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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

Addendum

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* The present report contains replies received from Member States after 7 December 2006.

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II. Replies received from Member States

Chile

[Original: Spanish]

1. Fourteenth International Air and Space Fair

1. The International Air and Space Fair is the most important event organized in Chile to publicize advances in the aeronautics and space industry and the various resulting applications. The 2006 Fair was held at the upgraded facilities of Aviation Group 10 of the Chilean Air Force from 27 March to 2 April 2006.

2. The Chilean Space Agency participated in the 2006 Fair by:

(a) Setting up an information stand for members of the public and, in particular, representatives of other countries' space agencies;

(b) Organizing an international conference on satellites and distance learning, held within the framework of the preparatory meeting for the Fifth Space Conference of the Americas, which was held in Quito from 24 to 28 July 2006;

(c) Hosting that preparatory meeting, which was held on 28 and 29 March 2006 and attended by representatives of Latin American and Caribbean countries.

2. Chilean Space Agency

3. The Chilean Space Agency is a Presidential Advisory Committee. The following meetings were held in 2006:

(a) The final meeting under the previous administration took place on 4 January 2006. At that meeting, all members of the Presidential Advisory Committee were briefed on the implementation of the Aurora (Earth Observation Satellite) project and a decision was taken to transfer responsibility for running the Chilean Space Agency to the Ministry of Economic Affairs;

(b) The first meeting under the new administration was held on 20 June 2006 for the purpose of providing an update on the implementation of the Aurora project. It was agreed that the Deputy Minister of Aviation, the Deputy Minister for Foreign Affairs, the Secretary-General of the Presidency, the Deputy Minister of Education, the Director for Special Policy, the Chairperson of the National Commission for Scientific and Technological Research, the representative of the Chilean Air Force and the Executive Secretary of the Council of Deans of Chilean Universities would sign a recommendation in support of implementation of the project;

(c) The Minister of Defence convened a meeting of the Committee on 30 June 2006;

(d) A further meeting with the Minister of Defence took place on 12 July 2006. The Committee was informed of the ministerial decision to suspend negotiations with the European Aeronautic Defence and Space Company and invite international tenders. Consideration was given to providing the Chilean Space Agency with an appropriate institutional framework in connection with its transfer to the Ministry of Economic Affairs.

3. Meeting on the Aurora project

4. A meeting was held to discuss the Aurora project on 22 June 2006. Those attending were the Minister of Defence and the Deputy Minister of Aviation and Chairman of the Presidential Advisory Committee and his adviser, the Head of the Aurora project, General Luis Ili Salgado of the Chilean Air Force, satellite experts from the three branches of the armed forces, the Coordinator of the Chilean Space Agency and consultants from the Chilean Space Agency.

4. Fifth Space Conference of the Americas

5. The Chilean delegation to the Fifth Space Conference of the Americas was led by the Deputy Minister of Aviation and included representatives of the Chilean Air Force, the Aerial Mapping Service of the Chilean Air Force, the Navy, the Ministry of Foreign Affairs, the Water Center for Arid and Semi-Arid Zones of Latin America and the Caribbean, four universities and the Chilean Embassy in Ecuador. The Deputy Minister held bilateral meetings with representatives of Brazil, Ecuador, Germany, Peru and Venezuela (Bolivarian Republic of). The German Space Agency expressed interest in participating in Chilean space projects. In addition, meetings between representatives of the Chilean and Ecuadorian air forces resulted in a draft agreement on cooperation in space-related matters, to be submitted to the high commands of the two air forces.

5. Implementation of the Aurora project

6. The Deputy Minister of Aviation, in his capacity as Chairman of the Chilean Space Agency, is responsible for the Aurora project. The Government of Chile decided to suspend its negotiations regarding the acquisition of a satellite system. The Chilean Space Agency approved a space policy proposal recommending that the institutional framework for implementing the space policy be embedded within the civilian sector and that one objective of the policy should be the acquisition of an independent satellite system that would serve the development and security interests of Chile.

7. The Deputy Minister of Aviation and Chairman of the Chilean Space Agency announced the agreement and stated that the proposed space policy would create a frame of reference for the acquisition of satellite capabilities, encompassing satellites, antennae, professional skills and international cooperation. He further stated that 26 companies had been requested to indicate their interest in submitting tenders in response to preliminary specifications drawn up by Chile and that Chile would be ready to invite tenders internationally in late 2006 or early 2007.

6. Seminar on the general requirements to be met by an Earth observation satellite system

8. As part of the preliminary work programme of the project for the acquisition of an Earth observation satellite system through international private bidding, a seminar attended by representatives of State institutions and the three branches of the armed forces was held on 25 October 2006 to discuss the technical requirements to be met by a satellite system for the optical observation of Chilean territory.

9. The preliminary conclusions of the seminar were as follows:

(a) The essential features of the proposed satellite system, the basic description of its purpose, the specifications for its orbital mechanics, the panchromatic and multispectral resolution, the number of images to be obtained and the coverage fully met the expectations of the relevant State agencies;

(b) Some academic institutions requested a study of the feasibility of including two space research instruments, which would necessitate an evaluation of their potential impact on the optical Earth observation mission of the satellite system;

(c) It was suggested that a study be conducted to assess the feasibility of slightly extending the three or four spectral bands (red, green, blue and near-infrared) in order to utilize the observations in some mining-related applications and in space science.

7. Familiarization visits to the space agencies of Argentina and Brazil

10. From 25 to 30 November 2006, a delegation from the Chilean Space Agency visited the Teófilo Tabaneras Space Center of the National Commission on Space Activities of Argentina and the Brazilian Space Agency in San José dos Campos, Brazil.

Cuba

[Original: Spanish]

1. Cuba is continuing to support peaceful space research and, in particular, the efficient use of space applications in the interests of its sustainable development. The main activities of 2006 are described below.

1. Space meteorology

2. The quality of the meteorological forecasts of the Institute of Meteorology of the Ministry of Science, Technology and the Environment was greatly enhanced, thanks to the entry into operation of eight meteorological radar systems, the automation of its meteorological stations and optimal use of its high-resolution satellite station.

3. The dissemination of the meteorological forecasts of the Institute also improved, thanks to the installation of new software for their presentation on national television.

4. In the area of meteorological research, further software for the digital processing of meteorological data and the use of such data in various sectors of the economy was developed and installed.

2. Remote sensing of the Earth

5. In the interests of sustainable development, many bodies are using satellite images in order to gain a better understanding of the country in such areas as natural

disaster risk assessment, agriculture and industry. Some of the studies carried out in 2006 are described below.

6. Brazil's "Queimadas" system for the satellite detection and monitoring of vegetation fires was introduced into Cuba after scientific and technical cooperation between the Institute of Meteorology and the National Institute for Space Research of Brazil had resulted in adaptation of the system so that it could promptly provide information about active fires within "protected areas" in Cuba. Images from the Geostationary Operational Environmental Satellite (GOES) GOES-12, the GOES I-M Imager, the Terra and Aqua satellites and the Moderate-Resolution Imaging Spectroradiometer (MODIS) are being used, ensuring temporal and spatial coverage sufficient for the rapid detection and pinpointing of fires through digital processing using a specialized algorithm. The information is supplied to users in the form of tables, interactive maps and automatic mail, in almost real time, approximately 20 minutes after the satellite passes, using advanced communication technologies, the Internet, and so forth. A geographical information system (GIS) is used to enter information about pinpointed fires into a geographical database for Cuba, which makes it possible to visualize the fires and the lay of the surrounding land and to assess the options for fighting them. The "Queimadas" system has already been used successfully during two fire seasons.

7. An analysis of the impact of Saharan dust clouds on Cuba and the Caribbean Sea was carried out using satellite images from the National Oceanic and Atmospheric Administration of the United States of America and GOES, and multivariate statistical techniques. A statistical picture of the spatial and temporal behaviour of the dust over Cuba during the previous five years was obtained, and the effects of the dust on rainfall, tropical cyclone formation and the epidemiological patterns of some diseases were elucidated.

8. A preliminary study was carried out to determine the environmental sensitivity of a zone on Cuba's north coast, using digitally processed satellite images, existing cartographic information and data collected within the zone during an expedition carried out for that purpose. The basic information necessary for drawing up maps showing environmental sensitivity to oil spills in that coastal zone was determined and categorized.

9. The high-resolution images obtained at the Institute of Meteorology station continued to provide information used in tracking sea currents and monitoring oil spills at sea.

10. A study was made of the geological and hydrological evolution of the Zapata Swamp and its connection with the changes in vegetation cover. The use of GIS and remote sensing made it possible to determine how major water regime changes contributed to changes in vegetation cover.

11. The effects of tectonic movements in a sector of the Santiago de Cuba geodynamic zone were studied using Global Positioning System (GPS) techniques. Three series of GPS measurements of horizontal movements were carried out in Santiago de Cuba Bay, and data obtained through continuous monitoring of the control point of the reference frame station of the Global Navigation Satellite System (GNSS) service were used for increasing the precision of the measurements. The results were compared with values obtained for the speed of horizontal movement of the North American Plate in the eastern Cuban sector.

12. A study was made of the use of satellite methods in modernizing Cuba's geodesic network and recommendations were made for using such methods more effectively.

13. Agriculture in Cuba is benefiting from applications of advanced techniques such as global positioning using satellites, satellite remote sensing, the digital processing of images, GIS and digital mapping, and important results have been achieved in areas such as the production of detailed thematic maps of farms showing their infrastructure and crops and the soil conditions of fields and indicating, inter alia, the presence of weeds, insects and diseases. A sugar cane crop yield map was produced, and GIS developed and implemented for various farms are helping to increase yields. Areas suitable for livestock rearing were identified using these space techniques in combination.

14. A book entitled *El Pionero Explorador, la Cartografía y el Mapa* ("The Explorer-Pioneer, Cartography and the Map") was made available in digital format. Written chiefly for children and other young persons, it deals in particular with the use of topographical maps in exploration and the gathering of cartographic data for use in geomatic applications and various other purposes.

3. Space sciences

15. The Institute of Geophysics and Astronomy of the Ministry of Science, Technology and the Environment continued to monitor the Sun, the ionosphere and the Earth's geomagnetic field and to relay solar and geomagnetic data to centres worldwide.

16. The impact of physical parameters of the solar wind and the interplanetary magnetic field on the dynamics of the ionosphere in the American sector was analysed using temporal series of ionospheric parameters such as ion and electron velocity, temperature and density during two campaigns at the Millstone Hill, Arecibo and Jicamarca observatories, using incoherent scatter radars. Comparative studies were made of ionospheric electron concentration profiles and the ion velocity components during periods of perturbation and during geomagnetically quiet periods. The results showed that perturbations at different altitudes in the ionosphere are linked to the presence of atmospheric gravity waves resulting from geomagnetic perturbations.

17. A photometric characterization of symbiotic stars is being carried out with a view to identifying candidate stars in the galactic plane, using photometric data from the far-red and near-infrared portions of the optical spectrum. The main tool employed is the colour-colour diagram of the Isaac Newton Telescope/Wide Field Camera Photometric H-alpha Survey of the Northern Galactic Plane (IPHAS) project. The other tool is a colour-colour diagram in the near-infrared range of the 2-Micron All Sky Survey (2MASS) photometric catalogue. Normal stars and objects with significant H-alpha emissions have been used as references, which could limit the effectiveness of the search for symbiotic stars as part of the IPHAS project. During the search, which began only recently, the symbiotic nature of four candidate stars has already been confirmed by studying their spectrum.

18. A fragmentation model based on Tsallis's non-extensive formalism was used to analyse the size distribution of meteor particles on entry into the Earth's atmosphere. It was thought that the size distribution of meteor particles was the

result of the fragmentation of larger solid bodies. More than 10,600 visual observations of the Leonid, Perseid and Lyrid meteor showers of various years were analysed. The resulting values of the Tsallis parameter (q) were within the range predicted on the basis of the fragmentation theory ($1 < q < 2$), which shows that the size distribution of meteor particles is described very well by that theory.

19. The distribution of the intervals between solar explosions causing the emission of very short radio waves (of less than one second) was compared with that of the intervals between successive emissions due to ejections of two-component coronal material. The results show that both distributions obey a type of power law, which can be interpreted as evidence of the existence of avalanches of multiple magnetic reconnections in the solar corona on different spatial-temporal scales, indicating that the coronal magnetic field is in a state of self-organized criticality. According to this interpretation, solar activity may as a rule be the same both on the global and local scale regardless of the underlying mechanisms.

20. Records spanning a period of 13 years (more than one cycle of solar activity) at the Havana station for vertical sounding of the ionosphere were used in a study of F-diffusion in the ionosphere over Cuba. The daily and seasonal variations and the variations connected with solar activity in the probability of occurrence and the intensity of that phenomenon were determined.

21. Variations in the critical frequency of the F2 layer of the ionosphere over Havana, Toluca (Mexico), Huancayo (Peru) and Concepción (Chile) were studied using data available in Cuba and from the World Data Center for Marine Geology and Geophysics, Boulder, United States. It was found that the higher variability indices tended to be lower when the R12 values were high, more so over Havana and Toluca than over Concepción, and that they practically disappeared over Huancayo.

22. A plasma layer dynamics simulation was carried out by adapting the cellular automata model of Koselov and Koselova to different conditions of the interplanetary magnetic field. The simulation was based on a 40x80 matrix arrangement representing the plasma layer, with each matrix cell corresponding to a layer site through which there passed a magnetic field line that interconnected it with another site in the ionosphere. Energy entered the system through its boundary, represented by the Bz module of the interplanetary magnetic field, at a rate of one cell per minute, measured by the Wind satellite of the National Aeronautics and Space Administration of the United States. The avalanches in the matrix arrangement were associated with major variations in the Auroral Electrojet (AE) Index, which points to the presence of magnetic substorms.

23. A number of software programs were developed for the study of solar events and the forecasting of proton fluxes, using as input data, inter alia, the values of the magnetic field components observed in the immediate vicinity of the Earth, the density and speed of the solar wind and proton flux data for E > 10 MeV.

4. Distance learning

24. Cuba has continued to accord high priority to distance learning, with a varied schedule of programmes on its two educational television channels, which place strong emphasis on the acquisition of knowledge, as well as on culture. Classes are offered in all subjects at different levels, as are specialized courses in important

disciplines such as meteorology, geography, astronomy and history. Language courses continue to be offered: in 2006 there were German, Portuguese and Italian courses.

25. The availability of television sets and video players in all educational institutions in Cuba, however remote those institutions may be, ensures that Cuba continues to adhere to the spirit of the maxim of José Martí that "to be educated is the only way to be free".

5. World space week

26. World Space Week was dedicated to the Fourth Congress of Pioneers of Cuba, with nocturnal sky observations throughout the event. The press and radio reported on the objectives of World Space Week.

27. The fifth national workshop on outer space and its peaceful uses was held in the Jimaguayú Hall of the National Capitol building, where 24 presentations were given by representatives of 10 Cuban scientific institutions.

Ecuador

[Original: Spanish]

1. In order to promote international cooperation in the peaceful uses of outer space, the Centre for the Integrated Surveying of Natural Resources by means of Remote Sensing (CLIRSEN) has, since its establishment, pursued a policy of coordination and close cooperation with all national and international bodies whose work relates to space technology and its applications, concluding cooperation agreements with a view to joint participation in regional studies and projects.

2. The Framework Agreement between the Governments of Ecuador and Chile on Cooperation in Space Activities, signed in Quito on 1 December 2005, covers the following areas, among others, in which CLIRSEN has competence:

(a) Remote sensing of the Earth from space;

(b) Environmental monitoring of the Earth using space resources;

(c) The design, construction and use of ground stations for data reception, telemetric monitoring and the control of remote observation satellites;

(d) Joint satellite missions;

(e) The training and exchange of scientific and technical personnel in the area of space technology.

3. In the framework agreement between the Governments of Argentina and Ecuador on cooperation in space activities, which is in the process of being signed, article III identifies CLIRSEN as the body responsible for implementation of the agreement in Ecuador.

4. The agreement sets out the following areas of activity of CLIRSEN:

(a) Space science, space technology, observation of the Earth using remote sensors and other space applications;

(b) The design, construction and use of stations for data reception, monitoring, telemetry and the control of remote observation satellites;

(c) The development and integration of networks for the exchange of space data;

(d) The training and exchange of scientific and technical personnel in the area of space technology;

(e) Participation in regional projects implemented within the framework of the Mario Gulich Institute for Advanced Space Studies of the National Commission on Space Activities of Argentina.

5. In addition to these two major agreements at the State level, CLIRSEN has long-standing ties with the National Institute for Space Research of Brazil relating to the organization of training and technology transfer, studies of natural resources and the environment and the exchange of professional experience.

6. Currently, consideration is being given to two options for continuing this cooperation between the two countries: cooperation within the framework of the Project for the Advancement of Networked Science in Amazonia (PAN-Amazonia) II Agreement and cooperation within the framework of a strategic tripartite alliance between Argentina, Brazil and Ecuador with a view to establishing a Latin American network of space stations.

7. The PAN-Amazonia project is being implemented with the participation of eight States parties to the Treaty for Amazonian Cooperation through a strategic alliance presented during the Fifth Space Conference of the Americas, which was held in Quito from 24 to 28 July 2006, and in various other forums.

United Kingdom of Great Britain and Northern Ireland

[Original: English]

1. The UK Space Activities brochure is the annual publication of the British National Space Centre that covers the events and activities of the previous 12 months and looks ahead to the coming year. *UK Space Activities 2006* was distributed during the forty-fourth session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, held in Vienna from 12 to 23 February 2007.

2. In 2006, the space activities of the United Kingdom of Great Britain and Northern Ireland had their highest profile of recent years. Examples of successful projects with significant United Kingdom involvement were the exciting images obtained from the Mars Express and Cassini-Huygens missions; the important roles played by the Environmental Satellite (Envisat) and the Disaster Monitoring Constellation satellites in tracking Hurricane Katrina and imaging the aftermath; the successful launches of the Meteorological Operational (MetOp), Solar Terrestrial Relations Observatory (STEREO) and Solar-B satellites; and small satellites such as the TopSat Earth-surface imaging satellite.

3. The United Kingdom has also played a major role in a number of international meetings, chairing the Committee on Earth Observation Satellites and jointly chairing the European Union/European Space Agency Space Council.

4. In 2007, the House of Commons Science and Technology Committee will complete its inquiry into United Kingdom space activities. The British National Space Centre (BNSC) will hold a consultation on the new United Kingdom civil space strategy. The strategy itself will be published at the end of the year, after publication of the report of the Science and Technology Committee.

5. Two of the 11 members of the BNSC partnership, the Particle Physics and Astronomy Research Council and the Council for the Central Laboratory of the Research Councils, have merged to form a large facilities research council, called the Science and Technology Facilities Council. BNSC has also seen its own internal changes: Colin Hicks retired as Director General and was replaced by David Williams, formerly of the European Organisation for the Exploitation of Meteorological Satellites.

6. Further information on United Kingdom space activities can be found on the BNSC website at www.bnsc.gov.uk.