



**Committee on the Peaceful
Uses of Outer Space****Report on the United Nations/International Astronautical
Federation Workshop on Space Technology for Economic
Development****(Beijing, 20-22 September 2013)****I. Introduction****A. Background and objectives**

1. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), in particular through its resolution entitled “The Space Millennium: Vienna Declaration on Space and Human Development”,¹ recommended that the activities of the United Nations Programme on Space Applications should promote collaborative participation among Member States at the regional and international levels, emphasizing the development of knowledge and skills in developing countries.²

2. At its fifty-fifth session, in 2012, 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 2013. Subsequently, the General Assembly, in its resolution 67/113, endorsed the activities to be carried out in 2013 by the Office for Outer Space Affairs of the Secretariat under the auspices of the Programme.

3. Pursuant to General Assembly resolution 67/113 and in accordance with the recommendations of UNISPACE III, the United Nations/International Astronautical Federation Workshop on Space Technology for Economic Development was held in Beijing, from 20 to 22 September 2013, in conjunction with the

¹ *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. I, resolution 1.

² *Ibid.*, chap. II, para. 409 (d) (i).



sixty-fourth International Astronautical Congress, which was held in Beijing immediately after the Workshop, from 23 to 27 September 2013.

4. The Workshop was jointly organized by the Office for Outer Space Affairs, as part of the activities of the Programme on Space Applications in 2013, and the International Astronautical Federation (IAF), in cooperation with the International Academy of Astronautics (IAA), the Committee on Space Research (COSPAR) and the International Institute of Space Law (IISL). It was co-sponsored by the European Space Agency (ESA), the China National Space Administration (CNSA) and the Chinese Society of Astronautics (CSA).

5. The meeting was the twenty-third workshop organized jointly by the Office for Outer Space Affairs and IAF. It built upon the recommendations and experience gained from the previous workshops, held between 1991 and 2012.

6. At the Workshop, participants discussed a wide range of space technologies, applications and services that contributed to sustainable economic and social development programmes, primarily in developing countries.

7. The main objectives of the event included (a) to increase awareness among decision makers and representatives of the research and academic communities of space technology applications for addressing economic development, primarily in developing countries; (b) to examine low-cost, space-related technologies and information resources available for addressing economic development in developing countries; (c) to promote educational and public awareness initiatives in the area of economic development and to contribute to capacity-building in that area; and (d) to strengthen international and regional cooperation in the foregoing areas.

8. The discussion held in the Workshop, its working groups and its concluding round table also provided an opportunity for direct dialogue between space technology experts, policymakers, decision makers and representatives of the academic community and private industry from both developing and industrialized countries. All participants were encouraged to share their experiences and to examine opportunities for better cooperation.

9. The present report describes the background, objectives and programme of the Workshop. It has been prepared for submission to the Committee on the Peaceful Uses of Outer Space at its fifty-seventh session and to its Scientific and Technical Subcommittee at its fifty-first session, both in 2014.

B. Programme

10. The programme of the Workshop was developed jointly by the Office for Outer Space Affairs and the programme committee of the Workshop, which included representatives of a number of national space agencies, international organizations and academic institutions. A substantial contribution was made by the honorary committee of the Workshop, which consisted of prominent representatives of the Committee on the Peaceful Uses of Outer Space, IAF, CNSA, CSA and the United Nations Secretariat. The input received from both the honorary committee and the programme committee, as well as the direct participation of members of those committees in the Workshop, ensured that the aims of the Workshop were achieved.

11. The programme of the Workshop focused on technologies, applications and services that could help to maximize the benefits of the use and application of space-related tools to support sustainable economic development and to enhance the capacity of developing countries in that area through developing human and technical resources at various levels, improving regional and international cooperation, increasing public awareness and developing appropriate infrastructure.
12. The Programme of the workshop included four technical sessions. Two technical sessions focused on space applications for agriculture, and space applications for land use, respectively, and two sessions focused on space for disaster management. All sessions included presentations focused on applications of space technologies, information and services in specific thematic areas, international and regional initiatives and cooperation, and capacity-building activities.
13. A total of 31 oral technical presentations were made during the technical sessions and 16 papers were presented at a poster session. In addition, keynote addresses were delivered by representatives of China, COSPAR and ESA during the opening session of the Workshop.
14. Introductory and welcoming statements were made by representatives of the Government of China, the local organizing committee of the International Astronautical Congress, IAF, ESA, COSPAR and the Office for Outer Space Affairs.
15. Each technical session was followed by open discussion on specific topics of interest, with additional opportunities for participants to voice their opinions. The discussions were continued in depth and summarized by two working groups established by the participants to develop the observations and recommendations of the Workshop and to prepare for the discussions at the round table, addressing questions relating to critical issues and focal themes identified at the technical sessions.
16. The detailed programme of the Workshop is available on the website of the Office for Outer Space Affairs.

C. Attendance and financial support

17. The United Nations, on behalf of the co-sponsors, invited developing countries to nominate candidates to participate in the Workshop. Participants were required to have a university degree or well-established professional experience in a field related to the overall theme of the Workshop. In addition, participants were selected on the basis of their work experience in programmes, projects or enterprises that used space technology applications or that could potentially benefit from using that technology. The participation of specialists at the decision-making level from both national and international entities was particularly encouraged.
18. Funds allocated by the United Nations, IAF, ESA and the local organizing committee of the Workshop were used to provide financial support for the participation of 23 participants from developing countries. A total of 21 participants received full financial support, which included round-trip air travel, hotel accommodation and a living allowance for the duration of the Workshop and the International Astronautical Congress. A further two participants received partial

funding (for air travel, and/or hotel and living allowance, and/or the registration fee for the Congress). The co-sponsors covered the cost of the Congress registration fee for these 23 funded participants, thus enabling them to attend the sixty-fourth Congress.

19. The hosting organization, CSA, provided conference facilities, secretariat and technical support and transportation from/to the airport for funded participants, and organized a number of social events for all Workshop participants.

20. The Workshop was attended by more than 100 participants from the following 42 countries: Angola, Australia, Brazil, Cameroon, Canada, China, Colombia, Democratic People's Republic of Korea, France, Germany, Guatemala, India, Iran (Islamic Republic of), Iraq, Italy, Japan, Jordan, Lao People's Democratic Republic, Lesotho, Luxembourg, Mexico, Nepal, Netherlands, Nicaragua, Nigeria, Pakistan, Romania, Russian Federation, Saudi Arabia, Serbia, Singapore, Slovakia, South Africa, Syrian Arab Republic, Thailand, Tunisia, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Venezuela (Bolivarian Republic of) and Zimbabwe. The following international intergovernmental organizations, non-governmental organizations and other entities were also represented at the Workshop: COSPAR, European Commission, ESA, IAA, IAF, IISL, ISPRS, Group on Earth Observations (GEO) secretariat, Space Generation Advisory Council and Office for Outer Space Affairs.

II. Overview of technical sessions and round table discussion

21. In the first technical session, participants discussed applications of space technology, data and services for agriculture and food security. The session featured presentations on the use of space-borne synthetic aperture radar (SAR) instruments for estimating rice production, on integration of remote-sensing, Geographic Information System and Global Positioning System data for creating maps of risks of agricultural pollution and on the planned STUDSAT-2 twin satellite mission for agricultural applications. The presentations demonstrated the huge potential of Earth observation data in this thematic area and emphasized the necessity of regional and international cooperation.

22. In the second technical session, participants considered issues related to the use of remote-sensing and geospatial technologies for improved land use. Participants at the Workshop were updated on the latest developments relating to the 30-metre resolution global land cover mapping project carried out by the National Geomatics Center of China. Economic and social development, accompanied by population growth, have led to extensive changes in land use and land cover on a global scale. Spatially explicit land-use modelling provides a tool for exploring various change scenarios and assisting decision makers in long-term planning. Taking into account the importance of systematic global land cover mapping, the National Geomatics Center has used multispectral data from the Land Remote Sensing Satellite (Landsat) thematic mapper and the Moderate-resolution Imaging Spectroradiometer (MODIS), as well as from Chinese Earth observation satellites HJ and FY-3, to develop two global datasets of land cover maps at 30-metre resolution for two baseline years (2000 and 2010). These datasets provide much

more detailed land cover patterns and reveal land cover changes and can easily demonstrate 10-year changes in global land surface water and wetlands.

23. Participants were also briefed on the legal issues arising from the use of satellite imagery for agriculture and land use. Examples of complexity in development of a free-data policy for the Copernicus (previously known as Global Monitoring for Environment and Security) project were discussed and a role for international cooperation in the area of space law was highlighted. A number of case studies on successful applications of space technology were also presented to participants in the Workshop, including presentations on remote sensing applications for water resources in the Yellow River Basin, on Earth observation applications for agriculture and land use/land cover mapping in Pakistan and on assessment of data on the extent of flooding using SAR data in Tunisia. Other papers presented at the session demonstrated the use of space-derived images for estimates of gross domestic product, showed the benefits of having an economically sustainable national space industry and discussed the advantages of space-based information for promoting national socioeconomic development programmes.

24. In the third technical session, participants considered issues related to the use of space technologies, data and services for disaster management. The participants at the Workshop were updated on the latest activities carried out by ESA for improving disaster response capacity, including such projects, implemented within the framework of the ESA Advanced Research in Telecommunications Systems programme, as Resource for Emergency Services to Access Command and Control Data Using Satellite and Hybrid Technologies (REACT), Fully Automated Aqua Processing Service (FAAPS), Small Aircraft Service for Instant Situational Awareness (SASISA) and a demonstration of the response to a chemical, biological, radiological and nuclear (CBRN) disaster emergency. The participants were also given information on the ESA Satcom Operators Initiative, aimed at enabling rapid and guaranteed access to satellite communication capabilities, including service provision architecture, during disaster situations. It was recognized that the relevance for effective use of space for disaster management of ongoing ESA projects, carried out in cooperation with various international, regional and national organizations, had been demonstrated and that those projects could serve as good models for implementation by other agencies and institutions.

25. The session also featured presentations on collaboration in using space-based information for services in response to major disasters, on satellite-based monitoring and mapping services in support of disaster management and on novel space-based sensors and data links for disaster management. An overview of the activities of the new generation of the Disaster Monitoring Constellation and a report on the development of earthquake precursors on the basis of satellite ionosphere tomography data were also presented to participants. Other papers presented at the session demonstrated the global communication and information system for disaster management developed by SES and service capabilities provided by Astrium, and discussed legal issues associated with the use of space technologies for disaster management. It was emphasized that over the past decade the world had experienced a rapidly increasing number of disasters in all regions, which had affected more than 2 billion people and resulted in economic damage amounting to over \$500 billion. Space-based technologies and services could help to reduce the damage by between 20 per cent and 50 per cent.

26. At the fourth session, consideration of the use of space technologies for disaster management continued. Participants in the Workshop were given an update on the latest international and regional initiatives in that area, including activities carried out by the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) and the Global Earth Observation System of Systems (GEOSS). Established by the General Assembly in 2006 as a programme of the United Nations Office for Outer Space Affairs UN-SPIDER is a platform that facilitates the use of space-based technologies for disaster management and emergency response. It is aimed at providing all countries and international and regional organizations with universal access to all types of space-based information and services relevant to disaster management by providing a gateway to space information for disaster management support; serving as a bridge to connect the disaster management and space communities; and being a facilitator of capacity-building and institutional strengthening.

27. In bridging the gap between the space and disaster management communities, UN-SPIDER fosters alliances and creates forums where both communities can meet. Important aspects of its activities are technical advisory support, including advisory missions carried out upon request of Member States, and facilitation of direct cooperation between national institutions and satellite imagery providers. Since its establishment, UN-SPIDER has conducted 20 missions to developing countries in Africa, Asia, the Pacific, Latin America and the Caribbean. The missions usually consist of a team of experts from various space and disaster management agencies and countries and produce a report with recommendations, follow-up actions, guidelines and policies on disaster management issues. In the area of capacity-building, UN-SPIDER coordinates its efforts with the network of regional support offices and national focal points in designing training courses to be conducted through the regional centres for space science and technology education affiliated to the United Nations, centres of excellence, United Nations training centres linked to UN-SPIDER, and other national and regional training centres where remote sensing and Earth observation applications are taught.

28. Created in 2005 with a main objective of enhancing decision-making in nine areas for the benefit of society, GEOSS is a distributed system of existing systems coordinated by GEO, which has responsibility to (a) improve and coordinate existing Earth observing systems; (b) provide easier and more open access to data; (c) foster the use of space technology applications; and (d) build capacity for the use of Earth observation data. The strategic target of GEO is to enable the global coordination of observing and information systems to support all phases of the risk management cycle associated with hazards (mitigation and preparedness, early warning, response and recovery).

29. Participants were briefed on the status of pilot projects carried out by GEO in cooperation with national and international agencies and organizations, including such projects as the Caribbean satellite disaster pilot and the Southern African flood and health pilot projects, which were developed to demonstrate the effectiveness of satellite imagery to strengthen regional, national and community level capacity for mitigation, management and coordinated response to natural hazards; the Water Cycle Integrator, which integrates Earth observations, modelling, data, information and management and education systems into a virtual workbench for scientific collaboration; the Global Risk Data Platform, which is an effort by a number of

entities (including the United Nations Environment Programme and the United Nations Office for Disaster Risk Reduction) to share information derived from spatial data on the global risk from natural hazards; the Geohazard Supersites and Natural Laboratories initiative, which pools satellite imagery and terrestrial in-situ data for earthquake and volcano studies; the global wild land fire information system, which aims to provide targeted information from the local to the global scale and to integrate local information in the creation of fire management and fire danger ratings; the Global Flood Awareness System, which aims at providing early warning of flooding of large transnational rivers at the global level; and the global drought information system, which is being developed to integrate global, continental, and regional monitoring and to forecast information with sufficient accuracy to assist in early warning efforts.

30. Other technical papers at the session demonstrated the effectiveness of the use of space technology for disaster management and discussed challenges relating to legal and policy frameworks, as well as the economic and social constraints for private companies and non-governmental organizations. Participants were also briefed on dissemination and application of data from the China Resource Satellite in countries in the Association of Southeast Asian Nations and on International Telecommunication Union regulations related to radio communication in the context of emergency and disaster relief. Case studies on the use of SAR interferometry data for measuring earthquake motion and on the use of space-related technologies for disaster reduction in China and Pakistan were presented to the participants.

31. The papers delivered at the technical sessions of the Workshop and presented at the poster session are available on the website of the Office for Outer Space Affairs.

32. A concluding round table discussion was organized with the participation of high-level representatives of space agencies and other relevant national and international institutions and organizations from both space-faring and non-space-faring countries in order to establish a direct dialogue with the Workshop participants on how space technologies, applications and services could address social and economic issues and contribute to enhancing human and environmental security in developing countries.

33. The round table discussion was moderated by the Chair of the Committee on the Peaceful Uses of Outer Space, Yasushi Horikawa, and it included the following six panellists: Yu Dengyun (China Aerospace Science and Technology Corporation), Amnon Ginati (ESA), Mazlan Othman (Office for Outer Space Affairs), David Kendall (Canadian Space Agency), Ahmed Bilal (Pakistan Space and Upper Atmosphere Research Commission) and Chen Jun (International Society for Photogrammetry and Remote Sensing (ISPRS)).

34. Prior to the round table, two working groups were established to summarize for the panellists critical issues and focal themes identified in the presentations delivered at the technical sessions of the Workshop. The first working group focused on the application of space science and technology to land use and agriculture and the second group discussed the use of space-related technologies for disaster management. The chairs of the working groups presented the reports of the groups to the participants at the Workshop at the beginning of the round table discussion.

35. Within the limited time available for discussion, the round table panellists discussed the following issues brought to their attention by the moderator, the chairs of the working groups and the audience:

(a) The necessity of demonstrating the benefits of space technologies for economic development to policymakers, decision makers and the general public. Publication of a booklet on best practices was proposed by participants and discussed by the panellists. A proposal to establish an international bank or warehouse of applications was also brought to attention of the Workshop;

(b) The role of the United Nations in enhancing international and regional cooperation in the use of space technology for disaster management and food security;

(c) Access to space data, data sharing and data democracy. In this regard, the National Geomatics Center of China announced a plan to make its 30-metre resolution global land cover datasets for 2000 and 2010 available to all interested parties free of charge, and to provide the necessary training to use the data;

(d) The greater participation of developing countries in space activities;

(e) The allocation of more time for discussions and exchange of ideas at the United Nations/IAF workshops in the future.

III. Conclusions of the Workshop

36. Major observations and conclusions made by the working groups and round table are summarized in the following paragraphs.

37. The working group dealing with application of space science and technology to land use and agriculture recognized that the effective, productive and sustainable management of agriculture, land and water use on a global basis required comprehensive, multispectral temporal and spatial observations and measurements from space. The group observed that in the area of agriculture and fresh water use, climate change, natural events and human exploitation of land and fresh water resources were having a significant negative impact on the capacity of those resources to sustain essential human activities in the future and to respond to societal needs. In agriculture, arable lands needed to become more productive to support world population growth, since, on a global basis, arable land per person available for food production in 2013 was 40 per cent of the arable land available in 1950. Natural and technological disasters were increasingly affecting the availability and productivity of existing arable lands and to support future world population growth during the next three decades, arable land would need to become some 40 per cent more productive than in 2013.

38. The group noted that space assets provided accurate temporal and spatial observations and measurements of land, water and atmospheric conditions and of the impact of natural events and human activity, as well as accurate position and guidance information so that those observations and information could lead to better management of the use of land and fresh water and to making such use more productive and sustainable. The group also noted that from a technical point of view, existing satellite resources, systems and processing could fully support the

information requirements for more effective agriculture and land use. However, significant further development was required of a comprehensive infrastructure to transform space-derived data into strategic and operational information for effective use by governments at the national, regional and municipal levels, service providers and end-user operators in all parts of the world.

39. On the basis of the above-mentioned observations, the working group put forward the following recommendations:

- (a) The user community should be strengthened through:
 - (i) Identifying and characterizing users and their specific needs;
 - (ii) Engaging and increasing the interactions and building stronger partnerships between space data developers and the public entities for the governance of land and water use at the national, regional and local levels, and with end-user service providers and end users;
 - (iii) Using existing mechanisms, including the United Nations and development institutions such as the World Bank, and broadening user training programmes under the auspices of such entities, particularly for developing nations;
 - (iv) Inviting representation from end users and associated policy bodies to discussions of space applications in such forums as the United Nations/IAF workshop;
- (b) Various demonstrations of applications and social and economic benefits and effectiveness of applying space assets to agriculture and land use should be developed;
- (c) Communication between technology developers, decision makers and user communities should be enhanced through:
 - (i) Identifying and developing the most appropriate communication channels and tools between data developers, governing bodies and end users;
 - (ii) Accelerating efforts to provide timely information in a form directly applicable to daily operations by the end user;
 - (iii) Making educational material available to schools and universities;
 - (d) Efforts to resolve problems and legal impediments for sharing data with end users on a global basis for application to agriculture and land use should be increased.

40. The working group on the use of space-related technologies for disaster management divided their observations and conclusions into six themes discussed by the participants: (a) information gaps between the requirements of the disaster management community and the providers of space technology/space-based information; (b) space-based data policy for disaster management; (c) data and product standardization in support of disaster management; (d) coordination and liaison mechanisms for information sharing; (e) space-derived information support to monitor sub-national scale disasters or emergencies that are not supported by international mechanisms; and (f) the way forward: strengthening the role of

space-based information in light of the Hyogo Framework for Action and the post-2015 framework for disaster risk reduction.

41. Discussing the issue of information gaps, the group recognized that the products and maps based on space-derived information were usually available one or two days after a disaster but that such products were needed by disaster managers within hours after the disaster had occurred. Participants also noted a lack of coordination among different departments at the national level, as well as lack of pre-disaster base maps and risk assessment products. In that regard, the group suggested that capacity-building activities should be organized for both the technical community and disaster managers for better information support and understanding at the local and field levels.

42. In the area of space-based data policy, the group discussed such policies in the countries of a number of participants and concluded that the United Nations should play an active role in stimulating the development of data-sharing principles at the national and international levels. The group also emphasized the importance of standardization of data and products used for disaster management and recognized a lack of universal product standards in terms of space-based information for disaster management. It was suggested by the participants that UN-SPIDER, GEOSS and other international initiatives should act as the information-sharing platform to facilitate product standardization.

43. Discussing coordination and liaison mechanisms for information sharing, the Group recognized that communication among the space, disaster and technology communities should be strengthened and suggested that the United Nations should facilitate coordination among the various parties at the international and national levels. Participants also noted problems with accessing space-derived information in low-scale disasters, which were not supported by international mechanisms such as the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters. It was emphasized by the participants that training of end users on spatial data handling should be improved and that coordination bodies at the sub-national and local levels should be established. The group also concluded that attempts should be made to provide disaster managers at both the national and local levels not with data but with information that would support efforts to find solutions.

44. As a way forward, the participants recommended promoting coordination mechanisms for public-private partnerships in disaster management and emphasized the role of the United Nations in bringing together all stakeholders for the effective use of the space-based data required for providing accurate and reliable information. They also recognized the role of UN-SPIDER in providing access to space information for disaster management support and in facilitating capacity-building and institutional strengthening in that area.

IV. On-site evaluation of the Workshop

45. In order to obtain feedback from participants and to assess the success of the Workshop, a questionnaire survey of the participants was conducted on the last day of the event. A total of 22 completed questionnaires, mostly from the participants

who received financial support from the co-sponsors of the Workshop, were returned to the organizers. Some of the results of the survey are presented below.

46. All respondents felt that the theme of the Workshop was relevant to their current job. All responders felt that the programme of the Workshop met their professional needs and expectations and all respondents would also recommend participation in future United Nations/IAF workshops to their colleagues.

47. A total of 60 per cent of the respondents believed that the overall level and quality of the presentations at the Workshop were very good, while 40 per cent of participants estimated these as good. A total of 55 per cent of respondents estimated the overall organization of the Workshop as very good, and 45 per cent as good.

48. Participants indicated that participation in the Workshop helped them to:

(a) Gain and enhance knowledge of space technology and applications (17 replies);

(b) Confirm ideas and concepts in space technology and applications (14 replies);

(c) Generate newer application project ideas (16 replies);

(d) Enable potential cooperation with other groups (17 replies);

(e) Enable possible partnerships (14 replies).

49. Answering the question on the actions or project they would initiate as a follow-up to the Workshop, respondents indicated that they would:

(a) Contact experts and/or networks (18 replies);

(b) Define new projects (10 replies);

(c) Undertake additional education/training (10 replies);

(d) Procure equipment or technologies (8 replies);

(e) Seek funding support for projects (12 replies).

50. Assessing the round table discussion, 67 per cent of respondents judged it as very interesting and 33 per cent judged it as interesting. All responders believed that issues of particular interest to them or their agencies were addressed by the round table panellists. All respondents also felt that they had had a chance to bring their questions to the attention of the panellists.

51. A total of 70 per cent of responders considered the level of interaction between the panellists and the audience as very interactive and 30 per cent assessed it as interactive.

52. The survey also showed that only one of the funded respondents would have been able to attend the Workshop and the International Astronautical Congress without financial support provided by the organizers.

V. Follow-up actions

53. At the meeting of the IAF Committee for Liaison with International Organizations and Developing Nations, which was held during the International Astronautical Congress and which was attended by representatives of the Office for Outer Space Affairs, it was decided that the twenty-fourth United Nations/IAF workshop should be held in Toronto, Canada, from 26 to 28 September 2014, as an associated event of and in conjunction with the sixty-fifth Congress, which would take place from 29 September to 3 October 2014, also in Toronto.

54. The theme of the 2014 United Nations/IAF workshop should be “Space technology for socioeconomic benefits”, with particular emphasis on maritime applications and safety, tele-health and tele-epidemiology. Discussions on the objectives and programme of the next workshop would be continued at a planning meeting, to be held during the fifty-first session of the Scientific and Technical Subcommittee, in 2014.

55. It was also reconfirmed at the meeting of the Committee for Liaison that further round-table discussions between participants and heads or senior managers of space agencies and other relevant institutions or organizations should be held during future United Nations/IAF workshops.