

Commentary

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The contribution of space for a more sustainable earth: leveraging space to achieve the sustainable development goals

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Non-technical summary. This article raises awareness of how countries can leverage space and space technologies to achieve the Sustainable Development Goals (SDGs) through concrete examples. Space science, technology and applications can support a range of pro-developmental activities, such as agricultural planning, biodiversity protection, tele-health and disaster management. United Nations Office for Outer Space Affairs (UNOOSA) helps countries to use space technology in all of these areas, through capacity building and partnerships with government and private sector entities to expand access to space, especially for developing countries. This article also outlines the work of UNOOSA in promoting increased participation of women in the space sector and in STEM careers.

Technical summary. This article presents the mandate of UNOOSA and its activities to improve awareness and use of space and space technologies for achieving the SDGs. This article presents examples of UNOOSA work in this respect. One example of this work is the Human Space Technology Initiative (HSTI), which aims to involve more countries in activities related to human space flight. One of the flagship HSTI activities is the KiboCUBE programme, a partnership with the Japan Aerospace Exploration Agency (JAXA) that offers institutions from developing countries the opportunity to deploy 1U (1 Unit) cube satellites from the Japanese Kibo module of the International Space Station (ISS). Other HSTI activities include the partnership between UNOOSA and the China Manned Space Agency to give countries opportunities to fly experiments onboard China's Space Station, as well as partnerships with private firms such as Sierra Nevada Corporation (SNC) to fly experiments onboard SNC's DreamChaser® spacecraft. Through its UN-SPIDER programme, UNOOSA helps countries use space technology (in particular satellites) to prevent and manage disasters. Through its Space for Women project, UNOOSA promotes the increased participation of women in space and STEM careers. Through increased international cooperation and partnerships, space can make a difference for achieving all the SDGs.

1. The Sustainable Development Goals

In 2015, seeking to build on the success of the Millennium Development Goals and incorporate valuable lessons learned, United Nations Member States agreed on a new set of goals to end poverty, protect the planet and ensure prosperity for all as part of the 2030 Agenda for Sustainable Development. On 1 January 2016, the 17 Sustainable Development Goals (SDGs) of the Agenda officially entered into force. The goals cover social, economic and environmental development challenges. Each goal has a set of targets, totalling 169 targets overall, across the 17 goals; if the targets are met, then the goals are accomplished. The goals are interconnected, so that often the success of one goal involves addressing multiple other goals.

Space is an invaluable tool that can help the international community achieve the SDGs. With space science, technology and applications, we can for example track endangered species such as rhinoceroses to protect them from poachers, or provide imagery and data to farmers to help them monitor their crops, improve their yield, and avoid food shortages. We can use satellites to map the spread of diseases and public health emergencies, enable children to learn remotely, and observe damage after natural disasters. A recent joint study conducted by United Nations Office for Outer Space Affairs (UNOOSA) and the European Global Navigation Satellite System Agency (GSA) found that, of the 169 targets underpinning the goals, nearly 40% are reliant on access to space science and technology. It is therefore vital that everyone can access and enjoy the benefits that space brings to us all.

The SDGs provide an additional framework for the work of UNOOSA. As the gateway to space for the United Nations, we are helping countries maximize their capacity to use space for the achievement of the SDGs. We are employing new, more holistic and tangible approaches to our traditional capacity-building role to help Member States, particularly developing countries, use space to address the targets enshrined in the SDGs in a cross-sectoral and

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multi-disciplinary manner. Examples include our Space for Women project, the KiboCUBE initiative, and the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER).

2. Space for Women

Goal 5 of the SDGs seeks to achieve gender equality and empower all women and girls, while Goal 4 aims for quality education. UNOOSA is focusing on these two goals and their interlinkages through the development of a 'Space for Women' project. This project aims to empower women and girls to play a more active and equal role in the space sector and to reduce the gender gap in science, technology, engineering and mathematics (STEM) education and careers.

In 2017, UNOOSA hosted a Space for Women Expert Meeting in New York as part of preparations for the project. This brought together experts from around the world to share their experiences of how to involve more women and girls in the space sector and STEM more broadly, especially in developing countries. The outcomes and recommendations of that meeting are being incorporated into the development of the Space for Women project.

The project, currently in its early development stages, will consider questions such as:

- How can we attract more women to space?
- What can women do for space?
- What can space do for women?
- What do women need from space?

Specifically, the project focuses on increasing the awareness, capacity and skills of individuals and institutions related to promoting gender equality in the space sector and related educational fields through:

- Communicating STEM education opportunities
- Facilitating access to the space education and the space sectors
- Providing policy-relevant advice and information to institutions and governments on Space for Women
- Facilitating training on access to and use of space technology
- Promoting a Space for Women mentoring platform.

It is disappointing that, in the 21st century, and in fields such as the space sector, which is known for breaking boundaries, we are still not making the most of what women have to contribute. We have a lot to do for the Space for Women project, which will be an important contribution that UNOOSA, and indeed the wider space sector, can make to the SDGs, in particular Goals 4 and 5.

3. HSTI and KiboCUBE

To help everyone, everywhere access space and its benefits for sustainable development, the Office has been building up our Human Space Technology Initiative (HSTI) to involve more countries in activities related to human space flight and make space a truly international effort, inclusive and open to all. Partnerships are key to this work. In particular, the Office often takes a triangular capacity-building approach, where we work with one or more space-faring nations to help non-space-faring nations develop their space technology capabilities.

One of the flagship HSTI activities is the KiboCUBE programme, a partnership with the Japan Aerospace Exploration Agency (JAXA) that offers educational and research institutions from developing countries the opportunity to deploy 1U (1 Unit) cube satellites from the Japanese Kibo module of the International Space Station (ISS). This not only helps countries develop their own space science and technology for addressing specific SDGs, but also impacts on scientific education and innovation in those countries, thereby contributing to Goal 4 'quality education' and Goal 9 'industry, innovation and infrastructure'.

The first round of the KiboCUBE initiative enabled a team from the University of Nairobi in Kenya to develop a cube satellite that was successfully deployed from the International Space Station on 11 May 2018. This was Kenya's first satellite, enabling Kenya to become a 'space nation' with UNOOSA and JAXA's support and the first space hardware ever deployed under the auspices of the United Nations. The cube satellite is named 'IKUNS-PF', or 'First Kenyan University Nano Satellite-Precursor Flight'. The University of Nairobi team is using its KiboCUBE CubeSat to test technologies it has developed for the future launch of a larger earth observation satellite. The team also hopes to apply data acquired from its CubeSat to the monitoring of agriculture and coastal areas, which contributes to goals such as Goal 14 'life below water' and Goal 15 'life on land'.

A team from the Universidad del Valle de Guatemala was selected for the second round of the initiative, and development of their cube satellite is underway. The Universidad del Valle de Guatemala team plans to use its Guatemalan CubeSat to test equipment for monitoring the concentration of harmful cyanobacteria (algae blooms) over inland bodies of water, contributing to Guatemala's ability to acquire remote sensing data for natural resource management and work towards the SDGs.

The Mauritius Research Council, which was selected for the third round of KiboCUBE in 2018, will use its cube satellite and onboard longwave infrared thermal camera to develop its knowledge of satellite technology and how to efficiently collect and process space-based land and ocean data, making this an innovative contribution to Goal 4 on quality education.

The opportunity to partner with space-faring nations such as Japan in order to provide developing countries with the capacity to have access to space for sustainable development is a huge step forward in reducing the so-called 'space divide' – the gap between the nations that have developed space-related capabilities and technologies, and those who do not have access to these capabilities and their benefits.

4. UN-SPIDER

Disasters can have devastating effects around the world, from loss of life and property, to tremendous damage to societies and environments. Space technologies, including navigation and positioning systems, and meteorological, communications and Earth observation satellites, can play a vital role in supporting disaster management and avoiding loss of life by providing accurate and timely information for decision-making.

In 2006, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) was established by the United Nations General Assembly as a programme of UNOOSA. UN-SPIDER uses a variety of tools to build capacities in developing countries so that they can access and use space technologies in order to reduce

the impact of disasters. In South East Asia, for example, UNOOSA has worked with Myanmar and Vietnam to deliver technical assistance and institutional strengthening missions on remote sensing and how to acquire, process and use satellite imagery to enhance policy interventions. In the Pacific, we have worked with Tonga, the Solomon Islands, Samoa and Fiji to enhance their institutional capacity to tackle such issues as climate change mitigation and disaster risk reduction.

This work helps us understand the hazards our urban areas face. Space technology is building catalogues of historic events and scientific models that describe the spatial and temporal dynamics of hazards and disasters. Furthermore, societies that can use space to not only survive disasters, but to thrive, are in fact sustainable cities and communities – Goal 11 – and this resilience enables them to continue striving towards achieving all of the SDGs.

5. Partnerships

Partnerships are vital, not only to the work of UNOOSA, but to the achievement of all of the SDGs, hence Goal 17: ‘partnerships for the goals’. UNOOSA has a long history of engaging with stakeholders in order to bring the benefits of space to people who lack access to the very basic opportunities to take advantage of what space has to offer. In addition to the KiboCUBE programme with Japan mentioned above and many others, UNOOSA works with the China Manned Space Agency to give countries opportunities to fly experiments onboard China’s Space Station, as well as private sector entities such as Sierra Nevada Corporation (SNC) to fly experiments onboard SNC’s DreamChaser® spacecraft that contribute to the achievement of the SDGs. These are just a handful of examples of UNOOSA’s partnerships within the space community to contribute to the

goals. In addition, UNOOSA is now developing a ‘global space partnership for the SDGs’ as a voluntary mechanism to deliver already existing space assets to countries worldwide and help them develop new and unique solutions to monitor and achieve the 2030 Agenda for Sustainable Development. It will bring together stakeholders from all fields to deliver the access to space technologies and applications to address all of the 17 SDGs.

6. Conclusion

As the space frontier grows, and more technological advancements are made, it is imperative that we harness the advantages of space and use it to reduce inequalities on Earth. The achievement of the SDGs lies not in just forward-looking space exploration, but also in Earth-focused space science and technology. At UNOOSA, we believe that space provides valuable solutions to global problems. We’re working hard to make this a reality, and we invite the international community to join us. Cooperation is key; despite political differences, the world has proved repeatedly throughout the space age that we can come together through science, and work for the benefit of humanity. Now let’s take that great history of partnership and innovation, and apply it to the fulfilment of the 2030 Agenda for Sustainable Development and its 17 goals.

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