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Human Space Technology Initiative (HSTI)

Activities in 2011-2013 and plans for 2014 and beyond

I. Introduction

1. The Human Space Technology Initiative (HSTI) was launched in 2010 under the framework of the United Nations Programme on Space Applications, with the aims of raising awareness of the benefits of human space technology, promoting international cooperation in activities related to human spaceflight and space exploration, and supporting capacity-building in microgravity research and education.

2. From the beginning, outer space caught the imagination of humanity. With technological development, travelling into space finally became a reality. On 12 April 1961, Yuri Gagarin became the first human being to venture into space, opening up a new era of human activity which was no longer limited to the surface or atmosphere of the Earth. Within a decade, Neil Armstrong became the first human to set foot upon the surface of the Moon on 20 July 1969. In the 1980s, the USSR launched the Mir space station and operated it for more than a decade.

3. In furtherance of peaceful cooperation in space and through the combined efforts of its five space partner agencies, namely the Canadian Space Agency (CSA), the European Space Agency (ESA), the Japan Aerospace Exploration Agency (JAXA), the National Aeronautics and Space Administration (NASA) and the Russian Federal Space Agency (Roscosmos), the International Space Station (ISS) was developed, launched and constructed. Since November 2000, it has been the only continuously manned outpost of humankind in space.

4. The Third United Nations Conference on the Peaceful Uses of Outer Space (UNISPACE III), held in Vienna from 19 to 30 July 1999, recognized that large human space exploration missions exceeded the capacity of a single country and that cooperation should be privileged in that area. The ISS was cited as an example

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of that new paradigm made possible by the end of the Cold War.¹ UNISPACE III recommended the development of future space science programmes, in particular through international cooperation and the encouragement of access to the ISS from countries that had never participated in that endeavour. It also advocated the worldwide dissemination of information about research activities aboard the ISS.²

5. In response to the growing interest expressed by Member States, the relevant recommendations of the UNISPACE III and in-line with the mandate of the Programme on Space Applications, the Office for Outer Space Affairs launched the Human Space Technology Initiative (HSTI). HSTI and two other Initiatives, called the Basic Space Science Initiative (BSSI) and the Basic Space Technology Initiative (BSTI), represent new cornerstones of the Programme on Space Applications.

II. Human Space Technology Initiative (HSTI)

6. HSTI aims at promoting space exploration as a common and unifying goal for humankind and assisting Member States of the United Nations that want to participate in space exploration and its achievements. Furthermore, increasing the use of space applications and spin-off technologies in emerging and developing countries as well as supporting the long-term sustainability effort of activities in space are also parts of the mission of HSTI.

7. The role of HSTI in these efforts consists of providing a platform to exchange information, to foster collaboration between partners from spacefaring, and non-spacefaring countries and to encourage emerging and developing countries to take part in space research and to benefit from human space technology and its applications. Based upon these three pillars, the main objectives of HSTI activities can be specified as follows:

(a) To promote international cooperation in human spaceflight and space exploration-related activities;

(b) To create awareness among Member States on the benefits of utilizing human space technology and its applications;

(c) To build capacity in microgravity science education and research.

8. To achieve these objectives, HSTI collaborates with many different partners from the international space community and other United Nations entities. In close cooperation with International Space Station (ISS) partners, HSTI provides information on the ISS, its management structure and its research facilities. Furthermore, HSTI informs Member States about opportunities to cooperate with space agencies and provides educational materials on space science and technology.

9. In cooperation with other research facilities related to human space technology, HSTI seeks to establish programmes/fellowships that enable researchers from non-spacefaring countries to have access to these facilities. Within these programmes, HSTI provides information on the facilities and on opportunities of

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. II, para. 388.

² *Ibid.*, paras. 389, 390, 401 and 402.

how to utilize them. In some cases, HSTI develops, together with the owner of the facility, user manuals or instructions for experiments.

10. The work of HSTI is geared to the mandate of the United Nations Programme on Space Applications (General Assembly resolution 37/90, 10 December 1982). Each activity is in accordance with at least one element of the mandate.

III. HSTI activities 2011-2013

11. HSTI activities have been implemented by the Space Applications Section of the Office for Outer Space Affairs, led by the United Nations Expert on Space Applications, with three staff members provided by the Governments of China, Germany and Japan, on the basis of a non-reimbursable loan.

12. In addition, HSTI uses the expertise of part-time consultants related to specific topics. These consultants support the work of HSTI for a clearly defined limited period of time and only related to topics clearly defined beforehand. These consultants get reimbursed, mainly for their travel expenses, provided by the Trust Fund of the Programme on Space Applications.

13. Member States interested in providing funding support for activities of HSTI are invited to contact the Office for Outer Space Affairs. In particular, funding support is sought for the development and publication of educational materials related to microgravity research and for technical assistance to support capacity-building in regional/national human space technology development activities.

14. A workplan spanning three years from 2011-2013 was set up, encompassing the objectives mentioned beforehand: (1) to provide a forum for exchanging information on human space technology and its applications; (2) to inform Member States about utilization opportunities of the ISS and other facilities; and (3) to support Member States in increasing their capacity in microgravity research and education.

15. The concrete activities cover the areas of: A. International cooperation, B. Outreach activities and C. Capacity-building.

A. International cooperation

16. As the first activity of HSTI, the Office for Outer Space Affairs organized a one-day activity called "Outreach Seminar on the Activities of the International Space Station (ISS)" in Vienna on 8 February 2011, during the 48th session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space (COPUOS).³ With the purpose of disseminating information on the activities carried out on-board the ISS to a broader community, as well as facilitating discussions on HSTI, the seminar brought together a total of 17 countries including developing nations. The participants shared the status of various activities and accomplishments on-board the ISS and information on cooperation opportunities between ISS partners and interested institutions.

³ Report on Outreach Seminar A/AC.105/2011/CRP.13.

17. After exchanging views among participants, the seminar concluded that HSTI could be a meaningful mechanism for raising awareness of the potential of ISS research and educational activities among countries, regions, and potential users that had, up to that point, not been involved in such activities, thereby contributing to capacity-building in microgravity science and technology education.

18. Based on the results and the recommendations of the United Nations Expert Meeting on Human Space Technology in Malaysia in November 2011, the United Nations Expert Meeting on the International Space Station Benefits for Humanity⁴ was held from 11 to 12 June 2012 in Vienna, Austria, during the 49th session of COPUOS. The Meeting brought together experts from ISS partners and United Nations agencies to discuss and identify potential collaborations with the aim of extending the ISS benefits to all humankind in the identified areas of Earth observation and disaster response, health, and education.

19. The agencies that participated from the ISS partners were CSA, ESA, JAXA and NASA, and the specialized United Nation agencies were the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

20. Throughout the two-day meeting, activities on board the ISS and those pursued by the United Nations were presented to serve as the grounds for identifying potential ways of extending the benefits.

21. As a result, three possible projects in the areas of education and health were identified. In order to realize these identified projects, further assessment by the interested parties would be needed.

B. Outreach activities

22. The United Nations/Malaysia Expert Meeting on Human Space Technology was held in Putrajaya, Malaysia, from 14 to 18 November 2011. This was the first United Nations event of its kind to discuss how the world can benefit from human space technology, and to further develop international collaborative activities in human space exploration. Hosted by the Institute of Space Science of the National University of Malaysia, co-organized by the Office for Outer Space Affairs and the five ISS partner agencies, 125 professionals from 23 countries participated in the meeting.

23. Throughout the five-day meeting, various presentations on the following topics were delivered: ISS programmes; microgravity science; education, outreach and capacity-building; and national, regional, and international space programmes. These were followed by discussions in three working group sessions: Microgravity Research; Education, Outreach and Capacity-Building; and HSTI. Participants provided remarks and observations on these themes with the final objective being to develop shared recommendations on the Initiative.

24. On-orbit human facilities such as the ISS can provide and have been providing an ideal microgravity environment for research and experiments to better understand

⁴ Report on Expert Meeting A/AC.105/1024.

fundamental scientific questions and to provide solutions for problems on Earth, in the fields of physics as well as fluid, materials, life science, and engineering science. The utilization of ground-based research facilities, such as clinostats, drop towers, parabolic flights and centrifuges can, however, facilitate microgravity research and is essential as a preparatory step towards in-flight experiments.

25. A presentation on ISS benefits for humanity reported that the ISS Partnership had recently identified the following three areas in which activities on the ISS could benefit humanity — education, Earth observation and disaster response, and human health. To facilitate cooperation in extending benefits of ISS research and education to the world, potential partnership activities between the ISS and HSTI were also brought up for further consideration.

26. At the end of the meeting, ten recommendations were endorsed by the participants. The following five directly refer to the work of HSTI:

(a) The Human Space Technology Initiative should take action to create awareness among stakeholders, including decision makers in the public and private sectors, researchers and students, of the social and economic potential of space science and technologies and to initiate outreach activities;

(b) The Initiative should identify and inform Member States about space-related research opportunities and organize meetings in which invited experts can provide information to interested parties;

(c) The Initiative should establish capacity-building programmes, including through the provision of educational materials, instrument distribution and/or access, national or regional expert centres, training of trainers, exchange programmes and competition and motivation programmes;

(d) The Initiative should serve as a catalyst for international collaboration by promoting the formation of common interest groups, conducting regular surveys of countries concerning their space competence profiles, developing a set of guidelines for collaboration, promoting multi-national institutional agreements and creating regional expert centres;

(e) The Initiative should promote the exchange of knowledge and the sharing of data by raising awareness, promoting user-friendly mechanisms for data access and providing knowledge about self-supporting habitats for application, including for energy efficiency on Earth.

27. From 16 to 20 September 2013, the United Nations/China Workshop on Human Space Technology will take place in Beijing. This Workshop is jointly organized by the Office for Outer Space Affairs and the China Manned Space Agency (CMSA). The International Academy of Astronautics (IAA) is also co-organizing the Workshop.

28. The Workshop will bring together senior experts, professionals and decision makers from the public sectors, academia and industry worldwide. The Workshop participants will exchange information on recent accomplishments and efforts in the areas of human space technology, relevant science and research activities as well as educational promotion for the next generation. The Workshop will also aim to contribute to establishing institutional capacity in microgravity

science and enhancing international cooperation in human space exploration as a global endeavour.

29. Furthermore, in the past three years, the Office for Outer Space Affairs has presented HSTI's activities at numerous occasions including conferences, symposiums and meetings. For these activities, papers and presentations about HSTI activities were prepared and presented by members of the HSTI team.

30. On the web page of the Office for Outer Space Affairs, HSTI has established a web page with information about HSTI and its activities. This web page is constantly being updated with the latest information on current and past announcements, workshops and meetings.

31. A brochure on HSTI, which has recently been published, gives an excellent overview of HSTI and its connection to other activities within the Office and beyond. This brochure will be presented to COPUOS at its 56th session.

C. Capacity-building

32. Based on the recommendations of the United Nations Expert Meeting on Human Space Technology in Malaysia in 2011, HSTI has been carrying out science activities aimed at enhancing capacity-building in the areas of microgravity science, particularly in developing countries.

33. The "Zero-Gravity Instrument Project", the first project of HSTI to foster science activities, is now underway. In this project, one-axis clinostats are being distributed worldwide to selected institutions of higher education. This project is expected to provide unique opportunities for students and researchers to observe growth of indigenous plants to their countries in a simulated microgravity condition. The target groups for distribution are high schools, universities and research institutions, particularly in developing countries. A one-axis clinostat along with a teacher's guide was selected for distribution on the basis of its ease of use as well as the potential scientific benefits of the project.

34. In order to select suitable institutions to receive the clinostats and increase the scientific value of the project, the HSTI Science Advisory Board (HSTI-SAB) was established and is comprised on a voluntary basis of seven prominent experts in microgravity life science.

35. One cycle is scheduled for two years from the announcement of opportunity to the submission of the final activity report. Currently, two cycles are being scheduled, distributing 20 clinostats per cycle. The experiment phase will last approximately a year, during which institutions will use the clinostats to conduct experiments on the proposed projects. One of the conditions of the selection will be to provide annual reports on the activities with the clinostat to the Office for Outer Space Affairs. Furthermore, the project is expected to create datasets of plant species with their gravity response, which would be used to design future space experiments as well as contribute to the advancement of science.

36. The Announcement of Opportunity of the first cycle was published on 1 February 2013. Further information can be obtained via the web page: www.oosa.unvienna.org/oosa/en/SAP/hsti/zgip.html.

IV. HSTI plan of activities for 2014 and beyond

37. Based on the achievements of the past three years, HSTI is now preparing a workplan for 2014 and beyond. The work of the past three years was characterized by introducing HSTI as a new initiative within the Programme on Space Applications and getting acquainted with the Member States. During several meetings and workshops organized by HSTI, the Member States have given valuable recommendations concerning the future work of the Initiative. The forthcoming workplan makes allowances for these recommendations.

A. International cooperation

Collaboration with space agencies

38. During the United Nations Expert Meeting on the ISS Humanitarian Benefits, a concept called “Space-proven Telemedicine Devices and Services for Underserved Populations” was proposed by the Office for Outer Space Affairs and the Technical University of Munich. The proposal aims at identifying and transferring space-proven telemedicine applications on-board the ISS to be used on Earth to benefit underserved populations.

39. As this is a very promising approach, HSTI is planning to have a two-day Expert Meeting which will focus on the topic of space applications for telemedicine/e-health in general. This Expert Meeting aims to lay the groundwork for case studies of successful transfer projects, transfer candidates, and general guidelines. The Expert Meeting is planned to take place early in 2014.

40. China offered the utilization of the facilities on its planned manned space station to the world during the 55th session of COPUOS. The construction of the Chinese space station is scheduled to begin in 2018 and become operational in around 2020. HSTI will work with the China Manned Space Agency to review a possible collaboration in utilizing China’s space station to promote space exploration related activities in the world.

41. Other Member States who want to offer their knowledge and/or their facilities to share with the Office for Outer Space Affairs are invited to contact HSTI.

Collaboration with other United Nations entities

42. UNESCO proposed several concepts on outreach and education. “Educational Activities in Schools” would take advantage of UNESCO’s school network to distribute educational materials developed for the ISS and other space missions. “Educational Activities in Universities” would use a network of universities to make user-friendly educational materials and distribute them worldwide. HSTI will work together with UNESCO to elaborate these proposals.

43. A concept called “Using Portable Ultrasound to Enhance Diagnostics in Vulnerable Populations Based on ISS Experiences” was presented by the Technical University of Munich during the United Nations Expert Meeting on the ISS Humanitarian Benefits. Together with WINFOCUS, an ultrasound educational organization, this concept aims at training non-specialist users on how to utilize the available training and remote-guidance tool developed for the ISS in order to

contribute to enhanced diagnostic and management procedures in underserved regions and their populations. HSTI will pursue and support this concept in cooperation with WHO and the Technical University of Munich.

B. Outreach activities

44. HSTI will continuously organize workshops, meetings and conferences annually to raise awareness of the benefits of human space technology and its applications as well as to promote international cooperation on humans space exploration endeavour.

45. A United Nations Workshop on Human Space Technology scheduled for 2014-2015 is going to take place in Costa Rica.

46. HSTI will also present its range of activities at international conferences and meetings to build up a network of users and supporters.

C. Capacity-building

Zero-Gravity Instrument Project (ZGIP)

47. The second cycle of the Zero-Gravity Instrument Project (ZGIP) is scheduled to start in early 2014. Based on the scientific evaluation of the final reports submitted at the end of the 1st and 2nd cycles as well as the status of support from Member States, the Office for Outer Space Affairs may extend the project to its 3rd and 4th cycles.

48. The Office for Outer Space Affairs may organize a workshop on microgravity science at the end of the second cycle to further promote educational and research activities in microgravity by providing a platform for exchanging experience and “lessons learned” in ZGIP.

ZARM Drop Tower Campaigns

49. In cooperation with the Centre of Applied Space Science and Microgravity (ZARM) and the German Space Agency, HSTI is planning to offer research groups from Member States the opportunity to conduct a series of microgravity experiments in the Drop Tower facility at ZARM in Bremen, Germany. ZARM as well as an additional scientific consultant might help the research team to make the campaign successful.

50. On a yearly basis, one research group would have the opportunity to apply for a drop tower campaign. Depending on the agreement of the German Government, the first cycle could start in early 2014, and the Announcement of Opportunity would then be published by the end of 2013.

51. A campaign is supposed to be proportionally funded by ZARM, the German Space Agency, the Office for Outer Space Affairs and the applicants’ home institution/country.

Educational and Outreach Measures Related to Microgravity

52. In order to make microgravity research accessible and understandable for students from all Member States, HSTI will establish a web-based educational platform with collected information from Member States. This educational platform will be at the disposal of students from all over the world and will enable them to conduct their own experiments without any previous knowledge needed.

53. As one outcome of the United Nations Expert Meeting on ISS Benefits for Humanity in June 2012, HSTI will seek to collaborate with educational and research institutions to identify and distribute educational materials to students around the world.

V. Conclusions

54. The Human Space Technology Initiative (HSTI) was launched in 2010 under the framework of the United Nations Programme on Space Applications. The three pillars of HSTI activities are international cooperation, outreach and capacity-building.

55. HSTI is striving to bring the benefits of human space activities to all and to bring nations together for this endeavour, thus, creating new opportunities for international cooperation. HSTI is continuing to organize workshops, conferences and meetings annually to raise awareness of the benefits of human space technology and to promote exploration-related activities.

56. HSTI is also conducting its capacity-building projects. Currently, the Zero-Gravity Instrument Project (ZGIP) is under way to promote microgravity education and research worldwide.

57. The Office for Outer Space Affairs welcomes comments on HSTI and invites Member States to make full use of the activities offered under this Initiative.