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

Note by the Secretariat

Addendum

Contents

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II. Replies received from Member States

Russian Federation

[Original: Russian]

1. The national activities of the Russian Federation in the peaceful exploration and use of outer space in 2004 were carried out by the Federal Space Agency in accordance with Russia's Federal Space Programme in cooperation with the Russian Academy of Sciences, the Ministry of Defence, the Ministry for Civil Defence, Emergency Situations and Natural Disasters Management, the Ministry for Information Technologies and Communication, the Federal Geodesy and Cartography Agency, the Federal Hydrometeorology and Environmental Monitoring Service and some other clients and users of space information and services.

2. In 2004, the Russian Federation launched 23 carrier rockets of the Proton, Soyuz, Cosmos, Molniya, Tsiklon, Zenit and Dnepr type, putting into space 33 objects of which 19 were Russian, including 2 manned spaceships of the Soyuz TM series (Soyuz TMA-4 and Soyuz TMA-5), 4 automatic cargo vehicles of the Progress M series (Progress M1-11, Progress M-49, Progress M-50 and Progress M-51), 2 satellites of the Express AM series (Express AM-11 and Express AM-1), 9 satellites of the Cosmos series (Cosmos-2405 to Cosmos-2413), two satellites, Molniya-1 and Raduga-1, and 14 foreign satellites.

3. Successfully accomplished was the first test launching to a suborbital trajectory of the Soyuz 2-1a carrier rocket with a full-scale dummy of the Oblik satellite, which was later sunk in the Pacific.

4. Also in 2004, the Russian Federation launched satellites on behalf of Argentina, France, Italy, Saudi Arabia, Ukraine and the United States of America.

5. Seventeen carrier rockets, which put into orbit 24 satellites, were launched from the Baikonur launch site. Six carrier rockets with a total of seven satellites were launched from the Plesetsk launch site.

6. Furthermore, Russian organizations and specialists participated in the preparation and launching of three artificial Earth satellites (Telstar 14/Estrela do Sul for Intelsat/Brazil, DirecTV 7S for the United States and Telstar 18/Apstar 5 for the United States/Hong Kong Special Administrative Region of China) from the Sea Launch international site.

Main results

A. Manned space flight programme

7. In 2004, in accordance with its international obligations under the agreement on the construction and operation of the International Space Station (ISS), the Russian Federation launched two transport spaceships with crews aboard and four cargo spacecraft, and carried out flight control of the Russian segment of the ISS, as well as the planned programme of research and experiments. Work under the manned space flight programme included:

(a) On 29 January 2004, the Progress M1-11 cargo vehicle delivered to the ISS food, water, oxygen and fuel and also two electronic dummies for the programme of preparation for manned flight to Mars. The purpose of the experiment was to determine the highest radiation doses that the vital organs of the human body may be exposed to during such a space flight. It also delivered to the ISS Orlan-M spacesuits for work during spacewalks, as the service life of the spacesuits on board had ended. On 31 January, the Progress M-1 cargo vehicle was docked to the Russian Zarya cargo module of the ISS. The docking of Progress M-1 was executed in the automatic mode, as planned;

(b) On 19 April 2004, the Soyuz FG carrier rocket, launched from the Baikonur launch site, delivered to the ISS the Soyuz TMA-4 spaceship carrying the crew of the ninth main mission. The launching was in the regular mode. The crew of that mission, Russian cosmonaut Gennady Padalka and astronaut Edward Michael Fincke of the National Aeronautics and Space Administration (NASA) of the United States, took over from the crew of the eighth main mission, Alexander Kaleri and Michael Foel, who during their six months on board the ISS had carried out numerous scientific experiments, more than 40 of them part of the Russian programme. During his short mission to the ISS, European astronaut Andre Kuipers carried out an intensive programme of experiments. Twice during their stay, in July and August, the crew made spacewalks. During the first spacewalk they installed equipment on the service module, including for the docking of the Automated Transfer Vehicle (ATV), Europe's first cargo vehicle; during the second they replaced the panels of the Zarya Control Module (FGB);

(c) On 21 April 2004, the Soyuz TMA-4 spaceship was docked to the ISS;

(d) On 24 May 2004, Progress M-1 was undocked from the ISS. For 10 days, Progress M-1 was used to flight test new types of orientation, which will serve to reduce the micro-load factor on board the promising orbital modules. In the future, these autonomous laboratory modules will make it possible to conduct technological experiments and produce new materials under conditions of lower microgravity, including experimental production in orbit of very pure biocrystals and alloys. Cargo vehicles of the Progress series have been used repeatedly as scientific laboratories. In 2003, for instance, for one month after separating from the ISS and using special equipment, Progress M1-10 conducted observation of areas of the Earth where natural and environmental disasters had occurred. The data obtained were transmitted in automatic mode to the flight control centre. Later on the vehicle was sunk in a designated area of the Pacific Ocean;

(e) On 25 May 2004, the Progress M-49 cargo vehicle was launched from Baikonur to deliver to the ISS fuel components, supplies for scientific experiments, containers with food and personal parcels for the crew, as well as sets of on-board documents. The cargo vehicle brought a total of 2.5 tons of food, water, fuel and equipment to the ISS;

(f) On 27 May 2004, Progress M-49 docked in automatic mode to the Russian segment of the ISS (the Zvezda module), following the standard procedure. The crew of the ISS performed a number of operations to integrate the Progress vehicle into the common supply system of the ISS, such as checking the transfer chamber for airtightness, opening the transfer hatches and preserving the spaceship. The cargo compartment of Progress M-49 contained 26 kilograms (kg) of equipment for the systems maintaining the proper gas composition, 34 kg of equipment for the water supply systems, 129 kg of sanitation and hygiene supplies, 192 kg of food products, 61 kg of medical supplies, 211 kg of equipment for spacewalks, 51 kg of equipment for servicing the heating systems, 77 kg of equipment for the power supply systems, 111 kg of equipment for the operation of the cargo module, 40 kg of equipment for refitting and servicing of the on-board systems of the ISS, 225 kg of equipment for the American segment of the ISS and 20 kg of on-board documents and personal parcels. Some 640 kg of fuel, 28 kg of liquid oxygen, 20 kg of liquid air and 420 kg of water were also delivered to the refuelling components compartment. The vernier engine installation of the Progress vehicle contained 250 kg of fuel for use on the ISS;

(g) On 30 July 2004, Progress M-49, loaded with waste from the ISS, was separated from it and, unlike its predecessor, Progress M-48, was removed from orbit and sunk in the Pacific on the same day. (After undocking, Progress M-48 had stayed in orbit not far from the ISS, conducting scientific experiments, and was sunk in the ocean only 10 days later, on 28 January);

(h) On 11 August 2004, the Soyuz U carrier rocket with the Progress M-50 cargo vehicle was launched from Baikonur. Progress M-50 took to the ISS fuel components, water, service equipment and supplies, instruments for scientific experiments, 28 mini-containers with food and personal parcels for Gennady Padalka, the pilot cosmonaut, and Edward Michael Fincke, the flight engineer, as well as for the next crew, who were to leave for the Station on 9 October. Progress M-50 replenished the supplies of fresh fruit and vegetables, as well as of medicines, at the ISS. Formerly, it had taken two days for Progress spacecraft to reach the Station, but this time the vehicle was sent following a so-called three-day scheme for the purpose of testing its engines. In preparation for the arrival of the cargo vehicle, the ISS crew checked the operation of the Kurs automatic approach system;

(i) On 14 October 2004, the Soyuz FG carrier rocket with the Soyuz TMA-5 spaceship carrying the crew of the tenth main Russian-American mission to the ISS was launched from Baikonur. Its docking was automatic. The spaceship transported a crew consisting of United States astronaut Leroy Chiao and Russian cosmonaut Salizhan Sharipov and also cosmonaut Yuri Shargin, who went for a 10-day orbital mission and then returned on 24 October together with the crew of the ninth main mission who had worked on the Station for six months. Their spaceship, Soyuz TMA-4, was separated from the ISS on 24 October 2004, and the crew capsule landed on the same day;

(j) On 24 December 2004, a Soyuz carrier rocket with the Progress M-51 cargo spacecraft was launched to the ISS from Baikonur. The docking to the ISS on 26 December was in automatic mode. Progress M-51 brought to the ISS food, water, fuel and scientific equipment, as well as Christmas and New Year's parcels for the crew. It also brought a new "crew member", a German-made manipulator robot named Robotics Component Verification on ISS (Rokviss). Its intended function is saving the crew time and effort. On 26 January 2005, Rokviss was installed on the outer surface of the Station in order to test its capabilities in open space. Another item that was brought to the ISS was a new Russian-made running machine to replace the previous United States-made machine. The replacement was covered by a Russian-United States arrangement as the original treadmill had malfunctioned too often.

1. Experiments on a contractual basis

8. The following experiments took place on a contractual basis:

(a) Granada Crystallization Facility-Japan Aerospace Exploration Agency (GCF-JAXA): study of the formation of embryos and the growth of protein crystals under conditions of microgravity;

(b) Micro-Particles Capture and Space Environment Exposure Device (MPAC and SEED): study of the micro-meteoroid situation along the ISS orbit and obtaining experimental data on the influence of space factors on the samples of materials and coatings planned for use in the prospective space projects of JAXA;

(c) Development of a Global Time System (GTS);

(d) Cardiokog-3: study of the reactions of the human cardiovascular system during adaptation to prolonged space flight;

(e) Neurokog-3: study of induced brain potential during efforts to concentrate attention in virtual three-dimensional space under conditions of weightlessness;

(f) Eye Tracking Device (ETD): study of the effect of prolonged microgravity on coordinated eye and head movements;

(g) Fluorescence: assessment of the effect of radiation on the fluorescent properties of yeast cells in space and study of the possibility of using yeast cells as biological sensors to detect DNA deterioration caused by radiation.

2. Geophysical research

9. The following geophysical research took place:

(a) Relaxation: study of the interaction between the exhaust products of turbojet engines and the upper strata of the Earth’s atmosphere by examining the images and spectra obtained in the ultraviolet range. The radiation resulting from the interaction between the exhaust products of the power plant of the Russian segment of the ISS and atomic oxygen was measured, as was the radiation resulting from the reactions caused by the interaction of the exhaust products emitted by the jet engines of the Soyuz and Progress spacecraft during undocking, braking and entering the upper layers of the Earth’s atmosphere;

(b) Uragan: experimental development of an Earth-space system of forecasting natural and man-made disasters in order to mitigate their effects and of criteria for their classification and decoding;

(c) Molniya-SM: study of the optical phenomena in the Earth’s atmosphere and ionosphere associated with thunderstorms and seismic activity. In the course of the experiment, methods of monitoring thunderstorm activity in low and middle latitudes and the luminosity of the night sky over seismically active regions were studied.

3. Astrophysical research

10. The following astrophysical research took place: Platan, study of the components and spectra of galactic cosmic rays in order to verify methods of ensuring radiation security for the crew and the durability of space products.

4. Medical and biological research

11. The following medical and biological research took place:

(a) Prognoz: development of methods of making quick forecasts of the radiation situation in orbit depending on solar activity and the intensity of cosmic radiation;

(b) Bradoz: obtaining experimental data on the amount of ionizing cosmic radiation inside the living modules of the ISS;

(c) Sprut MBI: determination of volumes of intra- and extra-cellular fluid, total circulating blood volume and the proportion of cellular and fluid blood components in the human body under conditions of weightlessness;

(d) Diurez: study of specific features of the water-and-salt exchange in the human body and the hormonal regulation of the kidneys during prolonged space flight, as well as during the early post-flight period;

(e) Pharma: study of the patterns of the effects of medicinal preparations on the human body during prolonged space flight;

(f) Cardio-ODNT: a comprehensive study of the basic functioning of the human cardiovascular system in conditions of weightlessness during periods of repose and under the impact of negative pressure on the lower part of the body;

(g) Haematology: identification of how the human blood circulation system adapts to space flight and development of diagnostic criteria to evaluate the state of the human organism under extreme conditions;

(h) Prophylaxis: obtaining additional information on the effectiveness of different kinds of physical training as a means of preventing the negative impact of weightlessness on humans;

(i) Pilot: an experiment aimed at devising and testing ways of helping cosmonauts to maintain their fine spacecraft control skills under adverse conditions;

(j) Pulse: gathering scientific information in order to obtain in-depth knowledge of how the human cardiorespiratory system adapts to prolonged space flight;

(k) Biorisk: study of the influence of the microflora in the Station's living modules on various materials used in space technology;

(l) Rasteniya-2 (Plants-2): evaluation of the effectiveness of the humidification and aeration systems in root-inhabited environments in conditions of weightlessness;

(m) Biotest: research into human biochemical status;

(n) Plasmida: examination of the influence of space flight factors on plasmatic DNA transfer during conjugation;

(o) Inter-cellular interaction: study of inter-cellular interactions during space flight;

(p) Matrioshka-R: study of the dynamics of the radiation situation along the space flight route and in the modules of the ISS, as well as the accumulation of radiation doses in the human body models installed inside and outside the ISS.

5. Biotechnological experiments

12. The following biotechnological experiments were conducted:

(a) Biodegradation: development of methods of ensuring the biological security of spacecraft on the basis of research into the initial stages of colonization by various micro-organisms of the inner and outer surfaces of the living modules of the ISS;

(b) Mimetic-K: study of anti-idiotypic antibodies such as mimetics of adjuvantactive glycoproteide;

(c) Vaccine-K: structural research into proteins intended for anti-AIDS vaccines on Earth and in space;

(d) Bio-ecology: obtaining highly effective strains of micro-organisms for producing biodegradable preparations of petroleum, organophosphorous substances, means of protecting plant life and exopolysaccharides used in the oil industry;

(e) Interleucine-K: obtaining high-quality crystals of alpha-1 and beta-1 interleucines as well as of the interleucine-1 receptor antagonist.

6. Technology experiments

13. The following technology experiments were conducted:

(a) Identification: verification of the parameters of the mathematical model of the ISS in its various configurations to determine the dynamic impacts on the structure of the Station and assessment of the values of the micro-accelerations occurring on board;

(b) Acoustics-M: evaluation of the cumulative acoustic impact on ISS crew members, including the noise made by the operating equipment, the sound signals and radio interference during communication sessions, as well as assessment of the cosmonauts' hearing, and development of methods aimed at lowering the acoustic impact on crew members and improving the quality of on-board communication;

(c) Meteoroid: registration of the fluxes of micro-meteorites and technogenic particles along the ISS flight route;

(d) Izgib: registration of the levels of micro-accelerations caused by the operation of the on-board equipment;

(e) Priviazka: development of methods of high-precision orientation of scientific instruments in space, taking due account of constructional deformations of the ISS;

(f) Iskazhenie: study with magnetometric sensors of the influence of magnetic fields inside the ISS on the precision of its orientation;

(g) Scorpio: testing the operation during space flight of a multifunctional device to monitor parameters of the environment in the living modules of the ISS. The device was used to study the microgravity, electromagnetic and radiation situations, as well as the temperature, humidity and luminosity in different compartments of the ISS;

(h) Tensor: development of methods of ascertaining the dynamic characteristics of the ISS that are necessary to increase the precision of its orientation, prediction of the functioning of the on-board systems and proper conduct of scientific experiments;

(i) Kromka: study of the influence of pollutants (produced by the operating jet engines) on the characteristics of samples of the construction materials and outer coatings of the ISS such as the radiators and solar battery panels;

(j) Plasma crystal-3: study of physical phenomena occurring in plasma-dust crystals at different levels of inert gas pressure and the power of the high-frequency generator in conditions of micro-gravity;

(k) Toxicity: development of a system of rapid monitoring of water toxicity during space flight;

(l) Vector-T: exploration of the system of high-precision forecast of the movement of the ISS.

7. Earth observation

14. The following Earth observation experiments were conducted:

(a) Diatomeya: study of the biological resources of the world’s oceans;

(b) Econ: examination of the possibility of using the Russian segment of the ISS to observe the environment in regions where various facilities are functioning.

B. Space technology applications programmes

1. Space communication, television broadcasting and navigation

15. The orbital constellation of communication, television broadcasting and navigation space objects includes the following satellites: Gorizont, Express A, Express AM, Yamal-100, Yamal-200 (communications and television), Ekran-M, Bonum-1 (NTV channel), Gonets-D1 (communications), Glonass, Glonass-M and Nadezhda (navigation and rescue).

16. In 2004, the use of space systems providing various telecommunication services continued, including long-distance telephone and telegraph communication and relay of radio and television programmes, as well as transmitting information for different industries and departments of the Russian Federation and for international communication.

17. In 2004, the Express AM-11 and Express AM-1 satellites were launched to facilitate central and regional television and radio broadcasting in the central part of the Russian Federation.

18. In the immediate future, the satellites of the Gorizont space communication and broadcasting satellite system will be gradually replaced by new-generation satellites. In introducing such promising communication and broadcasting satellites as those of the Express AM, Yamal-200, Yamal 300 and Express AK series, it is planned to use the latest technologies, which will increase the capacity and power of on-board relay complexes and prolong the active service life of satellites in orbit to 12-15 years.

19. The operation of the Global Navigation Satellite System (GLONASS) continued. GLONASS is used for the navigation of civil aircraft, sea ships and fishing vessels, as well as for some other branches of the economy. Put into service in 1993, GLONASS has created a global navigation-and-time environment—on land, in the air and in the near-Earth outer space—which allows a wide range of customers to use the navigation information supplied by the system. Transport is a major sphere of application (all types of aviation, marine and river fleets, motor and railroad transport and so on). Also, navigation information is widely used in geodesy, cartography, geology, forestry and agriculture. In December 2004, GLONASS gained three more satellites—Cosmos-2411, Cosmos-2412 and Cosmos-2413. At present, the system has 14 satellites in operation. In keeping with a purpose-oriented federal programme, by the year 2010 GLONASS will have its full complement of 24 space vehicles.

20. In 2004, the satellites of the Nadezhda series continued to operate within the space segment of the International Satellite System for Search and Rescue (COSPAS-SARSAT). At present that segment of the search and rescue system includes three Nadezhda satellites. Since beginning its operation, COSPAS-SARSAT has helped rescue over 17,000 people, including more than 700 citizens of the Russian Federation and other countries members of the Commonwealth of Independent States. Work to develop and produce a small specialized satellite, Sterkh, which is scheduled to be completed in 2006, is now under way.

2. Remote sensing of the Earth, meteorological and environmental monitoring and natural disaster management

21. In order to address environmental monitoring problems, the Russian Federation uses hydrometeorological and natural-resource exploration space facilities. The Russian space system for the remote sensing of the Earth provides for the use of hydrometeorological satellites (of the Meteor and Elektro type) and fast natural-resource survey satellites (of the Resurs type). Information supplied by those satellites may be used to address a wide range of tasks in such fields as agriculture, climatology and weather forecasting, cartography, efficient land management, prospecting for mineral resources, forestry, water resource management and monitoring emergency situations.

22. A middle-altitude meteorological satellite, Meteor-3M No. 1, which carries equipment of the MSU-E heliogeophysical complex and of Sage (United States), is at present in orbit and supplying limited amounts of targeted information. Compared with its predecessor, Meteor-3, the satellite has a longer service life (three years instead of two) and carries a wider range of improved data-processing equipment. The natural resource surveying satellites, Resurs-O1 No. 3 and Resurs-O1 No. 4, carried medium-resolution equipment (29-45 metres). A prompt-action satellite, “Ocean-O”, was used to obtain data on ocean parameters.

23. The long-range development of the Russian remote Earth sensing space system is based on the country's federal space programme for the period up to the year 2005, as approved by the Government of the Russian Federation. Under the programme, the development of a new generation of hydrometeorological satellites has begun—the medium-orbital Meteor-M and the geostationary Elektro L—which are expected to be put into service in 2006 or 2007. One of the Meteor-M satellites will be designed for oceanographic research.

24. Resurs-DK, a fast-action highly detailed survey satellite, is expected to be launched in September 2005. At present, a Russian space system, Vulkan, for rapid short-term forecasting of earthquakes, is being developed. Monitor-E, a natural resource satellite carrying medium- and high-resolution equipment is due to be launched in June 2005.

25. In order to address the tasks of environmental monitoring to the fullest possible extent, it is planned to develop space facilities gradually within the framework of a prospective remote sensing system, which will initially include artificial Earth satellites of the Meteor-M, Elektro-L, Resurs-DK and Monitor-E types.

26. The intention is to create and operate the above system as part of mutually beneficial cooperation with other countries and organizations that have advanced capabilities in the development and operation of remote sensing facilities for various purposes. This requires the application of effective and economical forms of multifaceted international cooperation (in particular in environmental monitoring and early warning of natural disasters such as tsunamis), which is ultimately aimed at the development of national space facilities and their integration into a single global remote sensing system.

27. Multispectral high-resolution space data processing for the benefit of a wide range of users will be given a fresh impetus during the development of Resurs-P, a new generation of multifunctional satellites. Their development will be conducted on a competitive basis.

28. The year 2004 saw the continued development and modernization of the main ground-based complex for receiving, processing, compiling and distributing satellite-supplied information. Work was conducted to further develop the federal remote sensing centre. New stations for receiving, processing and compiling data were established; a system of collecting data on the territory of Eurasia was set up. Work on substantial enhancing of capacity for prompt provision of information to users is in progress.

3. Using space technologies for natural disaster management

29. Space technologies and information support for natural disaster management are being developed in the Russian Federation along the following priority lines:

(a) Forecasting, detecting and monitoring dangerous occurrences in the atmosphere and at sea (hurricanes, storms, typhoons, ice formations, etc.) with the aid of data supplied by satellites of the Meteor-3M and Elektro-L types and received in different parts of the optical and radio (super-high frequency) ranges of the electromagnetic wave spectrum;

(b) Detecting and monitoring floods, using data supplied by satellites of the Meteor-3M, Resurs-DK and Monitor-E types. Provisions have been made for the development and introduction of new space technologies to supply information necessary for dealing with natural disasters;

(c) Detecting and monitoring forest fires (on areas of more than 40 hectares) by observing the smoke trail on the basis of data supplied by satellites of the Meteor-3M, Resurs-DK and Monitor-E types, which are received in the visual and infrared sections of the optical range of the electromagnetic wave spectrum. It is necessary to provide satellites with state-of-the-art infrared instruments in order to detect and monitor the boundaries of forest fires with an area of more than 0.1 hectares as they start;

(d) Detecting (at any time of day or night and in any weather) and appraising the scale of oil spills in the ocean resulting from accidents involving oil tankers or from the deliberate dumping of oil, with the aid of data supplied by satellites equipped with synthetic aperture radars of the Arkon-2 type;

(e) Identifying parameters of wind and wind-caused sea waves in order to detect and monitor dangerous occurrences at sea—with the aid of data supplied by satellite—by measuring variations in the radiation of and reflection from the surface of the sea of electromagnetic waves that depend on the velocity of wind-caused sea waves.

C. Space research programmes

30. Fundamental space research provides the necessary basic data for understanding the processes taking place in the universe and assessing their influence on Earth.

31. In 2004, in the framework of a scientific research programme, space technologies were used for an in-depth study of solar-terrestrial links and the subsequent development of a system of heliogeophysical monitoring. At present, the Coronas-Foton satellite is being designed to monitor solar activity. Comprehensive study of the Earth’s magnetosphere and of the connection between the processes occurring in the Sun and in the near-Earth plasma and the processes on Earth is continuing.

32. In 2004, the programme of solar studies continued within the framework of the Coronas programme, as part of the international Coronas-F project (a satellite for that purpose was launched on 31 July 2001), including investigation of dynamic processes in the active Sun; the characteristics of solar cosmic rays and of the Sun’s electromagnetic radiation in the radio, visible, ultraviolet, x-ray and gamma spectra; a study of the solar cosmic rays; and a helioseismological sounding of the Sun’s depths and of the solar corona. The programme has provided data on the location of active areas on the Sun, facilitated the search for advance indications of solar flares and, as a result, the forecasting of solar activity. Significant scientific results were obtained during the period of solar flares in 2004.

33. The scientific tasks of the Coronas-F project are as follows:

(a) To study processes occurring in the active Sun, including sunspots, solar flares and discharges of plasma, with the aim of forecasting such phenomena;

(b) To investigate processes of energy transfer from the Sun's depths to its surface, the accumulation of energy in the upper atmosphere and its emission during the occurrence of transient solar phenomena;

(c) To study the characteristics of the solar cosmic rays accelerated during solar flares and other activities, the conditions in which their emission occurs, their propagation in the interplanetary magnetic field and their influence on the magnetosphere of the Earth;

(d) To study seismic processes in the depths of the Sun by observing global oscillations.

34. Of particular interest are ascertaining the mechanism of solar flares; studying the evolution of active areas in the pre- and post-solar-flare phases; continuous observation of the large-scale structure of quiet coronae and the evolution of coronal holes; identifying the nature of plasma in the area of its transformation into solar wind; studying variations in the Sun's radiation at the peak of the 11-year activity cycle for the purpose of gathering the experimental data necessary to develop methods of predicting solar activity and its influence on the magnetosphere and ionosphere of the Earth. The data from the satellite were received at the Neustrelitz Centre in Germany and the Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation (IZMIRAN) radiation-forecasting centre in Troitsk, Moscow Region.

35. In 2004, the programme of experiments focused mainly on studying solar-terrestrial links and cosmology using Coronas-F satellites and Conus-A instruments as part of the Conus-Wind project (undertaken jointly with the United States).

36. Launched on 7 April 2001, the NASA Mars Odyssey spacecraft carried a Russian-made instrument called HEND. Its function is to register fast neutrons, variations in the flow of which provide data on the mineral composition of Mars. HEND helped lead to the discovery that 15 per cent of the surface of Mars was permafrost. Such areas were found in the north and south of the planet, in latitudes above 60^{o}. It was also found that up to 30-35 per cent of the soil in those areas was water ice. This completely changed the earlier idea of Mars as a dry waterless planet. The data obtained with the aid of HEND fully agreed with the findings based on independent measurements made by United States instruments on board the same satellite and those of the European satellite Mars Express, which also carried some Russian-made instruments, such as the Planetary Fourier Spectrometer (PFS), the Ultraviolet and Infrared Atmospheric Spectrometer (SPICAM) and the Visible and Infrared Mineralogical Mapping Spectrometer (OMEGA).

37. The Russian committee for the international scientific research programme is conducting experiments aboard the European "Integral" space laboratory for continued observation and study of X-ray and gamma radiation from space sources. This is done within the Russian Federation's quota of the exposure time (25 per cent).

38. The scientific equipment for the space laboratory was designed and manufactured at the request of the European Space Agency (ESA) through the joint efforts of scientists and engineers of the Agency's member States. The laboratory

was launched by a Proton carrier rocket. The practical stage of the programme has been in operation since 30 December 2002.

D. The use of space technologies in the economy of the Russian Federation

39. The Russian Federation's activities in the exploration of outer space accelerate progress and make it possible to use the results of scientific research, various engineering solutions and promising space technologies in practically all branches of the country's economy. In order to make the application of the scientific and technical achievements in space research and technology in the Russian economy more extensive and effective, so as to bring more benefits to more industries and enterprises, efforts have been made to create the necessary economic, organizational and legal framework for the country's space activities.

40. At present, space industry enterprises are converting their production capacities to civilian uses—for turning out world-standard high-technology competitive products relying, among other things, on space technology. The following are some of the priority development areas in the manufacture of civilian products:

(a) Boosting the production of equipment for the fuel and energy sector, including laser measuring systems, optoelectronic flame-control systems, instruments to measure gas density, multiphase pumping plants and control systems for high-performance gas-pumping stations;

(b) Starting and developing production of new types of medical equipment and technical aids for the rehabilitation of incapacitated persons, including devices to restore natural mobility, special beds for burn patients, a device for removing kidney stones and orthopaedic and prosthetic devices;

(c) Developing the means of communication and of computer science, including new mobile paid radio telephones and electronic cards for them, large ground-based antenna systems for communications and television broadcasting and river navigation systems;

(d) Developing machinery and equipment for the processing branches of the agroindustrial sector and the construction industry, including production of broad-band polyethylene film, equipment for applying heat insulation based on composite polyurethane foam materials, heating systems for vulcanizing presses and pneumatic polishing machines;

(e) Developing new materials and advanced technologies for their production, including foam aluminium and new ceramic materials.

E. International cooperation

41. The Russian Federation is taking part in programmes associated with the launching and operation of the ISS, environmental monitoring space systems, detecting the early signs of imminent natural disasters and emergencies and with search and rescue operations, as well as monitoring the movement of more

important objects as part of programmes aimed at controlling and reducing space debris.

42. In cooperation with other ministries and departments, as well as with space and rocket manufacturers, the Russian Space Agency, Roskosmos, participates in international space cooperation efforts in the following areas:

(a) The use of national apparatus and technology to launch payloads on behalf of other countries, relying, among other things, on joint ventures with foreign partners;

(b) Joint development of rocket engines, including the RD-180 engine, for Atlas carrier rockets;

(c) Building, in cooperation with ESA, France and Europe's industrial community, a site for the launching of the Soyuz-ST carrier rocket from the Guiana Space Centre (in French Guiana);

(d) Participation in the partnership to develop and launch the ISS and conduct on-board scientific experiments;

(e) Cooperation with India in the field of satellite navigation;

(f) Cooperation with Brazil in the field of space communications and remote sensing of the Earth;

(g) Basic space research, implementation of the Spektr project jointly with ESA, the German Aerospace Center (DLR) and NASA;

(h) Participation in the Integral project;

(i) Implementation of projects in space medicine and biology (the Bion satellite) and in meteorology (the Meteor-3M satellite with the United States-made SAGE-3 instrument on board);

(j) Development of COSPAS-SARSAT (the Nadezhda satellite).

43. In pursuance of international cooperation, in particular in view of the current negotiations with ESA on broadening the scope of such cooperation, the following actions are possible:

(a) Placing foreign-made payloads aboard prospective satellites of the Meteor-3M and Resurs-O1 type;

(b) The Russian Federation's participation in the Global Monitoring for Environment and Security (GMES) initiative (envisaging the creation of ground-based infrastructure to provide the countries taking part in the project with environmental monitoring data), in shaping the GMES concept and working out acceptable funding terms for the Russian enterprises participating in the European programmes within the GMES framework, which will help develop a simplified procedure for the use by Russian enterprises of other countries' facilities in manufacturing remote sensing instruments (with a view to perfecting Russian-made remote sensing equipment);

(c) The Russian Federation's participation in the European programme to monitor forest fires and emergencies, as well as forecast earthquakes, with the aid of the instruments of the Meteor-3M and Resurs-DK satellites and the Vulkan space system;

(d) Conducting talks on cooperation in the Galileo programme;

(e) Cooperation in developing the minor launch vehicle Vega.

44. In 2004, the Russian Federation launched satellites on a contractual basis on behalf of other countries using its own carrier rockets of various types (five launches).

45. In 2004, operation of the ISS in the manned flight mode continued. Two Soyuz spaceships and four cargo vehicles of the Progress series were also launched.

46. The Russian Federation has the necessary range of launch facilities to put into near-Earth orbits of various inclinations payloads weighing from several hundred kilograms to 20 tons, which, thanks to their reliability and relatively low costs, compete successfully with other countries on the world market of launching services. Steps are being taken to modernize existing launch vehicles and to develop more advanced ones in order to guarantee reliable access to space exploration. These include Soyuz-2, Proton-M and the Angara family of carrier rockets.

47. In order to meet the growing environment-related demands on space rockets, widen the sphere of their application and increase the payloads carried under their nose cone, the basic models of the Proton and Soyuz carrier rockets, which account for up to 80 per cent of satellite launches annually, have been modernized in recent years. A programme to develop launch vehicles from converted military missiles within the framework of the Start, Rokot and Dnepr projects was started with a view to ensuring the launching of light-weight space satellites.

48. To date, the Russian Federation has concluded inter-State and inter-governmental agreements on cooperation in exploring and using outer space with 18 countries, including Argentina, Australia, Brazil, Bulgaria, Chile, China, France, Germany, India, Italy, Japan, the Republic of Korea, Sweden, the United States and also with some member States of ESA. Roskosmos has also signed agreements with the space agencies of some 20 countries and ESA on matters pertaining to joint projects (provision of space services), use of launching facilities and so on.

49. On the whole, owing to active government support, the Russian Federation's space activities in the interests of international cooperation have good prospects. One of the Russian Federation's assets in this area is its vast experience in prolonged manned space flights. The country's exploration of space by manned spacecraft has proceeded by stages—from the first spaceships and orbital stations to unique multi-purpose orbital complexes, with due account being taken of the latest scientific and technical achievements and emerging scientific and technical goals and problems.

50. The Russian Federation has established world records in the length of a human's stay aboard an orbital station and has developed, in the course of operating the Mir orbital complex, effective technologies for medico-biological support during prolonged stays in outer space.

51. At present, the country's manned space flight programme is being carried out in the Russian segment of the ISS. The Russian Federation's participation in its

construction makes the completion of the ISS programme more feasible and certain at all of its stages.

52. The Russian Federation's space capabilities ensure a complete cycle of space activities—from the development and design of space facilities to obtaining the results required to meet the country's needs and its effective operation on the world market. The Russian Federation pursues an active policy of integration into international space projects—together with India, the United States, Far Eastern and South-East Asian countries, member States of the European Union and other partners. The Russian Federation sees the ever broadening links with all countries to ensure steady progress for itself and the rest of the world as the main vector in developing international cooperation in the exploration of outer space.