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Committee on the Peaceful Uses of Outer Space

Report on the United Nations/International Astronautical Federation Workshop on Space Technologies Applied to the Needs of Humanity: Experience from Cases in the Mediterranean Area

(Naples, Italy, from 28 to 30 September 2012)

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 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-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 United Nations Programme on Space Applications for 2012. Subsequently, the General Assembly, in its resolution 66/71, endorsed the activities to be carried out by the Office for Outer Space Affairs of the Secretariat under the auspices of the United Nations Programme on Space Applications in 2012.

3. Pursuant to General Assembly resolution 66/71 and in accordance with the recommendations of UNISPACE III, the United Nations/International Astronautical Federation Workshop on Space Technologies Applied to the Needs of Humanity:

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).



Experience from Cases in the Mediterranean Area was held in Naples, Italy, from 28 to 30 September 2012, in conjunction with the sixty-third International Astronautical Congress, which was also held in that city, from 1 to 5 October 2012.

4. The Workshop was jointly organized by the Office for Outer Space Affairs, as part of the activities of the United Nations Programme on Space Applications for 2012, and by the International Astronautical Federation (IAF), in cooperation with the International Academy of Astronautics (IAA) and the Committee on Space Research (COSPAR). It was co-sponsored by the European Space Agency (ESA) and by the Italian Space Agency (ASI).

5. The workshop was the twenty-second 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 2011.

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 primary objectives of the event included the following: (a) to increase awareness among decision makers and representatives of the research and academic community of space technology applications for addressing human and environmental issues, primarily in developing countries; (b) to examine low-cost space-related technologies and information resources available for addressing human and environmental needs in developing countries; (c) to promote educational and public awareness initiatives in the area of natural resources management, and to contribute to the capacity-building process in that area; and (d) to strengthen international and regional cooperation in the foregoing areas.

8. The Workshop and its concluding round-table discussion 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-sixth session and to its Scientific and Technical Subcommittee at its fiftieth session, both in 2013.

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, ASI and the United Nations Secretariat. The input received from both the honorary committee and the programme committee, as well as the direct participation of the 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 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, which focused on the following themes: (a) space technology applications for the discovery and preservation of cultural heritage; (b) maritime applications of space technologies; (c) space applications for desert environment monitoring; and (d) space applications for land management. The sessions were comprised of presentations that focused on the application of space technologies, information and services to particular thematic areas; international and regional initiatives and cooperation; and capacity-building activities.
13. A total of 33 oral technical presentations were made during the technical sessions, and 25 papers were presented at a poster session. In addition, keynote addresses were delivered by representatives of COSPAR, IAA and ASI during the opening session of the Workshop.
14. Introductory and welcoming statements were made by representatives of the Government of Italy, the local organizing committee of the International Astronautical Congress, IAF, ESA, IAA, 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 in order to develop observations and recommendations of the workshop and to prepare for the round-table discussion by addressing questions on critical issues and main 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 (www.unoosa.org).

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 for the organization of the Workshop were used to provide financial support for the participation of 28 participants from 25 developing countries. Twenty-four participants received full financial support, which included

international round-trip air travel, hotel accommodation and a living allowance for the duration of the Workshop and the International Astronautical Congress. An additional four participants received partial funding (for air travel and/or hotel and living allowance and/or the registration fee for the Congress). The co-sponsors also covered the Congress registration fee for 25 funded participants, thus enabling them to attend the Congress, held immediately after the Workshop.

19. ASI and the local organizing committee provided conference facilities, hotel accommodation for fully-funded participants, secretariat and technical support and local transportation, as well as transportation to and from the airport for funded participants. It also organized a number of social events for all Workshop participants.

20. The Workshop was attended by more than 100 participants from the following 45 countries: Algeria, Argentina, Armenia, Australia, Belarus, Brazil, Burkina Faso, Cambodia, Canada, China, Costa Rica, Ecuador, Egypt, France, Germany, Ghana, India, Iran (Islamic Republic of), Iraq, Italy, Japan, Jordan, Kenya, Libya, Mexico, Mongolia, Nepal, Netherlands, Nigeria, Pakistan, Philippines, Russian Federation, Saudi Arabia, Serbia, Spain, Sri Lanka, Sudan, Sweden, Thailand, Tunisia, Uganda, United Kingdom of Great Britain and Northern Ireland, United States of America, Uzbekistan and Viet Nam. The following international intergovernmental organizations, non-governmental organizations and other entities were also represented at the Workshop: COSPAR, European Maritime Safety Agency (EMSA), European Commission, ESA, IAA, IAF, Space Generation Advisory Council, United Nations Educational, Scientific and Cultural Organization (UNESCO) and Office for Outer Space Affairs.

II. Overview of technical sessions and the round-table discussion

21. The first technical session focused on applications of space technology and data and services for the discovery and preservation of cultural heritage. The presentations at the session demonstrated the huge potential of Earth observation data for archaeological exploration and world heritage monitoring, and emphasized the necessity of regional and international cooperation in those areas. Participants in the Workshop were given an update on the latest developments of the joint ESA and UNESCO Space for Heritage initiative on the use of space technologies to support the Convention for the Protection of the World Cultural and Natural Heritage. That initiative was a cooperative network of partners, open to space agencies, research institutions, non-governmental organizations, universities and the private sector, aimed at assisting developing countries, through space technologies, to improve the observation, monitoring and management of World Heritage cultural and natural sites. The participants also reviewed the status of the World Heritage monitoring by Remote Sensing (WHERE) project, the international effort led by ASI with the objective of developing and demonstrating a pre-operational system and a cost-effective service based on remote sensing to monitor UNESCO sites in urban areas. By using space technology, WHERE would monitor such factors of influence on historical sites as the impact of urbanization and human activities, small-scale meteorological and climate change impacts (including pollution) and the geotechnical and structural stability of buildings and the surrounding land. The

above elements would be addressed by implementing three separate data-processing chains: change detection; microclimate; and interferometry integrated into a geographic information system.

22. The session also featured presentations on the potential, limitations and future prospects of the use of space technology for addressing natural and cultural heritage, and on the application of COSMO-SkyMed synthetic aperture radar (SAR) data to archaeological surveying, with examples from the Byzantine Heritage Network (ByHeriNet) project and studies on stability monitoring of various archaeological sites in Italy. At the session, participants were provided with updates on the use of remote sensing data for archaeological exploration in Egypt, the activities of the National Commission on Space Activities (CONAE) of Argentina and its cooperation with the Space for Heritage project on the use of space remote sensing data for monitoring Iguazú national park, and the use of satellite data for making an archaeological atlas of Thailand.

23. At the second technical session, participants considered maritime applications of space technologies. In that context, the presentations demonstrated the ways space could contribute to safe maritime navigation and sea pollution control. The papers reviewed international efforts of EMSA and ESA in that area, including their ongoing space-related projects such as CleanSeaNet, LRIT (Long-range Identification and Tracking), SafeSeaNet and the development of a satellite-based automatic identification system (SAT-AIS). CleanSeaNet was a European satellite-based oil spill and vessel detection service which offered assistance to participating States for such activities as identifying and tracing oil pollution on the sea surface, monitoring accidental pollution during emergencies and contributing to the identification of polluters. The service, which was integrated into national and regional pollution response chains, was based on radar satellite images, covering all European sea areas, which were analysed in near-real time in order to detect possible oil spills on the sea surface. LRIT had been set up to identify and track European Union-flagged vessels worldwide and integrate that information into its wider international database. Such information was also used in areas such as search and rescue, maritime safety and protection of the marine environment. The LRIT Cooperative Data Centre tracked about 9,000 ships per day. SafeSeaNet was a vessel traffic monitoring and information system that had been established as a centralized European platform for maritime data exchange, linking together maritime authorities from across Europe. SAT-AIS was a user-driven project implemented by ESA and EMSA for enhancing maritime security, safety and surveillance services, as well as for fleet management, search and rescue operations and environmental monitoring.

24. At that session, presentations were also made on European cooperative research and pilot projects in integrated maritime surveillance, including such projects as SeaBILLA, DOLPHIN and BlueMassMed. In those projects, space-related technologies, information and services were used for improving border surveillance, enhancing traffic safety on the open seas, fisheries control and search and rescue operations. Other presentations featured papers on the Ambassador Platform for Dual-Use Space-based Services (APDUSS), Russian maritime automatic identification systems, nanosatellite and microsatellite platforms and the contribution of SAR technology to future integrated operational services for maritime security. An overview of the Preliminary Assessment of Route

Optimization for Fuel Minimization and Safety of Navigation (PROFUMO) project, as well as an update on maritime applications and services provided by Inmarsat and a comparison of a European high-performance satellite-based AIS system with existing commercial medium-performance SAT-AIS ones, were presented to Workshop participants.

25. At the third technical session, participants discussed space applications for desert environment monitoring. Participants were given an update on the latest international and regional initiatives aimed at the implementation of multilateral environmental agreements dealing with drylands and desertification, including the United Nations Framework Convention on Climate Change; the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa; the Convention on Biological Diversity; and the Convention on Wetlands of International Importance, especially as Waterfowl Habitat. In that context, ESA had developed its Climate Change Initiative, which had as its objective the full realization of the potential of both long-term global Earth observation data collected by ESA in the past and data from current and planned missions, by making a significant and timely contribution to the databases on essential climate variables required under the United Nations Framework Convention on Climate Change. Earth observation data provided substantial input for impact indicators to monitor progress in the implementation of the 10-year strategic plan and framework to enhance the implementation of the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, namely for indicator II, on change in land use; indicator VI, on the level of land degradation; indicator VIII, on the aridity index; and indicator IX, on land cover status. Space-derived information was also widely used for the programme of work on dry and sub-humid lands adopted by the Conference of the Parties to the Convention on Biological Diversity in 2000. ESA also actively contributed to the creation of the Global Wetlands Observing System, which was being developed within the framework of the Strategic Plan for 2009-2015 for the implementation of the Convention on Wetlands of International Importance especially as Waterfowl Habitat.

26. Other presentations at the session featured papers on the current activities of the European Commission Joint Research Centre with regard to the use of satellite data for land degradation and land productivity assessments, on the use of moderate resolution imaging spectrometer sensor data for assessing the quality of fresh water in semi-arid areas and on the application of remote sensing information for desertification monitoring in the Mediterranean region. Benefits of the use of satellite data for assessing a water budget in Mediterranean desert areas, as well as the activities of a water cycle observatory in Spain, were discussed. Case studies and reports on national and regional projects in Algeria, Burkina Faso and Italy were also brought to attention of participants.

27. The fourth session addressed the application of space technology, information and services to land management. Workshop participants were given an update on the latest developments in the "Processing Russian and European EARTH Observations for Earthquake Precursors Studies" (PRE-EARTHQUAKES) project, which was an international effort related to the investigation of earthquake preparation phases by integrating independent ground and satellite-based

observations with primary objectives to improve knowledge of preparatory phases of earthquakes and their possible precursors, to promote a worldwide earthquake observation system as part of the Global Earth Observation System of Systems (GEOSS) and to offer to the scientific community a common integration platform for the independent observation of earthquake precursors. The project was carried out by space agencies and academic institutions from Greece, Italy, the Russian Federation, Turkey and the United States. Participants were also briefed on the status of the European Volcano Observatory Space Services (EVOSS) project, which was built upon ESA Global Monitoring for Environment and Security (GMES) service elements and was based entirely on the use of Earth observation data. EVOSS was a geographically distributed system that relied on space-borne data from eight satellite payloads (SEVIRI, MODIS, OMI, IASI, GOME-2, SAR 2000, JAMI and, until 8 April 2012, SCIAMACHY), which were acquired at five different downlink stations and were split and automatically processed at six locations in Europe. The results of observations over various volcanoes in Europe, Africa and the Caribbean were disseminated via a dedicated web portal.

28. The session also featured presentations on the activities of the Working Group on Capacity-Building and Data Democracy of the Committee on Earth Observation Satellites (CEOS), on new features of the COSMO-SkyMed satellite mission for land management and on the biomonitoring of Earth from space. An overview was provided of the activities of the new generation of the Disaster Monitoring Constellation and reports on the use of space-borne SAR interferometry techniques for the monitoring of land surface deformations and Eastern Mediterranean seashores.

29. The papers delivered at technical sessions of the Workshop, as well as presented at its poster session, are available from the website of the Office for Outer Space Affairs.

30. 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 spacefaring and non-spacefaring countries in order to establish a direct dialogue with 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.

31. The round-table discussion was moderated by Yasushi Horikawa, Chair of the Committee on the Peaceful Uses of Outer Space, with the participation of the following five panellists: Gérard Brachet (IAF), Amnon Ginati (ESA), Mazlan Othman (Office for Outer Space Affairs), Conrado Franco Varotto (CONAE) and Antonio Moccia (University of Naples, Italy).

32. Prior to the round-table discussion, two working groups were established in order to summarize critical issues and main themes identified in the presentations made at the technical sessions of the Workshop so that the panellists could address them. The first working group focused on maritime applications of space science and technology. The second group discussed the use of space-related technologies for land applications. Reports of the working groups were presented by their chairs to Workshop participants at the beginning of the round-table discussion.

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

- (a) Awareness development among policymakers and decision makers;
- (b) Role of the United Nations and its thematic programmes, such as UN-Oceans, UN-Water and UN-Energy, in enhancing international and regional cooperation in the use of space technology for the needs of humanity;
- (c) Access to space data, data-sharing and data democracy;
- (d) Sustainability of space activities, especially in developing countries;
- (e) Greater participation of developing countries in space activities.

III. Observations and conclusions of the Workshop

34. Major observations and conclusions made by the working groups and at the round-table discussion are summarized below.

35. The working group on maritime applications of space technology recognized that space-related technologies, information and services were extremely useful in areas such as understanding the ocean environment and the interaction of oceans with land or the atmosphere. Space tools could also increase understanding of the relationship between humans and oceans by monitoring the impact on oceans of human activities such as shipping, fishing, oil extraction, tourism and freshwater extraction. Space assets allowed unique capabilities in the observation of oceans, as well as communication and navigation by ocean travellers. Space technology also allowed individual nations and international organizations, such as the World Meteorological Organization (WMO), the International Maritime Organization and the Intergovernmental Oceanographic Commission of UNESCO, to have greater situational awareness of ocean activities.

36. The working group addressed some concerns about gaps in the technology and policy that drove maritime applications of space. There was a need to further integrate ocean data from space and in situ sources at a global level. Some end users of ocean data found that raw data were available but that there was limited access to useful data products. Developing countries faced several barriers to using space-based assets for ocean applications. They might lack the terrestrial communication infrastructure to effectively share space-derived data. If they did not have the local capability to monitor ship traffic, their ability to manage illegal activity such as oil dumping was diminished. Several current and planned projects, such as the Disaster Monitoring Constellation and CANEUS, were aimed at developing satellite constellations that would increase the availability of satellite data and services.

37. The working group recommended several approaches to encourage capacity-building in developing nations with regard to using satellite-based maritime applications, including the following:

- (a) More workshops, e-learning courses and tool boxes should be made available to allow decision makers to learn how to use satellite-based tools;

(b) International mechanisms should be developed to help developing nations coordinate with the global community in areas such as sea traffic control;

(c) Experts from developed countries who were approaching retirement age should be encouraged to volunteer for short-term assignments in developing countries to share their knowledge.

38. The working group also recommended some approaches aimed at approving future workshops. It suggested that workshops should include a mix of attendees, such as technologists and policymakers. Representatives of the Office for Outer Space Affairs, UN-Oceans, WMO and the World Health Organization should participate in workshops hosted by end users of space services and share their expertise. The working group suggested that the Committee on the Peaceful Uses of Outer Space could help identify end user policy personnel that could be invited to future workshops.

39. The working group on land management divided its observations and conclusions into three themes: governance/decision-making, data/tools and capacity-building/awareness development. In the area of governance, the working group suggested that in most countries there were too many governmental institutions that had responsibilities related to using space technology for land management. There was a need for each country to designate one organization as a national focal point that could coordinate the activities of all relevant institutions to ensure that space resources were applied effectively for national benefit. The United Nations might be able to play a role in encouraging that by advising Governments on the benefits of having a coordinating organization serve as a focal point. Participants in the working group also felt that their countries could benefit from increased participation in international forums and initiatives such as the Committee on the Peaceful Uses of Outer Space, GEOSS and the Global Environment Monitoring System (GEMS) in order to fully harness opportunities to apply space technology for land management. Organizations serving as national space focal points could also coordinate the way in which a country participated in such international activities.

40. It was recognized by the working group that Government decision makers and funders would support space investment if they clearly understood the benefits and received information in a format that was easy to understand. The working group suggested that efforts should be made to create awareness of the benefits of space technology for land management and to develop space-enabled products that were readily useful to end users. That process could be enhanced by developing common language between space experts and potential end users of space-based data and services. The effort should also show how decision makers could address their own priorities by using space technology.

41. In the area of data products and tools, members of the working group expressed concern about the cost of data. Although there was a large amount of data available, there were problems in accessing it. In particular, people in developing countries might not be aware of how to access, evaluate and apply freely available data and software tools. Much of the high-resolution data useful for local land management were controlled by commercial companies and therefore were quite expensive to buy on regular basis. Countries with limited resources were hesitant to invest in data, supporting hardware or modelling tools if they did not have

confidence that such tools would meet their needs. The working group proposed that the United Nations, GEOSS, GMES and CEOS could assist developing countries in gaining access to available tools and guidelines for using existing data.

42. In the area of capacity-building, the working group concluded that the international space community should work to better communicate to the public the economic and societal benefits of using space technology, information and services. GEOSS, GMES and the Office for Outer Space Affairs should initiate awareness-building workshops oriented exclusively towards decision makers in order to demonstrate to them the benefits of space technologies for the well-being of their societies. Universities around the world could play a role in helping young people to identify and begin space-related careers. The United Nations could play a role in helping countries with less experience to identify and adopt appropriate training materials.

IV. On-site evaluation of the Workshop

43. In order to receive feedback from participants and to assess the Workshop, participants were given a questionnaire on the last day of the event. A total of 24 completed questionnaires, mostly from the participants who had received financial support from the Workshop's co-sponsors, were returned to the organizers. Some of the results of the survey are presented below.

44. All respondents felt that the theme of the Workshop had been relevant to their current position. All respondents felt that the programme of the workshop had met their professional needs and expectations. All respondents said that they would recommend participation in future United Nations/International Astronautical Federation workshops to their colleagues.

45. Seventy-eight per cent of respondents considered the overall level and quality of presentations at the Workshop to have been very good; 22 per cent rated it as good. Sixty-seven per cent of respondents considered the overall organization of the Workshop to have been very good; 33 per cent rated it as good.

46. Participants indicated that participation in the Workshop had helped them:

(a) To gain and enhance knowledge of space technology and applications (21 replies);

(b) To confirm ideas and concepts in space technology and applications (18 replies);

(c) To generate project ideas for new applications (20 replies);

(d) To enable potential cooperation with other groups (21 replies);

(e) To enable possible partnerships (18 replies).

47. Answering a 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 network (22 replies);

(b) Define new projects (14 replies);

- (c) Undertake additional education or training (14 replies);
- (d) Procure equipment or technologies (12 replies);
- (e) Seek funding support for projects (16 replies).

48. In assessing the round-table discussion, 67 per cent of respondents considered it to have been very interesting; 33 per cent rated it as interesting. All respondents believed that issues of particular interest to them and their agencies had been addressed by the panellists. All respondents except one felt that they had had a chance to bring their questions to the attention of the panellists.

49. Seventy-two per cent of respondents considered the level of interaction between panellists and the audience to have been very interactive; 26 per cent described it as interactive.

50. The survey also showed that all but one person among the funded respondents would not have been able to attend the Workshop and the International Astronautical Congress without the financial support provided by the organizers.

V. Follow-up actions

51. 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-third United Nations/International Astronautical Federation Workshop should be held in Beijing from 20 to 22 September 2013, as an associated event of and in conjunction with the sixty-fourth International Astronautical Congress, which would also take place in Beijing, from 23 to 27 September 2013.

52. The theme of the twenty-third United Nations/International Astronautical Federation Workshop should be finalized by the Office for Outer Space Affairs, in cooperation with the local organizing committee, the IAF secretariat and other co-organizers of the event, by the end of 2012. Discussions on the objectives and programme of the twenty-third workshop would be continued at a planning meeting to be held during the fiftieth session of the Scientific and Technical Subcommittee, in 2013.

53. It was also reconfirmed at the meeting of the Committee for Liaison with International Organizations and Developing Nations 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/International Astronautical Federation workshops.