



General Assembly

Distr.: General
9 November 2017
English
Original: Chinese/English/Spanish

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-fourth session, 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.105/1138](#), para. 42).
2. In a note verbale dated 26 July 2017, the Secretary-General invited Member States to submit their reports by 16 October 2017. 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]
[16 October 2017]

Austrian space sector: new edition of the brochure entitled “Austrian Technology in Space”

A new edition of the brochure entitled “Austrian Technology in Space” has been issued and is available from www.spacetechnology.at. This portal gives an overview of the Austrian space industry and related research. It helps users search for and find organizations by their technological competences and products. The overview shows the increasing importance of the sector in Austria: more than 120 Austrian organizations are active in the space sector, which has an annual turnover of about 125 million euros and about 1,000 employees. Austria is represented in both the upstream and the downstream sectors. The majority of organizations are active in the satellite-based applications segment. Intellectual capital is reflected by an average of about 20 patents and slightly more than 1,000 publications per year. Austria is one of the most cited nations in the field of solar system exploration (see www.spacetechnology.at).

Coordination and organization in Austria

The Federal Ministry for Transport, Innovation and Technology of Austria is the Austrian ministry that administers space-related activities. The Austrian Aeronautics and Space Agency implements the strategy of the Federal Ministry for Transport, Innovation and Technology. The Austrian Space Strategy was formulated in 2012 and will remain in effect until 2020. Austria participates in European Space Agency (ESA) programmes for Earth observation, telecommunications, technology development, scientific instruments and exploration, launchers, satellite navigation and space situational awareness.

In addition, Austria is a co-owner of European Union space infrastructure such as Copernicus (Earth observation) and Galileo (navigation), as well as infrastructure for space surveillance and tracking and the Horizon 2020 programme (research and innovation on space technologies).

The Austrian Space Applications Programme is managed by the Austrian Research Promotion Agency and has been running since 2002. It is a bottom-up research and development funding programme in support of and complementary to bilateral and European programmes in the areas of technology development, space science and the application of space technology. It is aimed at strengthening the position of Austrian industry, promoting the ideal use of space technology and supporting international and bilateral cooperation in space. A cooperation agreement concluded between the national space programmes of Austria and Switzerland addresses common themes and issues in its 2017 call for proposals. Several projects with relevance to developmental aid and/or the United Nations Platform for

Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) have been funded in recent years. The programme also funds Austrian support to the activities of the Office for Outer Space Affairs of the Secretariat and UN-SPIDER through voluntary cash and in-kind contributions (see www.bmvit.gv.at/innovation/raumfahrt/weltraumprogramm.html).

In recent years, several new initiatives have been launched with the cooperation of ESA, including those listed below.

European Space Agency Business Incubation Centre and Ambassador Platform

The ESA Business Incubation Centre in Austria is a resource for entrepreneurs from research centres, universities and space-related and non-space-related businesses seeking to realize their innovative ideas and transfer technologies (e.g., navigation, telecommunications, satellite data) from space to other areas of the economy (e.g., logistics, health, tourism, environment, energy). Launched in 2016, the Centre is managed and coordinated by Science Park Graz in close partnership with accent Wiener Neustadt (see www.esa-bic.at).

With the objective of creating new and sustainable businesses, the ESA Ambassador Platform in Austria fosters engagement between both space and non-space players from industry and academia in national and international partnerships.

In addition, it serves as a starting point for performing business and technical feasibility checks, undertaking demonstration and pilot projects and obtaining both technical expertise and funding from ESA and industry partners (see <http://business.esa.int/ambassador-platforms/apaustralia>).

European Space Education Resource Office

The European Space Education Resource Office (ESERO) project is the European Space Agency's main way of supporting science education in primary and secondary schools. The Austrian office is hosted by Ars Electronica in Linz, Austria. ESERO Austria uses the space context to awaken and increase interest in science, technology, engineering and mathematics. It provides training sessions for teachers, as well as innovative teaching materials and tools. It thus inspires young people to pursue science-related studies and careers, in particular in the space domain (see www.aec.at/esero).

European Space Agency Broker Austria

ESA has established a network of technology brokers aimed at assessing market needs in areas where there is the potential to exploit space technologies. Brimatech Services is the ESA technology broker for Austria. Brimatech conducts market analysis and mediates technology transfers between the space sector and non-space industries. The goal is to make Austrian technologies and intellectual property accessible to European non-space industries and start-ups.

European Space Policy Institute

The European Space Policy Institute aims to provide decision makers with an independent view on mid- to long-term issues relevant to the use of space, with the goal of supporting space as a strategic policy area for Europe. In that connection, it provides recommendations, policy options and forward-looking vision as to how European engagement in space can bring maximum benefit to society. The Institute's work also reflects the importance of international cooperation in the international space sector and sustainability in global space activities. The Institute's Eleventh Autumn Conference, on the theme "Innovation in the new space economy", was held on 12 and 13 September 2017 (see www.espi.or.at).

National Point of Contact for Space Law Austria

The National Point of Contact for Space Law Austria acts as an interface between the European Centre for Space Law and persons interested in space law in Austria. It is coordinated by Irmgard Marboe of the Department of European, International and Comparative Law of the Law Faculty at the University of Vienna. Its main objective is the promotion and development of space law in Austria. Its work is focused on enhancing space law in research and teaching, as well as on raising public awareness of space law through the annual publication of the *Austrian Space Law Newsletter* and the organization of space law-related events and conferences.

Recent events include the symposium on the theme “Looking to the future: changing international relations and legal issues facing space activities”, held at the Law Faculty at the University of Vienna on 11 June 2016, which was organized in cooperation with the Institute of Space Law of the Beijing Institute of Technology and the Space Policy Institute of George Washington University; the evening event on the theme “Planetary defence: technical, legal and economic aspects”, held at the natural history museum in Vienna on 2 February 2017; and the United Nations/Austria symposium on the theme “Access to space: holistic capacity-building for the twenty-first century”, held in Graz, Austria, from 3 to 7 September 2017, which was organized together with the Office for Outer Space Affairs and the Technical University of Graz in preparation for the celebrations of the fiftieth anniversary of the United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50) (see www.spacelaw.at).

Summer School Alpbach

Held annually since 1975, the Summer School Alpbach is a talent incubator for European space issues. Each year, about 60 participants selected from among the member and cooperating States of the European Space Agency carry out in-depth studies on different space research topics. Over 10 days, graduate and postgraduate students, young scientists and engineers develop concepts for future and innovative satellite missions. The topic of the Summer School Alpbach 2017 was “Dust in the universe”. From 18 to 27 July 2017, the participating students attended stimulating lectures on dust in the universe, its composition and structure and associated scientific challenges, justifications and methods for observing dust remotely, and various aspects of space science and technology. The students worked intensively to define and design a space mission, all under the supervision of noted scientific and engineering experts within the field (see www.summerschoolalpbach.at).

Austrian nanosatellites: a new field of competence

Within the last decade, a new field of competence has emerged in Austria: the so-called nanosatellites, which are small satellites with a mass between 1 and 10 kg. Increasing expertise in and the development of nanosatellites has also made the formulation of an appropriate legal framework necessary. Consequently, the Austrian Outer Space Act was adopted in 2011 and the Austrian Outer Space Regulation followed in 2015.

Following the launch of the first two Austrian satellites, BRITE-AUSTRIA/TUGSAT-1 and UNIBRITE, in 2013, the nanosatellite PEGASUS became the third Austrian satellite to be launched into outer space. The 2-Unit CubeSat was successfully launched on 23 June 2017 by the Indian Polar Satellite Launch Vehicle PSLV-C38 from the Satish Dhawan Space Centre in Sriharikota, India. The satellite was developed by a team consisting of representatives of the University of Applied Sciences in Wiener Neustadt, the Space Team of the Vienna Technical University and the Space Tech Group.

PEGASUS is part of the QB50 project, which is coordinated by the von Karman Institute for Fluid Dynamics, Belgium. The main objective of the project is to conduct atmospheric research in the thermosphere using a network of 36 nanosatellites that were built by universities and research institutions in 23 different countries.

PEGASUS is equipped with a set of Langmuir probes to perform plasma measurements and provide information about essential properties of plasma in the thermosphere, such as the temperature and density of electrons. The results will allow for the improvement of atmospheric models that are used for, inter alia, weather forecasting and assessments of phenomena such as the depletion of the ozone layer. The communication with the satellite is conducted via four ground stations distributed throughout Austria. All data generated by PEGASUS are downloaded upon command and stored on a dedicated server operated by the Space Tech Group.

Brazil

[Original: English]
[17 October 2017]

Contributions of the National Institute for Space Research regarding the recommendations made by the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space at its fifty-fourth session

The National Institute for Space Research (INPE) currently has 49 formal cooperation agreements in force with foreign entities. Among the current cooperation instruments are memorandums of understanding, letters of intent, cooperation programmes, intellectual property agreements for research and technical and software licence agreements. The agreements can be viewed at www.inpe.br/ingles/institutional/about_inpe/aci/agreements.php.

Cooperation agreements have been concluded in the areas of science and technology, academia, capacity-building and education, as well as for the purposes of carrying out specific scientific and technological projects and for data-sharing and infrastructure, among others.

Among the cooperation instruments in force are agreements with Argentina, Canada, China, France, Germany, India, Italy, Japan, Mozambique, the Netherlands, the United Kingdom of Great Britain and Northern Ireland and the United States of America, as well as agreements with international organizations, including the Food and Agriculture Organization of the United Nations, the International Center for Relativistic Astrophysics, the Permanent Secretariat of the Amazon Cooperation Treaty Organization and the European Centre for Medium-Range Weather Forecasts.

During the period September 2016 to August 2017, the following agreements were signed:

- (a) Letter of intent for academic cooperation with Delft University of Technology, the Netherlands, on 5 September 2016;
- (b) Intellectual property agreement with the University of Leeds, United Kingdom, on 20 September 2016;
- (c) Intellectual property agreement with the National Centre for Scientific Research (CNRS) of France, on 9 September 2016;
- (d) Cosmic Data Analysis and Archive Center/University Corporation for Atmospheric Research software usage licence agreement with the University Corporation for Atmospheric Research, United States, on 27 September 2016;
- (e) Letter of intent for academic cooperation with the Digital Globe Foundation, United States, on 28 September 2016;
- (f) Academic cooperation agreement for the implementation of the project "Climate Science for Service Partnership Brazil" with the Met Office of the United Kingdom and the National Centre for Monitoring and Early Warning of Natural Disasters (CEMADEN) and the National Institute for Amazon Research (INPA) of Brazil, on 1 December 2016;

(g) Cooperation agreement with the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), on 1 December 2016;

(h) Intellectual property agreement with the University of Maryland, United States, on 30 January 2017;

(i) Consortium agreement on the CLIMAX Project, with CNRS, the Commission for Alternative and Atomic Energy and the Research Institute for Development of France, the Munich Technical University and the Potsdam Institute for Climate Impact Research, Germany, and Wageningen Environmental Research (Alterra) of the Wageningen Research Foundation, the Netherlands, on 27 February 2017;

(j) Licence agreement for use of GIPSY-OASIS II software, with the California Institute of Technology, United States, on 19 May 2017;

(k) Agreement between the European Centre for Medium-Range Weather Forecasts, the Ministry of Science, Technology, Innovation and Communication of Brazil and INPE, on 1 August 2017;

(l) Amendment No. 8 to technical assistance agreement 2780-11H UCAR/Constellation Observing System for Meteorology, Ionosphere and Climate, on 4 August 2017;

(m) Agreement on space weather cooperation with the University of La Plata, Argentina, on 8 August 2017.

In the period September 2016 to August 2017, INPE received 28 foreign delegations for campus visits and meetings. The delegations that visited INPE during that period were from Argentina, China, France, Germany, Iran (Islamic Republic of), Indonesia, Japan, the Netherlands, Paraguay, Portugal, the Russian Federation, Sweden and the United States. The visits received, as well as the schedule for each of the delegations, can be found at www.inpe.br/ingles/institutional/about_inpe/aci/visits.php.

Regarding current cooperation, the following are highlighted: (a) cooperation with China on the development, launch and operation of the CBERS-4A satellite; (b) cooperation with China on the implementation and operation of the Sino-Brazilian Laboratory; (c) cooperation with the Amazon Cooperation Treaty Organization, implemented by the Amazon Regional Center (CRA); and (d) cooperation with the Friedrich Schiller University of Jena, Germany.

In November 2016, the supplementary protocol for the development of the CBERS-4A satellite was ratified by the National Congress of Brazil and sanctioned by the President. During the first half of 2017, contracts were concluded with domestic industry actors for equipment and subsystems, as well as inputs, parts and materials to be used in the assembly, integration and testing activities of the satellite. The documentation for the satellite launch service and international parts and equipment contracts has been completed and is in the legal evaluation phase.

Within the framework of the Sino-Brazilian Space Weather Laboratory, the first China-Brazil Workshop on Space Science was held in December 2016. The purpose of the event was to promote collaborative projects relating to scientific research and the development of technological applications in the space weather area, and to discuss the progress of planned activities in the areas of: (a) space science (joint campaigns and studies); (b) space weather (space mission and terrestrial network); (c) remote sensing; and (d) space debris.

Under the joint project of the Amazon Regional Centre and the Amazon Cooperation Treaty Organization, the first online course on the subject of monitoring tropical forests was held in the first half of 2017, with participants from the Amazon basin invited by the project.

Under the cooperation agreement with the University of Jena, four students from the Master's in Space Technologies programme of the University of Jena visited INPE

and participated, for periods of three to four months, in project teams at the Integration and Testing Laboratory and at the Coordination of Engineering and Space Technologies.

Finally, the international research related to the Laser Interferometer Gravitational-Wave Observatory (LIGO) was announced as the winner of the 2017 Princess of Asturias Award for Scientific and Technical Research. Promoted by the Princess of Asturias Foundation of Spain, the award was awarded to the LIGO group for “responding to one of the most important challenges in the history of physics”. INPE is the only Brazilian research institution to participate in this collaboration.

Contributions of the Brazilian Space Agency regarding the recommendations made by the Scientific and Technical Subcommittee at its fifty-fourth session

International cooperation is a pivotal component of the progress of space programmes, especially in developing countries. International partnerships are a growing trend in this field. Their enhancement enables countries to share common interests and objectives, increase their investments in the sector, share costs and risks, address challenges in a coordinated and collaborative way, and enjoy the benefits of space science. International cooperation is also a key element in mitigating the risks of conflict in space, since it fosters the sharing of goals and, consequently, interest in preserving the use of space for peaceful uses only.

Brazil carries out relevant space cooperation activities with several countries. The following paragraphs summarize the latest developments in this area.

China

Cooperation between Brazil and China in space has no equivalent in the developing world. Space-related cooperation between Brazil and China allows for the joint development of technologies and training. It is in line with the strategic objectives of the Brazilian space programme, especially with regard to the expansion and consolidation of the national space industry. In August 2016, the National Congress of Brazil ensured the continuity of the China-Brazil Earth Resources Satellite (CBERS) programme by approving the protocol for the joint development of the CBERS-4A satellite. The next meeting of the CBERS Joint Programme Committee was to take place in October 2017. This important cooperative arrangement, which has led to the successful launch of four satellites so far, will celebrate its thirtieth anniversary in August 2018. Brazil and China also have a partnership in the educational field, with a focus on the participation of Brazilian scientists in Master’s programmes at Beihang University in Beijing. In September 2017, three Brazilian researchers started their studies at Beihang University.

Russian Federation

In April 2017, a Russian telescope was inaugurated at the Pico dos Dias Observatory in Brazil. This project is the result of a cooperation agreement between the Brazilian Space Agency (AEB) and the Russian State Space Corporation Roscosmos on space debris monitoring. The station also provides important input to Brazilian scientific and technological education, owing to its contribution to research and development on data and applications.

Germany

The first qualification flight of the Microsatellite Launching Vehicle (VLM-1), a partnership between Brazil and Germany, is scheduled to take place in 2019 from the Alcântara Launch Centre, in Maranhão, Brazil. The success of its flight will be an important milestone for Brazil, accomplishing the country’s goal of having a full space mission. A letter of intent between AEB and the German Aerospace Centre (DLR), signed in March 2016, offers the framework for the development of the structure of a low-cost S50 motor envelope, with a bank-burn test scheduled for the

end of 2018. This new project involves the company MT Aerospace, partner of the German institute, AEB and the Brazilian Institute of Aeronautics and Space (IAE).

France

The main cooperation activity involved a project to develop the Geostationary Defence and Strategic Communications Satellite (SGDC). The technology transfer project resulting from the acquisition of SGDC contributes to increasing the technological level of the Brazilian space industry, with the aim of increasing the national contribution to the development of future satellites. The acquisition of SGDC also provided the opportunity for the specialized training of several Brazilian engineers employed by the satellite provider company. The satellite was successfully launched from Kourou Space Centre in French Guiana in May 2017.

United States

The activities of the Global Learning and Observations to Benefit the Environment (GLOBE) Programme in Brazil began in June 2016, with the first GLOBE-Brazil workshop. In 2017, three additional workshops were held, aimed at bringing the GLOBE Programme to other Brazilian states. One important contribution initiated in 2017 was a GLOBE-National Aeronautics and Space Administration (NASA) of the United States project involving collection of data on and scientific studies of *Aedes aegypti* mosquito larvae and the launch of the Mosquito Habitat Mapper mobile application. The GLOBE Programme is active in the cities of Brasília, São José dos Campos, Rio de Janeiro and the coastal region of Paraná. The programme network comprises 117 schools.

Brazil, Russian Federation, India, China and South Africa

In September 2017, Brazil held the first BRICS Remote Sensing Satellite Constellation Forum, which had a friendly, pragmatic and constructive atmosphere. Delegations from Brazil, the Russian Federation, India, China and South Africa (the BRICS countries) expressed their satisfaction with the opportunity for technical teams to jointly discuss the prospects of the BRICS remote sensing satellite constellation. During the meeting, the participants discussed the BRICS fleet, the BRICS ground segment, exchange of information and technical data, and common applications.

Other projects carried out by the Brazilian Space Agency

Amazônia-1

The first remote sensing satellite to be built and operated entirely by Brazil. The satellite will be used for ground observation using the 64 metre-resolution wide-field imager camera.

Wide Field Imager

Previously used in CBERS-4. Some important subsystems have already been finalized. The Amazônia-1 launch is scheduled for 2019.

Space Technology Vocational Centre

The Space Technology Vocational Centre (CVT Espacial) was created in 2014 by AEB in partnership with the Ministry of Science, Technology, Innovation and Communication and the Barreira do Inferno Launch Centre. Its main goal is to support the qualification and technological training in space issues, and to disseminate, throughout the north-eastern region of Brazil, space technology through practical activities. The inauguration of the Centre is scheduled for November 2017.

China

[Original: Chinese]
[23 October 2017]

In 2017, China made progress in space launches, satellite applications and international cooperation, as described below.

1. Space launches

Since the beginning of the year, China has conducted a total of 10 space launches, sending 21 space vehicles into space.

In the area of human space flight, China has made important progress. In April, the Tianzhou-1 cargo spacecraft was successfully launched, which proceeded to complete its orbital flight around the Tiangong-2 space lab, as well as a test of automated rapid rendezvous and docking with it. As a result, tasks for the second phase of the country's human space flight programme have been fully accomplished.

Regarding communications satellites, the first high flux volume telecommunications satellite of China, Practice-13, was launched successfully on 12 April. It is the first time that such a high-orbit satellite project has been undertaken with electric propulsion systems autonomously developed in China. Its communication capacity amounts to 20 Gb/s in total, exceeding the combined total of all telecommunication satellites previously developed and launched into space by China.

Regarding remote sensing satellites, the task of launching the Venezuelan remote sensing satellite VRSS-2 came to a successful conclusion on 10 October. Its applications are mainly intended for surveying land resources, environmental protection, disaster monitoring and management, crop estimation and urban planning.

In terms of technological experimentation satellites, a new experimental satellite, Tiankun-1, was launched on 3 March and entered smoothly into its pre-set orbit. Its main purpose is to carry out remote sensing, telecommunications and validation tests of small satellite platforms. On 15 June, China successfully launched its first X-ray astronomical satellite, which significantly enhanced its national programme to develop large scientific satellites and filled the gap in its provision of X-ray satellites for space exploration.

Unfortunately, launch vehicle LM-5/YZ-2 ended in failure during its lift-off on 2 July 2017. Backtracking investigations and thorough examinations for a renewed start are under way. The planned launch of the Chang'e-5 mission has thus been postponed.

2. Satellite applications

In 2017, the Government of China accelerated the construction and operationalization of a space-based information corridor for its Belt and Road Initiative, applying space technology extensively to various fields such as meteorology, environmental monitoring, disaster mitigation and relief, and space science in order to provide additional impetus to economic development, improvement of livelihoods and scientific and technological advances in countries and regions along the "Belt and Road" routes.

In the area of remote sensing applications, the country's meteorological satellite Fengyun-4 captured its first images and data on 27 February, which represented a successful upgrade to a new generation of geostationary meteorological satellites. In March, Chinese scientists generated the first satellite interference synthetic-aperture radar images in China by using the Gaofen-3 high-resolution radar imaging satellite, marking a breakthrough from nil in the country's capacity in satellite synthetic-aperture radar imaging interferometry.

In the area of space science, the world's first quantum scientific experimentation satellite, Micius, was officially delivered to its intended client on 18 January. It lays the scientific and technological foundation for the development of quantum communication technology and for cutting-edge research and testing, on the outer space scale, involving fundamental issues in quantum physics. It represents a solid step towards the future realization of global coverage by a quantum-based confidential communications network.

3. Major international conferences

On 24 April 2017, China celebrated its second Space Day of China. A major event dedicated to the theme "Space for a better life" was successfully held in Xi'an, China. Simonetta Di Pippo, Director of the Office for Outer Space Affairs of the Secretariat, attended the event and, together with representatives of several States members of the Committee, observed the lift-off of China's Tianzhou-1 cargo spacecraft, witnessing an important moment in the history of Chinese astronautic development.

On 14 May, the first Belt and Road Forum for International Cooperation was successfully convened in Beijing. The Government of China is enhancing its efforts to promote the construction and utilization of a space-based information corridor for the Belt and Road Initiative, providing support for space-derived information for the economic development and improvement of livelihoods in countries and regions along the "Belt and Road" routes.

On 6 June, the Global Space Exploration Conference 2017 was held in Beijing, bringing together approximately 1,000 guests and representatives from 51 countries and territories around the world to explore opportunities for global activities in deep space exploration.

From 3 to 5 September, leaders from Brazil, the Russian Federation, India, China and South Africa (the BRICS countries) gathered in Xiamen, China, for a successful summit meeting, during which space was identified repeatedly as an important area of cooperation. At the meeting, the importance of the remote sensing satellite constellation to the economic and social development of the BRICS countries was highlighted.

On 23 and 24 November 2017, China and the International Academy of Astronautics (IAA) will jointly hold the Seventh International Conference on Advanced Space Technology, in Shanghai, China, with the aims of building a useful platform for space scientists and researchers and expanding, both in depth and breadth, international academic exchanges and cooperation in space.

4. International cooperation

As of October 2017, China had signed a total of nine intergovernmental agency agreements.

Regarding deep space exploration, China signed a series of memorandums of understanding on cooperation in respect of the Chang'e-4 mission with Germany, Saudi Arabia and Sweden, giving strong impetus to the cooperation efforts of China in deep space exploration.

Regarding remote sensing satellites, China signed memorandums of understanding on cooperation with the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the French Space Agency (CNES) and the Egyptian National Authority for Remote Sensing and Space Sciences that initiated and enhanced cooperation in the field of remote sensing satellites.

With respect to mechanisms for space cooperation, China organized subcommittee meetings on space cooperation with ESA, CNES and the Russian State Corporation for Space Activities (Roscosmos), which further enhanced bilateral cooperation in space.

Denmark

[Original: English]
[29 September 2017]

Annual report on space activities of Denmark in 2016

Denmark has signed and ratified four United Nations treaties on outer space: the Outer Space Treaty, the Rescue Agreement, the Liability Convention and the Registration Convention.

In accordance with the Danish Outer Space Act, the Minister had, by 15 November 2016, established a public registry of space objects. This registry contains information about space objects launched into earth orbit or beyond for which Denmark is the launching State.

Also in accordance with the Danish Outer Space Act, all Danish satellites that had already been launched were registered at the end of 2016, both nationally and in the Register of Objects Launched into Outer Space, and new space objects have been and will be added after their launch.

Space activities in 2016

One Danish satellite was launched in 2016: AAUSAT4. The satellite was approved by means of a provisional act by the Danish Parliament (*Folketinget*), because the launch took place on 25 April, which was before the Danish space authority was established in accordance with the new Outer Space Act.

AAUSAT4 is a student 1U CubeSat from Aalborg University; the purpose is primarily educational. The AAUSAT4 CubeSat is a pilot project of the ESA “Fly Your Satellite!” CubeSat education programme. The most important components are designed by engineering students, e.g., an automatic identification system receiver. The satellite was launched on 25 April 2016 on board a Soyuz-STA Fregat-M from French Guiana (France). Re-entry is expected to occur in 2019.

In 2016, Denmark did not conduct any national research on space debris, the safety of space objects with nuclear power sources on board or problems relating to collision with space debris.

Germany

[Original: English]
[13 October 2017]

The German Aerospace Centre (DLR) is where the country’s national and international space flight activities converge. Space research is carried out by the research institutes of DLR and includes a strong international dimension (e.g., cooperation with partner institutions of different types), whereas policy issues are the remit of the Space Administration of DLR, which acts as the national space agency and is responsible for carrying out national and international space-related activities on behalf of the Federal Government.

Even though some programmes remain within national boundaries, many can only see the light of day through international partnerships and cooperation. DLR represents Germany on the Council of the European Space Agency (ESA), which initiates ambitious space missions by pooling investments.

For the European space calendar, the year started with the launch of the Spanish satellite Hispasat 36W-1 in January 2017. It weighs only 3 tons and is therefore comparatively light for a telecommunications satellite. The satellite, developed by the Spanish telecommunications provider Hispasat, is the first in the ESA SmallGEO programme, led by Germany. The satellite platform and its payload were built on

behalf of ESA, with German space companies being the main contractors. A total of 12 ESA member States are involved in the programme.

Another ESA mission reached a milestone in 2017: in June, the Agency gave the go-ahead for the further development of the PLATO space telescope. PLATO is the next large-scale European space mission; it will search for and characterize exoplanets. The primary goal of the mission is to look for Earth-like planets that show signs of having liquid water – in other words, planets that have the potential to support life. A consortium of several European research institutions will provide the payload (a scientific instrument comprising 26 telescopes and cameras), the on-board computer, the data centre and the scientific data analysis. DLR will head the consortium and will also take on joint responsibility for the readout electronics of the fast telescopes, as well as for the computer on board the spacecraft.

The proven cooperation between the European Union and ESA ensures further successful joint European space activities, such as the fruitful European Earth Observation Programme (Copernicus).

The Copernicus satellites Sentinel-1, Sentinel-2 and Sentinel-3 are already operational. In March 2017, the European Earth observation satellite Sentinel-2B was launched from the European spaceport in French Guiana. Together with its “twin satellite”, Sentinel-2A, the new environmental monitoring system doubles the recording frequency. Sentinel-2 will also provide information about the condition of forests and landlocked bodies of water, including important fundamental data required to counter global impacts on natural resources. Important components of the instruments and platform were manufactured by various companies in Germany, which is also where the platform was assembled. The laser communication terminals installed on all Sentinel satellites were developed and built in Germany and use the European Data Relay System to ensure rapid and secure data transmission to the ground station. With the planned launch of Sentinel-5P at the end of 2017, the first Copernicus mission dedicated to monitoring the Earth’s atmosphere will be brought into orbit.

With the successful launches of 12 European Satellite Navigation System (Galileo) satellites in 2015 and 2016, the development of the ambitious European navigation system Galileo is proceeding.

The Stratospheric Observatory for Infrared Astronomy (SOFIA) is a joint project of DLR and the National Aeronautics and Space Administration (NASA) of the United States of America. The numerous 10-hour-long flights have been so successful that DLR and NASA extended the service life of SOFIA until 2020. From June to August 2017, SOFIA visited New Zealand for the fourth time and took advantage of the long winter nights there. This campaign will use two significantly improved versions of the German Receiver for Astronomy at Terahertz Frequencies (GREAT) instrument: UpGREAT and 4GREAT. UpGREAT operates 21 detectors simultaneously, which will permit simultaneous, parallel observations at two different frequencies for the first time. 4GREAT extends the spectroscopic range as far down as 490 GHz, which is particularly relevant for detecting the spectral lines of water.

With the launch of the on-board computers, the ICARUS project reached an important milestone in 2017. ICARUS is an International Space Station (ISS) payload developed collaboratively by DLR and the Russian State Space Corporation Roscosmos; it is planned that it will be installed on the Russian Federation segment of ISS. The ICARUS initiative is a global collaboration between scientists that was founded in 2012 with the aim of establishing a global observation system for (small) animals as the basis for a scientific revolution in biology and zoology. ICARUS extends satellite-based Earth observation to fauna.

Having a long tradition of supporting space activities within the framework of the United Nations, in 2017 Germany will host the United Nations/Germany International Conference on International Cooperation towards Low-emission and Resilient Societies, which will be organized by the Office for Outer Space Affairs of

the Secretariat, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) and DLR. Climate change has become one of the most important issues that humankind will have to contend with in forthcoming decades. The conference will be used to discuss ways to link satellite technologies to achieve a better understanding of disaster risk and the effects of climate change.

Also within the scope of the United Nations, DLR supports the World Food Programme (WFP) through a special calendar for identifying, at an early stage, environmental risks recurring in certain regions and at certain intervals. The consequences of climate change continue to exacerbate the already precarious food supply situation in certain regions, with crop failure due to extreme periods of drought or flooding being just one example. Funded by the German Federal Foreign Office, DLR is now supporting WFP in the risk-mapping and early detection of critical weather and climate developments in order to help prevent, mitigate and prepare for natural disasters. The Spatial Risk Calendar is aimed at identifying environmental risks recurring in certain regions and at certain intervals, for instance by monitoring droughts, and designing the humanitarian response to save lives.

Within the framework of the project entitled “Ground Demonstration of Plant Cultivation Technologies for Safe Food Production in Space” (EDEN ISS), DLR is pursuing application-oriented research to bring fresh impetus to food production on Earth and for human space flight. A greenhouse operated in enclosed circles is a good way of growing food in deserts and low-temperature regions — as would be the case on missions to the Moon and Mars — as it permits harvesting regardless of the weather, the Sun and specific seasons. A model greenhouse of this type was deployed to the Antarctic at the end of 2017 for a year of long-term testing under extreme conditions. The objective of the project is to foster the development of key technologies that will provide a fresh diet to inhabitants of climatically harsh regions or to astronauts on future long-term missions. Numerous international partners are working together in a research consortium under the auspices of DLR to keep the greenhouse up and running in the Antarctic environment.

Italy

[Original: English]

[16 October 2017]

Fifty years after the first launch of an Italian satellite from the Broglio Space Centre in Malindi, Kenya, in 1967, Italy remains active in the field of space activities for peaceful purposes.

In December 2016, the Italian Space Agency (ASI), which has the mandate to promote, develop and disseminate scientific and technological research in the field of space and aerospace, published its *National Strategic Vision Document 2016-2025*. The document defines the strategic goals that Italy wishes to achieve in space within the next 10 years, in accordance with the National Research Programme, including participation by Italy in the European Space Agency (ESA) and European Union programmes, as well as in other international space programmes and initiatives.

Italy considers international cooperation to be a key element of progress in space activities and programmes.

UNISPACE+50

Italy is contributing to the preparations for the fiftieth anniversary of the United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50), specifically thematic priority 7 (on capacity-building for the twenty-first century), and to the achievement of the Sustainable Development Goals, in particular Goals 4 (on quality education) and 10 (on reducing inequality).

ASI is promoting two international initiatives: the International Space Forum (ISF) at the ministerial level; and the Open Universe Initiative.

The International Space Forum initiative was launched in 2016, with the holding of the first forum, ISF 2016, in Trento, Italy, on 24 October 2016. The forum was jointly organized by ASI, the International Astronautical Federation (IAF) and the International Academy of Astronautics, within the framework of Roberto Battiston's IAF Vice-Presidency for Science and Academic Relations. Professor Battiston is currently the President of ASI.

The main goal of the International Space Forum is to involve universities and academia in space activities and programmes in order to increase local and regional capacity-building curricula and research activities. The 42 governmental delegations present in Trento adopted by consensus the Trento Space Statement, a document containing a set of recommendations for including university and national academic experts in governmental agendas as key contributors in addressing global challenges.

The second meeting of the International Space Forum, ISF 2017, will be dedicated to African countries and will be held in Nairobi on 28 November 2017, with the aim of involving African universities in the international space network. ISF 2017 is being jointly organized by ASI, IAF and the Kenya Space Agency and will have as its theme "Space science and academia for sustainable development in Africa".

The forum will gather competent governmental authorities in space activities, including representatives of national and regional space agencies, to better exploit the benefits of space for socioeconomic development.

The Open Universe Initiative was proposed by ASI, under the auspices of the Committee on the Peaceful Uses of Outer Space at its session in 2016. It strives to stimulate dramatic increases in the use of space science data through an open data approach in order to meet the needs of those who may be interested in observing and understanding the universe, from professionals to the general public. To that end, on 11 and 12 April 2017, ASI hosted a preparatory expert meeting at ASI headquarters to define the framework and objectives of the Initiative.

The United Nations/Italy Workshop on the Open Universe Initiative, organized by the Office for Outer Space Affairs of the Secretariat and ASI, with the support of ESA, will be held in Vienna from 20 to 22 November 2017. It will gather experts from the space science and astronomy sectors, as well as decision makers, educators and practitioners, to discuss the best ways and means of enhancing access to and the usability of space science data.

Space exploration

Italy is actively engaged in space exploration, both robotic and human, and participates in all the major initiatives of the international space community.

Italy participates in the work of the Action Team on Exploration and Innovation, established under the Committee, and is contributing to the report being prepared by the Action Team on thematic priority 1 of UNISPACE+50 (Global partnership in space exploration and innovation).

Italy is also deeply involved in the International Space Exploration Forum process, the second meeting of which will be held in Tokyo on 3 March 2018. ASI is also heavily involved in the International Space Exploration Coordination Group, along with 16 other space agencies.

On 28 July 2017, the Italian astronaut Paolo Nespoli, member of the ESA corps of astronauts, left Earth from the Russian Federation base in Baikonur, Kazakhstan, aboard the Soyuz MS-05 capsule, to reach the International Space Station (ISS). He will perform 200 experiments, 11 of which were selected by ASI, as part of his mission, named VITA (vitality, innovation, technology, ability). The VITA mission is part of the partnership between ASI and the National Aeronautics and Space Administration (NASA) of the United States of America, which entailed the provision

to NASA by ASI of three multi-purpose pressurized modules, one of which was transformed into a permanent ISS module, in exchange for flight opportunities to the ISS for Italian astronauts.

On 15 September 2017, the NASA-ESA-ASI Cassini probe, of the Cassini-Huygens mission, concluded its 13-year journey to and around Saturn with a “grand finale”. It plunged into Saturn’s atmosphere, which destroyed it, and sent its last scientific data to Earth by means of its large 4-metre diameter antenna, built in Italy. The antenna was an integral part of two instruments in which ASI and an Italian university have played a leading role, namely, the radar and radio-science instruments.

The ASI Sardinia Deep Space Antenna tracked the Cassini probe for two weeks, until its last day. The Antenna is a new configuration of the Sardinia Radio Telescope, built by the National Institute of Astrophysics in collaboration with ASI, the Sardinia Region and the Ministry of Education, Universities and Research, and was designed to support interplanetary missions and study the universe. As of January 2018, the Antenna will be officially operative within the NASA Deep Space Network and will also provide communication and navigation services for European interplanetary probes, with a particular specialization in Martian probes, in preparation for human exploration of the red planet.

Italy is participating in the NASA Juno mission to Jupiter, which is aimed at investigating Jupiter’s origins and evolution and is currently performing its first flybys over the planet; 37 flybys are envisaged before the end of the mission, in 2018. The Italian instruments on board the probe are the Jovian Infrared Auroral Mapper and the Ka-band Translator. The first is being employed to study the dynamics and chemical structure of Jupiter’s auroras in the near-infrared band, while the second is being employed to analyse Jupiter’s internal structure, with the objective of mapping its gravitational field.

ASI continues its active participation in the ESA-Roscosmos ExoMars programme. In December 2017, an Italian spectrometer is expected to be integrated into the rover that will be sent to the red planet in 2020.

ASI is also participating in the NASA Mars 2020 Rover and InSight missions by providing the instruments for landing-roving laser retroreflector investigations.

Earth observation for disaster management

After 10 years of activity, the Italian COSMO-SkyMed radar satellite constellation continues to provide valuable support in the management of disasters globally. COSMO-SkyMed images were provided to Mexico, following the earthquakes that hit the country in September 2017, as well as to the United States, following the devastation caused by Hurricane Harvey at the end of August 2017.

ASI is carrying out research activities on risk and disaster management jointly with the Japan Aerospace Exploration Agency (JAXA), by combining Italy’s COSMO-SkyMed and Japan’s ALOS-2 data on the X- and L-bands, respectively.

ASI is also collaborating with the China National Space Administration on the development of the China Seismo-Electromagnetic Satellite, which will be launched in February 2018. The mission will be dedicated to the study of the Earth’s electromagnetic field and waves, ionospheric plasma, energy particles and geophysical phenomena in order to monitor seismic activities from space.

At the multilateral level, ASI supports the activities and actions of the Committee on Earth Observation Satellites (CEOS) and actively participates in the Working Group on Disasters, the seventh meeting of which was held at ASI headquarters from 14 to 16 March 2017.

In October 2017, ASI assumed the Presidency of the Working Group. Furthermore, ASI is providing COSMO-SkyMed data, in the form of both archived and new data, to a number of relevant initiatives supported by CEOS, namely, the

Geohazard Supersite and Natural Laboratories, the Disaster Risk Management pilot project and the Recovery Observatory project.

Long-term sustainability of outer space activities, near-Earth objects and space debris

Italy actively contributes to the efforts of the Working Group on the Long-term Sustainability of Outer Space Activities and is deeply involved in the finalization of the Working Group's guidelines, with the aim of including them in a final compendium on the occasion of UNISPACE+50, in 2018.

Italy also participates in the Space Mission Planning Advisory Group, which addresses the threat posed by near-Earth objects. ASI is responsible for task 5.4 of the workplan, which deals with the definition of missions of reference for each relevant scenario.

ASI is a member of the Inter-Agency Space Debris Coordination Committee, which promotes the exchange of information on studies addressing space debris. ASI also contributes to the space debris issue through its Sardinia Deep Space Antenna, which includes the tracking of space debris among its activities.

At the European level, Italy participates in the European Union Space Surveillance and Tracking Support Framework, which is aimed at mitigating the risk of collisions with space debris.

Finally, Italy participates in the International Asteroid Warning Network through an Italian astronomer.

Space science

In January 2017, ASI was selected by NASA as the sole partner for its Imaging X-ray Polarimetry Explorer mission, which will study the most exotic objects of the universe, such as black holes, neutron stars and pulsars. ASI will provide several instruments as well as ground support from the Broglio Space Centre in Malindi, Kenya.

In the field of space weather, Italy is contributing to thematic priority 4 of UNISPACE+50, on the international framework for space weather services, through its participation in the Expert Group on Space Weather, established in 2015 under the auspices of the Scientific and Technical Subcommittee. Furthermore, ASI is conducting studies on risks linked to solar storms, making use of a national and European network of expert centres.

Spin-offs

Innovation and technology transfer from research in the aerospace sector to national industry, and vice versa, were at the centre of a two-day meeting entitled "Innovation spring" that was held in Rome on 25 and 26 May 2017. The meeting was organized by the Hypatia Research Consortium, which is composed of research entities, universities and private companies, and Ketlab, in collaboration with ASI and ESA. The initiative is a result of the 2015 agreement between ASI and the Consortium on the creation of a joint laboratory for innovation and technology transfer in the fields of six key enabling technologies, namely, micro- and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics and advanced manufacturing technologies.

In 2017, ASI and the Consortium also founded the Edoardo Amaldi Foundation, with the aim of promoting and sustaining scientific research devoted to technology transfer, which is understood as applied methodologies for the diffusion of aerospace innovation.

Mexico

[Original: Spanish]
[29 September 2017]

Mexico promotes international cooperation in the peaceful uses of outer space and enhancement of the legal regime governing aspects of its use. The Mexican Space Agency (AEM), in accordance with its capacities, in conjunction with national scientific and academic institutions and with the support of local governments, coordinates and carries out the establishment of space development centres, as well as activities in collaboration with space agencies such as the Italian Space Agency, the National Commission on Space Activities of Argentina, the French Space Agency (CNES), the German Aerospace Centre (DLR), the Indian Space Research Organization (ISRO), the Japan Aerospace Exploration Agency (JAXA), the National Aeronautics and Space Administration (NASA) of the United States of America, the United States National Oceanic and Atmospheric Administration (NOAA) and the Space Agency of the United Kingdom of Great Britain and Northern Ireland, on the basis of agreements providing for international cooperation.

Examples of those activities include workshops provided by CNES on the processing of satellite images of natural disasters and on satellite applications for monitoring the environment, climate and oceans; the workshop on best practices in the use of space technology for disaster management provided by ISRO, with the participation of local agencies involved in disaster risk management; and the donation to Mexico by NOAA of 10 GEONETCast reception stations, which generate information useful for research and the application and exploration of environmental data, climate change and environmental protection. AEM also participates in international programmes for the development of projects with other space agencies, such as the Space Agency of the United Kingdom and the European Space Agency (ESA).

Furthermore, AEM is represented in the Mexican delegation that participates every year in sessions of the Committee on the Peaceful Uses of Outer Space and its Legal Subcommittee and Scientific and Technical Subcommittee.

In addition, AEM, in its role as a regional support office of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), carries out activities relating to the use of space systems for the establishment of early warning systems and best practices and methodologies for addressing disaster risk.

Lastly, AEM chairs the Global Partnership Using Space-based Technology Applications for Disaster Risk Reduction, which is an international group that develops guidelines for action and recommendations, and promotes good practice in the area of natural disasters.

Norway

[Original: English]
[16 October 2017]

On 14 July 2017, the Norwegian satellites NorSat-1 and NorSat-2 were successfully launched into space. The two satellites are to monitor maritime traffic and test science and technology payloads. With the inclusion of NorSat-1 and NorSat-2, Norway now has four microsatellites operational in low Earth orbit, four commercial (Telenor) telecommunications satellites in geostationary orbit and one in graveyard orbit. More satellites are scheduled to be launched over the next few years. In addition, rockets are used by students for educational purposes at Andøya Space Center. The Center is also currently carrying out a technical feasibility study to explore the potential for launching small satellites from its facilities. The Norwegian space industry is also looking into developing innovative new launching concepts.

The Norwegian telecommunication operator, Telenor, owns and operates several telecommunication satellites in geostationary orbit.

The majority of Norwegian space activities are carried out through the country's participation in the space programmes of the European Space Agency (ESA), the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and the European Union. Norway is an active participant in European programmes such as the European Satellite Navigation System (Galileo), the European Geostationary Navigation Overlay Service (EGNOS), the European Earth Observation Programme (Copernicus), Meteosat and MetOp, as well as in upcoming ESA scientific missions such as EUCLID and Solar Orbiter.

Ground stations operated by the Norwegian company KSAT in mainland Norway, Svalbard and Antarctica provide important services for satellite operators from many nations, during both the critical launch and early orbit phase, and during regular operations.

Norway has bilateral agreements with several other nations regarding space research and applications, and makes important contributions to Mars 2020 Rover and the Interface Region Imaging Spectrograph (IRIS) solar observatory of the National Aeronautics and Space Administration (NASA) of the United States of America, and to Japan's Hinode solar observatory.

The Norwegian Mapping Authority and Tromsø Geophysical Observatory have important roles in the space weather programme of ESA. A new geodetic observatory is currently being established at Svalbard.

Many Norwegian research institutes and companies are involved in the development of new and innovative downstream applications for satellite remote sensing data.

There is much space-related ground-based scientific infrastructure in Norway. The new Super Dual Auroral Radar Network (SuperDARN) radar at Svalbard is part of an international radar network to monitor Earth's upper atmosphere and is useful for monitoring space weather. The radar is co-located with both the Kjell Henriksen Observatory and the European Incoherent Scatter Scientific Association (EISCAT) Svalbard radar, and operated by the University Centre in Svalbard. The Kjell Henriksen Observatory is the world's largest optical northern light observatory, with 32 different instruments from international institutions.

Norway also has a vibrant scientific community that is engaged in research on a broad range of issues, from solar physics, the structure of the universe, space weather and the cultivation of plants on the International Space Station to the development of hardware and software for space missions.

There is an increased focus on the critical role that space technology plays in modern society. This has generated interest in the legal and political dimensions necessary to ensure the peaceful uses of outer space. Against this background, at the sixtieth session of the Committee on the Peaceful Uses of Outer Space, in June 2017, Norway applied for membership in the Committee. The Committee decided to recommend to the General Assembly that Norway should become a member of the Committee, and a formal decision was to be made in the Fourth Committee of the General Assembly in October 2017.

Norwegian national space law dates back to 1969. Owing to rapid developments in the space sector, there are ongoing processes to evaluate the need for additional and/or revised national legislation to reflect modern realities. Active participation in the Committee is viewed as essential to guide and inform Norway in these processes.

Furthermore, Norway plans to adopt a new national space strategy, which will give it the opportunity to re-examine national priorities and set the course for the future.

Norway is actively promoting the use of satellite data in the United Nations system, in particular the use of high-resolution data for tropical forest monitoring. In that regard, a project to examine how satellites can be a tool in national strategies that are aimed at advancing the 2030 Agenda for Sustainable Development is being conducted.
