



# General Assembly

Distr.: General  
28 November 2017

Original: English

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## Committee on the Peaceful Uses of Outer Space

### **Report on the United Nations/Russian Federation Workshop on Human Capacity-building in Space Science and Technology for Sustainable Social and Economic Development**

**(Samara, Russian Federation, 30 October–2 November 2017)**

#### **I. Introduction**

1. The year 2018 will mark the fiftieth anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50), a milestone that will present a unique opportunity to highlight the key societal benefits of space and consequently define a stronger future international collaboration in the peaceful uses of outer space for the benefit of all of humankind.
2. At its fifty-ninth session, in June 2016, the Committee on the Peaceful Uses of Outer Space endorsed seven thematic priorities for the implementation of UNISPACE+50, including one on capacity-building for the twenty-first century (thematic priority 7).
3. The United Nations Programme on Space Applications, implemented by the Office for Outer Space Affairs of the Secretariat, was established in 1971 to assist Member States in building capacity in the use of space science, space technology and space applications in support of sustainable development and to promote international space cooperation. Since its inception, the Programme has organized several hundred training courses, conferences, seminars and meetings for the benefit of Member States, promoting collaborative participation by Member States in a variety of space science and technology activities at the regional and international levels. The Programme's emphasis has been on the development and transfer of knowledge and skills to developing countries and countries with economies in transition.
4. The Office has been carrying out an increasing number of capacity-building activities within the framework of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), as well as in the areas of space law and policy, in particular for developing national regulatory frameworks.
5. In that general context, the United Nations/Russian Federation Workshop on Human Capacity-building in Space Science and Technology for Sustainable Social and Economic Development was organized jointly by the Office for Outer Space Affairs and Samara National Research University, with the support of the Government



of the Russian Federation and with an additional financial contribution from the European Space Agency (ESA).

6. The Workshop was hosted by Samara National Research University, the Progress Rocket Space Centre, the Russian Ministry of Foreign Affairs; ESA supported the workshop with funding and provided a keynote presentation on its capacity-building activities.

7. The host organization, Samara National Research University (formerly Samara State Aerospace University), is one of the largest Russian academic institutions offering educational programmes in aerospace engineering and related fields.

8. The outcomes and recommendations emanating from the Workshop have been compiled as input for the note by the Secretariat on thematic priority 7 (A/AC.105/1174).

9. The present report describes the background, objectives and programme of the Workshop, and provides a summary of the observations and recommendations made by the participants.

## **A. Background and objectives**

10. At its fifty-ninth session, in 2016, the Committee on the Peaceful Uses of Outer Space endorsed seven thematic priorities for the implementation of UNISPACE+50. The objectives of the Workshop were directly related to thematic priority 7 of UNISPACE+50, on capacity-building for the twenty-first century, as well as to Goal 4 (Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all) of the Sustainable Development Goals.

11. The Workshop addressed the role of human capacity-building in the domains of space science and technology and their applications in support of sustainable development, with a particular focus on developing and emerging countries.

12. The objectives of the workshop were the following:

(a) Examine the opportunities for development of human potential in relation to thematic priority 7 of UNISPACE+50, on capacity-building for the twenty-first century, and Goal 4 of the Sustainable Development Goals;

(b) Review the status of global, regional and national capacity-building efforts in space science and technology and their applications;

(c) Promote the implementation and coordination of international cooperation programmes in space-related fields that promote sustainable development, in line with the 2030 Agenda for Sustainable Development;

(d) Exchange views on capacity-building in areas such as micro- and nanosatellites, remote sensing of the Earth, global navigation satellite system (GNSS) technologies, basic space science and applications of space technologies related to health care and disaster mitigation;

(e) Examine the role of academic institutions and the space industry in supporting capacity-building efforts;

(f) Define strategies to provide cost-effective capacity-building that meets social and economic needs, with a particular focus on developing and emerging countries.

13. The Workshop was designed to identify areas of work in which capacity-building could contribute to furthering these objectives. In particular, the expected outcomes of the Workshop were:

(a) Observations and recommendations agreed by Workshop participants that could contribute to a strategy for innovative approaches to capacity-building,

education in the areas of science, technology, engineering and mathematics, and the strengthening of partnerships in the context of thematic priority 7;

(b) A review of the status of global, regional and national capacity-building efforts in space science and technology and their applications.

## **B. Attendance**

14. Participants were selected on the basis of their scientific and educational background and their experience in implementing programmes and projects related to the topics addressed. The selections and preparations for the Workshop were carried out by the organizers in cooperation with a programme committee that included selected international experts and local organizers.

15. The Workshop was attended by some 80 registered participants, and its opening session, held on the University premises, attracted over 300 participants, including staff and students of the University. The last day of the Workshop was opened to 40 additional attendees from outside the University. The following 38 Member States were represented: Afghanistan, Algeria, Bangladesh, Brazil, Bulgaria, Burkina Faso, China, Costa Rica, Ethiopia, France, Germany, Ghana, India, Italy, Japan, Hungary, Kazakhstan, Malaysia, Mexico, Morocco, Nepal, Nigeria, Peru, Philippines, Romania, Russian Federation, Serbia, Spain, South Africa, Sri Lanka, Sudan, Syrian Arab Republic, Thailand, Tunisia, Turkey, Uganda, United States of America and Uzbekistan.

16. In attendance were representatives of ESA, the Russian State Space Corporation Roscosmos, the University Space Engineering Consortium-Global (UNISEC-Global), the regional centres for space science and technology education, affiliated to the United Nations, and the Office for Outer Space Affairs.

## **C. Programme**

17. The Workshop programme was developed by the Office for Outer Space Affairs in cooperation with the Workshop programme committee, which included representatives of ESA, Samara National Research University, the Kyushu Institute of Technology, UNISEC-Global and the Space Commercial Services (SCS) Aerospace Group.

18. The programme was specifically designed to contribute to thematic priority 7 of UNISPACE+50, and included nine thematic sessions, on the following topics:

- (a) From Sputnik to UNISPACE+50;
- (b) Global, regional and national initiatives to enhance space-related human capacity-building;
- (c) New methodologies and the way forward for capacity-building;
- (d) The role of universities and industry in supporting capacity-building activities;
- (e) Best practices and challenges in promoting space education;
- (f) The capacity-building role of the regional centres for space science and technology education, affiliated to the United Nations;
- (g) Capacity-building for space technology and applications;
- (h) Enhancing public awareness of and support for space activities;
- (i) Collaboration in space exploration and Earth safety in the twenty-first century.

19. To facilitate the discussions leading to the final recommendations of the Workshop, the thematic sessions were followed by three working group sessions, each

addressing one of the following topics: space society, space accessibility and space economy. At the closing session, the working groups presented their respective observations and recommendations.

20. The Workshop was advertised and promoted on various websites and on social media platforms such as Facebook and Twitter in order to highlight its importance and the interest shown in the topics to be addressed. It was also webcast live, and recordings of all the sessions were made available on a Samara National Research University web page dedicated to the Workshop.

## **II. Summary of the programme**

21. At each of the nine thematic sessions, participants presented their experiences related to the theme of the respective session. At the end of each thematic session, time was allocated for questions and answers, which triggered various discussions and led to the formation of working groups that held discussions during the last two days of the Workshop. Several poster sessions on different topics were organized in parallel with the thematic sessions.

### **A. Opening of the Workshop**

22. The Workshop was opened with welcoming remarks by the representatives of Samara National Research University, the Office for Outer Space Affairs, the Government of the Samara Region, ESA, Roscosmos, the Progress Rocket Space Centre, as well as with greetings from the International Space Station.

23. A presentation by the representative of the Office familiarized participants with the UNISPACE+50 process, establishing the necessary linkages between it and the objectives of the Workshop. A presentation was also made by a representative of the host University, establishing the background context of human capacity-building in aerospace science and technology and describing the expectations for the outcomes of the Workshop.

24. The key issues highlighted by all speakers during the opening session included the role of universities in supporting space-related human capacity-building and the need for stronger cooperation and coordination among all stakeholders.

### **B. Thematic session 1. From Sputnik to UNISPACE+50**

25. At thematic session 1, presentations were made by representatives of the Office for Outer Space Affairs, the joint stock company Space Rocket Centre “Progress”, Roscosmos and ESA. The presentations focused on the following topics:

(a) The importance of Sputnik in the United Nations context and for the global space agenda;

(b) The role of Samara in the development of Russian and world cosmonautics;

(c) The role of Roscosmos in building capacity in space science and technology;

(d) ESA training activities in Earth observation in European Union member States, European Cooperating States and worldwide.

26. The presentation on Sputnik highlighted the role of Sputnik as pivotal in triggering space-related development and prompting United Nations Member States to request the organization of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE) and the establishment of the Committee on the Peaceful Uses of Outer Space.

### **C. Thematic session 2. Global, regional and national initiatives to enhance space-related human capacity-building**

27. At thematic session 2, presentations were made by representatives of UNISEC-Global (Japan), the Regional Centre for Space Science and Technology Education for Asia and the Pacific (China), Bugema University (Uganda), Samara University (Russian Federation) and the Intersputnik International Organization of Space Communications (Russian Federation). The presentations focused on the following topics:

- (a) The challenge for UNISEC-Global: how to contribute to capacity-building;
- (b) Alliance of regional centres for space science and technology education;
- (c) Progress and challenges in building capacity for space science and technology in East Africa;
- (d) The Samara International Summer Space School: perspectives on 15 years of international human capacity-building and cooperation;
- (e) The Intersputnik International Organization of Space Communications and its contribution to human capacity-building in space science and technology.

28. A wide range of initiatives at the global, regional and national levels were presented, prompting a discussion on the history, challenges and future of space-related human capacity-building.

### **D. Thematic session 3. New methodologies and the way forward for capacity-building**

29. At thematic session 3, presentations were made by representatives of Samara University (Russian Federation), the Brazilian Space Agency, the Kyushu Institute of Technology (Japan), the Central European University (Hungary), Koç University (Turkey) and Terraztra. The presentations focused on the following topics:

- (a) Education through research as an effective way to build capacity in space science and technology;
- (b) Say “bye” to garage bands, say “hi” to garage satellites: future school and needs theory for space science and technology capacity-building in the twenty-first century;
- (c) The BIRDS paradigm of Kyutech;
- (d) The ISEPEI project and Eye on Earth: universities as hubs in promoting the practical application of information and communication technologies and space technologies;
- (e) Future Mars mission demonstration with gamification: next-generation workforce development and knowledge management for space education;
- (f) Sustainable space exploration through space tourism.

30. Several models for how to use new technologies for capacity-building were discussed in thematic session 3, and participants highlighted new opportunities that were made available through technological developments such as knowledge platforms and massive open online courses, as well as the widespread deployment of CubeSats facilitated by lower development costs and more launch opportunities.

## **E. Thematic session 4. The role of universities and industry in supporting capacity-building activities**

31. At thematic session 4, presentations were made by representatives of the Office for Outer Space Affairs, Samara University (Russian Federation), the Progress Rocket Space Centre (Russian Federation), Nanyang Technological University (Singapore), Volga State University for Telecommunication and Informatics (Russian Federation), the Cluster for Aerospace Technologies, Research and Applications (Bulgaria) and SAP SE. The presentations focused on the following topics:

- (a) Proposal for a United Nations capacity-building network;
- (b) Experiments and prospects for the development of science and educational Aist microsatellites;
- (c) Space activities at the Satellite Research Centre of Nanyang Technological University/International Satellite Program in Research and Education (INSPIRE) (Singapore);
- (d) Remote sensing of the Earth by means of space radar technologies for detecting subsurface structures and water reserves;
- (e) Opportunities and the role of academia and small business in the new wave of space exploration in Europe;
- (f) Piggyback payloads on the launch vehicles of the Progress Rocket Space Centre;
- (g) A global initiative of the International Space University, Stanford University and the Next-Gen Alliance (SAP SE) on capacity-building.

32. The draft terms of reference for the capacity-building network, a concept that was introduced during the United Nations/Austria Symposium on the theme “Access to space: holistic capacity-building for the twenty-first century”, held in Graz, Austria (see [A/AC.105/1162](#)), were presented. The network, which would be coordinated by the Office for Outer Space Affairs, would serve as a platform for integrating contributions to space capacity-building from universities, museums and other relevant capacity-building actors.

## **F. Thematic session 5. Best practices and challenges in promoting space education**

33. At thematic session 5, presentations were made by representatives of the Centre for Research on Microelectronics and Nanotechnology (Tunisia), Samara University (Russian Federation), Al-Farabi Kazakh National University (Kazakhstan) and Estrategia Siglo XXI (Costa Rica). The presentations focused on the following topics:

- (a) Tunisian capacity-building experience in space technology engineering;
- (b) Experience participating in international scientific and educational space projects: the example of the QB50 project;
- (c) Implementation of the specialized educational programme on space engineering and technology at al-Farabi Kazakh National University: experience and sustainable development;
- (d) Training for specialists from emerging countries on space technologies and their applications;
- (e) Space science and technology development in Costa Rica: achievements in and challenges for local human capacity-building.

34. Thematic session 5 touched on challenges and best practices in the promotion of space education. Presentations from research centres, universities and

non-governmental organizations provided different points of view on the session's theme.

## **G. Thematic session 6. The capacity-building role of the regional centres for space science and technology, affiliated to the United Nations**

35. At thematic session 6, presentations were made by representatives of the African Regional Centre for Space Science and Technology Education — in English Language (Nigeria), the African Regional Centre for Space Science and Technologies — in French Language (Morocco), Beihang University (China), the Regional Centre for Space Science and Technology Education for Western Asia (Jordan), and the Regional Centre for Space Science and Technology Education for Latin America and the Caribbean (Mexico). The presentations focused on the following topics:

- (a) African Regional Centre for Space Science and Technology Education — in English Language: update on activities, 1998–2017;
- (b) Study and analysis of the current situation regarding Earth observation in the French-speaking African countries benefiting from the training programme of the African Regional Centre for Space Science and Technologies — in French Language;
- (c) Introduction to the Regional Centre for Space Science and Technology Education for Asia and the Pacific;
- (d) The activities and programme of the Regional Centre for Space Science and Technology Education for Western Asia;
- (e) Challenges and future prospects for the integration of countries in Latin America and the Caribbean into space education and technological development towards UNISPACE+50.

36. During thematic session 6, discussions were held on the future of the regional centres for space science and technology education and links to other organizations in the field of capacity-building.

## **H. Thematic session 7. Capacity-building for space technology and applications**

37. At thematic session 7, representatives of the Indian Institute of Space Science and Technology and the Arthur C. Clarke Institute for Modern Technologies made presentations on modern technologies, and representatives of Samara University (Russian Federation) and the Progress Rocket Space Centre (Russian Federation) introduced a variety of projects. The presentations focused on the following topics:

- (a) Experiences in student capacity-building in the area of space engineering and technology;
- (b) Acquisition of national capacity in space technology and concurrent use of space technology applications in national development — the early-stage experience of a developing nation: Sri Lanka;
- (c) Teaching GNSS technologies at Samara University;
- (d) The use of remotely sensed data to support strong socioeconomic development;
- (e) Samara Centre for Nanosatellite Testing: opportunities and services.

38. The presentations included a wide range of examples and initiatives on capacity-building for space technology and applications in order to foster discussion on the session's theme.

## **I. Thematic session 8. Enhancing public awareness of and support for space activities**

39. At thematic session 8, presentations were made by representatives of the Space Generation Advisory Council (Ethiopia), Pattani Industrial and Community Education College (Thailand), Union University (Serbia), Samara University (Russian Federation) and the Office for Outer Space Affairs. The presentations focused on the following topics:

- (a) Course content for high school astronomy textbooks in least developed countries;
- (b) CanSat workshops and rocket competition in Thailand;
- (c) Regional cooperation in the Western Balkans: a joint approach to the space sector?;
- (d) Experience in developing interest in space education among schoolchildren;
- (e) Results from the United Nations/Austria Symposium on the theme “Access to space: holistic capacity-building for the twenty-first century”.

40. Thematic session 8 focused on high schools and school-age children, in particular on how to use space as an inspirational tool to attract young students to careers in science, technology, engineering and mathematics. It was noted that the results of the United Nations/Austria Symposium, in particular the space for development profile and the space solutions compendium, contributed to thematic priority 7 of UNISPACE+50 and were key elements in increasing the space-related capabilities of Member States.

## **J. Thematic session 9. Collaboration in space exploration and Earth safety in the twenty-first century**

41. At thematic session 9, presentations were made by representatives of the University of Bordeaux (France), the National Space Development Program (Philippines), the Institute for Biomedical Problems of the Russian Academy of Sciences (Russian Federation), the Centre for Disaster Mitigation and Management of Vellore Institute of Technology (VIT) University (India) and the University of Rome Tor Vergata (Italy). The presentations focused on the following topics:

- (a) Towards an East European space organization: basing a multilateral governance model on space science, technological innovation and industry;
- (b) Establishing the Philippine space programme: from technology development to policy legislation;
- (c) International cooperation on Bion-M biological satellite projects;
- (d) Programme of fundamental and applied experiments and investigations during flight tests of the Bion-M2 space vehicle;
- (e) Integrating space technology with social media for quick disaster response: a case study from India and adjoining areas;
- (f) Sustainability of in-space manufacturing.

42. Thematic session 9 included a mixture of technical and policy presentations that provided different perspectives on collaboration in space exploration and Earth safety in the twenty-first century.



## K. Poster presentations

43. The poster presentations were divided into four thematic groups of relevance to the topics addressed in the Workshop and contributed to the outcomes and formulation of specific recommendations of the Workshop. The presentations afforded participants who were not included in the thematic sessions an opportunity to present their work.

44. Among the presenters were participants from Bangladesh, Burkina Faso, Canada, Ghana, India, Malaysia, Mexico, Nepal, Peru, the Russian Federation, South Africa, the Sudan, the Syrian Arab Republic, Turkey, the United Arab Emirates and Uzbekistan. They addressed issues related to space technology and science for socioeconomic development and presented examples of best practices in space science and technology, space law, and applications of GNSS and geographic information system (GIS) technologies.

## L. Working groups

45. Three working groups were organized following the sessions. The groups focused on three pillars: space society, space economy and space accessibility. The participants were invited to choose which working group to participate in; however, an attempt was made to ensure that all three groups had an adequate level of participation.

46. The working groups presented their observations and recommendations to the Office for Outer Space Affairs during an interactive closing session in which the observations and recommendations were refined and agreed upon by all participants.

47. This method of working allowed the participants to express their views without being limited to the subjects contained in the presentations and to widen the scope of their recommendations related to the themes of the sessions and in line with the objectives of the Workshop.

48. Discussions were focused on capacity-building, the links between different space-related areas and taking an inclusive approach. For example, after visiting the Samara Space Museum on the invitation of Samara University, participants recalled the important role of museums as vehicles for inspiration and capacity-building.

49. In particular, it was recognized that science and space museums had the potential to inspire new generations of students to pursue careers in science, technology, engineering and mathematics and to raise public awareness of the benefits and challenges of space exploration. The possibility of including museums in the ongoing activities of the Office and the establishment of a world heritage programme on space were discussed during the working group sessions.

50. The working groups discussed the importance of building capacity at various levels, from the local level to the country level, emphasizing policymaking and intergovernmental bodies and encouraging the creation of communication networks at the country level. It was noted that capacity-building efforts, while responding to the needs of countries, should also serve to raise awareness of key topics such as space debris mitigation.

51. Emphasis was placed on the creation of capacity-building programmes focused on schoolchildren, a demographic group that had not been targeted by the Office as intensively as university students.

52. Capacity-building in the area of standards and guidelines, in particular in the context of data exchange between countries, was also a topic of interest during the discussions.

### III. Observations and recommendations

#### A. Observations

53. It was noted that the Office for Outer Space Affairs was the United Nations office responsible for promoting international cooperation in the peaceful uses of outer space. In the context of its capacity-building activities related to applications of space science and technology, the Office provided technical advisory services on space applications and organized international workshops to build capacity in remote sensing, satellite navigation, satellite meteorology, tele-education and basic space sciences for the benefit of developing nations. The Office was responsible for developing the strategy for thematic priority 7 of UNISPACE+50, on capacity-building for the twenty-first century, of which capacity-building in space science and technology and their applications formed an important part.

54. The Workshop participants, among them experts in the field of capacity-building, recognized the important role of the Office in bridging the space divide, defined as the gap between countries that have developed space-related capabilities and technologies and those that have not, and in ensuring that all countries could make use of and benefit from space-related capabilities.

55. Participants recognized that UNISPACE+50 offered a unique opportunity to reshape the capacity-building strategy of the Office and adapt it to the twenty-first century. Participants also recognized the importance of UNISPACE+50 in strengthening global governance of outer space activities, acknowledging that capacity-building was a prerequisite for the economic, societal and cultural growth of all nations, and underlined that a holistic, inclusive and cross-sectoral strategy for capacity-building activities could make a significant contribution to implementation of the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015–2030 and the Paris Agreement on climate change.

#### B. Recommendations

56. For the purposes of the present report, the recommendations of the three working groups have been combined to eliminate any overlap. The following recommendations were agreed:

(a) Acknowledging the recommendations emanating from the United Nations/Austria Symposium on the theme “Access to space: holistic capacity-building for the twenty-first century” and welcoming the proposal to develop a capacity-building network, the need to develop such a network under the auspices of the Office for Outer Space Affairs was reaffirmed, and it was further recommended that the scope of the network should be widened to include other actors, in particular museums, in order to expand the network’s awareness-raising potential and extend its reach beyond purely academic circles. Such an inclusive approach would facilitate the development of space society and would acknowledge the role of entities participating in the capacity-building network as hubs for space society development that addressed all age groups and that devoted particular attention to children of school age;

(b) In pursuing the creation of a capacity-building network, the Office for Outer Space Affairs should engage with the relevant observer organizations of the Committee on the Peaceful Uses of Outer Space and other relevant stakeholders;

(c) A train-the-trainers programme aimed at educators should be established as part of the capacity-building network. The network should also serve, where applicable, to consolidate decisions and recommendations stemming from network-related workshops, with the goal of harmonizing best practices in capacity-building;

(d) Without prejudice to their capacity to develop regional networks, the regional centres for space science and technology education, affiliated to the United Nations, should be part of the capacity-building network, in order to support and raise awareness of the role of space in monitoring progress made in the fulfilment of the Sustainable Development Goals;

(e) The Office for Outer Space Affairs was encouraged to develop publications jointly with the regional centres and to help reinforce the centres' activities, in particular through a proposed alliance of regional centres;

(f) Member States were encouraged to support the establishment of new regional centres in order to extend their reach to all regions and stakeholders (e.g., the Russian-speaking community). Such new regional centres could be modelled on existing centres of excellence;

(g) Particular attention should be given to raising awareness among children of space-related topics, careers and educational opportunities. In that connection, it was recommended that the Office should develop a special programme focusing on children, with dedicated events and activities such as summer or winter schools and competitions of various types, and for which goodwill ambassadors would be nominated in order to serve as role models and raise awareness at the regional level;

(h) In the context of higher education, the Office for Outer Space Affairs should, where possible, assist in the formulation and implementation of appropriate strategies for the higher education system at the national level aimed at generating a critical mass of human capital in disciplines involved in space matters. In particular, the promotion of the educational curricula developed by the regional centres might help to introduce space-related topics into the higher education system, preferably together with other related concepts and approaches, in order to ensure a higher degree of general awareness of such topics across all sectors of society;

(i) The creation of a world heritage programme on space was recommended as a possible tool to promote space education, contribute to capacity-building and increase public awareness. Such a programme would be specifically focused on sites in outer space, including those of special relevance located on the Moon and other celestial bodies;

(j) The synergies between the space solutions compendium, an initiative of the Office, and the capacity-building network should be adequately exploited. In that regard, the space-related activities and programmes of the network should be included in the compendium. That could serve as the basis for fostering cooperation between the network and governmental agencies willing to support activities or sponsor participants;

(k) The Office for Outer Space Affairs should continue to make efforts to reduce the space divide. In that respect, it was proposed that the Office could encourage countries to establish and adopt national mechanisms and tools to assess their progress in the development of space capabilities and the impact of such progress on their society and economy. Consequently, it was recommended that the Office should further develop the space for development profile, an initiative of the Office aimed at creating profiles of countries' activities in the space domain and measuring their evolution through time;

(l) In addition, it was recommended that a space information and training centre devoted to transferring knowledge to developing countries should be established. Such a centre should facilitate knowledge transfer, raise awareness of the uses and benefits of space-related science and technology, in particular as pertains to sustainable development, act as a reference centre and assist countries in the preparation of long-term action plans for space capacity-building;

(m) The space solutions compendium should be used in the context of knowledge transfer to enable users to find space-based solutions, including those from third parties, and should provide information on the availability of resources that

could be used to plan and monitor progress towards the implementation of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction 2015–2030 and the Paris Agreement on climate change. Of particular importance was the link to Goal 4 of the Sustainable Development Goals (Quality education), in that the compendium should serve to identify available educational opportunities related to space;

(n) In order to support the implementation of the proposed space information and training centre, it was recommended that partnerships with governmental entities and industry should be encouraged at all levels, including effective private-public and cross-cluster partnerships;

(o) The key role of the Office for Outer Space Affairs in providing technical support to United Nations entities and intergovernmental organizations in interdisciplinary and cross-sectoral space-related matters, including capacity-building, should be built upon and strengthened. In that context, the importance of technical advisory missions and follow-up activities to analyse the national situation and train governmental officials on space-based solutions was recognized;

(p) The Office for Outer Space Affairs was encouraged to raise awareness among government officials about the key role that space technologies could play in monitoring progress towards achieving the Sustainable Development Goals and to promote the notion that the goal of leaving no one behind is achievable in the context of space technology capacity-building. Key topics, such as space treaties, space debris mitigation and the long-term sustainability of outer space activities, could be drawn to the attention of all permanent representatives and missions based in Vienna in order to better orient newcomers and increase the effectiveness of the Committee and its Scientific and Technical Subcommittee and Legal Subcommittee;

(q) As a strategy to raise awareness of space-related matters, stronger vertical and lateral communication was encouraged across all groups of stakeholders, including Governments, space agencies and space users, relevant entities of the United Nations system, intergovernmental organizations, industry and the private sector, academia, non-governmental organizations and the general public. To that end, it was recommended that an extensive knowledge platform based on communication networks, machine learning and “big data” should be implemented in order to facilitate strengthened regulation, capacity-building and exchange of information and resources. The implementation of such a knowledge platform should draw on international collaborative platforms, such as e-learning platforms, as necessary, to support advanced capacity-building in the field of education;

(r) The trend of rapid proliferation and reduction in costs of CubeSats was an opportunity to involve young engineers in space programmes. In particular, that trend would be beneficial for:

(i) Fostering the development of a network of ground stations among the members of the proposed capacity-building network, which could benefit from a collaborative experience;

(ii) Supporting educational institutions, to the extent possible, in the implementation and launch of CubeSats, including in addressing the related legal aspects and in utilizing the reach of the capacity-building network;

(iii) Promoting the participation of young researchers and, in particular, women.

(s) The Office for Outer Space Affairs should encourage countries, through dedicated capacity-building and awareness-raising efforts, to agree upon and introduce an inclusive set of guidelines and standard operating procedures for the exchange of metadata on available space-based technologies and tools and space-related data, in particular satellite remote-sensing data, and to encourage interoperability among stakeholders.

## IV. Conclusions

57. The Workshop provided experts from 38 countries the opportunity to exchange views on human capacity-building in space science and technology for sustainable social and economic development, and served to raise awareness of the activities of the Office for Outer Space Affairs and the global agendas promoted by the United Nations. The Workshop also served as a platform for presenting a wide range of initiatives related to the theme of the Workshop and for formulating recommendations in support of thematic priority 7 of UNISPACE+50, on capacity-building for the twenty-first century.

58. There was consensus on the need to reinforce and better support the activities of the Office for Outer Space Affairs by creating and strengthening networks for the dissemination of knowledge and awareness-raising, in particular a capacity-building network. Initiatives such as the space for development profile and the space solutions compendium, which had been introduced at the United Nations/Austria Symposium on the theme “Access to space: holistic capacity-building for the twenty-first century”, were validated during the course of the Workshop.

59. The Office was urged to implement the recommendations made at the Workshop and to request the resources needed to adequately support the initiatives proposed in those recommendations. It was noted that UNISPACE+50 would serve as an important opportunity for Member States to work jointly on a dedicated “Space2030” agenda, which would respond to the needs identified and recommendations made during the Workshop. The Office stood ready to assist with the development and implementation of capacity-building initiatives necessary to address the global challenges that characterized the rapidly changing world in the twenty-first century.

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