



# General Assembly

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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-seventh session, in 2020, 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.105/1224, para. 34).
2. In a note verbale dated 16 October 2020, the Office for Outer Space Affairs of the Secretariat invited Member States to submit their reports by 13 November 2020. 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

### Australia

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The Australian Government established the Australian Space Agency on 1 July 2018. The purpose of the Agency is to transform and grow a globally respected Australian space industry that will lift the broader economy and inspire and improve the lives of Australians – underpinned by strong international and national engagement.

The activities of Australia in the space sector include:

1. The publication of the Australian Civil Space Strategy 2019–2028 in April 2019, which outlines the Australian Government’s plan to transform and grow the Australian space industry over 10 years.
2. Modernizing and streamlining Australia’s legal framework for space launches and returns with the Space (Launches and Returns) Act 2018, which amended the Space Activities Act 1998 and entered force on 31 August 2019.
3. The announcement of a new \$A150 million partnership over five years between the Agency and the National Aeronautics and Space Administration (NASA), as part of NASA Moon to Mars activities.
4. Delivery of the Space Infrastructure Fund, providing A\$19.5 million in investment over three years in seven space infrastructure projects to address gaps in space infrastructure.
5. The announcement of 10 successful applicants under the first grant round of the International Space Investment initiative.

The establishment of the Agency was accompanied by a A\$629.2 million investment in space-related activities by the Australian Government, including:

- A\$150 million to support Australian participation in the NASA plan to return to the Moon and on to Mars
- A\$19.5 million for the Space Infrastructure Fund
- A\$6 million towards the Space Discovery Centre in South Australia
- A\$15 million for international partnerships through the International Space Investment initiative
- A\$32.75 million for the ongoing operations of the Agency
- More than A\$325 million to Geoscience Australia to develop world-leading satellite infrastructure and technologies

- A\$26 million to the Commonwealth Scientific and Industrial Research Organization to support space science in Australia (including A\$16 million for Future Science Platform investment in space)
- A\$55 million to support the development of new technologies for space through the SmartSat Cooperative Research Centre

To date, the Agency has entered into memorandums of understanding with the space agencies of France, Canada, the United Kingdom of Great Britain and Northern Ireland, the United Arab Emirates and Italy, a joint statement of intent with NASA, the European Space Agency (ESA) and the German Aerospace Centre (DLR) and an arrangement with the New Zealand Space Agency. These arrangements create a basis for further collaborative activities between countries in mutually agreed priority areas. At the seventy-first International Astronautical Congress in October 2020, Australia was one of seven international partners to sign the Artemis Accords, which establish a practical set of principles to guide space exploration cooperation among nations participating in NASA lunar exploration plans.

### **Australian Civil Space Strategy 2019–2028**

The Australian Civil Space Strategy is the Australian Government’s plan to grow the Australian space industry from 10,000 jobs and a market size of A\$3.9 billion to 30,000 jobs and A\$12 billion by 2030. In order to achieve the vision of a space industry that lifts the broader economy and inspires and improves the lives of Australians, the Strategy contains seven national civil space priority areas:

1. **Position, navigation and timing.** Position, navigation and timing is critical for many areas of the Australian economy, including agriculture and mining. While Australia does not have its own global navigation satellite system, its position, navigation and timing infrastructure needs to be world-class to underpin the growth of the broader economy. To advance this goal, the Australian Government, through Geoscience Australia, is supporting the development of an Australian satellite-based augmentation system, which will improve the accuracy of global navigation satellite system signals, such as the Global Positioning System.
2. **Earth observation.** Earth observation has untapped the potential to grow the Australian economy, for example by improving agricultural monitoring and water management and monitoring shipping routes. Through the Geoscience Australia Digital Earth Australia initiative, Australia is leading the world in this field.
3. **Communications technologies and services.** Australia can play a lead role in emerging technologies, such as lasers for data communications, quantum technologies for secure communications and hybrid radio and optical communications.
4. **Space situational awareness and debris monitoring.** Collisions in space with debris pose a risk to assets and life. Its geographical position makes Australia an ideal location for space debris tracking and space traffic management activities.
5. **Leapfrog research and development.** Australia can encourage and support research that inspires, identify areas to develop and commercialize research and development that would grow and transform the space sector. Areas of opportunity include new rocket technology, new high-tech materials, space medicine, synthetic biology, quantum communications, in-orbit servicing and optical wireless communications technologies.
6. **Robotics and automation on Earth and in space.** Australia is a world leader in remote asset management in industries including mining, oil and gas, transport, agriculture and fisheries. Australia can leverage its

expertise in robotics technology and systems for remote operation and exploration in space.

7. **Access to space.** There are emerging opportunities for Australia to leverage international space missions and commercial launch activities from Australian territory to support industry growth.

The national civil space priority areas inform the development of Australian Government policy in relation to space activities. The Space Infrastructure Fund and the International Space Investment initiative will contribute to achieving the goals of the Australian Civil Space Strategy.

### **Modernizing the legal framework in Australia with the Space (Launches and Returns) Act 2018**

The Space (Launches and Returns) Act 2018 came into effect on 31 August 2019, amending and renaming the previous Space Activities Act 1998. The amended Act supports the space sector by removing barriers to participation in space activities and encouraging innovation and entrepreneurship, while also ensuring the safety of space activities. The Amended Act expands the regulatory framework to include arrangements for launches from aircraft in flight and launches of high-power rockets, requires applications for Australian launch permits and overseas payload permits to contain space debris mitigation strategies, and streamlines approval processes and insurance requirements for launches and returns.

### **Partnering with NASA**

On 21 September 2019, the Prime Minister launched a new A\$150 million partnership over five years between the Agency and NASA, as part of NASA Moon to Mars activities. The focus is on integrating Australian businesses into international space supply chains. The investment will support activities in Australia, and includes three integrated elements:

- A supply chain programme that targets projects and activities to deliver products and services into domestic and international space supply chains
- A demonstrator programme to showcase Australian industry strengths to the world and provide a pathway to develop and launch products that will create new capability and enable new business ventures, revenue streams or markets
- A trailblazer programme that contributes flagship Australian space capability within an international space exploration programme and leverages Australia's competitive strengths in space

### **Space Infrastructure Fund**

The Space Infrastructure Fund is a A\$19.5 million investment in seven infrastructure projects, located around Australia, that will increase the capabilities of the space sector in supporting industry, including finance, agriculture, mining, health, tourism and manufacturing.

The following projects are planned:

1. **Space manufacturing facilities:** New South Wales (A\$2 million). Support the delivery of future space manufacturing capability and the development of high-tech skills and new space objects.
2. **Mission control:** South Australia (A\$6 million). A platform for small and medium-sized enterprises and researchers to control small satellite missions, enabling real-time testing and accelerated improvement of satellite technology.
3. **Tracking facilities upgrade:** Tasmania (A\$1.2 million). Upgrade infrastructure to support precision tracking of satellites and spacecraft.

4. **Robotics, automation and artificial intelligence command and control:** Western Australia (A\$ 4.5 million). Allow small and medium-sized enterprises and researchers control over autonomous operations in space; building capability in space technologies.
5. **Space data analysis facilities:** Western Australia (A\$1.5 million). Provide small and medium-sized enterprises and researchers with space data analysis capability for agriculture, mining, emergency services and maritime surveillance.
6. **Space payload qualification facilities:** A\$2.5 million. Provide capability for small and medium-sized enterprises and researchers to test space equipment and have it mission-ready in Australia.
7. **Pathway to launch:** A\$0.9 million. Undertake work to address the active interest and growing readiness in industry for launch in Australia, while ensuring safety on Earth and in space.

### **International Space Investment Initiative**

The International Space Investment initiative provides A\$15 million over three years to strategic space projects between the Australian space sector and international space agencies. The initiative will grow the Australian space industry and build collaboration with international space agencies, providing benefits to all participants.

The Agency will issue International Space Investment funds as grants to eligible projects that support the civil space priority areas and align with the programme's investment principles. The outcome of the first grant round was announced in June 2020, with 10 projects supported, including:

1. The SpIRIT (Space Industry Responsive Intelligent Thermal) CubeSat mission, by the University of Melbourne in partnership with Inovor Technologies, Sitael Australia, Nova Systems and Neumann Space: CubeSats that will enable Australian products to enter the global supply chain of small-sat constellations.
2. Spacesuits for preserving human health and mobility, by Human Aerospace: spacesuits that reduces the unhealthy side effects of living in space, such as bone and muscle loss and fainting upon return to Earth.
3. South Australian multi-sensor space observatory for space situation awareness, by Silentium Defence: a new space observatory, with sensors to support space traffic management and debris tracking.
4. Artificial intelligence (AI) crew for space to help with complex systems tests, by Akin Australia: an AI space crew will complement human teams to help people work more effectively in remote environments.
5. Design and qualification of microsatellite constellation launch systems, by Skykraft: the design and qualification of a satellite launch system for the launch and deployment of microsatellites into low Earth orbit.
6. Open Source Space Operations, by Saber Astronautics: developing an open source software infrastructure for spacecraft operations.
7. Advanced Global Navigation Satellite System receiver for CubeSats, rockets and remote sensing, by the University of New South Wales: an advanced Global Positioning System receiver for CubeSats, rockets and remote sensing to improve timing and position or velocity estimation.
8. Decision support system for collision avoidance of space objects, by Stamen Engineering: a tool to help satellite operators assess the real risks to satellites from collisions with other satellites and space debris. Operators will be able to make quicker and more accurate decisions.

9. Underwater virtual reality training simulations for astronauts, by Raytracer: developing an underwater virtual reality training simulator for astronauts and human space exploration.
10. VertiSense – mitigation of sensorimotor effects of simulated weightlessness, by the University of Canberra: countering sensorimotor disturbances experienced by astronauts after spaceflight.

## **Austria**

[Original: English]  
[11 November 2020]

### **International space law**

#### *Activities of the National Point of Contact Space Law Austria 2019–2020*

The National Point of Contact for Space Law of the European Centre for Space Law (ECSL) of the European Space Agency (ESA) is located at the Department of European, International and Comparative Law at the Law Faculty of the University of Vienna. It is financially supported by the Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology. Its objective is the promotion and development of space law and its application through research and teaching, as well as through public events. Most importantly, the National Point of Contact promotes and stimulates participation in ECSL activities in Austria. In this regard, the European Rounds of the Manfred Lachs Space Law Moot Court were launched in Vienna in June 2020. Owing to the global coronavirus (COVID-19) pandemic, they were held online. In 2021, the National Point of Contact will again host the European Rounds in Vienna, hopefully as a physical event.

Furthermore, the National Point of Contact for Space Law contributed to the United Nations/Austria World Space Forum on the theme “Access to Space4All”, held from 18 to 22 November 2019 at the premises of the United Nations in Vienna, as well as to the United Nations/Austria Symposium on the theme “Space Applications for Sustainable Development Goal 13: Climate Action”, held from 1 to 3 September 2020, at which the National Point of Contact was involved as a co-organizer and co-moderator.

In addition, the National Point of Contact contributed to the work of the Ad Hoc Working Group on Legal Issues of the Space Mission Planning Advisory Group (SMPAG). The Working Group drafted a report on legal aspects of planetary defence, which was adopted by SMPAG in February 2020. Currently, a book entitled “Legal Aspects of Planetary Defence”, with contributions from some 20 high-level international experts, is in preparation (see [www.spacelaw.at](http://www.spacelaw.at)).

### **Austrian research activities**

#### *Austrian space weather activities*

The University of Graz is actively participating in the Expert Group on Space Weather, is an expert member of the European Space Weather Assessment and Consolidation Committee and co-authored a paper entitled “Assessment and recommendations for a consolidated European approach to space weather – as part of a global space weather effort”, which was published in October 2019. The University plays a key role in the International Space Weather Action Team, which was initiated under the Committee on Space Research. Furthermore, the University 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 are the expert groups for the ESA space situational awareness Expert Service Centres on Solar Weather and on Heliospheric Weather and provide data and tools for forecasting and nowcasting space weather events coming from the Sun. In addition, the University of Graz, in

collaboration with the University of Technology Graz, is aiming to become a member of the ESA space situational awareness Ionospheric Weather Expert Service Centre (see [www.spaceweather.at](http://www.spaceweather.at) and [www.esa.int/Safety\\_Security/Space\\_Weather\\_Office](http://www.esa.int/Safety_Security/Space_Weather_Office)).

### **Austrian Earth observation activities**

#### *Launch of Christian Doppler Laboratory gEOhum*

Entering a new dimension of collaboration, the University of Salzburg launched a Christian Doppler Laboratory (CDL) funding programme to connect business and science concerning EO-based humanitarian action, in cooperation with partner Médecins sans Frontières (MSF). The CDL gEOhum was inaugurated in July 2020 and integrates Earth observation and geospatial technologies to support humanitarian interventions by MSF at the global level. An international team pursues cutting-edge research and innovation activities in three areas, namely, Img2Info (information extraction from Earth observation data), ConSense (integration of information from various data sources) and Info2Comm (information delivery and effective communication), leveraging technological advancements at the interface of Earth observation and artificial intelligence to generate relevant, yet scientifically substantiated, information products. Applications include humanitarian disaster response, mission planning and population estimation for food distribution or vaccination campaigns. The Laboratory will have a maximum duration of seven years and involves around 10 career positions (see <http://geohum.zgis.at>).

#### *Women in Copernicus*

Women are part of the space sector, but they are not always visible. The project “Women in Copernicus”, launched in April 2020 and supported by the University of Salzburg, aims to give a voice and a face to women in the space sector, in particular to those women who are active in the Copernicus ecosystem. In a first survey, facilitators in professional careers were identified, as were gender-related barriers and possible solutions to reduce and eventually eliminate gender bias in Copernicus and to inspire girls and women to be at the forefront of Copernicus and the space sector (see <https://womenincopernicus.eu>).

### **Austrian space education activities**

#### *Online Summer School*

From 1 June to 10 July 2020, 35 international students, young professionals and representatives of public authorities from 21 countries attended the online Summer School “OBIA for the Copernicus service challenge”, organized by the University of Salzburg Department of Geoinformatics and supported by ESA and EO4GEO. The Summer School provided an overview of Copernicus and its data and services, as well as training in object-based image analysis (OBIA). In addition, lectures and a hands-on session were given on land monitoring and climate change, topics that were actively chosen by the participants. Working in teams, the attendees developed Earth observation-based solutions for problems challenging our society, ranging from the rising water level in Venice to forest fires in the Amazon region, urban green space, climate-change induced vulnerability of mountain areas and anthropogenic marine debris detection (see [www.copernicus.eu/en/events/events/online-summer-school-obia-operational-copernicus-service-challenge](http://www.copernicus.eu/en/events/events/online-summer-school-obia-operational-copernicus-service-challenge)).

#### *Science Academy of Lower Austria*

The Science Academy of Lower Austria is an extracurricular education programme for curious and motivated young people 14 to 16 years of age. The Science Academy offers five different courses, with the opportunity for direct contact with outstanding scientists and experts. One of the courses is dedicated to space. The duration of each course is two years (four consecutive semesters). The space course covers astrophysics, space and planetary systems, space logistics and transport systems, living and working in space, on the Moon and Mars, robotics in space travel, new

technologies and materials, and technological philosophy and visions for the future (see [www.noe.gv.at/noe/Wissenschaft-Forschung/Science\\_Academy\\_Niederosterreich.html](http://www.noe.gv.at/noe/Wissenschaft-Forschung/Science_Academy_Niederosterreich.html) and [www.space-craft.at/spaceblog](http://www.space-craft.at/spaceblog)).

#### *Space education activities at the Vienna University of Technology*

The Mars Science City design studio took place from March to June 2020 at the Vienna University of Technology. Master's students studying architecture have developed 12 hypothetical scenarios for a future prototypical scientific city on Mars, and they set out in detail their ideas about how the first settlement might look. A booklet summarizing the course shows the latest research, design and development in research disciplines beyond mainstream architectural topics and aims to trigger a process of re-thinking and finding solutions to design challenges using an interdisciplinary approach (see <https://issuu.com/hochbau2>, [www.eventbrite.at/o/emerging-fields-in-architecture-tu-wien-30523505282](http://www.eventbrite.at/o/emerging-fields-in-architecture-tu-wien-30523505282) and [www.youtube.com/channel/UCO1kKw5xzCOmkU5yVQ1CrRA](http://www.youtube.com/channel/UCO1kKw5xzCOmkU5yVQ1CrRA)).

## **Germany**

[Original: English]  
[13 November 2020]

In 2020, Germany continued to engage in space activities, despite the difficulties imposed by the ongoing COVID-19 pandemic. Given the strong commitment of the Federal Government to multilateralism, as well as the guiding principle of intensifying international cooperation with its space strategy, many of these activities were carried out in collaboration with international partners. This report provides information on a selection of these activities.

### **Joint international scientific space exploration missions**

An ongoing cooperative effort is the German-United States of America Stratospheric Observatory for Infrared Astronomy (SOFIA). The joint project between the German Aerospace Centre (DLR) and the National Aeronautics and Space Administration (NASA) features a 2.7 metre telescope carried inside a modified Boeing 747SP aircraft. SOFIA conducts astronomical observations in the infrared and submillimetre wavelengths at an altitude of 11.3–13.7 kilometres. Operating since 2010, SOFIA has recently provided the first evidence of water molecules on the Moon outside the permanent shadow at the lunar poles. This major discovery demonstrates the positive achievements made possible through international cooperation in space science and exploration.

CHEOPS (characterizing exoplanet satellite), a European Space Agency (ESA) mission involving 12 nations, was launched on 17 December 2019 from Kourou, French Guiana. CHEOPS is a space telescope whose main objective is to investigate the structure of exoplanets that are larger than Earth but smaller than Neptune. It will determine the size, orbital period and physical characteristics of these planets. DLR is involved in the scientific evaluation of the CHEOPS data. The DLR Institute for Optical Sensor Systems and the DLR Institute of Planetary Research have contributed two electronic modules, the heart of the satellite telescope and the focal plane module containing the charge-coupled device (CCD) detector. The first results of the mission, measuring the unusual orbit of the giant planet WASP-189b, have already been published in the journal *Astronomy & Astrophysics*.

Another spacecraft, the Solar Orbiter, was launched on 10 February 2020 from Cape Canaveral, United States. An ESA mission with strong NASA participation, its aim is to better understand the processes in the heliosphere by investigating the formation of the solar wind and magnetic field. It will also produce the first detailed images of the polar regions of the Sun. Four German research institutes and facilities (Max Planck Institute for Solar System Research in Göttingen, Kiepenheuer Institute for

Solar Physics in Freiburg, Christian-Albrecht University of Kiel and Leibniz Institute for Astrophysics Potsdam) contribute to six of the 10 instruments of the mission.

The International Cooperation for Animal Research Using Space (ICARUS) project, a German-Russian observation system for animal migration, has made significant progress over the past year. In December 2019, a new board computer was brought to the International Space Station (ISS), which allowed the test phase of the project to start in March 2020. In September 2020, the scientific operations have begun. The project equips animals with tiny transmitters/sensors that record behavioural and health data, which is then transmitted via ISS to a ground station in Moscow. By studying the migration patterns of animals, scientists expect insights that assist in behavioural research, species protection and the understanding of the spread of infectious diseases. The observation data can also help improve the prediction of ecological changes and natural disasters. ICARUS is a cooperation project of the Max Planck Institute of Animal Behaviour in Konstanz, the State Space Corporation “Roscosmos” of the Russian Federation and DLR.

In fourth quarter of 2019, the DLR Earth Sensing Imaging Spectrometer (DESI), a hyperspectral camera that was launched to the ISS in 2018, began its operational use. The aim of DESI is to supply hyperspectral data to support scientific, humanitarian and commercial goals. By observing the Earth around the clock and recording changes to the land or ocean surface, it will help scientists to better understand environmental processes or make statements about the current state of forest and agricultural land. DESI is a cooperative effort by the DLR Institute of Optical Sensor Systems and United States-based company Teledyne Brown Engineering.

#### **General international cooperation and capacity-building activities**

Bartolomeo, a payload hosting platform developed and built by Airbus and operated with support from ESA, was launched to and installed outside the ISS in March and April 2020. It constitutes Europe’s first private external platform on the ISS and is a contribution towards the commercialization of the space station. Bartolomeo contains 12 different payload slots that can be used by companies and research institutions to bring their projects to low Earth orbit quickly. In an effort to improve access to space for all countries, Airbus has partnered with the Office for Outer Space Affairs to provide a payload slot to States Members of the United Nations, and to developing countries in particular. The announcement of opportunity closed in April 2020, and the deployment of the payload is expected by 2021 or 2022, subject to ISS operational requirements and the progress of the payload development.

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

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

In 2020, the fruitful cooperation between the University of Bonn and the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) continued through the Space-based Earth Observation Applications for Emergency Response and Disaster Risk Reduction (SPEAR) project. SPEAR was initiated in 2019 with funding from the German Federal Ministry for Economic Affairs and Energy (BMWi) and aims to produce new methods to characterize drought and flood risks on the basis of satellite data, with a regional focus on African countries. The University of Bonn and UN-SPIDER hosted an expert meeting in June 2020 on space-based solutions for risk and disaster management in Africa. The ongoing COVID-19 pandemic forced the event to be held virtually, but this allowed for broad participation. UN-SPIDER also conducted a technical advisory mission to Tunisia in March 2020.

### *International Charter Space and Major Disasters*

2020 marked the twentieth anniversary of the International Charter Space and Major Disasters, which was established on 20 October 2000 by ESA, the National Centre for Space Studies (CNES) of France and the Canadian Space Agency. German participation in the Charter also reached an important milestone in 2020, as DLR became a member 10 years ago, in October 2010. The main German contribution constitutes data from the radar satellites TerraSAR-X and TanDEM-X, which can quickly provide detailed images, regardless of cloud coverage or the presence of daylight. In some cases, DLR provided optical images through the RapidEye satellites, which were, however, decommissioned in 2020 (see [ST/SG/SER.E/569/Add.1](#) for further information).

### *Humanitarian technology*

Aerospace technologies often enable applications that lie outside their originally intended area of use. Activities in humanitarian aid are particularly important in that regard. For this reason, in 2019 DLR launched the Humanitarian Technologies initiative to make space technologies usable for humanitarian aid and systematically develop them further. At the DLR Human Technology Day event in October 2020, stakeholders discussed ongoing aid projects based on aerospace technology as well as new ideas for future projects. Ongoing projects under the initiative include MEPA, which aims to use mobile greenhouses to provide a means of producing fresh food in emergency situations, such as after floods or in confined, overpopulated areas. The project works closely with the World Food Programme and other humanitarian aid organizations. Another project, Data4Human, is developing analysis methods and tools to provide data from various sources, including satellites, to humanitarian aid organizations in crisis situations. The project is implemented in collaboration with the United Nations Development Programme.

### *Space-enabled climate research*

An international research team consisting of scientists from the Friedrich-Alexander University Erlangen-Nuremberg, as well as institutions in Chile, Bolivia (Plurinational State of) and Argentina has applied a new analysis method for mass changes in glaciers. Instead of on-site measurements, the team used space-based data to obtain a detailed picture of the mass changes in all of the glaciers in South America. Data was used from the German TanDEM-X radar satellite, the international Shuttle Radar Topography Mission (SRTM) and the United States Landsat satellites. The study highlighted the ongoing mass loss in glaciers and provided further proof of the rapid changes in the Earth's climate.

## **India**

[Original: English]  
[16 November 2020]

### **Indian Space Research Organization - Headquarters**

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 59 countries and five international bodies, namely: Afghanistan, Algeria, Argentina, Armenia, Australia, Bahrain, Bangladesh, Bhutan, 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, Nepal, Netherlands, Nigeria, Norway, Oman, Peru, Portugal, Russian Federation, Sao Tome and Principe, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sri Lanka, 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. In past year, nine cooperation documents were signed with the entities of six countries. The cooperative activities identified therein include conducting joint satellite missions, sharing expertise in the applications of space technology, sharing earth observation data, organizing international events in India and participating in international events.

The Indian Space Research Organization (ISRO) and NASA are working together on the ISRO-NASA synthetic aperture radar satellite mission. ISRO and the National Centre for Space Studies (CNES) of France have completed the feasibility study for a thermal infrared imaging satellite mission. ISRO and the Japan Aerospace Exploration Agency are conducting a feasibility study for a joint lunar exploratory mission. The Argos payload from CNES will be accommodated in the ISRO Oceansat-3 satellite. ISRO developed L and S band airborne synthetic aperture radar and conducted an airborne campaign using NASA aircraft at various sites in North America. A Ka-band propagation experiment is being conducted in association with French institutions. ISRO cooperates with the space agencies of France, Germany and the United States in professional exchange programmes. ISRO is in discussion with Japan, the Russian Federation, France and the United Arab Emirates with a view to establishing NavIC reference stations in the respective countries. In addition, in support of the ambitious Indian human spaceflight programme, ISRO is collaborating with the United States, the Russian Federation, France and Japan on various aspects of human spaceflight capabilities. Four Indian astronaut candidates are undergoing training in the Russian Federation.

ISRO has announced an eight-week capacity-building programme on nano satellite development, UNISpace Nanosatellite Assembly and Training (UNNATI), as an initiative to commemorate UNISPACE+50. The first batch of 29 officials from 17 countries (Algeria, Argentina, Azerbaijan, Bhutan, Brazil, Chile, Egypt, Indonesia, Kazakhstan, Malaysia, Mexico, Mongolia, Morocco, Myanmar, Oman, Panama and Portugal) successfully completed the training in the period January–March 2019 at ISRO. The second batch, a total of 30 officials from 16 countries (Bahrain, Bangladesh, Belarus, Bolivia (Plurinational State of), Brunei Darussalam, Colombia, Kenya, Mauritius, Nepal, Nigeria, Peru, Republic of Korea, Sri Lanka, Thailand, Tunisia and Viet Nam) underwent training in the period October–December 2019.

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 United Nations-affiliated Centre for Space Science and Technology Education in Asia and the Pacific at Dehradun. To date, more than 2,975 participants from 109 countries have benefited from these programmes.

The International Academy of Astronautics, ISRO and the Astronautical Society of India jointly organized a symposium on human spaceflight programme in Bangalore from 22 to 24 January 2020 on the theme “Human space flight and exploration: present challenges and future trends”. Some 500 participants, including invitees, national and international technical experts in human spaceflight-related technologies from international space agencies, astronauts, representatives of Indian and international space industries and academic institutions, young professionals and students participated in the symposium.

The fourteenth International Committee on Global Navigation Satellite Systems was organized by ISRO in Bangalore from 8 to 13 December 2019. A total of 400 participants from 23 countries participated and presented the updates and plans relating to their respective satellite navigation programmes.

ISRO organized the thirty-fourth Plenary of the Committee on Earth Observation Systems (CEOS). Some 130 officials from 62 entities participated in this event, which was held virtually from 18 to 20 October 2020.

A training course on the theme “Capacity-building on Earth observations applications and research: fundamentals, emerging technological tools and services” was conducted during from 4 to 17 January 2020 for the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) nations. Four candidates each from Bangladesh, Bhutan, Myanmar, Nepal, Sri Lanka and Thailand attended the training.

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 Satellites, the International Committee for 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 setting up an enabling mechanism to support the overall growth of space activities in India with a higher order of participation of various agencies, including public, non-governmental and private sector stakeholders, in compliance with the obligations under international treaties on space activities. This would support the pursuance of space activities by various agencies in India, including private sector and start-up companies, with due authorization by the Government of India.

## **Japan**

[Original: English]  
[16 November 2020]

### **International Space Station**

Japan has been actively participating in the International Space Station (ISS) programme for the peaceful uses of outer space since its foundation. ISS is the largest international science and technology cooperation programme ever attempted in the new frontier of space. The participants in the ISS programme are pursuing the further utilization of outer space with the aim of bringing benefits to the Earth.

One of Japan’s notable contributions to the ISS programme is the Japanese Experiment Module “Kibo”. Japan has been promoting the utilization of Kibo for maximizing outcomes, and various experiments have been conducted aboard Kibo, including the topic areas material/physical science, medical science, life science and capacity-building. Astronaut Noguchi Soichi will soon board a commercial crew vehicle and will to start a long-duration stay aboard ISS.

Japan is also contributing to capacity-building in developing and emerging countries through the utilization of Kibo, which is the only module on the ISS equipped with both a robotic arm and an airlock – a unique capability that allows various outboard projects, such as the deployment of small satellites. The Japan Aerospace Exploration Agency (JAXA) is collaborating with the Office for Outer Space Affairs under “KiboCUBE,” which provides developing and emerging countries with opportunities to deploy CubeSats from Kibo. Guatemala’s first satellite, selected for the second round of KiboCUBE, was successfully deployed from Kibo in April 2020. JAXA and the Office for Outer Space Affairs hope to further support the capacity-building of many countries through this programme, and will soon announce the extension of the programme until 2023.

### **Space transportation**

During Japanese fiscal year 2020, the following launches were conducted: H-IIB Launch Vehicle flight No.9 with H-II Transfer Vehicle No.9 (HTV9) on board and

H-IIA Launch Vehicle flight No.42 with Emirates Mars Mission, developed by the Mohammed bin Rashid Space Centre, on board. The following launch is expected to be conducted by the end of Japanese fiscal year 2020: H-IIA Launch Vehicle flight No.43 with Japanese data relay system “JDRS” on board.

## **Space exploration**

### *Exploration missions*

Collaboration with international partners is a key component of Japan’s space exploration missions. The Japanese Government updated its Basic Plan on Space Policy and Implementation Plan in June 2020, which highlights Japan’s participation in the Artemis programme. In July 2020, the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) and the National Aeronautics and Space Administration (NASA) also signed the Joint Exploration Declaration of Intent for Lunar Cooperation, which describes the plans for cooperation regarding lunar exploration, including Japanese contributions to ISS, the Gateway and lunar surface exploration. Japan’s expected contribution is to provide habitation capability and logistics resupply to ISS and the Gateway on the basis of the technologies acquired through ISS operation.

In the area of lunar surface exploration, JAXA is developing the Smart Lander for Investigating Moon (SLIM), scheduled to be launched in Japanese fiscal year 2022, to demonstrate pinpoint landing technology. JAXA is also cooperating with the Indian Space Research Organization and other agencies for the Lunar Polar Exploration (LUPEX) mission, targeting its launch in Japanese fiscal year 2023. LUPEX aims to explore potential resources such as water ice in the lunar polar region to investigate the feasibility of future resource utilization. Moreover, JAXA is conducting joint research with Japanese private companies to develop a pressurized human rover, targeted for launch in the late 2020s.

On 13 October, Japan signed the Artemis Accords together with seven international partners. The Artemis Accords establish the practical set of principles for cooperation in the civil exploration and use of the Moon, Mars, comets and asteroids for peaceful purposes.

Regarding Mars exploration, JAXA is planning the launch of the Martian Moons eXploration (MMX) mission in Japanese fiscal year 2024, which aims to investigate the two Martian moons, Phobos and Deimos. This is an extended mission of Hayabusa 2, which explored the C-type asteroid called “Ryugu” and aims to return to the Earth in December carrying the sample from the asteroid. MMX is an international cooperative mission, with contributions from NASA, the National Centre for Space Studies (CNES) of France, the German Aerospace Centre (DLR) and the European Space Agency (ESA).

### *Space science*

JAXA is actively planning and conducting various space science missions. In October 2018, Bepi Colombo, an ESA-JAXA joint mission to explore Mercury, was successfully launched by Ariane-5 rocket from French Guiana and started its seven-year journey to Mercury.

JAXA is developing the X-ray Imaging and Spectroscopy Mission (XRISM) which aims to investigate X-ray objects in the universe with high-throughput imaging and high-resolution spectroscopy. XRISM is a collaborative mission with NASA and ESA, and is scheduled to be launched in Japanese fiscal year 2022.

## **Remote sensing**

The Global Change Observing Mission (GCOM) aims to monitor global climate change. GCOM consists of two satellites: GCOM-W and GCOM-C. JAXA launched GCOM-W in May 2012; it aims to observe water cycle-related parameters, such as water vapor, liquid, sea surface wind speed, sea surface temperature, sea ice extent

and snow depth. So far, GCOM-W has monitored the global water cycle, including ice coverage in polar areas which are vulnerable to changes in climate. GCOM-C was launched in December 2017 to monitor 15 parameters, including aerosols, clouds, vegetation and surface temperatures on the land and in oceans. The monitoring of such data is necessary to enhance accuracy in the projection of future environmental changes.

A series of satellites for observing greenhouse gases have been developed by the Ministry of Environment, the National Institute for Environmental Studies and JAXA. The first Greenhouse Gases Observing Satellite (GOSAT) was launched in 2009. The world's first satellite dedicated to monitoring greenhouse gases such as carbon dioxide and methane, it has been accumulating data for almost a decade. On 29 October 2018, Japan launched the follow-up mission, GOSAT-2, which monitors the same observables, carbon dioxide and methane, but with higher accuracy across a broader range of locations, and also observes carbon monoxide to estimate local carbon dioxide flux more accurately and precisely.

JAXA is also promoting international cooperation in satellite data utilization. In 2017, JAXA initiated cooperation with ESA, CNES and DLR regarding the remote sensing of greenhouse gases and related missions for supporting the implementation of the Paris Agreement. Japan is also actively engaged in international frameworks such as the Group on Earth Observation and the Committee on Earth Observation Satellites to address global challenges.

#### **Space-based positioning, navigation and timing system**

Japan has been developing a space-based positioning, navigation and timing system known as “Quazi-Zenith Satellite System” (QZSS). QZSS has been operating as a four-satellite constellation since November 2018, and three satellites are visible at all times from locations in the Asia-Oceania region. QZSS can be used in an integrated way with the Global Positioning System, ensuring a sufficient number of satellites for stable, high-precision positioning. By the end of March 2023, Japan will have established a seven-satellite constellation to maintain and improve capabilities for sustained positioning.

#### **Asia-Pacific Regional Space Agency Forum**

The Asia-Pacific Regional Space Agency Forum (APRSAF) was established in 1993 to enhance space activities in the Asia-Pacific region. Space agencies, governmental bodies and international organizations such as United Nations agencies, as well as companies, universities and research institutes, from over 30 countries/regions and international organizations take part in APRSAF every year. It is the largest space-related conference in the Asia-Pacific region.

The twenty-sixth session of APRSAF was successfully held in Nagoya from 26 to 29 November 2019 on the theme “Advancing diverse links towards a new space era”, co-organized by MEXT and JAXA. The forum was attended by 469 participants from 31 countries and regions and nine international organizations, including seven heads and two deputy heads of space agencies from Asia-Pacific countries, as well as high-level officials from governmental institutions in charge of space policies. The participants discussed common issues and interests in the Asia-Pacific region and adopted the “Nagoya Vision”, which addresses the direction of activities over the next 10 years while looking ahead to the next quarter century. The vision has set four goals, which are solutions for a broad range of social issues, human resource development, advancing capabilities in policy implementation and encouraging the participation of new players.

Owing to the global coronavirus disease (COVID-19) pandemic, the twenty-seventh session will be postponed by one year and an online APRSAF event will be held on 19 November 2020 on the theme “Sharing space visions beyond distance”.

## Norway

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Norway currently has four microsatellites operational in low Earth orbit, four commercial (Telenor) telecommunications satellites in geostationary orbit and one in graveyard orbit. Several new satellites are scheduled to be launched over the next few years, especially microsatellites within the domain of maritime surveillance and communications.

Andøya Space Center is continuing its activities as a hub for launching scientific and student sounding rockets. At the same time, the project of developing a commercial spaceport for microlaunchers on the island is progressing well and passed the first milestone this year when the Government announced it would invest 365 million Norwegian kroner to establish a launch capability for small satellites. The first launch is currently planned for early 2022 with a microlauncher developed by an international partner.

The Norwegian space industry currently includes more than 40 companies, both large and small, in various locations across the country. The industry delivers high-tech products from ground station services to advanced mechanisms and payloads for satellites and rockets, and has a total combined revenue of approximately 8 billion Norwegian kroner per year. A major player is the Norwegian telecommunication operator, Telenor, which owns and operates several telecommunication satellites in geostationary orbit.

The majority of Norwegian space activities are carried out through Norway'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, Copernicus, Meteosat and MetOp; in the upcoming ESA scientific missions, such as Euclid; and in the recently launched 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, both during the critical launch and early orbit phase, and in regular operations.

Norway has bilateral agreements with several other nations regarding space research and applications, and makes important contributions to the NASA Mars 2020 Perseverance rover and IRIS solar observatory as well as to Japan's Hinode solar observatory.

Norway has several roles in the space weather part of the Space Safety Programme of the European Space Agency.

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

There is much space-related ground-based scientific infrastructure in Norway. This includes the Alomar Observatory at Andøya, the Kjell Henriksen Observatory (KHO) at Svalbard and the EISCAT Svalbard radar. KHO is the world largest optical northern light observatory, with 32 different instruments from international institutions. A large geodetic observatory is currently being upgraded at Svalbard.

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 an interest in the legal and political dimensions necessary to ensure the peaceful uses of outer space. Norway has been a member of the Committee on the Peaceful Uses of Outer Space since 2017.

Norwegian national space law dates back to 1969. Owing to the rapid developments in the space sector, there is an ongoing process to revise national legislation to reflect modern realities. Active participation in the Committee on the Peaceful Uses of Outer Space is viewed as essential to guiding and informing Norway in these processes.

Furthermore, Norway has completed work on a new national space strategy, which has given us the opportunity to re-examine national priorities and set a course for the future. The new national space strategy was published by the Government at the end of 2019 and approved by the parliament in 2020.

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 this regard, a large acquisition of high-resolution satellite data over land areas in the Tropics has recently been announced. This is a major contribution to the “Space2030” agenda.

## **Slovakia**

[Original: English]  
[13 November 2020]

### **Cooperation with the European Space Agency**

Slovakia has been cooperating with the European Space Agency (ESA) since 2010. Since 2015, within the period of the Plan for European Cooperating States (PECS), 39 PECS projects have been launched and are being successfully implemented.

Slovakia and ESA are starting negotiations on the next steps of cooperation after the PECS period, on the basis of the outcomes of the Slovakia PECS end-of-period report. This report identified the following key existing competences in Slovakia, demonstrated in the PECS open calls:

- Space hardware instrumentation and analysis
- Use of Earth observation satellite data – downstream products and applications
- Participation in space situational awareness/tracking

### **Diversification activities of the Slovak Investment and Trade Development Agency**

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

In recent months, SARIO organized several events focused on the Slovak space industry, including:

#### **Getting into Space: diversification workshop**

The workshop took place on 18 September 2019, introducing space sector entry opportunities for Slovak companies not yet involved in space activities.

### **Slovak Space in Brussels**

The Slovak Space in Brussels event (20 January 2020) introduced the Slovak space industry to representatives of international institutions, companies, embassies and industry associations from various European countries based in Brussels.

### **German-Slovak space industry e-meeting**

The German-Slovak space industry e-meeting (18 June 2020) was prepared in cooperation with the DLR to exchange information on the current space industry capabilities on both sides with focus on areas of joint interest and to identify potential business partnerships with research and development institutions.

### **“Emerging Space 2020”**

The “Emerging Space 2020” online event (10 September 2020), the main Slovak space industry event of the year, presented the Slovak potential to form new international partnerships within the space sector. The event included three sessions on the following themes: (a) Emerging space countries: integrating Slovakia and other new space countries into the European space economy; (b) Emerging space actors: building a space ecosystem by spinning-in and supporting start-ups; and (c) Emerging space domains: finding new promising areas in the global space economy.

### **International Telecommunications Union Conference**

Within the framework of cooperation in space by the Visegrad Group countries, Slovakia (together with the Czechia and Poland) were invited by the Department for Space Activities of the Ministry for Foreign Affairs and Trade of Hungary to participate in the International Telecommunications Union World Conference. The conference was held in Budapest on 12 September 2019. Four Visegrad Group countries presented their national space sector landscapes. In addition, three companies from each country had the opportunity to promote themselves at the Visegrad Group pavilion during the ITU exhibition, thanks to the invitation of the hosting country.

The Slovak Academy of Sciences is participating in the ESA JUICE (JUperiter ICy moons Explorer) mission, which has been integrated in 2020 and is planned for launch in 2022. It is going to Jupiter and will spend at least three years there making detailed observations of the planet and three of its largest moons, Ganymede, Callisto and Europa.

### **International Astronautical Congress**

In relation to the seventieth edition of International Astronautical Congress (21–25 October 2019), two events were important for Slovakia. The Faculty of Aeronautics of the Technical University of Košice became a member of the International Astronautical Federation (IAF), the very first Slovak institution to do so, and cosmic engineer Ján Baláž from the Institute of Experimental Physics at the Slovak Academy of Sciences in Košice became a member of the International Academy of Astronautics. Great success was also achieved by an international team, with participation of the Faculty of Aeronautics of the Technical University of Košice, the Slovak University of Technology, the Slovak Organization for Space Activities and two Slovak companies, Spacemanic and Needronix, whose GRBAlpha CubeSat project ranked second in a competition by IAF and the GK Launch Services company. That international project was prepared in cooperation with partners from Czechia, Hungary and Japan. The mission was announced at Brno Space Days 2019, and the planned launch date is 2021.

### **Copernicus Masters Space Awards**

The Slovak company Insar.sk received the Copernicus Masters Space Award at European Space Week 2019 for RemotIO – an infrastructure monitoring service with automatic updates and data-mining capabilities.

### **Space mission simulations**

A simulated Moon mission that was supported by ESA and took place in Hawaii in January was led by Slovak astrobiologist Michaela Musilová and used a mobile robot, Androver, developed by a Slovak company, RoboTechVision.

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