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Committee on the Peaceful Uses of Outer Space

Report on the United Nations/International Astronautical Federation Workshop on Space Technology for Socioeconomic Benefits

(Toronto, Canada, 26-28 September 2014)

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-sixth session, in 2013, 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 2014. Subsequently, the General Assembly, in its resolution 68/75, 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 2014.

3. Pursuant to General Assembly resolution 68/75 and in accordance with the recommendations of UNISPACE III, the United Nations/International Astronautical Federation Workshop on Space Technology for Socioeconomic Benefits was held in Toronto, Canada, from 26 to 28 September 2014, in conjunction with

[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).

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the 65th International Astronautical Congress, which was also held in Toronto, from 29 September to 3 October 2014.

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, and the International Astronautical Federation (IAF), in cooperation with the European Space Agency (ESA), the International Academy of Astronautics (IAA), the Committee on Space Research (COSPAR) and the International Institute of Space Law (IISL).

5. The meeting was the twenty-fourth workshop organized jointly by the Office for Outer Space Affairs and IAF. It built upon the recommendations of and experience gained from the previous workshops, held between 1991 and 2013.

6. At the Workshop, participants discussed a wide range of space technologies, information and services that contributed to sustainable economic and social development programmes, primarily in developing countries, with a particular focus on global health and maritime applications.

7. The main objectives of the event were the following: (a) to increase awareness among decision makers and representatives of the research and academic community with respect to space technology applications for addressing social and economic development, primarily in developing countries; (b) to examine low-cost space-related technologies and information resources available for addressing socioeconomic development needs in developing countries in the thematic areas of global health and maritime applications; (c) to promote educational and public awareness initiatives and to contribute to the capacity-building process in those areas; and (d) to strengthen international and regional cooperation in those areas.

8. The discussion held in the Workshop, its working groups and its concluding round table also provided an opportunity for direct dialogue among 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 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-eighth session and the Scientific and Technical Subcommittee at its fifty-second session, both to be held in 2015.

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, comprising representatives of ESA, the Canadian Space Agency, COSPAR, the German Aerospace Centre (DLR), IAA, IAF and the Public Health Agency of Canada. The input received from members of the programme committee, as well as the direct participation of members of the committee in the Workshop, ensured that the aims of the meeting were achieved.

11. The programme of the Workshop focused on technologies, applications and services that can help to maximize the benefits of the use and application of space-related tools to support sustainable economic and social development and to enhance capacity of developing countries in this area by developing human and technical resources at various levels, improving regional and international cooperation, enhancing public awareness and developing appropriate infrastructures.

12. The programme of the Workshop included the four technical sessions focusing on the following themes: (a) space technology for global health; (b) space applications for tele-epidemiology; (c) space technology for maritime safety, communication and navigation; and (d) space technology for the monitoring and management of ocean resources. All sessions included presentations focusing on applications of space technologies, information and services in particular 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 six papers were presented at a poster session. In addition, keynote addresses were delivered by representatives of Canada and ESA at the opening session of the Workshop.

14. Introductory and welcoming statements were made by representatives of the Government of Canada, IAA, IAF, ESA, IISL 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 observations and the recommendations of the Workshop and to prepare for the round-table discussion in addressing questions on 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 (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 ESA, IAF and the United Nations for the organization of the Workshop were used to provide financial support for the participation of 22 participants from developing countries. Twelve 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. A further 10 participants received partial funding (for air travel, hotel and living allowance and/or the registration fee for the International Astronautical Congress). The co-sponsors also covered the cost of the Congress registration fee for the 22 funded participants, thus enabling them to attend the 65th Congress, held immediately after the Workshop.

19. More than 120 individuals from the 40 following countries had registered for the Workshop: Afghanistan, Argentina, Australia, Bolivia (Plurinational State of), Burundi, Cameroon, Canada, Democratic People's Republic of Korea, El Salvador, France, Gambia, Georgia, Germany, India, Iran (Islamic Republic of), Israel, Japan, Jordan, Kazakhstan, Kenya, Libya, Malaysia, Mauritius, Mexico, Mongolia, Netherlands, Nigeria, Pakistan, Philippines, Russian Federation, Sierra Leone, Singapore, South Africa, State of Palestine, Tunisia, Turkey, 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, ESA, European Maritime Safety Agency (EMSA), European Space Policy Institute, IAA, IAF, IISL, International Civil Aviation Organization, International Maritime Satellite Organization (Inmarsat), Space Generation Advisory Council and Office for Outer Space Affairs.

II. Overview of technical sessions and round-table discussion

20. In the first technical session, participants discussed applications of space technology for global health. Participants in the Workshop were briefed on activities and experiences of the Action Team on Public Health (action team 6) established by Member States to follow up on the recommendations of UNISPACE III relating to the use of space applications for human security, development and welfare, with the primary focus on measures to improve public health services for telemedicine and for controlling infectious diseases. Following that mandate, the Action Team addressed the following issues, which had initially been proposed by the Office for Outer Space Affairs: (a) facilitating the development of national policies for utilizing broadband services and data in developing countries to support health surveillance and data acquisition for that purpose; (b) applying space-based data to develop an early warning mechanism capable of predicting public health threats and alerting authorities in a timely manner; and (c) facilitating the provision of or access to capacity-building and training in the field of tele-epidemiology.

21. In 2011, the Action Team on Public Health published its final report on the use of space technology to improve public health (A/AC.105/C.1/L.305), in which Member States proposed the way forward in the continued development, promotion and implementation of telehealth and tele-epidemiology initiatives, in the light of the increasing interest in those cross-disciplinary fields and the broad applications and direct pertinence that they were expected to have in the delivery of core public health programmes, both in developed and developing nations, over the next decade. Participants were further briefed on the Action Team's ongoing follow-up initiative, initiated in 2012, which focused on the development of the open community framework for improving public health through the application of space technology.

22. The session also featured a presentation on potential telemedicine applications to assist developing countries, with a primary focus on humanitarian telemedicine, which could be defined as the provision of telemedicine (primary and/or secondary) to developing countries in times of immediate medical need and/or for permanent medical need, with the aim of improving personal health. It was emphasized that while telemedicine was being used in industrialized States, there was deep interest in its potential use for developing countries and the humanitarian aid it could help deliver. Humanitarian telemedicine would not only enable the broader reach of medicine but could also give patients access to improved care. The assistance could be delivered from industrialized States, as well as transferred between developing countries. Humanitarian telemedicine could provide primary and secondary care for developing countries in permanent need of medical aid or in a situation of humanitarian crisis. Other papers presented in the session discussed the socioeconomic benefits of space assets for e-health in Africa, space technology usage and e-health initiatives in India, telemedicine programmes in Malaysia and an IAA project on a virtual institute of space life sciences.

23. In the second technical session, participants considered issues related to space applications for tele-epidemiology focusing on studying the emergence and propagation of human and animal diseases (water, air and vector-borne diseases) that were closely linked to climate and environmental changes. Participants in the Workshop were provided with updates on the latest status of development of the tele-epidemiology applications in public health in Argentina, Canada, Japan and Mauritius. The Centre national d'études spatiales of France presented an overview of projects carried out in various regions focusing on the use of remote sensing data to address relationships between climate, environment and health; the outcomes of those initiatives could contribute to disease surveillance policies and early warning systems for decision makers in the field of public health, in particular with respect to outbreaks of diseases such as Rift Valley fever, malaria and dengue.

24. The session also featured a presentation by the National Aeronautics and Space Administration (NASA) of the United States on the use of Earth observation data in the areas of air quality management and public health, in particular infectious disease and environmental health issues. It addressed issues of toxic and pathogenic exposure and health-related hazards and their effects for risk characterization and mitigation, and demonstrated the effectiveness of the use of Earth observation data and models to implement air quality standards and policies and regulations for economic and human welfare. Other papers presented in the session concerned legal issues arising from the use of satellite technology, data and services for public health, the potential benefits of space applications for monitoring the spread of Ebola in Central Africa, and introduced participants to innovative approaches in utilizing space assets for disaster management and public health, which were developed by the International Space University.

25. In the third technical session, participants considered issues related to the use of space technology for maritime safety, communication and navigation. The session's presentations demonstrated the ways space technology could contribute to safe maritime navigation and reliable broadband communication. The papers reviewed international efforts of the European Maritime Safety Agency and ESA in that thematic area, including their ongoing space-related projects such as the CleanSeaNet, LRIT and SAT-AIS projects. It was noted that CleanSeaNet was a

European satellite-based oil spill and vessel detection service that 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. Long-range identification and tracking had been set up to identify and track vessels worldwide operating under the flag of European Union member States and integrate that information into the wider international long-range identification and tracking database. It was also used in areas such as search and rescue, maritime safety and protection of the marine environment. It was noted that the European Union's Cooperative Data Centre tracked around 9,000 ships per day. The European initiative on the development of Satellite-based Automatic Identification System (SAT-AIS) was a user-driven project implemented by ESA and the European Maritime Safety Agency for enhancing maritime security, safety and surveillance services, and for fleet management, search and rescue operations and environmental monitoring. Integrated tailor-made information and services provided by ESA and the European Maritime Safety Agency were routinely used by such European missions and projects as the European Union Naval Force (antipiracy), the European Fisheries Control Agency (fishery control) and the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union (Frontex) (border control).

26. At the session, presentations were also made on existing and upcoming national capabilities, current challenges and future innovations for maritime safety and security. Synergies between safety and security applications and commercial interests were addressed by representatives of the German space industry, with a special focus on the integration of space-based services into existing ground-based surveillances and reconnaissance systems. It was noted that a combination of space-, air- and ground-based surveillance sensors and systems would help to overcome existing shortcomings in the continuous tracking and identification of vessels in the space-time domain. The proposed space segment of the integrated maritime safety system of systems might consist of up to four optical satellites in medium Earth orbit (an orbit altitude of approximately 11,000 kilometres (km)) and up to six high-resolution synthetic aperture radar satellites in low Earth orbit (orbit altitude of about 990 km). It was noted that such a constellation, when complemented by appropriate communications, global navigation and automatic identification system infrastructures, might meet the data needs for a highly-desired global maritime safety system capable of achieving the best performance at a reasonable cost. Other presentations at the session featured papers on operational maritime Automatic Identification System services offered by ESA and Canada, and overview of the use of GNSS reflectometry (signals of the Global Positioning System and the Global Navigation Satellite System reflected off the Earth's surface) for maritime monitoring using small satellites, as well as an update on maritime applications and satellite communications services provided by Inmarsat.

27. At the fourth technical session, participants considered uses of space technology for the monitoring and the management of ocean resources. The session featured technical presentations given by COSPAR on the use of satellite altimetry to observe storm surges, activities of the Canadian Ice Service related to tracking of

sea ice, icebergs and oil spills, and the use of moderate resolution chlorophyll time series to study the functioning of ocean ecosystems. Participants in the Workshop were given an update on the latest activities of DLR in developing a multi-sensor and multi-information approach to future maritime domain awareness, which could provide solutions for better marine environmental protection and the improvement of maritime security in coastal areas. In 2012, DLR and its industrial partners launched a major multi-annual research and development programme for the development and operation of the Integrated Maritime Services. As its contribution to the programme, DLR established the interdisciplinary research cluster for maritime safety and security, with the major objective of developing a multi-sensor Earth observation satellite data approach ensuring the near-real-time availability of required remote sensing products and services, as well as the capabilities to make those products and services available to decision makers, stakeholders and end-users.

28. Other technical papers in the session demonstrated the effectiveness of the application of synthetic aperture radar data derived from the German TerraSAR-X and TanDEM-X (a TerraSAR-X add-on for digital elevation measurement) missions for near-real-time oil and ship detection. It was noted that those data were used for implementing the maritime situational awareness value-added service in Germany, which was available for the commercial market. With respect to user needs, different product formats were used and the required products were operationally available 15 minutes after the data were transmitted to a ground station. Papers were presented on capacity-building needs for the efficient use of space-borne synthetic aperture radar data in developing countries, challenges to legal and policy frameworks in the use of satellite data for maritime control and a case study of the integrated use of remote sensing and geographic information system data for mapping sources of oil pollution in the South China Sea.

29. All presentations made in the technical sessions of the Workshop demonstrated the huge potential of space technology, space-derived data and services both for global health and maritime applications and emphasized the necessity of regional and international cooperation in those thematic areas.

30. Two working groups were established to summarize critical issues and focal themes identified in the presentations delivered at the technical sessions of the Workshop for addressing those to the panellists. The first working group focused on the application of space science and technology in the field of global health, and the second working group discussed the maritime applications of space technologies. Reports of the two working groups were presented by their respective chairs at the beginning of the round-table discussion.

31. The concluding round-table discussion included 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.

32. The round-table discussion was moderated by Dr. Kai-Uwe Schrogl, Chair of the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, and included the following six panellists: Simonetta Di Pippo, Director of the Office for

Outer Space Affairs; Amnon Ginati, Head of Department, ESA; David Kendall, Senior Executive Advisor to the President, the Canadian Space Agency; Pascal Michel, Head of Division, the Public Health Agency of Canada; Chiaki Mukai, Japan Aerospace Exploration Agency; Johann-Dietrich Wörner, Chairman of the Executive Board, DLR, Germany.

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

(a) The role of the United Nations in general, and the Office for Outer Space Affairs in particular, in building the capacity of developing countries in the use of space technology for social and economic benefits;

(b) Bridging gaps between developers of space technologies and users of those technologies. A proposal to establish an international warehouse of applications was brought to the attention of the round table by a participant and was discussed by the panellists;

(c) Existing and required international frameworks and instruments in applications of space technology for global health, as well as the necessity of developing appropriate legal mechanisms in telemedicine;

(d) The role of the commercial market in the development of telemedicine, and relationship between the market-oriented approach and public needs in telemedicine;

(e) Ways to establish closer cooperation between the United Nations entities and other relevant organizations for enhancing the use of space technology for social and economic benefits.

III. Conclusions of the Workshop

34. The main observations and conclusions made by the Workshop's working groups and at its round table are summarized in the paragraphs below.

35. The working group on the application of space science and technology to global health considered that subject in the context of the United Nations Conference on Sustainable Development and the post-2015 development agenda. The working group recognized the need to develop capacity in using space-based solutions for global health, taking into account the necessity of integrating those solutions with existing terrestrial applications and tools, especially bearing in mind the strong link between climate change and public health.

36. The working group also observed that expertise and knowledge in space-related disciplines should be translated into practical health applications. In that regard, the Group noted the importance of understanding what was actually needed, rather than developing solutions that did not fit the practical needs of end-users in the public health sector. To that end, the involvement of the space and medical communities and the linking of the user and space communities were essential.

37. The working group emphasized that international efforts should focus on the global health issues that have the greatest impact, such as Ebola, dengue and malaria. In that regard, participants noted the lack of reliable mechanisms that could promptly respond to requests for assistance in case of epidemic outbreaks. The working group also noted that space could contribute to reducing the international divide in access to health care. However, Member States and non-governmental organizations should introduce mechanisms to make that possible.

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

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(a) The Committee should consider, under its agenda item "Space and sustainable development", the contributions of space technology in global health;

Capacity-building

(b) An interdisciplinary workshop should be organized by the Office for Outer Space Affairs on space and public health addressing global health priorities;

(c) A database of existing resources should be established (applications, software, models, information on training and educational opportunities, etc.);

(d) The regional centres for space science and technology education, affiliated to the United Nations, should promote the application of space technology for global health in their activities;

Engagement of communities

(e) The space community should engage recognized experts and international and regional organizations, as well as non-governmental organizations (for example, the World Health Organization, the Pan American Health Organization, Médecins Sans Frontières and Red Cross societies);

(f) Space communities and agencies should promote open and affordable solutions such as virtual labs, open communities, crowd-sourcing approaches and free and open data access;

Policy-related recommendations

(g) Member States should consider space-based solutions in implementing national health policies and strategies;

(h) Representatives of institutions and agencies of Member States should promote policies that support the contribution of space to global health in the framework of the One Health Initiative;

(i) Member States should ensure that contributions of space to global health are clustered to align and harmonize them with international policy initiatives;

Expertise-related recommendations

(j) Member States should consider the establishment of virtual national/international focus expert teams to serve as a "single window" for space-based health solutions;

(k) The international community should examine the scope of current international mechanisms and instruments (such as 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)) to include responding to health emergencies.

39. The working group on the maritime applications of space technologies 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 and the atmosphere, for monitoring sea traffic and ice conditions at northern latitudes, controlling illegal fishing and fighting sea piracy. Space assets provided unique capabilities in the observation of oceans and enabled communication and navigation by ocean travellers. Space technology also enabled individual nations and international organizations to have a greater situational awareness of ocean activities.

40. The working group observed that there was still a need to better identify the needs of end-users and meet those needs and to accommodate both the evolution of users' requirements and the development of the technologies. Further development of common data standards and an improved understanding of the potential user base could dramatically enhance the overall efficiency and socioeconomic benefits of maritime applications of space technology. Other important areas noted by the working group were capacity-building, primarily in developing countries, and increasing awareness among policymakers about the socioeconomic benefits of space technology. Participants also underlined the difficulties in identifying sources of sustainable funding for capacity-building in the areas of human resources and infrastructure.

41. The working group recommended several approaches to address the above issues, including the following:

User requirements

(a) Seek to develop user requirements to drive further technology developments and to engage users in the application of space assets for maritime purposes through government, private sector and international user communities. The Committee on the Peaceful Uses of Outer Space should engage the organizations involved in the Inter-Agency Meeting on Outer Space Activities to approach specific international community users;

Capacity-building

(b) Develop capacity at all levels to fully exploit space assets for maritime applications. Emphasize building the capacity of potential users in developing countries with maritime assets. Capacity-building needs to include both infrastructure and personnel. The regional centres for space science and technology

education, affiliated to the United Nations, various government programmes (space or user-oriented), academic institutes and industry should be engaged;

Funding

(c) Encourage Governments to facilitate funding for developing countries from development banks and the World Bank, as well as regional and national funds.

IV. On-site evaluation of the Workshop

42. To receive feedback from participants and assess the Workshop, a questionnaire was given to participants on the last day of the event. A total of 19 completed questionnaires, mostly from the participants who received financial support from the Workshop's co-sponsors, were returned to the organizers. Some of the results of the survey are presented below.

43. All respondents considered that the theme of the Workshop was relevant to their current job. All respondents considered that the programme of the Workshop met their professional needs and expectations, and all respondents considered that they would recommend participation in future United Nations/International Astronautical Federation workshops to their colleagues.

44. Sixty per cent of respondents considered that the overall quality of presentations at the Workshop was very good, and 40 per cent considered it to be good. Sixty-seven per cent of respondents considered that the overall organization of the Workshop to be very good.

45. Participants indicated that participation in the Workshop helped them to do the following:

(a) Gain and enhance knowledge of space technology and applications (13 replies);

(b) Confirm ideas and concepts in space technology and applications (12 replies);

(c) Generate newer application project ideas (12 replies);

(d) Enable potential cooperation with other groups (13 replies);

(e) Enable possible partnerships (10 replies).

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

(a) Contact experts and/or network (15 replies);

(b) Define new projects (9 replies);

(c) Undertake additional education or training (8 replies);

(d) Procure equipment or technologies (6 replies);

(e) Seek funding support for projects (7 replies).

47. Assessing the Workshop's round-table discussion, 37 per cent of respondents considered it very interesting, and 67 per cent considered it interesting. All

respondents believed that issues of particular interest to them or their agencies were addressed by the round table's panellists. All respondents also considered that they had had a chance to bring their questions to the attention of the panellists.

48. Sixty-three per cent of respondents considered the level of interaction between panellists and the audience to be interactive.

49. The survey also showed that no one among the funded respondents, with the exception of one person, would have been able to attend the Workshop and the International Astronautical Congress without financial support provided by the organizers.

V. Follow-up actions

50. At the meeting of the IAF Committee for Liaison with International Organizations and Developing Nations held during the International Astronautical Congress, which was attended by representatives of the Office for Outer Space Affairs, it was decided that the twenty-fifth United Nations/International Astronautical Federation workshop should be held in Jerusalem, Israel, from 9 to 11 October 2015, as an associated event of and in conjunction with the 66th International Astronautical Congress, which would take place from 12 to 16 October 2015 in Jerusalem.

51. The theme of the 2015 United Nations/International Astronautical Federation workshop would be "Space technology for socioeconomic benefits", with a particular emphasis on the use of space technology for water management. Discussions on objectives and the programme of the following workshop would continue at a planning meeting to be held during the fifty-second session of the Scientific and Technical Subcommittee, in 2015.

52. It was reconfirmed at the meeting of the Committee for Liaison with International Organizations and Developing Nations that further round-table discussions involving participants and heads or senior managers of space agencies and other relevant institutions or organizations should be held at future United Nations/International Astronautical Federation workshops.