ukraine is an active member of the International Cartographic Association from 1993.

Ukrainian cartographic works were the winners of the International Cartographic Exhibitions award:

the wall training map "Physical and administrative maps of France" State Scientific and Research Enterprise "Cartography" (2nd place in the category of "Educational cartography", 2011);

"Physical-geographical map of Ukraine" State Scientific and Research Enterprise "Cartography" (2nd place in the category of "Electronic editions", 2013).

Children's drawings from Ukraine won three times prizes at the Barbara Petchenik Children's World Map Drawing Competition in 1997, in 2007 and in 2013.

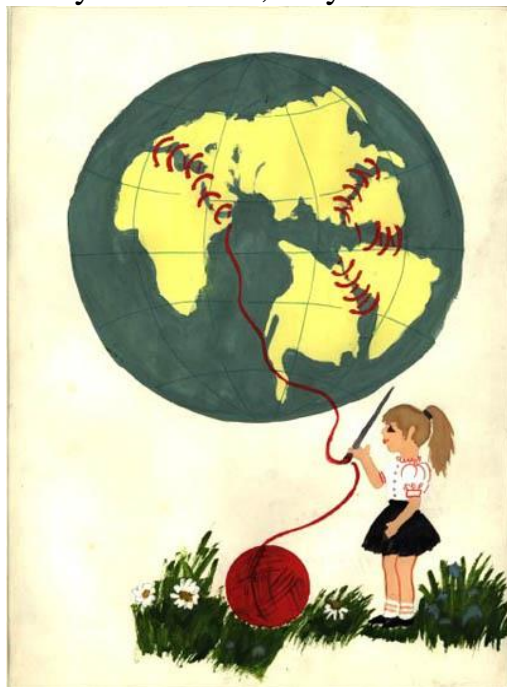
Stoliarov Nazar, 6 years old



Moskalenko Svitlana, 14 years old



- Feklyna Svitlana, 10 years old



Young Ukrainian scientists have received three grants from the International Cartographic Association for participating in the international cartographic conferences:

2007 - N. Polyakova (Kyiv National Taras Shevchenko University),

2009 - V. Molochko (State Scientific and Research Enterprise

"Cartography"),

2013 - V. Putrenko (Institute of Geography of the National Academy of Sciences of Ukraine).

2. Organization of cartographic activity.

Cartographic activity in Ukraine is regulated by the Laws of Ukraine “On Topographic, Geodetic and Cartographic Activity” and “On Geographical Names”.

The Law of Ukraine “On Topographic, Geodetic and Cartographic Activity” (1998) sets the legal framework for the regulation of relations in the sphere of topographic, geodetic and cartographic activity for the needs of the state and citizens by the results of topographic, geodetic and cartographic activities.

The Law of Ukraine "On Geographical Names" (2005) determines the legal framework for the regulation of relations and activities related to the establishment of geographical objects names, as well as the standartization, registration, accounting, use and preservation of geographical names.

The State policy formation in the sphere of cartographic activity provides the Ministry of Agrarian Policy and Food of Ukraine <https://minagro.gov.ua/ua>.

The State Service of Ukraine for Geodesy, Cartography and Cadastre (StateGeoCadastre) is responsible for implementing government policy in the matter of cartographic activity <https://land.gov.ua/>.

Priority directions of activity of the StateGeoCadaastre in the sphere of topographic, geodetic and cartographic activity include:

- legislative and regulatory support in the field of topographic, geodetic and cartographic activity;
- development of the national reference system, ensuring the functioning and development of the State Geodetic Network and special-purpose networks;
- topographic mapping of the territory and development of the national mapping system;
- functioning of the State Cartographic-Geodetic Fund of Ukraine;
- creation, development and functioning of the national geospatial data infrastructure;
- installation, standardization, accounting, registration, use and preservation of geographical names;
- creation and maintenance of the State Register of Geographical Names;
- carrying out works on the demarcation of the state border of Ukraine;
- international cooperation in the field of geodesy, cartography and geographic names.

Cartographic activity is organized by the Ministry of Defense of Ukraine through the General Staff of the Armed Forces of Ukraine for the needs of defense and national security of Ukraine. 1: 100,000, 1: 200,000, 1: 100,000, 1: 200,000, 1: 100,000, 1: 200,000, 1: 100,000, 1: 200,000, 1: 500 000, as well as a general geographic map of Ukraine, scale 1: 1 000 000 (edition 2016), and survey maps of scale 1: 1 000 000.

Cartographic activities in Ukraine are performed by subjects of entrepreneurial activity of all ownership forms.

In the StateGeoCadaastre management area there are 23 state topographic, geodetic and cartographic enterprises as of 2019 in order to meet the needs of the country's economy, science, education and defense in geospatial information and cartographic products, to intensify fundamental and applied scientific research, and to introduce advanced science and technologies.

In order to increase the economic efficiency of the state topographic -geodesic and cartographic enterprises, the process of optimizing their activities according to the regional principle still lasts (reorganization, liquidation).

3. The scientific mapping activity

The scientific mapping activities are carried out by the scientific and research institutes of the National Academy of Sciences of Ukraine, state academic and research enterprises of the StateGeoCadaastre, and higher educational institutions.

The scientific, research and development works are carried out by state enterprises in the following main areas:

geodesy, topographic cartography, geoinformatics and standardization - at the State Enterprise "Research Institute of Geodesy and Cartography" (Kyiv);

thematic cartography, standardization of geographical names - at the State Academic and Research Enterprise "Cartography" (Kyiv);

photogrammetric engineering and software at the State Academic and Research Enterprise "Geosystem" (Vinnytsia);

scientific developments of certain types of thematic mapping are carried out by scientific institutions of the National Academy of Sciences of Ukraine;

Institute of Geography of the National Academy of Sciences of Ukraine (<https://igu.org.ua>) is a leading scholarly-research institution in Ukraine dealing with nature-geographical, socio-geographical and cartographic research and investigation (theoretical and methodological foundations of geographic cartography, scientific development of fundamental cartographic works, in particular, National Atlas of Ukraine);

<https://atlas.igu.org.ua/> - is an official website of National Atlas of Ukraine.

Institute of Geological Sciences of the National Academy of Sciences of Ukraine (<http://www.igs-nas.org.ua/>) deals with fundamental and applied research in the field of natural sciences and geological mapping;

Vegetation mapping at the Institute of Botany M. G. Kholodny of the National Academy of Sciences of Ukraine;

Linguistic cartography and toponymical research at the Institute of the Ukrainian language of the National Academy of Sciences of Ukraine.

Cartographic scientific researches on ecological, socio-economic, nature conservation and tourist mapping, history of cartography and geoinformation mapping are carried out by higher educational institutions:

- Taras Shevchenko National University of Kyiv

The Scientific National Cartography School was initiated by the professor Kharchenko.

The Department of Geodesy and Cartography of the Faculty of Geography conducts scientific work on the following areas of research: geoinformational maintenance of cartographical modelling and development of maps for educational needs, geodynamic researches, in particular deformation of engineering structures, land surveying, including ground, with the use of digital photogrammetry methods in architectural measurements and reconstruction, comprehensive thematic mapping, in particular ecological and medical-geographical problem-oriented mapping of Ukraine.

- The Military Institute of Taras Shevchenko National University of Kyiv conducts research in the field of geoinformation technologies, military geography, geodesy, cartography and topography.

- Kyiv National University of Construction and Architecture

The main areas of scientific research of the Department of Geoinformatics and Photogrammetric mapping of the Faculty of Geoinformation Systems are:

development of geoinformation models, technologies and systems for territorial management, land and town-planning cadastre and monetary valuation of land;

creation of WEB-services, development of instrumental geoinformation systems, development of software-methodical complexes;

development of methods and practical technologies of digital photogrammetry for the applied problems solution in construction and other branches of economy;

development of methodological foundations for the development of geospatial data infrastructure and standardization in the field of geographic information / geomatics.

- The Institute of Geodesy of Lviv Polytechnic National University

The scientific areas of the Institute of Geodesy are the Earth shape researching, external gravity field of the Earth and planets, creating of geoinformational systems, creating of the software solutions and geospatial data bases, general geographic and thematic mapping, mathematical modeling in cartography, geodesy, geophysics and history of cartography.

- V. N. Karazin Kharkiv National University

Scientific research at the Department of Physical Geography and Cartography of the Faculty of Geology, Geography, Recreation and Tourism are evolving in the following areas:

theory and methodology of geographic science;

scientific foundations of education modernization cartographic support at all levels of education;

scientific fundamentals of landscape-ecological and geoinformation mapping;

regional thematic (environmental protection, tourism) cartography and cartography theory;

mapping of natural and historical-cultural heritage;

assessment of surface water quality in the Siverskyi Donets basin (within the boundaries of the Kharkiv region);

scientific fundamentals of tourism system and recreational mapping of the regions of Ukraine.

- The National University of life and environmental sciences of Ukraine

The basic scientific research at the Department of Geodesy and Cartography of the Faculty of Land Management are:

scientific principles of problems solution of land management of rural territories on the basis of geoinformation and cartographic modeling of land use indicators;

atlas electronic large-scale mapping of land resources of scientific research facilities;

the concept of the electronic geoeological atlas of the river-basin system as an instrument for monitoring and management of nature use on the basin principle;

the latest concept of creating an instrument for regulating market land relations and spatial development – a digital Atlas of Land Value of Ukraine.

Ivan Franko National University of Lviv

The Faculty of Geography performs research works on soil-geographic classification of the territory Ukraine.

Main types of cartographic activity

Topographic mapping

The national topographic mapping is carried out on a scale of 1:10 000, 1:25 000, 1:50 000, 1: 100 000, 1: 250 000, 1 500 000 and 1: 1 000 000.

The state base topographic map is a topographic on a scale 1:10 000, which is the basis for geo referencing and the determination of the coordinates of all data coming to the geographic information system, designed to build the national geospatial data infrastructure and is used as a base layer for the state land cadastre, urban cadastre and inventories of other natural resources, registers of all kinds and definition of the state border of Ukraine on the ground.

The territory of Ukraine is fully equipped with topographic maps of different years, the publication on a scales:

1:1 000 000	9 pages
1:500 000	26 pages
1:200 000	157 pages
1:100 000	536 pages
1:50 000	1 975 pages
1:25 000	7 554 pages
1:10 000	29 402 pages

Ukraine is covered by topographic maps in scale 1:10 000 for 99,9% of its` territory except some mountain areas.

The territory of city settlements is covered by topographical plans in scale 1:5000 and 1:2000. For the separate city, village and production zone parts the topographic plans in scale 1:1000 and 1:500 are being developed.

There are topographic maps in scale 1:10 000 and 1:25 000 on internal reservoirs and areas of the continental shelf.

The creation and updating of topographic maps is carried out using the latest geoinformation technologies in the United State Geodetic Reference Coordinate System YCK-2000 and the Baltic Elevation System in 1977. The geodetic framework for maps and plans is the State Geodetic Network and points of geodesic condensation networks. The scalability and nomenclature of all scale differentiations are subordinated to a single system.

Digital maps and plans are created in the classification and coding of topographical information within the rules for digital description of topographical objects and appropriate data storage format, development of geospatial data based on them.

The StateGeoCadastre introduced in Ukraine a new high-precision system of heights of the United European Leveling System/European Vertical Reference System UELN/EVRS2000. For this purpose, the project for alignment and cataloging of 1st and 2nd class levelling networks points (13,800 stations) has been implemented, and the value of normal heights of leveling points in the UELN/EVRS2000 levelling system has been obtained. The data for alignment of nod points of the levelling network BKG are provided to the Federal Agency for Cartography and Geodesy of Germany, the results of the common alignment of the

UELN network were announced during the EUREF conference (Tallinn, Estonia, May 22-24, 2019) and the accession of Ukraine to the European system of heights EVRS2000 was also announced.

4. National Spatial Data Infrastructure

The development of National Spatial Data Infrastructure (NSDI) is based on the compatibility and rules for the submission of geospatial data and metadata to ensure their sharing by the EU countries in accordance with the recommendations of the European Parliament and Council Directive of 14 March 2007 on the implementation of the European Spatial Information Infrastructure (INSPIRE).

In order to provide legal grounds for the creation, operation and development of the National Spatial Data Infrastructure, a draft Law of Ukraine "On the National Spatial Data Infrastructure" was drafted, which is under consideration in the Verkhovna Rada of Ukraine from 2018. The complex of international standards ISO 19100 "Geographic information / geomatics" is harmonized and implemented in Ukraine:

The national standard of Ukraine DSTU ISO 19101: 2009 "Geographical information. Standard model" was adopted in 2009;

14 national standards ISO 19100 "Geographic information / geomatics", harmonized by verification method with European and international normative documents in 2017;

The national standard of Ukraine DSTU 8774:2018 "Geographic information. Rules for modeling of geospatial data" in 2018.

The open data is actively developing in Ukraine, which contributes to the principles of transparency and openness in the public sector.

In accordance with the Law of Ukraine "On Access to Public Information", the Unified State Web-portal of Open Data (<https://data.gov.ua/>) was created. Maintenance of the portal is provided by the State Agency for Electronic Government of Ukraine. The portal is designed to provide access to public information in the form of open data and provides access for businesses, public organizations and citizens to full and accurate information of state authorities with the possibility of its subsequent use without further processing. The administrators can update the data automatically, allows to receive real-time information.

Potential components of the National Spatial Data Infrastructure are created by the StateGeoCadastré and are used by both the public and private sectors through the following geoportals:

Public Cadastre Map of Ukraine (<http://map.land.gov.ua/kadastrova-karta>) - provides access to the basic data of the State Land Cadastre on the cadastral number of the land plot, its boundaries, area, form of ownership, purpose, according to the classifier.

State Geodetic Network (<http://dgm.gki.com.ua>) - provides access to metadata and geodetic information about the points of the State Geodetic Network, which coordinates are defined in the system of coordinates USK-2000 and which are the

basis for topographic and geodetic, cartographic and land management works conductment and the provision of services for transformation of coordinates.

Administrative territorial organization of Ukraine (<http://atu.minregion.gov.ua/>) - provides creation, completion and updating of the database and metadata about administrative-territorial units, topographical objects, settlements, highways and railways, legislative data about changes in the administrative-territorial organization, prospective plans for the formation of community territories, data on conglomerated territorial communities, the image of the state border, the borders of the Autonomous Republic of Crimea, oblasts, cities of Kyiv and Sevastopol, rayons, cities, settlements and villages.

The electronic database of names of geographical objects of Ukraine in the State Register of Geographical Names was implemented by StateGeoCadaastre, which contains more than 100 000 standardized geographical names of settlements and units of the administrative-territorial organization, physico-geographical and socio-economic objects using the Ukrainian and Latin alphabet. The database contains 46 indicators: the registration number, the standardized name of the geographical object in Ukrainian and Latin, the type of the geographical object, the administrative status (for settlements), the administrative-territorial binding, geographical coordinates (latitude and longitude), information about renaming a geographic object, historical names, etc. The formation of the database of the State Register of Geographical Names was carried out according to the administrative-territorial units (Autonomous Republic of Crimea, regions, districts, cities, rural and settlement councils) on the basis of a topographic map of scale 1: 100 000.

The permanent update of the information of the State Register of Geographical Names is carried out according to official data (<http://land.gov.ua/info/informatsiia-pro-derzhavnyi-reiestr-heohrafichnykh-nazv/>).

Information from the State Register of Immovable Monuments on Unique Cultural Heritage Objects of the Ministry of Culture of Ukraine (<http://mincult.kmu.gov.ua/>) is also an integral part of the National Spatial Data Infrastructure. Scientific research entitled "Metadata Standardization and Data Exchange in the Context of Creating an Electronic Information Resource for Cultural Heritage and Cultural Property Objects" was completed in 2018. The pilot project on ensuring the electronic accounting of objects of cultural heritage "State Register of Fixed Monuments of Ukraine" began in June 2019. The pilot project is being implemented in cooperation with the National Academy of Sciences of Ukraine and the Institute of Geography of the National Academy of Sciences of Ukraine and local authorities and territorial communities on the territory of the Vinnytsia region (more than 4,300 objects of cultural heritage, including 8 - monuments national importance) with a view to practical development of the necessary and Important aspects of completing and functioning of the electronic platform with its subsequent introduction on the national level.

The formation of the national spatial data infrastructure was influenced by the implementation of international projects:

Ukrainian-Canadian Educational Project "Establishing the Basis of Spatial Data Infrastructure: Providing framework to Support Sustained Economic Growth in Ukrainian Government" by introducing training programs for specialists in the field of GIS and the National Spatial Data Infrastructure (2014-2018);

the project of international technical assistance "Creation of the National Spatial Data Infrastructure in Ukraine" with the Japanese International Cooperation Agency (JICA) (2015-2018), within the project the prototype of the national spatial data infrastructure in the pilot area of Vinnitsa and Vinnytsia Rayon was created, which includes dozens of information layouts on a single geodetic and cartographic basis with the possibility of quick access to information through a single web portal: <http://nsdi.land.gov.ua/>;

The Agreement for the implementation of the project of international technical assistance "Maps for sustainable land management in Ukraine" (hereinafter referred to as the Project) was signed on February 28, 2018. The implementation of the Project takes a place within the framework of the Agreement between the Cabinet of Ministers of Ukraine and the Government of the Kingdom of Norway on technical and financial cooperation, as well as the Memorandum of Understanding and scientific and technical cooperation between the State Service of Ukraine for Geodesy, Cartography and Cadastre and the Mapping Service of the Kingdom of Norway in the field of geodesy, cartography, cadastre and land relations.

The aim of the project is to prepare a digital map for the territory of Ukraine, a decision to distribute maps for proper management, land management, sustainable land management, and also to create the network of ground reference stations for the Ukrainian permanent observation network of global navigation satellite systems - GNSS (UAPOS) as a segment of the State Geodetic Network, to provide safe, stable quality and long-term positioning services, research and the provision of opportunities for cooperation at the European level.

5. Thematic and special cartography

State thematic maps are created by state enterprises and organizations, branch scientific research and scientific technical institutions, enterprises and organizations on the basis of topographic maps of the corresponding scales taking into account the needs of science, education and culture.

Data and materials from public authorities, institutions and organizations are used to create state thematic maps.

In the structure of state bodies there are institutions and organizations that carry out certain types of thematic mapping:

State Service of Geology and Subsoil of Ukraine, Ministry of Ecology and Natural Resources (geological mapping) <http://www.geo.gov.ua/>;

State Agency of Forest Resources of the Ministry of Agrarian Policy and Food of Ukraine (mapping of forests) <http://dklg.kmu.gov.ua/forest/control/uk/index>;

government bodies subordinated to the Ministry of Infrastructure of Ukraine:
State Aviation Service (Aeronautical Mapping) <https://avia.gov.ua/>;

State Service for Marine and River Transport of Ukraine (Marine and River Navigation Mapping) <https://marad.gov.ua/ua>.

Complex geological, hydrogeological, ecological-geological and engineering geological mapping of the territory of Ukraine is carried out by the State Service of Geology and Subsoil of Ukraine. The priority type of geological mapping is the geological study of the areas at scale 1: 200 000 with the purpose of publishing the State Geological Map of Ukraine at a scale of 1: 200 000 - a basic multi-purpose complex geological basis for planning the development of natural resources, development of the mineral resource base, the development of scientifically grounded exploration works, construction, land reclamation, protection of mineral resources and the environment, as well as solving other urgent issues of state development: <http://geoinf.kiev.ua/wp/kartograma.htm>.

The information resource "Mineral Resources of Ukraine" was created by the State Research and Production Enterprise "State Information Geological Fund of Ukraine" within the framework of a joint project with the Geological Survey of Norway, which contains information on the current state of the mineral-raw material base of Ukraine, distribution of minerals, their reserves, mining, etc. : [\(http://eng.minerals-ua.info/\)](http://eng.minerals-ua.info/).

Special forestry mapping, creation of various thematic maps on inventory of forests, assessment and monitoring of forest resources is carried out by the Ukrainian State Project Design and Forestry Production Association [\(http://www.lisproekt.gov.ua/\)](http://www.lisproekt.gov.ua/) of the State Agency of Forest Resources of Ukraine.

The branch of the state institution "State Hydrography" "Ukrmorkartografiya" (http://www.charts.gov.ua/index_en.htm) of the Ministry of Infrastructure of Ukraine is a modern research and production complex, the only specialized authorized enterprise in Ukraine for the production and publication of official paper and electronic navigational charts, inland waterways and navigation guides in accordance with international and national standards, creation and maintenance of cartographic, topographical and hydrographic databases on the level of modernity. It, as well as the publication of special publications.

The data of electronic marine navigational charts is standardized in terms of content, structure, current format of the exchange of hydrographic information, is fully in line with the special requirements and recommendations of the International Hydrographic Organization and are suitable for use in electronic navigation systems.

In the period from 2015 to 2018, the State Hydrography Department prepared and issued official cartographic works in paper and electronic form:

Marine navigation maps for the Black Sea-Azov region in scale 1: 500 000, 1: 350 000, 1: 300 000, 1: 350 000, 1: 250 000, 1: 200 000, 1: 100 000, 1:50 000, 1 : 30 000, 1:25 000, including ports of scale 1: 5 000, 1:10 000, 1:12 500;

marine navigation maps for the Mediterranean region (Marmara Sea) in scale of 1: 200 000;

river electronic navigational maps of the Southern Bug River in scale 1:10 000 (contains all the mapping information required for safe navigation and comply with current international standards, the main one is the Inland ECDIS Standard, jointly

implemented by the International Hydrographic Organization, the Central Commission for Navigation on the Rhine and the Economic UN Commission on Europe for Inland Waterways Maps);

cells of electronic navigational maps, developed in accordance with the requirements of the standard S-57 of the International Hydrographic Organization in the scale of 1:50 000, 1:20 000;

the album of sea navigational maps "Odessa - Strait of the Bosphorus". Navigational and Hydrographic Essay" (2017) contains maps of different scale range in the WGS-84 Worldwide Coordinate System, a local description of the entire route required for sailing along the coast, as well as the Rules for the Navigation of Small, Sports and Walking watercraft (http://www.charts.gov.ua/albums_ua.htm).

The functioning of the national air navigation system of Ukraine and the United Civil-Military Air Traffic Management System of Ukraine, high-quality and safe air navigation services in the airspace of Ukraine and in the airspace over the open sea, where the responsibility for servicing air traffic under international agreements is entrusted to Ukraine, is provided by the State Enterprise Air Traffic Service of Ukraine (<http://uksatse.ua/index.php?>) of the Ministry of Infrastructure of Ukraine with the help of air navigation maps, created in accordance with International Civil Aviation Organization (ICAO).

The State Scientific-Production Enterprise "Kartografiya" (<http://www.ukrmap.com.ua/>) is the leading state cartographic enterprise, which works in the sphere of cartography and printing for 75 years.

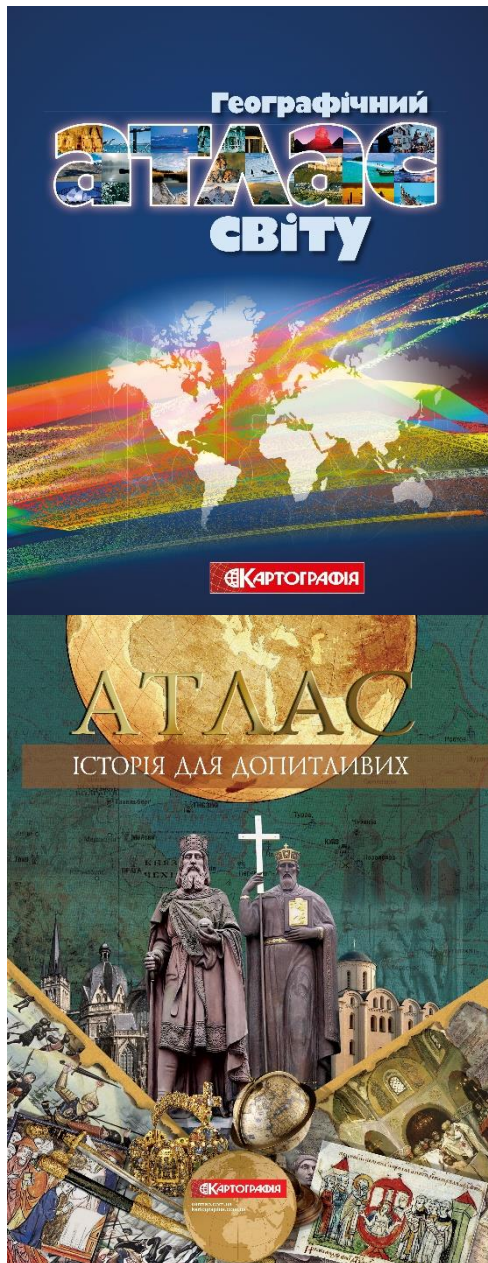
Thematic cartography, carried out by SSPE "Cartography", focuses mainly on the development and publication of basic scientific reference cartographic works, political-administrative, general geographic, tourist and reference atlases and maps of Ukraine, other countries and the world as a whole, as well as atlases and plans of Ukrainian cities, atlases and road maps of Ukraine and Europe, wall maps and atlases on geography and history, contour maps and relief maps.

At the moment the most important activity of the enterprise is the creation of electronic large-scale maps and plans of cities, GIS and databases.

The company produces a wide range of cartographic publications: educational maps and educational atlases, wall maps for the teaching of history and geography, atlases and maps of motorways, plans and atlases of cities, tourist maps, reference maps and atlases of Ukraine, atlases of the world, maps to encyclopaedic editions, for offices, relief maps, electronic maps, digital maps and geographic information systems that, in content and quality, meet the requirements of the most demanding consumer.

Product catalog of the company is available by the link: <http://www.ukrmap.com.ua/catalog/>.

Among the most significant publications of recent years:



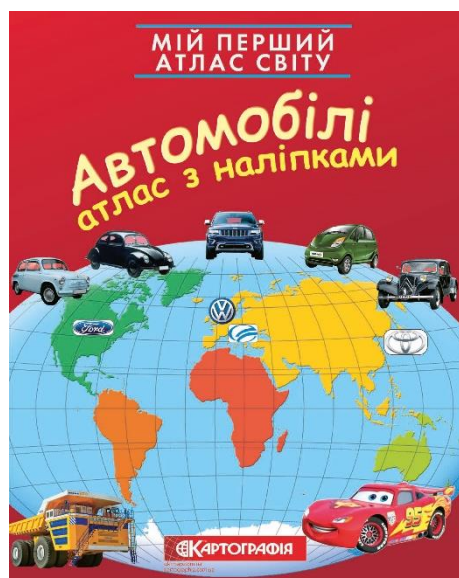
«The "Geographic Atlas of the World" (2018) is a modern reference cartographic publication containing about 100 political, physical maps of the world and political maps of separate countries and groups of countries. Separately presented political and administrative maps of the regions of Ukraine. The atlas contains a reference block with flags and country information, thematic illustrations, reference data, interesting facts, a list of more than 16 000 geographic names.

The child atlas "History for curious ones" (2017) - the concept of the atlas is to demonstrate the common historical path and the initial relations of Ukraine and the countries of Western Europe. The range of users of the atlas - this is primarily students 5-7 classes.

The series of maps "Tourist routes of the Carpathians" on a scale 1:50 000 (2015-2017) got the first place in the nomination "Maps" at the 2nd International competition "The best editions about the mountains" (Krakow, Poland, October 26th – 29th, 2017).



The children's series «My First Atlas of the World» (2015-2019) with bright illustrations and stickers – «Countries of the World», «Plants», «Animals», «Birds», «Peoples of the World», «Fairytale», «Cars», «Football», «Dinosaurs», «Money», "Miracle of the World", "Inventions", which introduce children to the animal and plant world, interesting places of our planet, culture of different nationalities, natural wonders, achievements of humanity, etc.



6. Cartographic funds

Topographic-geodesic, cartographic, aerial materials and data created by state topographic-geodesic and cartographic enterprises, units of the Ministry of Defense

of Ukraine and undertakings are stored and systematized in the State Cartographic and Geodetic Fund of Ukraine.

List of materials of geodetic, leveling, gravimetric, topographical works and works on construction of geodetic density networks of the State Cartographic-Geodesic Fund of Ukraine available by the link: <https://data.gov.ua/dataset/def448c0-79d1-4034-8fa3-612abf843c46>

The archive of topographic maps of different years of publication in the State Cartographic and Geodesic Fund of Ukraine consist of more than 250 thousand copies.

In 2018, the software of the Geoinformation system of the State Cartographic and Geodetic Fund of Ukraine was developed. Its implementation will allow to automatize the state registration of materials for topographic-geodesic and cartographic works, increase the efficiency of work, operability and quality of cartographic monitoring of the territory of Ukraine, provide users topographic-geodesic and cartographic data at any possible spatial, scale and problem levels.

Cartographic materials are also kept in:

State Academic and Research Fund «Nature» of the State Space Agency of Ukraine (<http://www.nkau.gov.ua> - data of space survey)

The State Academic and Research Enterprise "State Information Geological Fund of Ukraine" - scientific and production institution of the State Service of Geology and Mineral Resources of Ukraine, which collects, stores, analyzes and provides information that has been formed in the process of geological study and use of subsoil, preserves unique cartographic materials (<http://geoinf.kiev.ua/>).

A big collection of cartographic products is stored in the libraries

V.I. Vernadskyi National Library of the NAS of Ukraine is the main Ukrainian bookstore, the national comprehensive library-information, scientific-research, scientific-methodical and cultural-educational center with the largest amount of documents and information resources of the bookkeeping of Ukraine. The cartographic fund contains about 50 thousand copies (<http://nbuv.gov.ua/node/73>).

Vasyl Stefanyk Lviv Scientific Library of the NAS of Ukraine is the state depository of unique handwritten and printed historic notice of book culture works of Ukrainian and foreign art, one of the largest collection of cartographic early printed books in Europe, the XVI century edition, atlases and maps of the XVII-XVIII centuries. (more than 22 thousand depositary items)

<http://www.lsl.lviv.ua/index.php/uk/golovna2/>

The Scientific Library of the Ivan Franko Lviv National University
<http://library.lnu.edu.ua/bibl/> - contains a collection of cartography from 1511.

A page for viewing city plans from the collection of the Scientific Library
www.lvivcenter.org/uk/umd/collection/nb-lnu-franka Cartographic collections are retained in the state archival establishments, primarily in the Central State Historical Archives of Ukraine (Lviv), as well as in such museums:

the D.I. Yavornytsyi Dnipropetrovsk Historical Museum;

the Odessa Archaeological Museum of the NAS of Ukraine;

the Alupka Palace Museum;

the Odessa Museum of Local Lore;

the Crimean Republican Museum of Local Lore.

7. Cartographical education

In Ukraine there is a branched network of establishments for the preparing of experts of "Junior Specialist", "Bachelor" and "Master" academic levels and training of highly qualified personnel in postgraduate education and doctoral studies in the sphere of topographic-geodesic and cartographic activity. Training of specialists in cartography, geodesy, photogrammetry and geoinformatics is provided by the following higher educational establishments:

- the Taras Shevchenko Kyiv National University

The Department of Geodesy and Cartography of the Geographical Faculty is one of the oldest departments of the Taras Shevchenko National University of Kyiv (1838) <http://www.geo.univ.kiev.ua/uk/kafedri/geodeziji-ta-kartografiji.html>.

The basis for the advanced professional training of all students is the fundamental sciences: physics, economic and social geography, geology, geomorphology, meteorology, climatology, hydrology, soil science, biogeography, physical geography of continents and oceans, economic and social geography of foreign countries, landscape ecology, topography, cartography, geodesy, aerospace research methods, geoinformatics, etc. As of January 1st, 2019, the Department of Geodesy and Cartography has 16 teachers (2 doctors of geographical sciences, 3 professors, 13 candidates of sciences, 4 assistants). On the basis of the department a specialized edition of geographical sciences "The journal of cartography" is published.

- The Kyiv National University of Building and Architecture

The Department of Geoinformatics and Photogrammetry of the Faculty of Geoinformation Systems of Territory Management

http://www.knuba.edu.ua/?page_id=47928 provides professionally-oriented

training of bachelors and masters on the specialty "Geodesy and land management", specialization "Geographic information systems and technologies", "Space monitoring of the earth". The faculty staff is: 3 doctors of sciences, 8 associate professors and candidates of sciences, 4 of them have the academic rank of professor, 8 tutors, and assistants.

Students are studying the most effective achievements in the field of information technology and programming, object-oriented geospatial databases, geographic information collection and processing methods, geoinformation analysis and modeling, web mapping, Earth remote sensing and digital photography, digital information, GIS cadastral systems, GIS in engineering networks. The educational process at the department is carried out by using the international standards of the series ISO 19100 "Geographic information / geomatics" and the INSPIRE specifications. In the scientific and educational process, the department uses the latest computer and photometric technologies and software licensing for geoinformation and remote sensing: ArcGIS, PostGRE / SQL, QGIS, Autopilot Map, Delta CMS, 3D Civil, Erdas, ENVI, TerraScan, MicroStaton, etc.

- The "Lviv Polytechnic" National University

At the Institute of Geodesy of the National University "Lviv Polytechnic" <http://lp.edu.ua/igdg> today, there are 14 professors, doctors of sciences, 51 associate professors and Ph.D. More than 600 full-time and part-time students study at the Institute of Geodesy. Their training is provided by six departments: Geodesy, Cartography, and Geospatial modeling, Higher Geodesy and Astronomy, Engineering Geodesy, Photogrammetry and Geoinformatics, Cadastre of territories.

The collected book "Geodesy, cartography and aerial photography" is published in order to highlight current problems in astronomy, the theory of the figure of the Earth and planets, gravimetry, precise leveling, triangulation and trilateration, as well as studies in the field of earth's refraction, earth surface movements, higher geodesy, engineering geodesy, cartography, aerial photography, photogrammetry, and geoinformatics.

- the N.V. Karazin Kharkiv National University

The Department of Physical Geography and Cartography of the Faculty of Geology, Geography and, Recreation <http://physgeo.univer.kharkov.ua> conducts its history science 1804 and is the oldest geographical faculty of Ukraine. The department carries out preparation of bachelors, masters, and specialists on the specialty "Geography". Masters and specialists have the opportunity to receive special training on specialties: "Land inventory and monitoring", "Regional studies and tourism", "Geographical cartography", "Physical geography and geoecology",

"Physical geography and hydrometeorology", "Management of education", as well postgraduate study on specialties "Geographical cartography" and "Constructive geography and rational use of natural resources". Professional training is provided by 2 doctors of sciences, 3 professors, 9 candidates of sciences, associate professors, leading specialists in geography and specialists in the field of education, management, tourism, geodesy and land management of such professionally oriented disciplines as: topography with the basics of geodesy, earth sciences, ecology, general hydrology, cartography, remote sensing of the Earth, meteorology and climatology, landscape science, nature management and nature conservation, physical geography of Ukraine, physical geography of continents and oceans, theory and methodology of geografic science, methodology of teaching geography, etc.

- The Ivan Franko Lviv National University

The Faculty of Geography <http://geography.lnu.edu.ua/> is the leading scientific center for the training of specialists of high qualification level. Today, there are eight departments in the Faculty of Geography: physical geography, economic and social geography, geomorphology and paleogeography, rational use of natural resources and nature conservation, the geography of Ukraine, soil science and soil geography, constructive geography and cartography, tourism. The departments of the faculty carry out training of the students on the specialties "Secondary education", "Ecology", "Earth sciences", "Geography", "Hotel and restaurant business", and "Tourism". More than 100 scientific and pedagogical employee work at the faculty, more than 1500 full-time and part-time students study at the faculty.

- National University of Life and Environmental Sciences of Ukraine, The department of geodesy and cartography of the Faculty of Land Management <https://nubip.edu.ua/node/1189> provides training for bachelors and masters in specialties: "Geodesy and land management". The department provides preparation of candidates for physical geography, geophysics and geochemistry of landscapes specializations; candidates and doctors of sciences in the sphere of economics of nature use and environmental protection. The staff of the department provide teaching of such disciplines: topography, geodesy, engineering geodesy, topographic and land blackening, geodesy, mathematical processing of geodetic measurements, higher geodesy, satellite geodesy and spherical astronomy, electronic geodetic instruments, cartography, geography of tourism and political geography of the world, computer technologies in cartography, cartographic provision of land management, thematic mapping, methodology of geospatial data modeling of transformation processes, modeling in cartography (land management), national spatial data infrastructure , mapping of natural resources. New courses: geocological monitoring of the region; assessment of the economic suitability of the relief were introduced as new courses in the 2018 - 2019 academic year.

• Latest publications on cartography and geodesy at the link: <https://nubip.edu.ua/node/1189/10>.

• The training of specialists in cartography, geodesy and geoinformatics is also carried out by the following higher educational institutions:

• Donetsk National Technical University (Pokrovsk) <https://donntu.edu.ua/gorn>;

• Kriviy Rih National University <http://www.knu.edu.ua/fakultety>;

• National University of Water Management and Natural Resources (Rivne) <http://nuwm.edu.ua/>;

• National Aviation University <https://febit.nau.edu.ua/kafedry/kafedra-zemleustroi-ta-kadastru/>;

Lviv State Agrarian University (Dublyany, Lviv region) <http://lnau.edu.ua/lnau/index.php/uk/f-s/zv.html>;

East-European National University of Lesia Ukrainka <https://eenu.edu.ua/en/structure/faculties-and-institutes/geografichniy-fakultet>;

• Military Institute of Taras Shevchenko Kyiv National University <http://mil.univ.kiev.ua/>.

• The training of junior specialists and bachelors in cartography and geodesy is conducted by the College of Information Technologies and Land Management of the National Aviation University <http://kitz.nau.edu.ua/>.

An important area of scientific knowledge dissemination is the holding of the scientific and technical conferences, symposiums and seminars. The following events took place in Ukraine in 2015 - 2019:

Seventh National Scientific and Practical Conference "National Cartography: Cartographic Works in Cognition and Development of Regions" (Kyiv, November 11, 2016);

International scientific and technical conference "Geoforum", (Yavoriv city, Lviv city, annually);

International Symposium "Development of cartographic activity and geoinformation systems for the needs of Ukraine's security and defense" (Kyiv, October 7, 2016);

International conference "Unlocking the power: how to create an effective geospatial data infrastructure in Ukraine" (Kyiv, November 9, 2016);

TAIEX Workshop on Spatial Data Infrastructure Development Strategy (Kyiv, November 10-11, 2016);

Ukrainian-Polish International Seminar on State Geodetic Nets and Geospatial Technologies (Kyiv, November 27, 2017);

International Conference "NSDI: Towards an Information Society" (Kyiv, February 22, 2018);

Ninth International Conference "GISTECH UA 2019 New Technologies of GIS / Remote Sensing in Ukraine" (Kyiv, May 16, 2019);

Scientific-practical conference "GEO Digital Ukraine 2019" (Kyiv, May 23, 2019).

7. International cooperation

International cooperation in the sphere of geodesy, cartography and geographical names was carried out through the participation in the activities of the following international organizations:

- Association of national cartographic-geodesic and cadastral services of European countries (EuroGeographics) Ukraine has been a full member of EuroGeographics since 2006. Ukraine participates in international projects EuroGlobalMap, EuroRegionalMap, EuroBoundaryMap, programs and projects of the Association European Location Services, INSPIRE and Copernicus Emergency Mapping Service.
- UN Expert Group on Geographical Names;
Since 1993, Ukraine has been a member of the UN Expert Group on Geographical Names and is a part of its two divisions: the Eastern Europe, North and Central Asia Division, the Eastern, Central and Southeast Europe Division and as an observer in the Baltic Division.
- United Nations Expert Committee on Global Geospatial Information Management (the United Nations Committee of Experts on Global Geospatial Information Management (UNGIM)))

Ukraine takes part in the activities of UN-GGIM and UN-GGIM EUROPE.

The StateGeoCadastre participated in updating information about the administrative-territorial structure of Ukraine in the global project of the United Nations "The Second Administrative Level Boundaries" (SALB).

There are four geodetic points on the territory of Ukraine (Baranivka - BARANIWKA, Katerinovka - KATERINIWKA, Felshtin - FELSCHTIN and StaroNekrasivka - STARO-NEKRASSIWKA) within the cross-border object Struve Geodetic Arc, included to the UNESCO World Heritage List on July 15, 2005. 63 geodetic points of the Struve geodetic arc were discovered and inspected on the territory of the country, some of them included in the State Geodetic Network. In 2019, a survey was conducted on the location of the preservation of the geodetic points of the Struve geodetic arc and on the territory of the Odeska oblast (Izmail, Kotlabukh Sukhyi, Staronekrasivka, Tashbunar II) and Khmel'nitska oblast (Baranivka, Katerynivka, Felshtyn).

Such NGOs are operating in Ukraine:

Ukrainian Society for Geodesy and Cartography (part of the International Federation of Surveyors);

Western geodesic society <http://zgt.com.ua/>;

Ukrainian Society for Photogrammetry and Remote Sensing - is a permanent member of the International Association of Photogrammetry and Remote Sensing <http://usprs.com.ua/>;

Ukrainian Geographical Society <http://geoukr.at.ua/>.