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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**

Contents



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# I. Introduction

1. In the report on its forty-sixth 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.105/933, para. 16).

2. In a note verbale dated 31 August 2009, the Secretary-General invited Governments to submit their reports by 30 October 2009. The present note was prepared on the basis of reports received from Member States in response to that invitation.

# II. Replies received from Member States

## Armenia

[Original: Russian ]

Research is taking place at Yerevan State University to examine the properties of cosmic microwave background radiation and to discover the large-scale structure and evolution of the early universe. The data received from the Antarctic Balloon Observations of Millimetric Extragalactic Radiation and Geophysics (BOOMERanG) experiment and the Wilkinson Microwave Anisotropy Probe (National Aeronautics and Space Administration (NASA) satellite) for four frequency bands were examined using specially developed mathematical algorithms. Kolmogorov's statistics and criteria for stochastic processes were used initially to identify those properties of relict radiation charts that are directly associated with discontinuities in the large-scale distribution of matter, including the possible properties of recently discovered dark energy. In terms of information content, Kolmogorov charts are comparable to temperature and polarization charts of cosmic relict radiation. The research is taking place in collaboration with Russian specialists (Landau Institute for Theoretical Physics) and specialists from the United States of America (California Institute of Technology), Italy and Brazil. The mathematical algorithms that have been developed will be of particular importance in analysing the data expected from the Planck satellite launched recently (European Space Agency (ESA)) and in researching the atmosphere and surface of the Earth using spacecraft.

## Belarus

[Original: English]

**Goals and tasks of space activity in the framework of the National Space Programme of Belarus**

*Introduction*

Space technologies are recognized as an important tool for development, and in the future they will become even more important, playing a great role in further scientific and technical progress. Space research activities are at the forefront of

scientific and technical achievements, contributing to the solution of global, national and regional problems. Space research plays a significant role in the development of science, technology, economy and culture, provides security and defence capabilities, fosters the development of information technologies and assists in the monitoring of the environment. The development of space exploration in the twenty-first century will be defined not only by previous scientific and technological achievements but also by progress in many fields of science, technology, economy and world politics.

Active participation in space activities defines significantly the political prestige of a modern State, its economic, scientific and technical development and the strength of its defence. The analysis of current trends in space activities clearly shows that the leading countries of the world are making significant efforts to increase their space capability. Space research programmes, which are considered a priority in national scientific policies, are being carried out in various countries. In this context, Belarus also develops space research programmes.

The first developments in this area date back to the 1960s. One of the most important incentives for the development of the space-related scientific and industrial complex of Belarus was its participation in a number of space programmes of the former Union of Soviet Socialist Republics.

More recently, the joint space programmes between Belarus and the Russian Federation, such as Cosmos-BR (1999-2002), Cosmos-SG (2004-2007) and Cosmos-NT (2008-2011), contributed substantially to the reconstruction and development of space cooperation in the framework of the Union of Belarus and the Russian Federation.

It is important to mention the current programme of the Belarusian space system for remote sensing of the Earth, which is being implemented under the Decree of the President No. 278 of 14 June 2007, as well as the development of the National Space Programme (national programme for research and utilization of space for peaceful purposes for the period 2008-2012).

*Importance of development*

The recognition of the social and political importance of space activities and their significance in State policy led to the establishment of the National Space Programme. A number of important matters, such as human security, rational management of natural resources and the improvement of the ecological situation in regions of active anthropogenic impact on environment, can be addressed more effectively by using space technologies and systems.

Space activities in Belarus are developed through inter-branch and inter-agency cooperation and coordination. This allows us to achieve effective solutions to social, economic, organizational, industrial, legal, scientific and other problems by coordinating resources, implementers and time frames. It is important to note that for the implementation of the Space Programme not only is State financial support involved, but other types of investments are encouraged as well. It is also important to recognize that the implementation of the Space Programme requires the centralized and coordinated efforts of scientific, educational and industrial enterprises of different branches of the economy under State supervision and control.

The main goal of the National Space Programme is the development and effective utilization of the scientific and technological capabilities of Belarus, with a view to providing space solutions for social and economical matters, in particular in the fields of human security, science and education.

The main objectives of the programme are:

(a) Manufacture of spacecraft for remote sensing of the Earth and prospective technologies for the creation of space facilities;

(b) Construction of ground infrastructure for space information management and for space vehicle control;

(c) Development of information and space technologies and systems and their use in the different fields of social and economic activities;

(d) Carrying out scientific research and scientific and engineering programmes for the creation of basic elements, systems and prospective technologies for space equipment;

(e) Preparation of basic and advanced training programmes for staff involved in space activities and the formation of State policy in the field of space activities.

*Implementation stages and structure*

The first stage of the implementation of the National Space Programme was planned for the period 2008-2012. The programme was developed taking into consideration the economic situation of the country at that time, but it is envisaged that the planned activities may be extended until 2020. The National Space Programme set up the following main objectives and activities:

(a) Manufacture of prospective space vehicles;

(b) Construction of the ground infrastructure for space information management and for space vehicle control;

(c) Development of space information technologies;

(d) Development of satellite navigation systems;

(e) Creation of basic elements and prospective technologies for space equipment;

(f) Staff training;

(g) Organizational and legislative support.

The system of the National Space Programme is based on the various specific subprogrammes under the supervision of different governmental agencies and the National Academy of Sciences of Belarus, and on joint scientific and technical programmes and projects carried out by the Union of Belarus and the Russian Federation.

In the first stage of the implementation of the National Space Programme (2008-2012), 11 subprogrammes are being executed:

(a) State complex programme of scientific research: “Development of scientific fundamentals, technologies and prospective instrument equipment for carrying out complex studies of space and utilization of space information”, 2010-2012 (State customer is the National Academy of Sciences);

(b) State science and technology programme: “Space systems and technologies”, 2010-2012 (State customer is the National Academy of Sciences);

(c) Subprogramme: “Development of the Belarusian space system for remote Earth sensing”, 2008-2012 (State customer is the National Academy of Sciences);

(d) Subprogramme: “Prospective Belarusian space vehicles”, 2008-2010 (State customer is the State Military Industrial Committee);

(e) Subprogramme: “Ecological monitoring, hydro-meteorological observations and assessment of effective use of natural resources”, 2009-2012 (State customer is the Ministry of Natural Resources and Environmental Protection);

(f) Subprogramme: “Application of space information in geodesy and cartography”, 2009-2010 (State customer is the State Property Committee);

(g) Subprogramme: “Monitoring natural and technogenic emergencies with the use of space information”, 2009-2012 (State customer is the Ministry of Extreme Situations);

(h) Subprogramme: “Assessment of actual condition of agricultural areas with application of space information systems”, 2009-2012 (State customer is the Ministry of Agriculture and Food);

(i) Subprogramme: “Creation of the professional aerospace education system”, 2009-2012 (State customer is the Ministry of Education);

(j) Subprogramme: “Organization of safety support system for information space technologies”, 2009-2011 (State customer is the Operative Analytical Centre of the Office of the President of Belarus);

(k) Subprogramme: “Application of space information in the interests of forestry”, 2009-2012 (State customer is the Ministry of Forestry).

The scientific and technical programme carried out jointly by Belarus and the Russian Federation called “Development of fundamentals and technologies for the creation and application of orbital and ground-based tools for a multifunctional space system” (Cosmos-NT) is currently under way (2008-2011) within the framework of the National Space Programme (State customer, on the Belarusian side, is the National Academy of Sciences).

The following is planned within the implementation of the Cosmos-NT programme:

(a) Utilization of common scientific and technical areas between Belarus and the Russian Federation for the development of scientific programmes on space issues;

(b) Establishment of sustainable cooperation between Belarusian and Russian organizations for the development of space facilities and technologies that are competitive in the world market;

(c) Development and application of methods, technologies, hardware and software to promote space information, scientific and technical products and services of organizations working on space matters to the world market;

(d) Implementation of space technologies in science, technology and economy in Belarus and the Russian Federation.

The main players of the National Space Programme include the scientific and technological institutions and enterprises of the National Academy of Sciences, the high educational and scientific institutions of the Ministry of Education, the technological design and production enterprises of the State Military Industrial Committee, the Ministry of Industry, the Ministry of Natural Resources and Environmental Protection, the State Property Committee, the Ministry of Emergencies and the Ministry of Forestry. The Russian enterprise FGUP NPP VNIIEM participates in the implementation of the subprogramme "Development of the Belarusian space system for remote Earth sensing", and the following Russian enterprises are joint participants in the Cosmos-NT programme: A. A. Maksimov Space Systems Research Institute, FGUUP NPP BNIIP and Scientific Production Amalgamation of Space Instruments Ltd., as well as a number of other leading enterprises and organizations of the rocket and space branch of the Russian Government.

The National Academy of Sciences of Belarus is assigned as the State customer coordinator of the National Space Programme; the executive officer in charge of the scientific and organizational support of the programme is the United Institute of Informatics Problems of the National Academy of Sciences.

With the aim of increasing the efficiency of implementation and interaction between the relevant ministries, agencies and organizations, specific rules and regulations were approved and the inter-agency Coordinating Council for the National Space Programme was established.

*Main expected results*

The implementation of subprogrammes within the National Space Programme will facilitate the scientific and technical progress and improve the competitiveness of the Belarusian economy. In the first stage of the programme implementation, the following outputs are expected:

(a) The manufacturing and utilization of a Belarusian space vehicle for Earth remote sensing;

(b) The construction and equipment of ground-based control facilities;

(c) The creation of a digital space-images archive at the national offices of the Belarusian Space Remote Sensing System;

(d) The creation of special high-resolution hardware for the Belarusian space vehicle for Earth remote sensing;

(e) Further development and application of advanced space technologies and systems in different branches of national economy;

(f) Creation of a base system for professional aerospace education;

(g) Participation of Belarus in international organizations and international agreements in the sphere of space activity.

Pilot microsatellites, unified microsatellite platforms and the technology for space information management and ground control will be developed under the Cosmos-NT programme of the Union of Belarus and the Russian Federation. These developments will facilitate access for the general public to good-quality space information at a comparatively low cost.

The results of the implementation of the Cosmos-NT programme will be used as scientific and technical bases for the construction of new Belarusian space vehicles, and in the development of a ground segment of the Belarusian space system for Earth remote sensing.

*Conclusion*

The development of space activities under the National Space Programme corresponds to the State interests of Belarus and is in line with the modern trend of public support for space research. The programme was developed within the capabilities of the Belarus economy, taking into consideration the attraction of budget and extrabudgetary funds.

In the framework of the National Space Programme, a new space branch for the development of the Belarusian national economy and space service for social and governmental needs should be created.

The implementation of the National Space Programme will allow the systematic development of the Belarusian space system for Earth remote sensing, taking into consideration the launch of a new Belarusian remote sensing satellite to increase the number of space information consumers in the country and abroad. This gives the Republic the opportunity to participate in the creation of space satellite groups, which, in turn, will provide opportunities to join the countries that are participating in the project for the creation of an international aerospace monitoring system.

## Germany

[Original: English]

At the beginning of each calendar year, an annual financial and research report of the German Aerospace Centre (DLR) is published (an English version of the report is also made available). As in previous years, the DLR annual report was distributed during the annual session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space. Distribution of the 2009 report is again planned to coincide with the annual session of the Subcommittee in 2010.

# Italy

[Original: English]

**Space activities — 2009**

Enrico Saggese was the Commissioner of the Italian Space Agency (ASI) for one year, and on 3 July 2009 he was appointed President of ASI by the Italian Government. ASI promotes space activities through national programmes and through international space cooperation at the bilateral and multilateral levels in Europe and around the world. During 2009, ASI initiated new cooperation relations and intensified existing ones. On 16 October 2009, in Daejeon, Korea, the International Astronautical Federation General Assembly unanimously elected Naples to host the 63rd International Astronautical Congress in 2012.

Delegations from the 29 members of the European Space Agency (ESA) and from the member States of the European Union (EU) met in Prague on 23 October for the first EU-ESA International Conference on Human Space Exploration. The main objective of the meeting was to prepare a road map leading to the definition of a common vision and strategic planning for space exploration. Italy, as Chair of ESA, actively participated in the Conference and in its preparation.

In the following summary of the 2009 report, cooperation projects and national programmes on the peaceful uses of outer space are briefly presented.

Italy devotes special attention to Earth observation programmes. ASI is completing the deployment of a sophisticated dual-use (civilian/military) Earth observation constellation of four satellites, Constellation of Small Satellites for Mediterranean Basin Observation (COSMO)-SkyMed, dedicated to natural-resource protection and disaster management.

On 24 October 2008 the third COSMO-SkyMed satellite was successfully launched from the Vandenberg Base in California, the United States of America. The launch of the fourth satellite has been delayed until the last quarter of 2010. A second generation of COSMO-SkyMed satellites has already been planned.

COSMO-SkyMed satellites are part of the Italy-France dual system called Orfeo and of the Italian-Argentine Satellite System for the Management of Emergencies (SIASGE).

The first two COSMO-SkyMed satellites have provided images of natural disasters such as the shipwreck of the Russian tanker *Volganeft* in the Black Sea, the cyclone in Bangladesh, the landslide in Bolzano, the floods in Myanmar and Haiti, the earthquake in China and several other emergency situations during 2009. A first operational use of these satellites has been made by the National Civil Protection Authority during events in Italy, such as the Etna eruption, the floods in the Piemonte and Sardinia regions and the L'Aquila-Abruzzo earthquake. The COSMO-SkyMed programme is also the key element of the ASI programme on Earth observation applications dedicated to understanding and proving how space observation data could be used to deal with natural and manmade disasters (hydro-geological risks, geophysical risks and risks related to fires, oil spills and pollution). The scope of the programme is to integrate new functionalities, based on Earth observation data, in the decision support systems of institutional users, such

as the Civil Protection Authority, the Environmental Agency and local authorities. These projects are also the Italian contribution to the Global Monitoring for Environment and Security (GMES) programme and to the Global Earth Observation System of Systems (GEOSS).

ASI has finalized the development of the Radio Occultation Sounder for Atmosphere (ROSA) payload. ROSA is dedicated to collecting important information regarding the temperature, pressure and humidity of the atmosphere, thus contributing to the study and monitoring of climate change. ROSA has been installed on the Indian satellite Oceansat-2, which was successfully launched in September 2009. It will also be installed on the Argentine satellite SAC-D, scheduled to be launched in 2010.

On 17 March 2009 the European Gravity Field and Steady-state Ocean Circulation Explorer (GOCE) satellite was put into orbit. The satellite has completed the stage of commissioning and calibration in orbit, and in October it passed the flight tests. GOCE is a highly technologically innovative satellite that confirms the level of absolute excellence of the Italian aerospace industry, which has been the prime contractor for its manufacture.

In May 2009 Italy hosted in Stresa the 33rd International Symposium on Remote Sensing of the Environment (ISRSE).

In the field of solar system exploration, Italy is playing a significant role in the exploration of Saturn and its satellites with the NASA-ESA-ASI mission Cassini-Huygens, and in Mars exploration through collaboration with NASA and ESA. In particular, ASI developed the Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS), which is on board the Mars Express mission, and Shallow Radar (SHARAD), carried on the NASA Mars Reconnaissance Orbiter mission, with the goal of searching for liquid water and ice in the subsurface of Mars.

During 2009 the two radar systems have continued to send very significant information. In particular, radargrams provided by SHARAD allowed scientists to measure the stratification of the polar ice sheet. ASI has also completed the development of a Geographical Information System (GIS) for Mars and, for other planetary surfaces, the Planetary Geosciences Information System (PAGIS). PAGIS has produced a first high-definition Martian geological map as part of the ASI planetary map series. ASI is also deploying a test facility in a Martian analogue environment, which is located in the Moroccan desert. There it will be possible to test instruments and to land elements or training operation teams.

The Italian Planetary Fourier Spectrometer (PFS), on board the Mars Express, is mapping the abundance of water vapour and methane in the Martian atmosphere.

ASI-led instruments play a fundamental role in the study of primitive bodies, such as comets and asteroids, on missions that are currently cruising towards their targets. This year, the instruments on board the ESA Rosetta spacecraft, on its way to comet 67P/Churyumov-Gerasimenko, have observed the Steins asteroid during its fly-by, which occurred on 5 September. The Osiris wide angle camera, made in Italy, produced the first images of the asteroid. In the meantime, the NASA Discovery mission Dawn continues towards Vesta and Ceres, carrying the Italian Visible-IR Mapping Spectrometer.

Italy is also developing hyperspectral technologies. A new Earth observation system, Prisma, which is pre-operative, uses electro-optic instruments that integrate a hyperspectral sensor with a middle resolution panchromatic camera. Such equipment helps space observers to identify the chemical composition of objects.

Experimental campaigns performed with stratospheric balloons represent an important part of the Italian endeavour in space: tests and calibration of instruments to be employed in space are carried out through mid- and long-duration flights within the Earth's atmosphere. In the late spring of 2009 the Sounding Radar was successfully launched. It took on board a radar system similar to SHARAD to investigate polar and Antarctic areas in order to calibrate the radar data acquired on Mars and in three piggy-back experiments. The main experiment suffered a major problem, while the data from the other three are under analysis.

In the field of high-energy Astrophysics, the Italian satellite for gamma ray astronomy, Astrorivelatore Gamma a Immagini Leggero (AGILE), was launched in April 2007. The core of the mission is a new generation of gamma detectors used for experiments on the physics of elementary particles. In 2009, AGILE captured one of the most powerful events in the Universe, anticipated for decades by theoretical studies but never observed before: the gamma ray emission from the collision winds in a binary stellar system, produced by the huge gas masses of two stars orbiting around each other. Also in 2009, the mission, with an initial operational life of two years, was extended for two more years.

Italy participates in the international Alpha Magnetic Spectrometer project, a high-energy particle physics experiment in space to be installed on the International Space Station in 2010. The Italian astronaut Roberto Vittori will be a member of the shuttle mission that will investigate the composition of cosmic rays and provide the most sensitive search to date for the existence of anti-matter nuclei and for the origin of dark matter.

In the field of cosmology and fundamental physics, the Italian scientific community is participating in ESA Herschel and Planck Programmes, launched in May 2009. Planck will examine cosmic microwave background radiation, to a degree of accuracy never achieved before, to test theories of the early universe and the origin of cosmic structures. Herschel will study the evolutionary processes of the galaxies and the inner areas of star-forming regions. ASI funds and manages the development of the Italian PI-ship low-frequency instrument, the Italian contribution to the high-frequency instrument for Planck, to the instrument hardware and to the instrument control centres for Herschel. The first results of the two missions are confirming the excellent performance of the on-board instruments.

Italy contributes to the progress and expansion of human knowledge by exploring the mysteries and the opportunities of the universe, through data obtained from high-tech space systems. Along with numerous contributions to international missions, Italy is also carrying out national projects: in 2009 the preliminary studies have been completed for five small missions: (Spectroscopic Active Galaxies and Clusters Explorer, X-band Polarimeter, Microsatellite Floral Constellation for Radiometric Observations, Missione Altimetrica Gravimetrica Geochimica LunAre and Advanced Astronomy for Heliophysics).

Italy is involved in space debris initiatives at the national level and supports international activities to mitigate and prevent damages caused by space debris.

The operators of the Italian COSMO-SkyMed satellite constellation performed some collision-avoidance manoeuvres during 2009, following the crash of the Iridium 33.

At the fifty-second session of the Committee on the Peaceful Uses of Outer Space, in 2009, the Italian delegation and the German delegation made a request for the establishment of an international platform of data and information on objects in outer space, under the auspices of the United Nations (see A/AC.105/2009/CRP.19). That database — fed on an exclusively voluntary basis and freely accessible to Member States — would favour the promotion of a safe and sustainable development of the peaceful uses of outer space and is in line with the long-term sustainability of space activities, as proposed by the French delegation.

*Important projects in the field of life science*

The Mice Drawer System facility, aimed at shedding new light on the genetic mechanisms that drive the physiology and pathologies of bone mass, was uploaded to the Station in August 2009, and is now fully functional.

Disorders of Motor and Cardiorespiratory Control is a national programme aimed at developing scientific and clinical know-how in the field of gravitational physiology and at finding applications to use in rehabilitation treatments for neuromotor and cardiorespiratory diseases. After three intense years, the project produced interesting results.

Osteoporosis and muscle atrophy are strictly connected pathologies, both related to ageing and to degenerative pathologies. The Osteoporosis and Muscle Atrophy project is aimed at explaining the unresolved problems connected with these pathologies, which with incredible similitude are noted both in elderly persons and in astronauts.

From Molecules to Man is a programme that aspires to improve the level of scientific knowledge of the ageing processes in space and on Earth, and to develop measures against the effects of severe and extreme environmental conditions. Innovative countermeasures for human health in space, and the subsequent improvement of the quality of life of the elderly on Earth, are the end targets of these activities. The programme, coordinated by the University of Udine, involves 57 research institutes and in July 2009 successfully concluded its first phase.

With regard to Italian astronauts, in November 2008, Paolo Nespoli was assigned to Expedition 26/27. This is a long-duration mission to the International Space Station, planned to take place from November 2010 to May 2011. He recently started his International Space Station training in the Russian Federation, after being trained in the United States.

In January 2009 Roberto Vittori started his training in Houston, the United States of America, in preparation for a shuttle mission to the International Space Station that will take place in 2010.

Of the six new recruits of the European Astronaut Corps, two are Italian: Samantha Cristoforetti and Luca Parmitano. They were selected to serve on the International Space Station beginning in 2013, following a Europe-wide recruitment process, started in 2008.

Italy supports the development and realization of transportation systems that contribute to the strategic independence of European access to space by means of several projects regarding the European family of launchers now and in the future.

Most of the Italian activities dedicated to the current European family of launchers sector are included in ESA programmes such as Ariane 5, the Vega development support and Soyuz at the Guyana Space Centre.

Italy is the main sponsor of Vega, a launch vehicle for satellites up to 1.5 tons in low Earth orbit. The programme includes the development both of the launcher and of the ground infrastructures at the Guyana Space Centre that are deemed necessary for the integration and exploitation of the launch vector.

For the purpose of studying the evolution of the Vega launcher, ASI is supporting, on a national basis, the Lyra project. In the framework of a memorandum of understanding between ASI and the Russian Federal Space Agency on cooperation on launcher and space propulsion, Italian and Russian industrial companies have started a cooperative relationship concerning the development, manufacture and testing of a new demonstrator engine operating using liquid methane fuel.

*Telecommunications*

ASI supports the development of high-frequency communications capacity through research and innovation. In particular, ASI is carrying out three projects concerning experimental communication payload in W, Q/V and optical bands. Concerning the Q/V band, ASI is developing the first experimental civil telecommunication network in the world operating at 40/50 GHz. It is composed of a space segment that will be flown on board the Alphasat ESA satellite, and a ground station network that includes Earth stations in Italy and throughout Europe.

The Athena-Fidus cooperation project between Italy and France should also be mentioned. This is a geostationary satellite for dual broad-band communication services dedicated to independent users and for use by both the Government of France and the Government of Italy. Telecommunication services will be provided in the entire hemisphere of the geostationary orbit. It is also expected to support Italian institutional and humanitarian missions abroad.

Sigma is a new national telecommunications satellite system using highly advanced technology. For the first time, ASI will start a mission through the use of a public-private partnership. Sigma will have the double advantage of optimizing investments by private companies and restarting Italian research in telecommunications.

*Navigation*

Italy participates in the European Geostationary Navigation Overlay Service (EGNOS) and Galileo projects and promotes and develops national application projects aimed at fostering the use of satellite navigation, harmonizing them with European projects. The national satellite navigation projects represent an answer to a specific public demand relating to increasing the security of the transport sector and, in general, of improving territorial safety and security.

The Italian plan of activities comprises a set of macro projects in the transport sector: a maritime project focused on sea highways and personal navigation; a dangerous goods transportation project aimed at supporting all the phases of this sensitive transport activity; and a civil aviation programme, developed together with the national entity for air traffic control (ENAV), aimed at introducing EGNOS and Galileo services to the world of air traffic control and management.

Furthermore, there is a project aimed at sustaining "infomobility" and providing new services for traffic control, road tolls and billing. A specific project has been set up to develop new services for the urban mobility of blind people in order to provide them with detailed navigation both outdoors and indoors.

In May 2009 Italy hosted the European Navigation Conference (organized by the European Group of Institutes of Navigation) in Naples. In addition, it will host the 2010 International Committee on GNSS Assembly in Turin and will co-chair it with the European Commission.

*Education*

ASI promotes and funds scholarships for higher education courses to allow Italian and foreign students to have access to aerospace studies. On the basis of an agreement with the Conference of Italian University Rectors and individual universities, ASI organizes internships for university students and recent graduates. ASI is also deeply involved in developing new communication schemes and promoting activities oriented towards primary-school students. In particular, three comic books on space topics and a fascinating didactic performance on astronomy have been accomplished. The creation of a new three-dimensional didactic puzzle of the COSMO-SkyMed satellite is in progress.

In the framework of the collaboration programme between ASI and the National Commission on Space Activities of Argentina (CONAE) for the Mario Gulich Institute for Space Studies in Córdoba, Argentina, the Government of Italy offers annual fellowships to Argentine students and researchers, giving them the opportunity to study in Italian universities and remote sensing research centres. In 2009, ASI and CONAE launched the first two-year master's course in space applications and early warning.

In the framework of the intergovernmental agreement between Italy and Kenya regarding the San Marco project in Malindi, Kenya, ASI supports the technical education and professional training of Kenyan students. Scholarships have also been offered by the Italian Government to Kenyan researchers for PhD studies in Italian universities.

## Japan

[Original: English]

**Participation in the International Space Station programme**

The International Space Station programme is the largest international cooperative science and technology programme that humankind has ever attempted

in the new frontier of space. The ISS programme will contribute to the further utilization of outer space and will improve the quality of human life.

Japan has been active in promoting the International Space Station programme in cooperation with all the other countries involved. Japan's contributions to the programme are the development of the Japanese Experiment Module (Kibo) and the H-II Transfer Vehicle (HTV) to support ISS operations.

In July 2009 the last Kibo element, the exposed facility, was launched by space shuttle, and Kibo assembly was finally completed. Kibo is the largest laboratory in the International Space Station. We believe our future activities on Kibo will contribute to new scientific insights and innovations in various fields. In conjunction with this project, the Japanese astronaut Dr. Wakata stayed on board the Space Station for more than four months. This was Japan's first experience of a long-term stay in space.

HTV was successfully launched from Tanegashima Space Centre by H-IIB, a powerful new launch vehicle, and docked with the Space Station in September. Additionally, the new HTV rendezvous system has been verified. HTV will play an important role in transportation to the Space Station.

**Remote sensing**

Japan has also been promoting international cooperation in a number of other fields. For example, in the field of Earth observation, Japan cooperates closely with space-related organizations through the Committee on Earth Observation Satellites. As a co-chair of the Architecture and Data Committee of the Group on Earth Observations, Japan has been promoting the establishment of GEOSS and continues to take a lead role in the efforts towards its establishment, in line with the GEOSS 10-year implementation plan.

Additionally, Japan has been promoting international cooperation using the Advanced Land Observing Satellite (ALOS), also known as Daichi. Daichi began contributing to a better formulation of response measures to climate change threats in Latin America and the Caribbean, a project initiated by the World Bank. This includes an application, on a regional scale, to assess the effects of the rapid retreat of a glacier for the Tropical Andes Project, according to the agreement made on 17 April 2008 between Japan Aerospace Exploration Agency (JAXA) and the World Bank.

JAXA has started collaborating with the United Nations Educational, Scientific, and Cultural Organization (UNESCO) with a view to monitoring World Heritage Sites using Daichi. JAXA will acquire image data on 10 World Heritage Sites about twice a year; it will provide data to UNESCO and make a database of World Heritage Site images.

In order to estimate the amount of and changes in forest-originated carbon, last July JAXA made the dataset available on the website of the ALOS Kyoto and Carbon Initiative.

In order to detect the decrease of the ice sheets at the poles and track the changes, and as a contribution to the International Polar Year, in August 2008 JAXA made the mosaic datasets of the poles obtained by the Phased Array-type L-band Synthetic Aperture Radar sensor on-board Daichi available online.

In addition to Daichi's contributions, Japan is currently creating high-resolution, global digital elevation model datasets based on data obtained by a satellite operated in collaboration with the United States.

**Asia-Pacific Regional Space Agency Forum**

The Asia-Pacific Regional Space Agency Forum (APRSAF) meets yearly under the auspices of the Government of Japan with the cooperation of international partners. The fifteenth session of the Forum was convened in Hanoi and Halong Bay, Viet Nam, from 9 to 12 December 2008; the main theme was "Space for sustainable development". The aim was to strengthen the ability of the countries of the Asia-Pacific region to improve the quality of life of their people through enhancement of the use of space-based systems, activities and services.

Jointly organized by the Ministry of Science and Technology of Viet Nam, the Viet Nam Academy of Science and Technology, the Ministry of Education, Culture, Sports, Science and Technology of Japan and JAXA, the fifteenth session of APRSAF brought together about 200 participants from 20 countries and 6 regional and international organizations.

During the presentations and discussions of the four working group sessions and the plenary session, Japan launched two new initiatives. The first, Space Applications for Environment, is an initiative to observe climate change using Earth observation satellites. The second is the Satellite Technology for the Asia-Pacific Region programme. All the participants in the fifteenth session adopted its recommendations, and also agreed that the next session would take place in Bangkok from 26 to 29 January 2010, with the co-sponsorship of the Ministry of Science and Technology of Thailand and the Geo-Informatics and Space Technology Development Agency. The theme is "Space applications: contributions towards human safety and security".

**Sentinel Asia Project**

The Sentinel Asia Project, which is an international joint project that Japan has promoted and for which Japan serves as secretariat, was created with the aim of disaster management and rescue support in large-scale disasters in the Asia-Pacific region. In January 2008, the project moved to its second stage.

The second stage includes an increase in the number of satellites providing necessary data and will also involve a high-speed, large-capacity experiment of transmitting disaster information using the Japanese satellite Kizuna. This experiment has been conducted by Japan, the Philippines and Thailand since April 2009.

With the aim of enhancing services, Japan will continue its work through JAXA to promote the project with the cooperation of 54 national organizations from 22 countries and 9 international organizations.

# Myanmar

[Original: English]

## Introduction

There is no doubt that the application of space technology has influenced the socio-economic status of humankind. In Myanmar, the benefit of space technology has become known over a decade, and the utilization of space technology has been gradually implemented in governmental departments and the private sector.

Although space technology has been utilized widely all over the country, the knowledge of space science and the development of space technology are only at the initial stages. The Government of Myanmar supports the development of space technology for the peaceful uses of outer space.

In accordance with the guidance of the Chairman of the State, the Government plans to implement information technology and the utilization of space technology and its applications in all ministries, as well as in the private sector.

## Space Education and Training Programme

With regard to space technology, students in primary and high schools are taught basic science under the topic “The Earth and the sky”, which covers weather, the Sun, Moon and stars, wind, changes of the Moon, and atmospheric and temperature changes, and the topic on “Space and the weather”, covering such subjects as the solar system and the universe, the utilization of space, solar energy and the Earth. At the higher education level, some universities under the Ministry of Education offer postgraduate and training courses in remote sensing and geographic information systems.

Under the Ministry of Science and Technology, space education is imported mainly by the Myanmar Aerospace Engineering University (MAEU) and the Remote Sensing Department of Mandalay Technological University. MAEU offers a bachelor’s degree in aerospace engineering, including space systems engineering and space technology, and conducts research on aerospace. The Remote Sensing Department offers postgraduate courses on remote sensing and geographic information systems, and also conducts national research using space technology.

In the Ministry of Forestry, space technology is widely used. The Forest Department gives training courses on remote sensing and geographic information systems for watershed management. The University of Forestry also taught the subject of remote sensing and geographic information systems for forest management in postgraduate courses.

In the Ministry of Agriculture and Irrigation, three departments use space technology and applications, and hold training courses to advance the knowledge and usage of space technology. The training courses are the geographic information systems application course in the Department of Settlement and Land Records, the course on map cartography editing with TNT mips in the Department of Survey and Cartography and the remote sensing and geographic information systems course in the Department of Irrigation.

The Department of Meteorology and Hydrology, under the Ministry of Transport, forecasts weather conditions in Myanmar, and saves lives in natural disasters by using applications of space technology. It also offers training courses on satellite meteorology, the application of geographic information systems to flood monitoring and flood plain delineation, the application of remote sensing techniques to flood plain mapping and the integrated application of remote sensing and geographic information systems. The undergraduate class "Surveying and geographic information systems" is also taught at the Myanmar Maritime University. The private sector contributes to the knowledge and application of space technology by providing some training courses.

**International cooperation with space agencies**

There are three main space agencies for the Asia-Pacific region: CSSTEAP (affiliated with the United Nations), APRSAF and the Asia-Pacific Conference on Multilateral Cooperation in Space Technology and Application.

CSSTEAP is the regional centre for space science and technology education. It was established on the basis of affiliation with the United Nations in developing countries, and India was designated as the host country according to the report of the evaluation mission of the Office for Outer Space Affairs.

CSSTEAP offers postgraduate courses of nine months' duration in the fields of remote sensing and geographic information systems (at the Indian Institute of Remote Sensing), satellite communications, satellite meteorology and global climate (at the Space Application Centre) and Space and Atmospheric Science (at the Physical Research Laboratory).

APRSAF was established in 1993 to enhance the development of each country's space programme and to exchange views regarding future cooperation in space activities in the Asia-Pacific region. The Ministry of Education, Culture, Sports, Science and Technology of Japan and JAXA are the main host organizations.

At the annual sessions of APRSAF, four working groups — on communications satellite applications, earth observation, space education and awareness and International Space Station utilization — discuss the issues in their specific areas of responsibility, and then the results of discussions are adopted by the plenary as recommendations for future action.

Myanmar is a member country of CSSTEAP. Trainees are sent to the courses to learn how to design and implement education, research and application programmes in space science and technology. Moreover, representatives from Myanmar also participate in the annual session of APRSAF, and share knowledge of space technology and its applications gained from that Forum.

**Conclusion**

In Myanmar, the benefits and application of space technology have become well known. Lives have been saved by using weather satellites, as occurred in the Nargis storm in lower Myanmar in May 2008. The role of space technology has become more important for saving and improving the lives of people.

Although space technology is only at the beginning stages in Myanmar, with the support of the Government and the private sector, as well as through

international cooperation, Myanmar is planning to build the foundations for the development of space technology in the country, with the aspiration of launching its own satellite for the peaceful uses of space technology.

The Ministry of Science and Technology has tried to develop space technology and applications through the working groups on research on space technology and national research using the applications of remote sensing and geographic information systems for the peaceful uses of outer space.

## Poland

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### Space policy

Polish space policy in 2009 has focused mainly on national space research activities, national space industry development and international cooperation. The main coordinating body for national space research is the Committee on Space Research of the Polish Academy of Sciences (PAS):

Polish space research activities were performed in the framework of the programmes defined by the Polish Academy of Sciences and the Ministry of Sciences and Higher Education. The institutions carrying out these activities were the Space Research Centre of PAS, the Nicolaus Copernicus Astronomical Centre of PAS, Warsaw University of Technology, Warsaw University, Jagiellonian University of Krakow, Adam Mickiewicz University of Poznań, AGH University of Science and Technology and others. A more detailed description is in the paragraphs on space sciences. Some of the Polish space research activities were performed in the context of the European Union Seventh Framework Programme and cooperation with ESA.

Polish space industry development was supported by the Ministry of Economy in the framework of an ESA-Plan for European Cooperating State (PECS) agreement. The ratification of the agreement in April 2008 gave Polish companies access to ESA industrial markets and opportunities for cooperation with European partners in ESA space projects. The Ministry of Economy decided to increase the financial contribution for PECS, but implementation was delayed by the world financial crisis.

The main aim of international cooperation for Poland was to increase participation in ESA in the framework of the PECS agreement, with the final goal of becoming a full ESA member in five years. Poland actively cooperated with ESA countries. In addition to ESA and its countries, there was a good record of cooperation with the Russian Federation in space sciences, which was evident in experiments performed by scientists of both countries. The other partners cooperating with Poland are PECS countries (Hungary and Romania) and Eastern European countries. Poland is a member or cooperating member or user of the following international intergovernmental space organizations: European Telecommunications Satellite Organization (EUTELSAT), European Organisation for the Exploration of Meteorological Satellites (EUMETSAT), International Telecommunications Satellite Organization (INTELSAT), International Maritime

Satellite Organization (INMARSAT), International Satellite System for Search and Rescue (COSPAS-SARSAT) and International Organization of Space Communications (INTERSPUTNIK).

Other space policy activities in Poland were the following:

(a) The Polish Parliamentary Outer Space Group supported the acquisition of full membership by Poland in ESA;

(b) The draft national space law was presented, regarding the implementation of space treaties signed and ratified by Poland;

(c) The national strategy for the use of the space applications was developed by the Ministry of Economy with the support of the Space Research Centre of PAS;

(d) The space research strategy was developed by the Ministry of Science and Higher Education, with the support of the Committee on Space Research.

**Space technology**

In 2009 the main activities in the area of space technology dealt with instruments for space missions and small satellite development.

**Space transportation**

The main player is the Space Research Centre of PAS, whose instruments were placed in the following active missions: Rosetta, Mars Express, Venus Express, IBEX, Herschel, Coronas Photon, Integral and Demeter. Other instruments will be installed in future space missions, including the International Space Station. Antennas designed and built by Wroclaw University of Technology were installed in the Columbus laboratory of the Space Station.

In 2009 the Warsaw University of Technology and Wroclaw University of Technology performed projects related to small satellites. Student groups are engaged in the construction of European Student Space Exploration and Technology Initiative satellites, the European Student Earth Orbiter and the European Student Moon Orbiter. PW-Sat nanosatellite project is conducted by Warsaw University of Technology in cooperation with Gdynia Maritime University, the Polish Astronautical Society and the Planetary Society. Its launch is currently planned for fall 2010 on board the ESA Vega launcher. There were delays in launcher development.

Research was conducted on propulsion and elements of the small launcher by Warsaw University of Technology and the Institute of Aviation. The research activities in this area include participation in GRASP, Aerocapture for Future Space Transportation and Space Transportation Assets Valorisation in Europe projects in the Seventh European Framework Programme.

In May and June 2009 the Warsaw Space Days were observed. The main goal of this event was to demonstrate to the general public the benefits of space technologies and their applications. Workshops, conferences and training sessions were held on the subjects of project and information technology management. The new area emerging in Poland is space architecture. There were two projects conducted by non-governmental organizations, and one of them is prepared to enter into the investment phase.

**Space sciences**

Space sciences are a triad consisting of the exploration of outer space, study of the Earth from space and research in the outer space environment (including microgravity). In 2009 Polish activities were carried out in most of the above-mentioned areas. The contributions to this subject are scientific instruments and data interpretation.

Outer space exploration activities were carried out in the following areas: astrophysics, heliophysics, planetology, plasma physics and, recently, astrobiology. In astrophysics Poland participates in the ESA Integral and Herschel projects. Future participation is planned in the Cross-scale and Laplace missions. In heliophysics, Poland participates in the IBEX and Coronas-Photon missions. There is planned participation in the Solar orbiter mission. In planetary sciences, Poland participates in the Mars Express, Venus Express, Cassini-Huygens and Rosetta missions. In the future it will participate in the Bepi-Colombo mission. In plasma and space physics, Poland participated in the following space missions and experiments on board the International Space Station: Demeter, Obstanovka and Matrioshka. Missions and experiments in which it plans to participate are Asim, Cross-scale and Taranis. In astrobiology, Poland participates in preparations for the ExoMars mission.

The study of the Earth from space is conducted in the fields of remote sensing and satellite geodesy. Satellite geodesy research activities were concentrated on Global Positioning System (GPS) and Laser Ranging Station (SLR) measurements in the framework of the International GNSS Service, the International Laser Ranging Service, the International Earth Rotation and Reference Systems Service and the European Reference Frame Permanent Network. Participating institutions include AGH University of Science and Technology, Warsaw University of Technology, the Institute of Geodesy and Cartography, the University of Warmia and Mazury, the Space Research Centre PAS and Wroclaw University. GPS and SLR measurements are supported by theoretical and analytical activity on gathered measurement data.

In the field of remote sensing, research activities concentrated on methods of utilization and interpretation of remote sensing data from satellite sensors and sensed phenomena modelling performed in the frame of the Seventh European Framework Programme and national programmes. Examples of these activities include pollution mapping, forest health monitoring, flood documentation, soil moisture monitoring and modelling in meteorology. Remote sensing activities are supplemented by air and ground measurements. Institutions engaged in these activities include the Space Research Centre of PAS, the Institute of Geodesy and Cartography and Polish universities. Remote sensing activities are supported by remote sensing technology development programmes. The most recent is the Proteus project, led by the Space Research Centre of PAS. Preliminary studies are being conducted on a small remote sensing satellite.

Microgravity research has not been performed in Poland since the days of the Council on International Cooperation in the Study and Utilization of Outer Space. New possibilities for microgravity research on board the International Space Station are under consideration.

**Space applications**

In Poland in 2009 there were activities in the following fields of space technology applications: telecommunication, meteorology, remote sensing, satellite navigation and geodesy, and space weather.

In 2009 Poland was a user of the following satellite telecommunication systems: INTELSAT, INMARSAT, EUTELSAT and INTERSPUTNIK. The main Satellite Services Centre of Telekomunikacja Polska is located in Psary, near Kielce. The Centre offered services in:

(a) VSAT data transmission;

(b) Voice, telefax and data transmission in the INMARSAT system;

(c) Capacity leasing for the space segment;

(d) Operator services for satellite ground stations.

The Institute of Meteorology and Water Management carried out activities on the use of meteorological satellites from EUMETSAT and National Oceanic and Atmospheric Administration constellations for weather and water resources management. Poland has become a full member of the EUMETSAT organization.

Remote sensing activities were carried out by public and private entities. Projects involved thematic maps based on satellite images; forest, environment, industrial and urban development monitoring; geographic information systems; and projected use of small satellites for crisis management. Participation in the European Global Monitoring for Environment and Security Copernicus programme involved the use of remote sensing data for various projects.

Satellite navigation and geodesy data use was very intensively developed. It was based mainly on use of the United States GPS and the European EGNOS system. There were over 100 Differential GPS reference stations and EGNOS reference stations used. The use of satellite navigation by private users and public institutions was very actively pursued. Research institutions mentioned above actively participated in these efforts.

Space weather activities were carried out by the Ionospheric Forecasts Centre of the Space Research Centre of PAS as a part of international network action in this field.

## Thailand

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As a State member of the Committee on the Peaceful Uses of Outer Space, Thailand has emphasized activities on the peaceful uses of outer space by having bilateral cooperation with many countries: China, France, India, Japan, Lao People's Democratic Republic, United States and Viet Nam. In addition, Thailand is an active member of international organizations: Committee on the Peaceful Uses of Outer Space, Committee on Earth Observation Satellites, Group on Earth Observations (GEO), Asian Conference on Remote Sensing, APRSAF, Asia-Pacific Space

Cooperation Organization, CSSTEAP and Economic and Social Commission for Asia and the Pacific.

Thailand, through the Geo-Informatics and Space Technology Development Agency, served as a Chair of the Committee on Earth Observation Satellites. During that tenure, the Committee prioritized supporting the 2009-2011 GEO workplan and supported the efforts of sharing Earth observation data, technologies and end-to-end service with developing countries. The coordination and cooperation to reach the aforementioned objectives were mainly developed through its working groups, virtual constellations and societal benefit areas. Working progress and tangible outcomes were reported at the 23rd Plenary Meeting of the Committee on Earth Observation Satellites, held in Phuket, Thailand on 4 and 5 November 2009. The workplan and expected outcomes for 2010 were also discussed at the Plenary Meeting. It is clear, on the basis of the Committee's deliverables, that 2009 is another successful year.

Thailand regularly participates in APRSAF. In 2010 the sixteenth Conference of the Forum will be held in Thailand, jointly organized by the Ministry of Science and Technology of Thailand, the Geo-Informatics and Space Technology Development Agency, the Ministry of Education, Culture, Sports, Science and Technology of Japan and JAXA, under the main theme "Space application contributions towards human safety and security". The objectives are to contribute towards solving problems not only in the Asia-Pacific region but throughout the world, as well as to exploit space technology development and utilization for the sustainable development of countries in the Asia-Pacific region. The sixteenth Conference will be held from 26 to 29 January 2010 in Bangkok.