UNITED NATIONS
Office for Outer Space Affairs

INTERNATIONAL SPACE UNIVERSITY

TP Small Satellites
Background and Objectives

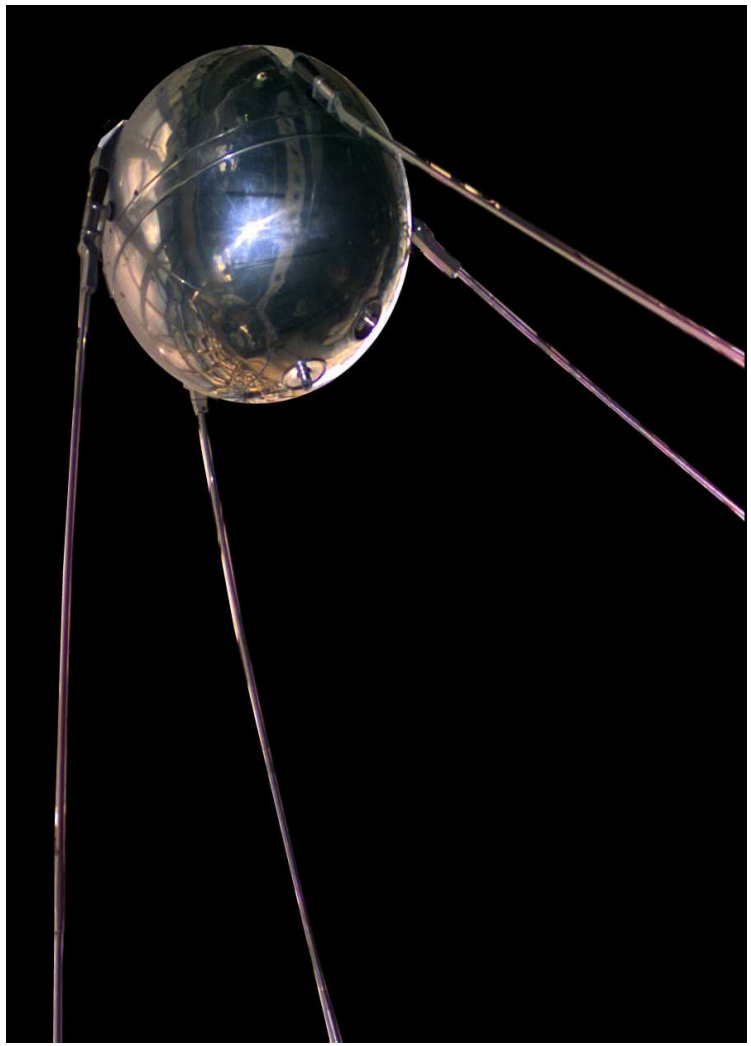
International Space University
Space Studies Programme
11 July – 9 September 2011

Presentation Overview

- Background
  - UN Programme on Space Applications
  - Basic Space Technology Initiative (BSTI)
- Team Project Small Satellites
  - Objectives
  - TP Report
  - TP Follow-up

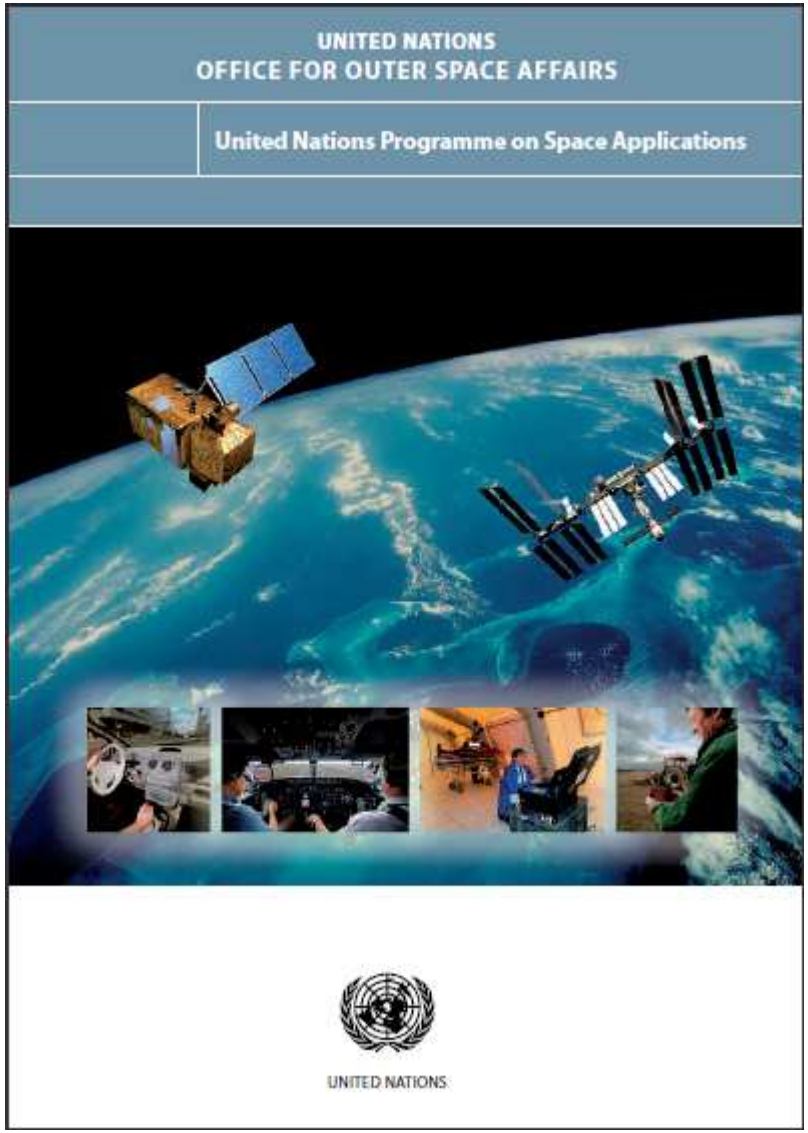
The United Nations and Outer Space

- 4 October 1957: Beginning of the space age with the launch of Sputnik-I
- Concerns over an arms race in space, the fair sharing of space benefits and the need for rules to regulate the activities of States in outer space
- In 1958 UN General Assembly establishes the **Committee on the Peaceful Uses of Outer Space (COPUOS)**
- Serviced by the United Nations Office for Outer Space Affairs (UNOOSA)



United Nations Office for Outer Space Affairs

UN Programme on Space Applications

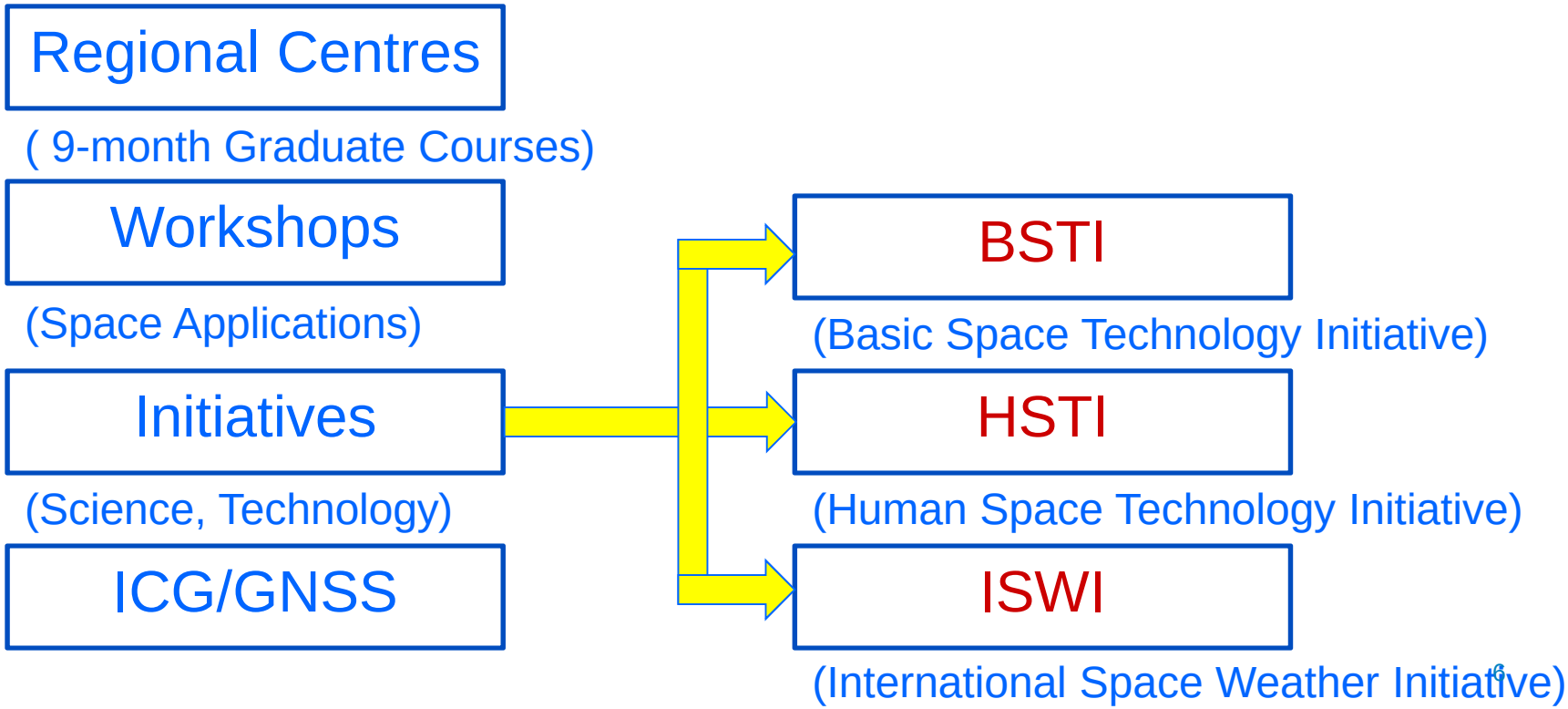


- Established in response to recommendations of the first UNISPACE conference in 1968
- Became operational in 1971
- Implemented by UNOOSA
- United Nations Expert on Space Applications
- UNISPACE'82 in 1982, and UNISPACE III in 1999, further expanded the mandate of the Programme

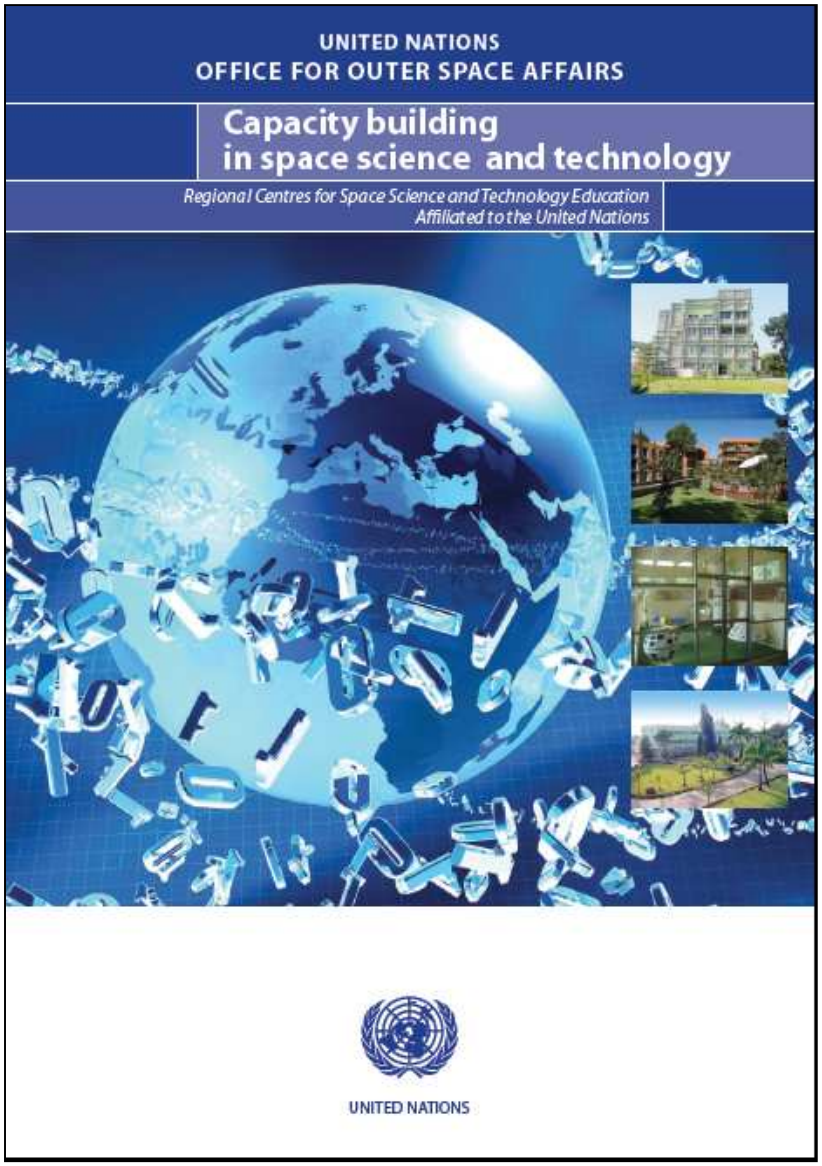
http://www.unoosa.org/oosa/en/SAP/history.html

Programme Structure

- Programme Mandate
  - A. International Cooperation
  - B. Capacity Building
  - C. Dissemination of Information
  - D. Technical Advisory Services
- Programme Activities



Programme Achievements

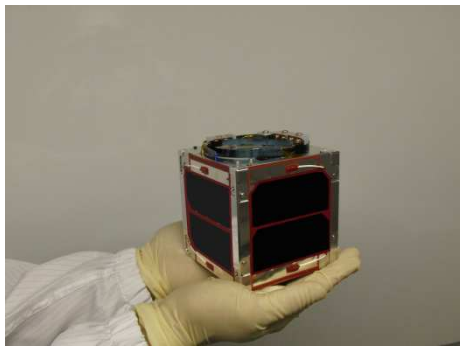
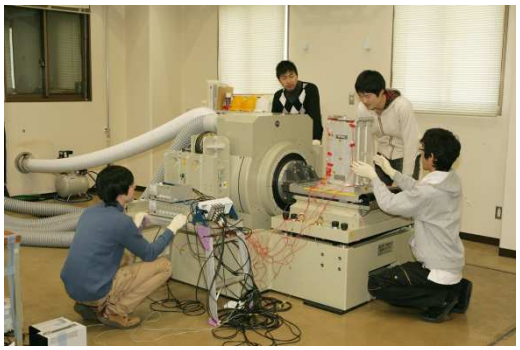
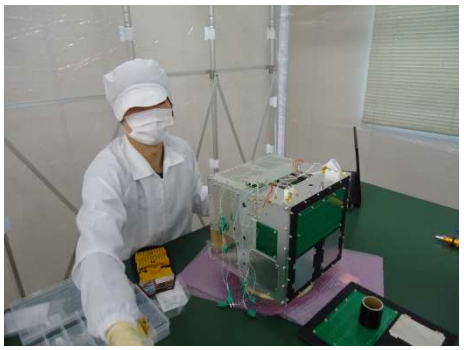


- >11,000 people participated in more than 200 activities (workshops, seminars, training courses…)
- ~300 specialists, selected from among ~1500 applicants, participated in various long-term fellowships programmes
- Establishment of four **Regional Centres for Space Science and Technology Education, affiliated to the United Nations**

http://www.unoosa.org/oosa/en/SAP/accompl.html

Small Satellites

- Increasingly capable nano- and small satellites
- Can be developed with limited infrastructure and at low cost
- Affordable to universities and smaller institutions and to countries with limited space expenditure
- Growing interest to establish adequate capabilities for basic space technology development in many countries that have previously only been space-using countries

UNCOPUOS Small Satellite Activities

- Small satellites have been addressed by the Committee on the Peaceful Uses of Outer Space since the mid-1990s
  - Microsatellites and Small Satellites: Current Projects and Future Perspectives for International Cooperation, 2 November 1995 (A/AC.105/611)
  - Symposium on Utilization of Micro- and Small Satellites for the Expansion of Low-cost Space Activities, Taking into Account the Special Needs of Developing Countries, 12-13 February 1996 (A/AC.105/638)
  - Report on the United Nations/Instituto Nacional de Técnica Aerosespecial/European Space Agency International Conference on Small Satellites: Missions and Technology, Madrid, 9-13 September 1996 (A/AC.105/645)
- UNISPACE III: UN/IAA Workshop on Small Satellites
  - UNISPACE III, "Report of the Technical Forum", 28 July 1999 (A/CONF.184/L.13)
  - UNISPACE III, Technical Forum, "Conclusions and proposals of the Workshop on Small Satellites at the Service of Developing Countries", 27 July 1999 (A/CONF.184/C.2/L.7)

Documents available from http://documents.un.org

THIRD UNITED NATIONS CONFERENCE
ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

Some benefits of small satellite programmes

- Training and educating systems engineers, industrial engineers and project management specialist which also benefit other than aerospace sectors
- High-technology, in reach for smaller countries and countries having limited resources for space activities
- Acquire technical capabilities in miniaturization, microelectronics and micro-manufacturing with spin-offs into robotics, entertainment & IT industry, other industry sectors
- Opportunities for establishing commercial businesses and for becoming a player in an open, global market place for small satellite technologies

Some benefits of small satellite programmes

- Create new opportunities for international technology cooperation
- A stepping stone in developing/enhancing a country's space capacity and to creating a long-term plan for space technology development
- Demonstrate technology and space capability and encourage the people
- Raise attention of government industry and people to the importance of space technology and its applications
- Benefit from the actual applications
- …

Basic Space Technology Initiative (BSTI)

- Launched in 2009 in the framework of the United Nations Programme on Space Applications
- **Mission**
  - To enhance access to space application tools for sustainable development through building capacity in basic space technology
- **Objectives**
  - Respond to the growing **interest in many countries to establish indigenous capacities in basic space technology**
  - Address the **growing role of small (nano-) satellites** for education, basic space science and for operational applications
  - Assist countries to assure **adherence to the relevant regulatory frameworks** and promote the **use of standards**
  - Promote **international cooperation and information exchange** in capacity building in basic space technology

A Results-Oriented Work Programme

I. Basic Activities

- UN Workshops/Symposiums on Basic Space Technology
- BSTI Website & Mailing List (http://www.unoosa.org/oosa/en/SAP/bsti/index.html)
- Regulatory aspects (registration, frequencies, space debris…)

II. International Space Technology Conferences

- Conferences in the regions that correspond to the United Nations Economic Commissions for Africa, Asia and the Pacific, Latin America and the Caribbean, and Western Asia

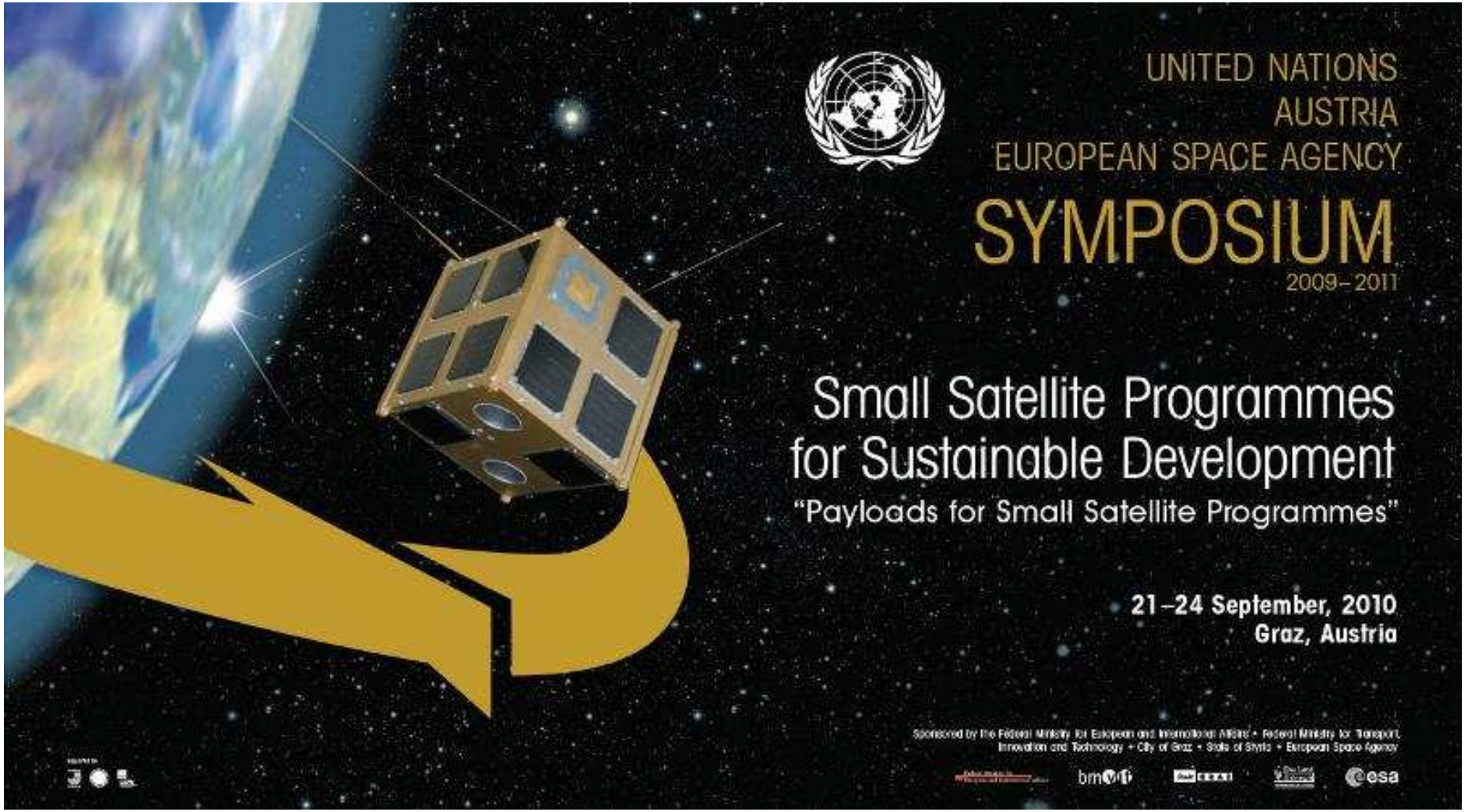
III. Space Technology Education Curriculum

- Basic Space Technology Education Directory based on a survey of Aerospace Engineering and Small Satellite Programmes
- Development of a Space Technology Education Curriculum

IV. Establishment of Long-term Fellowship Programmes

V. BSTI Projects

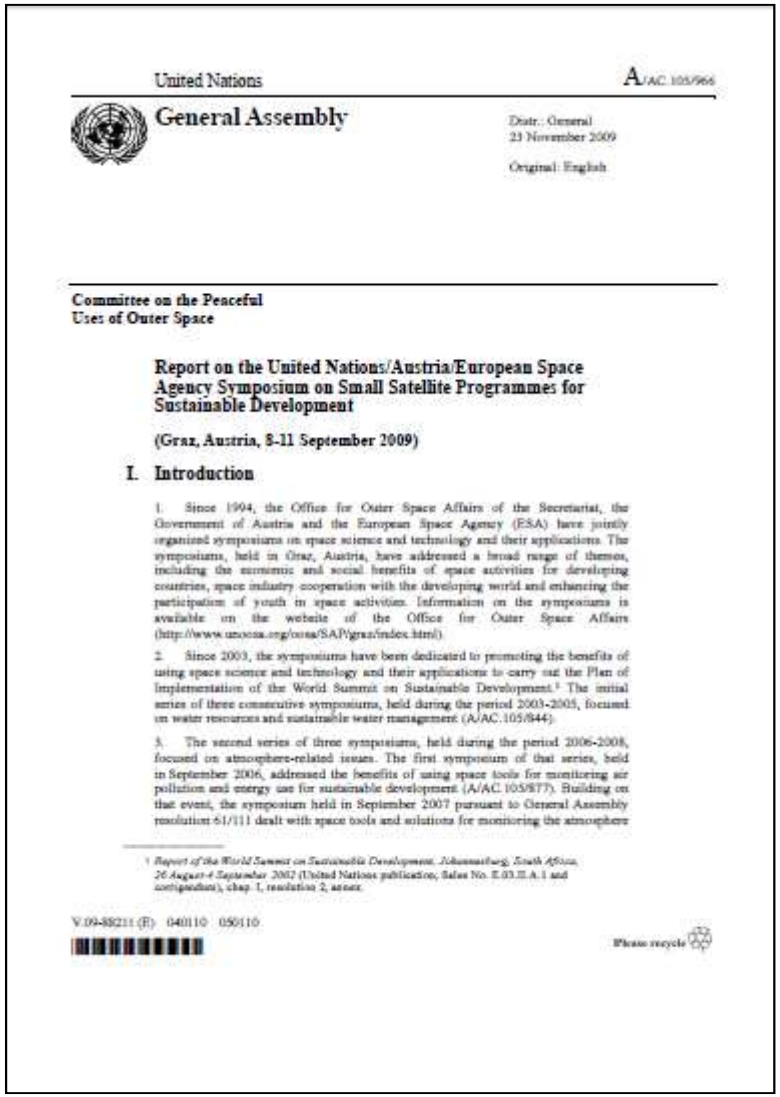
I. Foundations: UN/Austria/ESA Symposium



http://www.unoosa.org/oosa/en/SAP/act2010/graz/index.html

UN/Austria/ESA Symposium 2010

UN/Austria/ESA Symposium 2010



United Nations A/AC.105/966

General Assembly

Distr.: General
23 November 2009

Original: English

Committee on the Peaceful
Uses of Outer Space

Report on the United Nations/Austria/European Space Agency Symposium on Small Satellite Programmes for Sustainable Development

(Graz, Austria, 8-11 September 2009)

I. Introduction

1. Since 1994, the Office for Outer Space Affairs of the Secretariat, the Government of Austria and the European Space Agency (ESA) have jointly organized symposiums on space science and technology and their applications. The symposiums, held in Graz, Austria, have addressed a broad range of themes, including the economic and social benefits of space activities for developing countries, space industry cooperation with the developing world and enhancing the participation of youth in space activities. Information on the symposiums is available on the website of the Office for Outer Space Affairs (http://www.unoosa.org/oosa/SAP/graz/index.html).

2. Since 2003, the symposiums have been dedicated to promoting the benefits of using space science and technology and their applications to carry out the Plan of Implementation of the World Summit on Sustainable Development.[1] The initial series of three consecutive symposiums, held during the period 2003-2005, focused on water resources and sustainable water management (A/AC.105/844).

3. The second series of three symposiums, held during the period 2006-2008, focused on atmosphere-related issues. The first symposium of that series, held in September 2006, addressed the benefits of using space tools for monitoring air pollution and energy use for sustainable development (A/AC.105/877). Building on that event, the symposium held in September 2007 pursuant to General Assembly resolution 61/111 dealt with space tools and solutions for monitoring the atmosphere

[1] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, annex.

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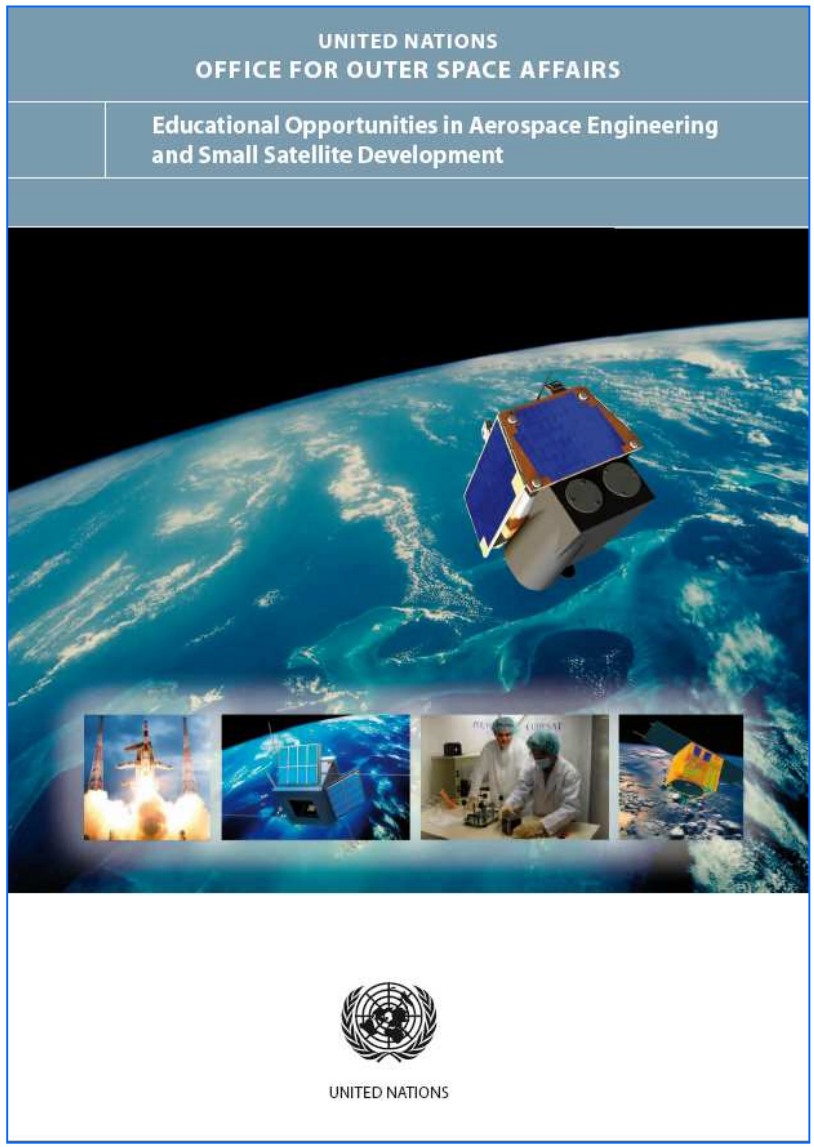
Please recycle

- Symposium report will be issued in the six official UN languages (Arabic, Chinese, English, French, Russian, Spanish)
- Includes observations and recommendations made by participants
- Reflects future plans for BSTI
- Submitted to UN Member States through UNCOPUOS and the UN General Assembly

II. Regional Space Technology Conferences

- Conferences are planned in the regions that correspond to the United Nations Economic Commissions:
  - Africa
  - Asia and the Pacific
  - Latin America and the Caribbean
  - Western Asia
- Objectives:
  - Address regional aspects of small satellite programmes and capacity building in basic space technology
  - Develop the Space Technology Education Curriculum in cooperation with educators and experts
  - Consider possible BSTI Pilot Projects
- These conferences will build on the outcomes of the UN/Austria/ESA series of Symposiums

III. Space Technology Education Curriculum



- A survey of world-wide academic programmes in aerospace engineering and small satellite development
- 250 academic institutions in more than 40 countries contacted and replies received from 43 academic institutions in 18 countries
- Published as UN publication ST/SPACE/53
- Available from http://www.unoosa.org/oosa/en/SAP/bsti/bsti-education/index.html
- BSTI will build on these contacts in the development of the Space Technology Education Curriculum

IV. Establishment of Fellowship Programmes

- United Nations/Japan Long-term Fellowship Programme, hosted by the Kyushu Institute of Technology at its Center for Nanosatellite Testing
- 3-year PhD programme ending with a doctorate degree in Nano-satellite Technologies (Doctor of Engineering) after successful thesis defense
- All cost (tuition, living cost, travel) covered by KIT and UN
- Application package will be available from
  http://www.unoosa.org/oosa/en/SAP/bsti/fellowship.html (for UN) and
  http://cent.ele.kyutech.ac.jp/index_e.php (for KIT)
- Application deadline: 30 April 2011, Start: October 2011

V. BSTI Projects

- BSTI can be used as a framework to implement regional or international projects related to capacity building in space technology

- Examples of projects being implemented:
  - Support to the HUMSAT Constellation Project (with University of Vigo, Spain)
  - Development of a Best Practices Handbook for Small Satellite Programmes (with International Space University)

SSP 2011 Team Project Small Satellites

TP Small Satellites

Introduction

The project team is tasked with creating a comprehensive guidebook to build and maintain the capability to perform space technology development through application of nano- and small spacecraft technology.

The guidebook shall contain advice and best practices on technical issues, cost-benefit and programme and project management considerations, infrastructure requirements as well as on regulatory (frequency allocation, satellite registration practices, space debris mitigation) and policy (international cooperation, technology transfer) aspects.

Background

Article 1 of the Outer Space Treaty states that "the exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind."

Establishing simple standards for nano- and small-satellite platforms, such as the CubeSat Standard, has enabled a growing number of organizations to develop, build and launch their own satellites. These organizations are increasingly also located in countries with limited means for expenditures for space activities and in countries that have previously only been passive users of space applications. The establishment of a basic capacity in space technology development, through measures such as the education and training of the necessary experts or the creation of the required testing and building infrastructure, is therefore becoming relevant to more and more countries. The United Nations, through its Programme on Space Applications, has recently embarked on the Basic Space Technology Initiative (BSTI), encompassing a set of activities aiming to assist these countries with their efforts.

As part of the BSTI, the United Nations intends to provide its Member States with a primer/best practices guidebook on establishing nano- and small satellite projects. Project team members should consider themselves as advisors to the BSTI in helping to prepare such a guidebook.

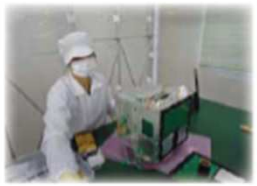
There is no universally agreed upon definition of the mass and size of nano- and small satellites, however, for the purpose of this project the project team shall focus on satellites with a mass of up to 50 kg. The guidebook may however include information on the options available and steps necessary to progress from the development of such smaller to larger-sized satellites.

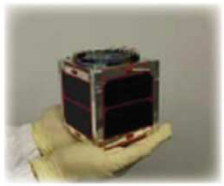
Objectives

Produce a high-quality guidebook with concise and comprehensive information, tools and techniques to enhance the use of nano- and small satellite projects for capacity building in space technology development, targeted to relevant decision makers in academia, industry and governmental organizations. Provide participants with the opportunity to contribute to the growth of space technology development throughout the globe and gain experience in interdisciplinary and international teamwork, while fostering skills in effective management of time and resources.

Tasks

1. Identify a feasible scope for the project and devise a team organization, outline and work plan required to deliver a high-quality guidebook consistent with the time and resources available (Letter of Intent, beginning of Week 6).





2. Collect and compile relevant information, best practices, tools and techniques on:
   - State-of-the-art applications and general (cost-) benefits of nano- and small satellite projects for capacity building in space technology development;
   - Infrastructure requirements for nano- and small satellite development projects;
   - Technical issues—design, development and operation of small spacecraft (platforms, payloads, ground stations, assemblies, components, equipment along with suppliers);
   - Programmatic, management issues (project management models, concurrent engineering, cost, schedule and risk issues);
   - Relevant regulatory issues (space law, satellite registration, frequency allocation, space debris mitigation guidelines, and others as required);
   - Standardization issues (standards for platforms, ground-stations, project and programme management, communication protocols, and interfaces);
   - Policy issues (nano- and small satellite development as part of an overall research and development strategy, modes of international cooperation and their benefits and drawbacks, technology transfer issues, industrialization, start-up opportunities, and related issues);
   - Available (open source) software, hardware, people along with other relevant tools;
   - Any other information considered relevant.
3. Present the above information in a comprehensive and concise manner, suitable for a quality guidebook.
4. Use the standard ISU template on format and references.

Additional Deliverables

(In addition to the project report and executive summary)

- Presentation for external review of the team project to the Third United Nations / Austria / European Space Agency Symposium on Small Satellite Programmes for Sustainable Development, to be held in Graz, Austria, from 13 to 16 September 2011.
- IAC Conference Paper for presentation at the 62nd International Astronautical Congress, to be held in Cape Town, South Africa, from 3 to 7 October 2011.
- Presentation of the team project to the 49th session of the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space, to be held in Vienna, Austria, in February 2012.

Suggested References

United Nations Basic Space Technology Initiative, http://www.unoosa.org/oosa/en/SAP/bsti/index.html.

Second United Nations/Austria/European Space Agency Symposium on Small Satellite Programmes for Sustainable Development: Payloads for Small Satellite Programmes, United Nations Document A/AC.105/983, December 2010, http://www.unoosa.org/oosa/en/SAP/act2010/graz/index.html.

CubeSat Website, http://www.cubesat.org/.

HUMSAT Website, http://www.humsat.org.

Space Mission Analysis and Design, Third Edition, Wertz and Larson, Microcosm Press.

Reducing Space Mission Cost, Larson and Wertz, Microcosm Press.

The Logic of Microspace - Technology and Management of Minimum-Cost Space Missions, Rick Fleeter, Microcosm Press.

UN Document Style Guide and the ISU Project Report Template.

Personnel

Co-Chair
Werner BALOGH
Austria

Co-Chair
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USA

Teaching Associate
Joshua NELSON
USA

Objectives

- SSP Team Project participants act as technical experts to BSTI.
- The project team is tasked with developing a **“primer/best practices manual” (guidebook)** for countries and institutions seeking to embark on using small- and nano-satellite projects to establish a basic capacity in space technology development.
- The manual is envisioned to contain advice and best practices on technical issues, programme and project management considerations as well as on regulatory (frequency allocation, satellite registration practices, space debris mitigation), legal and policy (international cooperation, technology transfer) aspects.

TP Report

- Potential Readers
  - Anyone interested in basic space technology development (academia, industry, NGO‘s …)
  - Government officials (COPUOS delegates, space agency representatives …)
  - R&D experts
  - …
- Format
  - ~ 100 pages
  - Should be complete but concise
  - Can be complemented by dedicated website/webpage
- TP Report is the actual TP product!

Possible TP Report Content I

- History, State-of-the-art applications and general (cost-) benefits of nano- and small satellite projects for capacity building in space technology development;
- Technical issues - design, development and operation of small spacecraft (platforms, payloads, ground stations, assemblies, components, equipment along with suppliers);
- Programmatic, management issues (project management models, concurrent engineering, cost, schedule and risk issues);
- Infrastructure requirements for nano- and small satellite development projects;
- Available (open source) software, hardware, other relevant tools;

Possible TP Report Content II

- Relevant regulatory issues (space law, satellite registration, frequency allocation, space debris mitigation guidelines, and others as required);
- Standardization issues (standards for platforms, ground-stations, project and programme management, communication protocols, and interfaces);
- Policy issues (nano- and small satellite development as part of an overall research and development strategy, modes of international cooperation and their benefits and drawbacks, technology transfer issues, industrialization, start-up opportunities, and related issues);
- Country examples;
- Any other information considered relevant.

SSP 2011 Team Project – Follow Up

- Presentation to the United Nations/Austria/European Space Agency Symposium on “Small Satellite Programs for Sustainable Development”, to be held in Graz, Austria, from 13-16 September 2011
- Presentation to the International Astronautical Congress 2011, to be held in Capetown, South Africa
- Presentation to the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) when it holds its sessions in 2012 in Vienna, Austria

After its review the Team Project report may be published and distributed as a UN-publication