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## Committee on the Peaceful Uses of Outer Space

### Report on the United Nations/Chile Workshop on Space Technology Applications for Socioeconomic Benefits

(Santiago, 12-16 November 2012)

#### I. Introduction

1. The Office for Outer Space Affairs of the Secretariat has organized a series of workshops to promote the use of space technology and its applications for socioeconomic benefits, particularly in developing countries.
2. The first workshop in the series was held in Istanbul, Turkey, from 14 to 17 September 2010. The recommendations emanating from that event are contained in the report on the United Nations/Turkey/European Space Agency Workshop on Space Technology Applications for Socioeconomic Benefits (A/AC.105/986).
3. The second workshop of the series was held in Hanoi from 10 to 14 October 2011 and hosted by the Viet Nam Academy of Science and Technology. Detailed information on the workshop, including the programme and the presentations made, is available from the workshop webpage ([www.sti.vast.ac.vn/spaceworkshop\\_UN\\_VAST-2011](http://www.sti.vast.ac.vn/spaceworkshop_UN_VAST-2011)) and the website of the Office for Outer Space Affairs ([www.unoosa.org/oosa/en/SAP/act2011/Vietnam/index.html](http://www.unoosa.org/oosa/en/SAP/act2011/Vietnam/index.html)). The recommendations emanating from the workshop are contained in the report of the United Nations/Viet Nam Workshop on Space Technology Applications for Socioeconomic Benefits (A/AC.105/1020).
4. The United Nations/Chile Workshop on Space Technology Applications for Socioeconomic Benefits, held in Santiago from 12 to 16 November 2012, was the third activity of the United Nations Programme on Space Applications focusing exclusively on the socioeconomic benefits of space technology applications.
5. The workshop was organized by the Office for Outer Space Affairs as part of the activities of the United Nations Programme on Space Applications for 2012 and was hosted by the Natural Resources Information Centre (CIREN) on behalf of the Ministry of Agriculture of Chile, in cooperation with the International Society for

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Photogrammetry and Remote Sensing (ISPRS) and the National Aeronautics and Space Administration (NASA) of the United States of America. The workshop was co-sponsored by the Secure World Foundation (SWF).

6. The present report describes the background, objectives and programme of the workshop and contains observations made by workshop participants. The report has been prepared pursuant to General Assembly resolution 66/71.

## A. Background and objectives

7. At the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), Member States recommended that activities of the United Nations Programme on Space Applications should promote collaborative participation among Member States at the regional and international levels<sup>1</sup> and emphasized the development of knowledge and skills in developing countries.

8. In its resolution 54/68, the General Assembly endorsed the resolution entitled “The Space Millennium: Vienna Declaration on Space and Human Development”,<sup>2</sup> adopted by UNISPACE III. UNISPACE III had formulated the Vienna Declaration as the nucleus of a strategy to address future global challenges by using space applications.

9. Implementation of the recommendations contained in the Vienna Declaration could support many of the actions called for in the Plan of Implementation of the World Summit on Sustainable Development.<sup>3</sup> In particular, existing space-based tools could contribute to and strengthen the capacities of developing countries to improve the management of natural resources and environmental monitoring by increasing and facilitating the use of data acquired through the use of space technologies.

10. At its fifty-fourth session, in 2011, the Committee on the Peaceful Uses of Outer Space endorsed the programme of workshops, training courses, symposiums and conferences of the Programme on Space Applications for 2012. Subsequently, the General Assembly, in its resolution 66/71, endorsed the activities to be carried out under the auspices of the Programme in 2012.

11. The overall objective of the United Nations/Chile Workshop on Space Technology Applications for Socioeconomic Benefits was to increase awareness among policymakers and planners of the socioeconomic benefits of utilizing space technologies and contribute to international cooperation by providing opportunities to exchange in-depth information in that regard.

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<sup>1</sup> *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. II, para. 409 (d) (i).

<sup>2</sup> *Ibid.*, chap. I, resolution 1.

<sup>3</sup> *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, annex.

12. The workshop had the following specific objectives:

(a) To share information on research and applications studies that have demonstrated the use of space technology for societal benefits;

(b) To address the principles and mechanisms for enhancing national, regional and international cooperation in the development of space technology and its applications;

(c) To demonstrate the benefits of using various space technology applications for priorities highlighted by the United Nations Conference on Sustainable Development (Rio+20), held in 2012;

(d) To promote the integration of space solutions into national development agendas, including the building of institutional and governance frameworks.

## **B. Programme**

13. Introductory statements were made by the Deputy Regional Representative of the Food and Agriculture Organization of the United Nations (FAO), the Executive Director of CIREN, the Senior Programme Officer of the Office for Outer Space Affairs and the Minister of Agriculture of Chile.

14. The workshop consisted of a session of keynote addresses, four thematic plenary sessions, a panel discussion and two round tables. The workshop programme also included a tutorial on how to use Earth observation data in various applications with socioeconomic benefits.

15. The programme of the workshop included a series of technical presentations describing the successful use of space technologies providing cost-effective solutions and providing essential information for planning and implementing programmes and projects with socioeconomic benefits.

16. The first keynote address, entitled “Outcomes of Rio+20 and ‘The future we want’, the perspective from Latin America and the Caribbean”, was given by Carlos de Miguel, officer in charge of the Sustainable Development and Human Settlements Division of the Economic Commission for Latin America and the Caribbean. The speaker provided an overview of the socioeconomic situation in Latin America and the Caribbean and of how the United Nations development agenda was being implemented in the region. He outlined the main challenges the region faced in relation to the different pillars of sustainable development and areas where geospatial information was crucial for achieving the development goals.

17. The second keynote address, entitled “Overview of space technology applications in Latin America and the Caribbean”, was given by Félix Menicocci of the National Commission on Space Activities (CONAE) of Argentina and Chair of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space. The speaker described space-related activities and applications, focusing on regional and international collaborations and partnerships. Many of the initiatives in that second keynote address were in line with the issues raised in the first keynote address, thus demonstrating that relevant initiatives were under way. The workshop helped to make those linkages clear and create a common framework vocabulary.

18. Participants made presentations on relevant activities and contributed to discussions held to identify priority areas for possible follow-up action and to determine possible partnerships or strengthen existing ones.

19. In more than 35 oral presentations, speakers addressed socioeconomic benefits of space technology applications, focusing mainly on environmental monitoring and natural resources management, food security and agriculture, spatial data infrastructure, disaster risk reduction and emergency response, capacity-building and regional and international cooperation. While many of the presentations were made by participants from the countries of Latin America and the Caribbean, many presenters from Africa, Asia and Europe raised interest in possible collaboration with countries of Latin America and the Caribbean, and noted the issues and contexts that were common to those regions. In some cases, it was considered that specific tools (e.g. radar for agriculture) could be adapted for Latin America and the Caribbean.

20. There were two round-table discussions, on “Regional coordination and institutional context in Latin America and the Caribbean” and “Capacity-building in the use of space technology for Latin America and the Caribbean, focusing on its application in different areas of the regional economy”. Each round table resulted in a series of recommendations and actions with responsible focal points in the region (see sect. III of this report).

21. The programme of the workshop included a tutorial organized by ISPRS, with one plenary session and two parallel sessions led by four experts. The tutorial was designed to provide some basic information to participants who used Earth observation data but were not remote sensing specialists, and to provide in-depth case studies in two specialized areas in order to demonstrate how Earth observation could provide socioeconomic benefits. The training consisted of lectures, presentations, demonstrations and hands-on exercises on the following topics: an introduction to microwave satellite remote sensing (basic characteristics, processing and applications); case studies of remote sensing as applied to protected natural and cultural areas; methodology for data/information and decisions (a case study); and case studies in agriculture and forestry.

22. The workshop programme also included a panel discussion entitled “Gender balance in space sciences: from providers to decision makers and end users”, with panellists from the Economic Commission for Latin America and the Caribbean, SWF, the Chilean Red Cross and the Office for Outer Space Affairs.

23. A statement was made on the outcome of a meeting of space agencies of countries of Latin America and the Caribbean that had been held in Santiago on 12 November. The pro tempore secretariat of the Space Conference of the Americas highlighted some perspectives on regional cooperation.

24. The workshop programme included a technical field trip to the Hydrographic and Oceanographic Service of the Chilean Navy in Valparaíso. The participants were shown the preparation of three-dimensional bathymetric maps and the official nautical charts and publications of Chile, as well as the system for the dissemination of official time signals and urgent information for navigation. The operation of the National Tidal Wave Warning System (SNAM) was also demonstrated for participants.

25. Finally, for the duration of the workshop, there was an exhibition at the workshop's venue, with the participation of space-related international, regional and national entities, as well as industry.

### **C. Attendance**

26. A total of 160 participants from the following 27 countries attended the workshop: Argentina, Azerbaijan, Belarus, Belgium, Bolivia (Plurinational State of), Brazil, Chile, China, Colombia, Costa Rica, Cuba, Ecuador, France, Germany, Guatemala, Honduras, India, Libya, Mexico, Pakistan, Sudan, Thailand, Tunisia, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States and Uruguay. Representatives of the Office for Outer Space Affairs, the Economic Commission for Latin America and the Caribbean, FAO, ISPRS and SWF also participated.

27. Funds allocated by the United Nations and the co-sponsors were used to defray the cost of air travel, daily subsistence allowance and accommodations for 22 participants. The co-organizers also provided funds for local organization, facilities and the transportation of participants.

## **II. Summary of technical presentations**

28. The plenary sessions provided participants with an opportunity to learn how the use of space technology could be of benefit in areas such as environmental monitoring and natural resources management, food security and agriculture, spatial data infrastructure, disaster risk reduction and emergency response, capacity-building, and regional and international cooperation. In the workshop sessions, successful national and regional experiences were described, and potential applications were explained. Participants discussed how countries could use space technology and its applications in many sectors as a cost-effective means of achieving sustainable development goals.

29. The first workshop session was devoted to applications for environmental monitoring and natural resources management. Presentations were made on advances in the region in the use of space technologies, notably in the sector of forestry. Participants were also briefed on highly relevant experiences from countries outside Latin America and the Caribbean, such as experiences with radar imagery in Ukraine and Belarus. Other presenters highlighted the importance of access to various data-sharing mechanisms and invited entities represented at the workshop to take advantage of free resources such as GEONETCast (a near-real-time, global network of satellite-based data dissemination systems designed to distribute space-based, air-borne and in situ data, metadata and products to diverse communities) and the Mesoamerican Regional Visualization and Monitoring System (SERVIR), a joint venture between NASA and the United States Agency for International Development (USAID) that provides satellite-based Earth observation data and science applications to help developing countries improve environmental decision-making. The Chair invited the participants to explore those opportunities further.

30. The second workshop session was devoted to applications for food security and agriculture. Most presentations demonstrated the benefits of advanced techniques and methods to better monitor the conditions for agriculture and livestock management in order to better manage or mitigate risks. The role of the private sector in those actions was illustrated, and best practices were proposed. Discussions highlighted the need for better regional coordination on issues pertaining to food security as all countries faced similar pressures.

31. The third workshop session was devoted to spatial data infrastructure and socioeconomic benefits. The session highlighted the fact that spatial data infrastructure was essential for the proper use of geospatial information and applications in geomatics. Participants proposed concrete models, such as the structure institutionalized by the Government of Thailand and the sectoral approach of Chile, and in the discussion panellists referred to resources such as the Global Spatial Data Infrastructure Association and the Open Geospatial Consortium, which offered models, best practices, guidelines and other references.

32. The fourth workshop session was devoted to applications for disaster risk reduction and emergency response. Various presentations described how, at the national level, space-based information (including geospatial information) was being integrated into applications reaching end-user communities. Bilateral exchanges on tools, techniques and approaches were promoted. A few presentations focused on the needs and conditions of end users and communities affected by earthquakes and tsunamis, thus highlighting for participants that the main objective of better decision-making was to ensure the security and the livelihoods of the population.

33. The presentations made at the workshop were distributed to the participants on DVD-ROM. Further information on the workshop programme, background materials and presentations are available on the website of the workshop ([www.spaceworkshop-chile2012.cl/en](http://www.spaceworkshop-chile2012.cl/en)) and the website of the Office for Outer Space Affairs ([www.unoosa.org/oosa/en/SAP/act2012/Chile/index.html](http://www.unoosa.org/oosa/en/SAP/act2012/Chile/index.html)).

### **III. Outcomes of round-table sessions and panel discussion**

#### **A. Round table on cooperation in Latin American and the Caribbean**

34. In the first round-table session, entitled, “Regional coordination and the institutional context in Latin America and the Caribbean”, participants identified common issues in the use of space technologies, exchanged views on opportunities for collaboration and proposed the creation of networks with responsible focal points.

35. Participants noted the ongoing cooperation projects that are of great interest and relevance to the region, including projects such as Andesat (an initiative using satellite information for sustainable development in the Andes) and the “Ceniza” project (a Latin American network for the monitoring and modelling of volcanic ash and aerosols and their impact on infrastructure and air quality). Andesat forecasts flows from melting snow and glaciers, with input and technical support from CONAE and the European Space Agency (ESA). It was noted that there was an

interest in developing those projects together with additional countries from the region, given the importance of water for human use and productive activities.

36. Drought, land degradation (e.g. desertification) and other related risks are becoming more common and more intense in many parts of the region. For that reason, efforts must be made to identify partners with common interests and similar experiences and to seek international support to improve the models of analysis and their spatial resolution in order to establish efficient operating systems in support of decision-making. The Ministry of Agriculture of Chile, working with support from FAO, had relevant experience in risk management using information from the National Oceanic and Atmospheric Administration (NOAA), the International Research Institute for Climate and Society at Columbia University, the Moderate Resolution Imaging Spectroradiometer (MODIS) and other resources of NASA, and the United States Geological Survey. As part of the workshop, a presentation was made on the use of advanced technology using radar imagery (e.g. from Tunisia), such as differential synthetic aperture radar interferometry (DInSAR), which could be replicated in the region. Reference was also made to services complementing the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters (also called the International Charter on Space and Major Disasters) that should be considered for the acquisition of data.

37. The workshop participants hoped to increase their participation in forest monitoring projects such as the Global Forest Observation Initiative of the Group on Earth Observations and in projects of FAO, among others. Brazil, one of the nine countries containing the Amazonian rain forest, proposed a regional approach for the monitoring of changes in the vegetation cover and its value as a carbon sink.

38. Participants referred to the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD) and highlighted the benefit of preparing a five-year monitoring programme, for which countries of Latin America and the Caribbean were not fully prepared, according to the participants. It required training of human resources, establishing relationships with research groups such as ISPRS and finding the economic resources that could make the project viable.

39. In the light of the fact that the United Nations Educational, Scientific and Cultural Organization (UNESCO), ESA, CONAE and Governments had projects for the management and conservation of world heritage sites such as the Galápagos, the “Camino Andino” and national parks, round-table participants proposed the establishment of links between those various institutions for collaboration to monitor priority sites of natural and cultural heritage, as a way of contributing to the evaluation of the relevant policies and actions of the national authorities.

40. With respect to institutions, participants underlined that it was necessary to work with governmental economic authorities to achieve awareness among policymakers regarding the need to finance training activities, research and operational development with respect to space applications. For example, countries in the region sought to better understand the processes and gain access to data, methodologies and modelling of climate impact on hydrology and on the cryosphere. Regarding the use of radar, important and relevant experiences from other countries, such as India, Pakistan, Thailand and Tunisia, were noted with

interest, as those countries had similar environmental conditions and similar technological capabilities.

41. Others important topics of interest to the countries of Latin America and the Caribbean were as follows: monitoring and forecasting systems for agricultural production (e.g. the experience of Argentina); ocean observation (biological, physical and geochemical); and monitoring of water quality.

42. Six regional projects were identified for potential collaborations between various countries of the region, and mailing lists would be created for their respective coordination. The following individuals/institutions were named as leads for the mailing lists:

(a) Uriel Pérez Gómez (University of Tolima, Colombia): monitoring of the Amazon basin;

(b) Graciela Salinas de Salmuni (CONAE): mountain hydrology: water, snow and glaciers;

(c) Sergio Camacho Lara (Regional Centre for Space Science and Technology Education for Latin America and the Caribbean (RECTEALC)) and Ricardo Cabezas Cartes (CIREN): desertification;

(d) Mario Hernández (affiliated to ISPRS): cultural heritage;

(e) Tania María Sausen (RECTEALC and the National Institute for Space Research of Brazil) and María Ilia Cárdenas (CIREN): emergencies;

(f) Federico Soria (Estación Experimental Agroindustrial Obispo Colombres (EAAOC)): monitoring of harvests and agricultural production.

43. Additionally, participants noted the interest in the establishment of a directory of training institutions with capabilities in space technologies and their applications in the region in order to harmonize and organize those processes and related training.

## **B. Round table on capacity-building in the use of space technology for Latin America and the Caribbean, focusing on its application in different areas of the regional economy**

44. The second round-table session, entitled “Capacity-building in the use of space technology for Latin America and the Caribbean, focusing on its application in different areas of the regional economy”, provided a wealth of information on opportunities and what was required in future efforts. Participants made recommendations concerning the need to provide training and education in line with the requirements and expectations of authorities and institutions, leading to the formation of better professionals.

45. It was noted that the Regional Centre for Space Science and Technology Education for Latin America and the Caribbean had been established in 1997 through an intergovernmental agreement between the Governments of Brazil and Mexico. The central objective of the Centre was to gain and disseminate knowledge in diverse disciplines of space science and technology in the countries of the region and thus support their scientific, economic and social development. To achieve that

objective, the Centre organized educational programmes and research activities fostering the development of practical applications, with a duration of 9 or 12 months, initially in the areas of remote sensing, geographic information systems and satellite communications. The courses were offered at the Centre's campuses located in Brazil and Mexico, with support from the National Institute for Space Research of Brazil and the National Institute of Astrophysics, Optics and Electronics of Mexico. Subsequently, the Centre will offer courses on satellite meteorology, atmospheric and basic space sciences, as well as on the use of satellite navigation systems and space law.

46. It was also noted that in cooperation with CONAE and the Ecuadorian Centre for Integrated Remote Sensing Applications for Natural Resources (CLIRSEN), the Centre had organized a series of courses and workshops in Ecuador and Argentina. The Centre had also organized seminars in Colombia and Chile on diverse space applications, as well as on policies and space law.

47. Following the invitation of the Governments of Brazil and Mexico for the Governments of Latin America and the Caribbean to join the Centre, the workshop recommended that the Centre enter into agreements with regional institutions with educational activities in order to build on existing capabilities.

48. It was also noted that it was necessary to offer master's degrees in space science disciplines in order to produce highly skilled specialists, for academia, research and professional technical fields. It was recommended that such educational programmes should focus on areas in which graduates could obtain rewarding positions. It was also recommended that students who had completed their courses should be encouraged to pursue their master's thesis work at different national, regional or interregional institutions, thus promoting exchanges of academic and professional experiences.

49. Participants also noted that the Committee on Earth Observation Satellites (CEOS), through its working groups, offered high-level specialization courses in which specialists from developing countries might be trained and gain experience. One of the interesting training programmes was that proposed by the Working Group on Capacity-building and Data Democracy with the objective of facilitating access to satellite images, image analysis software and training to use those images in the nine societal benefit areas identified by the Group on Earth Observations. It was also recommended that countries with emerging capabilities in space applications seek to participate in CEOS as observers or associate members.

50. It was recognized that institutions such as ISPRS provided comprehensive sources of expert knowledge and their resources should be used more in the region. To realize that potential, the round table recommended that conferences and other activities regularly involving experts from the region propose courses and workshops in cooperation with the private sector to optimize the participation of professionals in the region, particularly young professionals. Professional societies should also serve as a source of expertise to support educational programmes in the region.

51. Participants indicated that cooperation in regional and international projects was a good way to strengthen the capacities of the participating institutions. However, it was also necessary to increase the number and level of specialists through formal education.

### **C. Panel discussion on gender balance in space sciences: from providers to decision makers and end users**

52. A panel discussion entitled “Gender balance in space sciences: from providers to decision makers and end users” was held on the last day of the workshop, with four panellists from the Economic Commission for Latin America and the Caribbean, SWF, the Chilean Red Cross and the Office for Outer Space Affairs. The issues addressed ranged from end usage to problems in developing solid and equitable working environments and opportunities. The discussion shed light on what needed to be considered in order to develop a more equitable and impactful community in the realm of applications of space technologies and the use of products. The panel discussion linked to the round-table on capacity-building in the use of space technology and how spatial data infrastructure was built and developed.

53. Participants recognized the need to address the gender balance in space sciences more often in activities such as the present workshop. They also recommended that gender balance should be achieved in all areas of space technology research and development, applications and end use. Participants also recommended developing further, similar activities to promote and create awareness of gender issues in space-related activities in general.

## **IV. Conclusions**

54. As a result of the discussion in the plenary sessions and the round tables, the workshop made the following recommendations:

(a) Institutions should develop bilateral agreement with and use existing platforms of data acquisition such as GEONETCast and SERVIR to access imagery and other geospatial data that are free of charge and that can complement the scope of the International Charter on Space and Major Disasters;

(b) The role of the private sector in the use of innovative and advanced space-based geospatial technologies should be promoted in various sectors, including for addressing common regional issues related to food security;

(c) National spatial data infrastructures being developed should take advantage of existing resources such as the Global Spatial Data Infrastructure Association and the Open Geospatial Consortium;

(d) Additional countries from Latin America and the Caribbean should participate in regional projects such as Andesat and the “Ceniza” project as all face important and common issues concerning water quality and quantity;

(e) Regional coordination should be developed in Latin America and the Caribbean to improve the use of space-based technologies (including advanced techniques demonstrated at the workshop) to monitor drought and degradation;

(f) Governments should increase their participation in forest monitoring projects such as the Global Forest Observation Initiative of the Group on Earth Observations and develop a regional approach to the monitoring of changes in vegetation cover and its value as a carbon sink, including as a means of better preparing to the meet their commitments towards the United Nations Collaborative

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Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries;

(g) Relevant national and international authorities, including relevant professional associations, should collaborate in using geospatial data in the monitoring of priority sites of natural and cultural heritage;

(h) Coordination should be undertaken to develop and maintain a directory of training institutions with capabilities in space technologies and their applications.

55. The workshop provided a forum for participants from 27 countries to share their experiences in exploring opportunities for collaborative research and development in space technology applications. The workshop increased awareness of socioeconomic benefits of space technology applications at the national, regional and international levels in the areas of environmental monitoring and natural resources management, food security and agriculture, spatial data infrastructure, disaster risk reduction and emergency response, capacity-building and regional and international cooperation.

56. In discussions at the workshop, participants identified focal points to support six regional projects through electronic mailing lists in the following areas: monitoring of the Amazon basin; mountain hydrology (water, snow and glaciers); desertification; cultural heritage; emergencies; and monitoring of harvest and agricultural production.

57. Participants recommended that CIREN and the Office for Outer Space Affairs further develop the website of the workshop, which was vital for disseminating information on the workshop.

58. Participants also recognized the need for additional workshops and training courses to build upon the results of previous workshops and appreciated the offer of Belarus to host the next workshop, in 2013.

59. Participants expressed their sincere appreciation to CIREN for organizing a very successful workshop and for its hospitality.

60. Participants also expressed their appreciation for the significant support provided by the co-sponsors the Government of Chile, the Office for Outer Space Affairs and SWF, and the co-organizers ISPRS and NASA.