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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

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I. Introduction

1. At its fifty-sixth session, in 2019, the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space recommended that the Secretariat continue to invite Member States to submit annual reports on their space activities (A/AC.105/1202, para. 41).

2. In a note verbale dated 15 July 2019, the Office for Outer Space Affairs of the Secretariat invited Member States to submit their reports by 21 October 2019. The present note was prepared by the Secretariat on the basis of replies received in response to that invitation.

II. Replies received from Member States

Austria

[Original: English]
[18 October 2019]

Austrian space law and policy activities

Space policy

The European Space Policy Institute (ESPI), the European think tank for space, conducts independent research on space policy issues. The Institute publishes reports and executive briefs covering a wide range of issues across space policy, economy and security, as well as international and legal affairs.

In 2019, ESPI addressed, inter alia, commercial space exploration, space power, space in Africa, and the United Nations and space security.

This year the Institute also published the first issue of the *Space Venture Europe* series, which provides the latest data and information on private investment and entrepreneurship trends in the European space sector. Major findings revealed that private investment in European space start-ups exhibits massive growth since 2014. A new record high was hit in 2018, with 219.5 million euros invested. The study also showed that there is dynamic space entrepreneurship, widespread across Europe, with a few countries at the forefront.

In 2019 the Institute also launched a new quarterly report on major developments in the space sector, called *ESPInsights*. Additional publications are planned by the end of the year, including reports on space-traffic management and space defence, as well as a new formula for the annual yearbook of the Institute, which provides a complete and thorough overview of developments in space affairs during the year. ESPI publications are available on the ESPI website (www.espi.or.at).

ESPI also organizes various meetings and conferences, including evening events during sessions of the Committee on the Peaceful Uses of Outer Space and the annual ESPI Autumn Conference. The latter is a two-day event that brings together high-level officials and space-industry representatives to discuss a selected topic of interest for space policy. On 18 and 19 September 2019, the thirteenth Autumn Conference was held in the Urania observatory in Vienna and addressed the role of space diplomacy. The Conference addressed three issues: policy perspectives on European space diplomacy; space diplomacy for business; and space diplomacy for security and defence. Keynote speakers and panellists shared their views on current and upcoming international challenges and discussed how space diplomacy could further strengthen Europe’s position and role in a fast-changing global landscape. More information is available online (www.espi.or.at/13th-espi-autumn-conference). The next ESPI Autumn Conference will address long-term perspectives for the space sector, beyond 2030, and implications for space policy today.

International space law

The National Point of Contact for Space Law of the European Centre for Space Law of the European Space Agency (ESA) is coordinated by the Department of European, International and Comparative Law at the Law Faculty of the University of Vienna. Its main objective is the promotion and development of space law and its application through research and teaching, as well as through advisory activities. The National Point of Contact for Space Law Austria is financed by the Austrian Federal Ministry for Transport, Innovation and Technology and supports the Ministry in the preparation and representation of Austria at meetings of the Committee on the Peaceful Uses of Outer Space and its Subcommittees and Working Groups. In addition, the work of the National Point of Contact is focused on raising public awareness of space law, inter alia, through the annual publication of the Austrian Space Law Newsletter and the organization of space law-related events and conferences. At the margins of the fifty-sixth session of the Scientific and Technical Subcommittee, on 12 February 2019 the National Point of Contact co-organized, together with the Secure World Foundation, the event “Guidelines for the long-term sustainability of outer space activities: implementation experiences and challenges”, which was hosted by the delegations of Austria, Brazil and South Africa. For more information see www.spacelaw.at.

Austrian research activities

Austrian space weather activities

The University of Graz is an expert member of the European Space Weather Assessment and Consolidation Committee and actively participates in the Expert Group on Space Weather. In 2019 the International Space Weather Action Team) was initiated under the Committee on Space Research; the University of Graz plays a key role in that Action Team. Furthermore, the University of Graz is the national coordinator for the International Space Weather Initiative and the national contact point and regional warning centre for the International Space Environment Service. The research groups on solar and heliospheric physics maintain groups for the ESA space situational awareness Expert Service Centres on Solar and Heliospheric Weather, providing data and tools for forecasting and nowcasting space weather events coming from the Sun. In detail, the services comprise (a) an automated flare detection at the Kanzelhöhe Observatory for Solar and Environmental Research, (b) the software development for the Spectrometer/Telescope for Imaging X-rays (STIX) instrument aboard the ESA Solar Orbiter mission, which will be launched in February 2020, (c) solar wind forecasting software based on automated image data extraction and persistence modelling and data assimilation and (d) a software application for ensemble modelling of impact probability, arrival times and speed of coronal mass ejections.

Earth observation for the Sustainable Development Goals

Austrian companies and research groups working in the Earth observation and geospatial information domain are very active in utilizing satellite data for addressing global challenges such as poverty, monitoring environmental changes and stimulating economic growth, in particular for developing countries.

As an example, GeoVille and its partners from the United Nations Environment World Conservation Monitoring Centre, the United Nations Environment Programme-DHI partnership and DHI GRAS are running the project “Earth observation for the Sustainable Development Goals” , funded by ESA. The aim of the project is to support the utility of satellite Earth observation in the context of the 2030 Agenda on Sustainable Development and, in particular, of the global indicator framework adopted by the United Nations Statistical Commission at its forty-eighth session, in March 2017. The project produces targeted high-quality indicator-monitoring guidelines and effective outreach material, showcasing the usability of Earth observation data, in dialogue with United Nations stakeholders. A

dedicated case study will be implemented in Uganda, concentrating on Sustainable Development Goal indicators 6.4.1 (Change in water-use efficiency over time) and 15.3.1 (Proportion of land that is degraded over total land area).

Earth observation and digital Earth activities

The two-week summer school programme called "Copernicus for digital Earth: benefit from the potential of freely available satellite data and Copernicus services for your domain" was held by the University of Salzburg Department of Geoinformatics from 23 June to 4 July 2019, with support from ESA, the Group on Earth Observations and the European Association of Remote Sensing Laboratories (EARSeL). It brought together international students and practitioners from 11 countries. The intensive programme explored the potential of freely available satellite data and information products derived from those data, with a focus on Copernicus and its various service domains. The summer school participants presented their group work at a special meeting of the thirty-ninth EARSeL Symposium, in 2019.

The EARSeL Symposium in 2019 was dedicated to the topic digital Earth observation, exploring challenges and opportunities in this field. Supported by the Copernicus Academy, ESA and industrial partners. it was held in Salzburg from 1 to 4 July 2019. Keynote addresses by representatives of science, industry and ESA; scientific talks; round-table discussions with representatives from the Office for Outer Space Affairs, ESA and the Copernicus Academy; and workshops given by the Research and User Support Service of Copernicus and the industry were open to 180 participants.

Copernicus Academy Hub for Knowledge, Innovation and Outreach

The European Commission has launched the Copernicus Academy Hub for Knowledge, Innovation and Outreach to help spread awareness and knowledge about Copernicus across and outside the European Union. The project's aim is to establish a long-term knowledge and innovation hub for boosting and sustaining the uptake and use of Copernicus data and technology. Earth observation-related skills and technology trends are turned into a future-oriented educational agenda under the Erasmus+ Sectoral Skills Alliance project EO4GEO. Also, the first Copernicus-related joint master's programme is now offered by the University of Salzburg and European partners. Presentations on these initiatives and Copernicus in general were given at the sixty-second session of the Committee on the Peaceful Use of Outer Space, in Vienna in June 2019, and this year's United Nations/Austria Symposium, held in Graz in September 2019.

Austrian space education activities

European Space Education Resource Office

The European Space Education Resource Office (ESERO) project is the European Space Agency's main way of supporting the primary and secondary education community in Europe. ESERO uses space-related themes and the fascination felt by young people for space to enhance pupils' literacy and competence related to science, technology, education and mathematics (STEM) subjects. The Ars Electronica Centre in Linz hosts the Austrian ESERO, with the support of the Austrian Research Promotion Agency and the Austrian Federal Ministry for Transport, Innovation and Technology. ESERO Austria supports teachers by making the teaching and learning of STEM subjects more attractive and accessible to students, using the space context. It produces teaching material for Austrian schools and has offered a series of training sessions for schoolteachers. In addition, ESERO Austria provided opportunities to take part in educational challenges as follows:

(a) Pupils and teachers participated in the International Space Camp 2019;

(b) Another Austrian CanSat competition was successfully organized, together with the Space Team of the Technical University of Vienna, and was held in April 2019. The winning team took part in the ESA CanSat campaign in June 2019;

(c) There was participation in the ESA Climate Detectives, Moon Camp and AstroPi challenges;

(d) In Austria the Mission X “Train like an astronaut” challenge took place from January to April 2019, leading up to a final event on 10 May, with 20 classes (about 400 schoolchildren) and the Austrian cosmonaut Franz Viehböck at the Ars Electronica Centre in Linz.

Summer school in Alpbach

From 16 to 25 July 2019, 58 university students from 23 nations attended the forty-third summer school in Alpbach, organized by the Austrian Research Promotion Agency and ESA. The topic was “Geophysics from space using micro- or nano-satellite constellations”. The participants were challenged to propose ideas for new satellite missions to observe in high resolution the magnetic and gravitational field of the Earth from space, using an unprecedented mission configuration. The attendees worked intensively to define and design a space mission, under the supervision of noted scientific and engineering experts. Over 10 days, each team developed its own mission plan to the point where, in principle, a space agency could take the concept and begin the mission assessment phase. These mission plan were presented to a jury of experts on the final day of the summer school.

Bulgaria

[Original: English]
[8 October 2019]

Space activities 2019 (Plan for European Coordinating States)

The management of Bulgarian participation in space activities is entrusted to different governmental bodies, whereas the Ministry of Economy coordinates the space policy at the national and the European level.

The authorities for space activities and programmes include: Ministry of Economy, Ministry of Education and Science, Ministry of Interior, Ministry of Foreign Affairs, Ministry of Transport, Information Technology and Communications, Ministry of Defence and Ministry of Environment and Water, as well as other authorities and science structures.

Bulgaria is a country with scientific infrastructure and technical capabilities pertinent to space activities. The major strengths are in the fields of space electronics (i.e. instruments), remote sensing (optical, radar), space weather, space science (data exploitation) and space technology (integrated circuits, optics, antennas, electronics and microelectronics). Furthermore, a variety of educational activities in the field of space are provided in secondary schools and universities (BSc., MSc. and Ph.D.).

In 2014 Bulgaria became the ninety-second member of the Group on Earth Observations and on 30 April of the same year the thirtieth State member of the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT).

In 2015 Bulgaria became the tenth country to sign the European Cooperating State Agreement with the European Space Agency (ESA) and in February 2016 it signed the Plan for European Cooperating States (PECS) charter. As a result of the European Cooperating State Agreement, up to December 2018, 34 project proposals had been submitted, of which 14 had been approved for implementation. On the first PECS call for proposals, five projects were approved:20 per cent in industry and 80

per cent in academia. The main areas were Earth observation (38 per cent), exploration or science (50 per cent) and education (12 per cent).

The second call for proposals was launched on 10 October 2016, and when the selection of the future projects was concluded in March 2017, nine projects were approved.

The third call for proposals for Bulgaria was opened on 12 February 2018 and ended on 13 April 2018, and three projects were approved.

In accordance with the European Cooperating State Agreement, the Ministry of Economy coordinates activities with ESA in order to enable Bulgarian companies to participate successfully in the PECS charter. It is expected that the capacity of Bulgarian industry will be increased.

In the first half of 2018, during its Presidency of the Council of the European Union, Bulgaria provided a solid platform for a political debate regarding the future long-term financial framework and the funds allocated for the space sector.

In addition, several space events were jointly organized with the European Commission and ESA in Sofia, including a Copernicus training and information session and an event on space-based services for regional strategies in the digital economy, from Balkan and Black Sea perspectives.

The fourth PECS call for proposals was launched on 10 December 2018 and closed on 27 March 2019. Subjects include:

- Activities related to the flight segment
- Research and development activities
- Space applications
- Preparatory activities
- Information and education activities

Eighteen proposals were received and six were approved. There was 71 per cent industry involvement and 29 per cent participation of academic and scientific organizations.

Summarized results for Bulgaria in 2019 under the Plan for European Cooperating States

The budget of PECS for Bulgaria is currently 6.8 million euros. The budgetary value of the projects currently under way is equal to 2,694,631 euros.

For 2019 ESA will open two tendering procedures for Bulgaria. From 9 to 11 October 2019 ESA will hold in Sofia the “information day” on the guidelines for participation under the fifth tender procedure for Bulgaria, accompanied by individual consultations. At the initiative of the Ministry of Economy, ESA has launched a procedure for the selection of project proposals for implementing a study defining the potential of the Bulgarian space industry. As a result of the joint work, the activity was announced on the ESA website together with a call for project proposals.

Denmark

[Original: English]
[7 October 2019]

Denmark has signed and ratified four United Nations treaties on outer space: the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement), the Convention on

International Liability for Damage Caused by Space Objects (Liability Convention) and the Convention on Registration of Objects Launched into Outer Space (Registration Convention).

The Danish Outer Space Act has been in force since July 2016. In accordance with the Act, Denmark has established a national public registry of space objects. This registry contains information about space objects launched into Earth orbit or beyond, and for which Denmark is launching State.

Space activities in 2018

Two Danish satellites, GOMX-4A and GOMX-4B, were approved in accordance with the Danish Outer Space Act and launched in February 2018.

GOMX-4A is a 6U satellite working in a tandem operation with another 6U satellite, GOMX-4B. GOMX-4A is equipped with an Automatic Identification System payload, an Automatic Dependent Surveillance-Broadcast payload, an X-band receiver and a visual camera. The GOMX-4A demonstration is part of an analysis seeking to identify best practices and future efforts to reinforce the Danish defence's surveillance of the Arctic within Denmark.

GOMX-4B is equipped with an Automatic Dependent Surveillance-Broadcast payload, a star-tracker, a propulsion module, a radiation hardness assurance board and a hyperspectral camera. The purpose of the tandem operation is to demonstrate intersatellite linking and station-keeping capabilities (satellite separation and orbit control) through GOMX-4B's propulsion system.

Estimated re-entry for both satellites is in 2031.

Germany

[Original: English]
[21 October 2019]

Intensifying international cooperation is one of the three guiding principles of the German Federal Government's space policy. Together with a clear orientation towards benefits and needs and the principle of sustainability, international cooperation forms the backbone of Germany's space strategy. Approximately two thirds of the German space budget is allocated to the European Space Agency (ESA). Within the national space programme, a high ratio of space projects is also conducted with international partners. Furthermore, the German Aerospace Centre (DLR), Germany's national aeronautics and space research centre, cooperates with the world's leading research institutions and relevant organizations, including more than 400 international partners from more than 60 countries. In 2018 and 2019, Germany was involved in many international collaborative undertakings in the peaceful uses of outer space. This report presents a selection of these undertakings.

Joint international scientific space exploration missions

BepiColombo, to date the most comprehensive European-Japanese project to explore a planet in the solar system, was launched in October 2018 with an Ariane 5 rocket and will reach Mercury in December 2025. BepiColombo consists of two orbiters that will gather data during a one-year nominal mission. ESA is responsible for the overall mission, as well as the development and construction of the Mercury Planetary Orbiter, whereas the Japan Aerospace Exploration Agency (JAXA) contributed the Mercury Magnetospheric Orbiter. DLR delivered a mercury radiometer and thermal infrared spectrometer, as well as a laser altimeter.

The DLR Heat Flow and Physical Properties Package (also called "the Mole") was placed on the Martian surface by the National Aeronautics and Space Administration (NASA) InSight mission's robotic arm in November 2018. The

instrument measured the thermal conductivity of the Martian regolith and the heat flow from the interior of the planet.

In December 2003, the space probe Hayabusa2, operated by JAXA, embarked on a sample return mission to the C-type asteroid Ryugu. It carried the Mobile Asteroid Surface Scout (MASCOT), a lander built by DLR in collaboration with the Centre national d'études spatiales (CNES). Hayabusa2 and MASCOT worked together as a team and reached Ryugu in June 2018. Three months later, MASCOT separated from the Hayabusa2 spacecraft and landed on Ryugu to collect data from the asteroid's surface.

On 3 January 2019, the Chinese Chang'e-4 mission released the second Jade Rabbit rover on the far side of the moon. Among other things, the landing probe carried a measuring instrument from Germany funded by the DLR Space Administration: the Lunar Lander Neutron and Dosimetry Experiment, provided by Christian Albrechts University of Kiel, Germany. The lander gathers information about the radiation environment on the surface of the Moon and will help to investigate the radiation levels that future astronauts might be exposed to. This is innovative, as so far radiation was measured only in orbit during two individual Moon missions but not actively on the Moon's surface.

European Space Agency milestones

In November 2019, European ministers in charge of space activities met at the ESA Ministerial Council in Seville, Spain, with a view to initiate ambitious space missions by pooling investments. German industry and research organizations will continue to participate actively in ESA programmes.

In August 2019, a milestone was reached for the ESA European Data Relay System (EDRS) system with the launch of the satellite EDRS-C. The network of geostationary relay satellites delivers large data volumes from space to Earth with minimal delay using laser communications and already provides data transfer services for four Sentinel satellites within the European Union's Copernicus Earth observation programme. EDRS is a public-private partnership of 14 ESA member States and the primary industrial contractor, Airbus Germany.

ESA made progress towards new, more economical rockets: the BERTA (biergol space transport drive) engine was manufactured by 3D printing and successfully completed its first test. The engine is jointly used by DLR, CNES and industrial partner ArianeGroup.

General international cooperation and capacity-building activities

United Nations/Germany high-level forum

The United Nations/Germany high-level forum to discuss the way forward after UNISPACE+50 and on to "Space2030" (13 to 16 November 2018 in Bonn) was organized by the DLR Space Administration on behalf of the German Federal Ministry for Economic Affairs and Energy in cooperation with the Office for Outer Space Affairs and supported by ESA. Over 300 participants from 60 countries discussed the contribution of aerospace applications to solving global challenges such as climate change, disaster management and sustainable development. The forum demonstrated the increasing interest of the broader space community in collectively addressing international cooperation in the peaceful uses of outer space across the seven thematic priorities of the UNISPACE+50 process and the four pillars: space economy, space society, space accessibility and space diplomacy.

E-learning platforms

SAR-EDU is a virtual learning platform dealing with applications based on radar satellite data. It was developed with funding from the German Federal Ministry for Economic Affairs and Energy and contributes to the ESA Earth Observation College. An online course entitled "Echoes in space" is now available at the website

eo-college.org for e-learning users worldwide. Further online courses in English, French, German, Spanish and Portuguese are planned. In the near future, the education initiative HYPERedu will be added in order to promote the potential of hyperspectral Earth observation for many areas of application. The German hyperspectral satellite Environmental Mapping and Analysis Programme (EnMAP) mission is scheduled for launch in early 2021.

United Nations/Germany teach-the-teacher School Lab workshop

From 27 October 27 to 3 November 2019, Germany hosted 14 teachers and scientific experts from Africa for an open exchange of information and experiences related to space science and technology education. During the workshop, participants were introduced to the DLR School Lab programme: across the country and together with local universities, DLR student laboratories offered experimentation opportunities for pupils and invited school classes to interactively discover topics related to aerospace, aviation, transportation and energy. Participants in the teach-the-teacher workshop visited facilities in the German cities of Cologne, Bremen and Berlin and actively engaged with German teachers and pupils. The capacity-building initiative aimed at promoting space education for the next generation with a focus on Africa and was supported by the Office for Outer Space Affairs and the regional centres for space science and technology education, affiliated to the United Nations.

Space applications supporting the United Nations global agendas on climate change, disaster management and sustainable development

Global TanDEM-X forest map

Forests are Earth's lungs; they help reduce greenhouse gas concentrations in the atmosphere and thus counteract global warming, while also providing protection and resources for humans, animals and plants – and they are being lost at an alarming rate. DLR has created a special dataset to monitor, assess, and protect the current state and development of this green organ with precision: the global TanDEM-X forest/non-forest map. Interferometric data acquired by the German TanDEM-X radar satellite mission for the creation of a global elevation model were used for this purpose; algorithms from the field of artificial intelligence were developed for global data-processing. These have been optimized for different types of forests based on tree height, density and structure. This has resulted in a global map that shows the extent of forested areas at a resolution of 50 metres. The global TanDEM-X forest/non-forest map is now available free of charge to scientific users.

Space-based Earth Observation Applications for Emergency Response and Disaster Risk Reduction

Convinced that space technologies can play a vital role in supporting disaster management, the German Federal Ministry for Economic Affairs and Energy and DLR have been contributing human and financial resources to the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) for the last 10 years. In 2018 this commitment towards the UN- SPIDER office in Bonn, Germany, was renewed through funding for the project Space-based Earth Observation Applications for Emergency Response and Disaster Risk Reduction (SPEAR). Under this initiative, a research team from the University of Bonn cooperates closely with UN-SPIDER staff to enhance the application of space-based applications in disaster management through joint conferences and capacity-building activities. In 2019 the conference was dedicated to the theme "Space-based solutions for disaster management in Africa: challenges, applications, partnerships". Successful technical advisory missions were conducted to Cameroon and Ethiopia.

International Charter Space and Major Disasters

Since 2010, Germany has contributed data from its radar satellites TerraSAR-X and TanDEM-X to the International Charter “Space and Major Disasters”. DLR also supports the Charter’s universal access policy, which allows disaster management authorities of all countries to become users of the International Charter. In 2019, with funding from the Federal Ministry for Economic Affairs and Energy, DLR laid the groundwork for the next five years of strong German support for the International Charter and satellite-based assistance for emergency response after major disasters worldwide.

Humanitarian technology

The DLR Humanitarian Technology Days (6–7 February 2019) brought together approximately 80 scientists and humanitarian experts from the United Nations and non-governmental organizations to exchange ideas and understanding on research demands and needs in humanitarian relief to jointly develop project ideas and for improved technology support in humanitarian actions. Through the presentations, ideation workshops, demonstrations and the marketplace, a process of matchmaking between “problem owners” and DLR experts’ partnerships and project ideas was initiated. During the event, DLR signed an agreement with its long-standing partner the World Food Programme to intensify their successful cooperative efforts. The purpose of the agreement is to develop and implement key technologies for the Zero Hunger mission in order to defeat global hunger by 2030. Another area of focus is establishing a common “thought leadership” to connect research and development activities with the development of new, future-oriented projects.

India

[Original: English]
[20 October 2019]

Indian Space Research Organisation – Headquarters

International cooperation in the peaceful uses of outer space: October 2018 to September 2019

India pursues bilateral and multilateral relations with other countries and space agencies in the peaceful uses of outer space. Over the years, India has signed space cooperation documents with 55 countries and five international bodies, namely: Afghanistan, Algeria, Argentina, Armenia, Australia, Bahrain, Bangladesh, Bolivia (Plurinational State of), Brazil, Brunei Darussalam, Bulgaria, Canada, Chile, China, Egypt, Finland, France, Germany, Hungary, Indonesia, Israel, Italy, Japan, Kazakhstan, Kuwait, Maldives, Mauritius, Mexico, Mongolia, Morocco, Myanmar, Netherlands, Norway, Oman, Peru, Portugal, Republic of Korea, Russian Federation, Sao Tome and Principe, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Syrian Arab Republic, Tajikistan, Thailand, Tunisia, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uzbekistan, Venezuela (Bolivarian Republic of) and Viet Nam; and the European Centre for Medium-Range Weather Forecasts, the European Commission, the European Organization for the Exploitation of Meteorological Satellites, the European Space Agency and the South Asian Association for Regional Cooperation. During the period from October 2018 to September 2019, 17 space cooperation documents with the space agencies of 15 countries were signed. The cooperative activities identified therein include the undertaking of joint satellite missions, sharing expertise in the applications of space technology, sharing Earth observation data, the organization of international events in India and the participation in international events.

The Indian Space Research Organisation (ISRO) and the National Aeronautics and Space Administration (NASA) of the United States are jointly working on the

ISRO-NASA synthetic aperture radar satellite mission. ISRO is conducting feasibility studies with the Centre national d'études spatiales (CNES) of France for a thermal infrared imaging satellite mission and with the Japan Aerospace Exploration Agency for a lunar exploratory mission. The Argos payload from CNES will be accommodated in the ISRO Oceansat 3 satellite. In addition, ISRO conducted an airborne campaign and balloon measurement campaigns with NASA instruments. The Ka-band propagation experiment is being conducted in association with French institutes. ISRO cooperates with CNES and the German Aerospace Centre for professional exchange programmes. ISRO also collaborates with Japan, the Russian Federation and France on the establishment of the Indian regional navigation satellite system reference stations in the respective countries. In addition, to support the ambitious human spaceflight programme of India, ISRO is collaborating with the United States, the Russian Federation, France and Japan on various aspects of human spaceflight technology.

ISRO has announced an eight-week capacity-building programme on nanosatellite development, named UNNATI (United Nations Conference on the Exploration and Peaceful Uses of Outer Space Nanosatellite Assembly and Training by ISRO), as an initiative to commemorate UNISPACE+50. The first group of 29 officials from 17 countries (Algeria, Argentina, Azerbaijan, Bhutan, Brazil, Chile, Egypt, Indonesia, Kazakhstan, Malaysia, Mexico, Mongolia, Morocco, Myanmar, Oman, Panama and Portugal) has successfully completed the training, conducted from January to March 2019, at ISRO. A total of 30 officials from 16 countries have been selected for the second group.

During the sixty-second session of the Committee on the Peaceful Uses of Outer Space, ISRO made two announcements of opportunity to:

- Carry scientific payloads on board sounding rockets for conducting experiments in the region of the atmosphere between 60 and 110 km in altitude[1]
- Use the spent fourth stage of the polar satellite launch vehicle to carry out scientific experiments in orbit[2]

ISRO continues to share its facilities and expertise in the application of space science and technology by conducting short-term and long-term courses through the Indian Institute of Remote Sensing and the Centre for Space Science and Technology Education in Asia and the Pacific, which is affiliated with the United Nations and located in Dehradun. At the time of writing, those courses had benefited more than 2,885 beneficiaries from 109 countries.

The following capacity-building programmes have also been carried out:

- An exclusive sounding rocket launch for officials of the United Arab Emirates space agency
- A short course on space debris and space situational awareness by the European Space Agency for ISRO officials
- A one-week course for officials from Sri Lanka on geospatial technologies for drought and water management
- A specialized one-week training on forest fire monitoring through space technologies for officials from Mexico

ISRO continues to play an active role in the deliberations of the Committee on the Peaceful Uses of Outer Space. ISRO also actively participates in the meetings of prominent multilateral forums, including the International Astronautical Federation, the International Academy of Astronautics, the International Institute of Space Law, the Committee on Earth Observation Satellites, the International Society for Photogrammetry and Remote Sensing, the Coordination Group on Meteorological

[1] See www.isro.gov.in/update/17-jun-2019/announcement-of-opportunity-ao-sounding-rockets.
[2] See www.isro.gov.in/update/15-jun-2019/announcement-of-opportunity-ao-orbital-platform.

Satellites, the International Committee on Global Navigation Satellite Systems, the Committee on Space Research, the International Space Exploration Coordination Group and the Inter-Agency Space Debris Coordination Committee.

The Government of India is in the process of enacting legislation to support the overall growth of national space activities with a higher level of participation of various agencies, including public, non-governmental and private sector stakeholders, in compliance with its obligations under international treaties on space activities. Once enacted by Parliament, the proposed legislation will support the pursuance of space activities by various agencies in India, including the private sector and start-up companies in the aerospace sector, pending due authorization by the central Government.

Italy

[Original: English]
[21 October 2019]

National space policy

In March 2019, the Inter-Ministerial Committee for Space and Aerospace issued the government guidelines on space and aerospace, which identify the strategic sectors and the specific policies, programmes, plans and strategies to be defined by the relevant governmental entities, stressing in particular the importance of international cooperation, both at the bilateral and multilateral levels. The Italian Space Agency (ASI) is consequently elaborating a national space policy strategy and a space strategic vision in line with those guidelines, as mandated under the new law on Italian space governance.

Contribution to the 2030 Agenda for Sustainable Development

Launched in 2016 as a contribution to UNISPACE+50 and to the achievement of the Sustainable Development Goals, the International Space Forum, a ministerial-level initiative that is aimed at increasing the involvement of universities and scientific institutions in decision-making related to space activities, was convened for its fourth edition in 2019, with a regional chapter dedicated to the Mediterranean region. The Forum is built on the assumptions that space activities require a high level of scientific and technical knowledge and a multidisciplinary approach, and that academic institutions represent an immense reservoir of knowledge and human talent that is very well distributed all over the world and characterized by a great propensity for cooperation. Greater interaction between the academic world and established space actors would facilitate the dissemination and sharing of space knowledge, in particular in favour of developing countries, improve awareness of the benefits of space technologies and applications and, finally, contribute to the search for better space solutions to global and regional challenges and for achieving the Sustainable Development Goals. Following the regional chapters dedicated to Africa and Latin America and the Caribbean, the Mediterranean chapter was held on 5 September 2019 in Reggio Calabria, Italy. Fourteen countries, nine space agencies and nine international space organizations were represented. The Forum was jointly held by ASI, the International Astronautical Federation and the Mediterranea University of Reggio Calabria. Mediterranea University was the first academic institution to ever be involved in the organization of the Forum. Several local universities and scientific institutions also attended the Forum as observers, which demonstrates the growing interest of academia in the initiative.

At the end of September 2019, as a follow-up to the African chapter of the International Space Forum, ASI published an announcement of opportunity to invite people from African countries to apply for a training course on remote sensing, space sciences and space policy schedule to take place at the Luigi Broglio Space Centre, in Malindi, Kenya, from 9 to 13 December 2019. The course is organized by ASI in

collaboration with the Kenya Space Agency and with the support of the Office for Outer Space Affairs. Participants will acquire basic knowledge and training on remote sensing, with an emphasis on the Constellation of Small Satellites for Mediterranean Basin Observation (COSMO-SkyMed) and other ASI programmes and services; space sciences and observations, using real data from satellites; and key current space policy issues that affect space programmes. The training course will also contribute to international cooperation by providing participants with an opportunity to exchange information and establish contacts. Ten selected participants will be offered financial support to attend the course, with due regard paid to gender balance.

Space science and exploration

ASI is providing a strong contribution to the efforts of the international scientific community towards the understanding of the laws of physics and the evolution of the universe. It is actively supporting and participating in a large variety of space missions currently ongoing (e.g., LISA Pathfinder, the Alpha Magnetic Spectrometer, the Calorimetric Electron Telescope, Gaia, the X-ray multi-mirror mission, the Neil Gehrels Swift Observatory and many more) to measure the properties of the messengers of the universe (electromagnetic waves, cosmic rays, gravitational waves, solar radiation, etc.) and, consequently, to achieve breakthroughs in the fields of astrophysics, cosmology and fundamental physics.

Under ASI management, Italy built the telescope that will be carried on board the European Space Agency (ESA) CHEOPS satellite for the search of exoplanets, with a launch planned for December 2019. In 2019, Italy also delivered to ESA the miniaturized Mars Multispectral Imager for Subsurface Studies for the ExoMars 2020 mission, as well as the Multi-Element Telescope for Imaging and Spectroscopy and the Solar Wind Analyzer for the Solar Orbiter mission, for a launch planned in February 2020.

Space transportation

In 2019, Italy increased its participation in the European scenario for suborbital activities, taking part in the creation of the European Commercial Spaceport Forum and the European Group on Suborbital Flight Regulation. During the same period, Italy started a complex procedure for regulating suborbital activities over the Italian territory and founded the first European commercial spaceport, in the Taranto-Grottaglie airport.

With regard to launchers, Italy continues its participation in the development of the Vega launchers, especially the Vega-C. The first firing tests of the qualification models of the first-stage engine P120 and of the second-stage engine Z40 were successfully completed in January and May 2019, respectively.

Earth observation

Italy is developing two second-generation satellites of COSMO-SkyMed for Earth observation. The first of the two satellites is planned to be launched at the end of 2019. The second-generation satellites will introduce important innovations that will allow the constellation to remain at the cutting edge of radar technology.

In 2019, COSMO-SkyMed data were used to support the response to several emergencies. Such data were thus provided to the relevant authorities for monitoring and managing the eruption of the Etna and Stromboli volcanos. At the international level, data were provided to the Japan Aerospace Exploration Agency (JAXA), within the framework of the ASI-JAXA cooperation for satellite support to disaster risk management, to support Japanese authorities in responding to the June earthquake.

On 21 March 2019, Italy launched a new Earth observation satellite called PRISMA. PRISMA is a hyperspectral satellite equipped with innovative electro-optical instrumentation capable of capturing images in the spectral band from 400 to 2,500 nanometres and of identifying chemical and physical characteristics of

the Earth surface. The mission provides a unique contribution to the observation of natural resources and the study of key environmental processes, such as the interaction between atmosphere, biosphere and hydrosphere, the observation of global climate changes and the impact of human activities on ecosystems.

Human spaceflight

Italy is actively engaged in space exploration, both robotic and human, and participates in all major initiatives of the international space community. It also participated in the activities of the Action Team on Exploration and Innovation, established under the framework of the Committee on the Peaceful Uses of Outer Space. In addition, Italy is deeply involved in the International Space Exploration Coordination Group, which comprises 19 space agencies.

On 20 July 2019, the Italian astronaut Luca Parmitano, member of the ESA European Astronaut Corps, left Earth from the Russian base of Baikonur, in Kazakhstan, aboard Soyuz MS-13 to reach the International Space Station. There he will perform some 200 experiments, 6 of which have been selected by ASI, as a scientific complement to his ESA mission called “Beyond”. The six experiments will make use, for the first time, of on-board resources coming from different agencies. Two will make use of ASI resources resulting from the strategic partnership between ASI and the National Aeronautics and Space Administration of the United States of America (NASA), three will make use of ESA resources, thanks to an ad hoc bilateral agreement between ESA and ASI, and the sixth experiment will make use of Roscosmos resources and will be the first Italian experiment to be operated inside the Russian segment of the Station. This sixth experiment stems from a wide international scientific cooperation, named “Extreme Universe Space Observatory”, led by Moscow State University and the University of Rome Tor Vergata.

Lao People’s Democratic Republic

[Original: English]
[15 October 2019]

Summary

Laosat-1 was launched by an LM-3B/E rocket from the Xichang Satellite Launch Centre on 20 November 2015, at 1707 hours (UTC). After the launch and early orbit phase, the satellite was positioned successfully at 128.5° East, on 27 November 2015.

To date, the spacecraft (subsystems and units) and all the payload equipment have been performing reliably without experiencing any critical anomalies. The satellite is operating well and all on-board equipment, including the primary and redundant equipment, is functioning correctly.

The measured performance of solar array and battery indicates that sufficient power margin will be available until the satellite end of life.

Satellite payload

Laosat-1 is equipped with C-band and Ku-band payload consisting of the antenna subsystem and the repeater subsystem. There are two antennas, 14 C-band active transponders and 8 Ku-band active transponders.

Station keeping

Laosat-1 is positioned at 128.5° East and the station-keeping manoeuvres performed include East-West station-keeping manoeuvres, North-South station-keeping manoeuvres and double-pulse manoeuvres.

With regard to current orbital elements, as at 17 August 2019, the orbital elements, as calculated on 19 August 2019, were as follows:

- Semimajor axis (m): 42166117.259000
- Eccentricity: 0.000218
- Inclination (degree): 0.083469
- Right ascension of ascending node (degree): 88.636003
- Argument of perigee (degree): 41.921185
- Mean anomaly (degree): 98.163820

Satellite ground control stations

The single ground control station for the monitoring and control of Laosat-1 is located at a satellite control facility in Vientiane.

The Ministry of Posts and Telecommunications of the Lao People's Democratic Republic has been actively involved in the design, development, launch and operation of satellites since 2015. The Laosat-1 operation team was also initially trained in all aspects of satellite control and operations in China.

The operation team has the backup support of a large number of Laosat-1 engineers who have been extensively trained by the China Association for Science and Technology in satellite design, development, manufacturing and testing in China. The team also enjoys the support of other highly qualified, trained and experienced Laosat-1 engineers who have been closely involved in the satellite system and subsystem design and in its product assurance.

Payload operations

The satellite payload services are monitored 24/7 at the station of the Lao People's Democratic Republic by Laosat-1 engineers. All the equipment used for this purpose is also backed up by sufficient redundancy on site.

A payload capacity of more than 12 transponders has been leased out to numerous national and international customers, which are satisfied with the quality of services supported by the satellite.

Conclusion

No critical or major anomalies have so far occurred or been detected on the satellite. Since its launch, the satellite has been performing in line with its designed specifications and supporting various types of communication services, and all statuses on the satellite are normal. Most of its payload capacity has already been leased out to numerous national and international customers, and most of the services are running.