

United Nations/ Austria Symposium

"Access to Space: Holistic Capacity-Building for the 21st Century"

Abstract Book

Venue: Institute of Communication Networks and Satellite Communications Graz, Austria

Graz, Austria, 3 – 7 September 2017

Organized by

The United Nations Office for Outer Space Affairs

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The Government of Austria

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Symposium Committees

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Objectives

This symposium is a flagship event towards UNISPACE+50 Thematic Priority 7 (TP7). Under TP7, the Office for Outer Space Affairs has started a pilot project on a Space for Development Profile (SDP), to create a profile of the space domain of countries, and a Space Solutions Compendium, to provide solutions to improve the indicators defined in the SDP.

The Symposium will be an opportunity to open a dialogue on TP7 to discuss innovative approaches to capacity-building in the space domain, particularly in the areas of policy, applications and technology, including the need to measure progress and development, identification of partners, tools for capacity-building and funding opportunities and aims at providing recommendations to COPUOS for UNISPACE+50 concerning this Thematic Priority.

The Symposium will deliver plans and identify required partnerships for consideration by the Committee on the Peaceful Uses of Outer Space for its strategy towards Space2030. Its objectives are to:

- 1. Identify innovative and effective approaches to overall capacity building;
- 2. Discuss infrastructure for cross-sectoral and integrated applications;
- 3. Enhance existing partnerships and forge new ones for capacity building and institutional support;
- 4. Promote participation of women and youth in space science;
- 5. Provide recommendations on the Space for Development Profile and Space Solutions Compendium;
- 6. Discuss the role of the regional centers for capacity building
- 7. Discuss the role of UNOOSA in implementing capacity building activities

For the SDP and SSC, the particular objectives are:

- Provide measurable indicators of space capabilities and space applications currently used in a country
- Enable the identification of long term plans for developing its space capabilities based on the indicators, targeting the needs of each country
- Support Result Based Management
- Offer a catalogue of solutions which can be used to enhance particular indicators

Expected Outputs and Contributions to UNISPACE+50

The outputs of the Symposium must help countries to equip themselves with the technical and policy capabilities to integrate space technology and applications in their strategic planning towards the 2030 Agenda for Sustainable Development. The UNISPACE+50 process shall provide recommendations on how to proceed with the implementation of this thematic priority.

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To this aim, the Space for Development Profile has to be accompanied by a collection of solutions specifically addressing capabilities in the areas of interest. For each indicator of the Space for Development Profile, the Space Solutions Compendium offers a set of possible solutions that can be applied to improve the future measurements of a particular indicator. The Symposium will discuss plans to design and build the Space for Development Profile and its associated Space Solutions Compendium.

2018: UNISPACE+50 years of space cooperation and development

UNISPACE+50 will take stock of the contributions of the three UNISPACE conferences (UNISPACE I, held in 1968, UNISPACE II, held in 1982 and UNISPACE III, held in 1999) to global space governance. In line with the 2030 Agenda for Sustainable Development and sustainable development goals, UNISPACE+50 aims to chart the future role of the Committee on the Peaceful Uses of Outer Space (COPUOS), its subsidiary bodies and the United Nations Office of Outer Space Affairs at a time of an evolving and more complex space agenda when more actors, both governmental and non-governmental, are increasingly involved in space activities. The activities of the United Nations Programme on Space Applications are an integral part of the UNISPACE+50 thematic cycle, contributing to space economy, space society, space accessibility and space diplomacy. More detailed information is available at the website of the Office for Outer Space Affairs:

http://www.unoosa.org/oosa/en/aboutus/history/unispace.html

The Symposium will deliver plans and identify required partnerships for consideration by the Committee on the Peaceful Uses of Outer Space for its strategy towards Space 2030. Additionally, it could consider the following issues for recommendations to UNISPACE+50:

- Recommendations for the way forward on the Space for Development Profile and Space Solutions Compendium based on the results of the pilot projects.
- Identify and propose new and innovative capacity-building approaches to UNISPACE+50, including recommendations on tools and means to be used, supporting a Result Based Management approach for capacity building.
- Propose holistic solutions on space capacity building encompassing from space law to space applications and technologies;
- Provide recommendations on partnerships for capacity building considering the existing ones and potential ones as identified during the symposium
- Provide recommendations specifically targeted at the promotion the participation of women and youth in space science
- Provide recommendations on the role of UNOOSA as institutional capacity-building organisation in developing countries upon request and in cooperation with developed countries

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Session 0

Tool and Technologies for Capacity-Building in the 21st Century

Moderator: Markus Woltran / Jorge Del Rio Vera Rapporteur: Yukiko Okumura / Hui Du

Sunday, 3 September 2017

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Capacity Building: A Comparison of International Collaboration at Two Different Levels

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ABSTRACT

Micro satellites capable of providing medium or low-resolution images are a preferred choice for several developing nations wanting to procure their first satellites with some form of technology transfer. Understandably, micro satellites within this class are not only able to provide useful images and a wider range of functionality but they also appear to be more representative of what is expected from national space agencies of these developing nations. Cubesats on the other hand, are a quick and cost effective means of building capacity because they are less complicated; subsystem goals are clearer and easier to achieve. Additionally, for technology-disadvantaged space emerging nations, cubesats introduces a more basic approach to technology transfer with higher returns from absorptivity standpoint. Surrey Satellite Technology Limited, TU Berlin and Astrium are amongst the leading companies providing technology transfer with micro satellites - mostly for national space agencies of emerging nations. Kyutech through its BIRDS-1 project – a joint multinational cooperation amongst five countries - launched a flock of five cubesats developed within its facility in Japan. Space agencies are often more funded than universities and are likely to adopt a more expensive microsatellites or higher for procurement along with transfer of technology. Universities would however, mostly opt for a less costly, less complicated and a short development time alternative as cubesats. This paper examines the capacity building potential of international collaboration at two different levels: national space agencies and universities with focus on interest protection and stakes between collaborating institutions and subsequent technology transfer validation for the recipient nation.

KEYWORDS: CAPACITY BUILDING COLLABORATION

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Session 1

Tool and Technologies for Capacity-Building in the 21st Century

> Moderator: Johannes Ortner Rapporteur: Hui Du

Monday, 4 September 2017

Leadership transformation – tools and approaches in international development cooperation

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ABSTRACT

Leadership is a personal choice and not embedded per se in an organization or an institutional body. Therefore capacity development for organizations needs to focus on individuals and transform first individuals before further changes can take place in organizational settings.

Navigating through the complexity and ambiguities that characterize today's world requires an adaptive mindset and solid leadership and decision-making skills. Today's leaders must be prepared to anticipate, analyse, and address complex challenges involving multiple stakeholders.

Yet, most leadership programmes in the UN and the public sector, if offered at all, focus on concrete skills or behaviors, in other words these are focused on how to do what we are already doing better, more consistently and with higher reliability. To support the changes in skills or behaviours, assessment tools such as MBTI, Hogan, FIRO-B are used to provide further insights into individual leaders' personality traits, characters and behaviors and what they think. Beyond this level, some leadership development tools and approaches focus on how leaders think, i.e. what is the cognitive structure of their mental models, how do the leaders make meaning of the world around them. In this sense, these programmes are transformational, as they transform the foundations of our meaning-making.

Transformational leadership means more than adjustments in current approaches to leadership. It requires a deeper questioning of the assumptions and beliefs that frame both problems and solutions and moving to a different way of thinking about the issues. The tools and approaches that can be applied to support a leader in her transition range from (1) transformational approaches that aim at deconstructing limiting beliefs and assumptions, across a set of (2) tools developing

complex adaptive skills to (3) tools on advanced technical skills built on new foundations.

The learning outcomes of such leadership development programmes are firstly increased awareness of leaders' about their own hidden and protected behavioural patterns and thinking (meaning-making) (Arbinger, 2010; Kegan & Lahey, 2009; Johnson, 1992). Once identified, leaders' learn to integrate their understanding of and their relationship to deep-rooted limitations. From this shifted mindset, a new foundation, they can gain solid leadership competencies to deal better with volatile, uncertain, complex and ambiguous world.

This process can be supported by cutting-edge leadership development tools:

The Lectical Decision Making Assessment (LDMA) is a leading online measurement instrument that identifies with precision where a person's current reasoning fits in the sequence of decision making development. It is evident that as managers and leaders get promoted from a specific, often technical background into more complex roles, they face new levels of complexity in decision making. The LDMA accurately assesses decision-making skills along six dimensions: (1) cognitive complexity, (2) perspective taking, seeking, and coordination, (3) collaborative capacity, (4) contextual thinking, (5) decision-making process, and (6) coherence. The precise assessment of the current stage of a person's reasoning allows also for defining the growth edges and thus where the leader will benefit most from developmental support.

The Leadership Circle (TLC) provides a comprehensive framework for using feedback to generate self-awareness that can strengthen creative competencies that drive leadership effectiveness. It goes further than most 360 tools. It analyses the deeper patterns underneath every day behavior in the workplace and makes the distinction between creative leadership competencies and reactive tendencies that hold leaders back. This enables leaders to identify their pathway for sustainable, effective change.

Working with hidden and protected patterns. Our reactive patterns are for most of us unconscious and often sabotaging our best intentions (Kegan & Lahey, 2009). Yet there are specific coaching methods to support leaders in in uncovering competing commitments or assumptions that are driving our reactive behaviors.

KEYWORDS: LEADERSHIP, TRANSFORMATION, DEVELOPMENT

Creating a dialogue platform between space and NGOs to enhance sustainable development: the case of Change Onlus in Madagascar

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ABSTRACT

Following the approval of the UN Agenda 2030 and in view of the upcoming UNISPACE+50, the European Space Policy Institute organized a dialogue platform in order for the Space community to set up innovative ways of working together with development user communities, with a focus on NGOs. When Space aims at truly supporting sustainable development efforts, its community should become more and more proactive in opening up new cooperation channels with the field, and this was the case in this context, where the United Nations Office for Outer Space Affairs, CNES and the European Space Agency were represented. All in all ESPI and these Space partners established an effective communication platform with various NGOs (Médecins Sans Frontières, SOS Children Villages, Change Onlus), private actors and financing institutions (Development Seeds, Erste Bank) and with Academia (University of Salzburg).

This activity aims at creating an holistic approach to the filling of user needs by the use of space technology and services, in line with the Sustainable Development Goals set in the UN Agenda 2030, and the case study of a small NGO, Change Onlus, presents this possible interaction between Space and field activities in Africa. NGOs are nowadays some of the key actors in the field for Sustainable Development, so the key question is how can Space be a concrete added value to these Organizations, providing the most appropriate solutions and reaping the maximum benefit of space-based infrastructures and applications.

As an example, the potential of GIS applications for the optima utilization of water resources and renewable energy is presented, in the context of a rural settlement in Madagascar where the NGO Change Onlus built and manages a hospital and supports the local community with nutrition and health programs. From the perspective of a small

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NGO, it is clear that Space can play an important role in its daily activities, particularly when a bottom-up perspective is the best approach in convincing larger, more powerful actors to intervene where local forces need help.

One of the clear benefits of building such a dialogue platform among the most relevant stakeholders is that all can contribute, sharing needs, experiences and know-how. This approach particularly benefits field actors and small NGOs that do not have the necessary resources to fully exploit the vast amount of useful space-derived data that is freely available today. For this reason, the involvement of intergovernmental organizations, space agencies and space-data service providers capable in filling this capacity gap is increasingly relevant and it represents one of the key recommendations in defining innovative ways for building capacity in the XXI century.

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The Open Universe Initiative

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ABSTRACT

"Open Universe" is an initiative under the auspices of the United Nations COPUOS with the objective of stimulating a large increase of the utilization of space science data (e.g. astrophysics, planetary science, cosmic rays), extending the potential of scientific discovery to new participants in all parts of the world. Open Universe was proposal by Italy at the 2016 COPUOS session where it was included among the activities in preparation of UNISPACE + 50, in line with the thematic priority "Capacity Building".

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THE DREAM CHASER[®] SPACECRAFT MISSION IN COOPERATION WITH THE UN

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ABSTRACT

The core business of the United Nations Office for Outer Space Affairs (UNOOSA) is to promote international cooperation of outer space to achieve developmental goals for the benefit of humankind.

Last year UNOOSA and Sierra Nevada Corporation signed a Memorandum of Understanding for organizing a Dream Chaser spacecraft mission that can to carry up to 35 experiments proposed by emerging space countries. The mission is slated to launch in late 2021 or early 2022 and Dream Chaser will be in orbit for two to three weeks.

The mission is part of the outreach activities to promote increased awareness among Member States of the benefits of utilizing space technology and its applications. This will support the UNOOSA capacity-building efforts worldwide in microgravity science education and research.

KEYWORDS: UNOOSA, SNC, DREAM CHASER

New Visions, Methods and Tools for Capacity-Building in the 21st Century

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ABSTRACT

It's commonly recognized that the space sector is currently entering into a new era. This is brought about by changes in technologies and in social and environmental conditions, such as the advent of digitalization, increased access to space data thanks to free, full and open data policies, and new key players from start-ups, private companies and NGOs to entire spacefaring nations. In this context, new disciplines and methodological approaches are converging towards new ways of conducting business and academic research, which open up new opportunities for the emergence of an holistic capacity-building scenario for all humankind.

In the space sector, such a scenario could open the doors to achieving a seamless chain of innovation and exploitation of space, distributed across the world thanks, for example, to digitalization, innovative manufacturing technologies and miniaturization of satellites. In this way, it could become possible for a vast majority of people to access space technology, conduct research and development, design, manufacture, assemble flight hardware, finally launching it to exploit the wealth of space data and services, that respond to the needs of their communities. The well established United Nations/Japan Cooperation Programme on CubeSat Deployment from the International Space Station (ISS) Japanese Experiment Module (Kibo) "KiboCUBE", already provides developing countries the unique opportunity to deploy, from the ISS Kibo, cube satellites (CubeSats) which they develop and manufacture.

This enhanced networked and decentralized model, which includes CubeSats concurrent design, additive layer manufacturing, "KiboCUBE" launch and operations, could be initially implemented and validated through the Regional Centres for Space Science and Technology Education which are affiliated to the United Nations. These centres are uniquely positioned to engage in synergistic

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partnerships with space agencies and industries to share design best practices, convey specific needs and requirements and identify existing matching space solutions. This could further the potential for economic growth and sustainable development in the regions covered, which could benefit from technology spin-offs, a larger number of educated young people, the availability of key services in the agricultural sector, in natural resources management, in e-health and tele-epidemiology domains, ensuring a more sustainable living for all on this planet. For the longer term, improved connectivity in rural and under-served areas could extend these opportunities to both schools and universities, which could start with co-creating and delivering dedicated Massive Open Online Courses (MOOCs) in order to enhance STEM education opportunities for the younger generations. Space Agencies, Intergovernmental Organizations, Academia and Industry, thanks to their access to advanced space know-how, could sponsor and contribute to the creation of these innovative interdisciplinary curricula, thereby preparing more citizens to fully exploit the benefits arising from innovation, space technologies and data. This new approach is fully aligned with the objectives of the UN Agenda 2030 and could contribute to the achievement of a substantial number of sustainable development goals, while also addressing thematic priority 7 of UNISPACE +50.

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Session 2 UNISPACE+50 Panel Discussion

Moderator: Otto Koudelka / Irmgard Marboe Rapporteur: Markus Woltran / Jorge Del Rio Vera

Monday, 4 September 2017

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Panel Discussion There are no abstracts for this session

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Session 3 Infrastructure for Capacity-Building

Moderator: Jorge Del Rio Vera Rapporteur: Yukiko Okumura

Tuesday, 5 September 2017

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Three decades of '3i's space education – the International Space University at 30

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ABSTRACT

In 1987, the International Space University (ISU) was founded as an institution of higher learning, dedicated to the development of outer space for peaceful purposes through an international, intercultural and interdisciplinary approach - the '3Is'. Starting from its Space Studies Program (SSP), a professional development program that has been held annually every summer since 1988 at different locations around the world, ISU now operates from its central campus in Strasbourg, France and offers Master of Science in Space Studies (MSS), as well as other professional development programs such as the Executive Space Course and the Southern Hemisphere Space Studies Program. There are now more 4000 ISU alumni from more than 100 countries, while ISU faculty members include astronauts, space agency leaders, space engineers, space scientists, managers, and experts in space law and policy comprising an international collection of experts in technical and non-technical space-related fields.

Investments in Space are made on Earth but can developing countries reap the benefit?

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ABSTRACT

It is often said that investments in space are made on earth but can developing countries really benefit from investing in space science and technology. For developing countries to significantly change the trajectory of economic development, they need to invest in advancing the knowledge economy. The knowledge economy requires investment in skilled individuals, research institutions, interrelationships and an innovation ecosystem.

In order for South Africa, and other developing countries, to achieve economic growth and participate in global trade, it is important for the countries to build knowledge intensive industries and reduce dependence on the resource economy. Space is considered as one of the most knowledge intensive industries, which pushes the boundaries of knowledge, skills and innovation.

South Africa has had a long history with space science and technology dating back to the early 1960s, even though the investment hasn't remained consistent through the transition to a democratic government. This has allowed the country to tap into the existing heritage and local capabilities to revive its space program.

This presentation will review the approach adopted by two projects, the Sumbandila satellite project and the MeerKAT telescope projects. Sumbandila is South Africa second micro-satellite launched in 2009 and MeerKAT is the technology demonstrator, currently being built in South as part of the ambitious global SKA radio telescope. Both projects, to some degree, incorporated all four aspects of skilling individuals, institutional capacity, interrelationships and an innovation ecosystem. The presentation will outline the structure of both projects, present some qualitative outcomes and summarise lessons learned.

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Proposed Infrastructure and Development Facilities at Nagpur, India Aimed at Facilitating Global Capacity Building and Access to Satellite Technology Including Design and Construction of Small Satellites To Serve the Needs of UN Member States, and To Support UNISPACE+50 & 2030 Agenda

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ABSTRACT

With the emergence of new approaches in satellite design and construction, specifically small satellites, added with new and increasing number of space actors at all levels; the space and user community worldwide is seeking requisite infrastructure to support new initiatives and new concepts for improved delivery of space-based data and capacity building. Furthermore, the UN-OOSA HLF (UN A/AC.105/1129), identified the need and benefits of space accessibility and development facilities for the benefit of humanity; to enhance access to space and its assets for scientific and commercial endeavours by joining a global public-private partnership (PPP) effort in the development of the global space sector and to serve the 2030 Agenda for Sustainable Development. The International CANEUS Organization is dedicated to serve the socio-economic needs and bridge the gap between the "haves" and "have-nots" for emerging space technology solutions through coordinated and shared approach. India is one of the leading nations in space technology and its commitment to use the technology for socio economic development is second to none. The eco-system offered by India is best suited to help fulfil the objectives set by UN-OOSA under UNISPACE +50 programme. The proposed initiative supported by the State of Maharashtra under the 'Make in India' programme of Government of India envisioned by the Prime Minister of India, proposes unique infrastructure and development facilities in MIHAN, Nagpur region. This historical initiative is aimed at facilitating Global capacity building and access to

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satellite technologies including design and construction of small satellites to serve the needs of UN Member States in preparation of UNISPACE+50. The development facility will support a broad cross section of stakeholders, e.g. agencies, small & medium enterprises, educational institutions for the design and development of both the component / sub-systems as well assembly, integration, test, and handson training of small satellites for range of applications covering Agriculture, Disaster management, Environment, Transport & Logistics, Maritime and socio-economic applications to support their local and regional needs. It aims at enabling developing countries to use space based technologies to achieve targets of Sustainable Development Goals (SDGs), Sendai Framework and Climate Change Agreement. The development facility will offer capacity-building services for research, development, demonstration of affordable, adaptable, sustainable and scalable small satellites with payloads customized to the needs of the developing countries. Each satellite produced at this facility is a potential contributor to a bigger constellation, coordinated by UNOOSA, thus offering much more to the end user than just a satellite. Therefore, the proposed infrastructure and development facilities is a milestone opportunity for contribution and relevance to "UNISPACE+50" and "2030 Agenda" to further demonstrate the broad societal benefits of space as an area of innovation, inspiration, interconnectedness, integration and investment, and to strengthen unified efforts at all levels and among all relevant stakeholders of the space sector in addressing the overarching longterm development concerns of society, with concrete deliverables pertaining to space for development. This presentation will outline the project plans and partnership efforts from stakeholders to ensure that all the goals are met in time bound manner. It will raise awareness, provide advisory and contribute to capacity building efforts targeted to benefit developing countries and world community at large.

KEYWORDS: SMALL SATELLITES; INFRASTRUCTURE AND DEVELOPMENT FACILITIES; CAPACITY BUILDING

Availability of Space Science and Technology infrastructure in Africa

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ABSTRACT

Many African countries have their space agencies and space programmes. Few of them have managed to put spacecrafts on orbit. Many have space physics programmes. Most of them have satellite remote sensing centres. And considerable amount of them have cubesat projects at universities and research centre. But how many of them have built capacity capable of running these space activities? How many of them are really contributing to the knowledge? What is the size of infrastructure that is available in Africa now weather it was space laboratories, ground stations, observatories, etc. And where does Africa go for capacity building in the fields of space science and technology? This paper tries to answer these questions by conducting a survey that captures these information, targeting the African countries with most records related to space science and technology, for example South Africa, Egypt, Nigeria, Algeria, Ethiopia, and others.

Developing the Space Workforce through LEAP2 and LCATS Industry Clusters and International Student Exchange

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ABSTRACT

Industry clusters, considered the building blocks of modern economies is an economic concept used to identify and define the geospatial density, growth and network behavior associated with innovation and economic performance. Our research uses cluster analysis related to Space-STEM education and space-industry to identify aerospace system-sector industry clusters and factors on a global scale related to Lunar Site Technology Development. The goal is to document and encourage space-industry cluster network development, facilitating space-STEM workforce and economic development for communities, based on technologies relevant to particular community areas of interest and aerospace resources.

Initial cluster network participants identified for system-sector component technologies needed for lunar exploration architecture include: Satellite Communications (Mexico), Mission Operations (Germany and Italy), ISRU Vacuum Chamber Test Environment (Korea), and Lunar Ecosystem and Architectural Prototype development (United States). Program participation is underway through the LCATS and LEAP2 Global Space-STEM Education Network project, a Lunar Caves Analog Test Sites (LCATS) for Space-STEM learning performance, featuring a Lunar Ecosystem and Architectural Prototype (LEAP2) as a framework for technology development.

To expand the LCATS and LEAP2 initiative, our research seeks to identify, map, and analyze additional potential collaborating corporate, industry and governmental agency players representing other systemsector components needed for lunar site development. Aspects examined include local, regional, and international factors from the perspective of evolving a global space-STEM education network beneficial to the local community of the collaborating organization relevant to their expertise in system-sector component development.

Expertise sought includes mining and energy generation; food and waste processing; water production for fuels; vehicles and equipment systems, and logistics, to name a few.

As a practical implementation of this effort, a Lunar Caves Analog Test Sites-Student Exchange Program (LCATS-SEP) is in development between current system-sector program participants. Anticipated types of program experiences and products for student exchange in this global network of LEAP2/LCATS Space-STEM communities include: - Year 1 student summer program in Seoul, South Korea for In-Situ Resource Utilization (ISRU), testing excavation methods and 3D printed habitat technologies, robotics, and drilling.

- Year 2 student summer program in Europe, choice of mission control operations in Darmstadt, Germany or mission simulation and performance skills in cave environment in Sardinia, Italy.

- Year 3 student summer program in Mexico learning about satellite communications and lunar communication architectures.

- Years 1 - 3, international students from partner international organizations join US students in San Antonio, Texas, USA, for summer program to build CubeSat satellites which will be launched from the International Space Station.

Anticipated outcomes for student involvement include:

- Attitudes toward STEM and STEM careers
- Increase in knowledge & skills: Space-STEM concepts/challenges
- Robot programming/operation
- Written & oral communication
- Collaboration between teams and international participants
- Critical thinking, problem solving, creativity, & innovation

Space exploration and space science are typically international endeavors often involving multiple countries and international space agencies. Anticipated project goals, objectives, and intended outcomes for LCATS-SEP are to demonstrate to our students the value of international collaboration, which is so prevalent in our industry for many space exploration missions. The understanding of space is a global concern, requiring multi-level international collaborations for optimal success. Through our project-based learning experiences, we can help build a robust, multi-generational, international space workforce for the future. Collaboration between communities with international exchange programs can change students' lives by opening their eyes to different ways of doing things, and that the friendships students make abroad promote the cause of international cooperation and world peace.

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KEYWORDS: STEM; STUDENT EXCHANGE; SPACE WORKFORCE

ICE CUBES – International Commercial Experiment Cubes establishing a fast-track, simple and affordable access service for small experiments to the International Space Station bringing a great asset and innovative approach for capacity building and allowing to bring access to space to the broad community

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ABSTRACT

The International Space Station (ISS) is a great international achievement, designed as a flexible laboratory able to support science in a range of disciplines. However making use of the ISS is still not attractive for a large number of potential users, due to the burden of complex rules, procedures and duration associated. The International Commercial Experiment Cubes (ICE Cubes) service is providing fast-track, simplified, affordable access to the ISS under a public/private partnership with ESA, creating opportunities by enabling any organisation, public or private entity or individual to perform experiments on the ISS.

The ICE Cubes service is particularly suited for:
Fundamental or applied research,
University studies (Bachelor, Master and Doctoral theses),
Technology Readiness Level enhancement of components,
In-orbit testing and validation of technologies,
Science, Technology, Engineering and Mathematics (STEN)

•Science, Technology, Engineering and Mathematics (STEM) education.

The ICE Cubes service supports the process of experiment development and takes care of flight certification, launch and installation on board. Once the experiment is installed in the ICE Cubes Facility the user can operate it from his home base via internet. Customers will develop their own Experiment Cubes according to a specific set of interface and safety requirement documents. They will remain owners of their experiments and results.

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The service includes:

As much or as little customer support as needed, throughout experiment development, flight readiness certification, launch and support to the operation of the experiment.
An out-of-the-box installable ground monitoring and control software to allow access for the customers to their experiments.
Market driven development of additional added-value miniaturised equipment and facilities.

As such the ICE Cubes service provides for a very appealing asset and innovative approach for capacity building by providing access to space for the broad community.

The importance of infrastructure in Capacity-Building to perform Space-Related projects in Iran

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ABSTRACT

Iran, as one of the countries in Middle-East with the area of 1,648,195 Sqkm, around 80 million population and 5 million university scholars is located in transactional region. According to the World Bank report, Iran is the second largest economy in Middle-East. Environmental challenges which Iran is prone to are: Drought andWater Deficiency, Dust and Sand Storm, Low Productivity of Agricultural fields, Desertification and Deforestation, Unauthorized Construction and Air Pollution. Capacity-building as an effective way to elevate the level of knowledge in space-based technologies in order to diminish the harmful effects of such challenges, needs properly defined nfrastructures. In this research the application of three methods of Capacity –Building will be examined as follows.

Human capacity building; refers to the education and training of individuals to be aware of,

Infrastructure capacity building is related to establish an environment to work,

Institutional Infrastructure capacity building is related to establish an environment to work,

the hardware, software and other technology required to access, use and develop data and products for decision making Institutional capacity building; focused on developing and fostering an environment to enhance decision making. This includes building policies, programs and organizational structures in governments and organizations Iran has an important potential including natural, cultural and human resources. The country has a growing interest and investment in the fields of space. This presentation will review the situation of Iran, the challenges which the country is facing, the ways and means to tackle them and to improve the space-based projects with establishing appropriate infrastructures.

KEYWORDS: CAPACITY-BUILDING, INFRASTRUCTURE

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The First Kenya University NanoSatellite 1KUNS-PF: capacity building using the KiboCube launch opportunity

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ABSTRACT

Nanosatellites proved to be an effective and affordable tool for handson education in several Universities around the world. The Cubesat standard allows to use standardized commercial of the shelf components, reducing the development time and launch cost. Cubesats have in particular tremendous potential for personnel training and capacity building in space technology.

An initiative in this field is the program 1KUNS-PF (1st Kenya University Nano-Satellite), a jointed program among the Italian Space Agency (ASI), Università di Roma "La Sapienza" and University of Nairobi, which has been selected for launch aboard the ISS in the framework of the UNOOSA/JAXA KiboCube program.

The paper will review the status of the program, focusing on the satellite design, manufacturing, testing and preparation for launch, including all the relevant education and capacity building aspects.

The main goal of the program is to establish a frame for space technology growth in Kenya at an academic level, in view of future developments which might involve Kenyan institutions and industries. The partnership between Italy and Kenya on space activities dates back to the sixties, when the San Marco program was established by Italian

institutions at the facility today named Broglio Space Center, in Malindi.

University of Roma "La Sapienza" has a long tradition in the field of small satellites and has been recently involved in several student satellite activities, including Cubesats. For example the Cubesat URSA MAIOR, partially funded by ASI, is under development and scheduled for launch next year in the framework of the QB50 program.

The School of Engineering of University of Nairobi has experience in relevant field of engineering, which can be specialized to satellite applications within the 1KUNS-PF program.

A fully functional Cubesathas been developed as a research and education activity, with strong involvement of bachelor's master's and PhD level students from Italy and Kenya. The satellite design will take advantage of the expertise developed at Università di Roma "La Sapienza", with an active participation of professors and students at University of Nairobi.

A special Jointed Postgraduate Course in "Space Mission Design and Management" was established as a academic collaboration between Sapienza and University of Nairobi, in which student of both nations enroll and work together on the satellite, while conducting their regular studies. The Postgraduate Course is to international students, with the relevant participation of professors from African institutions.

A student and University personnel exchange program has been set up along with the technical cooperation program. The activity will be managed by meetings, seminars, video-conference tools and telematics exchange of documents.

This program represents a valuable example of an extensive international cooperation, with the direct involvement of institution such as: Kenya National Space Secretariat, UNOOSA, JAXA, ASI, besides the academic institutions. The role and support of each will be highlighted; showing how capacity building in space activity can be obtained thanks to the cooperation of relevant interested actors.

KEYWORDS: KIBOCUBE PROGRAM; HANDS-ON EDUCATION; CAPACITY BUILDING

The Overview development of Ghana First Satellite, GHANASAT-1

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ABSTRACT

Ghanasat-1 is a collaborative project under the Birds Project initiated by the management of Laboratory of Spacecraft Environment Interaction Engineering at Kyushu Institute of Technology (LaSEINE, Kyutech) in Japan. Birds Project was established to provide hands-on training to Kyutech international students from non-space faring countries to learn about the whole satellite development process from satellite mission planning to satellite disposal. Moreover, the project also serves as catalyst to create an international human network to help develop and sustain indigenous space program in the different nations taking part in Birds. Ghanasat-1 CubeSat was developed by three Ghanaian students at Kyutech and was fully sponsored by the management of All Nations University College in Ghana. The Ghanasat-1 project started on October 2015 and completed all development phases on January 2017. The development phases of the satellite were reviewed by JAXA safety and management teams as well as Kyutech peers in satellite engineering to ensure the CubeSat satisfy both launch and space environment requirements. Ghanasat-1 is scheduled to be deployed from the International Space Station (ISS) under the JAXA/Kibo Cubesat Deployment Programme on July 6, 2017, after the successful launch of SpaceX falcon 9 Cargo Launch to the ISS on June 1, 2017. Ghanasat-1 is a 1U CubeSat with a mass of 1.12kg.The main mission of Ghanasat-1 is to take a picture of the coastal belt of Ghana. In addition to the main mission, there are two secondary missions: 1) digi-singer, which aims at sending voice data from space and will be used for outreach to raise awareness about satellites, their utilization, and their benefit to society; 2) Single Event Latch-up mission to investigate the radiation effects on commercial-off-the-shelf microprocessors, whose data will be used to contribute to scientific research on the topic. Ghanasat-1 will communicate with Earth ground stations using amateur VHF and UHF bands with a data rate of 1200bps and 9600bps for downlink. In this paper,

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the authors will present the challenges encountered during the development phases, the lessons learned, the positive impacts Ghanasat-1 could provide to Ghanaian space researchers, and the way forward for the establishment of sustainable space programs in Ghana.

KEYWORDS: GHANASAT-1; CUBESAT; BIRDS PROJECT

Nanosatellites for Technological and Science Mission

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ABSTRACT

Nanosatellite missions and constellations of nanosatellites have gained substantial momentum in recent years. CubeSats/nanosatellites in the beginning were geared at education, allowing students to be involved in all phases of Space projects. Now they are considered by industry and Space agencies as means to demonstrate and validate in orbit novel technologies at low cost and within short time scales. Companies, particularly in the US, already operate large constellations of nanosatellites for commercial applications such as remote sensing or radio signal monitoring from Space. Internet giants like Google and Facebook are investing in constellations of small satellites to provide global Internet access. AIRBUS is already building the first batch of small satellites (though not in the nanosatellite class) for OneWeb.

For professional missions key questions arise with respect to performance, reliability and lifetime of a small, inexpensive spacecraft which uses COTS components instead of space-qualified electronics.

TU Graz has been successfully operating a nanosatellite for more than four years, called TUGSAT-1/BRITE-Austria. This spacecraft measures the brightness variations of massive luminous stars. It has been originally designed for a two year's mission, but current assessment of the spacecraft performance indicates that the mission can be extended by at least two more years. A remarkable achievement of the mission is that three-axis fine pointing could be consistently achieved below 1 arcminute.

Within the framework of an ESA project, called OPS-SAT, TU Graz is responsible for the development of a technological-oriented nanosatellite. It has the purpose to demonstrate novel operational procedures and allows on-board hardware and software experiments, among them optical communications, radio signal monitoring, camera and attitude control experiments. A new ESA project, called PRETTY, is based on the OPS-SAT technology and will demonstrate altimetry

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(using GNSS signals) and measure the radiation environment in the LEO orbit.

The presentation will introduce these missions, their applications and results of the BRITE mission. It will also discuss the PA/QA and testing approach.
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Session 4

Workshop on UNOOSA Pilot Project on Space for Development Profile and Space Solutions Compendium

> Moderator: Luc St-Pierre Rapporteur: Hui Du

Tuesday, 5 September 2017

Space for Development Profile and Space Solutions Compendium: Pilot Project Results and Lessons Learnt

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ABSTRACT

The Fiftieth anniversary of the first global United Nations Conference on the Exploration and Peaceful Uses of Outer Space, held in Vienna in August 1968, will be marked in 2018 by UNISPACE+50, an ambitious Committee undertaking to consider the current status and define the future role of the Committee, its subsidiary bodies and the United Nations Office for Outer Space Affairs (UNOOSA) in promoting international cooperation in peaceful uses of outer space and in shaping global governance of space activities. In preparation for the event, the Committee endorsed in 2016 the seven UNISPACE+50 thematic priorities. Activities under Thematic Priority 7 (Capacity building for the 21st Century) must help governments to equip themselves with the technical and policy capabilities to integrate space technology and applications in their strategic planning towards the 2030 Agenda for Sustainable Development and to the Space2030. Building on the concepts of 'Space Capacity Index' and 'Space Solutions Compendium' - presented at the IAF 67th in Guadalajara -UNOOSA has developed prototypes of the Space for Development Profile (SDP) and Space Solutions Compendium (SSC) to this aim.

The SDP consists of a set of indicators, based on the four pillars defined in the Dubai declaration adopted at the first High Level Forum on Space as a driver for socio-economic sustainable development. Measuring this set of indicators results in a country profile on 'space development'. The set of generic indicators is fixed, but can be expanded on a country basis, to monitor priority areas tailored to the country's development strategy and needs. This work is done in collaboration with each country. The benefit for the country is to have a synoptic view on space development, tailored to the country needs, being a tool to create and develop space development strategies and contributing to the Sustainable Development Goals.

However, measuring the indicators is not enough to improve them. Tailored solutions have to be identified and applied to improve the

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reality reflected by the indicator. Therefore, the SDP has to be accompanied by a collection of solutions, the SSC, addressing capabilities in the priority areas identified by the country. For each indicator of the SDP, the SSC offers a set of possible solutions that can be applied. The SSC lists the providers offering a solution that could contribute to the improvement of the value of a given indicator. UNOOSA will present the results of the pilot project on SDP and SSC.

KEYWORDS: SPACE FOR DEVELOPMENT PROFILE; SPACE SOLUTIONS COMPENDIUM, UNISPACE+50, CAPACITY-BUILDING

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ESA CATALOGUE OF ACTIVITIES SUPPORTING UN SDGS

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ABSTRACT

Space programmes and activities are supporting, since decades, challenges on Earth. In September 2015, the European Space Agency (ESA) decided to develop the knowledge and understanding on how its projects and activities were supporting and could support in the future the UN 17 Sustainable Development Goals (SDG) that were just adopted. Indeed, many can support at least one, if not more of the SDGs and it is not often known. This project was seen as a first step towards the establishment of a world database in support of SDGs.

In order to give an idea to the stakeholders on what type of projects could be considered, a draft catalogue was published on the web end November 2016. In parallel, discussions started with UNOOSA as it appeared that it had a similar project with the Space Solutions Compendium proposed.

Work is now on its way to build the full database of relevant projects and activities, to be seen as the seed of the Compendium. Today some 600 examples have been identified, solely based on ESA activities. The examples include of course the traditional services and applications, but also technologies, technology transfer or methods.

The concept behind the ESA catalogue supporting the UN 17 Sustainable Development Goals and the process followed will be presented and examples will be given to illustrate how it has been built and can be used.

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2Mp Education Program from Argentinian Space Agency: Spatial Technology as a learning tool for children and young people

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ABSTRACT

In the framework of the National Space Plan 2004-2015 of the National Commission for Space Activities of the Argentina, it was created the "2Mp Program" with the objective of to get available the satellite technology for 2 million children (pibes). Development of the Program is intended that students from 8 years of schools in our country know, have access to and use the information of satellite origin, and can apply it in future to the activities they develop in their daily lives.

The 2Mp Program begins with the concept that satellite imagery is a powerful tool to expand the scope of knowledge about many topics. In this way, it is considered essential that the students who are currently training use and know these tools through the school and then transfer it to other areas of their life or their professional field.

Strategy: Integral Educational Proposal.

As a strategy, to fulfill the objective of the Program, a series of activities are framed in the following Integral Educational Proposal:

1) Development of didactic resources and geospatial software for the handling and processing of satellite information.

The 2Mp Program develops geospatial software designed as environments where teachers can generate and develop teaching proposals that incorporate satellite technology in a meaningful way. They can be included in all levels of education, with a professionalproductive projection.

To this end, a family of software is currently being developed, consisting of two computer applications: Software 2Mp and SoPI, the first one fundamentally for the primary level or first years of medium level and the second for more advanced users: middle school specializations, technical institutes and universities.

In addition, considering the content that teachers deal with in schools, the selection and preparation of satellite information is done so that

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they can incorporate this source of information into their teaching proposals. Some examples: Deforestation, climate change, environmental emergencies, etc.

(https://2mp.conae.gov.ar/index.php/materiales-educativos/materialeducativo/modulos-tematicos).

2) Activities in schools, teacher's Institutes and universities.

From these activities we seek to obtain a feedback from the Program's beneficiaries (students-teachers), testing the materials and software designed in order to evaluate and update them.

The activities are grouped in the following spectrum of proposals:

- □ Associated Schools.
- □ *Reference Schools*.
- □ Project Schools.

 \Box 2Mp Agro Schools: Its purpose is to train future technicians and professionals of the agricultural sector in the application of geospatial technologies in the agricultural, livestock and forestry industries.

 \Box *Mission SAE* (Probe of educational application). Its purpose is to introduce students and teachers of technical schools in the main concepts of satellite engineering (https://2mp.conae.gov.ar/index.php/mision-sae-detalle).

3) Teacher Training and articulation with teams of replicators.

These are work instances aimed at training in remote sensing and transfer the experiences developed to new actors who can assume the implementation of satellite technology in their teaching practices. Inperson and distance courses are taught through the 2Mp online platform (https://2mp.conae.gov.ar/aulavirtual/).

2Mp Program Website (https://2mp.conae.gov.ar/)

In 2Mp Program Website, it is offered all activities, training and materials in a free way to the entire user community.

Participation in courses and activities are free and are made through open calls to the entire educational community.

Data related to the 2Mp Program scope:

 \Box Amount of students which have been working in some of the activities that the Program offers: **162.137** (indirect estimation were calculated that shows the number is 300.000).

 \Box Amount of teachers which have been participating in some of the training that the Program offers: **11.748**.

 \Box Amount of schools which have been enrolling in some of the activities that the Program offers: 3.344.

□ 2Mp Program Website suscriptors: 20.716.

□ 2Mp Software installations (expected users with access to 2Mp Software): **3.454.968.**

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KEYWORDS: 2MP PROGRAM; SATELLITE INFORMATION; TEACHER TRAINING

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Session 5

Cross-Cutting Aspects of Capacity-Building

Moderator: Irmgard Marboe Rapporteur: Yukiko Okumura

Tuesday, 5 September 2017

CEOS Working Group on Capacity Building and Data Democracy (WGCapD) Initiatives: Lessons Learned and Best Practices

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ABSTRACT

The Committee on Earth Observation Satellites (CEOS) was established in September, 1984 for coordinating international civil space-based Earth observation programs and promoting exchange of data to optimize societal benefit and inform decision making, securing a prosperous and sustainable future for humankind efforts to benefit society. One of its working groups, the WGCapD (Working Group on Capacity Building and Data Democracy), formed at the 25th CEOS Plenary in 2011, undertakes a variety of activities based on the four pillars of the Data Democracy Initiative Mission and aims to unify CEOS efforts toward:

• Providing wider and easier access to Earth Observation data;

• Increasing the sharing of software tools such as the use of open source software and open systems interface;

• Increasing data dissemination capabilities and transferring relevant technologies to end users;

• Providing intensive capacity building, education, and training (including building awareness & outreach and building skills) for enabling end users to gather the information they need and for increasing communication on achieved results.

Over the past 6 years, a number of capacity building initiatives having been carried out by WGCapD, aimed at effective using Earth Observation data as well as providing wider and easier access to those data. The objective of this paper is to present an overview of the lessons learned and share best practices from all these activities for capacity development, online (short and long-term courses, as well as webinars) and onsite (workshops and seminars).

KEYWORDS: BEST PRACTICES; ONLINE & ONSITE EDUCATION AND TRAINING

"Reducing the Digital Gap and vulnerability of indigenous communities by using Satellite communication" (Euro Solar, Study case of Nicaragua)

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ABSTRACT

The use of information and communications technologies (ICT) for health and development has many facets, including e-Learning, health information, e-business, and tele-health are already playing an important role in this area. However, still exists an enormous gaps in ICT access not only between developed and developing countries, but also between urban and rural areas of developing countries. EURO SOLAR a pioneering global initiative funded by the European Commision's EuropeAid Cooperation Office was focused on the eight poorest countries in Latin America; Its main objective is the development of 600 electrification kits, including a satellite Antena receiver for VoIP and internet access in rural settlements of Central and South America, These kits are used by the communities in a broad range of applications, in telephony, education, health, and in accessing information to promote the sustainable development of these rural communities. The lessons learned from Nicaragua will be presented as a study case from this regional initiative.

KEYWORDS: ICT; RENEWABLE ENERGY; DEVELOPING COUNTRIES; SOCIAL INCLUSION; RURAL COMMUNITIES

Using Online Social Media Channels

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ABSTRACT

How does CERN use social media to make science publicly appealing? What lessons have we learned along the way?

CERN has been using social media since 2007 and evaluating our impact has become more and more important. In 2016, we co-published a paper detailing how CERN's social media drives public engagement with particle physics and cultivates support.

We have communicated not only the latest advancements in particle physics but also showcased the people behind the science with two 2016 campaigns (#InTheory and #InPractice), profiling theoretical and experimental physicists. New social media techniques were trialed and evaluated: 360 photos and videos, portraits and quotes, Instagram grids and Instagram stories.

The European Particle Physics Communication Network (EPPCN) has also now integrated social media into its communication strategy, and CERN works closely with representatives across the network to increase visibility of worldwide particle physics research.

Analysis is an important part of managing CERN's presence on social media, in order to know the audience and be aware of its expectations. We want to share with you our latest findings, show how they have helped us and how they could also help your organisations.

KEYWORDS: SOCIAL MEDIA, COMMUNICATION

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Utilizing the Full Potential of Space for the Implementation of the Europe 2020 Strategy in the Field of Education

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ABSTRACT

This report summarizes what is being done and identifies what more the space sector can potentially do to help attain the goals of the EU growth strategy "Europe 2020 for smart, sustainable and inclusive growth" in the fundamental policy area of education. The presentation of the multiple links between space activities and education shows the economic and social utility of space. In the first chapter, the report demonstrates the potential of underused space educational resources to support the attractiveness of STEM subjects in schools and presents ESA's most important educational programme, ESERO. In the second chapter, the report analyses the multiple ways in which space can help in achieving the "Europe 2020" targets in tertiary education. It demonstrates that through the decisive contribution of space to the attainment of the Strategy's target for universal broadband coverage, space technology creates the technical prerequisites for the utilization of distance education in all European regions, thus also supporting Europe's territorial cohesion. In addition, because of their iconic and fascinating nature, space activities can motivate youth (including under-represented groups) towards the acquisition of those skills that a 'smart economy' needs most. In sum, through its interaction with higher education, the space sector can make a vital contribution to the quality and the relevance of Europe's educational efforts.

KEYWORDS: EDUCATION; STEM; ASTRONAUTICS

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Session 6

Workshop on Specific Tools for Space Law Capacity-Building

Moderator: Peter Stubbe Rapporteur: Jorge Del Rio Vera

Wednesday, 6 September 2017

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Overview of UNOOSA capacity-building in space law and policy

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ABSTRACT

The presentation will provide an orientation of the programme of the Office dedicated to capacity-building in space law and policy. The presentation will address the series of United Nations Space Law Workshops organized together with Member States over the past decade. It will also address certain aspects on technical-legal assistance and other capacity-building efforts by the Office either being undertaken or under development. There is a strong connection between those activities and the objectives of UNISPACE+50, in particular of the thematic priorities on the legal regime of outer space and on capacity-building for the 21st century, respectively.

KEYWORDS: UNISPACE+50, CAPACITY BUILDING; SPACE LAW; COPUOS

Endeavours for a Renewed Capacity Building in Space Law for the Space Agenda 2030

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ABSTRACT

Capacity building in Space Law would unquestionably have a positive impact on achieving the goals of the thematic priority Nr. 2 of UNISPACE +50. A universal understanding of the international legal regime governing outer space activities would allow better opportunities to assess the state of affairs of those treaties and their relationship with other relevant international instruments and to promote a wider adherence to them.

In addition, a better understanding of what space law is and how it should be applied will be very helpful in developing national legal systems as tools to help fully realize the benefits that space activities and their applications can bring to society and, in turn, achieve the goals of sustainable development. This is particularly important in developing countries, where space legislation is still at a very early stage.

The multilateral work of the UN bodies is of critical relevance in the understanding of legal matters. COPUOS is the prime body of the UN system dealing with space issues. However, sustainability of outer space activities has revealed that there are topics of common interest and impact on other UN bodies, such as the Conference on Disarmament. A better knowledge of the legal issues behind the work of the First and the Fourth Committees will enhance a more comprehensive understanding of Space Law.

In many countries Space Law is not part of the Law career at all; not even essential elements of this field are included in the curricula of graduate courses. Furthermore, Master or other post-graduate degrees in international law usually do not include Space Law as a subject, and just a very few universities offer specialization degrees in Space Law.

The UN curriculum on Space Law is an excellent tool for integrating understanding of legal matters related to space activities in the postgraduate courses of the Regional Centres. Very technical and scientific matters, such as remote sensing, satellite communication and

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global navigations systems can be now understood from a legal perspective as well. Synergy between technical and scientific and legal matters should be further promoted.

UNISPACE+50 could provide the opportunity to assess whether this curriculum can also serve as an educational tool for other institutions and training initiatives, and examine possible partnerships in achieving this goal. Member States could examine ways and means of bringing together different stakeholders in the field of Education, Technology and Foreign Affairs for the expansion of Space Law at different levels of education.

The last workshop on Space Law organised by OOSA that took place in Vienna allowed the participation of many Member State delegates to COPUOS. This is an important tool of capacity building in Space Law that could be further considered as a permanent practice for the future in addition to regional workshops. Capacity building for national delegates could have a positive effect on the understanding of the matters discussed within the Legal Subcommittee and might enhance the engagement of Member States in its discussions.

UNISPACE+50 will outline the Space Agenda 2030. Capacity building for the 21sth century is of outmost importance in the agenda of COPUOS. Renewed endeavours in capacity building in the next 12 years will definitely make a great difference in understanding the legal international regime governing space activities.

KEYWORDS: CAPACITY BUILDING; SPACE LAW; COPUOS

A HOLISTIC APPROACH TO NATIONAL SPACE-LAW AND POLICY EDUCATION AND CAPACITY-BUILDING

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ABSTRACT

There is universal recognition that the development and use of space applications and technology can meet a variety of national economic, social, scientific and/or strategic needs and interests. Having clear and coherent national space law and policy is integral to ensure the furtherance of such national needs and interests is in line with a State's international obligations and commitments, and will also go a long way to establish transparency and build confidence in the global outer space arena. Proper capacity-building and education in space law and policy are hence essential for spacefaring and aspiring spacefaring States. It is imperative that alongside developing space applications and technology, States possess the competent professionals and tools to make laws that are reflective of national conditions and legislative processes and responsive to evolving national needs and interests.

With over sixty-five years of experience, the McGill Institute of Air and Space Law and its research arm, the McGill Centre for Research in Air and Space Law, are recognized worldwide as a centre of excellence in space law and policy education and outreach. Valuable lessons can be learned from education and training conducted through a neutral and comparative lens firmly grounded in the belief that only a multidisciplinary and global perspective is suited to address issues and concerns in the final frontier where the actions of one State can have global implications and consequences for the security and sustainability of activities of all States, and humanity, in outer space and on Earth.

RUSSIAN TRANSLATION OF THE COLOGNE COMMENTARY ON SPACE LAW

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ABSTRACT

The translation of Volume I of the Cologne Commentary on Space Law into Russian – a fundamental work, a unique comprehensive expert interpretation of the 1967 Outer Space Treaty – appeared due to the initiative of Professor Dr. Stephan Hobe, Director of the Institute of Air and Space Law, Cologne University, and Dr. Bernhard Schmidt-Tedd, Head of Legal Support, Space Administration of the German Aerospace Center (DLR). The translation was prepared by a team of international lawyers specializing in international space law, under the supervision of Dr. Olga Volynskaya of the Russian Foreign Trade Academy with the participation of Valeria Katsura-Trumpel (Kutafin Moscow State Law University) and Alexander Ladeyshchikov (Russian Foreign Trade Academy).

It is symbolic that this new incarnation of Volume I of the Commentary dedicated to the Outer Space Treaty appears this year celebrating the 50th anniversary of the Treaty and 60 years from the launch of the first artificial Earth satellite Sputnik-1.

This book is not just a translation from English into Russian. It is a result of a fascinating process, a brainstorming undertaken by the editors, assistant editors and translators all together to make the Commentary understandable to a new huge audience speaking Russian.

The translated Commentary takes in due account the longstanding legal traditions of Russia, transforms specific English concepts and terminology into the language commonly used in the Russian legal field. Special side comments by the translators, which additionally clarify the authors' ideas, are definitely an added value of the book.

The translators in their comments to the Russian text draw the Reader's attention to such interesting points as, for instance, the use of terminology and legal concepts in the English version which are not typical for the Russian legal science (for example, the term "international legislation" which cannot be translated into Russian literally as "законодательство", but rather as "право"; the "duty of care", "squatters' rights" and "piercing the corporate veil" concepts

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that do not have direct equivalents in the Russian law). The difference in approaches of the Russian and foreign international legal doctrines to the interpretation of the "common heritage of humanity" and "the common heritage of mankind" concepts is highlighted. The translators also point out interesting facts of using two different terms in the official English text of the Outer Space Treaty, which are translated with the same word in the official Russian version (e.g., "responsibility" and "liability" – "ответственность", "concerned" and "appropriate" – "cootветствующий"), or vice versa, when the same English words are translated with two different Russian equivalents (e.g., "all possible assistance" - "всемерная помощь" and "возможная помощь"); an explanation of the nuances of the semantic differences between these terms is given as well. In the commentary to Article VI of the Outer Space Treaty, which states that "responsibility [for national activities]" and "liability [for damage]" are used as two different terms in the official English version, while the same term for both is used in the Chinese, French and Spanish versions, the translators indicate that the equally authentic Russian and Arabic texts of the Outer Space Treaty follow the same single-term approach.

The Russian translation of the Commentary is already enjoying substantial support by the Russian scientific community and the space industry. The contributions by Professor Vladlen Vereshchetin, Former Judge of the International Court of Justice, and by Professor Yuri Baturin, pilot-cosmonaut and Hero of the Russian Federation, speak for themselves.

We are confident that the Russian translation of the Commentary will be a real treasure for a wide range of specialists of the Russian space industry, diplomatic community and academia in their research and practice in the exploration and use of outer space.

KEYWORDS: COLOGNE COMMENTARY; OUTER SPACE TREATY; SPACE LAW; RUSSIAN FEDERATION

Chinese Version of Cologne Commentary on Space Law

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ABSTRACT

The Chinese version of Volume I (Outer Space Treaty) of Cologne Commentary on Space Law (CoCoSL) was published at the beginning of 2017, which happens to be the 50th Anniversary of the 1967 Outer Space Treaty. It has profound significance not only for the capacity building in research and education of space law, but also for the promotion of the awareness of the OST among space practitioners of China.

The Outer Space Treaty, as the corner stone of space law, sets up fundamental principles and regulations on space activities and provide a stable space order under the rule of law. The Volume I of CoCoSL reflects the international and interdisciplinary diversity of space law through the contribution from a broad international expert authorship. A profound and evaluative inquiry into the theoretical, methodological and practical aspects of space legislation and space law-making has been undertaken by the various authors, with the aim to provide an interpretation congruous with the object and intention of the UN treaties as a baseline for the further development of law both internationally and nationally.

The presentation introduces the application and promotion of CoCoSL in China, in particular in the preparation for the Manfred Lachs Space Moot Court Competition among universities, followed by a description about the status of space law dissemination in China. It discusses the limitations of space law capacity building in China and points out that there are only a few materials and works on space law in

Chinese. Subsequently, it introduces the background of the initiative and the work of the Chinese translation. It points out the difficulties and challenges during the translation taking some terms of art as examples, such as "international responsibility".

It envisages the prospects of the usage of the Chinese version of CoCoSL in China and addresses its significance in the space law capacity building in China and beyond.

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Session 7

How to Attract Women and Youth to Space-Related Careers

> Moderator: Markus Woltran Rapporteur: Yukiko Okumura

Wednesday, 6 September 2017

INSPIRING AND ENGAGING THE NEXT GENERATION

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ABSTRACT

ESA's founding fathers understood that whenever you are able to advance mankind's understanding, you have the duty to share it and make it available to all... and so Education is included in the ESA Convention.

ESA shares the concern that there is a decrease of interest in STEMrelated careers and still a low performance in these subjects compared to others, and it has the view that this trend can be reversed by introducing new methods in science teaching on a large scale, with the main mandate for its Member States.

The main objective of the ESA Education programme is thus to, as from the earlier age, help enhancing scientific literacy and competences, promoting the skills of future responsible innovators/researchers as well as of science-active citizens.

For this, we are building on the fact that space is a unique motivational context for the study of STEM subjects, with ESA as a source of unique and multidisciplinary scientific knowledge in a truly international collaborative dimension.

Targets and challenges, as well as some of the major projects will be presented, putting the emphasis on those that by nature are accessible to all, including outside of Europe, or the models that can be implemented in other regions.

How to attract women and youth to space-related careers?

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ABSTRACT

Gender diversity and the involvement of the young generation in the space sector is still an area where strong progress needs to be achieved. There is a need for dedicated promotion of opportunities for female space professionals within the space sector in general. Likewise, the creation of platforms devoted to facilitate the continued participation of the young generation in cooperative space-related activities and to provide them with professional development opportunities is needed.

UNISPACE+50 will present a long-term vision for space. Considering the inputs from all stakeholders in the space sector, the objective of UNISPACE+50 is to define a roadmap towards 'Space 2030'. The Space Generation Advisory Council (SGAC) is expected to play an important role in fostering and shaping the UNISPACE+50 thematic priorities, bringing into the process the views of the future generation of space leaders regarding their long-term visions for space and the actions that can be taken towards a more responsible use of space. Importantly, capacity building has been flagged as one of SGAC's priorities to support UNISPACE+50, particularly focusing on women and youth to support the fulfilment of the 2030 UN Agenda for sustainable development.

Since its creation at UNISPACE III in Vienna in 1999, SGAC has grown tremendously and now accounts for more than 10 000 members in more than 6 regions covering over 110 countries. In regards to capacity building, SGAC has been working on a variety of initiatives aimed at attracting and retaining women and youth to space-related career through global events and professional development opportunities. These initiatives include a platform for professional development, speed mentoring sessions, year-round project groups introducing and exposing our members to different areas of the space sector further enabled by SGAC's numerous international partnerships.

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SGAC has a strong commitment to demonstrate the importance of diversity and how further involving women and youth can strengthen the global space community in line with the capacity building thematic area of the Sustainable Development Goals (SDGs) and more specifically the SDG 4, 5, 7 and 10 of the 2030 UN Agenda. The aim of the presentation is to present a collection of inputs from the future generation of space leaders offering women and youth a unique opportunity to contribute and participate to discussions on today's top space issues. Second, to highlight the discussion on how to retain the next generation of professionals in the space sector. Third, to provide an overview of the necessity to have more platforms where the young generation can learn from senior professionals of the industry. Fourth, it emphasizes the need to have more women role models in the space industry, particularly in emerging space nations.

Challenges and Opportunities that exist in the Space Sector for Mexican women

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ABSTRACT

The Organization of Ibero-American States (OEI) has highlighted that we live in a society where science and technology occupy a fundamental place in the productive system of the everyday life, and that also plays a fundamental role in the countries economies. The Space Sector is part of that everyday life, and its attracting much more attention worldwide, as public and private investors look for new sources of economic growth and innovation and space economy has become a relevant domain for high-tech innovation, commercial opportunities and strategic purposes. This opens the opportunity to promote the need of a space culture that allows and encourages the empowerment of women (young, adolescent or adult), making visible that gender equality is a human right and impacts on the development of countries, and that is why we need to start playing an active and equal role in the space political decision-making.

According to OECD, only nine percent of Mexican women under the age of 15 expect to be a scientist or an engineer compared to 27 percent of men of the same age. At the same time, it is more likely that Mexican families have high aspirations about the professional development of their male children. However, with information of 2012, México has the third highest ratio of women awarded computer – science tertiary degrees, just after Saudi Arabia and Ireland (View Image 1). This data shows that Mexico has an opportunity to strengthen its capacity building efforts in computer – science, which is really important for space development.

There is a need to provide measurable indicators of space capabilities to see our weak point and to strengthen our goals to make equal countries and equal outer space.

The privileged astronomical position of Ecuador known from the time of the Aboriginal culture Quitu-Cara, and how this can stimulate the young people to study astronomy

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ABSTRACT

The astronomical position of Ecuador is just in the center of the planet latitude 0°, which gives to the this land the opportunity to see all the stars in the same range of view the whole year, this is an advantage for the astronomical study, which opens the door for the knowledge, agriculture and others sciences, that had been done since pre-Hispanic ages, this is the case of the Quitu-Cara culture, that is known as one of the most advance in astronomical matters. The Quitu-Cara built their temples in locations from which the sky could be observed clearly without any optical support, taking into consideration that those strategic places allows their structures to be safe from natural disasters, which has been seen in many occasions through the time.

Since the beginning of mankind human beings have generated questions like where do we come from? Or where do we go? And the youth is who makes these questions more often. By studying Astronomy through the eyes of our ancestor we can try to understand not just the beginning of the universe, but we can understand the relations between our land, our planet and the universe itself or a possible outcome of it. For those young who wish to develop technology, a laboratory that has not been much explored is the space where unique conditions are given and different for both travel and life support. As well as knowing how to take advantage of the astronomical conditions to optimize the processes in our planet, as the Quitu-Cara culture knew how to perform on it moment.

Activities of the African Regional Centre for Space Science and Technology Education to Promote the Participation of Girls in Space Science in Nigeria

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ABSTRACT

The vision of the African Regional Centre for Space Science and Technology Education in English (ARCSSTE-E), located in Nigeria, is to bring the benefits of space to the African society. ARCSSTE-E is committed to ensuring that these benefits reach both the male and the female genders, and that girls play an active role in space science and technology. This presentation is focused on the efforts made by ARCSSTE-E, within the past 5 years, to attract pre-collegiate girls to space science and technology (SST). Between 2011 and 2016, over 2000 school children, aged between 8 and 18 years from schools distributed in all the 6 geopolitical zones of Nigeria, participated in the zonal workshops coordinated by ARCSSTE-E. These events were packed with fun-filled, hands-on educational activities introducing the participants to Astronomy, Robotics and demonstrating the use of outer space to address prevailing national socio-economic problems. The students were introduced to the Nigerian Earth Observation Satellites, and learned why these satellites could not be used to track the school girls kidnapped by the terrorist group in the northern part of the country. They also participated in activities on the applications of TRMM satellite data to monitor flood events in Nigeria. The Global Positioning System (GPS) technology was introduced as a navigational tool to curb criminal activities in the country and participants used the hand-held GPS unit for geocaching. These zonal workshops usually culminated in the launching of space clubs in all the participating schools and a teacher from each school received resource materials on DVD to nurture the space clubs. To assess the impact of the workshop on the knowledge level of the participants in space science, quiz competitions were administered and the study noted that the scores obtained by the female participants in these assessment tests, compared favorably with that of their male counterparts. This observation eliminated the preconceived notion that the 'hard' sciences are reserved for boys. Furthermore, the enthusiasm displayed by the students, coupled with the brilliant performance in the evaluation tests, indicated that this method of informal education, that linked science to real life occurrences, is viable, not only for stimulating the interest of Nigerian pre-collegiate youths in SST, but also to inspire young girls, develop their interest in the Sciences, Technology, Engineering and

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Mathematics (STEM) and attract women to space related careers. Using the model employed ARCSSTE-E, the paper concludes with ideas on how the UN-OOSA, acting as a coordinating center, can collaborate with space agencies and academic institutions in developing nations (such as Nigeria and other African countries) to ensure the successful implementation of this 'Catch them Young' approach to develop human capacity and prepare school children for careers in space science and technology.

KEYWORDS: SPACE SCIENCE EDUCATION; INFORMAL EDUCATION FOR SCHOOL CHILDREN; HUMAN CAPACITY DEVELOPEMENT

Status and Practice of e- learning of Space Program in Nepal

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ABSTRACT

Education of basic space science and astronomy is nominal in Nepalese society. Institutionalizations of it providing space science education are few in number. No space agency is in existence till. Yet, the development in space science and technology is very much essential in raising our living standard.

Space physics curriculum in 4-years undergraduates was implemented in Nepal from Tribhuvan University, from 2014. Involvement of women in this field is miniscule. Practice of Online e –learning platforms by creating moodle might be new approaches to attract youth and women in this field. So the best practices adopted by Tribhuvan University to attract youth and women in space physics will be shared which could be the inspirational and motivational for the other developing nations. Study of Space physics outside the capital is in Prithvi Narayan Campus, Pokhara. So, the future possible opportunity of Space physics in Nepal will be discussed.

Different awareness activities conducted by different organization to make people aware in such fields to attract youth and women will be discussed. Research activities brought by different organizations and Tribhuvan University in and outside the region will be highlighted which is believed to play a vital role for the promotion and development of space physics activities in developing countries like Nepal.

KEYWORDS: E-LEARNING; YOUTH AND WOMEN; AWARENESS ACTIVITIES; RESEARCH

Breaking the glass ceiling for women in the world of government and commercial space

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ABSTRACT

The space sector has traditionally been seen as a domain dominated by men. This does not mean that women have not greatly contributed to the space endeavor; however, the recognition for their efforts and leadership opportunities have been quite limited throughout the space age. The conditions have been improving but there is still a long way to go. Although, organizations such the United Nations, Space Generation Advisory Council and Women in Aerospace have played an important role in promoting women and young professionals in the space sector, many women still experience the effect of the glass ceiling in various steps of their career.

As a woman in the space sector who, for many years, has worked with young space professionals through-out the globe I would like to share my experience as well as lessons learned in order to provide some food for thought in regard to breaking the glass ceiling for women in the world of government and commercial space.

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Session 8

Workshop on Model Curricular for Space Technology and Space Law

Moderator: Otto Koudelka Rapporteur: Hui Du

Wednesday, 6 September 2017

Overview of the existing United Nations curricula on space technology and space law

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ABSTRACT

The presentation will provide an overview of the United Nations Education Curricula developed under the leadership of the Office for Outer Space Affairs for the purpose of the education and training programmes of the six Regional Centres for Space Science and Technology Education, affiliated to the United Nations. The curricula on space science and technology and their applications comprise the areas of satellite meteorology and global climate; satellite communications; space and atmospheric science, remote sensing and geographic information systems; and global navigation satellite systems. The curricula are available on the website of the Office for Outer Space Affairs. In 2007 the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space requested the Office to explore the possibility of developing a curriculum for a basic course on space law that could be used in the activities of the Regional Centres. The Office developed the curriculum closely together with a group of experts and educators in the field of space law. In 2013 the space law curriculum was officially published on the website of the office together with a supplemental materials, including lists of monographs, articles and other material, in all official languages of the United nations. Although the Curriculum is developed to support the activities of the Regional Centres, it has been structured in such a manner that it can serve as an educational tool for other institutions and training activities.

KEYWORDS: UNISPACE+50, EDUCATION CURRICULA, CAPACITY-BUILDING

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Global Navigation Satellite Systems: Education Curriculum

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ABSTRACT

Efforts to build capacity in space science and technology are considered a major focus of the Office for Outer Space Affairs and are of specific interest to the International Committee on Global Navigation Satellite Systems (ICG) with particular reference to global navigation satellite systems (GNSS). Such efforts should aim to provide support to the regional centres for space science and technology education affiliated to the United Nations, which would also act as ICG information centres.

Negotiations with the regional centres are ongoing in order to utilize them as "hubs" for training and information dissemination on global applications of GNSS and their benefits for humanity. ICG Information Centres aim to foster a more structured approach to information exchange in order to fulfil the mutual expectations of a network linking ICG and the regional centres; and to connect the institutions involved or interested in GNSS applications with GNSS system providers.

The ICG Executive Secretariat and GNSS providers see two areas where they can assist the process of the development and progress towards the further development of ICG Information Centres: the technical level, which will include various GNSS technologies, and the cooperative level with possible collaboration with industry leaders and linkages with current and planned system and augmentation system providers. Linkages would be facilitated through collaboration with the Providers' Forum (seminars/trainings and supportive material), as well as communication and outreach to the wider community through the ICG information portal, mailing lists, brochures and newsletter.

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From 2008 to 2010, the ICG Executive Secretariat took the lead in organizing training courses on satellite navigation and location-based services in the United Nations-affiliated regional centres for space science and technology education. These training courses addressed GNSS technology and its applications, including hands-on experience in the use of off-the-shelf software for specific applications and GNSS signal processing and facilitated the development of the GNSS education curriculum.

The GNSS education curriculum was developed by taking into account GNSS course outlines as used at the university level in a number of developing and industrialized countries. The incorporation of elements of GNSS science and technology into university-level education curricula served a dual purpose: (*a*) it could enable countries to take advantage of the benefits inherent in the new technologies, which, in many cases, are spin-offs from space science and technology; or (*b*) to introduce the concepts of high technology in a non-esoteric fashion and help create national capacities in science and technology in general. Currently serious efforts are being made worldwide to introduce GNSS, in terms of science, technology and applications, as a stand-alone discipline in university-level curricula.

This GNSS education curriculum differs from most of those available in literature and on the Internet. The GNSS education curriculum was a unique result of the deliberations of the regional workshops on GNSS applications since 2006.

This curriculum is made available to the regional centres for space science and technology education, affiliated to the United Nations. The regional centres may appropriately tune and structure the actual course by deciding on the depth/content of the topics. Centres may also finetune the topics to address issues related to the region. The course prerequisite is a degree in Electronics and Communications Engineering, Geomatics, or Software and Computer Engineering.

The course consists of nine modules covering specific areas of GNSS (theory, technology and applications). The duration of the course is 36 weeks, followed by one year of pilot project work in the participant's home country.

KEYWORDS: ICG; GNSS; INFORMATION CENTRES

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Modern Science in the Classroom

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ABSTRACT

CERN's mission includes the dissemination of the results of fundamental research as well as of the applied research needed to perform its research programme. Since 1998, CERN runs programmes for science teachers, and since 2009 actively researches modern science education.

This presentation gives an overview of the initiatives to motivate teachers and high-school students and instill curiosity for modern science in them. Furthermore, the educational and research goals will be outlined; these include curriculum research questions as well as the development of modules to include more modern science in the classroom.

KEYWORDS: SCIENCE EDUCATION, PHYSICS, CURRICULUM

Education Curricula for Space Law Capacity-Building

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ABSTRACT

The space competence of a nation heavily depends not only upon its capability in space science and technology but also in its space regulatory system. Therefore, capacity-building in space law should be pursued at the same time when efforts are being made to enhance capacity in space science and technology. Education and training of specialists in space law and regulation could follow standard/model curricula like the "UN Education Curriculum on Space Law" (2014). However, it is also important to keep in mind that constitutional and legislative system as well as political realities in different countries often vary—sometimes significantly. Therefore, curriculum for capability-building in space law ought to be custom-made to meet the unique requirements of each country.

The Institute of Air and Space Law of McGill University in Montreal, Canada, the world's leading educational institution in space law and policy, has over six decades of experience in designing and delivering its distinctive curriculum for capability-building in this field. This presentation will describe the McGill Model of capacity-building in space law, which comprehensively covers all aspects of space activities in both common law and civil law countries. At McGill, emphasis is placed on the study of law and policy from an international and neutral perspective, and in a way that is mainly practice-oriented. Through interactive lectures and seminars, courses are delivered by highly-qualified faculty members, and supplemented by experienced experts from industry and relevant institutions in the space domain. Further, the curriculum is regularly updated to cover new developments in the constantly evolving arena of space activities, applications and technology. This approach in capacity-building in space law has proven particularly useful to ensure students and professionals from all over the world understand that appropriate national space laws and regulations are imperative to guide the expansion.
New Space Law Issues with Private Enterprise in Outer Space

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ABSTRACT

The UN capacity-building curriculum should remind students of the special rights reserved for the developing countries in the existing space law. That requires analysis of OST Art. 1 and the 1996 UNGA Resolution. Since the original curriculum was drafted the emergence of private space-related services has raised new issues. Developing countries now have to learn to contract with private companies from developed countries to obtain telecommunication, and remote sensing services. Students need to know that the contractual basis has shifted from basic rights for equal service to profit-based services. Consequently, there are a number of recommendations to make the model curriculum more useful. The development of small remote sensing satellites are useful for such purposes as earth observation of agriculture, disasters, weather forecasting and national security. Students need to know how to obtain these new benefits. The ITU is the ultimate distributor of radiofrequencies and orbital slots for satellite communication. Students need to know that the ITU has a special mandate to benefit the developing countries. As to the four GNSS global services, students need to know about their differences, availability, interoperability and vulnerability to cyber security attacks. Students should learn about the need for space traffic management, the Kessler Syndrome on space debris, and the new issue of claims to property rights in outer space. The paper ends with an analysis of a number of programs for teaching space law.

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Challenges in Using the UN Curricula at Universities and in Online-Courses

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ABSTRACT

The presentation will discuss how the UN Education Curriculum on Space Law can be implemented at universities and in online courses worldwide. It will explore various options with a view to enhancing the life-long learning of professionals and experts in the space sector, but also in other areas. The main idea is to make space law more accessible to young and senior professionals not only in the area of law, but most importantly also in technical and science sectors, such as engineering, computer technology, physics, astronomy and geology.

The presentation will address the challenges of preparing the necessary material, both textbooks and online resources, and ask whether there is a need to address particularities at the regional and national levels. Furthermore, the issue of finding appropriate teaching personnel will be discussed together with the question whether it is feasible and desirable to have only one teacher covering all subjects or whether a group of teachers would be preferable. Organisational matters will be analysed at the example of a selected number of internationally renowned universities which have experience in life-long learning and training programs. Financial issues will also be addressed. In this respect, both the costs and the possible financing options shall be discussed. The latter will have a close connection to the question of who the students of such courses based on the UN Curriculum of Space Law will be. Finally, it shall be explored whether a concrete project can be planned together with the workshop participants which can be presented at the UNISPACE+50 Conference and be ready for implementation within 12 months thereafter.

KEYWORDS: SPACE LAW TEACHING; UN MODEL CURRICULM; SPACE LAW LITERATURE

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Session 9 Institutional Capacity-Building

Moderator: Niklas Hedman Rapporteur: Jorge Del Rio Vera

Thursday, 7 September 2017

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CHALLENGES OF CAPACITY-BUILDING IN A MULTI-STATE ENVIRONMENT

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ABSTRACT

The contributions of space technology and its applications has become an important driver for advancement of developing countries in the light of the continuous developments of technical, legal, social and regulatory aspects in this field. It is well-recognized that this flourishing area directly supports sustainable development of the countries and is capable of resolving many challenges faced by them. Disaster management, communication, navigation, search and rescue are only few of the things that could be achieved by space technology. On the other hand, it is as important to use space technology as a driver to foster other fields of technical and social development.

It goes without saying that space technology is very expensive and it is not affordable for many countries to follow independently, therefore, many logically decide to turn to collaborative solutions. International and regional collaboration platforms such as Asia-Pacific Space Cooperation Organization (APSCO) are formed as a result.

Multi-state collaborations have many well-known advantages such as pooling the resources together, getting benefit from each other's strengths, distributing the infrastructure such as ground stations, responding to cross boundary disasters and so on. Despite all these advantages, sometimes it is hard to measure the tangible impact of such collaborations and the parties complain about a number of challenges such as long decision chain, differing interests, economic and technical gaps among the participant countries and unequal benefits of participating countries. Many of these challenges are real and it is very difficult to find straightforward solutions for them. However in some cases, there are other invisible factors involved as well. For example, it

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is much more likely to evaluate highly an individual capacity-building activity simply because of the strong ownership feelings as compared with joint efforts which are usually much more effective but not open to claim by any cooperating party. This highlights the importance of correct evaluation of the outcomes of every joint capacity-building activity.

Based on our experience at APSCO, practical ways could be used to make the best out of multi-lateral cooperation. In this presentation, several constructive examples of challenging situations are deliberated and the compensating scenarios are described. It is observed that using some prudent choices, it is in fact possible to minimize the effects of challenging situations on multi-state cooperation and the overall costbenefit analyses shows strong support for continuing and strengthening such cooperation. Designing various programs with different levels of engagement by different countries based on their capabilities makes it possible to push the boundaries of capacity-building to new frontiers.

KEYWORDS: REGIONAL COOPERATION; CAPACITY BUILDING; APSCO

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The road to a Developing Country's Space Agency: Costa Rican Case

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ABSTRACT

The benefits of Space Activities to the development of a country have been proven to be multiple. From management of crops and water resources, monitoring of remote locations, to disaster management and emergency response, and even as an engine to promote Research and Development: space activities can play a key role in the development of countries. However, their implementation can present important challenges for developing countries. In Costa Rica many individual attempts have taken the country closer to becoming a Space Faring Nation Different governmental and non

becoming a Space-Faring Nation. Different governmental and nongovernmental institutions have taken important steps in the last decade: the country acceded to the Registration Convention in 2010, joined COPUOS in 2012, created a National Counsel for Space Matters in 2010, launched the "Aerospace Cluster" to promote internationally the private space sector in 2016, and will launch the first Central American Satellite in 2018.

However, in order to truly succeed, these efforts need to be paired with a governmental strategy and support. In this regard, Costa Rican authorities are currently studying the possibility to accede to the Outer Space Treaty, and ratify the other two treaties that were signed more than 40 years ago: The Rescue Agreement and Liability Convention. The country is also in the process of identifying other legal steps that should be taken in the short and medium term, including drafting a National Space Law and Policy. Another important step that will follow is to evaluate if the current structure in charge of space matters is the most effective one or if changes must be made in order to take advantage of the benefits derived from space while responding to national and international responsibilities. The results of this process could lead to the establishment of Costa Rica's Space Agency.

KEYWORDS: DEVELOPING COUNTRY, SPACE POLICY, SPACE AGENCY

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Maximizing the Benefits of a UN Regional Centre for Space Science and Technology Education for SDGs

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ABSTRACT

The opportunities accruing from the establishment of African Regional Centre for Space Science and Technology Education in English (ARCSSTE-E) in Nigeria (1998), by the United Nations Office for Outer Space (UNOOSA) has not being maximized by the Regional Member States. Using the 'Catch them young approach', the paper showcases the best practices in the public outreach activities organized by the Centre to stimulate the interest of pre-collegiate youths in Space Science and Technology (SST). These activities are designed to inspire the young learners and develop their interest in the Sciences, Technology, Engineering and Mathematics (STEM) to encourage them to pursue careers in SST. In the light of the focus on Sustainable Development Goals (SDGs2030), the paper is meant to highlight the capacity building achievements, challenges (which in turn impact on the local space workforce), and recommendations on how Member States can use it to develop indigenous space science technology towards achieving the SDGs.

KEYWORDS: SDG; HUMAN CAPACITY DEVELOPMENT; SPACE POSTGRADUATE PROGRAMME; BEST PRACTICES IN SPACE PUBLIC OUTREACH; AFRICA

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Promoting Space Science in Basic Education in the Philippines

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ABSTRACT

Science Education Institute is an agency of the Department of Science and Technology (DOST-SEI) that is mandated to produce a critical mass of Science and Technology (S & T) human resources in support of national development programs, as well as to strengthen Science, Technology & Innovation (STI) enculturation in the country. DOST-SEI fulfills its mandate by a) administering scholarships in S & T from the undergraduate to graduate levels; b) conducting science promotion activities (e.g. science camps, science fairs, robotics competitions, etc.) encouraging young people to love science and pursue Science, Technology, Engineering, and Mathematics (STEM) careers; and c) developing learning resources and conducting capacity-building programs for elementary and high school STEM teachers.

As the lead agency for promoting science and technology education in the country, DOST-SEI developed the Philippine Space Science Education Program (PSSEP) in 2008and continuously implements space science education projects in response to the request of the Space Education Programme Coordinator of the Division of Ecological & Earth Sciences, United Nations Educational, Scientific and Cultural Organization (UNESCO), Ms. Yolanda Berenguer. The program aims to: 1) promote knowledge on astronomy, space science and technology and its applications and benefits to society, among students and 2) implement space science educational activities for teachers: elementary, high school and college students, as well as the general public; 3) enhance school teachers' understanding of space science technology application and expand science subjects by including astronomy and space science in the lessons; and 4) establish linkages and partnerships with institutions and space organizations, both local

and international, for possible assistance and collaboration in space education programs and projects.

The major activities organized by DOST-SEI under PSSEP include: organizing and spearheading the annual World Space Week (WSW) celebration in the Philippines, organizing the Can Satellite Competition for high school students, participation in the water rocket event, poster making contest, supporting the participation of students in the international Olympiad on astronomy and astrophysics, and participation in regional space education policy-making through the Space Education Working Group (SEWG) of the Asia-Pacific Regional Space Agency Forum (APRSAF). It has also maintained collaborations with Japan Aerospace Exploration Agency (JAXA) in promoting space science education among students, and in upgrading the content knowledge of science teachers in space science.

Every year, DOST-SEI, leads the country in celebrating the World Space Week (WSW). Highlighting the celebration is the annual water rocket competition for high school students and poster making competition for elementary pupils. Training sessions for teachers on astronomy are also conducted to equip educators with the necessary information and teaching techniques to help them incorporate space science and astronomy in their science lessons. For the past two years, DOST-SEI has organized the Can Satellite (CANSAT) Competition for high school students. This competition provides opportunity for Filipino high school students to experience the process of satellite development- from mission definition, to assembly, and ultimately, to launch their own can satellites. The competition aims to spark the creativity of students in designing their own mission, encourage analytical and critical thinking, and enhance teamwork and camaraderie. The challenges do not just include technical skills, but also their capacity to interpret and make sense of the data they have gathered. The Can Satellite Competition was introduced as a special event in the APRSAF-23, which was hosted by the Philippines in 2016. Ten teams from five countries participated in the said competition.

To establish and strengthen linkages and partnerships with international institutions and space organizations, DOST-SEI supports the participation of Filipino students in astronomy and space science competitions and Olympiads. DOST-SEI, as member country in the APRSAF Space Environment Utilization Working Group (SEUWG) facilitates the local selection of participants and provides the necessary logistical support and training for the selected students to participate in the international events.

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The various science promotion activities in the country organized by DOST-SEI hopes to mobilize other institutions and sectors to sustain the interest of young students in Science and Technology, and to enable teachers and other individuals to advocate the peaceful uses of space technology and the benefits we derive from it.

KEYWORDS: APRSAF; CANSAT; WATER ROCKET

Novel Approaches by Nigeria's Space Agency (NASRDA) in Geospatial Intelligence Training and Capacity Development of Institutions, Ministries Departments and Agencies for Sustainable Implementation of socio-economic Projects and Programmes in the Country

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ABSTRACT

Availability of satellite data and the ability of countries in the developing world to access and acquire is an uphill task and challenge to address. This is as a result of limited funding and competing issues to be tackled. There is also a huge knowledge gap that has to be filled if effective and efficient use has to be made of the satellite data acquired for use in sub-Saharan African countries. In Nigeria the launch of NigeriaSat-1 an Earth Observation 32 Meter Medium Resolution Satellite seemed to have relieved the country of the burden of access to data. A survey during a validation worship in early 2004 showed that very few community of practice members in satellite technology applications had the capacity to effectively use the images from the Nigeria satellite. This indicated the extent of the dearth and paucity of trained personnel in the academia, companies, and people in industry, ministries, department and agencies that could use the satellite data. The Nigeria Space Agency therefore embarked on a novel programme to train, build and develop capacities of students, lecturers, companies, firms and MDAs in the satellite-based applications. This required training in GIS and Remote Sensing Applications, signing of MoU with Universities for establishment of GIS Laboratories that will be used in training. There was also support in training of students on internship at the Agency's GIS/Remote sensing facilities across the country. This paper provides insight into the various approaches, milestones and work packages adopted in the implementation process which is still ongoing.

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CAPACITY BUILDING AT THE BRAZILIAN NATIONAL INSTITUTE FOR SPACE RESEARCH (INPE): AN OVERVIEW OF THE CURRENT ACTIVITIES AND FUTURE CHALLENGES

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ABSTRACT

One of the important points of the mission of the Brazilian National Institute for Space Research (INPE), is the generation and diffusion of knowledge and space applications. Currently, INPE is involved in a series of capacity building initiatives in its areas of activity, ranging from rapid courses that aim the qualification of professionals in a given subject; partnerships with foreign institutions and international organisms to offer courses for the capacity building of students in specific technologies developed by INPE, mainly involving Latin-American countries; partnerships with universities and schools to train students and teachers and jointly develop projects; up to prestigious master's and doctoral courses in the areas of astrophysics, space engineering and technologies, applied computing, meteorology, remote sensing and earth system sciences. This article presents an overview of the capacity building initiatives at INPE and, based on this information, seeks to identify the areas that can be improved, especially with regard to encouraging women and young people to be trained in space sciences, setting some guidelines in order that these future challenges can be successfully met.

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Capacity building in earth observation in Morocco: Objectives and achievements by CRTS

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ABSTRACT

The presentation will be focused on the role of the CRTS as a national institution in charge of promoting and developing applications based on EO. The approach used since 1989 to develop and enhance capacities at national and regional scale and the impact on the users and their needs will be presented. Several activities like projects, training, and data availability are undertaken in the CRTS, with the objectives to improve capacities of the institutions to use space technology in their daily job.

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BHUTAN IN SPACE

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ABSTRACT

Bhutan is a developing Himalayan nation sandwiched between China in the North and India in the South. There has been no space activities in the country except for minimal usage of space applications in telecommunication, weather forecasting and disaster management sectors through commercial satellites. However, in 2016 the government took the initiative to sponsor the education of three space engineers with the aim to develop human capability in space science and technology.

This initiative marks an historic moment for the country. It signifies the interest of a small developing country to venture into space. In addition, it paves way for numerous questions such as "What will be the goal of space program in Bhutan?", "Who will take responsibility for establishing a space program that is sustainable and progressive?", "Does the country have enough human and financial resources to be an active member of the space community?", "What challenges does this young country face?", "How can we overcome those challenges?".

KEYWORDS: BHUTAN, SUSTAINABILITY OF SPACE PROGRAM, CHALLENGES

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Space Science Outreach and Capacity Building in Nepal

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ABSTRACT

Space has always become a dream for people in Nepal. When we share about its science and application, people try to refrain from the discussion as they find it very incompatible to the need of our society. To highlight the importance of space science and its application and how we are using it in our day-to-day life, Nepal Astronomical Society (NASO) started it space science outreach in 2007. Our outreach events emphasize on public awareness on how Nepal does its weather forecasting, mapping and even television and telephone works. We started advocating for Nepal's first satellite since 2007 as we knew that Nepal has two satellite parking lot allocated to us by International Telecommunication Union (ITU). In 2009, The Youth Grant Programme, now called Emerging Space Leaders Grant Programme (ESL Grants) of International Astronautical Federation (IAF), allowed us to attend IAC, as well as in the UN/IAF Workshop and the Space Generation Congress opening our doors to international community to share our ideas and vision. This paper presents an overview of our activities during 2007-2016 on space science outreach in Nepal. It will also share on how our programs motivated other groups to start their programs on space at university level. It will also share the latest development on space science from both government and nongovernmental level in Nepal. The linkages between outreach and capacity building will be discussed.

KEYWORDS: SPACE SCIENCE; OUTREACH; NEPAL

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Poster Session

(POSTERS WILL BE DISPLAYED FOR THE ENTIRE DURATION OF THE SYMPOSIUM)

Accessible Platform from Earth to Space (APES): A novel approach leading the world from Competition to Contribution via Collaborations for strengthening capacity building in space faring nations

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ABSTRACT

Space technologies are being widely used in our daily routine and for emerging space faring nations, these technologies can be extremely beneficial across the sectors, strengthening their capacity building. Every space faring nation is presently facing a major challenge of financial constrains. Especially in the developed nations, budget allocation is majorly limited for government institutions to conduct only a limited number of experiments and due to limited research grants, even in developed nations the acceleration in innovative solutions towards present roadblocks is significantly reduced. This has indeed adversely affected new space application based missions. While the developed nations are facing this challenge, emerging space faring nations and under privileged nations are much more worried about obtaining highly expensive space application based data which can be used for operating their resources more efficiently. Earth Observation data can be extremely important for not just government sectors, but also for private industries across the globe and obtaining data at high price may result into compromised effect in their budgets. Hence, BR Aerospace Solutions and Services (Canada) took initiative of the Project APES in December 2016, for providing secured and sustainable access of space based data for different application based projects across the world, and contributing in strengthening capacity building. The main vision of project APES is to share knowledge and data via cost-efficient and effective technology transfers across the globe. This model will embark a new mile-stone in the year 2018 by providing efficient and innovative solution to different pillars of any emerging and/or under privileged country's economy, e.g. Agriculture, Irrigation, Disaster Management...etc, at significantly reduced cost. Results of pilot studies will also provide innovative solutions to the government and private sectors for efficient space based data at much lower price.

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Planetary Defense Awareness

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ABSTRACT

Planetary defence or asteroid impact mitigation comprises a number of methods by which Near-Earth objects (NEO) could be diverted, preventing destructive impact events. A sufficiently large impact by an asteroid or other NEOs would cause, depending on its impact location, massive tsunamis, multiple firestorms and an impact winter. The need for such measures has become more evident by recent events such as the disintegration of a meteorite over Chelyabinsk in the year 2013.

While the odds of a major collision are not great in the near term, there is a high probability that one could happen eventually unless defensive actions are prepared.

There is a range of measures that are possible to mitigate the threat of possible impact, ranging from kinetic deflection, gravitational tractoring, laser ablation or deflection by nuclear blast.

Yet, there appears to be a need to raise awareness further about the necessity of planetary defence measures among decision takers and the broader public. Awareness raising can happen through several channels in order to better communicate the need to defend against the possible threats from asteroids.