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Committee on the Peaceful Uses of Outer Space

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat

Addendum

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II. Replies received from Member States

Armenia

[Original: English] [3 November 2021]

The Government of the Republic of Armenia has decided to gradually scale up its activities related to the peaceful use of the outer space, with the view to developing the national capacities and infrastructure needed for more effective engagement in this fast-growing, fast-developing and competitive sector.

In the period 2020–2021, a number of legislative and normative acts were adopted with the aim of putting in place the necessary regulatory framework regarding outer space activities. The National Space Law, adopted in 2020, defines the objectives and principles of outer space activities and grants a series of privileges to the private sector for operation.

Furthermore, a specialized expert working group has been formed within the Ministry of High-Tech Industry, tasked with developing the national strategy and programmes in this area. In particular, it is envisaged that the working group will develop and adopt strategic guidelines for the long-term sustainability of outer space activities. This will ensure the consistent and sustainable development of this field.

Along with the steps aimed at establishing the necessary national regulatory framework for outer space activities, Armenia has also funded a series of technical and scientific research programmes aimed at supporting national capacity-building and raising awareness in relation to space challenges.

Armenia believes that the peaceful and sustainable use of space and development of space technologies, including through enhancing international cooperation and joint partnerships, will contribute to the achievement of the Sustainable Development Goals established in the 2030 Agenda for Sustainable Development and to overcoming global ecological, economic and social challenges. At the seventy-second International Astronautical Congress, the Armenian delegation started a series of discussions with different national space agencies, research organizations and private companies to extend the sectoral network of Armenia.

An example of such partnership could be the establishment of an observation station consisting of three small telescopes at the Saravand base of the Byurakan Astrophysical Observatory.

The Byurakan Observatory, which is considered to be the fundamental basis of modern astronomy in Armenia, has participated since 2014 in near-Earth cosmic research in collaboration with the Russian joint-stock company Astronomy Research Centre.¹ The project is implemented as part of the overall programme of the Russian State Space Corporation "Roscosmos".

Currently, four specialized observation crews carry out the planned observations. Each crew consists of three observers, with two specialists from the Byurakan Observatory and one specialist from Russia.

The telescopes and the control equipment installed at Saravand are designed and provided by the Astronomy Research Centre. The largest telescope operating in the framework of the EOP-1 module is OES-1, with an objective diameter of 400 mm and a focal length of 1,200 mm. The focal field of this telescope is 1.75 degrees by 1.75 degrees, giving a total of about 3 square degrees. On a dark and astronomically good night, one can reveal objects of up to 17.5 metres in size with the mentioned instrument. The second telescope included in EOP-1 is somewhat smaller and provides good results of observations of objects of up to 15.5 metres in size. This

¹ The Centre carries out the monitoring of circumterrestrial space in order to identify asteroids and artificial cosmic apparatuses and their debris.

telescope has an aperture of 250 mm, and provides rather good images in the rectangular field of 3.3 degrees by 2.2 degrees. The focal length is 627 mm. Lastly, the smallest telescope consists of two identical VT-78 cameras. The cameras have an aperture of 190 mm and a focal length of 295 mm, providing a wide rectangular field of 7.1 degrees by 4.7 degrees. All of these telescopes are equipped with modern light detectors based on modern charge-coupled device (CCD) matrices. The central computer that controls and guides the movement of the telescopes collects observational data as well.

At present, Armenia is negotiating with its Russian partner to increase its observation capacities by adding another telescope with an aperture of 650 mm or 1,000 mm.

Belarus

[Original: Russian] [9 November 2021]

Under the legislation of the Republic of Belarus, the National Academy of Sciences of Belarus is responsible for implementing a unified State policy on, and for coordinating and regulating activities relating to, the exploration and use of outer space for peaceful purposes.

The Space Research Agency was established at the National Academy of Sciences of Belarus in 2015 in order to fulfil the Academy's mandated tasks relating to outer space.

The space policy of the Republic of Belarus is based on the provisions of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and is aimed at achievement of the Sustainable Development Goals adopted by the United Nations Member States on 25 September 2015.

Space-related activities in Belarus are carried out as part of the State programme for the peaceful exploration and use of outer space, covering the period 2021–2025, which was approved by the Government and for the coordination of which the National Academy of Sciences of Belarus is responsible.

More than 20 scientific and industrial organizations are active in the Belarusian space sector, which employs approximately 4,000 qualified experts.

The main areas of activity in the space sector in 2021 were as follows:

- The operation and improvement of the Belarusian Space System for Earth Remote Sensing, which functions on the basis of the Belarusian satellite BKA
- The operation of the National Satellite Communications and Broadcasting System, which functions on the basis of the Belarusian communications satellite Belintersat-1
- The production of electronic components and optoelectronic equipment for use in outer space
- Participation in the implementation of the science and technology programmes of the Union State of Belarus and Russia relating to outer space
- Cooperation in space-related activities within the framework of the Commonwealth of Independent States and the framework of the Eurasian Economic Union
- Aerospace education

The national operator of the Belarusian Space System for Earth Remote Sensing, which comprises the Belarusian satellite BKA, the Belarusian ground control station and the Belarusian ground station for receiving, processing and distributing

information generated by the system, is Geoinformation Systems, a science and engineering State unitary enterprise.

Launched into orbit on 22 July 2012, the BKA satellite, which provides 2-metre resolution, and the Belarusian Space System for Earth Remote Sensing, which operates on the basis of that satellite, continue to perform the tasks for which they were designed.

The launch of BKA has enabled Belarus to establish its informational sovereignty in the area of Earth remote sensing data.

In 2021, Earth remote sensing data from the Belarusian Space System for Earth Remote Sensing were transmitted under agreements concluded with 24 organizations attached to 11 State bodies and with 2 ministries. The main consumers are the Ministry for Emergency Response, the State Committee on Property, the Ministry of Natural Resources and Environmental Protection and the Ministry of Forestry.

Information from the BKA satellite is used for monitoring natural and human-caused emergencies, studying the state of and forecasting changes in natural landscapes and maintaining the State land registry, for agricultural applications and for road construction, reconstruction and planning. Satellite imagery forms the basis for the production of topographic maps and navigational charts and is widely used in geological exploration and aerospace education.

Optoelectronic equipment, microelectronic components, software, materials and component devices produced for space systems have reached a new technical and technological level in terms of their design.

The distributed system for receiving, processing and disseminating timely space information from satellites (Aqua, Suomi NPP, NOAA 20, MetOp and Fengyun-3), created as part of the national space programme for the period 2016–2020 and forming part of the Belarusian Space System for Earth Remote Sensing, makes it possible to receive, process, store and disseminate Earth remote sensing data from 12 meteorological satellites. These data are transmitted up to 26 times a day to the Ministry for Emergency Response, the Ministry's national centre, the National Centre for Hydrometeorology, Radioactive Pollution Control and Environmental Monitoring and other relevant users.

In 2020, Earth remote sensing data transmitted from meteorological satellites to the National Centre for Emergency Management and Response, which forms part of the Ministry for Emergency Response, served as the primary information source enabling the detection of 250 fires in natural ecosystems (10 per cent of the total number registered). From the time at which the national operator of the Belarusian Space System for Earth Remote Sensing received the data from the meteorological satellites, it took no more than 10 minutes for the information on the thermal anomalies detected to reach the Ministry for Emergency Response.

The Belarusian communications satellite Belintersat-1 has been successfully operating in orbit since 2016. Its service areas are Europe, Africa and Asia. The telecommunications satellite has made it possible to put into operation the National Satellite Communications and Broadcasting System, which provides a wide range of services, including data transmission, voice communication, Internet access and satellite broadcasting of television programmes.

The Belarusian State University is the leading educational institution in the aerospace education system in Belarus. The BSU Sat-1 scientific and educational nanosatellite was created at the University and launched from the Jiuquan launch site in China in 2018. The control and data receiving station is located at the University's Aerospace Education Centre. The nanosatellite represents an educational science laboratory. It is used to acquire technological expertise relating to satellite development, construction and operation, to conduct scientific experiments using special hardware and to train aerospace industry experts. A second scientific and educational nanosatellite is scheduled for launch in 2022.

Cuba

[Original: Spanish] [10 November 2021]

Despite the re-establishment of diplomatic relations with the United States in December 2014, the United States blockade against Cuba not only remains in place but has been tightened. Nonetheless, Cuba has been able to continue and develop its space activities for peaceful purposes. The fact that the global financial crisis is limiting the availability of funding sources in this area has presented an additional challenge.

Despite these difficulties, Cuba continues to collaborate with countries in the region and in Europe on a number of topics in relation to which the use of space-based data plays a key role, those activities yielding significant results.

The country has satisfactorily met the annual objectives of its space activities, in spite of its difficult economic situation and the impact of the coronavirus disease (COVID-19).

The following is a summary of the outcomes achieved by Cuba in 2021 in the area of space research and the effective use of applications based on such research in the interests of the peaceful use of outer space.

1. Space weather

The Institute of Meteorology (INSMET) of the Ministry of Science, Technology and the Environment (CITMA) uses data from meteorological satellites primarily to study and forecast hurricanes and is continuing to work on the application of those findings in the various forecasts that it produces.

It has focused in particular on agrometeorology through the use of space technologies and improvement of their application.

The Higher Institute of Technologies and Applied Sciences (InSTEC) offers a meteorology course that includes training in the use of space technology.

2. Earth remote sensing

The Environment Agency (AMA), through its various institutions, continues to implement research projects related to climate change and studies on natural, technological and health hazards, vulnerabilities and risks. The use of Earth remote sensing data is a key element of that research.

Mapping based on satellite imagery with the aim of improved land use for agricultural purposes has been enhanced over the course of the year, with the involvement of experts from the Institute of Geophysics and Astronomy (IGA), the Institute of Tropical Geography (IGT) and other entities. This subject is of great importance in Cuba in that it contributes directly to the achievement of sustainable agriculture through the multilayer analysis of cartographic information, which facilitates better interpretation by experts and decision makers in achieving appropriate land use.

Other projects such as Coastal Resilience and My Coast, in which multidisciplinary teams of researchers participate, and which are of vital importance for the fostering and conservation of biodiversity, use space technologies to conduct and support research within the framework of these initiatives.

3. Space science

IGA is continuing to carry out studies relating to the ionosphere, geomagnetism and the Sun, and the data generated through those studies are being exchanged with the international scientific community.

Three projects are being implemented in collaboration with Russia; a 20-cm telescope has been installed for the study of near-Earth objects and a global navigation satellite

system station has been constructed as part of the Global Navigation Satellite System (GLONASS) of the Russian Federation.

The Planetarium and Cultural Centre for Science and Technology, which is run by the Office of the Havana City Historian with the support of IGA, is now operating on a stable basis.

The First Congress on Geospatial Sciences and Disaster Risk was held as part of the Convention on Environment and Development.

4. World Space Week

Throughout October, a workshop on the peaceful use of outer space was held virtually as one of the activities organized to mark World Space Week. Research by experts from different entities that work in this area (MINEN, MINED, MES, UH, ISPJAE and CITMA) was published daily as part of the workshop.

The main topics were:

- Astronomy
- Global positioning systems (GPS)
- The ionosphere
- Applications in human health, agriculture and the economy
- The atmosphere
- Computational techniques applied to space studies
- Geological hazards

Various interviews were conducted by the National Information Agency (AIN), Radio Habana (operated by the Office of the Historian), Radio Taíno and other media outlets.

A drawing contest for children was held jointly with the Rosa Elena Simeón Planetarium, which is run by the Office of the Havana Historian.

Portugal

[Original: English] [9 November 2021]

Portugal has been a full member of the European Space Agency (ESA) since November 2000. Portugal's contribution to and participation in ESA programmes has steadily increased in the last two decades, over which a thriving space ecosystem has been developed.

International cooperation in Earth observation

Portugal, as member of the European Union, contributes to the development and operation of Copernicus, the European Union Earth Observation Programme. Furthermore, as part of the Framework Partnership Agreement for Copernicus User Uptake, Portuguese entities collaborate with over 45 European partners to foster the uptake of Copernicus data at both the European and the international levels, with specific activities involving African countries.

Bilateral cooperation

Portugal is also actively establishing a set of bilateral agreements with a diverse range of counterparts, such as space agencies of other countries, many not within the European Union, and non-national educational and research entities. These memorandums of understanding are aimed at establishing a specific framework for collaborative civil space activities between the participants on topics, programmes and/or projects of common interest, always in a manner that can contribute to the peaceful purposes of space and in full respect of the boundaries established by the international space treaties.

Among the areas and activities that can be identified are the interchange of information, technology and personnel, the exchange of views on space policy and human capital development in the space field and related areas, and cooperation in different areas, such as Earth observation to monitor the evolution of the climate and environment, robotic exploration of space, microgravity, space traffic management, space debris and space weather and the development of related technology and instruments, for example, cost-effective sensors.

Moreover, the Portugal Space has been actively engaged in the creation and development of an international educational programme dedicated to space business management, in addition to other cooperation aimed at various space-related outreach, education and scientific activities in the fields of science, technology, engineering and mathematics.

Portugal will host the programme for 2022 of the Space Studies Programme of the International Space University, which will be held in Oeiras, Portugal, in person, during the summer of 2022.

International cooperation in astronomy

Portugal is a full member of the two intergovernmental organizations dedicated to astronomical research, namely, the European Southern Observatory (ESO) and the Square Kilometer Array Observatory (SKAO).

With almost 60 years of existence and 16 Member States, ESO has its headquarters, constituting the scientific, technical and administrative centre of the organization, in Garching, Germany. In Chile, ESO operates the Vitacura centre and three state-of-the-art observation sites: La Silla, Paranal and the Atacama Pathfinder Experiment (APEX). ESO represents its member States in activities involving the Atacama Large Millimeter Array, a large array of 66 antennas, built and operated in partnership with countries in North America and East Asia and in cooperation with the Republic of Chile. ESO is building its new flagship project, the 39-metre Extremely Large Telescope, which will become "the world's biggest eye on the sky" by the end of this decade.

Portugal continues to fully support ESO and its programmes, with particular emphasis on the construction and start of operations of the Extremely Large Telescope. At the national level, through Portugal Space, Portugal is setting up a programme to further promote participation in the construction of astronomical instruments for the Very Large Telescope and for the future Extremely Large Telescope.

Established in January 2021, SKAO is the second intergovernmental organization dedicated to astronomical research, whose mission is to build and operate cutting-edge radio telescopes to transform our understanding of the universe and deliver benefits to society through global collaboration and innovation. SKAO has officially started construction of the Square Kilometer Array, which is expected to be concluded by the end of this decade.

Portugal is one of the founding members of SKAO, and Portugal Space is the national representative on the SKAO Council. The Agency is actively coordinating the participation of Portuguese industry in the construction phase of the Square Kilometer Array and is supporting the growth of radioastronomy know-how in the country to enhance the return to society of the investment in SKAO.

Portugal has recently become an observer member of Astronet, a forum whose goal is to build a common scientific vision for all of European astronomy. Along with the other 13 members of Astronet, including ESA, ESO and SKAO, Portugal Space aims to contribute to this common vision and strengthen its international cooperation initiatives to further develop astronomical research and space exploration in Portugal.

International cooperation in space exploration

In 2021, Portugal joined the International Space Exploration Coordination Group (ISECG). The Group combines the efforts of international space agencies and fosters their cooperation towards a common strategy for space exploration. Portugal Space is part of the ISECG Emerging Space Agencies Working Group, which aims to leverage existing know-how and learn from established agencies, while at the same time introducing new perspectives and possibilities for space exploration for smaller players. Portugal Space is also part of the ISECG Analogues and the Commercialization Working Group.

Portugal is one of the founding members of the International Telecommunication Union (ITU) and has been a member of the ITU Council since 1994. Portugal is committed to promoting international cooperation, peaceful relations and fair economic and social development through the improvement and rational use of telecommunications. Concerning the use of space, Portugal is committed to finding solutions and building bridges to ensure that spectrum and geostationary orbit management can answer the needs of all.

Saudi Arabia

[Original: Arabic] [31 October 2021]

The Kingdom of Saudi Arabia is a leader in the area of scientific research and space. It has contributed to scientific accomplishments, technological progress and the acceleration of digital economic growth throughout the Middle East region. Saudi interest in space activities began in 1977 with the establishment of the Saudi Arabian National Centre for Science and Technology. The Centre's name was changed to the King Abdulaziz City for Science and Technology in 1985. In that same year, His Royal Highness Prince Sultan bin Salman bin Abdulaziz participated as a payload specialist aboard the STS-51-G space shuttle mission. Thereafter, Saudi contributions in this field continued, leading to the establishment of the Saudi Space Authority in 2018, based on the Saudi leadership's understanding of the importance of space in many fields. The Saudi Space Authority is working to modernize the country's space system and to develop a strategy and national legislation to stimulate the space sector.

Since its establishment, the King Abdulaziz City for Science and Technology has overseen the launch of 17 Saudi satellites, the latest being Shaheen Sat, one of a new generation of small satellites for imaging the Earth and tracking ships from low Earth orbit. The King Abdulaziz City for Science and Technology has the infrastructure for assembling and testing satellites, including clean rooms and devices for testing special environmental conditions that simulate the conditions to which satellites are exposed in space or while being launched into orbit, including vibration factors, temperature differences, the absence of atmosphere and the intensity of solar radiation on objects in space orbits. The satellite industry, the largest segment of Saudi space activity, is based on high-quality national capacities.

Saudi Arabia is also a member of the Committee on the Peaceful Uses of Outer Space. It has been keen to conclude bilateral space cooperation agreements to expand and enhance international space cooperation and realize the vision for outer space exploration. To this end, it has undertaken a number of bilateral projects, including the following:

(a) The King Abdulaziz City for Science and Technology and the National Aeronautics and Space Administration (NASA) of the United States of America established a centre of excellence for research on lunar and near-Earth objects. In addition, a joint space and aviation centre was established with Stanford University to enhance research and develop resources with a focus on the aviation and space sectors; (b) Saudi Arabia and the China National Space Administration signed a memorandum of understanding during the visit of King Salman bin Abdulaziz to China in 2017. The memorandum provided for Saudi Arabia to participate in the Chinese Chang'e-4 Moon mission in 2018 by supplying a Saudi-manufactured optical imaging detector for taking photos of the Moon and the Earth;

(c) A cooperation agreement was signed between Saudi Arabia and the Russian Federation for a project on the exploration and use for peaceful purposes of outer space, during the visit of King Salman bin Abdulaziz to Russia in 2017. The agreement is intended to enhance space exploration cooperation. It provides for Saudi Arabia to participate in space flights and exploration carried out by the Russian Federation and to benefit from space technologies and the development of joint systems in various areas;

(d) Saudi Arabia and Ukraine have signed a bilateral agreement on cooperation in the exploration and use of outer space for peaceful purposes. The agreement covers research, remote sensing and geophysics.

In addition, Saudi Arabia has ratified the United Nations treaties relating to the exploration and use of outer space, thereby demonstrating its interest in space cooperation with friendly countries.

Saudi Arabia is keen to advance the Kingdom through international space cooperation and knowledge transfer. It organized the first Group of 20 (G20) Space Economy Leaders Meeting, held virtually, which brought together the heads of space agencies from the G20 countries. Saudi interest in the space sector and international space cooperation are fundamental to ensuring the exploitation of space technologies to improve the quality of life and promote progress in Saudi Arabia.

Slovakia

[Original: English] [2 November 2021]

Governance of space activities in Slovakia

The Slovak Republic established the Slovak Space Office on 1 January 2021 at the Ministry of Education, Science, Research and Sport of the Slovak Republic in order to govern and coordinate space activities in Slovakia, to cooperate with the European Space Agency (ESA) as well as in the context of the European Union Space Programme, to implement space activities aimed at companies and industry, and to build the national space ecosystem.

In May 2021, the Slovak Space Office was officially organized into two parts: the Space Policy Department established at the Ministry, responsible for space policies, governance and coordination, and the Space Industry Branch established at the Slovak Investment and Trade Development Agency (SARIO), as the agency under the auspices of the Ministry of Economy of the Slovak Republic dedicated to supporting the space industry ecosystem and enabling "spinning-in" in the space sector.

Slovakia perceives outer space not only as an important domain of research and exploration, but also as one of the key pillars of the modern economy. In the new space era, it is necessary to support the space sector not only through public funding, but also through a variety of non-financial tools, including sector-entry consultancy, business mentoring, local networking, and international partnership matchmaking for companies and researchers. The Industry Branch of the Slovak Space Office plays an active role in these areas, working on several systematic projects, such as space hackathons, the space business incubator and the annual Emerging Space conference. This kind of comprehensive support for the growth of the ecosystem is crucial for the development of countries with emerging space sectors.

Other relevant Slovak institutions and organizations are represented in the Committee for Space Activities, which regularly discusses current issues in the development of space activities in the Slovak Republic.

Diversification activities executed by the Industry Branch of the Slovak Space Office

SARIO supports the sector portfolio diversification of Slovak companies towards space and other promising high-tech areas with significant growth potential through sector-entry consultancy and matchmaking activities boosting the growth and internationalization of the Slovak space ecosystem. In order to work efficiently at the international level, SARIO is actively developing its international partner network, including with foreign space agencies such as the Japan Aerospace Exploration Agency, the German Aerospace Center, the Israel Space Agency, the Italian Space Agency, the Korean Aerospace Research Institute and the United Arab Emirates Space Agency, as well as industry associations and clusters and companies.

The following activities were carried out in 2021:

(a) Side event at the meeting of the Committee on the Peace Uses of Outer Space (2 September). The Industry Branch of the Slovak Space Office organized, in cooperation with the Office for Outer Space Affairs, a side event entitled "Space ecosystem building in emerging space countries", with the participation of the Secretary-General of ASD-Eurospace, Olivier Lemaitre, and the research manager of the European Space Policy Institute, Sebastien Moranta. The focus on supporting emerging spacefaring nations in sharing valuable information and experience regarding the scaling up of their national space ecosystems for the benefit of their societies and economies attracted about 30 delegates from all around the world;

(b) *Expo 2020 Dubai (17–23 October).* Slovakia was represented at the Expo 2020 Dubai "Space Week" by a delegation composed of representatives of the Slovak Space Office, the Ministry of Education, Science, Research and Sport, the Ministry of Foreign and European Affairs, the Ministry of Economy, the Ministry of Defence, the Ministry of Environment, astrobiologist and analogue astronaut Michaela Musilová, a business delegation comprising representatives of companies, small- and medium-sized enterprises and start-ups, and representatives of universities and the Slovak Academy of Sciences. Slovak representatives participated in the joint event of the four countries of the Visegrad Group, on the theme "Space policy priorities and development opportunities in Central Europe", along with Czechia, Hungary and Poland;

(c) Business delegation meetings at the Expo 2020 Dubai (18–22 October). The Industry Branch of the Slovak Space Office organized a series of four matchmaking events for its business delegation present at the Expo 2020 Dubai, along with India, Latvia, Slovenia and the United Arab Emirates;

(d) Best practice session at Expo 2020 Dubai (21 October). The Industry Branch of the Slovak Space Office organized an interactive discussion on space ecosystem development in emerging spacefaring nations, involving representatives of 10 countries from various continents. The session was held within the framework of the Expo's Global Best Practice Programme, focusing on five areas that are in line with a number of the Sustainable Development Goals;

(e) International Astronautical Congress (IAC) (25–29 October). Slovakia was represented by the Slovak Space Office, taking part in the conference programme as well as the exhibition. The Industry Branch of the Slovak Space Office/SARIO became one of the newest members of International Astronautical Federation during the seventy-second Congress (IAC 2021), which was held from 25 to 29 October 2021 in Dubai, United Arab Emirates;

(f) Space Climate Observatory (26 October). During IAC 2021, the Industry Branch of the Slovak Space Office/SARIO signed a letter of intent regarding

collaboration on the Space Climate Observatory project with the National Centre for Space Studies of France (CNES).

The extensive accomplishments of the Slovak Academy of Sciences and its institutes span the areas of space physics, geophysics, astronomy, life sciences, materials science, remote sensing and space meteorology. Since 2020, SAS has set up two cooperation activities with the National Aeronautics and Space Administration (NASA) of the United States of America.

International cooperation in the peaceful uses of outer space: activities of the Faculty of Mathematics, Physics and Informatics of Comenius University, Bratislava

The Faculty of Mathematics, Physics and Informatics (FMPI) of Comenius University, Bratislava, actively collaborates with the Astronomical Institute of the University of Bern, Switzerland, in collecting data on space debris objects to support their cataloguing. FMPI acquires, on a regular basis, observational astrometric data for objects in higher orbits with its 0.7-metre aperture Newtonian telescope (AGO70), situated at the FMPI Astronomical and Geophysical Observatory in Modra, Slovakia.

FMPI started active collaboration with the International Scientific Optical Network (ISON), operated by the Ballistics Service of the Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences. The Keldysh Institute and FMPI deployed a small ISON tracking sensor dedicated to the observation of space debris and near-Earth objects at the FMPI Astronomical and Geophysical Observatory in Modra, Slovakia.

Research on space debris, the safety of space objects with nuclear power sources on board and problems relating to their collision with space debris

Validation of a Slovak optical sensor for space debris satellite laser ranging tracking support, object cataloguing and research

The Department of Astronomy and Astrophysics of FMPI improved the hardware and software of its 0.7-metre Newtonian telescope (AGO70) through the ESA Plan for European Cooperating States programme for Slovakia. The primary goal was to develop a space debris research instrument and space surveillance and tracking sensor able to observe objects placed in all orbital regions, from low Earth orbits to geosynchronous orbits. The capability of AGO70 to meet the defined objectives was validated during an observation campaign performed in collaboration with the Austrian Academy of Sciences and the Satellite Laser Ranging (SLR) Graz station (Austria), primarily focused on the demonstration of real-time data handover from a passive optical sensor (AGO70) and active satellite laser ranging sensors.

Application of the Slovak all-sky meteor network for the monitoring of re-entry events

FMPI is investigating the possibility of using its Automatic Meteor Orbit System (AMOS) camera system for space debris re-entry measurements. AMOS is used for automatic detection of meteors, determination of their orbits and spectrum extraction. Comenius University has developed and is now operating worldwide a total of 23 AMOS cameras, including spectral cameras, of which 7 are situated in the Slovak Republic, 3 in the Canary Islands, Spain, 4 in Chile and 3 in Hawaii, United States, and has recently deployed 6 AMOS cameras in Australia. The AMOS network detects the re-entry events, which allows FMPI to perform modelling of the trajectories of created fragments in the atmosphere and analyse their spectral properties. Conducted analysis should lead to the improvement of predictions of the fragments' survivability and the estimation of risks to the terrestrial population.

Space debris characterization through photometry and spectroscopy

FMPI is performing several studies dedicated to the classification and characterization of space debris objects to better understand the origins and creation

mechanisms of space debris. AGO70 is used to acquire data on the light curves of space debris. These data are used to identify the reflectance properties and size and shape of the objects. By using different spectral-type photometric filters, FMPI is investigating the surface reflectance properties of space objects as a function of wavelength, which is directly related to the material properties of the objects. AMOS spectral cameras are used to acquire data on specular glints and their spectra from objects in low Earth orbit. Acquired spectral data provide high-resolution information about the surface properties as a function of wavelength.

Ukraine

[Original: English] [5 November 2021]

In 2021, Ukraine participated in the following international projects:

Antares

Within the framework of the Antares project, Ukrainian enterprises created the basic design of the first stage of the Antares launch vehicle, which was developed by the company Orbital ATK at the request of the National Aeronautics and Space Administration (NASA) of the United States of America in order to deliver cargo to the International Space Station. As at the beginning of October 2021, there have been two launches from the Wallops Flight Facility. The next launch is planned for February 2022.

Vega

Within the framework of the European Space Agency (ESA) Vega project, Ukrainian companies design, develop and manufacture the upper stage of the light-class Vega launch vehicle. The main contractor for the project is the Italian company Avio. As at the beginning of October 2021, two launches of the launch vehicle were made from the Kourou spaceport.

In the area of international cooperation, the development of cooperation with the European Union, ESA and the countries of North America and Europe remains the priority. Furthermore, China, India, Japan, Mexico, South Africa, Turkey and the United Arab Emirates are important partners of Ukraine in the field of outer space.

Canada

Cooperation continued with Canada in building a spaceport for space launches from the Canadian province of Nova Scotia; the project is being implemented by the Canadian company Maritime Launch Services and the Ukrainian enterprise Yuzhnoye State Design Office. The ceremony of laying the first stone of the future spaceport is scheduled to be held on 19 November 2021 in Canso, Nova Scotia, Canada.

United States of America

On 12 November 2020, the State Space Agency of Ukraine (SSAU) signed the Artemis Accords on the Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes.

In August 2021, SSAU and the United States Space Command signed a memorandum of understanding between SSAU and the Department of Defense of the United States regarding cooperation in the safety of spaceflight and the provision of space situational awareness services and information. The document, in particular, regulates the exchange of information in order to resolve abnormal situations that may arise with regard to spacecraft during, inter alia, their launch into orbit, descent from orbit, entry into the atmosphere and disposal.

European Space Agency

Engaging in the implementation of European space projects through further involvement in ESA is a priority area for international space integration for Ukraine. SSAU, in cooperation with ESA, cooperates in the field of remote sensing of the Earth in the framework of the implementation of the cooperation arrangement between SSAU and the European Commission in the area of access to and use of Sentinel data of the Copernicus programme. Space data from ESA Sentinel satellites are being transmitted to the Copernicus data centre in Ukraine.

European Commission

Cooperation with the European Commission is being carried out in the following areas:

(a) Expansion of the European Geostationary Navigation Overlay Service (EGNOS) functional supplementary satellite systems to the territory of Ukraine. In March 2020, SSAU held the first round of negotiations between the delegations of Ukraine and the European Commission on the international agreement on the extension of EGNOS to the territory of Ukraine. The signing of this document will ensure full coverage of the territory of Ukraine by the EGNOS system and will provide opportunities for the practical use of the system in the interests of Ukrainian stakeholders. The next round of negotiations is scheduled for mid-November 2021;

(b) Organizing the exchange of Earth remote sensing data with European partners in order to improve access to and use of the Copernicus Sentinel programme in Ukraine. A Copernicus regional mirror site has been created to enable access to and analysis of Copernicus data. Since 1 December 2019, the site has provided free access to data from the Sentinel-1, Sentinel-2 and Sentinel-3 satellites relating to the territory of Ukraine;

(c) Ensuring the participation of Ukraine in the implementation of space projects of the European Union Framework Programme for Research and Innovation, Horizon Europe. On 12 October 2021, at the twenty-third Ukraine-European Union Summit, the Agreement on the participation of Ukraine in the Horizon Europe Framework Programme for Research and Innovation was officially signed.

China

Cooperation was carried out within the framework of the Ukraine-China programme of cooperation in space for the period 2021–2025, signed at the end of 2020; in accordance with the main document, Ukraine and China are working together to explore outer space in the medium term.

Uzbekistan

[Original: Russian] [29 October 2021]

Current status of development of the space sector in Uzbekistan

In August 2019, the President of the Republic of Uzbekistan, Shavkat Mirziyoyev, signed a decree on the development of space activities in the Republic of Uzbekistan, whereby the Space Research and Technology Agency under the Cabinet of Ministers of the Republic of Uzbekistan was established.

Considerable work has been done since the creation of the Agency to develop the country's space activities, the objectives of which are to promote sustainable socioeconomic development and strengthen national defence capabilities and security.

In fulfilment of the Agency's mandated tasks:

(a) The regulatory and legislative framework for space activities, space research and space technologies is being developed;

(b) Efforts are being made to engage foreign experts from the space industry as consultants for the Scientific, Technical and Expert Council of the Agency in order to develop the national space sector;

(c) The Discovery Day Uzbekistan conference, which brought together foreign space companies and representatives of ministries and departments of the Republic of Uzbekistan, was held with the aim of familiarizing participants with the activities of the Agency and opportunities for using geodata in various economic sectors resulting from the introduction of space technologies, and also with the aim of sharing best practices and knowledge pertaining to space-related matters;

(d) Work is being carried out to enhance the efficiency of economic sectors such as agriculture, water management, forestry, land registration, geology, ecology, transport infrastructure and national defence and security through the application of space technologies;

(e) Consideration has been given to the possibility of setting up of competence centres and faculties at certain universities in the Republic of Uzbekistan for the purpose of training, retraining and providing advanced training to relevant specialists, and to possible scientific research;

(f) Pilot projects and targeted programmes relating to use of the results of space- and geoinformation-related activities for sector-specific applications are being implemented and planned;

(g) Intergovernmental agreements have been concluded on cooperation in the exploration and use of outer space for peaceful purposes;

(h) International cooperation is being established and strengthened with leading foreign space organizations and companies in the exploration and use of space for peaceful purposes, the effective use of space technologies to develop key sectors of the national economy and the training and retraining of personnel with the aim of developing the space sector in the Republic of Uzbekistan;

(i) Negotiations are taking place with regard to the possibility of the Agency joining various relevant international organizations and programmes;

(j) The Agency is currently taking steps to develop the necessary ground-based space infrastructure.

Taking into account the geographical and economic characteristics of the Republic of Uzbekistan, the development of areas in which space technologies can be put to more effective use is being explored, including Earth remote sensing, geographic information systems, satellite communications and satellite navigation. These applications are particularly important and can generate economic returns relatively quickly and effectively in many sectors of the economy.

By means of such applications, the following objectives will be pursued at a fundamentally new level:

(a) Enhancing the quality of forest resource management and detecting instances of logging in a prompt and reliable manner;

(b) Promoting the efficient and rational use of agricultural land and detecting land that is not being used for its specified purpose;

(c) Improving approaches to urban development planning and detecting illegal constructions and instances of land-grabbing;

(d) Conducting objective monitoring with a view to the rational use of water resources;

(e) Supporting the prevention of, and timely response to, emergencies;

(f) Ensuring that satellite communications and satellite-based Internet services are available in hard-to-reach areas of the Republic of Uzbekistan;

(g) Providing the country's population with high-precision navigation and other services.