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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. In its report on its forty-eighth 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.105/987, paragraph 27).

2. In a note verbale dated 9 August 2011, the Secretary-General invited Governments to submit their reports by 31 October 2011. The present note was prepared by the Secretariat on the basis of reports received from Member States in response to that invitation.

II. Replies received from Member States

Belarus

[Original: Russian]
[4 November 2011]

Space activities in the Republic of Belarus include such key elements as space exploration and scientific and technical development under the National Space Programme, further development of the Belarusian space system for Earth remote sensing, international cooperation in the space sector, the training of outer space experts and the organization of conferences and exhibitions.

The National Space Programme was developed on the basis of the country's current economic capacity. The first stage of implementation covers the period 2008-2012, but some of the planned activities may extend until 2020. The activities under the National Space Programme are based on 11 targeted subprogrammes conducted by governmental agencies and the National Academy of Sciences of Belarus and on joint scientific and technical space programmes and projects undertaken by Belarus and the Russian Federation.

The main goal of the National Space Programme is the development and effective utilization of the scientific and technical capabilities of Belarus, with a view to creating space resources and technologies that will provide solutions to socio-economic issues, in the interests of the economy, national security and improved science and education in Belarus.

The objectives of the National Space Programme are as follows:

(a) Development of satellites for Earth remote sensing and advanced technologies for the creation of space facilities;

(b) Construction of ground infrastructure for receiving, processing and disseminating space information and for controlling space vehicles;

(c) Development of space information technologies and systems and their application in various areas of socio-economic activity;

(d) Establishment of a single State system for mapping and navigation using the Belarusian Earth remote sensing system;

(e) Scientific research and scientific and technical solutions to create basic elements, systems and advanced technologies for space resources;

(f) Programmes for the training, retraining and advanced training of personnel working in the space sector;

(g) Implementation of a series of measures to enable the Republic of Belarus to accede to agreements and join international organizations relating to the space sector.

Through the National Space Programme, the Republic of Belarus is pursuing a new direction in its science- and technology-related activities in order to develop its economy and meet public and business demand for space-related services.

Work has continued on the Belarusian space system for Earth remote sensing, which comprises space- and land-based segments.

With regard to the space-based segment, an orbital complex consisting of two Earth remote sensing satellites — Russian satellite Canopus-B and Belarusian satellite BKA — is being built jointly with the Russian Federal Space Agency. Special equipment for both satellites has been developed and produced by Belarusian experts, while the satellites themselves are being produced in the Russian Federation. The launch of the satellites is scheduled for the first half of 2012.

The land-based segment's complex for the rapid receipt and processing of large volumes of space information has recently been upgraded to be able to receive information from both the Russian satellite Meteor-M and the planned satellite complex.

Furthermore, work has been carried out to establish a command and tracking station and a flight control centre. Comprehensive preliminary tests of the components of the Belarusian Earth remote sensing system have been conducted in order to evaluate their readiness for flight tests.

A communications channel has been organized for the exchange of service information during operation of the satellites of the Earth remote sensing orbital complex and for ensuring the joint use of the Canopus-B and BKA satellites.

The "Geoportal" hardware and software complex, designed as an interface between the Belarusian Earth remote sensing system and users of Earth remote sensing data, has been tested in pilot mode.

International cooperation has been carried out through the participation of Belarusian scientists in a number of international projects and scientific and technical conferences on space-related issues and on the basis of joint space programmes and intergovernmental agreements.

The Russian Federation is the country with which Belarus has engaged in the broadest range of cooperation activities relating to space. In March 2011, the two countries signed an intergovernmental agreement on cooperation in the exploration and use of outer space for peaceful purposes. The procedure for ratification of the agreement is currently in progress.

In addition to the joint development of the two aforementioned Earth remote sensing satellites in 2011, implementation of a collaborative scientific and technical

space programme for the period 2008-2011, entitled “Development of fundamentals and technologies for the creation and application of orbital and ground-based tools for a multifunctional space system”, or “Cosmos-NT”, is currently coming to an end.

The programme provides for three areas of joint activity. The first is the further development of the technologies, hardware and software used to provide Russian and Belarusian consumers with Earth remote sensing data; the second relates to the construction of an experimental model of a new-generation microsatellite; and the third is the development of new materials for use in space and special and supporting hardware with improved technical features.

Cooperation with Ukraine in space activities has also increased. In 2009, the Government of the Republic of Belarus and the Cabinet of Ministers of Ukraine signed a framework agreement on cooperation in the exploration and use of outer space for peaceful purposes.

Areas for future cooperation in the space sector between enterprises and organizations of the Republic of Belarus and Ukraine have been approved. They include joint basic and applied scientific research, the development of state-of-the-art technologies for processing Earth remote sensing data, the establishment of an Earth remote sensing database for the exchange of space information, collaborative work to establish control and calibration facilities and the joint development of mini-satellites and microsatellites, including for educational purposes. The creation of new materials for use in space and the sharing of information from Belarusian and Ukrainian Earth remote sensing satellites are planned. A programme of measures to implement these future cooperation activities has been drawn up. Separate agreements have been established directly between interested enterprises in the Republic of Belarus and Ukraine.

In June 2011, a meeting of representatives of member States of the Commonwealth of Independent States (CIS) was held in the Republic of Belarus on the issue of cooperation in the space sector. Participants in the meeting expressed their interest in undertaking collaborative work, particularly in areas such as Earth remote sensing, the use of a global navigation system and of space communications, and space exploration. It was decided to set up a working group of representatives of CIS member States interested in collaborative work to further develop and extend multilateral cooperation in the space sector. The working group has been tasked with preparing a list of possible areas of cooperation and collaborative pilot projects.

Owing to the expansion of space activities in the Republic of Belarus, the training of young personnel has become considerably more important. Accordingly, a centre for aerospace education, equipped with a complex of ground-based facilities for receiving and processing data from small satellites used for educational purposes and from meteorological satellites, has been established at the Belarusian State University. Training curricula for specialists have also been developed. New specialized courses on space technologies are being offered.

Special exhibitions of achievements in this field and the discussion of results at conferences are playing an important role in the successful development and use of space technologies for various applications.

Consequently, at the Fifth Belarusian Space Congress, to be held in the Republic of Belarus from 25 to 27 October 2011, Russian, Ukrainian, German, Lithuanian and Belarusian scientists were to make 144 presentations covering the following themes:

(a) Advanced materials and nanotechnology for space applications;

(b) The Multifunctional Space System project of the Russian Federation and the Republic of Belarus, the international global monitoring aerospace system and other international space projects and programmes;

(c) Satellites and special-purpose and scientific equipment;

(d) Processing of images of the Earth's surface;

(e) Geographic information systems and applications;

(f) Space technologies and education;

(g) Problems caused by man-made space debris and the risks posed by asteroids and comets;

(h) Space navigation systems;

(i) Application of the results of space activities in the interests of various sectors of the economy.

An exhibition of technologies used to process Earth remote sensing data and of equipment, instrumentation and hardware for space applications developed during implementation of the joint Russian and Belarusian Cosmos-NT space programme was to be held in conjunction with the Congress.

Canada

[Original: English]
[28 November 2011]

The Canadian space programmes and activities led by the Canadian Space Agency (CSA) are delivered in close partnership with other Canadian Government departments involved in space activities, and with the cooperation of Canada's international partners. International collaboration with other space agencies is a hallmark of the Canadian space programme and an important factor in the enhancement of Canada's science and industrial capacity to meet the country's evolving priorities. Throughout 2010-2011, collaboration continued on a number of projects. Canada's Minister of National Defence and the Secretary of Defense of the United States of America signed a statement of principles on space situational awareness in March 2011. This framework recognizes the importance of space situational awareness to both countries and encourages and guides cooperation between the two countries on related activities. Canada also continued its participation as one of the five international partners in the use of the International Space Station (ISS) and as a cooperating member in certain European Space Agency (ESA) programmes. The Cooperating Partnership Agreement with ESA, which was first signed in 1979, is also being renewed for another term of 10 years. A Canadian expert, David Grimes, was elected president of the World Meteorological

Organization (WMO) in 2011 for a four-year term. Canada was also pleased to host the 2011 International Geoscience and Remote Sensing Symposium. The Canadian satellite SciSat-1, launched in 2003, continues to provide superb data on the concentration of minor constituents in the stratosphere. RADARSAT-1, currently in its seventeenth year of operation, also continues to provide C-band synthetic aperture radar (SAR) data in support of Canadian requirements and with respect to natural disasters internationally.

Earth observation

Canada actively contributes to a number of international working groups offering data from RADARSAT-1 and RADARSAT-2 satellites to the international user community under the Joint Experiment for Crop Assessment and Monitoring, Forest Carbon Tracking, and the Polar Space Task Group. Canada is also collaborating with other space agencies to share time-series datasets from a variety of Earth observing satellites for combination with in situ data to support observational requirements, science priorities and user needs benefiting the international community. Activities continue in support of the development of the RADARSAT Constellation Mission, which consists of three smaller satellites that will increase Canada's maritime and coastal surveillance capabilities and its participation in international Earth observation programmes. The Constellation is designed to contain a module capable of enhancing ship detection by capturing signals emitted by large ocean-going vessels using the Automatic Identification System (AIS).

Canada continues to play a major international role in the reception and stewardship of Earth observation data. The Canada Centre for Remote Sensing (CCRS) downloads and processes data from Canadian, American and European satellites. CCRS is also the Canadian lead on the Working Group on Information Systems and Services and, together with ESA and other countries, is cooperating in the implementation of interoperable long-term data preservation using ground-based systems. In cooperation with the German Aerospace Centre (DLR) and the Canadian private sector, a satellite ground station facility was recently established in Canada's northern community of Inuvik to receive TerraSAR-X data. In return, Germany is providing Canada with TerraSAR X data for research purposes. CCRS is also an active participant in the Earth Observation for Global Change initiative, which involves collaboration between national Earth observation research organizations in Australia, Brazil, Canada and China (the ABCC Programme), to assess various impacts and trends in global change. In partnership with scientific organizations from the Governments of Mexico and the United States, CCRS is involved in the development the North American Land Change Monitoring System.

Through the Earth Observation Envelope Programme of ESA, Canadian scientists are contributing to the calibration and validation of data from CryoSat-2, which was launched in April 2010. Canada is also exploiting near-real-time data from the Soil Moisture and Ocean Salinity mission to improve its numerical weather prediction model. In multilateral forums, Canada continues to support the work of the Group on Earth Observations (GEO), the Committee on Earth Observation Satellites (CEOS) and WMO.

Disaster management

From the beginning of its membership and participation in the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters (also called the International Charter on Space and Major Disasters), Canada has tasked the RADARSAT-1 and RADARSAT-2 satellites with acquiring images in support of disaster relief and mitigation internationally. In 2011, Canada pursued its participation in the Charter by providing data and other informational products such as images for monitoring the extensive oil spill in the Gulf of Mexico, large-scale flooding in Pakistan and the tsunami and flooding in Japan. Through international agreements and programmes such as the Science and Operational Applications Research programme, satellite images were also provided to assist international research efforts. Recently, through its participation in the Caribbean Satellite Disaster Project, Canada provided RADARSAT-2 images for coastal disaster management and emergency preparedness.

Search and rescue

Canada remained active in the International Satellite System for Search and Rescue (COSPAS-SARSAT), another international initiative using space applications to help people in distress, which was established in 1979. Over the past 30 years, Canada has contributed several search and rescue payloads flying on board low-Earth orbiting weather satellites operated by the United States. Canada actively supported this humanitarian programme and is now developing the next generation of the COSPAS-SARSAT Medium-Earth Orbit Search and Rescue satellite system, which will have SAR payloads on navigation satellites operating in medium-Earth orbit, including Global Positioning System (GPS), Global Navigation Satellite System (GLONASS) and Galileo constellations.

Public health

As a member of the Action Team on Public Health of the Committee on the Peaceful Uses of Outer Space, Canada presented a report at the forty-eighth session of the Scientific and Technical Subcommittee on the use of space technology to improve public health (A/AC.105/C.1/L.305), in which it summarized observations on the current state of the application of telehealth and tele-epidemiology in the world. In June 2011, Canada hosted a workshop on the theme “Space technology for public health actions in the context of climate change adaptation”, which provided new insights, ideas and collaborations in the cross-disciplinary area of space technology and public health.

International Space Station

Canada continues to play a key role in ISS through its robotics, the conduct of science and the assignment of its Canadian astronauts. In January 2011, Canadarm2 captured and berthed the Japanese H-II Transfer Vehicle (HTV-2) with ISS. In early 2012, Canadarm2 will capture the SpaceX Dragon vehicle, marking the first capture of a commercial free-flying vehicle. During 2011 the Canadian Mobile Servicing System, which includes Canadarm2 Dextre and the Mobile Base system, supported Space Shuttle missions STS-133, STS-134 and STS-135. The last Space Shuttle flight, STS-135, launched the Goddard payload of the National Aeronautics

and Space Administration (NASA) of the United States, which is designed to demonstrate robotic refuelling with Dextre that will be carried out in 2012. On 19 March 2011, STS-133 landed at the Kennedy Space Center with samples of white spruce trees, specimens from the Canadian APEX-CSA2 experiment. The VASCULAR experiment on ISS continued in 2011, with the collection of pre- and post-flight measures of human vascular structures and functions. The Canadian Hypersole experiment collected data from eight subject astronauts on STS-133, STS-134 and STS-135, in order to determine whether short-duration stays in space affect the sensitivity of pressure sensors in the feet of astronauts.

Space exploration missions

Canada is preparing for the launch of the near-Earth object surveillance satellite (NEOSSat) microsatellite in 2012. Designed to detect and track near-Earth objects and provide key data on objects (satellites and debris) orbiting the Earth, NEOSSat will be the first space telescope to search for near-Earth asteroids. The Mars Science Laboratory was launched by NASA in 2011, as was the Alpha Particle X-ray Spectrometer on the Curiosity rover, which is Canada's contribution to enabling scientists to determine the chemical composition of rocks and soils on Mars.

Space astronomy missions

Canada continued its work with NASA and ESA on the James Webb Space Telescope. Canada is designing and building one of James Webb's four science instrument packages, which contain a high-sensitivity camera, the Fine Guidance Sensor and a science instrument called the Near-Infrared Imager and Slitless Spectrograph. Canada's instruments for the Space Telescope will guide the spacecraft in order to accurately point the telescope at its celestial targets, while also searching for exoplanets. The Bright Target Explorer (BRITE) nanosatellites are the offspring of the Microvariability and Oscillations of Stars (MOST) microsatellite. These nanosatellites will support similar science goals, and will use an even smaller telescope than MOST to measure the brightness variations of a large number of the brightest stars in the sky. A Canadian concept, BRITE has attracted international interest, with Austria and Poland each providing two nanosatellites, which, together with the Canadian pair of nanosatellites, will form an eventual constellation of small space telescopes. Canada continued its collaboration with Japan, contributing a metrology system for the ASTRO-H satellite. The Department of National Defence's Sapphire satellite is set to launch in 2012. Sapphire is a space-based optical sensor that will provide observations of high-Earth orbit objects and a broader operational awareness of the space domain. Sapphire data will contribute to the work of the United States Space Surveillance Network to support efforts to increase safety in space.

Long-term sustainability

Canada is currently working on two major aspects related to the long-term sustainability of outer space: space weather and space debris. Canada recognizes the creation of the International Space Weather Initiative (ISWI) as an important contribution to the development of space weather science and is serving as a member of its steering committee. Among other goals, ISWI will capture data used

for modelling space weather and enable the forecasting of space weather. It will be used by space weather centres around the world, including Canada's Space Weather Forecast Centre. Canada will also contribute to ISWI by providing data for studies gathered from its extensive array of ground-based instrumentation, such as magnetometer and radar arrays. Planning continues on the definition of user needs for the proposed two-satellite Polar Communications and Weather mission designed to improve weather forecasts and provide telecommunications services in the high Arctic. Canada is preparing to launch the Enhanced Polar Outflow Probe (ePOP) payload on board the Canadian small satellite CASSIOPE in 2012. The ePOP probe will include a suite of eight scientific instruments that will collect data on the effects of solar storms.

In the area of space debris, a hypervelocity facilities cross-correlation exercise has been initiated with NASA; results of this exercise will be presented at the Inter-Agency Space Debris Coordination Committee (IADC) meeting to be hosted in Canada in 2012. Canada became an IADC member in 2010 and is chairing the committee during 2011/12. The third session of the International Interdisciplinary Congress on Space Debris was organized in 2011 in Canada and primarily addressed legal questions associated with space debris remediation and the on-orbit servicing of satellites. A report from this session will be distributed and submitted to the Committee on the Peaceful Uses of Outer Space, with the objective of contributing to the international debate on the challenges posed by space debris while underlining the importance and necessity of international cooperation. In the context of protecting its space assets when facing close approach alerts, CSA developed and operationalized its Collision Risk Assessment and Monitoring System to safely manage risks associated with space debris.

Capacity-building

Canada continued to be very active in building its space capacity through collaboration with Canadian universities and the space industry and through international partnerships, including with ESA. Through Canada's participation in the Living Planet programme of ESA, Canadian industry is contributing an instrument, the Electric Field Instrument, to each of the Earth Explorer Constellation SWARM satellites of ESA that are focused on improving the measurement of Earth's magnetic field and its variations that result from the ionosphere. With its status as a cooperating member of ESA, Canada currently participates in several ESA programmes: the Earth Observation Envelope Programme, the space component of the Global Monitoring for Environment and Security (GMES) programme, the European Life and Physical Science programme, the Advanced Research on Telecommunication Satellites programme, the General Support Technology programme, the European space exploration (Aurora) programme and the European Transportation and Human Exploratory Activities programme. This longstanding membership has resulted in the development of key niche-space technologies and has facilitated Canada's access to European space data and infrastructure.

Ecuador

[Original: Spanish]
[6 October 2011]

The Ecuadorian Air Force has announced that an aerospace research and monitoring centre is currently being developed on the island of Baltra, Galápagos province, in collaboration with other defence bodies and in partnership with national and international universities. The centre has the following objectives:

(a) To conduct research on space debris;

(b) To monitor near-Earth objects;

(c) To research and monitor atmospheric and space weather.

The Ecuadorian Air Force reports that the above-mentioned project is in its initial phase and is expected to be operational by the third quarter of 2014.

Japan

[Original: English]
[31 October 2011]

Participation in the International Space Station programme

The ISS programme is the largest international cooperative science and technology programme ever attempted in the new frontier of space. It will contribute to the further utilization of outer space and improve the quality of human life.

Japan has been active in promoting the ISS programme in cooperation with the other countries involved. The contributions of Japan to the programme include the development of the Japanese Experiment Module (Kibo) and the H-II Transfer Vehicle (HTV).

Japan has been contributing to the ISS programme, which is one of the most iconic international cooperation programmes for the peaceful use of outer space, since the very beginning of the programme. The Japanese experimental module Kibo has been utilized to conduct various on-orbit experiments.

In July 2010, the Japan Aerospace Exploration Agency (JAXA) established the Kibo Utilization Office for Asia, which will promote the utilization of Kibo with Asian counterparts.

Japanese astronaut Satoshi Furukawa flew to ISS on the Russian Soyuz spacecraft and started his long-duration stay in June 2011. He is executing his mission on the Station, including various experiments, and is scheduled to return to Earth in November. Japanese astronaut Koichi Wakata will be the commander of ISS during Expedition 39, the first Asian astronaut to have that role. In addition, three more Japanese astronauts were qualified as ISS astronauts in July 2011.

HTV is now playing an important role in transporting supplies to ISS. From January to March 2011, HTV successfully conducted its second mission, transporting resupply materials, experiment racks and system spares to ISS.

Remote sensing

Japan is deeply grateful for having received about 5,000 scenes captured by 27 satellites of 14 countries and regions in response to the great east Japan earthquake through international collaborative frameworks such as the International Charter on Space and Major Disasters, as well as Sentinel Asia.

Japan has been promoting international cooperation in a number of other fields. In the field of Earth observation, Japan cooperates closely with space-related organizations through CEOS. As a co-chair of the Architecture and Data Committee of GEO, Japan has been promoting the establishment of the Global Earth Observation System of Systems (GEOSS) and continues to take a leading role in the efforts towards its establishment, in line with the 10-year implementation plan.

JAXA is currently serving as the chair of the CEOS strategic implementation team, which is contributing to the space technology activities of GEO. Japan plays a leading role mainly in the following priority items of CEOS: monitoring of greenhouse gases and forest and carbon tracking.

Under the item on greenhouse gases monitoring from space, the Greenhouse Gases Observing Satellite (GOSAT or IBUKI), a joint mission of the Ministry of the Environment, the National Institute for Environmental Studies and JAXA launched in January 2009, accurately observes the concentration distribution of global greenhouse gases in the atmosphere. Japan has been producing and distributing carbon dioxide (CO_2) and methane concentration data in cooperation with the NASA Jet Propulsion Laboratory. Japan has also started to distribute final products of CO_2 net flux.

With regard to forest and carbon tracking, the Phased Array type L-band Synthetic Aperture Radar on board the Advanced Land Observing Satellite “Daichi” is likely to be valid for achieving the measurement, reporting and verification of activities as proposed in the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+). Daichi can detect forest/non-forest areas and measure the amount of aboveground forest biomass, which is critical information for measuring forest carbon absorption and emission. In October 2010, JAXA generated 10-metre resolution images and maps of the global forest and non-forest area distribution using this Advanced Land Observing Satellite, which has the highest resolution in the world. In addition, Daichi monitored illegal logging in the Amazon, in cooperation with the Brazilian forest management entities, and JAXA has initiated cooperation under REDD+, using Daichi with the National Institute for Space Research (INPE) of Brazil. JAXA and INPE will verify the utilization of the SAR on board Daichi to monitor tropical deforestation. Although Daichi terminated its operation as at 12 May 2011, Japan will continue to contribute to the solution of global environmental and climate change issues by collaborating with international entities, such as the United Nations Educational, Scientific and Cultural Organization and the Ramsar Convention secretariat.

Finally, the Global Change Observing Mission (GCOM) will allow long-term and ongoing observations that are essential to understanding the effects of climate change over many years. The GCOM mission consists of two series of satellites: GCOM-W for observing water circulation changes and GCOM-C for observing climate changes. GCOM-W1 will be launched early next year.

International Committee on Global Navigation Satellite Systems

Japan hosted the Sixth Meeting of the International Committee on Global Navigation Satellite Systems, held in Tokyo from 5 to 9 September 2011. When the devastating earthquake struck north-eastern Japan in March, the global navigation satellite system (GNSS) contributed actively to the wide-ranging efforts for search, rescue and restoration. Disaster management as one of the applications of GNSS and its expected contribution to the advancement of human security are highly anticipated. Japan has been promoting the Quasi-Zenith Satellite System and MTSAT Satellite-based Augmentation System.

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 the United Nations, as well as companies, universities and research institutes from over 30 countries and regions, have taken part in APRSAF, which is the largest space-related conference in the Asia-Pacific region. With increasing participation by high-ranking officials, APRSAF offers a good opportunity to discuss international cooperation in space activities.

APRSAF currently organizes working groups in the following areas: Earth observation, communication satellite applications, space education and awareness and space environment utilization, to share information about the activities and future plans of each country and region in those areas. APRSAF also supports the establishment of international projects that can help with disaster management and environmental protection and enhance cooperation between participating parties.

The seventeenth session of APRSAF, held in Melbourne, Australia, from 23 to 26 November 2010 had as its main theme the role of space technology and industry in addressing climate change. Australia proposed a new initiative named “Regional readiness review for key climate missions”, or “Climate R3”. The session was attended by approximately 230 participants from 23 countries and regions, and by six international organizations.

The eighteenth session of APRSAF was to be held in Singapore from 6 to 9 December 2011 under the theme of regional collaboration for tomorrow’s environment; it was to be co-sponsored by the Singapore Space and Technology Association; the Centre for Remote Imaging, Sensing and Processing of the National University of Singapore; the Ministry of Education, Culture, Sports, Science and Technology of Japan; and JAXA.

Cooperative activities of the Asia-Pacific Regional Space Agency Forum

During presentations and discussions in the four working groups and plenary sessions over the past few years, APRSAF has launched the following three cooperative activities to resolve regional issues:

(a) Space Applications for Environment, an initiative to contribute to climate change issues using Earth observation satellites;

(b) Satellite Technology for the Asia-Pacific Region (STAR), an initiative to develop small satellites in collaboration with APRSAF researchers and engineers for capacity-building purposes. Currently, STAR is evolving to be a mission of the University International Formation Mission project of Japan, funded by the Ministry of Education, Culture, Sports, Science and Technology;

(c) Sentinel Asia, which is an international joint project for which Japan provides the secretariat. It was created with the aim of disaster management and rescue support in large-scale disasters in Asia and the Pacific through the application of technology such as Earth observation satellite data. In April 2010, the project moved to the second stage (STEP2 Web-GIS), which involves an increase in the number of satellites that provide necessary data and a high-speed, large-capacity experiment of transmitting disaster information using the Japanese Wideband InterNetworking engineering test and Demonstration (KIZUNA) Satellite. This experiment has been conducted by Japan, the Philippines and Thailand since July 2009; Mongolia and Nepal joined in September 2010 (more information is available from http://sentinel.tksc.jaxa.jp).

In support of the rescue efforts in Japan following the great east Japan earthquake, which occurred in March 2011, images of satellites, including those of Daichi, as well as communication links by satellites, including KIZUNA, were provided through Sentinel Asia.

With the aim of enhancing services, Japan will continue its work through JAXA to promote the Sentinel Asia project with the cooperation of 66 organizations from 24 countries or regions and 11 international organizations.

Norway

[Original: English]
[26 October 2011]

Norway has had long tradition in space activities, owing largely to its northern latitude. The country has leading scientists within several space-related fields and is an established user of satellite communication, satellite navigation and Earth observation. It also has an internationally competitive space industry.

Space research

Norwegian space science is concentrated within relatively few areas. This concentration is necessary owing to limited resources, both in terms of funding and personnel. The main scientific activities relate to middle and upper atmospheric physics and solar physics. Cosmology has also been a growing field in recent years.

Andøya Rocket Range, with its launching site for scientific rockets, is an important site for space science in Norway, as is the international Arctic Lidar Observatory for Middle Atmosphere Research, which uses light detection and ranging (Lidar) systems to study the middle and upper atmosphere. At Tromsø and on Svalbard, European Incoherent Scatter (EISCAT) radars probe the nature of the magnetosphere.

Norwegian solar scientists are active in several international space projects and are deeply involved in the ongoing ESA-NASA Solar and Heliospheric Observatory project, which will continue until 2012. The scientific data from the Japanese Hinode mission are downlinked to the Svalbard and Troll ground stations and are processed and distributed at a European data centre at the University of Oslo. Norwegian scientists are also involved in the NASA solar mission Solar Dynamics Observatory mission, launched in 2010.

Scientists at the Norwegian Defence Research Establishment and the universities of Oslo, Bergen and Tromsø participate in several experiments on board spacecrafts, including research on particle currents, electric fields, X-ray radiation and dust. This includes the Cluster mission, which represents a constellation of four satellites flying in formation around the Earth to provide a three-dimensional map of the magnetosphere. The University of Bergen is developing a camera for the Atmosphere-Space Interactions Monitor (ASIM), which will be mounted on ISS. ASIM is designed to study the mysterious lightning phenomena high up the Earth's atmosphere called sprites, jets and elves. Norwegian space scientists are also participating in international projects such as Planck, Rosetta, Solar Dynamics Observatory and Transition Region and Coronal Explorer.

The Norwegian Defence Research Establishment and the Norwegian Mapping Authority also actively contribute to the International Earth Rotation and Reference Systems Service through analysis of GPS and very long baseline interferometry measurements.

In addition, Norway is involved in microgravity research. The University of Tromsø conducts cutting-edge research in dust formation in space and the upper atmosphere, and will take part in an experiment to produce this dust on board ISS. The Plant Biology Centre at the Norwegian University of Science and Technology hosts the user support operation facility for one of the key experiments on board ISS.

Earth observation

Norway has for many years focused on the development of Earth observation applications for maritime and polar areas. National user needs have been the driving force, furthered by close cooperation with major users, research institutes and industry. One example is radar satellite images, which have become an essential tool for the management of Norway's vast maritime areas, especially in combination with AIS data. Radar satellites are also used in the study of permafrost melting and in the monitoring of areas in danger of rockslides and tsunamis. Norway is an active member of the European Organisation for the Exploitation of Meteorological Satellites.

Kongsberg Satellite Services (KSAT) operates satellite stations at Svalbard, Tromsø and Grimstad, as well as in Dubai, South Africa and at the Troll station in

Antarctica. These ground stations support a large number of both national and international satellites and offer near real-time services. The stations have a very high level of reliability of services.

Industry

Norwegian industry is involved in the ISS programme, the Ariane 5 launchers, space telescopes and satellites for Earth observation, communication and navigation. The key companies within the Norwegian space industry are Telenor, Norspace and the Kongsberg Group. In 2010, the Norwegian space industry had a turnover of about 5.7 billion kroner, of which over 70 per cent was exported.

Communications

Telecommunications account for the lion's share of the Norwegian space industry, generating two thirds of the sector's annual turnover. Telenor is the principal company, with services and products for mobile satellite communications (Inmarsat), television broadcasting and, increasingly, satellite systems for multimedia and broadband. Several Norwegian companies are active in the market for maritime satellite communications.

Ship and oil spill detection

Norway's first satellite for space-based AIS monitoring service of ship traffic, AISSat-1, was launched in 2010 and has proved to be a success.

KSAT provides satellite-based monitoring and rapid reports of illegal discharges and accidental oil spills at sea. The combination of the AISSat-1 ship identification and the detection of oil spills from radar satellites is a powerful tool for identifying and catching polluters.

Satellite navigation

With its vast land areas and territorial waters, low population density and sub-Arctic to Arctic weather, Norway benefits immensely from GPS. Norway takes part in the development of Europe's global navigation satellite system Galileo as a member State of ESA as well as through cooperation agreements with the European Union.

Infrastructure

Norway's high latitude is a valuable asset for its space activities. Norway, in particular northern Norway and Svalbard, has geographical advantages with regard to the observation of northern lights and communication with polar orbiting satellites.

Rockets launched from the Andøya Rocket Range are well suited to study phenomena related to Sun-Earth interactions, as Andøya lies under the middle of the magnetic belt around the North Pole, where auroral activity peaks. Scientists can use sounding rockets launched from Svalbard to study the interactions of the solar wind with the polar magnetic cusp near the magnetic North Pole.

Northern Norway and Svalbard are also well located for studying the processes taking place in near-Earth space above the Arctic that can give indications of changes in the global climate.

Polar orbiting satellites pass near the North and South Poles 14 times a day. The SvalSat ground station on Svalbard has an optimal location for spacecraft control and for downloading data, as it can see all 14 daily satellite orbits. With the added capacity of the Troll ground station at Queen Maud Land in Antarctica, Norway possesses a pole-to-pole downlink capability.

Space debris

Norway contributes actively to space debris monitoring and takes part in the ESA preparatory programme on space situational awareness. The possible role of the EISCAT research radar system in this context is being explored.

Republic of Korea

[Original: English]
[3 November 2011]

The Republic of Korea establishes the Space Development Basic Plan every five years, in accordance with the Space Development Promotion Act of 2007. The Basic Plan covers space development matters in the Republic of Korea, including policy, organizational structure, financial and human resources, infrastructure expansion and international cooperation. Following the first Basic Plan, from 2007 to 2011, the Republic of Korea is preparing for the second Basic Plan, slated for 2012.

The Republic of Korea's first geostationary communication, ocean meteorology satellite (COMS) was successfully launched in June 2010 from the Guiana Space Centre. With a required minimum operational life of seven years, COMS entered into service in April 2011, offering meteorological and oceanic data for domestic and international users. The meteorological imager of COMS delivers weather images at 30-minute intervals during normal operation and at eight-minute intervals during emergencies, such as typhoons and floods. The ocean colour imager of COMS, the first of its kind to be placed in geostationary orbit, makes 10 observations of the ocean around the Korean peninsula per day.

Following Korea Multi-Purpose Satellite-1 (KOMPSAT-1), which completed its work in 2008, the Republic of Korea's remote sensing satellite in the low-Earth orbit, KOMPSAT-2, continues to operate successfully. Launched in 2006, it has outlived its designed lifespan by more than three years and has further extended its life expectancy to June 2013. KOMPSAT-2 carries a multispectral camera capable of capturing 1-metre resolution panchromatic images and 4-metre resolution multispectral images.

As a part of the KOMPSAT series, the Republic of Korea expects to operate a fleet of low-Earth orbit satellites in the coming years. Planned to be launched in late 2011 or early 2012, KOMPSAT-5 will carry the Republic of Korea's first SAR payload and will serve the GOLDEN (a geographical information system, ocean monitoring, land management, and disaster and environment monitoring) mission on

the Korean peninsula. KOMPSAT-3, to be launched in 2012, will carry a high-resolution electro-optical camera. KOMPSAT-3A, to be launched in 2013, will carry an infrared sensor and electro-optical instrument for Earth observation.

In 2011, the Republic of Korea continued to expand and strengthen international cooperation within the space community. The Korea Aerospace Research Institute (KARI) entered into an official partnership with ESA.

In June, KARI held its second international space training programme, with 24 participants from 16 countries (Colombia, Indonesia, Kazakhstan, Kyrgyzstan, Lao People's Democratic Republic, Mongolia, Nepal, Pakistan, Peru, Philippines, Seychelles, Romania, Singapore, Thailand, Turkey and Viet Nam), an increase from 11 participant countries in 2010. The programme offered courses in satellite systems, such as system engineering, spacecraft subsystems and payloads, satellite assembly and integration, satellite operation, remote sensing and application, and space communication, as well as in space science, including hands-on training on ground system operation. The Republic of Korea hopes that this programme will benefit the participating countries in utilizing space technology to improve the quality of life in their countries.

The Republic of Korea has also put forth great efforts to provide humanitarian assistance and support to countries in need by making its satellite data available. KARI, for example, contributed to damage analysis of disaster zones by supplying the International Charter on Space and Major Disasters with satellite footage of epicentres captured by KOMPSAT-2 in March 2011, at the time of the earthquakes and tsunami in Japan. KARI officially joined the International Charter on Space and Major Disasters in July 2011.

The Republic of Korea has employed various moves to raise public awareness of scientific culture related to space. Since its opening in June 2009, the Space Science Museum, located within the Naro Space Center, has greeted more than 500,000 visitors in two years. The museum contains a total of 5,520 m^2 of exhibition space, including 2,870 m^2 of indoor and 2,650 m^2 of outdoor exhibition space, with other facilities such as an auditorium. Several space education programmes are being held annually, such as the "aerospace science camp" for elementary, middle and high school students, the "vision camp" for university students and the "aerospace training" course for teaching staff.

KARI has been developing a risk management system for the collision of space debris since 2010. The system will consist of four major functions, such as a screening function, a fine assessment function, an orbit determination and prediction function and an optimized planning function for collision avoidance manoeuvres. The prototype system will be run by the end of 2013, and the final system will be used for mitigating the collision risk of the Republic of Korea's satellites, such as the KOMPSAT series and COMS.

Switzerland

[Original: French]
[27 October 2011]

Switzerland has a long tradition of engagement in space activities. The University of Bern designed a special solar sail to capture particles carried by the solar wind, which was erected by Neil Armstrong and his colleagues even before the American flag was unfurled on the Moon. Claude Nicollier, a Swiss citizen, was later among the first group of astronauts to be selected by ESA and took part in four space missions.

Organization of the space sector in Switzerland

Switzerland conducts most of its space activities through ESA, of which it is one of the founding members, and is also involved in the work of the organizations created to support the Agency's operational objectives: Arianespace, for issues relating to access to space; the European Telecommunications Satellite Organization; and the European Organisation for the Exploitation of Meteorological Satellites. In 2008, the country became a full member of the Committee on the Peaceful Uses of Outer Space, a forum in which it endeavours to defend its values regarding humanity's use of outer space. These values are founded on the belief that space should be exploited only for peaceful purposes and in a manner which is sustainable. Switzerland is therefore particularly focused on work relating to the long-term sustainability of outer space activities and the problem of space debris.

The impact of Switzerland's involvement in space-related activities is clearly visible in the country today. Swiss industry designs and manufactures a range of products, such as satellite structures, nose cones of launch vehicles, atomic clocks, on-board electronics and scientific instruments, using cutting-edge technologies whose innovative potential extends far beyond the space sector. Many synergies are being forged between industry and space research, which is concentrated in the country's universities, federal polytechnics and specialist higher education establishments and covers a broad spectrum of subjects, including the observation of very distant celestial bodies and the study of terrestrial climatic conditions, space biology and human physiological reactions to weightlessness. Researchers working in Switzerland enjoy an excellent international reputation and are involved in many large-scale projects. For example, no fewer than 35 scientists from the Swiss Federal Institute of Technology in Zurich (ETH Zurich) are involved in the development of the Euclid mission, which, classed as a priority by ESA in February 2010, seeks an understanding of the geometry of dark matter in the universe. In the field of robotics, Switzerland is also participating in the two ExoMars missions, run jointly by ESA and NASA.

Recent developments in space research

Switzerland recently took a further symbolic but nonetheless significant step forward in the development of its space capabilities with the launch of two entirely Swiss-built satellites. Seizing the opportunities afforded by the CubeSat concept, the Federal Polytechnic School of Lausanne and the University of Applied Sciences and Arts of Southern Switzerland celebrated successful launches into orbit of

picosatellites built by their students in collaboration with other educational establishments in Switzerland. The first picosatellite, known as SwissCube-1 and launched on 23 September 2009, was unable, for technical reasons, to begin its mission to photograph atmospheric airglow until the beginning of 2011. The second, Tlsat-1, which went into orbit on 12 July 2010, is designed to study the resistance of different materials to exposure to atomic oxygen. Both projects provide excellent opportunities for students to gain experience in space engineering and to see a real project through from start to finish, all while helping to stimulate interest in space among the Swiss population.

CHEOPS, a more ambitious Swiss satellite project that aims to characterize the structure and atmosphere of known exoplanets, is currently being prepared under the supervision of the University of Bern, with a launch date scheduled for 2017.

Space biology

Other scientific teams ran projects of great interest in 2010, making good use, for example, of the infrastructures offered by ISS, of which Switzerland is a partner. The Space Biology Group, based at ETH Zurich, was thus able to carry out the Pathway Different Activators experiment between 8 October and 26 November 2010. The experiment was conducted inside the Kubik incubator in the Columbus module of ISS and was aimed at studying the reaction of human T-lymphocytes to different types of stimulation in microgravity conditions. The experiment reflects the work of the group over more than 20 years in this area of space biology.

Solar radiation

Within the framework of the French PICARD space mission, the Davos Physical Meteorological Observatory conducted the Precision Monitoring of Solar Variability (PREMOS) experiment, which was aimed at monitoring solar irradiance. The PREMOS device is made up of six filter radiometers and one absolute radiometer, the latter able to measure total solar irradiance. PREMOS was brought into service on 27 July 2010 and has been operating to full satisfaction ever since. The calibration of its absolute radiometer is fully traceable, a first for a space experiment, enabling the value of total solar irradiance to be measured in August 2010 at 1,361 W/m^2, to an accuracy of 0.9 W/m^2, thus confirming the measurements taken as part of the Total Irradiance Monitor/Solar Radiation and Climate Experiment projects and resolving the debate on the absolute value of this quantity.

Earth observation

Situated lower in the atmosphere, the Airborne Prism Experiment (APEX), conducted under the Scientific Experiment Development Programme of ESA, carried out its test flights in the summer of 2010. Mounted on an aircraft, this new type of instrument, a dispersive pushbroom imaging spectrometer, will be used to examine processes on a regional scale as well as interactions between the Earth's surface and the atmosphere. APEX will also enable the observation tools of the future Sentinel-2 and Sentinel-3 missions of GMES to be calibrated and their results validated. This experiment, under the direction of the Remote Sensing Laboratories of the University of Zurich, is also being run in collaboration with the Flemish

Institute for Technological Research, a Belgian laboratory, and with technological support from the Swiss company RUAG.

Astrophysics

Space observation is another important component of space research in Switzerland. The Observatory of Geneva in particular has a high profile on the global stage thanks to the frequent advances it is making in the field of exoplanets following the observatory's discovery of the first such planet in 1995. In 2010, researchers at the institution revealed a surprising discovery concerning these distant planets, namely that the direction of their orbit around a star does not necessarily correspond to the direction of that star's rotation. The ISDC Data Centre for Astrophysics, which is linked to the Observatory and acts as a data centre for the INTEGRAL satellite of ESA, attracted attention in 2010 when, for the first time in relation to our galaxy, it provided evidence for the acceleration of cosmic rays emitted by Eta Carinae, a phenomenon which makes this hypergiant star the largest "Large Hadron Collider" in the Milky Way. The fifty-strong ISDC staff are involved not only in some of the best-known missions of ESA, such as Planck and Gaia, but also in projects run by the Japanese space organization and the Polar Research Institute of China. The work of the Zimmerwald Observatory, part of the University of Bern, involves observing objects orbiting the Earth and calculating their trajectory. It has become a world-renowned centre of excellence for the study of space debris and works with IADC.

Other research projects

Further information on recent space research in Switzerland has been compiled by the Swiss Academy of Sciences. The document is available from the following address: http://spaceresearch.scnatweb.ch/publications.html.

International collaboration

In the international arena, Switzerland is involved in the European Galileo satellite navigation system and GMES, as well as global programmes such as the Global Climate Observing System, Global Atmosphere Watch run by WMO, GEO and GEOSS. Several international data centres and international centres for the calibration of measuring instruments are based at Swiss institutions. Examples include the World Radiation Center at the Davos Physical-Meteorological Observatory; the world calibration centre for ozone, methane and carbon monoxide measuring instruments at the Swiss Federal Laboratories for Materials Science and Technology in Dübendorf; and the World Glacier Monitoring Service at the University of Zurich.

In recent years, Swiss support for the United Nations Programme on Space Applications has focused on sustainable development in mountain regions, a decades-long priority for the Swiss Agency for Development and Cooperation. Switzerland has provided financial and human resources to support a series of workshops organized since 2004 by the Office for Outer Space Affairs of the Secretariat, in collaboration with ESA, to encourage the use of space technology for the sustainable development of mountain regions, firstly in the Hindu Kush-Himalayas and subsequently in the Andes.

Turkey

[Original: English]
[10 November 2011]

Adhering to the peaceful uses of outer space, the activities of the Space Technologies Research Institute (TÜBİTAK-UZAY) of Turkey are summarized below.

Turkey's first national Earth observation satellite, RASAT, was launched by Dnepr rocket on 17 August 2011 from the Yasny launch base in the Russian Federation. Currently, all the equipment and subsystems of RASAT are being tested under the commissioning phase (see http://rasat.uzay.tubitak.gov.tr).

TÜBİTAK-UZAY initiated the Facility Establishment Project for Electric Propulsion Applications Research and Hall Thruster Development with the support of the State Planning Office of Turkey in July 2010. The project aims to set up an infrastructure for design, assembly, test and integration of electric propulsion systems and to manufacture a 70-mN Hall Effect thruster qualification model.

TÜBİTAK-UZAY is involved in the SEOCA project, a capacity-building initiative of GEO in Central Asia funded by the European Commission. The project, which started on 1 April 2010, is aimed at improving the collaboration between Central Asia and Europe in the use of Earth observation technologies for environmental monitoring as well as integrating the countries in Central Asia in the activities of GEO in order to tackle environmental problems.

TÜBİTAK-UZAY has joined the European Cooperation in Science and Technology COST Action MP0905 entitled "Black holes in a violent universe". The project focuses on the multiwavelength data analysis of supernovas, galaxies and clusters, with an emphasis on X-rays. Biannually, TÜBİTAK-UZAY shares its experience and presents research findings to the members of the working group.