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COMMITTEE ON THE PEACEFUL USES OF  
OUTER SPACE

Scientific and Technical Subcommittee

Forty-second session

Vienna, 21 February-4 March 2005

**Agenda item 3**

**General exchange of views and introduction to reports submitted on national activities**

**INTERNATIONAL COOPERATION IN THE  
PEACEFUL USES OF OUTER SPACE:  
ACTIVITIES OF MEMBER STATES**

Note by the Secretariat\*

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\* This document has not been formally edited. It will be edited, translated into all official languages of the UN and distributed as document A/AC.105/832/Add.2 after the forty-second session of the Scientific and Technical Subcommittee.

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## Algeria

[Original: French]

1. During 2004, the Algerian Space Agency (ASAL) put in place procedures to enable space activities to develop in such a way as to meet the needs expressed by national users.
2. The national space programme is implemented due to the work of national scientific and technical institutions such as universities, research centres, laboratories and institutes.
3. ASAL intensified and expanded the process of collaboration with national sectors and potential users of space technologies, to which end a number of agreements were concluded.

### **1. The concept and implementation of a national space programme**

4. The ASAL programme for 2004 set out the dimensions of the National Space Programme (NSP) over a 10-year timescale. The Programme objectives include strengthening Algeria's capacities for the benefit of the national community, contributing to the country's economic, social and cultural development, improving environmental protection, developing the knowledge and management of natural resources and improving the prevention of major disasters.
5. To that end, ASAL has set up specialized expert groups in the following fields:
  - (a) Plant and water resources: The aim is to draw up a programme covering the use of remote sensing for data collection, processing and analysis and thus providing better understanding and management of plant and water resources;
  - (b) Oil and mining resources: The use of Earth observation satellites at various spatial and spectral resolutions should make for more accurate assessment, monitoring and control of the country's potential oil and mining resources, which is the aim of NSP in this field;
  - (c) Fishery resources: The main objective is to attain the best possible level of knowledge and the optimum and sustainable use of fishery stocks. This may be achieved by the rational management of fishery resources on the basis of data produced by space technology, among other sources;
  - (d) Land-use planning and management of natural disasters: The objective is to apply space technology to land-use planning in such a way as to ensure the harmonious and sustainable development of the nation's land resources. As for natural disasters, space technology will contribute to the prevention and management of earthquakes, land movements, forest fires, locust infestations, floods, drought and desertification;
  - (e) Positioning using the Global Positioning System (GPS): Positioning using GPS is made possible by a satellite constellation that enables an absolute or relative position to be established at any point on Earth. The NSP aims to make efficient use of GPS in the fields of navigation, positioning and national security and to perfect processing methods and techniques;
  - (f) Agricultural statistics: The main objective is to help establish a collection and information system capable of harvest prediction and post-harvest management. This will enable the authorities to obtain regular, accurate and up-to-date information on agricultural production. Such information will contribute to the better management of yield fluctuations and consumption and import requirements;
  - (g) Space technology: The space technology programme will focus on ground segments, spacecraft, airborne instruments and analysis and processing software. The priority objective is to achieve technological expertise, create a national skills network and establish a space infrastructure;
  - (h) Space telecommunication: Satellite telecommunication constitutes an important aspect of the NSP. The Programme sets out the systems to be put in place for access to satellite

telecommunication services, such as fixed and mobile telephones, in rural as well as urban areas, audio-visual broadcasting, multimedia services (infrastructure and Internet access), mobile telecommunication, distance education, telemedicine and others.

## **2. Space applications**

6. Various projects were conducted in Algeria during 2004 on the basis of ALSAT-1 microsatellite data. The ground receiving station located at the National Centre for Space Technology (CNTS) at Arzew has downloaded about 700 scenes since 28 November 2002.

### **Prevention and management of forest fires**

7. For the second consecutive year, action was taken to monitor forest areas in Algeria in Summer 2004. On the basis of ALSAT-1 data processed at CNTS, an assessment of surface areas affected by fire was carried out using ALSAT-1 time series images covering the north of the national territory. The images of the areas affected were superimposed on the outlines of the country's forest areas. The results were conclusive and confirmed the calculations of the areas concerned by the Forestry Service.

### **Implementation projects**

8. Various projects undertaken by the Ministry of Agriculture and Rural Development were conducted as part of the National Plan for Agricultural and Rural Development, which was launched in 2000. Mention may be made in particular of the schemes to close some forest areas to grazing animals and to extract water from surface waters.

9. On the basis of ALSAT-1 images on different dates, CNTS and the High Commissariat for Steppe Development conducted a study on communities living next to steppe areas. The processing of the images showed the "territorialization" of the areas concerned by the use of land for pasture.

10. The methodology adopted aimed at making a qualitative and quantitative assessment of forest areas closed to grazing animals and of plantations and to make a quantitative estimate of spate irrigation areas.

### **Locust control**

11. Since Autumn 2003, ASAL has supplied the National Institute for Plant Protection (INPV) with over 40 ALSAT-1 processed images, each covering 600 square kilometres, to enhance its early warning system.

12. Chlorophyll activity was correctly identified throughout wadis (rivers) and irrigation areas in infestation regions, thus enabling INPV field parties to carry out preventive treatment in areas conducive to the growth and reproduction of desert locusts.

13. ASAL has established the Analysis and Decision-making Assistance System (SAAD), which matches ALSAT-1 data with weather charts over three days (wind speed and direction, precipitation) and with the digital terrain model in order to predict locust invasions in the areas concerned.

14. At a meeting of the Maghreb-Sahelian countries, which brought together ministers and experts under the aegis of the Commission for Controlling the Desert Locust in Western Africa and the Food and Agriculture Organization of the United Nations (FAO), ASAL made a presentation concerning SAAD. The use of ALSAT-1 data was made available to all the Commission's Member States (the Maghreb and Sahel countries).

### **Seismic hazards**

15. The year 2004 saw the implementation, through an inter-ministerial committee comprising the main sectors involved, of a joint project conceived and developed by ASAL in 2003, entitled "Updating of seismic hazard maps using space technology".

16. The scientific aspects of the project—the GPS network configuration—were presented by an Algerian research team at a meeting in Rabat, in September 2004, on the Wegener project (Working Group of European Geoscientists for the Establishment of Networks for Earth-science Research).

#### **Charting industrial infrastructures**

17. The energy and mining sector is engaged in elaborating a database using ALSAT-1 imagery making it possible to control and monitor oil infrastructures in relation to infrastructures affected by silting and improved security for urban locations in which such infrastructures are found.

18. The space maps obtained using ALSAT-1 images of the Hassi Messaoud oilfield have made it possible to identify and map the main infrastructures such as towns, roads, waterworks and oilfields.

#### **Basic cartography**

19. The National Institute of Cartography and Remote Sensing (INCT) is devoting serious attention to the use of space technology in the field of national cartography.

20. The establishment of a remote sensing centre for INCT in 1997 has been instrumental in supplying previously missing cartographic information on the scale of 1/200,000, covering almost 250,000 square kilometres using satellite imagery. These new procedures are currently being used to produce, and to update or revise, space maps and traditionally drawn maps, using various kinds of imagery from ALSAT-1, Earth Observation Satellites such as SPOT or the International Magnetospheric Survey (IMS) Reporting System (IRS).

21. As for satellite positioning, the geodesic network has been densified by GPS observations of a first network of 32 points, of zero order, and by the introduction of another network, of first order, encompassing 700 points.

### **3. Research and training**

22. Various research and training activities took place in 2004 and are described below.

#### **Postgraduate training**

23. With a view to promoting, perfecting and developing space technology, the National Centre for Space Technology and the University of Science and Technology of Oran have jointly launched a postgraduate course on space instrumentation. Two options are envisaged: “Space telecommunication” and “Satellite technology”.

24. The number of students taking the course rose to 62, of whom 16 submitted their theses during 2004. In addition, 27 engineers have submitted their final theses in space technology.

#### **The Eductel project**

25. This project aroused an interest in space technology among a large number of school children. The project was operational in a number of pilot schools in 2004 and will be extended nationwide.

#### **Organization of study days**

26. ASAL organized a number of study days with the energy and mining sector, the water resources sector and the agriculture and rural development sector. They focused, respectively, on:

- (a) “The role of ALSAT-1 as an instrument in the assessment of the activities of the High Commissariat for Steppe Development in the framework of the National Plan for Agricultural and Rural Development” (9 March 2004);
- (b) “How space technology can benefit the energy and mining sector” (12 July 2004);
- (c) “The Analysis and Decision-making System for dealing with locust invasions” (10 September 2004);

- (d) “How space technology can benefit the water resources sector” (8 November 2004); and
- (e) “Assessment by ALSAT-1 imagery of forest areas affected by fire during the summer season, 2004” (9 November 2004).

#### **4. International cooperation**

27. International cooperation is essential to the development of space technology. Algeria therefore pursues a policy of multidirectional cooperation.

28. Algeria participated, in its capacity as a permanent member, in the forty-seventh session of the Committee on the Peaceful Uses of Outer Space and the meetings of its two Subcommittees.

29. At the forty-first session of the Committee’s Scientific and Technical Subcommittee, held in Vienna from 16 to 27 February 2004, ASAL outlined its space programme. At that session, ASAL was able to present examples of thematic applications arising from images released by the Algerian satellite ALSAT-1 in various fields such as agriculture, forestry, national development and natural hazards.

30. The Subcommittee also discusses the Disaster Monitoring Constellation, which includes ALSAT-1, as well as British, Nigerian, Turkish, Czech, Chinese, Vietnamese and Thai satellites. Algeria has expressed its intention of joining, along with the other DMC countries, the International Charter “Space and Major Disasters”.

31. During the forty-third session of the Committee’s Legal Subcommittee, held in Vienna from 29 March to 8 April 2004, ASAL organized an exhibition on the Algerian National Space Programme and the ALSAT-1 satellite. A model of ALSAT-1 was presented to the Office for Outer Space Affairs for its permanent exhibition.

32. In the context of the work of the International Institute for the Unification of Private Law (UNIDROIT), ASAL contributed to the work of the second session of the Committee of Governmental Experts, held in Rome from 26 to 28 October 2004.

33. Algeria attaches particular importance to training and the transfer of know-how in the field of space technology. It has thus signed memorandums of understanding with three of its international partners: Argentina (National Commission on Space Activities (CONAE)), France (Centre national d’études spatiales (CNES) and the Institute for Space Astrophysics (IAS)) and the Russian Federation (Russian Federal Space Agency (Roskosmos)).

34. A protocol concerning cooperation has been signed between CNTS and the Institute for Higher Space Studies “J. Mario Gulich”, Argentina, for the joint development of projects relating to remote-sensing applications.

35. Algeria is involved in regional cooperation through its contribution to the work of the African Regional Centre for Space Science and Technology Education-in French Language, affiliated to the United Nations (CRASTE-LF), which is located in Rabat.

36. Algeria participated in various seminars, namely:

- (a) International scientific demonstration organized by the ad hoc Group on Earth Observations (GEO), held in Cape Town, South Africa, from 23 to 27 February 2004;
- (b) Second Earth Observation Summit, organized by the Japanese Ministry of Education and held in Tokyo from 22 to 25 April 2004;
- (c) International workshop on the topic “RANET Internet Presence Initiative (RIPI)”, organized by CRASTE-LF and held in Rabat from 7 to 11 June 2004;
- (d) Semi-arid/water resources seminar organized by the Brazilian Government within the framework of the South America-Arab League summit and held in Fortaleza, Brazil, from 29 September to 1 October 2004;

- (e) Forum on information and communication technologies (ICT), which formed part of the fourth session of the Algeria-South Africa Bi-national Commission, held in Pretoria from 4 to 6 October 2004; and
- (f) International Workshop on the Use of Space Technology for Disaster Management, held in Munich, Germany, from 18 to 22 October 2004. The contribution of the ALSAT-1 microsatellite to disaster management and its inclusion in the DMC were highlighted.

37. During World Space Week 2004, which coincided with the second anniversary of the launch of ALSAT-1, open days on space technology were held at ASAL headquarters and at CNTS. The open days focused on the contribution made by the Algerian microsatellite ALSAT-1, with particular reference to information on the DMC, the use of ALSAT-1 images to benefit natural resources and ALSAT-1 and natural hazards.

38. An exhibition of satellite images was presented for school children and members of scientific societies, followed by a guided visit to the Earth receiving station.

## Cuba

[Original: Spanish]

1. Cuba has continued to carry out and strengthen its space research and applications aimed at the peaceful use of outer space, and has made unquestionable progress towards its sustainable development. The numerous space-related activities carried out by Cuba in 2004 are detailed below.

### A. Space meteorology

2. Accurate meteorological forecasts made by the Institute of Meteorology of the Ministry of Science, Technology and Environment using high-resolution satellite images, together with the preventive evacuation measures implemented by the Civil Defence, helped to protect the population and many areas of economic importance at risk from hurricanes Charley and Ivan in the country's western region.

3. The two hurricanes caused significant economic losses exceeding one billion United States dollars. However, only four fatalities were reported in the wake of Hurricane Charley, and no human lives were lost as a result of Hurricane Ivan.

4. The Director of the United Nations International Strategy for Disaster Reduction declared that Cuba set an example in the prevention of hurricane risks and provided a model that could be applied in other countries with similar or better economic conditions that did not manage to protect their populations as effectively as Cuba did.

5. Advances in meteorological research notably include the development and installation of new computer programmes for the digital processing of meteorological data, including the development of Earth Observation Satellite (SPOT-SAT) software in its pilot operation phase for the diagnosis of areas of storm and severe storm activity using geostationary operational environmental satellite (GOES) images, inter alia, to measure the temperature and altitude of cloud tops and to identify associated severe phenomena.

6. In addition, SPFF-SAT software was developed for forecasting the displacement of cold fronts over the Gulf of Mexico as well as rain and wind over the extreme south-east of the Gulf of Mexico, the west of Cuba and the Yucatan peninsula, using GOES images and conventional data.

### B. Remote observation

7. The satellite images received at the high-resolution station installed at the Institute of Meteorology have been of great use in the remote observation of the Earth and in environmental surveillance and monitoring.

8. Advanced very high resolution radiometer (AVHRR) images were used to detect and monitor the development of ocean currents and to monitor oil spills at sea. Multispectral LANDSAT images were also used to study oil spills on land and the impact of oil slicks.
9. The detection of several forest fires during a campaign in 2004 led to swift action to locate and extinguish them, thus preventing substantial economic and environmental damage. A database of high-resolution picture transmission/geostationary operational environmental satellite (HRPT-GOES) images was created for the detection and monitoring of such fires.
10. In 2004, the GeoCuba enterprise group stepped up its research and development activities in remote sensing, implementing a project on the development of remote sensing applications, the main aim of which was to set up a methodological and technological database for the use of the technique in production and services.
11. The results of the project notably include the establishment of procedures and methodologies for the production of video maps, space maps and orthoimages, the development of technologies for the use of satellite images in updating topographical maps at various scales, the development of a methodology for the study of space-time variations in hydrographic basins and a methodology for the mapping of forest cover, and the installation and management of new software for the digital processing of images and new types of very high resolution satellite images.
12. The Cuban chapter of the Society of Latin American Specialists in Remote Sensing (SELPER) has contributed to the implementation of numerous advanced training activities in technical areas.

### **C. Space sciences**

13. In the area of space sciences, the Institute of Geophysics and Astronomy of the Ministry of Science, Technology and Environment has continued to monitor the Sun, the ionosphere and the geomagnetic field in Cuba, and to relay such data to centres worldwide.
14. Engineers and technicians of the Institute, working in collaboration with the Institute of Cybernetics, Mathematics and Physics, have set up a digital system to receive data from the radio-astronomical station in Havana, which facilitates the processing of solar data.
15. In addition, a system was developed in conjunction with the Institute of Meteorology for the digital recording of ionograms, and is now being installed as part of the Automatic Identification System (AIS) of the ionospheric station for the automatized processing of ionospheric data. The system is expected to improve ease of use and operation.
16. Research on the Earth-Sun relationship has continued with a study of solar wind-magnetosphere coupling, using multi-satellite measurements of the physical parameters of solar wind and the interplanetary magnetic field. A study of the influence of these factors on the dynamics of the ionosphere over the Americas demonstrated that solar wind disturbances and the z and y vector components of the interplanetary magnetic field play a crucial role in driving electric fields and ionospheric electrical currents towards the equator.
17. Research has continued on magnetic disturbances in the ionosphere over the the Americas, establishing the longitudinal variation of ionospheric storms in that hemisphere. In addition, a morphological characterization of positive ionospheric storms was carried out.
18. During the period under review, research continued on coronal mass ejections (CMEs), based on the analysis, by components and multiples, of two classes of CMEs with successive emissions. A study of the distribution of periods during which successive emissions diminished established that distribution was subject to a power law. The relationship between this index and the magnetic scenarios associated with emissions is under analysis.
19. Software using the LabVIEW graphical programming language was developed to diagnose solar events and forecast proton flux on the basis of qualitative diagnosis, calculation of proton flux

density at energies greater than 10 MeV, calculation of the spectrum index and calculation of the time delay from the time at which the radiation event is recorded at its peak.

20. An evolutionary and morphological characterization of Comet West (C/1975 V1) was carried out by means of the recovery and digitalization of photographic records made during observations in 2004. By processing the images obtained, using the digital processing methodology developed in Cuba, it was possible to establish that the comet's nucleus had fragmented into four parts, and to identify its rupture mechanism.

21. The meteor shower observation system was upgraded using software that, inter alia, performed operations to calculate the zenithal hourly rate and the population index for use by amateur groups.

#### **D. Distance learning**

22. Distance learning gained great momentum in 2004, with two Cuban television channels dedicated to broadcasting courses covering a range of subjects at the various educational levels.

23. English, Portuguese and Italian language courses were offered, as well as specialized courses and programmes in various subject areas that helped to broaden the knowledge and culture in general of the population.

#### **E. International activities**

24. The Seventh International Workshop on Informatics and Geosciences, "Geo-Info 2004", was held in Havana under the auspices of the Office for Outer Space Affairs and was attended by 75 specialists from several countries.

25. A course given by two eminent Brazilian professors within the framework of Geo-Info 2004 on the upgrading of global navigation systems, image processing and geographical information systems, was extremely well received.

26. Cuban specialists also participated, inter alia, in the following international events: the installation of PDI software Spring 4.1 at the National Institute for Space Research (INPE) in Brazil; the Fourth Workshop on Education in Remote Sensing in the Common Market of the Southern Cone (MERCOSUR) area, held in Brazil; the First Seminar on the Use of Remote Sensing in the Study of Global Changes, held in Argentina; and the International Geomatics Conference 2004, held in Havana, Cuba, within the framework of which an international workshop on remote sensing applications was held.

27. World Space Week was marked in Cuba by a large number of activities, including the screening of films and videos on space, the organization of night-time observations with manual telescopes by Cuban amateur groups, and the organization of the Third National Workshop on Outer Space and Its Peaceful Uses at the National Capitol.

## **Mexico**

[Original: Spanish]

1. As a member State of the International Telecommunication Union (ITU), Mexico has undertaken various activities in collaboration with the ITU and with other governments with a view to the replacement of satellites occupying the following geostationary orbit positions assigned to Mexico: 109.2°W, 113°W and 116.8°W.

#### **Geostationary orbit position 109.2°W**

2. This position was occupied by satellite Solidaridad 1 until 27 August 2000, when the satellite malfunctioned and consequently failed completely. The company Satelites Mexicanos therefore decided to replace Solidaridad 1 with satellite network Satmex 6 at that orbit position.



3. The fourth-generation satellite network Satmex 6 required technical coordination assistance from Canada, leading to the signing of a Memorandum of Understanding between the Mexican and Canadian Governments, which highlighted as the Mexican Government's greatest achievement the exchange of orbit position 109.2°W with the Canadian position 114.9°W, with a view to achieving the improved performance and coverage of Satmex 6.

**Geostationary orbit position 113°W**

4. This position is occupied by satellite network Solidaridad 2, which has second-generation features and has been operating successfully to date. Procedures have been initiated for the replacement of Solidaridad 2 with satellite network Satmex 7.

**Geostationary orbit position 116.8°W**

5. This position is occupied by third-generation satellite network Satmex 5, which is scheduled for replacement by satellite Satmex 8. The Government is currently applying to the ITU for the appropriate coordination.

**Geostationary orbit positions under the Broadcasting Plan**

6. In accordance with appendices 30 and 30A of the ITU Radio Regulations and under the plan for a satellite broadcasting service in the band 12.2-12.7 GHz in Region 2, Mexico has been assigned the following geostationary orbit positions and the permanent rights thereto: MEX01 78°N, MEX01 69°S, MEX02 136°N and MEX02 127°S.

7. In that regard, the Mexican Government has submitted an application to the ITU Radiocommunication Bureau to amend Region 2 plans to include the movement of the original position of 78°W to the orbit position of 77°W and the extension of its coverage to the territory of the United States of America.

8. In accordance with the provisions of the Federal Telecommunications Law, the geostationary orbit position of 77°W is to open for bidding, thus enabling satellite operators with an interest in that orbit position to apply to the Mexican Government for the necessary authorization to occupy and use its respective frequency bands.

## **Slovakia**

[Original: English]

1. The Chairman of the Slovak Commission for Research and Peaceful Uses of Space (the Slovak Space Agency) was appointed to be a member of the High Level Space Policy Group at the European Commission. A representative of the Slovak Republic participated in the agreement on the final version of the European Space Programme. M. Fronc, from the Ministry of Education of the Slovak Republic and R. Kvetnansky, Chairman of the Commission for Research and Peaceful Uses of Space, participated in the first meeting of the Space Council of the European Commission and the European Space Agency (ESA), which was held in Brussels on 25 November 2004. At that meeting, a common implementation of space policy by the Commission and ESA was agreed. The Slovak delegation proposed to incorporate the human component and life sciences in space into the priorities of the Space Council. The Slovak Republic will actively participate in the activities of the programme of the Space Council.

2. Several research projects in the field of space are currently being implemented at the universities and institutes of the Slovak Academy of Sciences (SAS), within the framework of wide international collaboration.

**A. Space Meteorology**

3. The Slovak Hydrometeorological Institute (SHMI) was involved in the following two projects in the field of space meteorology.

### **Central European Initiative nowcasting project**

4. The first part of this international project of the Central European Initiative, “Exploitation of meteorological satellites, radars and other remote measurements in the field of nowcasting and very short range forecasting”, was completed in April 2004. The results achieved in the project are:

- (a) obtaining nowcasting and very short range forecasting algorithms based on remote measurements; and
- (b) developing software for generating meteorological products, such as atmospheric motion vectors derived from satellite data; forecasted satellite images; automatically detected and classified convective cells in the satellite imagery; automatic detection and tracking of convective cells in radar measurements; detection and tracking of thunderstorms; vectors of cloud movement derived from radar measurements; and forecasted radar images.

5. The contribution of Slovakia has been the development by SHMI of the method of automatic detection and tracking of convective cells in radar measurements and the needed software.

### **Satellite Application Facility on Hydrology (H-SAF)**

6. The preparatory work on this project has continued. SHMI participated in the preparation of the final report of the Satellite Application Facility Hydrology Framework Working Group for the Science and Technical Group (STG) and the Council of the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

7. The main findings of that report are that the establishment of the H-SAF project is legitimate; and the interpretation of satellite data for product generation, especially on rain, snow and soil moisture is necessary for hydrological use.

8. The important task of the H-SAF project will be the validation of the products on rain, snow and soil moisture with higher space and time resolution on the base of microwave data from meteorological satellites and other measurements, their implementation into hydrological models and liaising with the users.

9. The first Proposal for the SAF on Support to Operational Hydrology and Water Management has been submitted to STG.

10. SHMI presented the poster on “The Tracking Algorithm as a CEI Nowcasting Tool” at the EUMETSAT Data User Conference in Prague in May 2004.

### **B. Remote Sensing**

11. Participation continued in the Image and Coordination of Information on the Environment Land Cover 2000 project. The aim of this project is to update the CLC90 database to 2000, as well as to identify land cover changes in Slovakia for the years 1990 to 2000 through the application of satellite data. About 55 per cent of the total area of Slovakia has been covered (the Institute of Geography of SAS in Bratislava and the Slovak Environmental Agency in Banská Bystrica have participated in this project).

12. Under the coordination of the Research Institute for Pedology and Protection of Soil in Bratislava, the preparation of an integrated administrative control system and its parts has continued, together with the registration of parcels (production blocks) of agricultural land, control of subsidies linked to agricultural land and crop yield forecasting by remote sensing data. Remote sensing activities of the Forest Research Institute in Zvolen continued through the national cooperative programme on assessment and monitoring of air pollution effects on forests, using Landsat enhanced thematic mapper data.

### **C. Space physics and technology**

13. Several institutions are involved in space physics research in Slovakia. Among them are the SAS Institute of Experimental Physics in Košice collaborating with Technical University and

University of P.J. Šafárik in Košice; the Faculty of Mathematics, Physics and Informatics of Comenius University in Bratislava, the SAS Astronomical Institute in Tatranska Lomnica; the SAS Geophysical Institute and other groups working in space physics. Those institutions continued to carry out experimental and theoretical research on physical phenomena in space. The results of their work were based on the analysis of measurements in space obtained from both their own instruments as well as from instruments of laboratories in other countries. Ground-based measurements were also used for the analysis. The research focused on magnetospheric, heliospheric and planetary explorations.

#### **D. Space biology and medicine**

##### **Postembryonic development of Japanese quails in conditions of hypodynamy**

14. This project is being undertaken at the SAS Institute of Animal Biochemistry and Genetics in Ivanka pri Dunaji. It is an extension of previous research in the embryogenesis of Japanese quails in weightlessness, which was carried out onboard the Mir space station. The aim of the experiments in 2004 was to study the effect of simulated microgravity on growth and mineral content in the leg bones of developing Japanese quail chicks. Hypodynamy (absence of mechanical bone loading) was used as a model for simulation of weightlessness on Earth. An experimental group of birds was subjected to the conditions of hypodynamy from 3 to 56 days of age. A control group was reared by standard method on the floor. Bone weight, length, width, breaking strength index and calcium, phosphorus and magnesium content in the femur and tibia were measured. The results indicated that hypodynamy had significant negative effects on studied anatomical properties of long bones during the whole experiment. Significant differences were also observed between test and control quails for bone index and breaking strength. Similarly, calcium, phosphorus and magnesium contents of the femur and tibia were significantly reduced. This, however, was not entirely unexpected, since hypodynamy and microgravity are known to be stressful factors. Therefore, this experiment offers preliminary but important insights into the influence of simulated microgravity on the development of female Japanese quail chicks. Based on these results, a similar experiment under conditions of real microgravity in space may be considered.

##### **Accumulation and persistence of cytogenetic damage induced by radiation and other factors of space flight**

15. The research on this project is undertaken at the Institute of Biological and Ecological Sciences, Faculty of Sciences, of P. J. Šafárik University in Košice. On the basis of previous findings on the trans-generational transfer of radiation-induced genomic damage of intact and regenerating liver, the rate of elimination of damaged cells through mitotic death during ontogenesis was studied. The elimination of damage was investigated in embryonic tissues and brains of irradiated rat male progeny at various stages of intrauterine and postnatal development. It was found that the radiation-induced cytogenetic changes diminished during embryonic development; however, in the brain of one- and three-day old offspring, the chromosomal aberrations persisted at a similar level to those in embryonic tissues. The persistence of chromosomal aberrations was related to the decrease in proliferative activity of neuronal tissue in the early period after birth.

##### **Changes in the function of neuroendocrine system during exposure to simulated microgravity and hypergravity**

16. This project is performed in conjunction with the Institute of Experimental Endocrinology, the Institute of Animal Biochemistry and Genetics and the Institute of Measurement Sciences, all at SAS in Bratislava.

17. The project is described in detail in document A/AC.105/816/Add.1. The preliminary data on the activation of the sympatho-adrenal system during exposure to hypergravity 3G have shown a huge release of adrenaline together with mild increase of plasma noradrenaline levels. These data suggest a specific activation of the adrenal medulla in hypergravity.

### **Influence of simulated microgravity on human postural responses to sensory stimulation**

18. This project is performed at the SAS Institute of Normal and Pathological Physiology. Its aim is to investigate the role of altered sensory interaction in postural instabilities after space flight.

19. A new method with tactile biofeedback for improvement and rehabilitation of imbalance in patients with sensory deficit was prepared. It is known that similar posture imbalance occurs in cosmonauts after space flight. Pilot measurements support the aim to develop a suitable way to help with recovery of decreased posture balance.

## **Ukraine**

[Original: Russian]

1. Space activities in Ukraine in 2004 were directed towards meeting the country's obligations under international programmes and projects, implementing the priority projects of the Third National Space Programme for the period 2003-2007 and improving the effectiveness of the work of the national space sector through restructuring and commercialization, increasing large-scale introduction of advanced space technologies, creating the conditions for increasing competition and private initiative and establishing broad cooperation with international financial, scientific and technical and other organizations. Activities that were carried out to implement priority projects under the Third Programme are described below.

### **1. Development of Space Technologies**

#### **(a) Satellite radio-navigation system**

2. Work continued on the establishment of a space navigational timekeeping system in Ukraine and its integration into the ground infrastructure of the European Geostationary Navigation Overlay Service (EGNOS):

- (a) The Kharkov reference station is being tested as part of the EGNOS System Test Bed;
- (b) Negotiations are in progress to conclude an agreement with the European Union on Ukraine's participation in the Galileo programme.

3. The implementation of the system will allow the formation in Ukraine of a navigation area meeting world standards for air, sea and land transportation safety, and will also facilitate the servicing of existing and development of new transport routes between European and Asian countries.

#### **(b) Remote sensing**

4. Inter-agency trials were carried out to test the ground-based flight control system and the special ground complex for the satellites Sich-1M and Mikrosputnik.

5. Systems for the reception of remote data were upgraded, and data are being received from the Russian remote sensing satellite Meteor-3M and the international satellite Terra. Work is in progress to increase capacity for the reception of remote data from various remote sensing satellites in the X-band.

6. Preparations are nearing completion for the launch of the Sich-1M and Mikrosputnik satellites, which are to perform remote sensing tasks. In 2004, flight models of the two satellites were assembled and are now undergoing a series of trials. Inter-agency trials were carried out to test the ground-based flight control system and the special ground complex, and the launch facilities and technical systems of the Plesetsk Cosmodrome (Russian Federation) are being prepared for launch-site trials in readiness for the launch of Sich-1M and Mikrosputnik. Applied science programmes were developed for the use of remote sensing data from those satellites.

7. The technical features of apparatus installed on board Sich-1M and Mikrosputnik facilitate a broad range of remote sensing tasks serving numerous sectors of the national economy. Scientific research was carried out to develop procedures for using data collected from monitoring the Earth's atmosphere, surface, seas and oceans.

## **2. Space research**

8. Space research in 2004 was directed towards the completion of preparations for the launch of Sich-1M, which was designed for the reception of remote data in the optical, infrared and very high frequency ranges, and the conduct of the international experiment Variant, which will be carried out by scientists from Ukraine and also from Austria, Bulgaria, Germany, Hungary, Poland, the Russian Federation and the United Kingdom of Great Britain and Northern Ireland. In addition, preparations were undertaken for joint experiments aboard the Russian segment of the International Space Station and for participation in the European Global Monitoring for Environment and Security (GMES) programme.

9. Work was carried out as part of Earth observation from space to establish methodological bases for the use of remote systems to monitor the environment, and to develop the Ukrainian part of an applied science programme for the use of remote data from the jointly launched Sich-1M and Mikrosputnik satellites. Research is being carried out jointly with Russian scientists, using data from the Meteor-3M satellite. These activities are aimed at a wide range of users in Ukraine, the Russian Federation and other countries engaging in research and development efforts in the areas of efficient use of natural resources, monitoring of natural disasters and anthropogenic hazards, and investigation of the factors influencing weather and climate formation.

10. Under the long-term programme for joint Russian and Ukrainian scientific research and technological experiments aboard the Russian segment of the International Space Station, preparations were undertaken for space experiments in space biology, biotechnology and medicine; technology and space applications of material sciences; physical and chemical processes under microgravitational conditions; research on near space and the Earth from space; astrophysics and extra-atmospheric astronomy; and space solar power. The system definition phase was completed for the development of on-board scientific equipment for experiments. The first experiments under the programme are scheduled to commence in 2005.

11. Ukraine's role in the GMES programme comprises the following tasks: assessment of environmental impact, in particular the risk of water pollution and landslides; monitoring of vegetation, particularly of agricultural land and forests; information support for risk management, particularly with regard to floods and forest fires; monitoring of the Sea of Azov, the Black Sea and their respective coastal areas; and monitoring of the atmosphere and space weather. A seminar on cooperation in space research was jointly organized by the European Union and the European Space Agency (ESA) with a view to broadening Ukraine's participation in the GMES programme, leading to the preparation and launch of a series of projects in collaboration with the International Astronautical Federation (IAF) under the GMES programme.

12. Work continued on the programme to provide the National Space Technology Operating and Test Centre in Evpatoria with antenna equipment for astrophysical research on very long baseline radio interferometry technology, scientific research based on the mapping of galactic background radiation at a frequency of 327 MHz, the radar identification of natural and man-made objects in the solar system (planets, asteroids and space debris), and the trial use of ground-based equipment at a centre for the reception of telemetry data from foreign satellites used in deep space research. In 2004, these activities were conducted with the participation of Ukrainian specialists within the framework of preparations for the large-scale international space project Radioastron, which is scheduled to begin in 2006. Solar research continued under the international project Coronas-F.

13. A scientific research project was carried out to study the effect of the Earth's atmosphere on the resistance of satellite reception equipment to very high and extremely high frequency interference affecting satellite control radio links.

14. A further scientific research project was carried out on mechanisms governing the formation of protogalactic systems (the occurrence of compression in a uniform magnetic field). The aim of the project was to conduct experimental research on physical phenomena occurring in the universe and to study their behaviour using radio-physical equipment at the National Space Technology Operating and Test Centre.

15. A third scientific research project was carried out to explore ways in which to strengthen the effectiveness of space-based radio surveillance systems in performing a range of tasks.

### **3. Space systems**

16. Work continued on the construction of a main data centre at the National Space Technology Operating and Test Centre and on the design and implementation of a data analysis system for the National Space Agency of Ukraine (NSAU).

17. Flight control centres for satellites Sich-1M and MS-1 TK were prepared for entry into operation.

18. Preparations were completed for the entry into pilot operation of systems based on integrated control and trajectory radio links and special measurement radio links.

19. Work was carried out at the Centre for Space Monitoring to prepare the Sazhen-S quantum optics station for service.

20. Stations for the reception of data generated at 137 MHz and 1.7 GHz were certified, and maintenance and repair work was carried out on the station units used for the reception of remote data generated in the 8.2 GHz range.

### **4. Cooperation with international organizations**

#### **(a) Inter-Agency Space Debris Coordination Committee**

21. NSAU shares the concerns of countries worldwide with regard to the danger of man-made space debris and the problem of removing space debris from near-Earth space. Recognizing the global nature of the problem, NSAU is actively contributing to the efforts undertaken by the Inter-Agency Space Debris Coordination Committee (IADC).

22. In 2004, a delegation from NSAU represented the country at a joint meeting of the Steering Group of the IADC and the United Nations Committee on the Peaceful Uses of Outer Space.

23. In compliance with the recommendations of the 18th session of IADC, Ukraine is conducting a series of studies on space debris issues, the results of which are presented at the regular sessions of IADC.

24. Ukraine's national research on space debris is described in document A/AC.105/838/Add.1.

#### **(b) European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)**

25. On 14 April 2003, a licence agreement was signed by NSAU and the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) for the cost-free use of half-hourly high-resolution data images transmitted from the Meteosat satellite of EUMETSAT.

26. The conclusion of the agreement will make it possible for NSAU and the State meteorological service, Gosgidromet, to receive digital data from the EUMETSAT Meteosat geostationary satellite, transmitted in coded form at half-hourly intervals, until 31 December 2005.

### **5. Space launches**

27. In 2004, six Ukrainian-made launch vehicles were launched as follows:

- (a) On 11 January, under the Sea Launch programme, the Brazilian telecommunications satellite Telstar 14/Estrela do Sul-1 was successfully launched by the Zenit-3SL launch

vehicle from the Odyssey floating launch platform in the Pacific Ocean. The satellite was manufactured by Space Systems/Loral of the United States for Loral Skynet of Brazil. The satellite carries 41 Ku-band transponders, with four unique and interconnecting coverage beams. Fifty per cent of the satellite's power will be allocated to Brazil, providing Ku-band services to users in the country. The satellite's other beams will cover the Americas and the North Atlantic Ocean, where the company Connexion by Boeing™ will use the satellite to provide its Internet-to-aircraft service;

- (b) On 4 May, the Zenit-3SL launch vehicle was successfully launched with the satellite Direct TV-7S, which was designed by Space System/Loral by commission of the digital television company Direct TV Inc. The satellite is intended to provide digital television services to users throughout the United States;
- (c) On 28 May, the Russian satellite US-PM was launched by the carrier rocket Tsiklon-2 from the Baikonur cosmodrome. The satellite was launched on behalf of the Ministry of Defence of the Russian Federation;
- (d) On 10 June, the satellite Cosmos-2406 was launched by the Zenit-2 carrier rocket from the Baikonur cosmodrome. The satellite was launched on behalf of the Ministry of Defence of the Russian Federation;
- (e) On 29 June, the Zenit-3SL carrier rocket was launched with the satellite Telstar-18. The satellite was manufactured by Space Systems/Loral by commission of the telecommunications operator Loral Skynet, and is intended to relay digital television programmes and to provide data transmission and Internet services to Asia, Australia, New Zealand and the Pacific Ocean islands; and
- (f) On 29 June, the Dnepr carrier rocket was used to launch the following eight satellites: Demeter (France), SaudiSat-2, SaudiComSat-1, SaudiComSat-2 (Saudi Arabia), LatinSat-S, LatinSat-D, AmSat-Echo (United States of America) and UniSat (Italy).

## **6. Bilateral cooperation**

28. In 2004, Ukraine's cooperation with foreign States on space research and the peaceful use of outer space was based on international agreements on space use, Ukraine's international obligations with respect to space activities and legislation in force in Ukraine governing those activities.

29. Ukraine's policy on international cooperation with other States was guided by the following key principles:

- (a) Compliance with international obligations with respect to outer space;
- (b) Fulfilment of the priorities and objectives of Ukrainian foreign policy;
- (c) Strengthening of the position of Ukrainian enterprises in the world market for space technology and services; and
- (d) Channelling of efforts into priority areas of space activity.

30. Efforts to strengthen international cooperation were focused on ensuring that the appropriate international legislation was in place to facilitate the participation of Ukrainian space sector enterprises in international space projects, as well as to encourage companies to engage in foreign trade and to maintain a stable and active presence on the space services market.

31. Brazil has been Ukraine's main partner in recent years. An international legislative framework has been drawn up for the implementation of a joint project to design a Tsiklon-4 launch site at the Alcântara cosmodrome. In 2004, implementation of the Tsiklon-4/Alcântara project entered its operational phase. The implementation of this large-scale project is a priority with respect to the future development of the Ukrainian space sector, since it will facilitate the construction of a launch site for Ukrainian carrier rockets at the cosmodrome, which enjoys a favourable geographical position. Ukraine has entered into negotiations with Brazil regarding

cooperation on further joint projects, including the design of an Earth remote sensing system, the upgrading of the Brazilian Veículo Lançador de Satélites (VLS) launcher and the implementation of scientific projects.

32. Ukraine's cooperation with the Russian Federation is based on broad cooperation between enterprises, joint participation in international space projects, the use of Russian sites for the launch of Ukrainian carrier rockets, a long-term programme for cooperation and a coordinated plan for the ongoing development by space agencies of space technologies.

33. Priority areas of cooperation with the Russian Federation in 2004 were as follows: preparations for the launch and operation of the satellites Sich-1M and Mikrosputnik; implementation of the international commercial space projects Sea Launch, Dnepr and Land Launch; and preparations for research and experiments aboard the Russian segment of the International Space Station.

34. Cooperation between Ukraine and the People's Republic of China continued under a long-term cooperation programme for 2001-2005. In 2004, the fourth meeting of the Ukraine-China Subcommittee on Cooperation in the Use of Outer Space adopted a decision to draw up a long-term programme for cooperation until 2010. The cooperation programme will involve the joint implementation by Ukraine and China of long-term projects for the development of space rocket technology and the implementation of scientific programmes, particularly the Moon research programme.

35. Cooperation continued between Ukraine and the United States on the development of joint research programmes on life sciences, the physics of weightlessness, astrophysics, and the implementation of joint space experiments aboard the International Space Station and of the international projects Sea Launch and Land Launch.

36. In 2004, Ukraine stepped up its cooperation with the European Union on space-related activities. Cooperation was strengthened with the European Commission and ESA. A joint working group was established to address issues relating to Ukraine's cooperation with the European Union on space research and the peaceful uses of outer space. In order to coordinate policy on space research, Ukraine drew up a white paper containing recommendations for European space policy. The main objective of Ukrainian space policy in the European context is to obtain the status of associate member of ESA and to participate in the design of the European global satellite navigation system Galileo. In 2004, Ukrainian enterprises actively participated in the implementation of the European project Vega.

37. Cooperation with Egypt, the Republic of Korea, India and Turkey was revitalized. Ukraine is assisting in the design, on behalf of Egypt, of a remote sensing satellite. Following the extension by a further 10 years of an agreement concluded in 2004 between the Governments of Ukraine and India relating to cooperation on space-related activities, cooperation has begun on the joint development of space technologies.