



# General Assembly

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## Committee on the Peaceful Uses of Outer Space

### International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat

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## I. Introduction

1. In the report on its forty-ninth 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.105/1001, para. 29).
2. In a note verbale dated 31 July 2012, the Secretary-General invited Governments to submit their reports by 19 October 2012. 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: English]  
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#### Introduction

The analysis of modern tendencies and factors in the development of space technologies shows that the world's leading countries make significant efforts to increase their space technology potential. Space exploration is pursued in many countries as a priority within their scientific and technical programmes. The Republic of Belarus is also involved in space exploration, and these activities can be traced back to the 1960s. The important incentive for the development of the scientific and industrial complex of the Republic of Belarus, which includes space technologies, was the participation of the Republic of Belarus in space programmes of the former Soviet Union. The joint Belarus-Russian space programmes "Cosmos-BR" (1999-2002), "Cosmos-SG" (2004-2007) and "Cosmos-NT" (2008-2011) represented a considerable contribution to the further development of scientific, technical and economic cooperation between the Republic of Belarus and the Russian Federation in the areas of space facilities and the development of space technologies. These activities were coordinated by the Russian Space Agency and the National Academy of Sciences of Belarus. In accordance with the decree of the President of the Republic of Belarus No. 278 of 14 June 2007 the Belarusian Space System for remote sensing of the Earth is being implemented, and the National Space Programme of the Republic of Belarus for exploration and use of space for peaceful purposes for the period 2008-2012 has been developed.

#### Importance of the development

The National Space Programme is characterized by its social and political importance and its general significance to the State, and defines a number of tasks that can be solved most efficiently by using space technologies for social-economic development in the Republic of Belarus, for improving the safety of the lives of its population, for a more rational natural resource management, and for the improvement of the ecological situation in regions of active anthropogenic impact on the environment.

### **Main goals and tasks**

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 for socioeconomic 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 socioeconomic activity;
- (d) Scientific research and scientific and technical solutions to create basic elements, systems and advanced technologies for space resources;
- (e) Programmes for the training, retraining and advanced training of personnel working in the space sector;
- (f) Formation of the state policy in the area of space technologies.

### **Implementation stages and structure**

The first stage of implementation of the National Space Programme covers the period 2008-2012. The Programme was developed on the basis of the country's economic capacity, but some of the planned activities may extend until 2017. The implementation of the Programme is based on targeted subprogrammes. In the first stage of the Programme's implementation for the period 2008-2012, the following 11 subprogrammes are being carried out:

- (a) "Development of scientific fundamentals, technologies and perspective instrument equipment for complex space exploration and use of space information", for the period 2010-2012, which is the State programme of scientific research. The State client is the National Academy of Sciences of Belarus;
- (b) "Space Systems and Technologies", for the period 2010-2012, which is the State science and technology programme. The State client is the National Academy of Sciences of Belarus;
- (c) "Development of Belarusian space system for remote sensing of the Earth", for the period 2008-2012. The State client is the National Academy of Sciences of Belarus;
- (d) "Perspective of Belarusian space devices", for the period 2008-2010. The State client is the State Military Industrial Committee;
- (e) "Ecological monitoring, hydrometeorological observations and assessment of the efficient use of natural resources", for the period 2009-2012. The State client is the Ministry of Natural Resources and Environmental Protection;

(f) “Application of space information in geodesy and cartography” for the period 2009-2010. The State client is the State Property Committee;

(g) “Monitoring natural and man-made emergencies with the use of space information”, for the period 2009-2012. The State client is the Ministry of Emergency Situations;

(h) “Assessment of actual conditions of agricultural areas with application of space information systems”, for the period 2009-2012. The State client is the Ministry of Agriculture and Food;

(i) “Creation of a professional aerospace education system”, for the period 2009-2012. The State client is the Ministry of Education;

(j) “Organization of a safety support system for information space technologies” for the period 2009-2011. The State client is the Operative Analytical Centre of the Presidential Office of the Republic of Belarus;

(k) “Application of space information in the area of forestry”, for the period 2009-2012. The State client is the Ministry of Forestry.

The main performing institutions of the National Space Programme are scientific and technological design institutions and enterprises of the National Academy of Sciences of Belarus, universities and scientific institutions of the Ministry of Education, 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 Emergency Situations, the Ministry of Forestry and others. The National Academy of Sciences of Belarus is the coordinator of the National Space Programme.

The head executing office carrying out the scientific and organizational support of the programme is the United Institute of Informatics Problems of the National Academy of Sciences of Belarus. The Coordinating Council of the National Space Programme was set up to coordinate interaction of relevant ministries, agencies and other institutions to enhance the efficiency of the Programme’s implementation.

### **Main results**

The first stage of the programme in the period 2008-2012 had the following results:

(a) Production and launch of the Belarusian Earth Remote Sensing Satellite on 22 July 2012;

(b) Construction and technical equipment of the ground-based Planning and Control Complex;

(c) Creation of digital space imagery archive at the National Operator of the Belarusian Space Remote Sensing System;

(d) Creation of special high resolution hardware for remote sensing satellites;

- (e) Further development and application of advanced space technologies and systems in different branches of the national economy;
- (f) Base system for professional aerospace education.

### **Conclusion**

The activities provided for in the National Space Programme correspond with the State interests of the Republic of Belarus and are in line with global tendencies of State support in the areas of space research, space development and space technologies.

On the basis of the National Space Programme, a new space branch for the development of Belarusian economy, as well as a space service for social and government needs, is to be created.

Implementation of the National Space Programme will lead to systematic development of the Belarusian space system for remote sensing of the Earth, that together with the launch of the Belarusian remote sensing satellite, could increase the number of consumers of space information in the country and abroad. The Republic of Belarus will be able to participate in the creation of space satellite groups and join the countries in the International Aerospace Monitoring System. The Republic of Belarus has concluded bilateral agreements on cooperation in the peaceful exploration and use of outer space with the Russian Federation and Ukraine.

### **Reference**

Resolution No. 1517 of the Council of Ministers of the Republic of Belarus dated 14 October 2008, on the National Space Programme for Research and Use of Space for Peaceful Purposes for the period 2008-2012, is available at <http://pravo.by/webnpa/text.asp?RN=c20801517>.

### **Germany**

[Original: English]

[29 October 2012]

The German Aerospace Centre (DLR) has close relations with nearly all spacefaring nations around the world. Next to its strong commitment to the European Space Agency (ESA), DLR cooperates with partners inside and outside Europe on bilateral and multilateral bases.

International cooperation is the key strategic aspect of DLR's activities. Beyond cooperation with agencies, DLR seeks to link institutionally to selected universities in the international arena (DLR@international). The Tohoku University in Sendai and the Nanyang Technological University in Singapore are examples of this kind of closer cooperation.

DLR and the French space agency, the Centre national d'études spatiales (CNES), are working jointly to develop a climate satellite, the methane remote sensing light detection and ranging (Lidar) mission (Merlin). It will measure the

atmospheric concentration of the greenhouse gas methane with high resolution and accuracy. The launch of this satellite is planned for 2016.

Germany contributes to the Japanese asteroid mission Hayabusa-2 by providing the DLR-developed Mobile Asteroid Surface Scout (MASCOT) lander. CNES has agreed to participate in the MASCOT lander on a subsystem level with the instrument MicrOmega. Hayabusa-2 with MASCOT is presently planned to be launched end of 2014.

DLR and the Japanese Aerospace Exploration Agency (JAXA) are continuing their annual strategic meetings to foster fruitful cooperation between the agencies. In December 2011, JAXA and DLR extended their joint memorandum of understanding on disaster monitoring. The partnership in disaster monitoring between JAXA and DLR proved to be very effective during the earthquake in Japan in March 2011. In spring 2012, DLR and the Tohoku University in Sendai decided to cooperate in disaster monitoring with the University holding expertise in this area.

In order to enhance the strategic cooperation with Japan, DLR plans to set up a DLR office in Tokyo beginning in 2013. This office will also seek to enhance collaboration with partners and agencies in other Asian countries such as China and the Republic of Korea.

The chair of the DLR Executive Board, Johann-Dietrich Wörner, and members of the Executive Board Gerd Gruppe and Hansjörg Dittus, as well as the German Ambassador Peter Ammon, met in December 2011 with the Administrator of the National Aeronautics and Space Administration (NASA) Charles Bolden and members of the United States Congress to discuss, in particular, the future exploitation of the International Space Station (ISS), the status of the Stratospheric Observatory for Infrared Astronomy (SOFIA) and the Grace Follow-On mission.

During the National Space Symposium in Colorado Springs in April 2012, the Space Foundation honoured DLR scientists twice for successfully commercializing the space technology-based fire watch system "FireWatch". It was the first time that an award had been given to a German organization for a space-derived system used for the benefit of humankind.

In May 2012, a general agreement between the Russian Space Agency Roscosmos and DLR was signed regarding the common implementation of the Kontur 2 experiment on the Russian segment of ISS. The DLR Institute of Robotics and Mechatronics as well as the Central Research Institute of Robotics and Cybernetics in St. Petersburg and the Russian Rocket and Space Corporation, RKK Energija, are involved. The experiment deals with the control of terrestrial robotical installations in Oberpfaffenhofen and St. Petersburg from on board of ISS.

In May 2012, the NASA Administrator Charles Bolden visited Berlin and DLR in Oberpfaffenhofen to further discuss bilateral and multilateral space cooperation opportunities and held further meetings at the political level, such as with the Parliamentary State Secretary of the Federal Ministry for Economics and Technology, Peter Hintze, and Klaus-Peter Willsch, Member of Parliament.

At the International Aviation and Space Salon (MAKS 2011) in Moscow, the chair of the DLR Executive Board, Johann-Dietrich Wörner, welcomed Prime Minister Vladimir Putin of the Russian Federation at the DLR exhibition. During

the Salon, DLR and Roscosmos signed an agreement for joint material science research on the re-entry capsule Foton M.

In September 2011, the DLR Institute of Planetary Research and the Moscow State University of Geodesy and Cartography opened the joint Extraterrestrial Laboratory (MExLab) for the investigation of the planetary surfaces in the solar system.

In February 2012, the project Communication Blackout Mitigation for Spacecrafts (COMBIT) was kicked off in Cologne as a joint project of the Russian Academy of Sciences and the Karlsruhe Institute of Technology.

The Russian-German Conference on Electric Propulsion and their Applications was held in June 2012 on the Volga river, focusing on forward-looking solutions for propulsion.

On 22 July 2012, the German satellite TET-1 was successfully launched by a Soyuz rocket from Baikonur. TET-1, with its 11 experiments, serves the on-board verification of technologies.

A high-level delegation from DLR headed by DLR Executive Board Member Gerd Gruppe was invited to watch the successful launch of Shenzhou-8 in Jinqian in November 2011. The return capsule contained the German experiment compartment Biobox, with 17 biological experiments prepared by Chinese and German scientists. The experiments delivered very successful results. Biobox was the first scientific payload provided by a western partner.

A delegation of the Taikonaut Training Centre Tangjialing in Beijing visited DLR in March 2012, on the basis of the bilateral framework agreement between DLR and the China Manned Space Engineering Office on the development of cooperation in manned space.

A delegation of the recently founded South African Space Agency (SANSA) visited DLR in Oberpfaffenhofen in November 2011. The visit resulted in concrete cooperation projects in the fields of Earth observation and ground stations.

DLR and its Brazilian partners, the Department of Aerospace Science and Technology (DCTA) and the National Institute for Space Research (INPE) as well as the Brazilian Space Agency celebrated the 40th anniversary of the joint agreement on scientific cooperation in São José dos Campos in November 2011. During the four decades, the partners established a close relation and initiated many bilateral projects in basic as well as applied science.

In September 2012, the biannual ILA Airshow was successfully concluded in Berlin in partnership with Poland. The Airshow served as a convenient frame for bilateral discussions with international partners from China, Japan, the Russian Federation, the United States, and other partners, as well as for conferences such as the Parliamentarian Conference, the Space Day under the auspices of the Federal Minister of Economics and Technology Philipp Rösler, and several thematic symposiums.

## Italy

[Original: English]  
[19 October 2012]

During 2012, Italy has continued to strengthen its efforts in space activities both at the national level and through European and international cooperation.

### International relations

Italy remains a key player in Europe through the high involvement of the Italian Space Agency (ASI) in the European Space Agency (ESA) programmes. In November 2012, Italy hosted and chaired the ESA Council at Ministerial level in Caserta.

Outside Europe, ASI has continued to enlarge the network of its relations. In 2012, space cooperation agreements were signed with new space agencies and new space programmes, and projects were started.

From 28 to 30 September 2012, Italy hosted the 22nd United Nations/International Astronautical Federation Workshop on Space Technologies Applied to the Needs of Humanity: Lessons Learned from Cases in the Mediterranean Area, held in Naples. One hundred and thirty participants from 50 countries, in particular from developing countries, attended the international event, which was co-sponsored by ASI and ESA.

From 1 to 5 October 2012, Italy hosted the 63rd International Astronautical Congress in Naples, with 3,500 participants from 83 countries. Many space agencies and space international organizations were represented by their Heads. Thirty per cent of those attending were young people and students of space sciences.

In 2012, ASI participated in different exhibitions and conferences, among which were the following: 2012 International Air and Space Fair (FIDAE 2012), in Chile; SpaceOps 2012, in Stockholm; “Giovani, formazione, università”, in Rome; Toulouse Space Show 2012, in Toulouse, France; Farnborough International Airshow 2012, in Farnborough, the United Kingdom of Great Britain and Northern Ireland; Futuro Remoto in 2012 in Naples, Italy; Bergamo Scienza 2012, in Bergamo, Italy; Japan International Aerospace Exhibition 2012, in Nagoya, Japan; and the Asteroids, Comets and Meteors conference, in Niigata, Japan.

### Space science

Italy is one of the main partners of the European space exploration programme Aurora in support of the “Worldwide Vision for Exploration”. In this framework, ASI is the main contributor to the ExoMars mission on the basis of the experiences gained through the contribution to two other missions. The first was the ESA Mars Express mission, where ASI embarked two instruments: the Subsurface Sounding Radar Altimeter MARSIS and the Planetary Fourier Spectrometer. The second contribution was to the National Aeronautics and Space Administration (NASA) Mars Reconnaissance Orbiter mission with the Shallow Subsurface Radar (SHARAD) payloads.



ASI has also contributed to the NASA Juno mission on its way to Jupiter with the Jovian Infrared Auroral Mapper (JIRAM) and Ka-band Translator instruments and to the NASA Dawn mission dedicated to the close observation of the asteroids Vesta and Ceres with the Visual and Infrared Mapping Spectrometer (VIR-MS) instrument. In September 2012, VIR-MS showed a large presence of volatile compounds, especially those containing hydrogen that arrived on the giant asteroid Vesta through a process radically different from the one already studied in the case of deposits on the Moon.

The Italian partnership in the Cassini mission is strongly contributing to the success of the mission. In 2012, the Visual and Infrared Mapping Spectrometer and the radio-science experiment allowed the discovery of a global water ocean in the interior of Titan.

In June 2012, ASI contributed to the NASA Nuclear Spectroscopic Telescope Array (NuSTAR) mission through the services offered by the San Marco ground segment in Malindi, Kenya, and the ASI Science Data Center contribution to the development of the NuSTAR data analysis software package.

In August 2012, the NASA rover Curiosity landed on Mars. Italy is on board through a historical chip with a copy of the Leonardo da Vinci's Codex of Flight, dated 1505.

ASI contributed to the realization of the particle physics experiment of the Alpha Magnetic Spectrometer (AMS) observatory on board the International Space Station. In 2012, AMS accomplished more than 18 billion observations.

In 2012, the Italian Laser Relativity Satellite, dedicated to the study of general relativity and, in particular, the Lense-Thirring effect, was launched on the maiden flight of the Vega launcher.

In 2012, data collected by the satellite AGILE demonstrating the variability of the X-ray emissions of the Crab Nebula have been published. The Crab Nebula is presently considered a very stable emitter and is used as a calibration source by many other missions.

Some Italian scientists have received important awards, such as the Smithsonian National Air and Space Museum Trophy for 2012 assigned to the Cassini-Huygens flight team, the Bruno Rossi Prize for 2012 awarded to a scientist of the AGILE team, the Woman in Aerospace Leadership Award for 2012 to an ASI scientist.

### **Earth observation**

COSMO-SkyMed constellation, with its four radar satellites in the X-ray band, is making an enormous contribution to Earth observation for the study and preservation of the planet and the management of risks and natural disasters.

In May 2012, Italy faced a new natural calamity: the earthquakes in the Emilia-Romagna region. The COSMO-SkyMed satellite constellation, with its very short revisit time, strongly supported emergency management, producing a large data set that was very fruitful for scientific analysis. In January 2012, the constellation was called to monitor the sinking of the Italian cruise ship *Costa*

*Concordia* at Giglio Island. This tragic event is constantly monitored because of the possibility of a dangerous oil spill.

The COSMO-SkyMed satellites have also recently been involved in the management of several international areas affected by natural calamities: the Nabro Volcano in Africa, the earthquakes in New Zealand, Japan and Turkey and the floods in Myanmar.

This international vocation made it possible for the Italian constellation to put at the disposal of Geohazard supersites (the Group on Earth Observations (GEO) project dedicated to the study of areas under geophysical risks) an annual set of valuable data for the analysis of these phenomena, starting in 2012. In detail, COSMO-SkyMed will provide an annual quota of about 100 images of the Hawaii area.

The COSMO-SkyMed constellation is also deeply involved in the wide BlueMassMed project.

The projects involves six Mediterranean countries and 37 local administrations interested in trade, fisheries, the environment and search and rescue at sea, but also in issues such as piracy, smuggling, pollution and immigration.

### **International Space Station**

Italy is the first European country involved in the development of the International Space Station through the ESA programme and in bilateral cooperation with NASA. Fifty per cent of the pressurized volume of International Space Station was realized in Italy (Columbus, Cupola, Node 2 and 3, Multi-Purpose Logistics Module (MPLM) and the Multipurpose Platform).

The Italian facilities and instruments, developed by ASI and presently operating on board the International Space Station, are the radiation and human physiology facility “Anomalous Long-term Effect on Astronauts” (ALTEA), the human physiology facility ELITE-S2 and the biology instrument “Evaluation and monitoring of microbial biofilms inside the International Space Station (VIABLE).

The Italian user support operations centre, located in Naples, has been operating for years to support the on orbit crew operations, monitor and remotely control and execution of the experiments (some using the facilities and instruments on board) and provide all Italian scientists with data coming from ISS.

During the last 20 years, five Italian astronauts flew with the United States space shuttle and Russian Soyuz spacecraft, and four of them stayed on board ISS. Two new astronauts are under training for their long-term flights planned in 2013 and 2014.

### **Launchers**

In February 2012, Italy participated in the extraordinary success of the first medium-sized European VEGA launching, to which Italy invested more than 60 per cent of the programme budget. The VEGA launcher, whose acronym stands for “Vettore Europeo di Generazione Avanzata” or the European Launcher of Advanced Generation, is able to place 300-2,000 kilogram satellites into the polar and low-Earth orbits for many scientific and Earth observation missions. Among the VEGA

payloads were the Italian Laser Relativity Satellite (LARES) and ALMASat-1 and seven nanosatellites provided by European universities: e-St@r (Italy), Goliat (Romania), MaSat-1 (Hungary), PW-Sat (Poland), Robusta (France), UniCubeSat GG (Italy) and Xatcobeo (Spain).

### **Education**

Italy actively promotes growth and education in space science, technology and space applications through programmes and activities for schools. Two major projects have recently been developed: the Aerospace web channel and EduSat, a microsatellite carrying teaching payloads, developed by the School of Aerospace Engineering of the Sapienza University of Rome.

Each year, ASI supports national and international opportunities for young people. In 2012, ASI continued to support different space master courses in Italian universities and institutes. In 2012, ASI funded the following fellowships: two in the United States in collaboration with the Italian Scientists and Scholars in North America Foundation (ISSNAF), one at the European Space Policy Institute (ESPI) in Vienna in collaboration with the Italian Society for International Organization (SIOI), two at the master course of the Mario Gulich Institute for Higher Space Studies in Córdoba, Argentina, in cooperation with the National Commission on Space Activities (CONAE) of Argentina, three for the summer school in Alpbach, Austria.

### **Japan**

[Original: English]  
[23 October 2012]

### **Participation in the International Space Station programme**

The International Space Station (ISS) programme is the largest international cooperative science and technology programme ever attempted in the new frontier of space. The ISS programme will contribute to the further utilization of outer space and improve the quality of our lives. Japan has been active in promoting the ISS programme in cooperation with all countries involved in this programme. Japan's contributions to the ISS include the development of the Japanese Experiment Module (Kibo) and the H-II Transfer Vehicle (HTV). Japan has been contributing since the beginning of the ISS programme, which is one of the most iconic international cooperation programmes for the peaceful use of outer space. The Japanese Experiment Module (Kibo) has been utilized to conduct various on-orbit experiments. JAXA established the Kibo Utilization Office for Asia (KUOA) in July 2010, aiming at strong promotion of Kibo utilization with the Asian counterparts.

Japanese astronaut Akihiko Hoshide started his long-duration stay on ISS in July, and is planned to return to Earth in November 2012. Astronaut Koichi Wakata will be the commander of ISS for the 39th expedition in 2013 and be the first Asian astronaut to assume this important duty. In addition, three more Japanese astronauts were qualified as ISS astronauts in July 2011.

The role of HTV is getting more important in transporting supplies to ISS after the retirement of the space shuttle. The third HTV (HTV3) to the ISS, namely “KOUNOTORI-3”, successfully completed its cargo transfer mission from July to September 2012.

### **Remote sensing**

Japan has been intensively promoting international cooperation through international frameworks such as the Group on Earth Observations (GEO) and the Committee on Earth Observation Satellites (CEOS). In particular, JAXA has taken a leading role for two years as the chair of the CEOS Strategic Implementation Team (CEOS SIT).

The 5th Global Earth Observation System of Systems (GEOSS) Asia-Pacific Symposium was held in Tokyo in April 2012, at the National Museum of Emerging Science and Innovation (Miraikan). The Symposium, which was co-organized by GEO Japan and with the support of Japan’s Ministry of Education, Culture, Sports, Science and Technology (MEXT), addressed the theme of “GEO initiatives towards green growth in the Asia-Pacific region”, particularly in the areas of water, biodiversity, forests, ocean and agriculture.

Japan also promoted GEO efforts for sustainable development on the occasion of the United Nations Conference on Sustainable Development (Rio+20) by taking the initiative of GEO side events. “The future we want”, the outcome document of Rio+20, specified the importance of space technology-based data, in situ monitoring and reliable geospatial information for sustainable development policymaking, programming and project operations, as well as the importance of global Earth observation through GEOSS.

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. JAXA successfully launched GCOM-W with Shizuku in May 2012 and started initial calibration and validation this August, after satellite commissioning. GCOM-W will observe water circulation mechanisms, such as precipitation, vapour amounts, wind velocity above the ocean, seawater temperatures, water levels on land areas and snow depths. In September 2012, Shizuku observation data showed that sea ice extent in the Arctic Ocean has become the smallest in observation history, comparing with the past record reached in 2007. GCOM-C will observe surface and atmospheric measurements related to the carbon cycle and radiation budget, such as clouds, aerosol, seawater colour, vegetation, snow and ice.

Under the item “Greenhouse gases monitoring from space”, the Greenhouse Gases Observing Satellite (GOSAT), or “IBUKI”, the joint mission of the Ministry of Environment (MOE), the National Institute for Environmental Studies (NIES) and JAXA launched in January 2009, can accurately observe the concentration distribution of global greenhouse gases in the atmosphere. In October 2011, for the first time in the world, MOE, NIES and JAXA quantitatively demonstrated the effectiveness of the application of satellite data in the observation of greenhouse gasses. Japan is also promoting the studies of GOSAT follow-on.

With regard to forest and carbon tracking, followed by the successful Daichi Phased Array type L-band Synthetic Aperture Radar (PALSAR) observation, which can detect forest/non-forest areas and measure the amount of above-ground forest biomass, JAXA has been developing the next generation satellite, ALOS-2, which will have on-board L-band Synthetic Aperture Radar (PALSAR-2). ALOS-2 enables wide-swath and high-resolution observation comparing with Daichi, so it will further contribute to global forest monitoring, as well as disaster, land, agricultural monitoring and so on. ALOS-3, which will have on-board optical sensors, will be launched in 2015.

### **International Committee on Global Navigation Satellite Systems**

After the successful meeting of the International Committee on Global Navigation Satellite Systems (ICG) hosted by the Japanese Government in Tokyo from 5 to 9 September 2011, Japan has continuously and actively participated in ICG-related activities. In particular, Japan is contributing to promote utilization of multiple global navigation satellite system (GNSS) constellations by supporting Multi-GNSS Asia, which was established in September 2011. Also, Japan has been promoting the Quasi-Zenith Satellite System and the 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 35 countries and regions and 24 international organizations have taken part in APRSAF, which is the largest space-related conference in the Asia-Pacific region. With the increasing attendance of high-ranking officials, APRSAF offers a unique opportunity to discuss international cooperation for space activities in concrete terms. APRSAF currently organizes four working groups — in the areas of earth observation, communication satellite applications, space education and awareness, and utilization of the space environment — to share information about the activities and the future plans of each country and region in the respective areas. APRSAF also supports the establishment of international projects as solutions for issues such as disasters and environmental protection so that the participating parties can realize cooperation.

The 18th session of APRSAF (APRSAF-18) was convened in Singapore from 6 to 9 December 2011 under the main theme “Regional collaboration for tomorrow’s environment” and was attended by approximately 280 participants from 28 countries and regions and 11 international organizations.

APRSAF-19 will be held in Kuala Lumpur from 11 to 14 December 2012 under the theme “Enriching the quality of life through innovative space programmes”, jointly organized by the Ministry of Science, Technology and Innovation and the National Space Agency (ANGKASA) of Malaysia, MEXT and JAXA.

**APRSAF-19 initiatives and supporting programmes/activities**

The plenary sessions will feature reports by the disaster management support system in the Asia-Pacific region (Sentinel Asia), the Space Applications For Environment (SAFE) programme, the Regional Readiness Review for Key Climate Missions (Climate R3), and the Asian Beneficial Collaboration through Kibo/International Space Station Utilization (Kibo-ABC). During the plenary sessions, there will also be a report on progress made on the University International Formation Mission (UNIFORM). The Satellite Technology for the Asia-Pacific Region (STAR) programme, which had been initiated following a proposal made at APRSAF-14, completed its merge into UNIFORM in March 2012. Activities of the Multi-GNSS Asia (MGA), an international entity to promote activities of the “Asia-Oceania Multi-GNSS Demonstration Campaign” will also be presented.

**Norway**

[Original: English]

[19 October 2012]

Norway has had a 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 is an important site for space science in Norway, with its launching site for scientific rockets, 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 ionosphere.

Norwegian solar scientists are active in several international space projects and are deeply involved in the ongoing ESA-NASA Solar and Heliospheric Observatory project of the European Space Agency (ESA) and the National Aeronautics and Space Administration (NASA) of the United States of America, which will continue until 2014. 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, launched in 2010.

Scientists at the Norwegian Defence Research Establishment and the universities of Oslo, Bergen and Tromsø participate in nearly 20 experiments on board spacecraft, 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 in 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 the global positioning system (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 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 the Automatic Identification System (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 (EUMETSAT).

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 2011, the Norwegian space industry had a turnover of about 6 billion kroner, of which about 68 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 location, Norway benefits immensely from the GPS satellite navigation system. 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. The Kjell Henriksen Observatory at Svalbard is one of the world's leading facilities for observation of the northern lights.

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 (SSA). The possible role of the European Incoherent Scatter (EISCAT) research radar system in this context is being explored.



## Philippines

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### **2012 activities of the Philippine Atmospheric, Geophysical and Astronomical Services Administration in international cooperation in the peaceful uses of outer space**

The Hydrometeorology Division of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) is currently involved in the application of space-based technology in the following three projects.

#### *Application of remote sensing technology in river basin management in the Philippines*

The application of remote sensing technology in river basin management in the Philippines (TA7276) is a technical assistance project funded by the Asian Development Bank (ADB), in collaboration with the Japan Aerospace Exploration Agency (JAXA), to develop regional capacity for development technical assistance to support countries in Asia and the Pacific in applying space-based technologies and information communications technology for improved river basin management.

The basic idea of the technical assistance project is to utilize the satellite-based rainfall data called Global Satellite Mapping of Precipitation (GSMaP) in order to interpolate ground-based rainfall observation and improve the quality (such as accuracy and lead time, among other aspects) of forecasting, prediction and/or warning. As the result of discussion among PAGASA, ADB and JAXA, GSMaP data will be integrated into the current flood warning system of PAGASA as a pilot demonstration. The main components of this technical assistance project are the calibration of GSMaP data and the integration of GSMaP data into the flood warning system. GSMaP consists of hourly rainfall data with a four-hour time delay, which covers the whole area of the Philippines. The spatial resolution of GSMaP is 0.1 degree  $\times$  0.1 degree (in the Philippines, about 10 km  $\times$  10 km).

To date, the aide-memoire is being finalized for signing by ADB. As a result of several meetings held in 2011 and 2012, PAGASA has provided 10-year historical rainfall data to JAXA, while JAXA has provided the corresponding GSMaP data to PAGASA. Both JAXA and PAGASA are simultaneously doing the calibration of GSMaP data while waiting for the official commencement of the project with the signing of the aide-memoire.

The project will be piloted in the Cagayan river basin, the largest river basin in the Philippines and one of the telemetered river basins in the country monitored by PAGASA. A joint mission of ADB, JAXA and PAGASA has been dispatched in Tuguegarao to present the project to the OCD Region 1, the provincial government of Cagayan and the Northern Luzon, PAGASA Regional Service Division.

*Philippine in-country component of the project “Application of remote sensing technology in river basin management in the Philippines” (TA7276)*

The Philippine in-country component of project TA7276 is currently being executed by ADB and implemented by the International Centre for Water Hazard and Risk Management (ICHARM), with an implementation period of nine months, from April 2012 to December 2012, after revision of the partnership agreement between ADB and ICHARM. Two PAGASA technical staff have recently undergone the first series of training sessions in Japan from July to August 2012 on the use of the Integrated Flood Analysis System (IFAS) software, a satellite-based flood warning system for supplementary system and capacity development in the field of flood forecasting. IFAS was developed by ICHARM, the implementing agency of the ongoing technical assistance “Supporting investments in water-related disaster management” project (TA7276). In the project, IFAS is being applied in the Cagayan and Pampanga river basins.

After the initial meeting with PAGASA in February 2012, when the first mission was dispatched to the Philippines, ICHARM and ADB prepared a detailed workplan and implementation arrangements to ensure the effectiveness of the Philippine in-country component of TA7276. The project officially started in April 2012 and will be completed in December 2012.

Another mission composed of ADB, ICHARM and PAGASA was dispatched to Cagayan and Pampanga river basins in June 2012. Two workshops on the application of IFAS were conducted in Manila from 26 to 28 September 2012 for the Pampanga river basin, and in Tuguegarao from 2 to 4 October 2012 for the Cagayan river basin. PAGASA is responsible for the coordination in the Philippines in support for the project.

*Validation of GSMaP rainfall data on Cagayan river basin*

Prior to the above, the project entitled “Validation of GSMaP rainfall data on Cagayan river basin” was implemented in November 2011 to 2012. This project aims to assess the performance of the hourly Global Satellite Mapping Precipitation (GSMaP) in the Philippines by comparing the amount of the rainfall stations over Cagayan river basin. There are five rainfall stations distributed along the Cagayan river basin. These are Tuguegarao, Tumauni, Pangal, Gamu and Maris telemetered rainfall stations, while the GSMaP rainfall, which is currently promoted by the JAXA Precipitation Measuring Mission (PMM) science team, has a  $0.1 \times 0.1$  degree resolution, or approximately 10 km resolution. The GSMaP rainfall data are generally a product of different global passive radiometer data (such as TRMM/TMI, Aqua/AMSR-E, ADEOS-II/AMSR, DMSP/SSMI) and brightness temperature data, merged from all available geostationary satellites (GOES-8/10, METEOSAT-7/5 and GMS) using the Kalman filter technique.

Using the GrADS software, the equivalent point GSMaP rainfall data were derived and used to compare to ground rainfall stations using the least squares method. The correlation coefficients ( $r$ ) were derived in daily, monthly and seasonal periods to describe the performance of the GSMaP in different temporal characteristics for data for the period of 2009-2011.

Initially, for the daily period, the correlation coefficients for three years were very low, especially for the amount of rainfall less than 10mm/hour, while the

frequency of “no rain occurred” was reasonably good. Furthermore, for the monthly and seasonal period the correlation coefficient was reasonably good especially for the months in which there is a higher amount of rainfall. The initial result of this project provides an initial assessment of GSMaP rainfall data and will provide more methodology to enhance the comparison of these data. This will also be done to other ground rainfall stations for the additional validation of GSMaP data.

*Harnessing of geographic information system and remote sensing technologies for agriculture*

A project entitled “Harnessing of Geographic Information System (GIS) and remote sensing technologies for improved governance and agricultural productivity” is being undertaken by the Commission on Higher Education in cooperation with Mariano Marcos State University (MMSU). Part of this is a series of training sessions (April 2012 and October 2012) which focus on remote sensing, GIS and system modelling in which PAGASA researchers participated. The main objective of the training is to build a pool of regional experts in these areas who will collaborate with MMSU to harness geospatial and remote sensing technology and system modelling as a platform of addressing climate change issues and in improving crop productivity through precision farming. At the end of the training, participants should conduct joint case studies with MMSU in their respective regions. All case studies will be presented in a two-day symposium, which will be sponsored by MMSU after a year of project implementation.

One of the resource speakers is the Department of Science and Technology (DOST) Balik Scientist, Josefino C. Comiso, a senior scientist of the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center in Greenbelt, United States of America. One of his activities as the DOST Balik Scientist is to strengthen institutional capacities on remote sensing for climate change studies and for precision agriculture.

PAGASA, as a partner in this endeavour, will conduct a study entitled, “Drought monitoring using remotely-sensed data” in Iloilo Province. The objective of the study is to develop a tool that would monitor drought using remotely-sensed data such as the Moderate Resolution Imaging Spectroradiometer (MODIS). MODIS data along with other GIS software will be used to study occurrences of droughts in the Philippines, particularly in Iloilo.

*Disaster Management Network (DMS-Net) for the ASEAN region*

A team of Japanese experts (from JAXA, NEC, PASCO and MELCO) have visited the Department of Science and Technology of PAGASA and other agencies to discuss satellite data and technology application for the agriculture sector in the Philippines. The visit was in connection with the project entitled “Disaster Management Network (DMS-Net) for ASEAN region”, which has been proposed by Japan. The Ministry of Economy, Trade and Industry of Japan has been developing a high performance small satellite to be launched in December 2012, as well as an integrated mobile ground station. JAXA will also launch ALOS-2 in 2013. The Japanese capability for DMS-Net satellite can carry out various applications using high-resolution optical observation and high resolution synthetic aperture radar (SAR) observation that can penetrate cloudy areas enhancing the observation for disaster and land management.

The next visit of the team of Japanese experts is planned for January 2013, to present a more detailed plan, including requests and expectations for the Network on the part of ASEAN member States and to identify future steps for DMS-Net.

*Enhancing capacities for risk analysis of tropical cyclones and severe wind for the greater metro Manila area*

“Enhancing risk analysis capacities for tropical cyclones and severe wind for the greater metro Manila area” is another project that involves the use of spaced-based information, and is implemented by PAGASA with the support of the Australian Government Aid programme (Risk Analysis Project of AusAid, 2010-2013). Its main objective is to develop an understanding of the hazards (such as tropical cyclones, severe wind, floods and earthquake), vulnerability and risk posed by these hazards to the Greater Metro Manila Area (GMMA). A statistical modelling of tropical cyclones will be undertaken to determine the regional-level severe wind hazard, which will provide information on the frequency and intensity of tropical cyclones affecting GMMA. An important input to the development of wind multipliers that will relate the regional wind hazard to the location-specific wind speed is the high-quality elevation and land-use classification datasets derived from the post processed high light detection and ranging (Lidar) data, an optical remote sensing technology that can measure the distance to, or other properties of a target by illuminating the target with light, often using pulses from a laser. Vulnerability models, which relate incident wind speed to building damage level, will be refined through collaboration between the Philippine engineering community, the Geoscience Australia engineers, and other Philippine agencies as appropriate.

*International training programmes attended by technical staff*

PAGASA technical staff attended the following international training programmes on satellite and remote sensing:

(a) Application of Space Technology to Enhance the Activities of Typhoon Committee, held in Macao, China, from 27 February to 2 March 2012, organized by the Economic and Social Commission for Asia and the Pacific, attended by Susan Espinueva and Socrates Paat, Jr.;

(b) Toward Effective Flood Management by Utilizing the Satellite Monitoring Precipitation Data of GSMaP, on 16 March 2012, organized by JAXA Earth Observation Research Centre, attended by Susan R. Espinueva;

(c) Master of Science and Technology in Spatial Information programme, from 12 June 2012 to 15 July 2013, supported by the Australian Agency for International Development, attended by Jayson W. Bausa;

(d) International Training Course on Navigation and Satellite Positioning Systems, from 18 June to 13 July 2012, organized by the United Nations-affiliated Centre for Space Science and Technology Education for Asia and the Pacific (CSSTEAP) and supported by the Government of India, attended by Robert Z. Quinto and Analiza C. Tuddao;

(e) Training Programme on Analysis of Communication, Ocean, and Meteorological Satellite (COMS) Data, from 2 to 22 September, supported by the

Korea International Cooperation Agency (KOICA), attended by Alma Dhyana Ferraris;

(f) 2012 Capacity-building Workshop of Satellite Remote Sensing for South-East Asian Scientists, from 13 to 21 September 2012, organized by the National Science Council, Taiwan, China, and attended by Nivagine Nievaes;

(g) 22nd United Nations/International Astronautical Federation Workshop on Space Technologies Applied to the Needs of Humanity: Lessons Learned from Cases in the Mediterranean Area, in conjunction with the 63rd International Astronautical Congress, held from 28 to 30 September 2012, and from 1 to 5 October 2012, attended by Landrico Dalida, Jr.;

(h) Korea Meteorological Administration/World Meteorological Organization High-Profile Regional Satellite Training event, and the 3rd Asia-Oceania Meteorological Satellite Users Conference, from 4 to 6 October 2012, and from 9 to 12 October 2012, sponsored by the World Meteorological Organization and attended by Cynthia Celebre.

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