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## **Basic Space Technology Initiative (BSTI)**

### **Activities in 2013-2014 and plans for 2015 and beyond**

#### **I. Introduction**

1. The United Nations Programme on Space Applications was launched as a result of discussions at the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE), held in Vienna in 1968.<sup>1</sup> The Programme is implemented by the United Nations Office for Outer Space Affairs (OOSA) and provides support to capacity-building in space technology and its applications to all Member States of the United Nations, independent of their level of economic development.<sup>2</sup>
2. The initial focus of the Programme was on the applications of space technology, such as in satellite communications, Earth observations and positioning and navigation services. In the 1990s space science-related activities were added to the Programme through the Basic Space Science Initiative (BSSI).<sup>3</sup>
3. In response to the interest in a growing number of Member States to build capacity in space technology development, the Basic Space Technology Initiative (BSTI) was added as a new cornerstone to the Programme on Space Applications

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<sup>1</sup> United Nations, General Assembly, Official Records Twenty-Third Session, Agenda item 24, Report of the Committee on the Peaceful Uses of Outer Space, Annex II "Documentation on the United Nations Conference on the Exploration and Peaceful Uses of Outer Space", New York 1968.

<sup>2</sup> United Nations Office for Outer Space Affairs, "United Nations Programme on Space Applications", United Nations, ST/SPACE/52/Rev 1, September 2012.

<sup>3</sup> Haubold, H., Gadimova, S., "Progress in basic space science education and research: The UNBSSI", Space Policy 26, Elsevier, February 2010, pp. 61-63.



in 2009.<sup>4,5</sup> BSTI focuses on the development of affordable, small-satellite platforms with mass below 150 kg and on their associated technical, managerial, regulatory and legal issues.

4. In 2013 there was an increase of 269 per cent in the number of nano/microsatellites (1-50 kg) launched over 2012. For example, over a period of just two days in November 2013, 61 small satellites were launched on two expendable launch vehicles (Minotaur 1 and Dnepr) and 4 small satellites were deployed from the International Space Station (ISS). Given ongoing small-satellite development activities, it can be expected that launch rates of small satellites may continue to increase in the future. Furthermore, the increasing number of small-satellite developers in a growing number of countries makes it necessary to ensure adherence to binding and non-binding regulatory and legal obligations, to the extent possible, to maintain the long-term sustainability of outer space activities. These developments point to an increasingly important role for BSTI in contributing to enhance international space cooperation in line with legal and regulatory frameworks.

5. This document reports on the BSTI activities conducted in 2013-2014 and on planned activities for 2015 and beyond. It should be read in connection with documents A/AC.105/2011/CRP.14, A/AC.105/2012/CRP.16 and A/AC.105/2013/CRP.14 which describe the mission and the underlying objectives of BSTI and report on the activities in 2009-2011, in 2011-2012 and in 2012-2013, respectively.

## II. BSTI Workplan

6. BSTI activities are conducted in accordance with a multi-annual workplan developed in consultation with representatives from Member States and space technology development experts from all around the world. The work programme, as described in more detail in document A/AC.105/2011/CRP.14, is structured around five activity categories: I. Basic activities, II. International conferences on capacity building in basic space technology development, III. Space technology education curriculum, IV. Establishment of long-term fellowship programmes, and V. Basic Space Technology Initiative projects.

7. The workplan is reviewed annually and updated to take account of changing needs in Members States and to reflect new trends in the field of space technology development. The latest version of the workplan is available from the BSTI website at [www.unoosa.org/oosa/en/SAP/bsti/index.html](http://www.unoosa.org/oosa/en/SAP/bsti/index.html).

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<sup>4</sup> Balogh, W., Haubold, H., "Proposal for a United Nations Basic Space Technology Initiative", *Advances in Space Research* 43, Elsevier, 15 June 2009, pp. 1847-1853.

<sup>5</sup> Balogh, W., "Capacity Building in Space Technology Development: A New Initiative within the United Nations Programme on Space Applications", *Space Policy* 27, Elsevier, August 2011, pp. 180-183.

### III. BSTI Funding

8. BSTI activities are implemented by the Space Applications Section of the Office for Outer Space Affairs. In terms of staffing the Initiative uses 85 per cent of the time of one P-staff and 20-25 per cent of the time of one G-staff. From October 2013 to June 2014, Ms. Chisato Kobayashi joined the Office in the temporary position of a Programme Officer and spent 50 per cent of her time working on BSTI-related activities, while the Programme Officer in charge of BSTI was on temporary promotion to another post. In total the staff resources devoted to BSTI remained at the level of approximately 85 per cent of one P-staff.

9. Basic funding for BSTI is provided through the regular budget of the Office. In 2013, a total of US\$ 33,316.77 were used to fund BSTI-related activities. These funds were complemented by in-cash and in-kind contributions from various co-sponsors. The Emirates Institution for Advanced Science and Technology (EIAST) provided US\$ 10,000 in-cash and US\$ 110,000 in-kind for the organization of the United Nations/United Arab Emirates Symposium on Basic Space Technology. The vast majority of these contributions were used to provide support to experts from Member States to participate in the Symposium. Other co-sponsors of BSTI activities in 2013 included the Kyushu Institute of Technology, the University of Tokyo and the University Space Engineering Consortium (UNISEC).

10. Member States interested in receiving technical assistance on matters related to capacity-building in regional/national space technology development or in hosting or co-organizing BSTI events are invited to contact the Office for Outer Space Affairs. For further information on partnership opportunities please also consult [www.unoosa.org/oosa/en/partnership/index.html](http://www.unoosa.org/oosa/en/partnership/index.html).

11. The Office for Outer Space Affairs is also looking for a donor country interested in providing the services of an Associate Expert to the Basic Space Technology Initiative. The job description (INT-190-11-P090-01-V) is available from the Associate Expert Website at <http://esa.un.org/techcoop/associateexperts/>. Interested donor countries are invited to contact the Office.

### IV. Activities in 2012-2013 and plans for 2014 and beyond

12. The following paragraphs describe the activities conducted in 2012-2013 and plans for 2014 and beyond under the five activity categories of the BSTI workplan:

#### I. Basic activities

13. From 2009 to 2011, the Office for Outer Space Affairs, in cooperation with the Government of Austria and the European Space Agency, organized a series of three United Nations/Austria/European Space Agency symposiums on small satellite programmes for sustainable development. A major objective of the symposium series was to prepare and review the work programme of the Basic Space Technology Initiative. A total of 279 space technology experts from 58 countries as well as from various international organizations participated in these events. The conclusions and recommendations of the symposiums are contained in the symposium reports A/AC.105/966, A/AC.105/983 and A/AC.105/1005.

14. Under the basic activities line the Officer under the BSTI continues, in close cooperation with the International Telecommunications Union (ITU), to provide advisory services on legal and regulatory issues of small satellite activities. Information on registration procedures for space objects, liability issues and space debris mitigation measures, frequency coordination, launch opportunities, orbital data information and conjunction assessment services and relevant open standards and standardization efforts is provided at [www.unoosa.org/oosa/en/SAP/bsti/fundamentals.html](http://www.unoosa.org/oosa/en/SAP/bsti/fundamentals.html).

15. BSTI is also disseminating at its annual international conference a CD-ROM with information on “Frequency Registration for Small Satellite Programmes” provided by ITU-R. The CD-ROM is updated annually.

16. The following presentations on BSTI were made in 2013-2014:

(a) “Aims and Achievements of United Nations Initiatives Supporting Small Satellite Projects”, Seminar on “Small Satellites: Chances and Challenges”, Faculty of Law, University of Vienna, 29 March 2014;

(b) “Small Satellite Activities and their Legal and Regulatory Implications”, Global Space Applications Conference (GLAC 2014), International Astronautical Federation, UNESCO Headquarters, Paris, France, 2-5 June 2014.

17. The following publications on BSTI were issued in 2013-2014:

(a) W. Balogh and D. Wood, “Capacity-Building in Space Technology Development in Africa”, Proceedings of the 4th African Leadership Conference on Space Science and Technology for Sustainable Development, Mombasa, Kenya, 26-28 September 2011, African Skies, No.17, ISSN 10278389, June 2013;

(b) M. Cho, J. Polansky, W. Balogh, “Engineering Education through On-the-Job Training in Nano-Satellite for Capacity Building in Basic Space Technology Development”, 64th International Astronautical Congress 2013, Paper IAC-13-B4.1.4, Beijing, China, October 2013;

(c) W. Balogh, “Activities of the United Nations Programme on Space Applications in Support of Space Education and Space Technology Development”, Proceedings of the 5th Nano-Satellite Symposium, Tokyo, Japan, 20-22 November 2013.

18. BSTI also contributed to the following activities:

(a) Chairing session on “Novel Missions and Applications II”, 5th Nano-Satellite Symposium, Tokyo, Japan, 20-22 November 2013;

(b) Chairing session on “Services combining satellite-based remote sensing and positioning”, Global Space Applications Conference (GLAC 2014), International Astronautical Federation, UNESCO Headquarters, Paris, France, 2-5 June 2014;

(c) Contributing to the International Scientific Committee, 6th European Cubesat Symposium, Estavayer-le-Lac, Switzerland, 14-16 October 2014.

## **II. International conferences on capacity building in basic space technology development**

19. Following the conclusion of the series of three United Nations/Austria/European Space Agency symposia on small-satellite

programmes for sustainable development held from 2009 to 2011, starting from 2012, BSTI is organizing international space technology symposiums on basic space technology development in each of the regions that correspond to the United Nations Economic Commissions for Africa, Asia and the Pacific, Latin America and the Caribbean, and Western Asia.

20. The second Symposium in this new series was held for the Western Asia region as the United Nations/United Arab Emirates Symposium on Basic Space Technology on the theme “Small Satellite Missions for Developing Space Nations” in Dubai, United Arab Emirates from 20-23 October 2013.

21. The symposium programme was structured around seven sessions on the following topics: (i) Capacity Building in Basic Space Technology Development; (ii) Infrastructures for Basic Space Technology Development; (iii) Launch Opportunities for Small Satellite Missions; (iv) Small Satellite Platforms for Earth Observations; (v) Regulatory and Legal Issues; (vi) Space Technology Development Activities in Western Asia; (vii) Working Groups — Education Curriculum on Space Engineering and Basic Space Technology Initiative; (viii) Way Forward.

22. The Symposium report, including the observations and recommendation of the participants, has been issued under the document number A/AC.105/1052 and all presentations made at the Symposium are available from the Symposium website at [www.unoosa.org/oosa/en/SAP/bsti/uae2013.html](http://www.unoosa.org/oosa/en/SAP/bsti/uae2013.html).

23. In 2014, the international space technology conference will focus on the Latin America and the Caribbean region and will be hosted by the Center for Scientific Research and Higher Education (CICESE) and the Mexican Space Agency, on behalf of the government of Mexico, at Ensenada, Baja California, from 20-23 October. Registration and applications for funding support to attend the Symposium can be made through the BSTI website at [www.unoosa.org/oosa/en/SAP/bsti/mexico2014.html](http://www.unoosa.org/oosa/en/SAP/bsti/mexico2014.html). Within the limits of the funds made available by the co-sponsors the United Nations, under the BSTI, will provide support for qualified space technology experts to attend the Symposium. The deadline for applications is 10 July 2014.

24. The technical sessions to be included in the Symposium are as follows:

- (a) Capacity Building in Basic Space Technology Development;
- (b) Small Satellites for Earth Observation and Disaster Management;
- (c) Small Satellite Projects for Engineering Education;
- (d) Space Technology Development Activities in Latin America and the Caribbean;
- (e) Education Curriculum on Space Engineering;
- (f) Regulatory and Legal Issues;
- (g) Use of Space Technologies for Early Warning Systems.

25. In 2015 the international space technology conference will focus on the region of Africa and an offer to host the Symposium has been received from South Africa. For the 2016 Symposium expressions of interest to host the meeting have been received from Pakistan and Turkey.

### **III. Space technology education curriculum**

26. In connection with the establishment of the Regional Centres for Space Science and Technology Education (affiliated to the United Nations), the Programme on Space Applications has prepared a series of education curricula to ensure an acceptable minimum common standard of teaching. The curricula, in line with the courses offered at the Regional Centres, initially focused on space applications. An education curriculum on Global Navigation Satellite Systems (GNSS) was issued in 2013 (ST/SPACE/59) and a curriculum on space law was published in 2014 (ST/SPACE/64). The BSTI workplan calls for the preparation of an education curriculum on space engineering, which should include topics such as space engineering, mission design and project management.

27. Work on the education curriculum on space technology began at the 2012 United Nations/Japan Nano-Satellite Symposium with the organization of a special session. The first draft of the curriculum will be circulated at the United Nations/Mexico Symposium on Basic Space Technology to be held in Baja California from 20 to 23 October in 2014 and it will be discussed among experts and the participants at the dedicated session during the Symposium.

28. The curriculum is planned to be finalized in 2015 and to be presented to the Scientific and Technical Subcommittee at its session in 2016. All the updated information on the curriculum development is available from [www.unoosa.org/oosa/en/SAP/bsti/bsti-education/ecse.html](http://www.unoosa.org/oosa/en/SAP/bsti/bsti-education/ecse.html).

### **IV. Establishment of long-term fellowship programmes**

29. In 2011 the Office for Outer Space Affairs and the Government of Japan in cooperation with the Kyushu Institute of Technology (KIT) established the United Nations/Japan Long-Term Fellowship Programme — Post-graduate study on Nano-Satellite Technologies (PNST) for nationals of developing countries and non-space-faring nations.

30. Since 2013 the Fellowship Programme accepts up to four three-year doctoral and up to two two-year master degree students per year with full support through a scholarship provided by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan. Presently seven doctorate degree students from Egypt (2 students), Mongolia, Nigeria, Romania, Thailand and the Ukraine and two master degree students from Singapore and Sudan are studying at KIT under this fellowship scheme.

31. More than 500 potential applicants registered through the PNST webpage for the 2014 round of applications. By the deadline of 27 January 2014, 120 valid applications had been received. The four doctorate degree scholarship were awarded to applicants from Algeria, Mongolia, the Philippines and the Ukraine. The two master degree scholarships were awarded to applicants from Colombia and Indonesia. They will begin their studies at KIT in October 2014.

32. The fifth selection round will open for applications at the end of 2014. Application information will be available from the Fellowship webpage at [www.unoosa.org/oosa/en/SAP/bsti/fellowship.html](http://www.unoosa.org/oosa/en/SAP/bsti/fellowship.html).

33. The Office for Outer Space Affairs is continuing discussions with educational institutions, including the Regional Centres for Space Science and Technology

Education, affiliated to the United Nations, to identify education opportunities for future space technology experts.

#### **V. Basic Space Technology Initiative projects**

34. HUMSAT is a nano-satellite constellation project led by the University of Vigo, Spain is being considered under the BSTI.<sup>6</sup> The HUMSAT constellation of satellites will provide services for the collection of data from globally distributed sensor networks. On 21 November 2013, HUMSAT-D, the first satellite in the constellation, was successfully released into orbit as a secondary launch payload attached to the UNISAT-5 satellite following its initial successful injection into orbit by a Russian Dnepr launch vehicle. After a mission duration of six months the satellite is fully operational and the HUMSAT concept has been confirmed with different test sensors located in Brazil and Spain. In 2014 it is planned to expand the test sensor network with new transmitters located in Japan, Mexico, the Republic of Serbia, Tunisia and the United States.

35. In follow up to the Team Project Small Satellites conducted during the International Space University (ISU) Space Studies Programme (SSP) held in Graz, Austria, from 11 July to 9 September 2011, several of the participants in the studies programme continue to work on developing a Small Satellite Program Guide (SSPG). The book is nearly complete and will be available in eBook format from InKling. The book provides processes, tools and data related to starting and growing small satellite programmes. It will discuss relevant small satellite program strategy, legal, program management, project management, systems engineering, satellite design, as well as policies and regulations, education and training, launching and operations. The target audience will be decision makers and managers in academia, government and industry.

#### **V. Conclusions**

36. BSTI is continuing to assist Member States interested in the establishment of basic capacities for space technology development. The first phase of the workplan has been completed in 2011 with the conclusion of the three-year series of Symposia on Small Satellite Programmes for Sustainable Development held in Graz, Austria. Since 2012 the focus is on the international space technology conferences and on the preparation of the space technology education curriculum.

37. Member States are invited to make full use of the activities offered under the BSTI. The Office for Outer Space Affairs welcomes comments on the Initiative as well as expressions of interest for cooperation on activities related to capacity-building in space technology development.

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<sup>6</sup> Castro, A., Walker, R., Emma, F., Aguado, F., Tubio, R., Balogh, W., "The HumSAT system and the ESA GEOID Initiative", European Space Agency, Bulletin 149, February 2012, pp. 44-50.