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United Nations/United Arab Emirates High Level Forum: "Space as a driver for socio-economic sustainable development"

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ABSTRACTS

The organisers of the United Nations/United Arab Emirates High Level Forum: “Space as a driver for socio-economic sustainable development” are grateful to the following sponsors for their contribution:

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Austria

UNISPACE+50: Activating the Next Generation

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As a result of UNISPACE III, the Space Generation Advisory Council (SGAC) attributes heightened importance to this conference series and is expected to play an important role in nurturing the dialogue pertaining to UNISPACE+50 and the wider strategic review promoted by the UNOOSA. From the organisation's beginnings at UNISPACE III in 1999, SGAC has grown to more than 10,000 members from over 110 countries.

Over recent years, SGAC has been focusing on different initiatives around Capacity Building, in line with Priority Item 7 of the Sustainable Development Goals (SDGs). The organisation has dedicated discussion groups at its international conferences, providing the next generation of space professionals a platform to express their views and insights to each of the UNISPACE+50 thematic areas. Moreover, SGAC is working with sponsors and partners from agency, industry and academia to raise awareness on and promote capacity building mechanisms that can be easily and efficiently implemented across the globe. The objective is to articulate and frame a new long-term vision for space that aligns with – to the greatest extent practicable and in a manner consistent with the UNISPACE+50 principles – the views of the future generation of space leaders.

The aim of the presentation is to present key contributions, inputs and focus areas from students and the young generation of space professionals under the pillar of 'Space Society'. Secondly, to showcase the different international activities that SGAC has been actively working on since the last High Level Forum in 2016 and the identified number of actions for SGAC to move forward with and define common grounds for shared action. Finally, to present the prioritised areas of further cooperation between SGAC and the other parties involved in the UNISPACE+50 process and strategic review.

Austria

Spaceflight meets Geriatrics!

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Physiological deconditioning similar to that seen in spaceflight also occurs on Earth, especially as a consequence of the aging process and also due to bedconfinement and/ or immobilization. Illness or injury in older persons frequently requires hospitalized based care. However, the immobilization that occurs during hospitalisation is itself a major factor in physiological deconditioning and functional decline and in older persons can further contribute to a downward spiral of increasing frailty, dizziness upon standing up (orthostatic intolerance) and increased risk and incidence of falls.

Bedrest is used as a ground-based analog for studying the effects of weightlessness on physiological systems as seen during space flight. As older persons spend up to 80% of their time in hospital bed-confined, bedrest studies can also help in furthering our understanding of the deconditioning process during hospitalization in older persons.

Astronauts in space spend substantial time doing physical training to counteract the deconditioning due to the effects of microgravity and to alleviate orthostatic intolerance on return to Earth. Could such physical activity programs carried out by astronauts in space be used during bedrest immobilization in older persons to counteract deconditioning as well?

Recent data generated from bedrest studies related to space research suggest that resistance exercise, together with proper nutrition, is effective in maintaining physiological functionality in astronauts during spaceflights of up to six months duration. Similarly, some studies have suggested that nutritional therapy (e.g high protein diet), along with resistance training, improves lean muscle mass and muscle strength in older persons. This presentation discusses how knowledge obtained from space research can provide guidance towards optimising health care strategies to tackle bed-confined deconditioning, especially in older persons (”Spaceflight meets Geriatrics!”).

Botswana

Space Based Geospatial Information for Food Security

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This presentation is focused on space based geospatial information for food security as the driver of sustainable development. Geospatial information can be used as an effective decision -making support tool to support societal activities related to land and water, environment and the atmosphere. The race to space technology is not based only on the exploration of the solar system; but a race against poverty and food insecurity on the continent. Geospatial information is needed for better monitoring, management and planning of resources for decision making.

There is a claim that information is the key ingredient for planning and management [1], and that high quality Information is the base of effective management [2]. Management is a challenge itself and it is a factor to achieve the stated outcome [2].Therefore management is a necessity for sustainability and productivity. Relating the technology to agriculture, there is a claim that farmers who effectively use information earn higher returns than those who don't. In this case information is related to spatial distribution and variability of soil and crop conditions across the farm. Spatial information can be used to show spatial distribution and variability of features being studied on the ground.

Geospatial technology has changed the traditional way of managing and monitoring the atmosphere, land, and water resources into modern digital precise spatial information. The challenge faced by agricultural crop farming farmers is that farmers lack precise spatial geographic data and information about their farms. Precise Geospatial information based crop farm management Information systems and models on crop farming in many countries are very scarce. The information used is mostly documented and printed reports. In most cases, this is due to lack of tools and expertise that can be used to provide precise digital data. To solve all these challenges, Space science is the solution.

This presentation showcase space techniques that can be used in the development of a precise crop farming geospatial information management models to assist farmers to manage farm activities in order to increase production and profit. The research has identified technologies such as Global Positioning System (GPS), Remote sensing systems, Geographical Information System (GIS) that are capable to collect, store and process geospatial farm data into useful management information. Remote Sensing and geographical information systems provide baseline spatial information and up to-date data.

Successful case studies based on both commercial and subsistence farming of developed and developing countries have been identified. The space technology can be used by agricultural extension workers, researchers and by farmers to increase production and reduce poverty.

Brazil

Monitoring environmental variables and earth system phenomena from space using nanosatellite technology

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In many studies of sustainability and climate change, several types of measurements are required to understand earth system phenomena and/or environment variables. Nowadays, there is a a significant amount of ground-based measurements of dozen types of environment features. However, observations from space can provide a more spatially uniform and time-continuous coverage, which is very important to any study of the earth system processes. As examples of the use of satellite measurements: (1) prediction of extreme weather events (one of the major features of climate changes) requires high-resolution numerical weather prediction (NWP) models and the maximum amount of observational data available; (2) remote observation of surface properties (both over land and sea) can be very useful for land use studies, deforestation impact assessment and interaction of the vegetation with the ground and sea (climatic conditions); (3) assessment of atmospheric gases from space (e.g. nitrogen and carbon dioxide) can provide biogeochemical traces to improve the studies of the greenhouse effect and global warming. Nowadays, in Brazil, there are several ground networks composed by different types of sensors that provide earth system measurements, including lightning and/or thunderstorm sensors, greenhouse gases, wind and solar potential for energy generation, however the Brazilian scientific community now demands new types of measurements that can be provided by satellite solutions, like for example the nanosatellites. Such data are important to expand the observational databases improving S&T studies towards sustainable driven problemsolving researches.

Brazil

UNISPACE+50 and beyond

André João RYPL
Ministry of External Relations – Brazil

As we gather to tackle the agenda of UNISPACE+50, we need to give some thought to the day after and the years ahead. More specifically, we need not only to think about the concepts, pillars and aims of UNISPACE+50, but also to discuss how to strengthen the Committee and ensure it retains its central role as the major multilateral forum for the discussion of space issues. We need to discuss the implementation of UNISPACE+50, but at the same time we need to consider the best way – or ways – to help COPUOS evolve in tandem with developments in space science and changing political scenarios.

The first 50 years of UNISPACE illustrate how fast change can be. Our predecessors could not have anticipated what today's reality would be – and yet they were wise enough to develop a system that is still functional in spite of its limitations.

The lessons we learned from the past mean that it is safe to say that the pace of change in the next 50 years is likely to prove all our forecasts wrong, however daring we choose to be. The only safe prediction I can make is to say that COPUOS will remain essential. The centrality of COPUOS as the multilateral forum for the discussion and advancement of the space agenda must be retained and renovated. As I look forward to the challenge of chairing the Committee in its first post-UNISPACE+50 session, this presentation will invite our fellow HLF2017 participants to consider how change can be a powerful ally to an effective COPUOS so that 50 years for now, our successors are able to pay homage to our vision of the future.

Canada

"UN COPUOS: Development of an International framework for space Weather Services for UNISPACE+50 in the context of the Space 2030 Agenda"

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Recent research has revealed new understanding of both the increased likelihood of, and potentially catastrophic impacts arising from, severe space weather. Affects on terrestrial and space-based technological infrastructure can be catastrophic, including the potential to collapse electrical power grids, damage or result in the total loss of satellites, disrupt international communications and the global financial network, interrupt of HF communications and GPS services, and impact airline operations. As a result, there is an immediate and urgent need to assess the vulnerability of the world's terrestrial and space-based infrastructure to space weather and to mitigate the related impacts. In particular, there is a pressing need for Member States to advance the scientific knowledge of the drivers and impacts of severe space weather with the goal of improved resiliency, improved space weather services, more accurate risk and socio-economic impact assessments, and actionable mitigation plans. In the 21st Century, all Member State national economies are connected both regionally and globally. Therefore even countries with a perceived low domestic space weather risk will benefit from a global approach to mitigating space weather risks. Mitigating the effects of extreme space weather is hence one of global international importance. In 2015, the Committee on the Peaceful Uses of Outer Space (COPUOS) mandated a milestone event, branded "UNISPACE+50", to take place in 2018, as a segment of its 61st session, to mark the 50th anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE I) held in Vienna in 1968. UNISPACE+50 represents a very timely opportunity to strengthen the mandates of COPUOS to better address current developments and challenges in outer space activities, and to determine the future thematic priorities which could be implemented on a global scale in cooperation with all relevant stakeholders. Building on the success of previous actions of COPUOS in relation to space weather under the Long-term Sustainability of Outer Space Activities, here we review the critical importance of undertaking future internationally coordinated actions to protect against threats from severe space weather. We focus in particular on the recent work of the UN COPUOS expert group on space weather, and the importance of the UNISPACE+50 Thematic Priority 4: Development of an International framework for Space Weather Services in the context of the Space 2030 Agenda.

CANEUS

Global PPP Effort to Create Small Satellites Development Facilities to Provide Access to Space, Space Technology data and facilities to Deliver Commitments for UNISPACE+50 and Space2030 towards SDGs

Milind PIMPRIKAR
CANEUS International, Montreal, Canada

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 2016 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. The planned initiative supported by the host/ contender/ interested Asian Country will be aimed at facilitating Global capacity building and access to satellite technologies including design and construction of small satellites to serve the needs of UN Member States in preparation of UNISPACE+50.

CANEUS is in dialogue to build long term coalition with Indian Government about this forthcoming “Design and Construction of Small Satellites” venture as 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 vision is to swiftly upgrade the existing eco-system offered by India by setting up world class “Center of Excellence on Space Sciences & Technologies for Development”-(CoE4SSTD) to provide all support and sustainability to the proposed venture and to be future Global Knowledge Hub for space sciences. Proposed strategy is best suited to help fulfill the objectives set by UN-OOSA under UNISPACE +50 programmes.

The objective of 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 hands-on 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.

Proposed "Center of Excellence on Space Sciences & Technologies for Development"-(CoE4SSTD) 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" including "CoE4SSTD" will be 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 long-term 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.

CANEUS

"Global Space Facility 4 Development" - GSF4D: Operational CORPUS Fund and Facility To Deliver Commitments for Space2030 towards SDGs

Milind PIMPRIKAR
CANEUS International, Montreal, Canada

In order for UNOOSA to explore the full potential of realization of Space2030 Agenda programmes and projects, there is an immense need to devise dedicated funding facility and by way of utilizing and leveraging existing official mechanisms in member countries.

CANEUS proposes partnership with the United Nations Office of Outer Space Affairs (UNOOSA) to create a Global Space Facility (Fund) for Development (GSF4D), an entity within and to be administered by UNOOSA, as an operational vehicle for implementing commitments for UNISPACE+50, leading to realization of Space2030 Agenda programmes and projects by way of UNOOSA to utilize and leverage existing official mechanisms in member countries.

The GSF4D initiative, with participation of stakeholders from worldwide, is mandated to generate and establish a corpus GSF4D Fund of 50 Million US Dollars, in consultation and partnership with UNOOSA and subject to its approval, proposes to develop the modalities to launch a comprehensive campaign covering two phases that will seek contribution and/or commitment pledge from stakeholders worldwide.

Whereas, the Phase 1 would generate Initial fund of approximately one million USD that will help develop and formulate the framework to define projects and services to be offered through GSF4D. These services and projects may include STEM for woman, advisory service, capacity building, assisting establishing space and ground infrastructure, building data centre, developing operational programmes based on space technologies and other practical areas to assist Member states.

Subsequently, the following Phase 2 will build on the framework to undertake a focused fund raising effort, which includes contribution from governments and public sector, private sector companies, foundations, amongst others, to accomplish a target of 50 million corpus fund to mark UNISPACE+50 in June 2018. With our successful efforts, GSF4D may invite countries to become its member.

The GSF4D should function as a fund from which various general or specific purpose Programmes can be launched. It will be with the understanding that the corpus fund will not

be spent, in order to sustain its further growth beyond 2030, and the core fund will tap into other resources for undertaking/facilitating initial projects and programmes contributing to 4 pillars of UNISPACE+50.

The Global Environment Facility (GEF) serves as an excellent proven example wherein $1 investment has been successfully leveraged with $5.2 from other resources.

The action plan based on priority areas identified within Space2030 will help UNOOSA to start working more effectively and efficiently soon after its establishment. UNOOSA would launch a formal call to invite proposals to develop projects from developing countries. Successful proposals would receive full or partial funding through GSF4D.

It is expected that the GSF4D mechanism will open up a vast market in developing countries for the space technology solution providers.

China

Application of Space Information Technology in Disaster Mitigation and Disaster Relief

Xijin FENG
National Space Science Center, CAS, Beijing, China

Application of space information technology for disaster management will be introduced in this presentation. The content of the report is divided into three parts. The first is a brief introduction to the natural disaster and disaster management system in china. The second part is to introduce the application of spatial information technology in the whole cycle of disaster management. This part will show the results of monitoring and assessment of floods, earthquakes and other disasters using spatial information technology in China. In addition, some cases of spatial information products serving international disasters are also introduced. The last part will make some suggestions on the follow-up development of space-based information for disaster reduction.

China

Progress of BRICS Remote Sensing Satellite Constellation

Jiang HUI
China National Space Administration, Beijing, China

In August 2015, an official initiative to the other BRICS space authorities was launched by China National Space Administration, to jointly build a BRICS remote sensing satellite constellation and establish a remote sensing satellite data sharing mechanism, to address challenges such as global climate change, major natural disasters and environmental protection faced by mankind and contribute to sustainable socio-economic development of BRICS countries. Since then, the cooperation of BRICS countries have been strengthened.

In this presentation, a comprehensive overview of progress of BRICS Remote Sensing Satellite Constellation since 2015 will be given, with focus on the mechanism of the BRICS Joint Committee on Space Cooperation, cooperation policies and space applications. Follow-up plan of the remote sensing data exchange will also be introduced. The willingness of cooperation with international partners to collectively contribute to the peaceful uses of outer space will be expressed.

China

Chinas New Generation of Recoverable Satellite

Xin LIU
Institute of Spacecraft System Engineering, Beijing, China

China's recoverable satellites (Fanhui Shi Weixing, FSW), the first generation of space experiment satellites with payload recovery ability, are applied to space scientific experiments, national land and resources surveys and other tasks and substantial results have been achieved after 24 times of successful launch and recovery. In recent years, China's demands for space scientific experiments and new technology demonstration are continuously increasing and higher requirements have been brought forward on operating costs, microgravity levels, data handling, operation mode and other aspects. Reusability is an important means of achieving low operating costs. In addition, the development and progress of such technologies as reusable thermal protection structures, accurate return site control and micro-vibration isolation have facilitated the formation of increasingly mature technological basis for the development of a new generation of reusable platform with more superior performance and lower costs. Based on our active promotion of research and development (R&D) of a New Generation Recoverable Satellite(NGRS), better and more convenient services can be provided for space scientific experiments and new technology demonstration by virtue of their superior performance, low costs and flexibility. This presentation will give an overview of research on the NGRS and explains several critical issues for reusability. Also experiments we carried out on recoverable satellite will be introduced.

China

The Requirement Analysis for User-Oriented Space Weather Products and Services

Tan MEI
Institute of Spacecraft System Engineering, Beijing, China

China's recoverable satellites (Fanhui Shi Weixing, FSW), the first generation of space experiment satellites with payload recovery ability, are applied to space scientific experiments, national land and resources surveys and other tasks and substantial results have been achieved after 24 times of successful launch and recovery. In recent years, China's demand for space scientific experiments and new technology experiments is continuously increasing and higher requirements have been brought forward on operating costs, microgravity levels, data handling, operation mode and other aspects. Reusability is an important means of achieving low operating costs. In addition, the development and progress of such technologies as reusable thermal protection structures, accurate return site control and micro-vibration isolation have facilitated the formation of increasingly mature technological basis for the development of a new generation of reusable platform with more superior performance and lower costs. Based on our active promotion of research and development (R&D) of a New Generation Recoverable Satellite (NGRS), better and more convenient services can be provided for space scientific experiments and new technology experiments by virtue of their superior performance, low costs and flexibility. This presentation will give an overview of research on the NGRS and explains several critical issues for reusability. Also experiments we carried out on recoverable satellite will be introduced. We recommend that experiences and achievements in other practices around the globe be shared in this workshop. It will be useful for establishing an international framework for space weather services.

Colombia

Space for Peace: Space Technologies as Means to Achieve the Sustainable Development Goals for a Peaceful Country.

Edgard RODRIGUEZ
Colombian Ministry of Foreign Affairs, Bogota, Colombia

Space is a driver for socio-economic sustainable development as is an opportunity to strengthen Colombia's peace process. Colombia is facing a significant change face towards becoming a peaceful country in which the Government and the society goals will be directed to live in a prosper country. This has been the work and final goal of the current presidency since 2010 and the terrain have been prepared for that achievement from day one. The leadership of Colombian foreign policy during the build-up of the SDG methodology was one example. Colombia's National Development Plan is aligned with the SDG and the Government institutions are working towards its accomplishment.

In this context, the outer space issues are a promising opportunity to forge a new industry raising the economic welfare, contribute to the I+D and ICT sector and use its applied technologies in several areas such as medicine, national security, meteorological studies, risk management, biodiversity preservations. This would be an add value to the peace process and the Government policy towards it by improving life standards in a society which is changing weapons for opportunities and a Government that must meet new needs in an environment of prosperity.

Nonetheless, there is a significant gap between the progress of the 2030 Agenda and its SDG and the lag of the country's space policy. In this presentation I will explain the linkages that this two variables have between each other and the important points where they meet to identify the challenges that the country has in terms of space activities and the significance that the fulfilling of these gaps would bring to a country living in peace.

Costa Rica

Role of an Emerging Country in fostering Space for Sustainable Development: The Costa Rican perspective

Marcela ZAMORA OVARES
Ministry of Foreign Affairs of Costa Rica, San José, Costa Rica

i. Aerospace Development in Costa Rica

The start of the registration of Costa Rica's activities in the space field dates back to 1980, when Dr. Franklin Chang Díaz, a Costa Rican scientist, was selected to participate in the NASA astronaut program in the United States, traveling to space for the first time in 1986, aboard the STS-61-C mission.

The interest of Costa Rican civil society and academy to become involved in space activities led to the founding of the Costa Rican Association for Space Research and Dissemination (ACIDE) in 1989, whose role was mainly the involvement of students and young professionals in educational and outreach activities for the new generations.

In 1990, Costa Rica hosted the I Space Conference of the Americas, an event led by Dr. Chang Díaz and with the collaboration of the United Nations, as well as officials from the academy and the Government of Costa Rica.

In 2004, the *Asociación Estrategia Siglo XXI (ESXXI,* in Spanish*)* was founded as a non-profit organization composed of members of the country's academic, business, institutional and political community. *ESXXI*'s mission is to "monitor and promote through critical thinking, analysis, discussion and diffusion of key information, the transformation of Costa Rica into a developed country by 2050," being the country's aerospace development an integral part of its program of work.

In 2009, the Central American Association for Aeronautics and Space (ACAE, in Spanish) was created as a non-profit organization, which leads the efforts to introduce the Central American region in the world's technological paradigm of aerospace development. Its vision is to inspire the Central American talent to participate in the development of the aerospace industry.

ACAE is working with the private sector, the government and academia of Costa Rica through initiatives as the development of the aerospace related law framework, promotion of research, generation of innovative projects and promotion and diffusion of knowledge in the aerospace field.

Several initiatives in all these fields have been leaded by ACAE since its creation in 2010. ACAE concluded that one of the most efficient ways to promote the benefits of aerospace development in Costa Rica is showing its potential, designing and building the first satellite of Central America: a nanosatellite based in CubeSat standards.

In 2010, the Government of Costa Rica incorporated the promotion of the aerospace industry as one of the objectives of the National Development Plan 2010-2014, which incorporated the space sciences as part of the strategic objectives in terms of competitiveness and innovation. Likewise, Decree No. 36102 RE-MICIT was signed which created the National Council for Aerospace Research and Development of Costa Rica (CONIDA, in Spanish)

In 2012, through efforts of the Costa Rican Ministry for Foreign Affairs, the country officially became a Member State of the Committee for the Peaceful Uses of Outer Space (COPUOS).

The United Nations/Costa Rica Workshop on Human Space Technology was organized from 7 to 11 March 2016 in San José, Costa Rica.

On 8 March 2016, Costa Rica Aerospace Cluster (CRAC) was officially launched, whose main objective is to position the country as a provider of solutions for the international aerospace sector.

ii. National space science and technologies actions in support of Agenda 2030 for Sustainable Development

What currently exists and what is the broad future potential?

- Promotion of Aerospace Industry
- Ad Astra Rocket Company Costa Rica
- Irazú Project
- DAEDALUS Project
- DSPACE Project
- ISS-NanoRacks Project

iii. Lessons learned, challenges and opportunities (Costa Rica)

- Empowering national awareness of the potential opportunities that sustainable space activities bring to an emerging space nation.
- Space diplomacy:
    - Assure adherence to international instruments, principles, resolutions and guidelines relating to the global governance of outer space activities, in line with national legislation and the pillars of the Costa Rican foreign policy.

- Building and strengthening partnerships in space activities as a key factor for space law and policy capacity-building efforts in Costa Rica. Also within the framework of the national initiative of the internationalization of services.

EURISY

Lessons Learned from End Users: The Eurisy Strategy to Connect Space and Society

Dominique TILMAS, Grazia M. FIORE
EURISY, Paris, France

KEYWORDS: Satellite-based services; Health; Sustainable cities; Innovation; Earth observation; Satellite navigation; Satellite Communication; Local administrations; SDG 3; SDG 11.

Space technologies — and satellite applications in particular — have entered the daily life of people everywhere. During the last ten years, efforts have been made at the international and national levels to improve the quality of space data and signals and to produce services that are increasingly accessible, affordable and in line with users' needs. The European Galileo, Copernicus and EGNOS services have indeed been conceived to support economic growth and social and environmental well-being in Europe and behind.

The direct work of Eurisy with public administrations and SMEs using operationally satellite-based services shows that professional communities operating at the local, regional and national levels are increasingly aware of the existence and of the potential of satellite-based services. In sectors such as agriculture, environmental protection, transport and risk management, satellite services have proven their added value, they are becoming even more accessible and efficient, and are today routinely used by a number of public and private organisations.

Despite such progresses, further efforts are needed to deploy the full potential of satellite information and signals, especially at the local level. Because of digital divides and communication gaps, also in Europe many still consider satellite-based services as tools for the exclusive use of researchers. Eurisy challenges this perception, by creating arenas for dialogue and exchange on the concrete operational uses of satellite-based services in fields that are often neglected by the space community, but that are fundamental for the achievement of the Sustainable Development Goals.

For the period 2017-2019, Eurisy is focusing on three main themes: Space for Cities, Future Health, and Search and Rescue in remote areas. The association aims at raising awareness on satellite-based services that are already operational and that could be transferred to other contexts, as well as at identifying barriers to the uptake of satellite-based services by the professional communities working in these sectors. Indeed, the work carried out by Eurisy with public administrations and SMEs under its User programme since 2006 indicates that the most efficient and sustainable satellite-based services are developed for and in

collaboration with the user communities themselves. Furthermore, as satellite data and services are by their very nature sharable, comparable and scalable, Eurisy fosters cross-border and cross-sector cooperation to minimise the costs and maximise the benefits of satellite-based solutions.

Satellites alone cannot fight global warming or inequalities, but they offer precious data and signals that can be used to improve the status of our environments, economies and societies. For their potential to be fully exploited, the discourse around space applications shall not focus on the technology *per se*, but rather on the needs, expectations, operational priorities and feedback of the public administrations, private companies and NGOs who can use such tools to build healthier, sustainable, and more inclusive societies.

European Commission

Sustainability and security at sea in the context of the EU's Copernicus Earth observation program

Harm GREIDANUS
European Commission – Joint Research Centre (JRC), Directorate for Space, Security and Migration, Ispra, Italy

The Copernicus program for Earth observation is one of the flagships of the European Union (EU). It aims to exploit space-based data for improved governance and economic growth. This multi-billion-euro investment comprises the operation of European satellites and ground stations, the integration of data from 3rd party satellites and of non-space ("in-situ") data, and the processing and analysis to create useful products and services. The data – mostly images – from the Copernicus satellites, calibrated and formatted to standards, are openly and freely accessible; but also a set of derived geophysical and regularly updated information products are created, in the form of the Copernicus services. The services address six main thematic areas: Atmosphere, Marine, Land, Climate, Emergency, and Security. Only the Security Service products have a restricted access. These data and services are aimed for use by authorities in designing and implementing their policies. In the case of the EU, information provided by Copernicus is essential to monitor the implementation of several EU policies related to e.g. water quality, civil protection and climate change. Many of these EU policies mirror the Sustainable Development Goals (SDGs). But the Copernicus data and services are also aimed to be used by private industry as a basis to create further downstream products for commercial customers, thereby inducing economic growth.

One of the aspects that need observation and monitoring is human activity at sea. This is done by tracking and mapping of ship traffic, a.k.a. maritime surveillance, and satellites provide a powerful tool for that. From the point of view of governance, the seas need to be controlled to prevent pollution, overfishing, piracy, smuggling, trafficking and unsafe situations – enforcing sustainable exploitation, and imposing a safe and secure maritime environment which is key to the development of the blue economy. From the side of business, improved tracking of shipping will enable e.g. more optimal decisions on asset allocation and pricing.

While the European Maritime Safety Agency (EMSA) is providing operational Maritime Surveillance under the Copernicus Security Service, this presentation will show some recent R&D examples of obtaining information on ship traffic by combining and analysing data from various satellite sensors, in the contexts of maritime spatial planning, fisheries control,

counter-piracy, and the Arctic. The role of the Copernicus satellites will be indicated; in particular, its Sentinel-1 radar imaging satellite has a unique value to probe and map ship traffic that may not duly report to authorities under IMO (International Maritime Organization) rules. But it will also be underlined that the EU's program alone is not able to cover all information requirements – considering the extent and global connectivity of the oceans, plus the dynamic nature of the ship traffic, international collaboration will be needed to obtain a more complete picture in the various regions of interest across the globe.

Germany

Societal Challenges of Global Dimension - Space for Sustainable Development Goals

Friedrich Erwin Rudolf DÄUBLE
Permanent Mission of the Federal Republic of Germany to the United Nations Vienna, Austria

In 2018, the international community will gather in Vienna for UNISPACE+50, a unique opportunity to chart the future course of international cooperation in outer space activities. One of the pillars on which this effort is built, space diplomacy, aims to foster socio-economic sustainable development and build constructive, knowledge-based partnerships through cooperation among nations. With multilateralism as one of the central themes of its foreign policy, and with the intensification of international cooperation as one of three guidelines of its space strategy, Germany strongly supports these objectives.

Through its participation in international organisations on a regional as well as the international level, such as the European Space Agency (ESA) and the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), but also in bodies such as the Inter-Agency Space Debris Coordination Committee (IADC), the Committee on Earth Observation Satellites (CEOS) or the International Charter for Space and Major Disaster, Germany already plays an active role in international space cooperation. As space activities continue to evolve, and as global phenomena such as globalisation or climate change pose ever greater challenges, we expect cooperation in space to become even more necessary and therefore endorse the efforts undertaken in preparation for UNISPACE+50 to build stronger partnerships and strengthen international cooperation in the peaceful uses of outer space.

In light of the aforementioned challenges, an important aspect of UNISPACE+50 will be to further align the work of UNCOPUOS, its subsidiary bodies and the United Nations Office of Outer Space Affairs (UNOOSA) with the global development agendas, i.e. the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction and the Paris Agreement. As outlined in its space strategy, Germany sees space as a key to solving these challenges. In particular, the Federal Government has placed a strong emphasis on engaging African countries to jointly address these challenges. Through its G20 Presidency, Germany has driven efforts toward the G20 Partnership with Africa, and the Federal Ministry for Economic Cooperation and Development has outlined the cornerstones of a Marshall Plan for Africa, which aims to establish a new partnership between Africa and Europe. DLR, with support from the German Federal Foreign Office, is assisting the World Food Programme in the risk mapping and early detection of critical weather and climate

developments to help prevent, mitigate and prepare for natural disasters as an essential part of WFP's mandate to combat global hunger. As part of ESA's AfriSAR project, Germany has also helped map the rainforest in Gabon to help improve climate models and better understand global warming.

Finally, UNISPACE+50 will also provide an opportunity to strengthen the governance of space activities at the global level. With the number of actors in space increasing, Germany welcomes the simultaneous increase in membership of UNCOPUOS. The key challenge ahead will be to preserve the substance of the core principles of the legal framework governing space activities, while at the same time further developing the legal framework to respond to the evolving nature of, and emerging challenges to, space activities. Efforts to universalise membership in the United Nations treaties on outer space is of high importance to Germany.

Germany

Fostering innovation and technology transfer in support of socio-economic development

Gerd GRUPPE
German Aerospace Center, Bonn, Germany

UNISPACE+50 constitutes an important opportunity to highlight and strengthen the role of space as a driver for socio-economic sustainable development. Space technology has enabled a revolution of society, characterized by instant global communications, navigation services for traffic, logistics and security, precise time signals for synchronisation of grids or financial transactions, and many additional applications. The previous High-Level Forum already observed that UNISPACE+50 is a milestone opportunity to demonstrate the broad societal benefits of space as an area of innovation, inspiration, interconnectedness, integration and investment. Harnessing and further expanding the benefits of space for society is also the overarching objective of Germany's space strategy, which calls for all space activities to be oriented toward benefits and needs of citizens on Earth.

An important aspect the Federal Government's space strategy highlights is that the economic benefits of space extend way beyond the traditional space industry itself. It recognizes that significant potential lies in applications and services markets which are only made possible through space-based infrastructures. Space applications and technologies therefore carry an enabling function that allows other economic sectors to prosper, thereby benefiting society as a whole. In order to promote such cross-sector synergies, and in fulfilling the Federal Government's new high-tech strategy, the DLR Space Administration has stood up the INNOspace initiative. INNOspace aims to enhance innovation and technology transfer from and into the space sector, exploit new markets and create platforms for information and communication between the space sector and other industrial sectors. Through activities such as INNOspace Masters, INNOspace Weekend or the action plan "Space Moves!", DLR Space Administration has brought together young and imaginative entrepreneurs with both the space and other industry sectors and has started a dialogue to create new synergies.

Beyond its domestic sphere, Germany is also committed to helping other countries use space applications and technology for their own benefits. DLR and the Federal Government are engaged in a range of capacity-building efforts with international partners to increase access to space-enabled services. By supporting the United Nations Platform for Disaster Management and Emergency Response (UN-SPIDER) regional office in Bonn, Germany helps making space-based services available to those struck by disaster who need them the most. In the field of education, Germany also plays an active role. For example, a number of

scientists from DLR serve as faculty in the International Earth Oriented Space Science and Technology (ESPACE) Master's program of the Technical University of Munich, which aims to provide space engineering education specially geared toward satellite applications such as navigation, remote sensing and Earth science systems. Germany also aims to share its expertise in synthetic aperture radar technology through its SAR-EDU remote sensing education initiative, an online educational tool free for everyone.

Space technologies have a great potential to address global challenges such as climate change and disaster risk reduction as well as to contribute to efforts in the field of sustainable development. To broaden and extend the benefits of space in these areas in particular, Germany will continue to work to expand international cooperation on space activities.

Greece

Building the Foundations for an International and Cross-Sector Collaboration for a Permanent and Sustainable Return to the Moon Surface

Angeliki KAPOGLOU
Moon Village Association, Ioannina, Greece

An increasing number of credible, governmental and private sector efforts are currently underway to bring a sustained human presence to the Moon and beyond. However, particularly in the private sector, these organizations are not well coordinated or actively collaborating, to the detriment of all. Making any real headway in the coming decade, will require building an unprecedented level of collaboration between leaders in the private and public sectors, unused to working together. Over time, the actions and interactions of these diverse yet interdependent stakeholders will have to generate new space technologies, services, business models, policy and regulatory innovations, common standards, impact metrics and cultural norms and behaviours that together deliver new results. The challenge for the global space community? How can we collectively prepare for novel, cost-efficient and agile programs for lunar settlement and allow for space agencies, commercial space, philanthropists and citizens to create an integrated, mutually reinforcing strategy?

Shifting from isolated impact to collective impact is not merely a matter of encouraging more collaboration or Public-Private Partnerships. Too often collaboration is thought to be driven by alignment to formal project plans, international treaties and investment memos. What is also needed is the informal sense of shared values, sources of pride, common language, and trust in others' intentions to tackle the issues and problems that emerge "off-plan". And motivating dozens or even hundreds of organizations to work together — and making sure that projects will be developed in a way that optimizes shared value and benefits and minimizes shared risks and costs among all the stakeholders — is extremely difficult when no one is clearly in charge.

Orchestrating this kind of collective effort is possible but requires a new scale of leadership: system leadership. As outlined in a recent paper by Peter Senge at the Massachusetts Institute for Technology (MIT), the fundamental role of system leadership is to "foster collective leadership". System leadership works by cultivating a shared vision for change, empowering widespread innovation and action, and enabling mutual accountability. This must happen at several levels: Individual leaders and institutions across commercial space, space agencies, and civil society must pursue their interests in ways that benefit the broader ecosystem in which they operate, recognizing that in the long term, the two are inextricably linked. And innovative interactive structures—called backbone organizations, multi-stakeholder initiatives, cross-sector coalitions, or partnership platforms—must mobilize,

support, align, and coordinate the efforts of individuals and institutions system-wide. A recent example of system leadership can be found in the food industry, where an initiative by the Word Economic Forum that began with 17 agribusiness companies grew into a global network of 500 organizations taking action in 19 countries. The New Vision for Agriculture was launched in 2010 in response to the United Nations Sustainable Development Goals call for profound change in agriculture and food systems in order to end hunger, achieve food security and improve nutrition by 2030. To date, over $10.5 billion in private-sector investments have been committed, of which $1.9 billion has been implemented, benefiting over 9.6 million farmers. We advocate that the lessons learnt from this initiative, can be used to enable collaboration on a massive scale at any sector.

In the lead up to UNISPACE+50 in June 2018, we advocate that many commercial space leaders and space agency directors need to learn and emulate these system leadership approaches in order to strengthen unified efforts at all levels and redefine space exploration for the 21st Century. This presentation is based on a comprehensive review of documents produced by Harvard's Kennedy School, the World Economic Forum (WEF), Stanford's Social Innovation and Stanford's Technology Ventures Program, as well as seminal academic and practitioner literature related to system leadership, cross-sector partnership, inclusive business, mission driven economy, and Intervention design. The insights that will be presented draw also heavily on interviews with the Moon Village Association stakeholders and illustrate the diverse yet interrelated range of issues that space leaders have to address simultaneously.

Italy

The new SpaceLand Center in Mauritius: benefits for Asian and African Countries

Carlo VIBERTI
SpaceLand Africa, Torino, Italy

Our universe was formed as we know it now, and it is further evolving due to gravity: our life exists thanks to it. We are all made of the same elements which are to be found in stars and these elements have formed the matter, we are composed of, thanks to gravity, this latter being a result of the interaction between matter and the time-space matrix. Notwithstanding all of that, Space still looks far and hostile to most human beings. Besides, microgravity and low-gravity not only can help colonize Space but also enable mankind to aim at a new range of discoveries in a myriad fields, ranging from progress in biomedicine and pharmacology to new materials thanks to low-gravity crystal growth and studies on fluid coalescence, from analysis on the aggregation of matter to a better understanding of stars and galaxies formation and collapse, all these phenomena being heavily influenced or even driven by gravity or by its reduction. Without initiatives such as the SpaceLand Center's one, though, the overwhelming majority of the seven billion (and counting) inhabitants of Earth would never have the chance to be part of all of that, namely could never get directly engaged in the fascination of flying and testing things and phenomena just like astronauts, and could never contribute to that drastic advancement in science, biomedicine and technology that only aerospace programs can provide through such special research, development and testing programs. As demonstrated with its world's youngest (11 year old) and world's oldest (93 year old) men and the first 100% disabled woman having flown in weightlessness for microgravity research activities (some tests also commissioned by Nobel-Prize-winner's research groups), SpaceLand has really "opened Space" to anybody, dropping the price of developing experiments, training and safely experimenting in research-friendly Marsgravity or Moon-gravity environments, including usage of underwater training facilities to qualify for flight. In other words, the SpaceLand Center been built in a governmental terrain of the Indian Ocean, in synergy with the Government and the President of the Republic of Mauritius, will help democratize the access to space through such a new destination of excellence, centralizing know-how, facilities and tools in one single open-door location to provide microgravity, Lunar and Mars-gravity laboratories for anybody needing such conditions, be them for professional or personal business or science and technology interests and education or even just for leisure, edutainment and fun, as the international tourism will also be welcome to hand-on participate to the scientific and technology test activities; visitors and users will also get a chance to enter major experimental programs as test-operators or test-subjects, if they will, supporting international space agencies and research or high-tech industrial entities which SpaceLand is engaged with. The Center, ready

in one year from now, will also support the development programs in such sectors of Countries in Asia and Africa facing the Indian Ocean, laying the foundations for unprecedented progress in most basic and applied research areas benefitting from weightless or low-gravity research and test programs, such as pharmacology, biomedicine, material sciences, robotics and crewed system development projects for remote and hostile applications as well as for planetary exploration e.g. addressing operational scenarios, reaction mechanisms, dynamic forces and momenta acting on rovers, robots, drillers, penetrators, deployable booms and solar panels in actual low-gravity conditions like on the Moon or on Mars, namely all those disciplines where kinematic and dynamic research and testing can greatly advance through actually reducing or zeroing the gravity force, also featuring new educational tools and activities for schools and academia. Generating dozens of direct high-tech jobs and, through the expected snow-ball effect of aerospace tourism activities triggered by the program, several hundreds of indirect jobs in the surrounding economic entities and entrepreneurships, the SpaceLand Center can indeed be a new tool for those driving actions being conceived for the socio-economic sustainable and knowledge-intense development in the whole geographical area of the Indian Ocean, welcoming all Arab, African and Asian entities and population. The multimedia presentation will also show videos of non-professionals supporting such cutting-edge R&D projects, while living the fascinations of out-of-this-world experiences accessible by anybody: the Center will be a hand-on opportunity to demonstrate the broad societal benefits of Space as an area of innovation, inspiration, interconnectedness, integration and investment, providing new jobs and knowledge, and strengthening unified efforts at all levels and among all relevant stakeholders in all such strategic sectors.

Kazakhstan

Growing knowledge and experience in space technology in Kazakhstan

Assyl BAKASHEVA, B. AKHMETOVA
JSC “Kazakhstan Gharysh Sapary”, Republic of Kazakhstan

In the past decade the Kazakhstani National Space Agency has implemented a set of space programs which has resulted in the creation and operation of space and ground segments for both Telecommunication satellites and Earth Remote Sensing satellites. The Space Agency provides financial support to scientific and technological institutions; educational programs of higher and postgraduate education in the field of space technology are created in cooperation with the Ministry of Education.

JSC “National Company “Kazakhstan Gharysh Sapary” operates the system of Earth Remote Sensing (ERS) Satellites, including two ERS spacecraft, a ground control complex and a dedicated ground complex for receiving and processing space data. The Kazakhstani ERS Space System is a national system that supports Government policy and decision making in a number of key areas. These include resource monitoring, resource management, land-use mapping and environmental monitoring.

We were supported in our work by being able to undergo training in leading companies outside Kazakhstan, such as Airbus in France and SSTL (Surrey Satellite Technology Ltd), a British company. The knowledge and experienced gained has been put into practice in the Spacecraft Operation Centre, operating the KazEOSat-2 spacecraft and mission. This is the second Kazakhstani ERS satellite, built upon heritage designs from theSSTL-150 class missions run by SSTL.

Space engineering and technology are in state of constant development. Kazakhstan is a country with a developing aerospace sector but does not have sufficient experience and expertise on its own. It is therefore necessary to learn from and partner with other countries and companies with leading and developed space technologies to grow our own knowledge. This is of the utmost importance in the design and launching of new satellites to replace our current ones. The opportunity of participation in international workshops, trainings and conferences is also essential for our professional employees to determine the right direction and choose the best technologies.

Kenya

Characterization of ionospheric irregularities causing GNSS signals scintillation over the low latitude regions in Africa.

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Ionospheric Scintillation over the equatorial region poses a significant threat to precision navigation using the Global Navigation Satellite System (GNSS). Equatorial scintillation of GNSS navigation signals follows a regular diurnal and seasonal variation from which a meaningful climatology can be derived. The diurnal behavior is driven by the formation of large-scale equatorial depletions which form post-sunset via the Rayleigh-Taylor instability near the magnetic equator. The highly-structured depletions map pole-ward along the magnetic field lines to approximately 15 degrees north and south of the magnetic equator, causing scintillation over a large geographic region as they drift eastward and slowly decay prior to sunrise. Seasonal variation is a function of geographic longitude and magnetic declination angle. Understanding the climatology and behavior of these depletions, however, provides a basis for developing real time now-casting and forecasting of the occurrence of scintillation events over a given region. The presence of scintillation causing irregularities in the ionosphere can be detected by using transionospheric radio signals such as those of the Global Navigational Satellite System (GNSS) by monitoring the fluctuations in amplitude and phase of the radio wave signals as they traverse the ionosphere. During such fluctuations in phase and amplitude, the ionosphere does not completely absorb the signal. The irregularities in the index of refraction scatter the signal in random directions about the principal propagation direction.

While several efforts have been made in studies of equatorial scintillation, scintillation forecasting still remains a challenge. The interconnection between mechanisms responsible for space weather events at both low and mid latitudes necessitates that ionospheric characterization and electrodynamics studies be carried out in conjunction with each other rather than in isolation. In this context we propose to use resources (data and instrumentation) from low latitude regions (based in Kenya) to improve the understanding of the mechanisms and distribution of scintillation and the models for prediction of scintillation. Studies on the characterization of regional scintillation occurrence remain

useful towards establishing a clear climatology of scintillation occurrence. The spatial distribution of scintillation occurrence can give information on the exact location in the sky where scintillation is intense and can thus form a basis for now casting and forecasting of scintillation occurrence for real time relay of the information to the potential users.

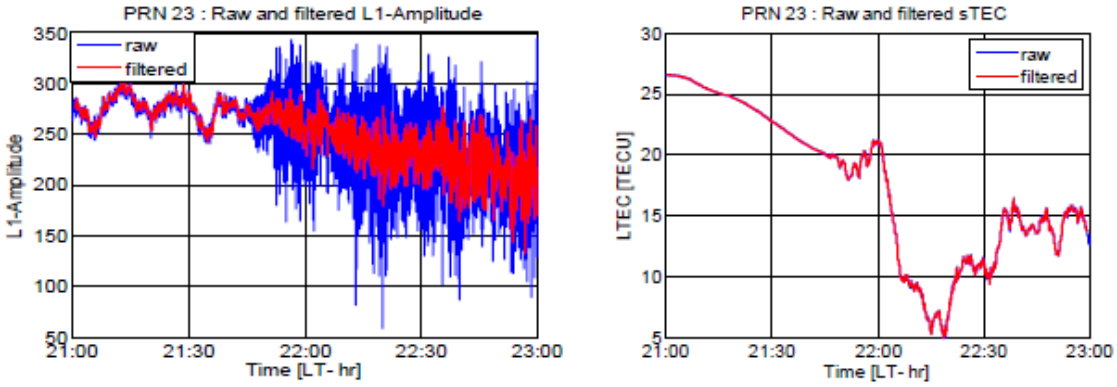

Figure 1: Raw and filtered L1 amplitude measurements and the raw and filtered relative TEC computed for PRN 23 over the Kenyan airspace on 2016-08-14.

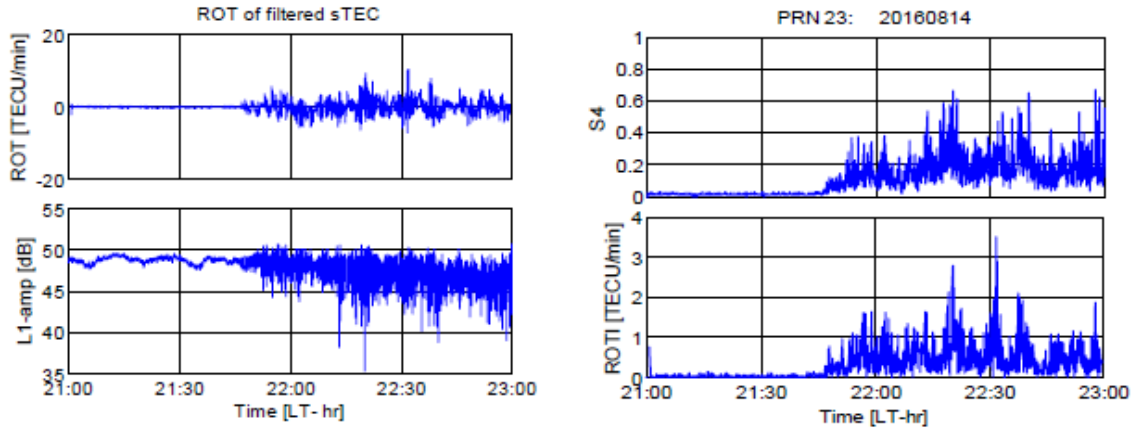

Figure 2: Comparisons between ROT of the filtered relative TEC and the filtered L1 amplitude in the left panel and the S4 and estimates for from PRN 23 in the right panel.

Lebanon

Remote Sensing Applications in Support of Public Sector in Lebanon

Ghaleb FAOUR
National Center for Remote Sensing (NCRS)

The National Center for Remote Sensing is an implementation of Lebanon's focused efforts to catch up with, and use of the application of scientific knowledge and advanced remote sensing technology notably in gaining knowledge towards achieving a proper redevelopment of the country. Areas of contribution are in: Agriculture, Environment, Human settlements, Natural Resources, Science & Technology, and Transport & Communications. The Center, both through the individual knowledge of its researchers and that gained from its involvement in regional projects, has added considerable experience to its name in geo-environmental projects.

NCRS is developing several decision tools to the serve the public sector in Lebanon. One of its mandate, is the mapping of the land cover/use map of Lebanon at scale 1:20000 each five years in cooperation of the Council of Development and Reconstruction which is in charge of comprehensive land use planning of the main sectors.

NCRS is also in charge to monitor each season through high resolution satellite image subsidized wheat crop at National level in cooperation the Ministry of Economy. Training and software also is developed to ensure sustainability in each institute.

Keywords: remote sensing, sustainable development, public sector, decision support tools.

"New Space": Private capitals and Public support enabling growth of a wider array of "Space Players"

Paola LEONI
Leoni Corporate Advisors, Geneva, Switzerland

Intro

Recent years have seen a new wave of activism when it comes to Space: next to Agencies and institutions, several new commercial players have emerged, with visionary ideas for the future of humanity.

Driven by a bold spirit and entrepreneurial mindset, companies such as SpaceX or Blue Origin are developing projects targeting Interplanetary Exploration and the deployment of permanent outer space settlements.

These entrepreneurs are re-shaping the industry future, not only looking at outer space, but also to our planet Earth with several new ventures focusing on downstream service market, with innovative ways of providing traditional services: ranging from a better earth imagery to ubiquitous broadband, potentially bringing billions into the global economy.

Agencies continue to traditionally support their programs: NASA with the SLS rocket specifically for mission to Mars, ESA focusing on the "Moon Village", nonetheless, these institutions are beginning to exploit commercial procurement models rather than directly developing in-orbit assets.

To reach these ambitious goals in reasonable timeframe and in a sustainable fashion, private capitals are consistently flowing in the space industry, reaching level comparable to the space budget of a small country, with start-up space ventures having attracted over $16.6 billion of investment since 2000.

New Space will enable a wider democratization of space, a future where not only Agencies and Governments of large space fairing states will have the lion-share. The New Space focus on cheaper off-the-shelf technologies and on downstream services will open the markets for several countries newcomers to the space industry enabling cheaper access to space, with small satellites; and easier access to space data.

The trillion dollars "New Space" market

New space is the space industry latest era, which is fostering a paradigm shift in space utilization opening a trillion $ market.

Such audacious leaps forward in space, has been fostered by the entrance in the industry of private capital and commercial players. "New Space" activities were valued 323$B in 2015:

private players are risk-takers, willing to experiment different solutions, focusing on a business case-customer need approach rather than only looking at the technology.

Asteroid and space mining alone is expected to be worth 3$ trillion by 2050, the number of commercial players is growing, with companies such as Planetary Resources, and DSI being the pioneers of such development.

Furthermore, the need of a functioning LEO infrastructure, enabling a faster and affordable access to space, is fostering the development of space tugs enabling On-orbit Services: refueling, repair and inspection of orbiting spacecrafts. The on-orbit services market has been valued 10$M in 2016, but is expected to hit 80$B in 2030.

In addition to these, the downstream Satellite Service market recently surged over $200B, with a stable 12% CAGR in the last 5 years pushed by the new wave of applications enabled by New Space ventures focusing on innovative Communication (e.g. OneWeb), Earth Observation (e.g. Planet) and Navigation services.

What's still missing and how to get there…

More nations are now within reach of space than ever before, while the influx of entrepreneurial capital is driving innovation and new technologies in the private sector. But to keep this momentum Nations investing in space should define their positioning: from Full-fledged space fairing nation, to Newcomers investing in Space to strategically harness the benefits (qualified workforce, return on investment, etc.)

A new eco-system is on the rise, with potential alliances among global corporations, states and non-state actors to address the high costs of development thus enabling international cooperation.

These topics will be discussed during the Space Economy panel session on the "“New Space”: Private capitals and Public support enabling growth of a wider array of “Space Players”” at 11:30 am on November 6th, during the UN/UAE High Level Forum: “Space as a driver for socio-economic sustainable development”

Mexico

Space Cooperation in Latin America

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As mentioned in the latest Dubai Declaration, Mexico recognizes the needs to strengthen the Committee on the Peaceful Uses of Outer Space in the field of international cooperation and to promote space activities to include new members.

Mexico foster the creation of stronger partnerships and international cooperation for the peaceful use of outer space, and thus generate innovative developments based on space technology, this allows the creation of new opportunities that can meet the needs of a global level as climate change, natural disasters management and outer space phenomena.

To emphasize the above, the Mexican Space Agency as a Federal Government Entity is carrying out activities to develop human resources, infrastructure and research through international cooperation by fora and workshops, as examples, workshops for the satellite images processing for disaster management by CNES (National Center for Space Studies, France), Good Practices Workshop on the Use of Space Technology for Disaster Management by ISRO, together with local agencies. Other kind of international instruments is the international program applications to develop projects with other space agencies like United Kingdom Space Agency (UKSA) and European Space Agency (ESA).

International support is also carried out for other countries through UN-SPIDER (Space-based information for Disaster Management and Emergency Response) with the GP-STAR platform (Global Partnership Using Space-Based Technology Applications for Disaster Risk Reduction) and the project SEWS-D (Space Early Warning Systems for Droughts) in Latin America and the Caribbean. Other example is the creation of the Mexican GEONETCast Americas network: Remote Perception Tools for Decision Making on Environmental Phenomena and Disasters in Latin America and the Caribbean which allows a solid international cooperation to meet the needs of developing countries.

Finally, it reaffirms the importance of achieving efficient international cooperation to achieve regional and global guidelines and mechanisms for the pacific use and exploration of the outer space.

Mongolia

Applications of Space Technology for Socio-Economic Benefits in Mongolia

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Mongolia is situated at the Central Asian highland and borders with Russia in the north and with China in the south. The geography of Mongolia is characterized by great diversity and is divided into such zones as forest taiga, forest steppe, steppe, dry steppe, Rocky Mountains and Gobi. Pastureland plays an important role for the Mongolian animal husbandry, because they are grazing home to over 50 million head of livestock and are used by over 200,000 herding families. Mongolian livestock producers still contribute a lot to the national economy. For example, in 2016 agriculture dominated by the livestock sector accounted for definite amount of GDP, while livestock products such as cashmere accounted for increased percentage of the recorded value of the country's exports.

In recent years, due to rapid development in space and information technologies, RS technologies have been significantly evolved. System capabilities have greatly improved. Meanwhile, the cost of many of the data sets has drastically decreased. Now the highest spatial resolution image can be acquired with centimetres-accuracy, whereas the ordinary high-resolution images can be acquired with a few metres accuracy. That means, it is now possible to extract different thematic information of varying scales, to integrate the extracted information with other historical data sets stored in a GIS and to conduct sophisticated analyses for socio-economic benefits.

This paper describes how a sophisticated space technology-based pasture monitoring system can be used for socio-economic benefits in Mongolia. Generally, the system calculates actual aboveground green biomass that is available for daily grazing livestock and pasture carrying capacity of entire country at provincial and village levels, using satellite RS information. From the pasture monitoring system, 4 different output products can be generated:

Actual biomass: the pasture absolute yield (kg/ha) as the amount of aboveground green biomass in dry matter.
Relative biomass: the pasture relative yield (%) or the actual biomass relative to the aboveground green biomass of pasture that would be attained without water limitations to the plant.
Biomass available for grazing livestock: the daily optimum amount of biomass (kg/ha) that is available for grazing.

Pasture carrying capacity: the number of cattle (0.1 Sheep Units/ha) that the pasture can support based on the information in the biomass available for grazing files.

Within the framework of the study, we conducted an integrated study, compiling the outputs of the pasture monitoring system with other socio-economic data sets. As could be seen from the analysis, space technology based on modern RS, can be successfully used for pasture productivity assessment, which is in turn used for socio-economic benefits in Mongolia.

Morocco

Space activities and space policy in Africa - *Social, economic and legal aspects*: Case of Morocco

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To ensure sustainable development in Africa, space activities can play an important role in promoting the socio-economic aspects of a country. International cooperation remains an unavailable solution for developing countries, in particular African countries, to benefit from scientific and technical progress in the field of space.

Space law is an important component in international cooperation, providing space activities with guidance, and its development has taken many forms over the years.

The increasing commercial use of space necessitates that policy and law makers become aware of the need for and ways of regulating such activities.

The importance of preserving the space environment and protecting outer space from inappropriate activity should be emphasized through the education on space Law.

To illustrate the situation of space activities and its evolution in Africa, we have chosen to present the case of Morocco.

In this presentation I will propose recommendations to promote space activities in Africa; these recommendations could be useful to the work of UNISPACE + 50 which will take place in June 2018

New Worlds Institute

Space Policy and the Frontier – Defence or Vision?

Rick N. TUMLISON
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International space policy has seen two periods since the era of exemplified by UNISPACE. The first, largely a reaction to the Cold War and its proxy "space race" was pro-active designed to control the extension of statist rivalries into space, in both military and potentially territorial aspects. As such it was a healthy and visionary (for its time) attempt to protect the people of the planet, block "land grabs" beyond Earth and leaven the extreme disparity between those in the race and those on the sidelines.

The second period, of which we are witnessing the end, was essentially a series of academic and incremental shifts, changes and additions to the first. Within it were leftover assumptions and attitudes born of ever fading concepts of socialist utopias, and the false narrative that applies colonialist objectives and the ravaging of Earth's fragile biosphere to the empty and essentially dead realms beyond our atmosphere.

Today and for the last five years or so, the world has begun to enter a third period, one still indeterminate in its outcome. Still in its early phase, we will soon see if it is either a last ditch defense of outdated concepts, agreements and institutions that history will judge as stultified anachronisms that inhibited humanity's potential and attempted to block our destiny or visionary actions and guideposts that helped catalyze the most important period in the history of humanity since the dawn of civilization.

And so we face a choice. To inform this choice we and those who advise, design and enact national and international policies must understand what is happening, why it is happening, what the risks *really* are and who stands to benefit. Of course we need to also know how best to support and guide this new space revolution – so that it happens as fast as possible, is as inclusive as possible, is as beneficial as possible and assures the best returns in knowledge, wealth and hope, both for those here on Earth, those who will go and those who will soon live out there on the frontier.

To this end I suggest that the international policy community immediately shift from trying to force this new reality into the format of the old, or to defend those parts of agreements, concepts and frame works never intended to apply to what is happening today and will happen tomorrow. Instead, we should embrace a pro-active approach that begins with an optimistic view of what might be possible for humanity should we realize the promise of

space rather than what we have to fear in some sort of dark and disorderly trans-solar wild west in space.

There are many examples of what we should not do, and many of what we should. Among those we should not is to presume the intentions of all those carrying out this work are evil, greed based or imperialistic. Nor should we apply pre-new paradigm concepts as baselines to what is in many ways a complete reversal of humanity's relationship to the world, the universe and each other. Among these are the idea that the expansion of human activities is an ongoing attack on the "natural order", that we are engaged in "taking" anything from anyone, or that the space arena is an elitist or exclusive zone. *Instead we should encourage the rights of human beings to explore and live where they wish, to create and harvest what they want and to own, utilize, profit from and share/hand down those resources and ideas, objects and places in which they invest their own wealth, sweat and imaginations.* We can do all of this. We can both protect this planet and those places out there that deserve protection. We can assure the best distribution of knowledge wealth and opportunity. And we can set the stage for the next great act of the human race – if we dare to drop our defensiveness and embrace what is possible, and try something new to enable the people of Earth to create new realms and ways of being.

We are on the verge of the human breakout into the universe. It sounds grandiose, and yet is also true. The decisions we make in terms of international space policy will either inhibit it or be ignored and circumvented, as it will happen. Rather than creating obstacles, burdens and limits, is it not better that this community get ahead of this incredible movement and help lead an enlightened humanity outwards?

Nigeria

Microgravity Research and Applications: Roles in Economic Prosperity and Poverty Reduction

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Prosperity encompasses every good thing of life. It involves wealth, riches, sound-health, affluence, well-being, plenty, ease, luxury, having-speed, fortune, peace, joy, success etc. Hence, Economic prosperity in this context means having a sustainable and developed economy. Sustainable development in an economy includes economic growth, environmental protection and social equality. The microgravity environment (or simulated microgravity) of space makes it an excellent biological laboratory. Cells, microbes, plants, macromolecules and samples from material science behave differently in space. Monitoring reactions and processes in the absence of the gravity variable - which can mask subtle observations - can lead to a better understanding or provide new insights into certain processes and phenomena. Therefore, Microgravity application stimulates economic growth and improves the quality of life of people. This makes it to increase economic prosperity and to reduce poverty. The applications and advantages of research in the life sciences under microgravity are enumerated. This includes the benefits in agriculture, pharmacy, medicine, microbiology, biotechnology etc. The results of some selected experiments performed under microgravity medium that led to sustainable development are also discussed.

Keywords: Prosperity, Poverty-Reduction, Microgravity, Applications, Life-sciences

Romania

The Impact of New Threats - Directed Energy & Kinetic Weapons - On the Critical Space Infrastructure

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1. "Directed Energy Weapons - DEW" is an umbrella term covering the armaments based on new technologies that produce concentrated EM energy and atomic or subatomic particles: High - Energy Lasers (HEL), High - Power Microwaves (HPM) and RF Technologies (EMP). After more than 3 decades the Directed Energy Systems are finally coming of age for Battlefield use, offering. cost-effective precision attacks or enhanced point defense and providing flexible non-kinetic engagement options for warfighters.

Actually the main concern of scientists is the realization of DEW that has to respond to a set of requests: (1) to fit and operate from a variety of platforms;(2) to be scalable, offering both high and low power output; (3) to demonstrate the ability to operate effectively on a wide range of frequencies; (4) to be compact and highly efficient, to minimize power, cooling and other system component requirements;

2. According with U.S. Defence Science Board and EDA CapTech prognosis, HEL should be considered as "The No.1 weapon having the potential to change future military operations in dramatic ways". The HEL program is concentrated on solid state lasers to achieve power densities exceeding 100 KW for battlefield use. The actual great hopes are related to Free - Electron Laser (FAL) and Diode-Pumped Alkali Laser (D-PAL) which may be able to achieve MW - class lasers.

3. WHAT DO MILITARY LEADERS EXPECT FROM DEW?

The DEW potential represents a certitude, enabling high-level defensive & offensive non-kinetic attack options - as: (1) precision - effect instruments; (2) HEL & HPM best suited for defensive missions, including Space; (3) long - term aspirations to offensive strike missions, Space included;(4) to serve as cost - effective force multipliers: for a generalized cost of USD 1 to USD 10 per shot, DEW offer the most favorable cost - exchange ratio; (5) use regularly electrical systems charged on-station and allow deep magazines, so the cost of multiple shots per engagement is low; (6) a wide range of options for warriors - assigned to defensive or offensive missions.

4. CRITICAL SPACE INFRASTRUCTURE (CSI) IS DEPENDENT ON NETWORK-BASED SYSTEMS: the degree to which any critical component of national infrastructure, including Space - is vulnerable and dependent on a number of characteristics: type of attack; scope of attack; time of attack; duration of outage.

5. HIGH POWER MILITARY LASERS: with today's technology, fiber lasers can scale beyond 300 KW, also the power of 500 KW can be reached soon. The final target: 1 MW!

- At higher power levels can be used to destroy munition depots, blind satellites' sensors or neutralize UAVs. The list of applications is limitless.
- Both FAL and D-PAL fiber-optic lasers have an extraordinary 30 - 35 % efficiency.
- To combat Mortar Shells: P = 100 KW / For Aircrafts: P > 120 KW for range > 4 km
- Individual scenario should be build for each target, including available time to combat the target and required power level to destroy it.
- The Laser Weapons allow: (1) extremely high precision on target; (2) high multi-target capability; (3) operators can aim the weapon at a new target very quickly.
- A great logistical advantage: as long as the platform is supplied with sufficient power, the weapon remains combat capable; the Americans call this a "Deep Magazine".
- HEL weapons doesn't require any munitions to be stored, transported and guarded with extremely low combat engagement costs. The only costs arise from electricity generation - less than one euro per engagement.

6. Last one considers the noiselessness - a decisive advantage in some scenarios. Their flexibility is also unique - can be switched from a low-intensity interference mode to a high-intensity neutralization mode extremely quickly,

7. THE LASER ANTI-SATELLITE ASAT-L can shape different forms:
- Ground-, Air- and Space-based Laser ASAT systems operating at visible & infrared wavelengths;
- Dedicated Satellites carrying weapons systems for attacking other satellites or targets on the ground or in the atmosphere using DEW
- Other methods: laser attacks on satellite sensors / laser dazzling / laser partial blinding / heating and structural damage by laser

8. EMP Generation methods - divided in 4 general classes: (1) High Altitude Nuclear EMP; (2) Source Region Nuclear EMP; (3) System - Generated Nuclear EMP; (4) Non - Nuclear EMP.
- In their turn the RF systems can generate 4 main types of electronic effects: Upset / Lockup / Latch-Up / Burnout.
- The devices & methods to create EMP effects in space: (1) Flux Compression Generator; (2) Magneto - Hydro-Dinamic Generator (MHD);(3) High Power Microwave (HPM) Generator; (4) Viractor (Virtual Cathode - Ray Oscillator): The Most Straight-Forward HPM Weapon (170 KW - to - 40 GW)

9. KINETIC WEAPONS - THE RAILGUN IN SPACE: Initially installed on USS Zumwalt - class destroyers with electrical propulsion - Range 250 NM / GPS Guidance
- ODIN - Orbital Defence INitiative
- RAILGUNNING Initiative - For A Safer World!

Secure World Foundation

The Secure World Foundation's Handbook for New Actors in Space: Best Practices, Capacity Transfer, and Integrating New Actors into the Governance Domain of Space

Christopher JOHNSON
Secure World Foundation, Washington DC, USA

Capacity and knowledge transfer of best practices and useful knowledge of governance structures can be very helpful for new actors in the space domain. The Secure World Foundation's *Handbook for New Actors in Space*, a publication detailing the international and national legal/regulatory framework for space activities, along with best operational practices, can be a useful tool for bringing emerging and aspiring actors in space (whether they be states, international organizations, private industry, academia, or a mix of the above) into the 'space club' of spacefaring states in a sustainable and safe manner. This type of capacity building on the governance structures and best practices foster the sustainable and peaceful uses of outer space. Additionally, undertakings of this nature directly support UNISPACE+50 thematic priorities *2. Legal regime of outer space and global space governance: current and future perspectives* and *7. Capacity-building for the twenty-first century.*

This presentation will discuss feedback received on the SWF Handbook, as well as methods and means of capacity building and knowledge transfer that fosters and assists UNISPACE+50 priorities. They also have resulting effects such as the accrual of views and issues that face new actors in space, as they begin their first forays into the space domain. As emerging issues and shortcomings in the governance structure can be teased out and discussed by a wider body of stakeholders, these capacity-building activities therefore can strengthen the international governance structure for outer space.

Secure World Foundation

Space2030 and the SDGs: Seeking to Broaden Benefits through Synergy

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It is not enough to integrate the Space2030 agenda with the Sustainable Development Goals. Achievement of the ambitious objectives of both bold plans requires us to seek synergies between them. In pursuing such synergy, the concept of extending the benefit of space activity as broadly as possible holds great promise as a shared ideal with practical impact. Present in the objectives of the International Geophysical Year that ushered in the space age and directly expressed ever since the first UN resolution establishing COPUOS, the objective of delivering benefit to all through space activity has been rewarded with considerable success since Sputnik opened the gates to Earth orbit in 1957. Space-enabled technologies of communication, broadcast, PNT, weather monitoring and Earth observation have improved daily lives while scientific missions have enhanced the knowledge and understandings that will be necessary to address even more complex challenges in the future. For all this success, there has been little debate and even less progress on identifying the diverse kinds of benefit that have been or could be delivered through space activity. This paper provides some suggestions about how opportunities for benefit might be better identified, different perspectives clarified, and disagreements reconciled. It concludes with a call to move beyond merely repeating the largely unchanged formula that exploration and use of space "be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development…" to a concrete discussion, measured against the objectives of the SDGs, of practical ways to identify and spread the benefits of space activity as widely as possible.

Secure World Foundation

Considerations on how to Maximize the Use of Space Technology in Support of the Sustainable Development Goals

Krystal WILSON
Secure World Foundation, Washington DC, USA

The Sustainable Development Goals are not meant to be achieved by state action alone and will require the commitment of many international actors ranging from national agencies, local civil society, international non-governmental organizations, industry, and others working in a variety of innovative ways. Though the SDGs provide a useful channel and focus, they do not, for the most part, represent "new" initiatives. There are already communities within government, donor, implementer, activist, and other communities devoted to these goals. How to build strong, long-lasting channels of collaboration among these communities is one of the most important building blocks to making progress on the SDGs. If space technologies are to be well-utilized and regularly adopted across projects related to the SDGs, it's important to identify the current best practices and potential challenges to widespread use. This presentation will explore how space technology can be used to address some of challenges faced in achieving the SDGs, including less-traditional areas such as poverty reduction, small-scale infrastructure, health, human rights, and governance. Most importantly, it will look at the existing state of space technology integration and methods for strengthening understanding, increased utilisation, and long-term application. For example, the presenter explore current impediments to open Earth observation data being used fully and easily by sustainable development actors.

This presentation will seek to draw on the presenter's unique perspective of the space community and the field of sustainable development to highlight policy, best practices, and tools that could further enhance the efficacy of integrating Earth observation data in service of sustainable development.

Space Trust

0G Peace Mission 2020 - Space Diplomacy in the Age of NewSpace

Namira SALIM
Space Trust, Monte Carlo, Monaco

As per past presentations at top space industry events during the last year, and at the 2016 UN-UAE Space Agency High Level Forum in Dubai, Space Trust's presentation this year will be an update to various milestones achieved and laid out toward the vision of "0G Summit - Space Diplomacy in the Age of NewSpace."

Given that the final frontier opens to all sectors at the advent of Privatization of Space, why not open space to world leaders for utilizing it as a sustainable tool for peace-making on Earth?

Therefore, the presentation will update the participants about the most recent launch of the inaugural annual 0G Summit on the sidelines of the 72nd Session of the United Nations General Assembly, where it convened two former Heads of State, space industry pioneers and peacemakers who supported Space Trust's thought leadership in Making Space the New Frontier for Peace on Earth.

Furthermore, the presentation will unveil the "0G Summit Declaration" which has been drafted in cooperation with the participants of the roundtable discussion at the aforementioned event.

In the wake of this successful event and the one held on Capitol Hill in the esteemed presence of UNOOSA Director Ms Simonetta Di Pippo and Congressman Jim Bridenstine, the US Presidential Nominee for the position of NASA Administrator, Space Trust is tapping into the opportunity of effective partnerships to develop annual High-Level 0G Summits on Earth in a multilateral setting to transform and enhance the way global leaders approach the world’s greatest challenges.

Commercialization of Space is encouraging public-private partnerships in an increasingly complex space environment, triggering a NewSpace Economy that contributed over 300 billion dollars in total revenue in 2016 alone.

Moreover, at the dawn of our NewSpace Age, peaceful uses of space science and technology on Earth and international cooperation in space opens to all nations alike. As spacefaring and new space nations expand co-operation via human and robotic missions, the world is on the verge of ushering Space “Shuttle” Diplomacy to find innovative solutions

for a peaceful world. With the International Space Station having become a beacon for international cooperation in space, the day is not far off when private space stations will serve as a concrete platform for convenings in zero gravity.
To that end, Space Trust is pleased to announce at this HLF its first space mission: "0G Peace Mission 2020 - Space Diplomacy in the Age of NewSpace." The mission aims to send a cube satellite into orbit to broadcast messages of peace in the voices of world leaders, peace makers, civil society and youth to inject inspirational and innovative perspectives into the 2030 United Nations Sustainable Development Agenda toward Space2030.

As a further reference, 0G Summit is being observed by United Nations Office for Outer Space Affairs (UNOOSA) and, amongst other top space fora, has been presented at the 54th Session of the Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space (COPUOS) and is being recommended as a new item on the Space Governance Agenda towards Space2030.

Sudan

"Space Technology for Sustainable Development in Sudan" Initiative at University of Khartoum

Rayan IMAM
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The "Space Technology for Sustainable Development in Sudan" is an initiative by young scientists at the Space Research Centre of University of Khartoum to raise awareness about the capabilities of space technology for developing countries, to build capacity in the utilization of space technology for sustainable development and to bring together researchers who utilize space related data in their research.

This initiative started at University of Khartoum following years of work on evaluating how space technology is being utilized in Sudan to serve the sustainable development goals (the millennium development goals at the time this research started). A survey on all the bachelor, master and PhD thesis that were written at University of Khartoum in the past 50 years shows that research at this university has actually been utilizing space technology for fourteen out of the seventeen sustainable development goals. University of Khartoum was taken as a representative of the scientific productivity of Sudan because it is the top university in Sudan and it has long history of utilizing space technologies in its research.

One thing to notice about these studies that usually no money was paid by either University of Khartoum or the students to buy space related data whether it was remote sensing data or astronomy data. The studies relied either on free data, or data provided for researchers for free for research purposes. This usually resulted in delays in finishing the studies (waiting for data donors) or for the study to consider periods of time in the past (old data are usually free) or to minimize the scope of the research (free data with less quality).

The initiative aims to achieve its goals through providing data needed by researchers for their research work free of charge and to make it easy for them to access by building strong connections with data providers. It also aims to organize conferences and workshops to allow researchers to learn from each other experiences and to raise awareness about the capabilities of space technology for sustainable development in Sudan. Moreover, the project aims to help providing training on using space data for the different research topics related to sustainable development (water, agriculture, wild life, health, quality education, etc).

In addition to that, from the study of research at University of Khartoum, the only three goals that have not been covered by research at university of Khartoum regarding utilizing

space technology are *partnerships for the goals, affordable and clean energy* and *gender equality*. This initiative will even cover the former goal by building collaboration between University of Khartoum and international partners for utilizing space technology for achieving sustainable development.

This presentation will discuss the initiative and demonstrate how can this initiative play role in sustainable development in Sudan.

Switzerland

Unleashing the Potential of Space Technologies and Tools for Global Health: observations and recommendations from the Expert Group on Space and Global Health of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space

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Introduction

In preparation of UNISPACE+50 and in the context of the United Nations efforts to meet the challenges of the Sustainable Development Goals (SDGs), the Expert Group on Space and Global Health of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space has elaborated a set of observations and recommendations related to several issues linking space and global health, with the following aims:

- To improve the use of space technologies and space-based information and systems in the global health domain,
- To promote enhanced cooperation and sharing of information in emergencies, epidemics and early warning events, as well as on environmental parameters,
- To enhance capability in integrating health data in disaster management plans,
- To strengthen capacity-building in advancing space technologies in global health efforts,
- To identify governance and cooperation mechanisms to support this objective.

Scoping

Developed during the First Meeting of the expert group on space and global health in 2015 and published in report (A/AC.105/C.1/2015/CRP.29, Appendix 1), a conceptual framework lists the main relationships between space activities and global health applications (Fig. 1). Four key domains of space activities are identified: telecommunications, global navigation satellite systems (GNSS), remote sensing, and space medicine. The current development of these activities has been evaluated through a scoping review involving the search of existing scientific literature and with the input of domain experts. This review demonstrates the main themes currently being addressed, which include (by order of frequency in the literature):

- Tele-epidemiology for infectious and non-communicable diseases (including environmental factors)
- Telemedicine and tele-education of care professionals
- Access to healthcare and improvement of autonomy

- Disaster prevention, early warning, management of humanitarian crises
- Decision-support systems and innovative research methods

SPACE AND GLOBAL HEALTH						
		Individual health	*Individual and Communities*		*Population Health*	
Key HEALTH activities		Medical practice	Health services	Medical Research	Prevention and control of infectious and chronic diseases	Global Health Security
Key Space Activities		**Tele-Medicine**	**Tele-Health**	**Health Sciences**	**Tele-epidemiology**	**Disaster Management**
Satellite Activities	*Tele-communications*	▪ Specialist ▪ Second opinion ▪ Remote monitoring ▪ Tele-diagnostic ▪ Tele-consultation ▪ Peer to peer ▪ Tele-Robotic	▪ Professional training ▪ Community health worker training ▪ Community health education ▪ Tele-education ▪ Peer-to-peer training	▪ Knowledge transfer	▪ Data dissemination through centres of expertise ▪ Water levels & water borne diseases ▪ Emergency communication for outbreak/pandemic management	▪ Flexible and deployable capacities ▪ Strategic planning, coordination and communication among relief workers; coordination sites; experts; individuals
	Global Navigation Space Systems & GIS	▪ Routing Medical Emergencies	▪ Contextual information on site ▪ Health services optimization		▪ Geographic occurrences of diseases ▪ Location of sources of infection/pollution ▪ Tracking animals as disease sentinels	▪ Detailed site information ▪ Response worker location coordination
	Remote sensing of the Earth and Atmosphere				▪ Tracking disease and risk factors ▪ Vector-borne diseases (malaria) ▪ Air-born disease, including dust, air pollution (ex: Asthma) ▪ Waterborne diseases (ex: Cholera) ▪ Food security	▪ Disaster mapping (before and after) ▪ Planning and response ▪ Emergency tele-epidemiology
Human Space Flight	*Space Life Science*			▪ Knowledge of the human body (ex: aging) ▪ Infection prevention		
	Technology Development	▪ Digital Applications		▪ Point of care medicine		

Figure 1. Main relationships between space activities and global health applications. A/AC.105/C.1/2015/CRP.29, Appendix 1

Key observations

During regular meetings of the Expert Group and via larger conferences, and, most recently, during the United Nations/World Health Organization/Switzerland Conference on Strengthening Space Cooperation for Global Health held in Geneva in August 2017 (A/AC.105/1161), key observations were made, including:

- The alignment of focus of the work of the Expert Group not only on SDG 3 (good health and well-being), but also on SDG 4 (education), SDG 6 (clean water and sanitation) and SDG 13 (climate change).
- The ability to support not only SDGs but also the Sendai framework for disaster risk reduction, and the Paris agreement on climate change.
- The importance of integrating the One Health perspective, i.e., the interdependence of human, animal health and environment.
- The need to strengthen cooperation between the World Health Organization and the UN Office for Outer Space Affairs.
- The value of connecting remotely sensed information with public health information systems, as a way to enhance understanding and decision-making in health systems.
- The key role of GEO, the Group on Earth Observations, in providing capacity and access to remotely sensed data.
- The importance of space technology for public health surveillance, emergency preparedness and field response.
- The need for capacity building in the domains of space-based data and technology in global health, at the level of public health actors, policy makers and citizens. The need for stronger involvement of youth was also noted.
- The challenges of technical and operational interoperability in order to develop seamless and efficient tools that leverage on multiple data sources.
- The enabling role of open approaches in developing and applying space-based solutions to health.

Recommendations

In order to unleash the potential of space-based activities and tools to improve global health, several recommendations are formulated, including:

- Encourage formal cooperative agreements between health authorities and space authorities at national level.
- Establish a dedicated coordination platform between UN entities and other relevant actors.
- Engage the WHO in some of the OOSA activities related to global health, such as UN-SPIDER technical advisory missions.
- Establish a global financing mechanism to promote application of space solutions for global health.
- Establish national governance mechanisms for removing barriers in the effective use of space-based technologies, including telemedicine.
- Promote open data sharing policies and participatory approaches in improving access to all geospatial information relevant to global health.

- Enhance inter-sectoral coordination and cooperation for effective capacity building activities.
- Engage learning institutions to motivate young professionals towards space-related abilities with particular attention to experts in health.
- Enable organizational and technical interoperability to facilitate the implementation of space-based science and technology in the health sector.
- Conduct appropriate drills and exercises to benchmark their preparedness for appropriate use of space technologies in responding to global health events.

Tunisia

Application of remote sensing for disaster and social risk management in MENA regions

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With human population and associated environmental degradation continuing to increase, it is inevitable that more and more people will be living in zones of hazardous terrain, and therefore the risk of disaster will increase. Add to this the growing evidence for global warming and the increased severity of geohazards related to larger and more frequent storms (i.e. storm surges, coastal erosion, landslides, fluvial flooding, erosion) and both the frequency and severity of disasters is set to increase. Remote sensing can help us to rapidly assess, and therefore better manage social risk. The use of remote sensing is becoming increasingly frequent in environmental studies. In the 1970s and 1980s satellite images were mostly used in simple interpretations or as a map background (Merifield and Lamar 1975, Rib and Liang 1978). However, more recently there are almost no serious environmental studies that do not include advanced image processing and analysis. Remote sensing has been successfully applied to forest fires detection, flood monitoring, deforestation studies, co-seismic displacement monitoring, pollution tracking in the atmosphere and the sea, weather devastation observation, pollution prevention, desertification and erosion observation and many more (ESA 2001, Cracknell 2000, Sabins 1997, Dixon 1995). One of the most important applications of satellite technology can be found in the case of natural disasters, where satellite images can be used to provide advance warning for specific hazardous events (Gens and Genderen 1996, Guo et al. 2001, Kohiyama and Yamazaki 2005), to monitor the concerned, or for a quick evaluation of the damage and therefore support the decision-making process in the rescue operations. Satellite and airborne imagery alone can offer an efficient contribution to natural resource management. Still, the most promising seems to be the application of remote sensing in combination with geographical information systems.

Satellite remote sensing is providing a systematic, synoptic framework for advancing scientific knowledge of the Earth as a complex system of geophysical phenomena that, directly and through interacting processes, often lead to natural hazards. Improved and integrated measurements along with numerical modeling are enabling a greater understanding of where and when a particular hazard event is most likely to occur and result in significant socioeconomic impact. Geospatial information products derived from this research increasingly are addressing the operational requirements of decision support

systems used by policy makers, emergency managers and responders from international and federal to regional, state and local jurisdictions. This forms the basis for comprehensive risk assessments and better-informed mitigation planning, disaster assessment and response prioritization. Space-based geodetic measurements of the solid Earth with the Global Positioning System, for example, combined with ground-based seismological measurements, are yielding the principal data for modeling lithospheric processes and for accurately estimating the distribution of potentially damaging strong ground motions which is critical for earthquake engineering applications. Moreover, integrated with interferometric synthetic aperture radar, these measurements provide spatially continuous observations of deformation with sub-centimeter accuracy. Seismic and in situ monitoring, geodetic measurements, high-resolution digital elevation models (e.g. from InSAR, Lidar and digital photogrammetry) and imaging spectroscopy (e.g. using ASTER, MODIS and Hyperion) are contributing significantly to volcanic hazard risk assessment, with the potential to aid land use planning in developing countries where the impact of volcanic hazards to populations and lifelines is continually increasing. Remotely sensed data play an integral role in reconstructing the recent history of the land surface and in predicting hazards due to flood and landslide events. Satellite data are addressing diverse observational requirements that are imposed by the need for surface, subsurface and hydrologic characterization, including the delineation of flood and landslide zones for risk assessments. Short- and long-term sea-level change and the impact of ocean-atmosphere processes on the coastal land environment, through flooding, erosion and storm surge for example, define further requirements for hazard monitoring and mitigation planning. The continued development and application of a broad spectrum of satellite remote sensing systems and attendant data management infrastructure will contribute needed baseline and time series data, as part of an integrated global observation strategy that includes airborne and in situ measurements of the solid Earth. Multi-hazard modeling capabilities, in turn, will result in more accurate forecasting and visualizations for improving the decision support tools and systems used by the international disaster management community.

In this paper a description of the Space and Major Disasters Charter related to social risk is given first. The application of GIS is presented in more detail. The use of remote sensing and geographical information systems, details on image interpretation and analysis are described. Special attention is given to data integration and GIS modelling performed with case study. At the end some general remarks and guidelines are presented.

UNDP Mali

Use of satellite images for monitoring and evaluation of development projects and programmes in inaccessible area - Case of North Mali

Aboubacar TOURE
UNDP Mali

Background

"A picture says a thousand words"[1] As the United Nations Development Programme (UNDP) develops and implements creative solutions and services to eradicate poverty while protecting the planet and help countries develop strong policies, skills, partnerships and institutions so they can sustain their progress, there is a recognized need for innovative approaches for more visible results, achievement and impact namely for monitoring results, tracking for change and communicating for development to all involved stakeholders, including in conflicts and post conflict contexts.

In Mali, despite a return to relative calm in the north, insecurity remains a concern in some areas, especially after recurrent clashes in some northern regions. The restoration of state authority, the return of refugees and Internally Displaced People (IDP) and access to intervention areas remain major challenges. The situation is characterized by significant dysfunctions in the justice sector and local administration, deterioration in the security of people and property, a disintegrating relationship between citizens and state officials and worsening social tensions. In addition, the dynamics of ecosystems make Mali even more vulnerable to various environmental degradation and climate change.

Therefore, UNDP is engaged since 2013 contributing to the transformational change in capacity-building of institutions, the State and local authorities, to improve Citizen-State relations, participation in decision-making, accountability and people's access to public services and judicial services; It has led the reconstruction of several state administrative building in the north. It has also supported rehabilitation destroyed sites classified sites to world heritage and promotes early recovery activities.

Yet, visibility of achievement gap is still a concern for the Country office and all involved partners. Although communication, monitoring and reporting teams have maintained some efforts to provide timely accurate and updated facts and illustrations from the field, security and access are inevitable constraints that still limit their expectations.

[1] Napoleon Bonaparte, 1769 -1821

Problem:

Then, UNDP Mali was exploring suitable solutions to address the issues of tracking changes and communicating for development in relation to field results,

Solution:

The use of Satellite Images Mapping System for Monitoring and Communication for Results appeared to fit this purpose. A joint partnership between UNDP Office of Information Management and Technology (OIMT) and UNDP Mali adopted and approach based on partnership development, capacity building, prototyping, testing and implementing the solution.

Our partners through different space agencies such as Digital globe, provided raw satellite imageries dating from 2012, and provided analysis to the imageries. The Data storage is done at our partner facility and hosted through a GIS platform for Data Visualization and Mapping Tools. In parallel, NASA-JPL,RBA and OIMT are partnering to utilize the ABCD technology to provide a complex automated analysis to the raw satellite imageries based on some pre-defined classifications.

For data and content collection from the ground, UNDP Mali used information from some field mission and monitoring reports which added an additional layer to the story maps. UN-Asign mobile application developed by our partner, and the DJI Phantom 4 Pro drones helped acquire images to upload on the platform. These images are a great verification layer to the satellite imagery analysis.

The use of Satellite Images Mapping System for Monitoring and Communication for Results appeared to fit this purpose. A joint partnership of UNDP Office of Information Management and Technology (OIMT) and UNDP Mali adopted an approach based on partnership development, capacity building, prototyping, testing and implementing the solution.

Results:

Since its pilot implementation in 2016, achievements include enhanced project monitoring, reinforced transparency for UNDP progress in the ground, amplified government accountability towards partners, stakeholders and beneficiaries, better coordinating among actors in crisis countries, planning responses and informing local communications, connections to SDG data monitoring.

Ground data collection, such as photos and videos from the ground, that are seen as an important layer to add to the maps, have been a great challenge which will be focused on during the next project phases. The usage of mobile phone to capture field data have shown to be and efficient way, though in some areas internet connectivity remain issues.

Conclusions and ways forward

Through this pilot project, satellite imagery analysis and Geographical Information Systems (GIS) have shown to be powerful tools and technologies that helps UNDP better plan, monitor, deliver, coordinate its interventions and report on results and impacts, including in crisis and post crisis conditions to involved partners and stakeholder. As of today, 4 regions with 27 cities/villages in Mali have been mapped through this solution to monitor the progress of UNDP progress in infrastructure rehabilitation. There is a growing demand to scale up the project even further. Therefore, developing UNDP internal capacities to efficiently carry out technical and management responsibility throughout the project cycle, cost effectiveness of the technologies and accessibility are challenges that need to be addressed.

Scope	Global Region	Country	Region	City/Town/Village	Co..
Development	Africa	Mali	Gao	Ansongo	3
				Total	**3**
			Mopti	Bankass	1
				Douentza	1
				Gourma-Rharous	6
				Koro	3
				Mopti	1
				Total	**11**
			Sikasso	Séré Moussa Ani Samou/Siékorolé	1
				Wassoulou Ballé/Balena Coura	1
				Wassoulou Ballé/Barila	1
				Wassoulou Ballé/Djéguenina	1
				Wassoulou Ballé/Fougamana	1
				Wassoulou Ballé/Gnakaracó	1
				Wassoulou Ballé/Sékou	1
				Wassoulou Ballé/Siékorolé	1
				Wassoulou Ballé/Solona	2
				Total	**10**
			Tomboctou	Bandiagara	1
				Diré	1
				Goudam	2
				Niafunke	1
				Tombouctou	1
				Total	**4**
			Total		**27**
		Total			**27**
	Total				**27**
Total					**27**

United Kingdom

Space Sustainability and Global Space Governance – The Potentials of On-Orbit Servicing Operations

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Outer space exploration has been an area where the international community demonstrated a significant level of co-operation, successfully transcending geographical, national and cultural boundaries. In the age of global governance, international co-operation has never been more important in resolving today's global challenges. One of such challenges is the growing amount of space debris in orbits, which, if unresolved, will not only undermine global information and communications technology (ICT) system, but will also hinder areas of sustainable development where outer space activities contributed to. (e.g. satellite imaging for disaster warning and management, satellite imaging for agricutlural purpose) This paper proposes to conceptualize space orbit as an essential global common, whose governance requires international co-operation. In examining potentials and challenges in moving forward space orbit governance, the paper pays particular focus on ensuring space safety and sustainability through the introduction of on-orbit servicing (OOS) operations, both by international, regional, national agencies and private operators. The paper will identify aspects of OOS that warrant further collaborations, specifically, the standardization of docking practices that could facilitate future space activities. Recognizing the potential rapid commercialization of refueling, repairing and debris removal operations in orbits, this paper argues that a standardization of docks and docking practices would be the first step towards enhancing international co-operation and strengthening the existing regime of peaceful use of outer space. Ultimately, it could play a role in addressing one of today's most imminent challenges – ensuring sustainability of global commons.

United States

Expanding Space Accessibility via Capability Building and Innovation

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National development is a multifaceted process through which countries progress in four areas, namely: 1) Technological Capability; 2) Economic Activity; 3) Human Condition; and 4) Environmental Sustainability. Progress in Technological Capability means empowering people with skills and harnessing technology to facilitate productive activity. Progress in economic activity means improving institutions in order to improve the way a country functions in the global economy, manages national debt, competes in foreign exchange, and balances the effects of population movements. Progress in the human condition refers to improving the opportunities for equitable access to health care, nourishment, shelter, education, security and self-determination. Progress in sustainability refers to effective managing and care for the environment while balancing short and long term needs. As a nation pursues national space activities, space-enabled capabilities can contribute to national development in areas such as applying satellite services, building technological capability, enabling economic activity, inspiring technology applications and building scientific knowledge.

Organizations within countries around the world are identifying space and small satellite technology as priority areas in which to increase their local capability. Satellites provide valuable public services in the areas of earth observation, communication, positioning, timing and scientific research. Small satellite projects are also an opportunity for universities and government agencies to foster goals in educating students, stimulating innovation, enhancing the capability of local firms, pursuing strategic international alliances and fostering national pride. Some nations that begins early activities with small satellites, find it valuable to develop partnerships with more experienced space nations that can provide mentorship. Such partnerships come in a variety of models, including political agreements between governments, commercial contracts with firms and educational agreements with universities. Each of these models has benefits and weaknesses; each may be appropriate for an emerging space nation depending on their local context, objectives and stakeholder needs.

This presentation highlights key findings from a decade-long research study examining the experience of capability building as emerging space nations pursue space accessibility. During the past few decades, many emerging space nations have worked toward increased autonomy in their application of satellite technology for sustainable development. These

emerging space nations often pass through similar phases of capability building, although the order of these experiences varies. The capability building phases often include exploration, building technological literacy, service orientation and innovation. During the exploration phase, there is often no intentional policy agenda for the application of space-enabled technology toward development, but some institutions and researchers implement space related services or educational programs. The second phase is often enabled by a policy emphasis on building domestic technological knowledge regarding satellite engineering, space science, instrument design, data analysis or earth observation applications. Once a country or community builds confidence in their skillset and experience, the focus often transitions to identifying a business or operational model that will provide consistent, space-enabled services to end users or decision makers in the country. Some countries pursue a limited technological literacy phase and move quickly into the service orientation phase. During the fourth state of capability building, countries often adapt the space-enabled technology to their local context and pursue process and product innovation to customize satellite services for their specific needs. Programs such as the United Nations Basic Space Technology Initiative contribute to capability building for emerging space nations. The presentation provides examples of outcomes enabled by the Basic Space Technology Initiative and case studies of innovation within emerging space nations.