
ANNUAL REPORT 2020



UNITED NATIONS

On the right: Original cover image
Cover: From a million miles away,
a NASA camera shows the moon
crossing the face of the Earth.
Credit: NASA



ST/SPACE/78

© United Nations, June 2021. All rights reserved.
The designations employed and the presentation of
material in this publication do not imply the expression of
any opinion whatsoever on the part of the Secretariat of the
United Nations concerning the legal status of any country,
territory, city or area, or of its authorities, or concerning the
delimitation of its frontiers or boundaries.

This publication has not been formally edited.
Publishing production: English, Publishing and Library
Section, United Nations Office at Vienna.

UNITED NATIONS
OFFICE FOR OUTER SPACE AFFAIRS

2020

A N N U A L
R E P O R T



UNITED NATIONS
Vienna, 2021

CONTENTS

Foreword iv

1 **1** UNOOSA: WHAT WE DO

2 **5** UNOOSA AT A GLANCE

3 **9** HIGHLIGHTS OF 2020

Guatemala deploys its first satellite thanks to KiboCUBE/JAXA 10

Memorandum of understanding with NASA to expand access to the benefits of space 13

Partnership with the United Kingdom to promote space sustainability 14

Memorandum of understanding with Ministry of Science, Technology and Innovation of Brazil 15

Space4Women launches its website and network of mentors. 16

Second edition of the Space4Youth Competition selects the best ideas on leveraging space to counteract climate change 18

UNOOSA and Avio announce joint opportunity to deploy satellites in orbit. 20

First winners of HyperGES Fellowship with the European Space Agency 21

First advisory services under the Space Law for New Space Actors project 22

UNOOSA and the United Nations Economic Commission of Africa conference on “Emerging Issues in Space Law and Policy: Perspectives for African countries” 23

4 **25** FOCUS CHAPTER: SPACE FOR BUILDING BACK BETTER

Leveraging the potential of space to respond to, and recover from, the COVID-19 pandemic . 26

Space for a better future 33

5 **41** LEVERAGING SPACE FOR DISASTER RISK REDUCTION AND MANAGEMENT: UN-SPIDER

UN-SPIDER technical advisory support to Member States in 2020 43

UN-SPIDER emergency support. 49

New resources on the UN-SPIDER Knowledge Portal 51

Other activities on space for disaster management 52

6

SPACE4SDGS

World Economic Forum Global Future Council on Space publishes report on six ways space benefits life on Earth.58

Space4Water59

Access to Space for All61

Other Space4SDGs activities66

New partnerships.68

7

SPACE EDUCATION

Regional Centres for Space Science and Technology72

Research and training opportunities75

8

INTERNATIONAL COOPERATION IN OUTER SPACE

COPUOS updates80

UN-SPACE81

Planetary Protection and the Committee on Space Research81

57

9

SPACE OBJECTS REGISTRATION

10

UNOOSA IN NUMBERS

List of abbreviations and acronyms92

83

89

71

79



FOREWORD



UNOOSA Director
Simonetta Di Pippo.
Credit: UNIS

2020 has been a year of unique challenges and changes all over the world. We have been, and are still being, tested by the fight against COVID-19, which has affected every aspect of our lives, from education to healthcare, from work to social practices. It is hard to compute the sheer amount of human suffering brought about by the global pandemic. Together, we must ensure these sacrifices were not in vain, by using this chance to envision a better post-pandemic future, based on lessons learned, that holistically brings together environmental, social and economic considerations for a sustainable development model.

During the fight against COVID-19, the space sector, and UNOOSA with it, stepped up our contribution by expanding access to space science, data and technology to help build resilience, keep essential services running, support scientific research and economic recovery. As

humanity starts to plan for a future beyond this pandemic, space applications also play a key role in developing a better world, helping us fight climate change, improve water resource management and reduce disaster risk, among many other areas that UNOOSA directly contributes to. Hence, the focus chapter of this report addresses how space and UNOOSA can support the fight against the current pandemic and help humanity build back better in its aftermath.

As we in the space sector know well, even the most complex challenges offer opportunities. In this report, we also reflect on how UNOOSA rose to the challenge of the new working modalities brought about by the pandemic, and on lessons learned: we were able to move most of our activities online, and even expand their reach and impact through accessible virtual platforms. While these could not

fully substitute the richness of in-person interactions, they came with the silver lining of enabling more accessible, inclusive and diverse events, with participants from all over the world easily tuning in. We also developed new online training courses that continued to build capacities to leverage space for development worldwide, in areas such as space law and space for disaster risk reduction. We kept working effectively with our partners in virtual formats to establish new strategic collaborations, some of which are captured in the highlights and focus chapters. We multiplied our range of webinars, open to all, to raise awareness of the benefits of space and help countries unlock them, in particular through the opportunities under our Access to Space for All initiative. We continued to push for inclusiveness in the space sector, particularly through our Space4Women and Space4Youth projects, successfully shifting some of their activities online. The best innovations developed under the circumstances of COVID-19 will remain with us in the post-pandemic world, to serve our stakeholders even better than before.

2020 was also a pivotal year for UNOOSA in other ways. Recognizing the increasingly important role of space science and applications in achieving sustainable development, the Secretary-General issued a bulletin establishing UNOOSA as a separate United Nations entity and myself as his Senior Adviser on space affairs. In recognition of the expanding portfolio of UNOOSA and the exponential rise in space activities worldwide, we were also pleased to receive a small increase in budget

for our activities upon request of the General Assembly, which will help us continue to step up the services we offer and our support for all Member States.

As a testimony to the boom in space activities, in 2020 we registered more new satellites and other functional space objects in orbit than ever before, just under 1,300, which corresponds to almost 10 per cent of all registrations in the history of space exploration. One of these new objects in space is Guatemala's first satellite, which was deployed thanks to our joint KiboCUBE programme with the Japanese Aerospace Exploration Agency (JAXA). This historic achievement will not only be the first step for Guatemala towards launching into more complex space endeavours, but will also inspire local youth to apply their talent to the space sector.

Clearly, despite the obstacles posed by the pandemic, this was a momentous year for UNOOSA, one that opened doors for an even more central role for our organization in expanding access to the benefits of space for everyone, everywhere. Together with the global space community, we stand ready to contribute to a post COVID-19 world that is in better equilibrium with nature, and more sustainable and inclusive.

Ms. Simonetta Di Pippo
Director, Office for Outer Space Affairs



View of Vienna
from space.
Credit: ESA

UNOOSA manages and implements the programme on the peaceful uses of outer space, advancing international cooperation in space activities and in the use of space science and technology for achieving sustainable development. It represents the United Nations in promoting international cooperation in the exploration and peaceful uses of outer space for economic social and scientific development, in particular for the benefit of developing countries. This chapter introduces the mandate and programmatic activities of UNOOSA.

1

UNOOSA: WHAT WE DO

1 | UNOOSA: WHAT WE DO

UNOOSA is the only United Nations Office entirely dedicated to outer space affairs.

The Office manages and implements the programme on the peaceful uses of outer space, advancing international cooperation in space and in the use of space science and technology for sustainable development, particularly for the benefit of developing countries.

UNOOSA serves as the Secretariat for the only committee of the General Assembly dealing with international cooperation in space: the Committee on the Peaceful Uses of Outer Space (COPUOS). The Committee has two subsidiary bodies: the Scientific and Technical Subcommittee (STSC) and the Legal Subcommittee (LSC), both established in 1961. COPUOS reports to the Fourth Committee of the General Assembly, which adopts an annual resolution on international cooperation on the peaceful uses of outer space.

Through its Space Law for New Space Actors project, the Office helps countries increase their capacity to draft or revise national space law and policy in line with existing international normative frameworks, such as the Outer Space Treaty, the Liability Convention, the Registration Convention and the United Nations Space Debris Mitigation Guidelines. This is particularly important as more countries and organizations than ever are entering space activities.

UNOOSA discharges the responsibilities of the Secretary-General under international space law, including maintaining the United Nations Register of Objects Launched into Outer Space, created in 1961 at the request of Member States. The Register is a treaty-based mechanism that identifies the State responsible for a space object, promoting transparency and confidence among countries operating in space.

The UNOOSA Programme on Space Applications helps countries build capacity in basic sciences, space technology

and human space technology, and leverage space data and applications in areas such as global health, disaster and climate change management, humanitarian assistance, environmental monitoring and natural resources management.

Through its Access to Space for All initiative, UNOOSA bridges the space capabilities gap among countries, striving to make access to space assets and the benefits stemming from their use truly universal. Partnerships with leading space stakeholders sit at the centre of the initiative, enabling UNOOSA to facilitate access to state-of-the-art facilities and research and orbital opportunities, particularly for developing countries.

UNOOSA works closely with the six Regional Centres for Space Science and Technology Education around the world affiliated to the United Nations to increase space-related education. These provide unique training and education programmes, especially for talent in developing countries.

Through the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) programme, with offices in Beijing, Bonn and Vienna, UNOOSA helps countries use space data and technologies, such as satellite imagery, to reduce disaster risks and respond to disasters when they occur. The funding of UN-SPIDER includes generous financial support from China and Germany.

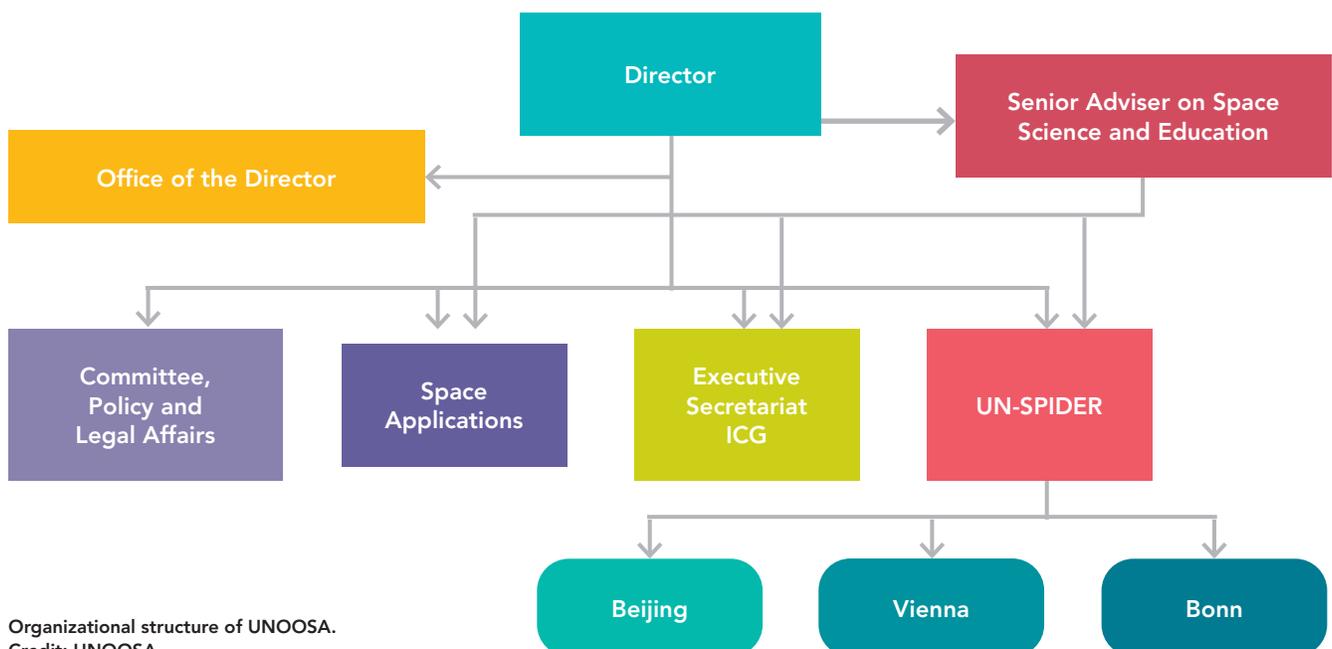
UNOOSA is the Executive Secretariat of the International Committee on GNSS (ICG), which brings together all global navigation satellite system (GNSS) providers to work together on improving their technology, compatibility and uses for sustainable development. The ICG Programme is made possible by the generous financial contributions of the United States of America and of the European Commission.

UNOOSA is Secretariat to the Space Mission Planning Advisory Group (SMPAG), which works with space agencies worldwide on planetary defence. UNOOSA also cooperates with the International Asteroid Warning Network (IAWN) in strengthening international coordination and cooperation in case of near-Earth object (NEO) impact hazards. The work of UNOOSA with SMPAG is supported by the contribution of the European Space Agency (ESA) as chair of SMPAG.

UNOOSA leads the Inter-Agency Meeting on Outer Space Activities (UN-Space) in its work on the examination of how space science and technology and their applications could contribute to the SDGs.

Through the breadth of its activities, UNOOSA addresses all stages and aspects of space applications, space law and space policy, helping all countries leverage the benefits of space for sustainable development.

UNOOSA organizational chart



Organizational structure of UNOOSA.
Credit: UNOOSA



View of one of the International Space Station's solar arrays, visible from a window in the ISS with an Earth limb in the background. Photo taken by the Expedition 37 crew. Credit: NASA

2

UNOOSA IN 2020 AT A GLANCE

2 | UNOOSA AT A GLANCE

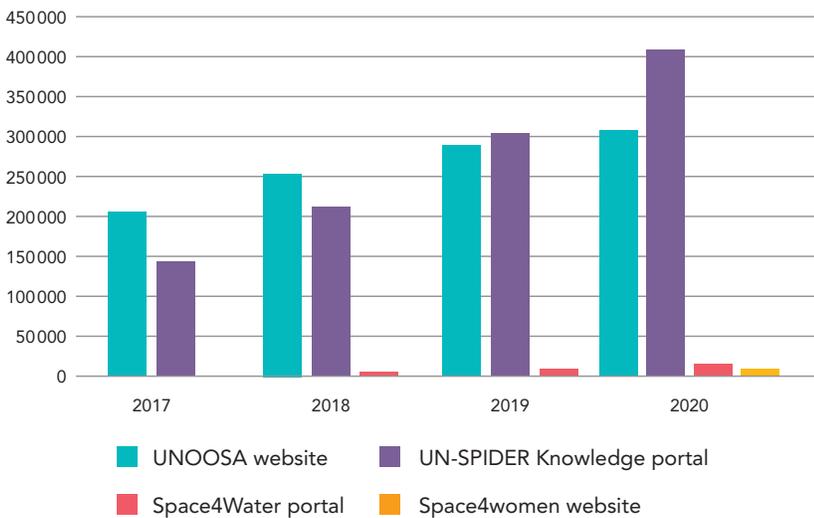
In the past few years, the Office has seen consistent growth in the number of users accessing UNOOSA online platforms.

Over 2020, on the UNOOSA website, the pages on space law treaties were the most consulted. However, new resources such as pages on how space can contribute to addressing the COVID-19 pandemic, on specific events such as the World Space Forum 2020, or on open opportunities under the Access to Space for All initiative, were also among the most visited.

The UN-SPIDER Knowledge Portal has seen the highest growth in users over the last four years, with numbers almost tripling. This is thanks to the relevance and quality of information it provides, particularly the “UN-SPIDER Recommended Practices” that present step-by-step instructions for processing satellite imagery in order to generate specific types of space-based information. Some of these have been translated into Spanish and French, reaching more users around the world.

In the second year of its existence, the Space4Water portal has seen a 50 per cent increase in users since its start in 2019. It keeps expanding its network and adding new resources on leveraging space applications for sustainable water management.

In 2020, the Office launched the Space4Women website, that attracted around 9,000 users in its first year of existence, and whose audience is rapidly growing.



Technical advisory support to countries

Countries that benefited from a space law and policy technical advisory mission

14

Countries that benefited from country-tailored UN-SPIDER technical advisory support

12

Countries with emergency incidents that received support from UN-SPIDER by acquiring satellite data/maps

9

Outreach

Social media followers

>61,000

Newsletter subscribers

>1,000

Participation in knowledge sharing resources and events

Participants in the Massive Open Online Course on Space Applications for Disaster Management

29,727

Persons from

142
countries

Completed Track 1

6,870

Completed Track 2

5,022

Participants in the World Space Forum

1,178

Participants in Dark and Quiet Skies webinars

964

Participants in the Space4Health webinar on leveraging space to combat COVID-19

400

Participants in the Space Economy virtual events series

791

Participants in UN-SPIDER webinars

>700

Participants at the United Nations/Austria Symposium on leveraging space to counteract climate change

340

Participants in webinars on Access to Space for All opportunities

>500

Young people connected with Space4Women mentors for education and career advice

>90

Participants at the United Nations Conference on Space Law and Policy: Emerging Issues in Space Law and Policy – Perspectives for African Nations

>189

Space objects registered

>1,300

(equivalent to nearly 10 per cent of all functional objects ever registered since the dawn of the space era)

The launch of the
Guatemalan satellite.
Credit: Ivan Castro

From the deployment of the first Guatemalan satellite through the KiboCUBE programme to the signing of a memorandum of understanding with NASA to advance the use of space for sustainable development, this chapter presents the highlights of UNOOSA activities in 2020.

3

HIGHLIGHTS OF 2020

3 | HIGHLIGHTS OF 2020

GUATEMALA DEPLOYS ITS FIRST SATELLITE THANKS TO KIBOCUBE/JAXA

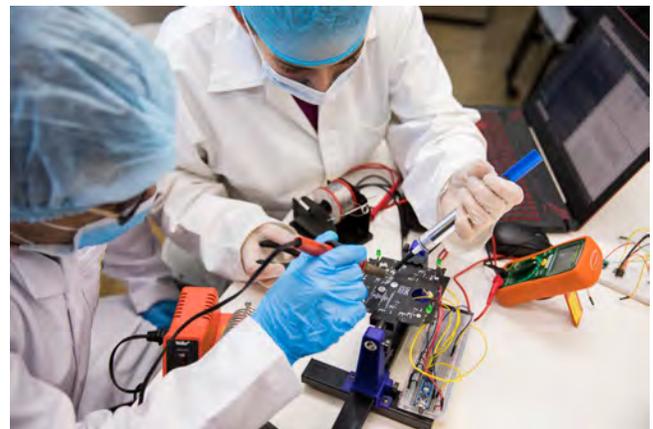
Thanks to the KiboCUBE programme, which is a joint endeavour of UNOOSA and JAXA, Guatemala's first satellite was deployed from the International Space Station on 28 April. The satellite, named Quetzal-1, was developed by a team from Universidad del Valle de Guatemala (UVG). The satellite was subsequently registered with the Secretary-General, through the register maintained by UNOOSA (see the final chapter of this report).

Guatemala is already the second country to deploy a cube satellite in space thanks to KiboCUBE. Kenya achieved the same feat with its CubeSat 1KUNS-PF, assembled by a team from the University of Nairobi, which was deployed in May 2018. KiboCUBE is one of the opportunities under the UNOOSA Access to Space for All initiative (see more about the initiative in the Space4SDGs chapter of this report).

The development and deployment of the satellite helps Guatemala acquire space capabilities and enables the independent acquisition of remote sensing data for natural resource management. The CubeSat tested technology to acquire remote sensing data for natural resource management: these may be used in the future, for example, to monitor water quality in inland water bodies for SDG 6, on clean water and sanitation. The CubeSat will also promote other high-tech projects in Guatemala, including in the field of aerospace, by raising awareness of the role that space science and technology play for sustainable development.



A member of the UVG team at work on the Guatemalan satellite.
Credit: UVG



Members of the UVG team at work on the satellite.
Credit: UVG



Guatemala's Quetzal-1.
Credit: UVG



The launch of the Guatemalan satellite.
Credit: Ivan Castro

Quetzal-1 demonstrated many ways in which space can support the 2030 Agenda for Sustainable Development and its 17 SDGs.

In particular, the project fostered SDG 5, on gender equality: seven women were part of the team that built the satellites, and they participated in several outreach activities for girls and women in Guatemala, for example, by contributing to teaching a module about Quetzal-1 in a “Women in Engineering” course for high school girls supported by the United States Embassy in Guatemala. In 2018 and 2019, the one-week course covered topics such as machine components, manufacturing, energy and how Quetzal-1 works, the latter taught by women from the UVG CubeSat team. In 2020 the course continued online and was also opened to girls above 12 years old.

During the entire construction period of the satellite that started in January 2014, students helped develop its

different modules, working on this as their senior project. When the team was selected as KiboCUBE winners, they called for volunteers – students from different years and programmes, as well as “alumni” who had been part of the project in the past – to collaborate on different tasks related to the satellite. Almost 100 people, mostly students with an average age of 21, but also faculty, external advisers and alumni, got to participate in the development of Quetzal-1, gaining priceless experience in satellite technology. The benefits of having young talented individuals with interest and expertise in this area will materialize for Guatemala in the years to come, contributing to SDG 4, on quality education, SDG 8, on decent work and economic growth and SDG 9, on industry, innovation and infrastructure, among others. SDG 9 was also supported with the creation of a satellite receiving station in the country that can support other national and international projects.

Finally, the project is a powerful example of SDG 17, on partnerships for the Goals, demonstrating the power of triangular cooperation and partnership.

“Having this CubeSat in orbit changes everything,” said Quetzal-1 team coordinator Víctor Hugo Ayerdi. “Five or six years ago, this was for us a project without much credibility. Now the question we get asked is when we are going to deploy another satellite. The project caused a change in attitude among university students: they no longer see these ideas as something illusory or unrealistic as they did before, but rather as something possible. The same thing is happening on a wider scale in Guatemala. The day the Falcon 9 took off with the CubeSat onboard, it was crazy in Guatemala, the entire country followed the event with so much pride. It really changed the perception that a developing country would not be capable of doing such a thing.”

“Without any doubt, without KiboCUBE, we would not have been able to put our first satellite in orbit in 2020. We are thankful to UNOOSA, JAXA and to all of the people and institutions who believed in this young group of trailblazers,” said team coordinator Luis Zea.



The moment when Quetzal-1 was deployed.
Credit: JAXA



Part of the Guatemalan team on the day of the launch of Quetzal-1.
Credit: Ivan Castro

MEMORANDUM OF UNDERSTANDING WITH NASA TO EXPAND ACCESS TO THE BENEFITS OF SPACE

This agreement brings together NASA's wealth of open source spacecraft data, tools and expertise, and the unique position of UNOOSA as the only United Nations entity dedicated to outer space affairs. Together, the partners will design capacity-building programmes, particularly for institutions in countries without space capabilities and those in the early stages of developing such assets, to help them access the benefits of space for future development.

Through this cooperation, UNOOSA and NASA will also engineer ways to leverage the Artemis programme as part

of the UNOOSA Access to Space for All initiative, adding new and exciting opportunities for international researchers and institutions, especially in developing countries, to gain space research and exploration skills. The two organizations will also work together on public outreach to increase awareness and understanding of the global benefits that can accrue from increased investments in space. A video of UNOOSA Director Simonetta Di Pippo and former NASA Associate Administrator Mike Gold presenting the memorandum of understanding is available on the [UNOOSA YouTube](#) channel.

UNITED NATIONS
Office for Outer Space Affairs

NASA

Simonetta Di Pippo
Director
UNOOSA

"UNOOSA's experience helping countries access space, combined with NASA's know-how and capabilities, will open doors for all countries, in particular developing ones, to take part in the benefits of the next exciting phase of space exploration and gain new tools to advance sustainable development."

Jim Bridenstine
Administrator
NASA

"In cooperation with UNOOSA, NASA's Earth observation data and capabilities can greatly improve life here on Earth, informing efforts to fight famine, support disaster relief efforts, and even improve water management and sustainable urban development."

Extract of the comments delivered by UNOOSA Director and the former NASA Administrator on the conclusion of the memorandum of understanding.
Credit: UNOOSA



A partial view of the United Kingdom from space.
Credit: ESA

PARTNERSHIP WITH THE UNITED KINGDOM TO PROMOTE SPACE SUSTAINABILITY

Through the agreement, UNOOSA and the UK Space Agency will raise awareness and provide capacity-building related to the implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities (LTS guidelines). The LTS guidelines were adopted in June 2019 by consensus of the 92 Member States of COPUOS, of which UNOOSA is Secretariat, with the objective of better preserving the outer space environment for future generations. The document contains a preamble and 21 guidelines on the policy and regulatory framework for space activities; safety of space operations; international cooperation, capacity-building and awareness; and scientific and technical research and development. The adoption of the LTS guidelines was welcomed with appreciation by the General Assembly in 2019, and, in his own annual report for 2020, the Secretary-General highlighted the significant progress made on outer space safety and sustainability thanks to their adoption.

The project to be undertaken through the agreement will reinforce the efforts of UNOOSA to raise global awareness on the importance of space sustainability and foster related capacity-building services, in particular for emerging space nations. Given the long-term and multifaceted nature of the topic, the project is foreseen as “Phase 1” of a multi-year initiative. This first phase will focus on awareness-raising activities and peer-to-peer sharing of operational case studies on the LTS guidelines as the basis for future UNOOSA capacity-building services.

MEMORANDUM OF UNDERSTANDING WITH MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION OF BRAZIL

Brazilian Minister and former astronaut Marcos Pontes and UNOOSA Director Simonetta Di Pippo signed this memorandum of understanding at the Vienna International Centre in September. The memorandum of understanding builds upon and formalizes the long-standing cooperation between UNOOSA and Brazil. UNOOSA and the Ministry will work on common goals by advancing cooperation in areas of space law, space policy, space science and technology, space for sustainable development, disaster management, navigation, telecommunication and capacity-building.

Brazil is also helping UNOOSA promote inclusiveness in the space sector. The Government is supporting the organization of an expert meeting on the UNOOSA Space4Women programme, that aims to advance gender equality in space. Scheduled to take place in Brazil in October 2021, the event will promote the exchange of best practices to foster gender equality in the sector.



A moment from the meeting between UNOOSA and the Brazilian Minister Marcos Pontes.
Credit: UNIS



UNOOSA Director Simonetta Di Pippo with Brazilian Minister Marcos Pontes at the signing of the memorandum of understanding.
Credit: UNIS

SPACE4WOMEN LAUNCHES ITS WEBSITE AND NETWORK OF MENTORS

On 11 February, the International Day of Women and Girls in Science, UNOOSA launched the [Space4Women website](#) that provides a variety of features to promote gender equality in the space and science, technology, engineering and mathematics (STEM) sectors. The launch was announced at a dedicated side event during the fifty-seventh session of the Scientific and Technical Subcommittee (STSC) of COPUOS.

One of the key features of the project is the Space4Women network, through which young women and men can interact with space leaders from all over the world, who act as mentors and help them navigate education and

careers in the space sector. The 35 mentors selected so far represent many of the different career paths available in the space sector. They come from diverse geographical and cultural backgrounds, ensuring interested young people can find a mentor in line with their profile. Around 90 formal requests from young people to reach out to mentees were received in 2020, and many others connected with them directly. Through the network, the mentors can also be invited for outreach and partnership opportunities related to inclusiveness in space.

The Space4Women website also offers a list of events and activities related to women's inclusion, and is in the process of collecting capacity-building needs on gender equality in space and STEM fields from Governments and institutions worldwide to design relevant support.

The Space4Women project contributes directly to SDG 4, on quality education and SDG 5, on gender equality, by helping unlock the full talent of women for scientific progress. The project was realized thanks to generous contributions from the Government of Israel, ESA and Women in Aerospace Europe.



Chinese astronaut Liuyang in Tiangong-1 Spacelab as crew of Shenzhou-9 manned space mission. She is holding a paperboard saying "Hello to all women" in Chinese.
Credit: China Manned Space Agency (CMSA)

Dr. Eng. TOKUGAWA Naoko, Senior Researcher, Aviation Systems Research Unit, Aeronautical Technology Directorate, JAXA.
Credit: JAXA

QUOTES FROM MENTEES

Do you have any questions, comments or suggestions for the Space4Women mentorship programme team, your mentor or the monthly mentee webinar organizer?

This programme has been wonderful

Emma Louden

Just a thank you!

Jung Ju Lee

I love it! I think it's amazing and it has helped me a lot. I just wish we had more sessions and more 1 to 1 time with our mentor. But of course, there needs to be a balance :)

Jas Purewal

I love this programme, thanks so much for organizing it!

Bhavi Jagatia

It's been a great programme! So glad I got the opportunity to participate and to have an awesome mentor such as Alissa!

Maya Nasr

What have been the benefits (if any) of having been mentored through the Space4Women programme?

Increasing my network in the field of space law and policy, meeting other incredibly talented mentees who helped me get involved in multiple organizations and programmes, in addition to great career and academic advice for my future work and my PhD thesis.

Maya Nasr

Through this very short time in the mentorship programme, I've been able to learn more about my journey in finding the next step for me as a learner. I also became involved in a new project with my mentor and was able to meet so many amazing and successful women, who she introduced me to.

Lynn Wahab

Having someone with experience in the industry and who gets you to take a step back and really think about what your goals and objectives are has helped me enormously.

Jas Purewal

Wonderful selection of speakers who each have taken unconventional paths.

Jung-Ju Lee

Getting exposed to a variety of careers in the space sector and learning from Dr. Haddaji about her path and advice for those beginning in the field.

Emma Louden

SECOND EDITION OF THE SPACE4YOUTH COMPETITION SELECTS THE BEST IDEAS ON LEVERAGING SPACE TO COUNTERACT CLIMATE CHANGE

UNOOSA continued to focus on elevating the voices of young people to contribute to a better future by launching, together with the Space Generation Advisory Council (SGAC), the [second edition of the Space4Youth competition](#). Around 400 young people from 70 countries registered for the competition, a large

increase on the first edition in 2019, which saw 130 participants from 40 countries. [Eight finalists and three young winners](#) were selected for their ideas and examples on how space in all its dimensions, including space technologies, policy and law can be used to tackle climate challenges in their local communities.

From Paraguay to the Himalayan region, from Lake Chad to the Arctic, incredible examples were presented by the young finalists. The essays of all finalists were published on the UNOOSA Space4Youth pages.

The three winners, which were announced in an [online webinar event](#), are:



Paola Ivanova Díaz Allen, from Mexico, 28 years old: her essay focuses on how space technology can support biodiversity conservation in Mexico.



Satrio Wicacksono, from Indonesia, 31 years old: his essay focuses on leveraging satellites to address deforestation in Indonesia.



Tsz Long So, from China, 22 years old: his essay focuses on how space applications can help mitigate greenhouse gas emissions in Hong Kong, China.

Thanks to the generous contribution of the United States, in 2021, if the pandemic situation allows, the winners will have the chance to travel to the United States to meet with representatives of the space industry and attend the Adult Space Camp, organized by the University of Alabama, at the United States Space and Rocket Center.

As well as gathering the best ideas on how to leverage space for increased resilience to climate change, the competition supports the implementation of the United Nations Youth Strategy, specifically its first priority: "Engagement, participation and advocacy to amplify youth voices for the promotion of a peaceful, just and sustainable world".



The United States Space and Rocket Center in Alabama, United States.
Credit: United States Space and Rocket Center

Space4Youth stories

In an effort to increase awareness of career opportunities in space and foster networking and exchanges among youth interested in the sector, UNOOSA is collecting stories from young people from all over the world in our Space4Youth Stories series. By the end of 2020, the series showcased experiences such as working in science communication, founding an aerospace start-up, shifting from working in design to

space, working in space diplomacy, conducting research in space law, participating in an analogue astronaut mission and working at the intersection of space, policy and society. The stories display the ingenuity and initiative of youth all over the world and provide ideas to inspire more young talents to contribute to the space sector. UNOOSA is always looking out for [new submissions!](#)

UNOOSA AND AVIO ANNOUNCE JOINT OPPORTUNITY TO DEPLOY SATELLITES IN ORBIT

UNOOSA and the Italian aerospace company Avio S.p.A. announced an opportunity for educational or research institutions, in particular from countries without established space capabilities, to deploy a 1 Unit (1U, 10 cubic cm) CubeSat or aggregates of up to 3U in orbit free of charge. The Vega C launcher, designed, manufactured and integrated by Avio and operated by Arianespace from the Guyana Space Centre, will take the selected CubeSat(s) into orbit. The opportunity is part of the UNOOSA Access to Space for All initiative that aims to bridge the gap among countries in their capability to access and benefit from space and its applications, particularly for sustainable development purposes.



Artist's rendering of the Vega-C rocket.
Credit: ESA

On 8 October, UNOOSA and Avio organized a webinar open to all to announce the opportunity, with UNOOSA Director Simonetta Di Pippo and Avio CEO Giulio Ranzo. With this collaboration, UNOOSA and Avio will raise awareness of the role small satellites play in sustainable development and contribute to building space science and technology know-how in countries without established space sectors. A selection board composed of experts from UNOOSA and Avio will review the applications and select the winner, who will be granted coverage of the launch service costs.

FIRST WINNERS OF HYPERGES FELLOWSHIP WITH THE EUROPEAN SPACE AGENCY

UNOOSA and the European Space Agency (ESA) announced the team from Mahidol University, Thailand as the [winner of the first cycle of the Hyper Gravity Experiment Series \(HyperGES\) fellowship](#). More details of their experiment can be seen on the UNOOSA [website](#). The fellowship, part of the UNOOSA Access to Space for All initiative, offers scientists from all over the world, with particular attention to developing countries, the opportunity to conduct their own hypergravity experiments using the Large Diameter Centrifuge (LDC) at the European Space Research and Technology Centre (ESTEC), which is part of ESA. The team will study the effect of hypergravity on watermeal, the smallest and fastest growing flowering plant on Earth, which could be used as a source of food and oxygen in space exploration.

The team is composed of five researchers, including two women scientists, from Mahidol University, Thailand. Each member brings a unique academic background, including physics, bio-innovation, biochemistry and electrical engineering.

By opening up the unique LDC facility to teams from all over the world, the HyperGES fellowship contributes to expanding access to space education and research in hypergravity, particularly for teams from developing countries, who may otherwise not have access to such equipment to advance their research.



A member of the team at work on the experiment.
Credit: Mahidol University

A member of the team at work on watermeal.
Credit: Mahidol University

FIRST ADVISORY SERVICES UNDER THE SPACE LAW FOR NEW SPACE ACTORS PROJECT

As global interest in space activities continues to grow, awareness of and adherence to international space law become ever more important. More and more countries are reaching out to UNOOSA requesting legal advisory services, as they look to continue assimilating international space law into their national contexts. In response to this increasing interest, in 2019, UNOOSA established the Space Law for New Space Actors project, to help Member States enhance their capacity to draft national legislation in line with international space law.

In 2020, two online technical advisory missions, tailor made for Chile and selected African countries (the online mission was attended by high-level representatives from Algeria, Angola, Egypt, Ethiopia, Ghana, Kenya, Morocco, Nigeria, Rwanda, Somalia, South Africa, Sudan and Tunisia) were delivered in October and December, respectively. As the next step, UNOOSA plans to conduct in-country missions to the nations that requested our support, as soon as the pandemic allows.

The Office also initiated the development of two e-learning modules, "Introduction to Space Law for New Space Actors Project" and "The Outer Space Treaty and the Fundamental Principles of Space Law" in English, French and Spanish.

In 2020, the Space Law for New Space Actors project is made possible through the generous contributions of the Governments of Belgium, Chile, Luxembourg and of the Secure World Foundation.



This view of Africa from space is actually a mosaic of satellite images, acquired by the Envisat medium-resolution imaging spectrometer (MERIS).
Credit: ESA



A sandstorm over the Sahara in Africa seen from the International Space Station. Credit: ESA

UNOOSA AND THE UNITED NATIONS ECONOMIC COMMISSION OF AFRICA CONFERENCE ON “EMERGING ISSUES IN SPACE LAW AND POLICY: PERSPECTIVES FOR AFRICAN COUNTRIES”

The Conference, held virtually from 8 to 10 December, focused on the legal regime of outer space, regional institution building and the use of space-based data in the African context, and on the multilateral approach to resolve emerging legal issues raised by current developments in space activities. While focusing on the perspectives of African nations, the virtual format allowed for increased global reach, with participants from around the world posing questions and commenting on

regulatory approaches to space activities that affect an ever-increasing number of people globally.

Experts and participants exchanged views on potential future governance frameworks for space activities that are of common interest to all States. These include the use of space-derived data for socioeconomic development, and legal measures to underpin the development of a global

space traffic management system that foster the safe, sustainable and responsible use of outer space while also addressing the growing space debris issue and the utilization of space resources for sustained human exploration of the Moon, Mars and beyond.



A deserted Frankfurt airport captured by the Copernicus Sentinel-2 mission on 30 March 2020.
Credit: ESA

Space provides humanity with essential tools to combat challenges such as the COVID-19 pandemic, and also to leverage lessons learned and build back better in its aftermath. This chapter focuses on how space technologies and UNOOSA contribute to fighting the pandemic and its ramifications, as well as supporting a more sustainable post-pandemic future. This chapter also focuses on how UNOOSA has adapted to and leveraged the advantages of new modalities of working to better serve its stakeholders.

4

FOCUS CHAPTER: SPACE FOR BUILDING BACK BETTER

4 | FOCUS CHAPTER: SPACE FOR BUILDING BACK BETTER

LEVERAGING THE POTENTIAL OF SPACE TO RESPOND TO, AND RECOVER FROM, THE COVID-19 PANDEMIC

Throughout the pandemic, space has helped limit disruption and keep our societies and economies on track. Three space technologies in particular supported the response and recovery from the pandemic: Earth observation, GNSS and satellite communications. When integrated with space-enabled mobile applications, they helped get essential goods across borders and assisted the observation of physical distancing rules. Satellites also helped Governments implement national coronavirus “track and trace” programmes on time, and at scale.

With lockdowns imposed across the world, people managed to stay connected thanks to space technology, that is the backbone of our modern communication channels. Many telehealth practitioners, including in developing countries, are using e-health platforms, and, in 2020, countless children were able to continue their education thanks to digital learning. The commercial space sector fully joined the fight against COVID-19, contributing ground-breaking technology and space application solutions. This resulted in a wide range of new open source technologies being brought to market, including handheld ventilators, 3-D printed respirator masks and cheap but

effective sterilization kits. For example, relying in part on skills acquired in space-related research, the Bolivian team winners of our DropTES fellowship produced an innovative ventilator for hospitals in their country that could be produced at a fraction of the cost of acquiring them on international markets ([see more on their story](#) on the UNOOSA DropTES page).

Throughout the pandemic, space agencies have drawn from the sector’s long-standing tradition of sharing knowledge through open data, which has been crucial for policymakers, the media, academia, international organizations and the general public. Linking open-source data with capacity-building activities increases access and utility for all users, especially in developing countries. This approach is fundamental to the support provided to developing countries by our UN-SPIDER programme on disaster risk reduction.

Throughout the crisis, UNOOSA has helped Member States and people everywhere learn about and leverage the solutions that space has to offer, as shown in the paragraphs that follow.



A view of the Red Sea coral reefs off the coast of Saudi Arabia from space.
Credit: ESA

Keynote at G20 Space Economy meeting in Saudi Arabia and white paper on the contribution of space agencies to fighting COVID-19

As part of the G20 virtual conference focusing on the global space sector, Space20, which was the first of its kind, UNOOSA was invited by the Government of Saudi Arabia, that held the Presidency of the G20, to deliver a [keynote](#) on how space agencies are supporting the global response to, and recovery from, COVID-19, and how space can contribute even more to avoiding and mitigating future disasters. This marked the first time space was included on the G20 agenda, bringing the potential of space technology for development to the attention of world leaders.

The keynote, delivered by UNOOSA Director Simonetta Di Pippo, showed how space agencies contribute to the world's response and recovery from COVID-19 and concluded with recommendations on how space data and know-how can be shared among nations going forward, to better respond to future crises.

In the weeks before the conference, UNOOSA and the G20 presidency engaged with G20 space agencies to

ensure the content of the keynotes reflected their latest developments, insights and activities.

Following the meeting, UNOOSA produced a white paper with examples of how G20 space agencies contribute to national and regional responses to the COVID-19 pandemic. The [paper](#) provides key recommendations on how to scale up these activities through international cooperation.

The G20 Saudi Secretariat and the Saudi Space Commission indicated a strong interest in establishing a governance model for a dedicated Space20 Working Group, to ensure the space sector becomes a stable component of the G20 institutional architecture in future Presidencies. This Working Group would act as a new hub for space-related discussions under the G20 umbrella. The Saudi G20 Secretariat and Saudi Space Commission indicated a desire for UNOOSA to act as the leading implementer of this G20 Space20 Working Group, once established.



This image shows post-COVID-19 truck traffic in four European countries: Romania, Poland, Italy and Spain, in 2020.
Credit: ESA

Repository of examples of leveraging space applications to fight COVID-19

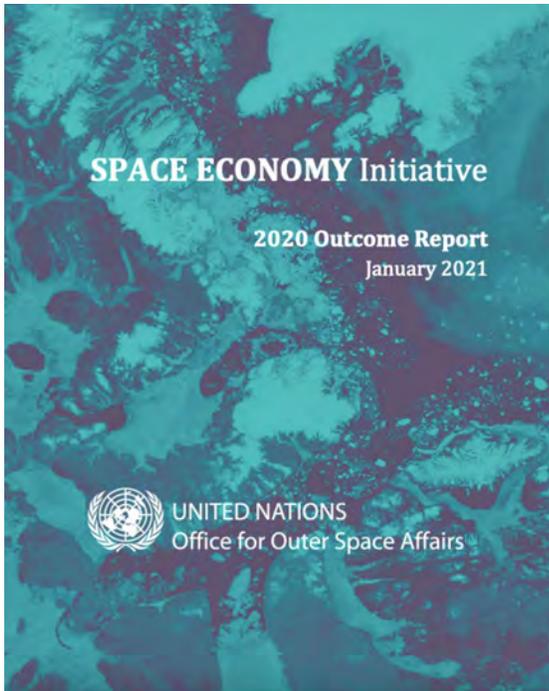
In order to help bridge the information crisis accompanying the global COVID-19 pandemic, the UNOOSA UN-SPIDER programme compiled examples of best practices to leverage space in the fight against COVID-19. The repository has over 70 examples of “space in action”, from leveraging GNSS to track virus cases to using satellite images to gauge the impact of coronavirus on the economy and greenhouse gas emissions. Around 4,000 users visited the page in 2020.

Space Economy to support the recovery

In June, UNOOSA launched a platform to engage with the private space sector during the pandemic: the Space Economy initiative began with a series of virtual events gathering success stories of how the space sector can support economic growth all over the world. The series discussed how to build successful space economies that contribute to job creation, innovation and productivity, as well as promote long-term economic recovery to “build back better”.

The term “space economy” refers to the economic benefits of a dynamic space sector and the role space can play in prosperous socioeconomic development. Today, around 80 countries¹ have operated at least one satellite, and Governments and commercial entities are investing record levels of political and economic capital in space activities. With an increasing number of public and private actors involved in the development and provision of space infrastructure and related products and services, the global space economy has been a consistent source of growth, exceeding US\$ 400 billion for the first time in 2018.

¹www3.weforum.org/docs/WEF_GFC_Six_ways_space_technologies_2020.pdf



The cover of the Space Economy Initiative Outcome Report.

The seven virtual events, open to all, took place from June to September, and addressed a variety of topics, from how to access funding for space endeavours to how Governments, the private sector and academia can work together to promote healthy space economies. Twenty-six high-level speakers from 22 countries, including from government agencies, the space industry and leading universities contributed to the events. UNOOSA published the Space Economy 2020 Outcome Report of the events series, available [on our website](#). Recordings of all the events can be found on our [YouTube channel](#).

The webinars saw over 1,500 registrations from over 70 countries. Ninety-four per cent of surveyed participants said the webinars had met or exceeded their expectations. Over the course of the coming year, UNOOSA plans to expand the initiative with more activities, including potential e-learning materials and ad-hoc advisory services.

Feedback received on the space economy webinars (anonymous)

Thank you UNOOSA for doing such a wonderful job bringing the global space community together!

Keep it up! You did a really good job, I really enjoyed it!

Please do all your best to continue such initiatives! Well done!

Keep up this great outreach programme!



The Earth at night seen from the International Space Station.
Credit: NASA

Space4Health webinar

On 14 May, UNOOSA organized a [Space4Health webinar](#) dedicated to the use of space infrastructure, its data, applications and services to combat the coronavirus pandemic, as well as counteract other global health challenges. The webinar brought together 20 experts from space agencies, the private sector, universities, research institutions, United Nations Member States and UNOOSA. More than 400 people registered for the event. The recordings of the two webinar sessions, the report of the webinar, as well as presentations, are available on our [website](#) and [YouTube channel](#).

Webinar on space technology for resilience

On July 8, as a side event to the High-Level Political Forum, panellists from UNOOSA and the international space community shared insights on how space technology is helping us increase the resilience of our planet to events such as the COVID-19 pandemic. A recording of this webinar is available on the [UNOOSA YouTube channel](#).

For every aspect of sustainable development, resilience is key: when actors are well prepared and informed, with strengthened capabilities to respond to hazards, then not only are lives saved, but progress is preserved and built upon. The COVID-19 pandemic has highlighted the value of resilience on a global scale.

Today, space technology enables effective policymaking around the world. Supporting access to and use of space data, as well as capacity-building and awareness-raising on its potential, are key to enhancing resilience.

Working Group on Space for Global Health

In 2018, COPUOS agreed to introduce a new item on space and global health in the agenda of the Scientific and Technical Subcommittee (STSC), and to establish a Working Group under that item. UNOOSA serves as Secretariat to this intergovernmental platform.

The Working Group on Space and Global Health held a meeting on COVID-19 on 12 June and is gathering information from States members and international organizations about their use of space applications for global health to develop concrete recommendations, including for the current pandemic. The Working Group aims to establish a platform to enhance the sharing of information, best practices, tools and capacity-building resources in the area of space and global health. Comprehensive information and documentation of the Working Group is available on the [dedicated webpage of the Working Group](#).

Other initiatives to leverage space for health

The UNOOSA Programme on Space Applications provides capacity-building in the areas of telehealth and tele-epidemiology (landscape epidemiology). It also assists Member States in the use of satellite remote sensing, global positioning, GIS and satellite communications to integrate ecological, environmental and habitation data into models for disease surveillance and control activities. The Programme regularly organizes or contributes to workshops, conferences and training programmes on leveraging space for global health.

Under its Access to Space for All initiative, UNOOSA provides a variety of programmes for all Member States, in particular developing countries, to access space, for example by conducting experiments onboard the China Space Station (CSS). Some of these programmes help winning teams conduct medical research that can lead to advancements in health care. For example, [one of the projects selected to fly on the CSS](#) will examine whether weightlessness can stop the growth of tumours.



The core module Tianhe of the China Space Station. Credit: CMSA



Massive congregations of greenish phytoplankton swirl in the dark water around Gotland, a Swedish island in the Baltic Sea.
Credit: NASA

SPACE FOR A BETTER FUTURE

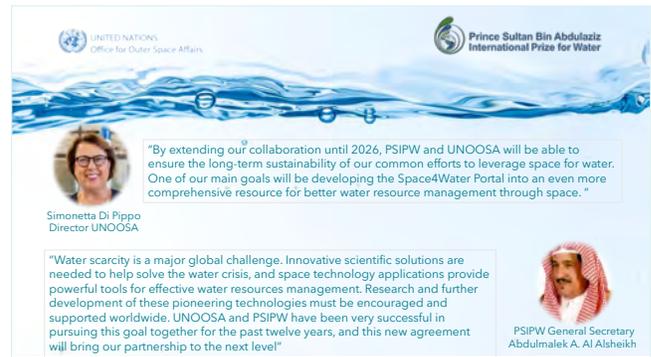
The paragraphs that follow set out the work that UNOOSA undertakes to build back better, both in the aftermath of the pandemic and in the context of the Decade of Action to achieve the SDGs. UNOOSA is working in both contexts to advance the uses of space applications for sustainable development here on Earth, and to promote the long-term sustainability of outer space, ensuring its safe and continued exploration for the benefit of future generations.

Agreement with Prince Sultan bin Abdulaziz International Prize for Water to leverage space for water resource management renewed for six more years

The partners renewed this long-standing agreement to promote the use of space-based technology for better water resource management until 2026. The two organizations have been working together since 2008, when the Prince Sultan bin Abdulaziz International Prize for Water (PSIPW) started participating as an observer at COPUOS. In the same year, they jointly organized the first international conference on the use of space technology for water resource management in Riyadh, which brought together experts from all over the world. Subsequent conferences were held in Buenos Aires in 2011, Rabat in 2014 and Islamabad in 2018.

In 2016, the two organizations formalized their collaboration, including an agreement to develop the Space4Water Portal, an innovative platform that brings together space and water experts to exchange knowledge, resources and practices. Organizations and actors active on the Portal share information on projects, satellite missions, software, capacity-building and training material, conferences, workshops and publications.

UNOOSA and PSIPW aim to further develop the Space4Water Portal into a comprehensive resource to foster better water resource management through space. Since its launch, the Portal has attracted over 25,500 users from 192 countries, who contributed a wealth of resources, best practices and tools. Regular international conferences will also be organized to spread awareness about the potential of space technologies for water sustainability.



Credit: UNOOSA



The Copernicus Sentinel-3 mission captured this image of the Mediterranean hurricane, or “Medicane,” crossing the Ionian Sea and approaching Greece on 17 September 2020. Credit: ESA

Online course on Geospatial Applications for Disaster Risk Management

Together with the Centre for Space Science and Technology Education in Asia Pacific (CSSTEAP), UNOOSA developed a first [Massive Open Online Course \(MOOC\) on using space applications for disaster management](#), and launched it on the occasion of the International Day for Disaster Reduction on 13 October. CSSTEAP, which is hosted by the Indian Space Research Organisation (ISRO), is one of the Regional Centres for Space Science and Technology Education affiliated to the United Nations.

MOOC is a free programme for anyone who wishes to enhance their capabilities for using geospatial and Earth observation technologies in disaster risk management. It has benefited from the input of experts from space agencies, research centres and the space industry all over the world.

Developed with the UNOOSA UN-SPIDER programme, MOOC offered two tracks: Track-1 targeted professionals interested in the latest developments in disaster risk management and how geospatial and Earth observation technologies contribute to it. After completing Track-1, participants had the option to continue with Track-2, to learn about geospatial applications for specific disaster types more in depth. As well as following the lectures,

MOOC participants can check their progress through quizzes and put the knowledge acquired into practice by developing maps and other information products using UN-SPIDER recommended practices to download, process and visualize space-based information.

In the six-week period when registration for the course was open, over 35,000 people from 147 countries signed up. Of those who registered, around one third are women, and 6,077 people completed Track 1, while 4,370 completed Track 2. Fifty-three per cent of the 2,373 people who provided feedback on the course found it outstanding and 47 per cent thought it good. Ninety per cent of participants felt the course enhanced their skills and said that they would share it with others. Additionally, the discussion forum on the learning platform has been very active from the very start, becoming a great networking hub for professionals working on disaster risk reduction. In 2021, based on the feedback received, CSSTEAP and UNOOSA will turn MOOC into an even better product and open it again for users.



The World Space Forum logo.
Credit: UNOOSA

United Nations/United Arab Emirates World Space Forum 2020 on “Space for our future”

The World Space Forum (WSF) series, launched in 2019, is a platform to promote discussions on the role of space science and technology in global sustainable development. It brings together stakeholders from the broader space community, including from governmental institutions, international intergovernmental organizations and NGOs, as well as industry, the private sector and academia.

In 2020, the event was organized jointly by UNOOSA and the United Arab Emirates Space Agency. It was held in a virtual open format that allowed for broader participation, with 1,178 registered participants, of whom 450 were women. Recordings of the sessions are all available on the [UNOOSA YouTube channel](#).

The Forum, titled “[Space for our future](#)”, focused on finding synergies to multiply the benefits of space for sustainable development. Space agencies and other space actors are already making substantial contributions to the achievement of the SDGs, and the WSF series aims to leverage and expand these efforts by promoting the exchange of know-how and actionable solutions to build a better future.

The event featured one high-level opening segment, with keynotes by UNOOSA Director Simonetta Di Pippo and the Director General of the United Arab Emirates Space Agency Mohammed Nasser Al Ahbabi, as well as four substantive sessions on space for humanity, space for the planet, space for the economy and a sustainable future in space. The programme also included a side event on the future of space exploration and a special event to announce the opening of the sixth round of the KiboCUBE programme to deploy a satellite from the International Space Station (ISS).

The Forum concluded with the launch of a “Call to Action” for organizations to share with UNOOSA the concrete actions they are taking to expand access to the benefits of space for sustainable development, under five domains: Partnership: Space for everyone, everywhere; People: Space for Humanity; Planet: Space for our Planet; Prosperity: Space for Economy; and Peace: Sustainable future in Space. UNOOSA will prepare a compilation of these activities, which will be presented annually at the Forum, highlighting in particular activities dedicated to the pursuit of common goals.

The WSF series was made possible by the generous long-term contribution of the Government of Austria.

United Nations/Austria Symposium on leveraging space to curb climate change

In 2020, the United Nations/Austria Symposium, the latest in a series of annual events on space for sustainable development organized by UNOOSA since 1994, focused on space applications for SDG 13, climate action.

The objectives of the event were to showcase concrete applications of space solutions to tackle climate change, discuss lessons learned and offer users, particularly from developing countries, an opportunity to explore tools and policies that could be adopted in their local context. Traditionally, the Symposium is an in-person event held in Graz, Austria. However, the 2020 edition was organized virtually due to COVID-19, creating an opportunity to reach a wider audience online. This allowed for greater geographical variety of both speakers and participants leading to more inclusive contributions. The Technical University of Graz provided the online platform and IT support. They also coordinated the welcoming ceremony with the Austrian partners and local authorities (including a performance by the world-class Austrian accordion player, Martin Harling).



The poster of the 2020 Symposium.
Credit: UNOOSA

Exceptional keynotes from ESA, Ben-Gurion University and UNOOSA itself complemented the sessions, providing insights into topics such as using Earth observation for climate change monitoring; promoting gender equality in the space sector; and progress in international cooperation to leverage space against climate change. All presentations made at the Symposium are available on the [UNOOSA website](#).



Feedback from participants

“The online format made it convenient for participants located outside Austria. [I particularly liked the] possibility of online participation. Even if this was due to COVID this year, I think it would be great to continue to offer online participation in the future.”

“Although a virtual platform is hard, effective management helps us to feel real and [allows us to gain] practical skills [and learn] proven methods for improving knowledge.”

“Networking in an interdisciplinary field and learning from real success stories is a major achievement of this symposium.”

“It really allowed me to understand more about the use of space applications for sustainable development goal 13 on climate action.”

“I discovered an initiative which may be very relevant. I already plan a call with the panellist.”

Medium-resolution imaging spectrometer (MERIS) image of the Austrian Alps.
Credit: ESA



A view of Abu-Dhabi, United Arab Emirates, from space.
Credit: ESA

UNOOSA and the United Arab Emirates sign an agreement to advance space sustainability and sustainable development through space

The agreement aims to increase collaboration on the long-term sustainability of space activities and promote the use of space for a more sustainable future. Space exploration is booming. Record political and economic capital is being invested in space, including by middle- and lower-income countries.

Such increasing interest, as well as the growing number of satellites and users, is great news for society, as space assets are game changers that accelerate sustainable development. This rapid growth in space activities, however, also poses challenges that test the secure and sustainable use of space. These include the proliferation of space debris, the emergence of large constellations of satellites and the increasing complexity of space operations. These pressures point to both a lively and

rapidly evolving global space sector, and to the need to reinforce dialogue and the exchange of best practices among both established and emerging spacefaring nations.

Moreover, the advantages space can offer for sustainable development are increasingly evident, and it is crucial that more countries are able to access their benefits, something UNOOSA is actively addressing through its Access to Space for All initiative. This agreement furthers the work of UNOOSA in bringing together the global space sector to support dialogue, research and trend analysis on space sustainability issues. The first step will be a stakeholder engagement study on the subject. Overall the project supports responsible activities in space towards leveraging the potential of space to accelerate sustainable development.



UNOOSA Director Simonetta Di Pippo and H.E. Ambassador HIKIHARA Takeshi, Permanent Representative of Japan to the international organizations in Vienna, during STSC in February 2020.
Credit: UNIS

UNOOSA and Japan join forces to mitigate space debris

On 6 February, on the occasion of the fifty-seventh Scientific and Technical Subcommittee of COPUOS, UNOOSA and the Government of Japan signed a joint statement to cooperate in addressing the challenge of space debris. Japan hosted a side event on space debris as an opportunity to invite all 95 COPUOS Member States for a seminar and a reception along with the signing ceremony. The amount of space debris is increasing, in parallel with the growing number of objects launched into outer space, and poses exponential risks of collision, threatening space operations and limiting the development of a secure commercial space environment.

UNOOSA and Japan agreed to work together to increase global understanding and the consolidation of knowledge on space debris; to disseminate information on the latest research on space debris; to cooperate with space actors in support of the implementation of existing mitigation guidelines; and to strengthen international cooperation and global awareness on space debris mitigation.

The two parties noted with satisfaction that many States and international intergovernmental organizations are implementing space debris mitigation measures, consistent with, inter alia, the LTS Guidelines, the Space Debris Mitigation Guidelines of COPUOS and the Space Debris Mitigation Guidelines of the Inter-Agency Space Debris Coordination Committee.

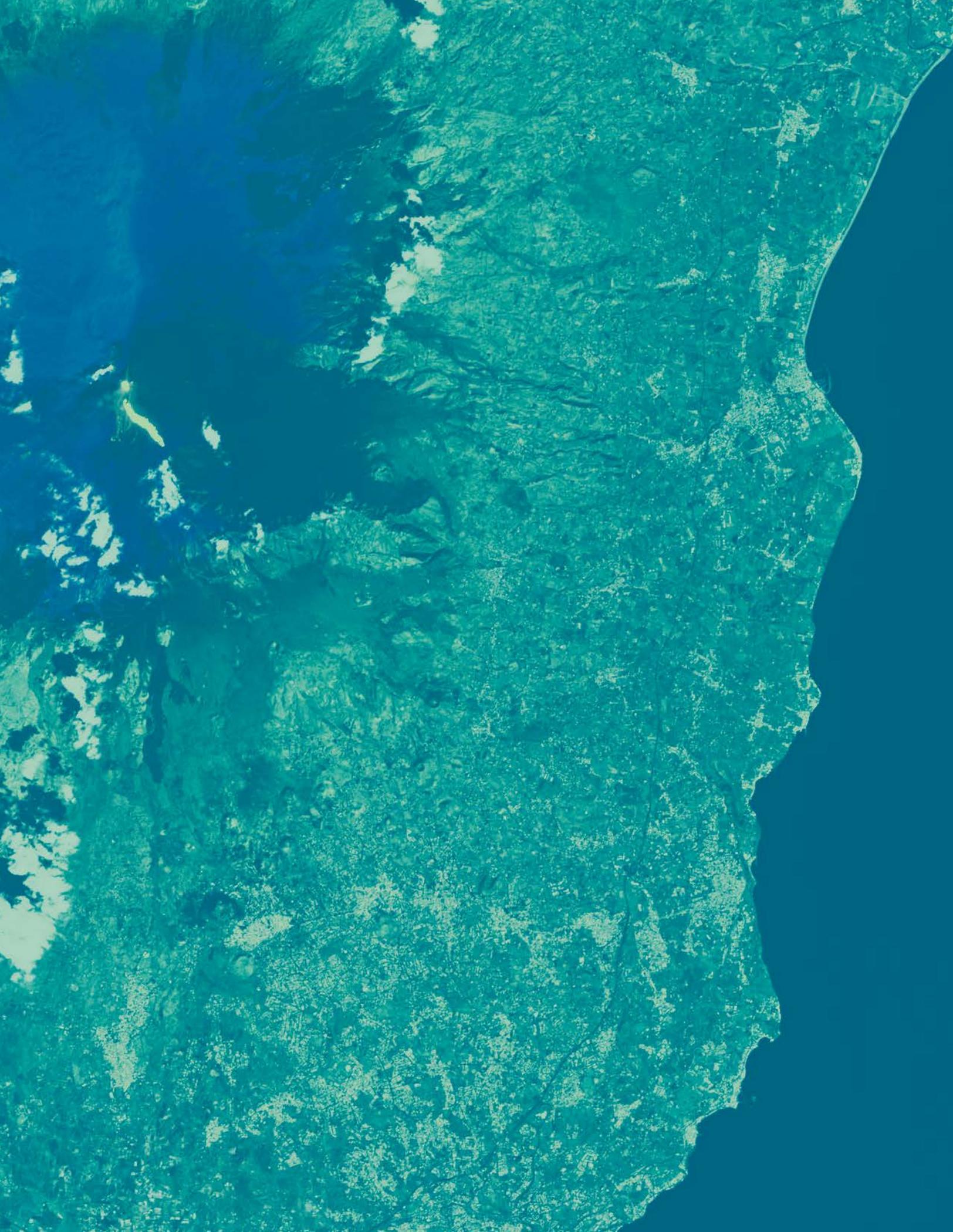


NASA/ESA Hubble Space Telescope captured this image of galaxy NGC 4848.
Credit: NASA/ESA

Briefing to the Executive and Deputy Committee of the United Nations on the sustainability of outer space activities

In April, UNOOSA Director Simonetta Di Pippo briefed the two highest-level committees of the United Nations System, the Executive Committee (attended by the Secretary-General) and the Deputy Committee, on the sustainability of space activities, particularly the growing problem of space debris.

The Director underlined that space is a limited resource facing unprecedented pressure due to the multiplication of space missions and objects, and that the United Nations, through UNOOSA, has a central role to play in ensuring sustainable global space governance. The Director also underlined the existing operations of COPUOS in this respect, including the adoption of the guidelines for the long-term sustainability of outer space activities (LTS Guidelines). In the future, even more cooperation and multilateral action are needed to protect the continuing health and sustainability of the space environment. The Director further stressed the importance of deeper international cooperation in disaster risk reduction, protection from space weather hazards and planetary defence from near-Earth object (NEO) impacts.



A 2017 image of an eruption of the Etna volcano in Sicily, Italy, captured by the Copernicus Sentinel-2A satellite.
Credit: ESA

Space is essential for increasing the resilience of communities all over the world to disasters. UN-SPIDER is a UNOOSA programme that helps developing countries find, access and use space-based information in all phases of disaster management – from preparedness to response and recovery. The work of UN-SPIDER helps countries implement the Sendai Framework for Disaster Risk Reduction, the Paris Agreement and the 2030 Agenda for Sustainable Development. This chapter presents the main activities of UN-SPIDER.

5

LEVERAGING SPACE FOR DISASTER RISK REDUCTION AND MANAGEMENT: UN-SPIDER

5 | LEVERAGING SPACE FOR DISASTER RISK REDUCTION AND MANAGEMENT: UN-SPIDER

In 2020, as the capacity of Governments globally was absorbed by the pandemic, the role of UN-SPIDER in helping to mitigate disaster risk through space was more important than ever, as it contributed to avoiding other crises, such as natural and technological disasters, which could mount on top of COVID-19.

UN-SPIDER also contributed directly to fighting the pandemic. For example, to explore how space-based information can support countries against the backdrop of COVID-19 pandemic, the 2020 United Nations International Conference on Space-based Technologies for Disaster Risk Reduction, carried out online jointly with the United Nations Office for Disaster Risk Reduction (UNDRR), addressed “Lessons learned during the unprecedented pandemic situation”.

At the request of Member States, UN-SPIDER carries out technical advisory missions that focus on assessing existing capacity for leveraging space for disaster management and emergency response. Over the years, UN-SPIDER has conducted 38 such missions, resulting in unique recommendations to help countries institutionalize the use of space-based information in disaster management. These address questions of policy and coordination; data access, availability and sharing; capacity-building; institutional



Tel-Aviv by night from space, captured from the International Space Station.
Credit: ESA

strengthening; early warning; and preparedness and emergency response efforts. UN-SPIDER follows up on missions with technical advice and training activities tailored to countries’ needs and strengthens local capacity for using Earth observation and remote sensing. In 2020, due to COVID-19, most of these activities were carried out online.

Besides Vienna, where UNOOSA is based, UN-SPIDER also has offices in Bonn and Beijing. The programme is backed by a global network of 25 regional support offices (RSOs) – and growing – hosted by space agencies, universities, research institutions and civil protection entities that provide a wide range of expertise and services.

In 2020, two new institutions joined the RSO network. The Federal University of Santa Maria in Brazil and UNOOSA signed a memorandum of understanding in May, which lays the foundation for even closer cooperation. Experts from the University have already supported several UN-SPIDER technical advisory activities in the past and have been contributing to the development of UN-SPIDER recommended practices since 2014. The Ben-Gurion University of the Negev in Israel has also agreed to host a new UN-SPIDER RSO – see details in the “New Partnership” section of this report.

UN-SPIDER TECHNICAL ADVISORY SUPPORT TO MEMBER STATES IN 2020



Tunisia

At the request of, and in coordination with, the National Civil Protection Office of Tunisia, UN-SPIDER carried out a technical advisory mission to Tunisia from 4 to 6 March, to help the country take full advantage of space-based information for disaster management. The mission was undertaken with the support of experts from the Algerian Space Agency, the Romanian Space Agency, the National Observatory of Athens and the Copernicus Emergency Management Service. It included a workshop attended by over 20 participants from nine institutions.

Following the mission, UN-SPIDER conducted a training course in Tunis, from 9 to 11 March, on flood mapping with radar data. Participants were introduced to the basic principles of synthetic aperture radar and applied the UN-SPIDER recommended practice for flood mapping with Sentinel-1 radar data using the Sentinel Application Platform of ESA.

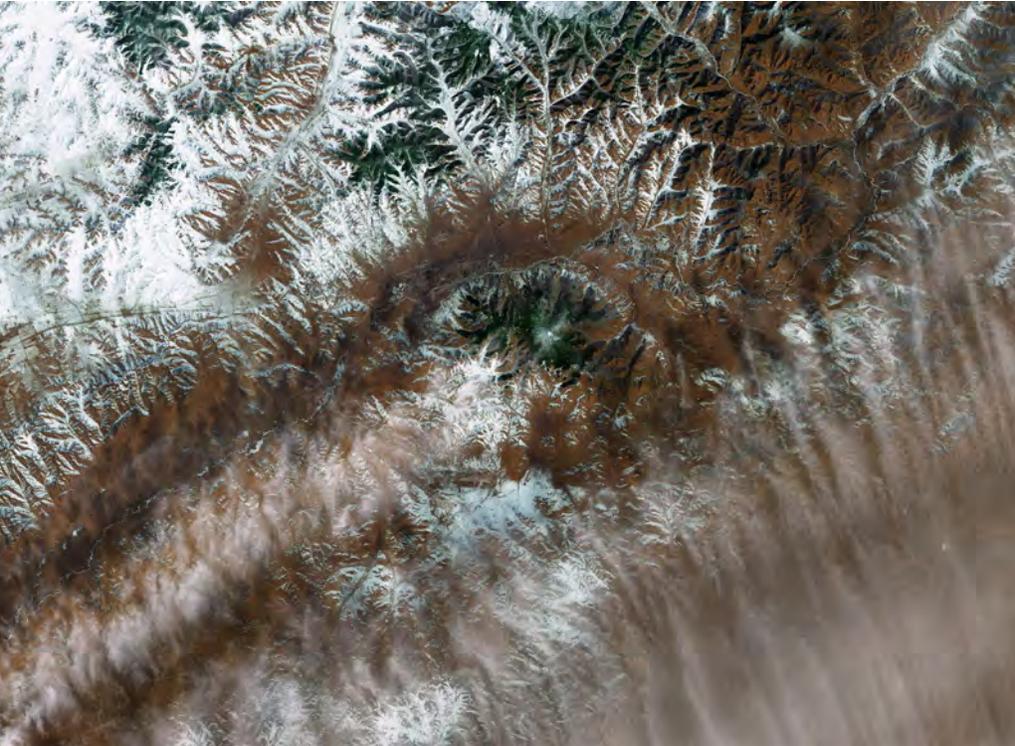


Participants in a workshop organized as part of the UN-SPIDER technical advisory mission to Tunisia.

Credit: UNOOSA, UN-SPIDER

Participants during a UN-SPIDER training course on flood mapping with radar satellite data in Tunisia.

Credit: UNOOSA, UN-SPIDER



View of the capital of Mongolia, Ulan Bator, captured by the Landsat-8 satellite in 2015.
Credit: USGS/ESA

Nepal

A virtual briefing session was held in June with the newly established National Disaster Risk Reduction and Management Authority of Nepal. The discussion between the Authority and the United Nations Resident Coordinator's Office enhanced cooperation in Nepal and paved the way for the provision of increased support to the country in the area of space applications for disaster management in 2021.

Honduras

Between July and December, UN-SPIDER held six webinars and discussion sessions with staff at the Forest Conservation Institute of the Ministry of Environment and at the national office of the Food and Agriculture Organization of the United Nations, in order to raise awareness of novel satellite technologies for monitoring forest fires. Participants learned about the UN-SPIDER recommended practice on burn severity mapping, the capacity of the Sentinel-5P satellite to monitor smoke dispersion in the atmosphere and a procedure developed in Colombia for assessing the susceptibility of vegetation to forest fires.

Mongolia

As a result of the pandemic, a technical advisory support mission to Mongolia scheduled for July to December could not go ahead. Instead, UN-SPIDER offered the National Emergency Management Agency of Mongolia the services of a national consultant from July to December, to facilitate the use of space-based information in disaster management. During this period, three capacity-building programmes were carried out with officials from various stakeholder agencies and provincial offices of the National Emergency Management Agency. The consultant supported the strengthening of the Platform for Real-time Impact and Situation Monitoring, which was developed by the World Food Programme of the United Nations and by the National Emergency Management Agency of Mongolia. The consultant also assisted the Agency in becoming an authorized user of the International Charter on Space and Major Disasters.



Zambezi delta in Mozambique in 2018 captured by the Sentinel-2 satellite. Credit: ESA

Mozambique

UN-SPIDER and the Federal University of Santa Maria of Brazil (a UN-SPIDER regional support office) conducted three webinars, between August and December, for staff at the National Institute for Disaster Management, the National Meteorological Institute, the Regional Water Administration Authorities, the Ministry of Public Works, Housing and Water Resources, the Mozambique Red Cross and local universities. The webinars focused on applying novel satellite technologies and products to monitor droughts and map the geographical extent of floods. UN-SPIDER, together with the National Institute for Disaster Management, the National Meteorological Institute and other local institutions, including universities, discussed the establishment of a technical, inter-institutional team in Mozambique that would focus on using geographical information systems and Earth observation applications to support disaster management.

Colombia

UN-SPIDER and the Agustin Codazzi Geographic Institute of Colombia (a UN-SPIDER regional support office) conducted two webinars, between August and November, for staff at the National Disaster Risk Management Unit and the Geological Survey of Colombia. Visiting scientists from UN-SPIDER presented the results of and challenges involved in the development of a methodology to map landslides triggered by earthquakes. In addition, UN-SPIDER was invited to participate in the eighth meeting of chiefs of the information technology offices of institutions linked to the agricultural sector, which was organized by the Ministry of Agriculture and Rural Development of Colombia. At the meeting, a UN-SPIDER visiting scientist delivered a presentation on the use of Earth observation technologies in the agricultural sector, with a focus on droughts and forest fires.

This false-colour image, acquired by the NASA Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) shows Colombia's highly active Galeras Volcano. Credit: NASA



Lao People's Democratic Republic

A UN-SPIDER mission was scheduled to take place in Savannakhet Province from 11 to 15 May, to offer technical advisory support to improve disaster risk management, early warning systems, emergency response and institutional capacity. However, due to the COVID-19 pandemic, the mission was postponed, and UN-SPIDER worked on ways to deliver the mission's objectives in a virtual format. A high-level technical advisory meeting was conducted on 19 October, attended by the Member of Parliament and Vice-President of the Economic, Technology and Environment Committee of the National Assembly, the Vice-Governor of Savannakhet Province and other senior officials. Representatives of two UN-SPIDER regional support offices, the International Water Management Institute and the Asian Disaster Preparedness Centre also attended the meeting.

Nigeria

At the request of the National Emergency Management Agency (NEMA) and the National Space Research and Development Agency of Nigeria, UN-SPIDER conducted three webinars in September to present UN-SPIDER resources and showcase how space technologies could support flood and drought monitoring efforts. During the virtual meetings, the two agencies discussed their use of geospatial data and geographical information systems in disaster management. In order to strengthen the capacity of NEMA to use space-based information to respond to floods in the country, UN-SPIDER conducted an online training course on flood mapping with Sentinel-1 radar imagery in Google Earth Engine in October. The three two-hour sessions were attended by staff of NEMA and the National Space Research and Development Agency.

The Niger

UN-SPIDER met with the General Directorate for Civil Protection of the Niger online in October to provide an overview of the UN-SPIDER programme and its technical advisory support activities, with a view to engaging in joint activities in the future. In order to strengthen the capacity of the General Directorate for Civil Protection to use space-based information to respond to floods in the country, UN-SPIDER conducted an online training course in November on flood mapping with Sentinel-1 radar imagery in Google Earth Engine. During the training, participants were introduced to the basic principles of radar remote sensing, learned to use the recommended practice, explored the process with selected case studies and presented the results in geographical information systems as flood maps.



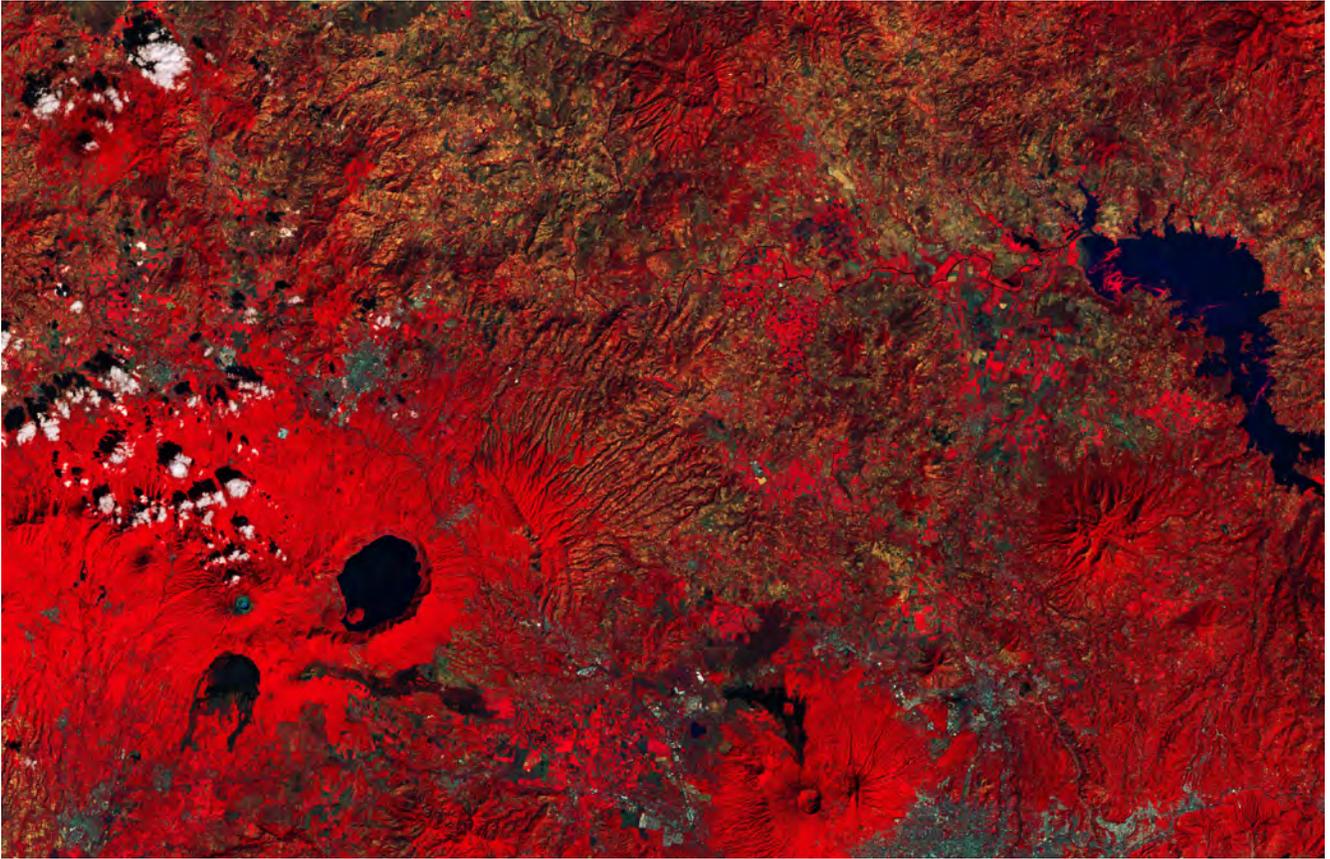
A view of the Niger river delta in Nigeria from space.
Credit: ESA



This view from a window on the SpaceX Crew Dragon vehicle docked to the International Space Station looks at a portion of the Sahara in the Niger 260 miles below.
Credit: NASA



The island nation of Sri Lanka and the brightly lit southern tip of India feature in this photograph from the International Space Station.
Credit: NASA



False-colour Sentinel-2 image over El Salvador, making vegetation appear in red.
Credit: ESA

Sri Lanka

UN-SPIDER offered the Disaster Management Centre of Sri Lanka the services of a national consultant for five months starting in November. The consultant has been working with the Centre and the International Water Management Institute, a regional support office based in Sri Lanka. This collaboration is expected to lead to the creation of data content in the geospatial dashboard that UN-SPIDER and the Centre developed in 2019 and to facilitate the monitoring of Sendai Framework targets.

El Salvador

At the request of the National Civil Protection Directorate of the Ministry of the Interior, UN-SPIDER participated in four virtual workshops organized in December by the Directorate for its staff in four provincial offices. In the workshops, UN-SPIDER facilitated the participation of experts from several regional support offices and national disaster management agencies of Latin American countries.

Mapping support following forest fires in Guatemala and Honduras

In order to raise awareness of new space-based tools available to monitor forest fires and of the UN-SPIDER recommended practice on burn severity mapping, a UN-SPIDER visiting scientist created maps of the burn severity of forest fires in Peten Province, Guatemala, and the central region of Honduras in May.

UN-SPIDER EMERGENCY SUPPORT

Activations of the International Charter “Space and Major Disasters” and the Copernicus Emergency Management Service

As part of its activities, UN-SPIDER facilitates activations of the International Charter on Space and Major Disasters, a worldwide collaboration through which satellite data are made available for disaster relief efforts. In 2020, the Charter was activated on the following four occasions:

- On behalf of the Department of Disaster Management of Myanmar, for a landslide at a jade mine that killed more than 180 people on 2 July
- On behalf of the Ministry of Agriculture and Natural Resources of the Sudan, on 8 August, following extreme and unprecedented floods that killed more than 150 people and affected more than 875,000
- On behalf of the General Directorate of Civil Protection of the Niger on 21 September. Heavy rainfall caused widespread flooding along the Niger river, killing at least 45 people and displacing more than 225,000 in various areas, including Niamey, Tenda, Diffa, Baleyara, Tahoua, Bangi and Dogondoutchi
- On behalf of the Federal Civil Protection System and the Mexican Space Agency on 1 December, owing to extremely large floods in the Tabasco region. The flooding began at the end of October and continued until the end of November.

UN-SPIDER also requested the activation of the Copernicus Emergency Management Service, at the request of the Permanent Contingency Commission of Honduras and the Coordination Centre for the Prevention of Natural Disasters in Central America, following hurricanes Eta and Iota in November.

In addition to requesting the activation of these mechanisms, UN-SPIDER raised awareness of them in events and during other discussions. It also worked with Cameroon, the Cayman Islands, Costa Rica, Ethiopia, the Gambia, Mozambique, the Niger, Panama and Zimbabwe to support them in becoming authorized users of the International Charter.



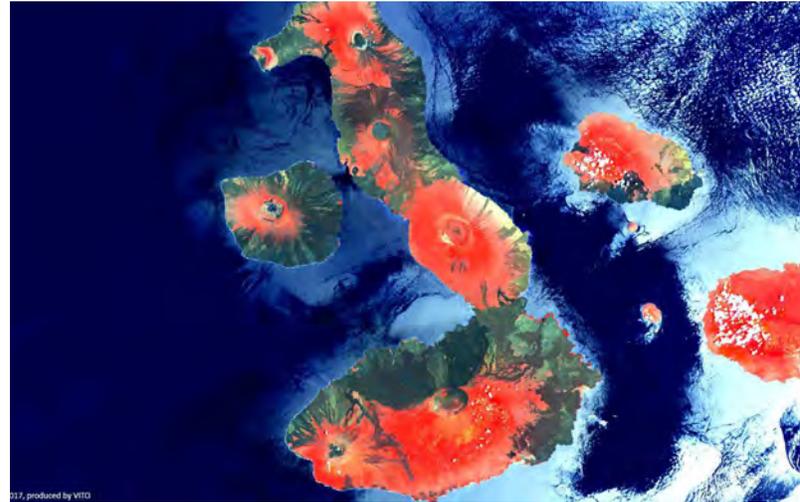
This night time image from the International Space Station shows Khartoum, the capital of Sudan, surrounded by the Nile, the Blue Nile and the White Nile rivers.
Credit: NASA



The active volcano of Popocatepetl captured from the International Space Station as it orbited 261 miles above central Mexico.
Credit: Roscosmos



Central Panama and its 80 km-long ship canal that connects the Atlantic – via the Caribbean Sea – and Pacific Oceans are pictured in this Envisat image. Credit: ESA



A Proba-V view of the internationally protected, volcanic archipelago of the Galápagos and its surrounding marine reserve. Credit: ESA

Provision of space-based information products to Member States following disasters

Throughout the year, UN-SPIDER supported civil protection and other partners in developing countries by creating and providing information products, upon their demand, to support them in addressing a wide range of natural hazards.

To help the National Civil Protection Office of Tunisia assess fires that occurred in the country between May and August, UN-SPIDER created a map indicating active fire hotspots and burned areas during that period.

Upon the request of NEMA, UN-SPIDER mapped flooding along the Niger river in September, through the UN-SPIDER recommended practice on flood mapping and damage assessments, using Sentinel-1 radar imagery in Google Earth Engine.

The programme also supported the General Directorate of Civil Protection of the Niger in responding to floods and wildfires in the country in October and November. This was done by mapping floods along the Niger river using Sentinel-1 radar data and by creating a map indicating active fire hotspots and the burn severity of affected vegetation using Sentinel-2 satellite imagery in Google Earth Engine.

UN-SPIDER and its visiting scientists created a number of maps of rural areas in the State of Oaxaca, Mexico that were hit by landslides triggered by an earthquake on 23 June. Radar interferometry procedures were employed with Sentinel-1 satellite radar images and change detection techniques were used with Sentinel-2 optical imagery. Airbus Defence and Space donated high-resolution TerraSAR X radar imagery for this assessment. The results were presented to the Mexican Space Agency, the National Centre for Disaster Prevention and the Federal Civil Protection System of Mexico to support the disaster response.

In November, two powerful hurricanes, Eta and Iota, struck Central America. At the request of the Permanent Contingency Commission of Honduras, the National Coordinating Agency for Disaster Reduction of Guatemala and the Coordination Centre for the Prevention of Natural Disasters in Central America, UN-SPIDER created several maps of areas in Guatemala and Honduras that were affected by floods. The maps were also shared with staff at the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) and the national offices of the United Nations Office for the Coordination of Humanitarian Affairs in Guatemala and Honduras. ECLAC was tasked with carrying out a damage assessment of the impacts in the two countries and benefited from the maps produced by UN-SPIDER.

NEW RESOURCES ON THE UN-SPIDER KNOWLEDGE PORTAL

Knowledge management is a cornerstone of UN-SPIDER: its Knowledge Portal (www.un-spider.org) hosts information on all activities conducted by the programme and provides easy digital access to resources and recommended practices on using space technologies for disaster management.

In 2020, the average number of monthly visits to the Knowledge Portal increased by over 30 per cent compared to the previous year, from 30,000 to approximately 40,000. By the end of 2020, the number of content items had increased to more than 9,100, from a starting point of 8,500. The sections with the most additions were those of news, events, data sources and institutions.

To enable a broader audience to access the information, step-by-step procedures, known as recommended practices, were created by UN-SPIDER and its partners. The Space and Upper Atmosphere Research Commission of Pakistan, a UN-SPIDER RSO, provided a recommended practice for “drought hazard monitoring and assessment”.

UN-SPIDER developed the following recommended practices:

- On the use of Sentinel-1 radar imagery to assess the extent of floods using the cloud-based Google Earth Engine tool
- On the detection of earthquake damage to urban areas using Sentinel-1 radar imagery
- On the integration of remote sensing data on recurring floods, infrastructure and socioeconomic circumstances using free and open-source software to support prevention and preparedness efforts

An additional version of the recommended practice on monitoring drought using vegetation indexes was also developed, to facilitate its use with cloud-based solutions.



Envisat radar image of the city of Karachi in Pakistan.
Credit: ESA

OTHER ACTIVITIES ON SPACE FOR DISASTER MANAGEMENT

United Nations International Conference on Space-based Technologies for Disaster Risk Reduction on “Lessons learned during the unprecedented pandemic situation”

Disaster management agencies all over the world have been and are helping to deal with COVID-19. This has increased their workload significantly, making it harder for them to prepare for and respond to other disasters. In view of this, disaster management agencies require even more precise information on hazards, risks and early warning of upcoming disasters in order to keep communities safe and plan effective emergency responses at such busy times. The theme of this year’s conference explored how to achieve this through the use of space-based tools and geospatial information. The two-day conference was co-organized by UN-SPIDER with the support of UNDRR and was attended by 204 people from 50 countries, representing over 110 organizations.

Regional training for the arid region of Western Asia

UN-SPIDER offered this international capacity-building programme on combating disasters in arid regions using space-based and geospatial technologies, which took place in Istanbul, Turkey, from 18 to 20 February. The event, which had 22 participants from 11 countries, promoted the use of space-based information in disaster management in Western Asia. It benefited from technical and financial contributions from Delta State University, an RSO of UN-SPIDER in the United States.



Group photo of UN-SPIDER regional training participants.
Credit: UNOOSA

UN-SPIDER regional training participants in the emergency room of the Disaster and Emergency Management Presidency of Turkey (AFAD).
Credit: UN-SPIDER



Image of fires in the Amazon forest taken on 24 August 2019.
Credit: ESA

UN-SPIDER webinar on “Novel satellite products and services for forest fire management”

With the support of a visiting scientist, UN-SPIDER conducted this webinar to address the use of products using the Sentinel-5P and GOME-2 satellite sensors and state-of-the-art Copernicus operational datasets in applications for forest fire management and monitoring systems. These can be used to map forest fires through cloud-based solutions and atmospheric observations of fire emissions. More than 200 participants, from Latin American countries, as well as from Germany, India and Spain, took part in the webinar.

UN-SPIDER and the International Water Management Institute webinar on locust monitoring

UNOOSA, through its UN-SPIDER programme, and the International Water Management Institute (IWMI) hosted a webinar on “Space-based inputs for locust early warning and preparedness” to promote the use of space technologies in combating a crisis that has been mounting on top of the COVID-19 pandemic.



The Upsala Glacier in the Los Glaciares National Park of Argentina is pictured in this Sentinel-2A image from 2016.
Credit: ESA

Expert meeting on “Space-based solutions for risk and disaster management in Africa”

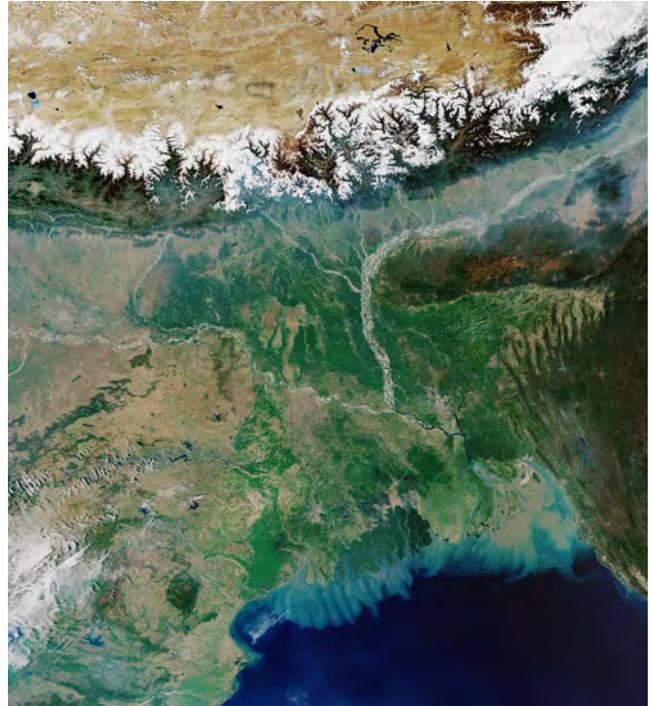
UN-SPIDER and the Centre for Remote Sensing of Land Surfaces of the University of Bonn (a UN-SPIDER RSO) jointly conducted this virtual meeting from 30 June to 2 July. The event, which brought together nearly 60 participants, addressed the role of satellite technologies and novel applications developed by the space community in responding to challenges posed by natural hazards in Africa. The meeting comprised three sessions over three days, as well as a technical training session on the use of the Global Flood Awareness System, delivered by the Joint Research Centre of the European Commission.

Expert meeting for Latin America and the Caribbean on “Space-based solutions for disaster risk reduction and emergency response in Latin America”

From 22 to 24 September, UN-SPIDER and four regional support offices (Argentina, Brazil, Colombia and Mexico) co-organized this virtual meeting to address the role of satellite technologies and novel applications developed by the space community in responding to challenges posed by natural hazards in Latin America and the Caribbean. The meeting was attended by nearly 200 people from approximately 70 disaster management agencies, space agencies, Governments, United Nations entities and other experts, including from the Central American Integration System and the Coordination Centre for the Prevention of Natural Disasters in Central America.



An Envisat MERIS image of the Caribbean Sea. The main island that can be seen in the image is Cuba.
Credit: ESA



An image of the world's largest river delta, the Ganges Delta, in Bangladesh and India, taken from Copernicus Sentinel-3 mission.
Credit: ESA

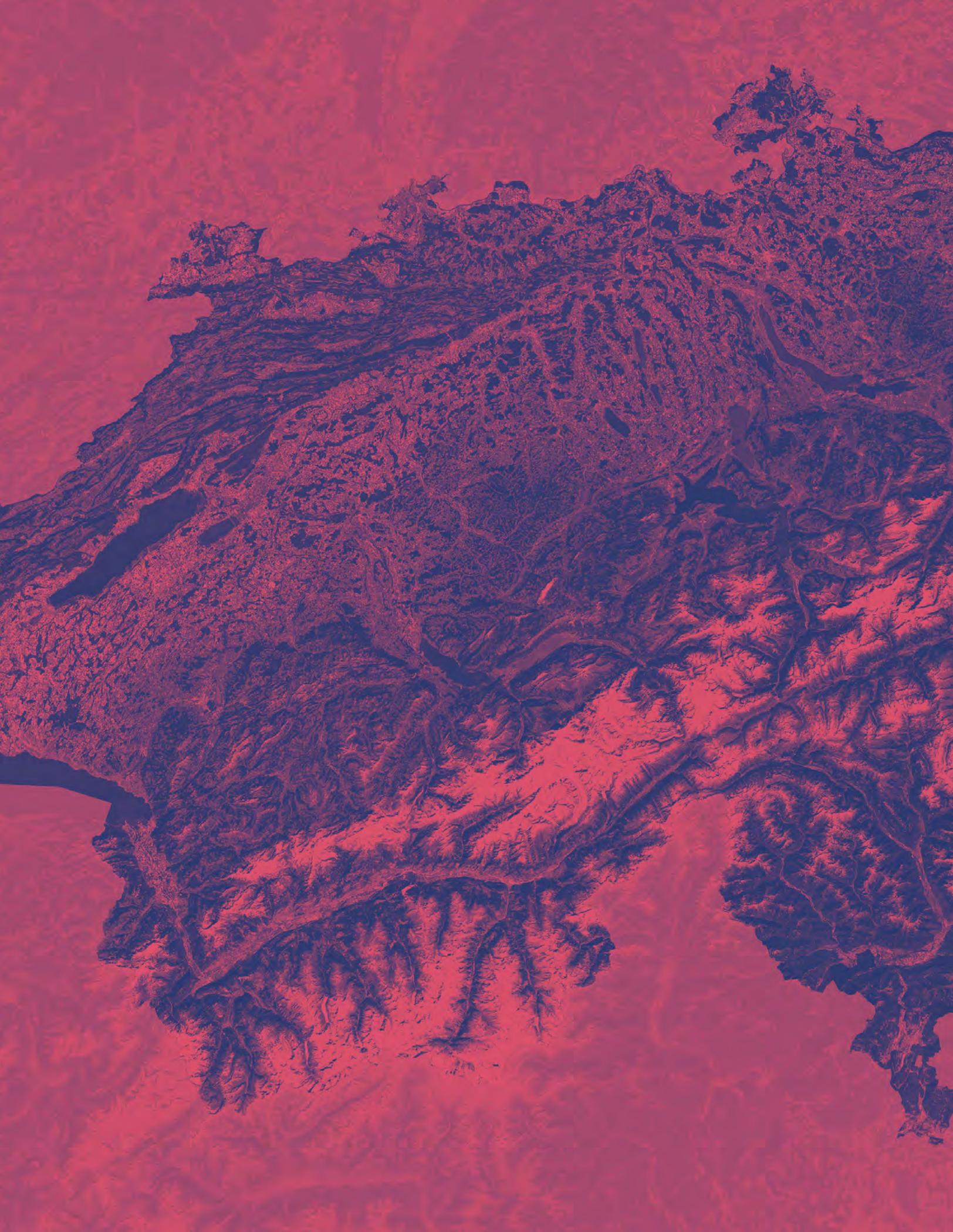
Annual meeting with UN-SPIDER regional support offices

Eighteen of the UN-SPIDER regional support offices (RSOs) attended this virtual meeting on 4 and 5 November. The two new RSOs were introduced, and updates were provided on ongoing and upcoming activities. A number of topics were discussed, including the engagement of end users, gender inclusivity and the potential for cooperation between regional support offices.

UN-SPIDER in the World Disaster Report 2020

Before, during and after a disaster, satellite images can reveal life-saving details: the communities most at risk or most affected, the destroyed or damaged roads and bridges, and the areas where helicopters can land safely to deliver medical staff and supplies.

UN-SPIDER contributed to this year's World Disaster Report, with focuses on climate disaster trends, including a case study on its work in Ghana, where UN-SPIDER helped develop the country's capacity to leverage space-based data for disaster risk reduction.





A view of Switzerland
from space.
Credit: ESA

Space applications are game changers that accelerate sustainable development. They provide unique insights on our planet, underpinning many of the technologies that our modern lives depend on, helping us fight climate change and monitor progress towards the SDGs. This chapter presents the main activities of UNOOSA in helping countries leverage space for sustainable development.

6

SPACE4SDGS

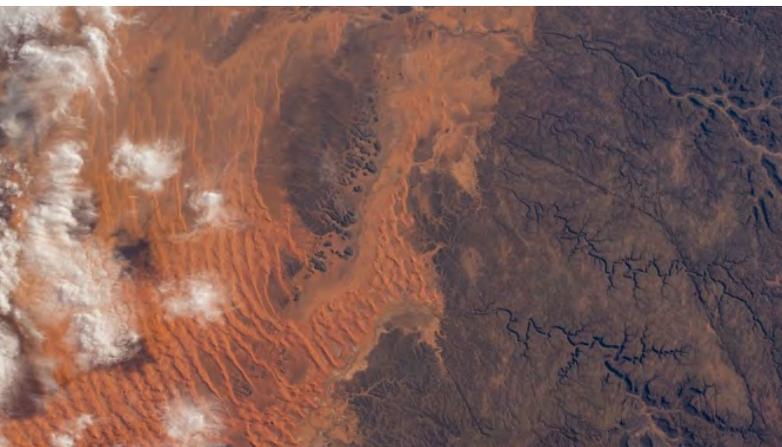
6 | SPACE4SDGS

Space technologies are essential allies in fighting disease and supporting populations at risk from rising seas or advancing desertification. They enhance the safety of refugees and victims of the impact of war as well as help counteract terrorism, piracy, slavery and crime worldwide.

Furthermore, space technologies play an important role in the preservation of biodiversity and cultural heritage. Simply put, we would not be able to address the fundamental challenges of our time without access to space.

As we enter the Decade of Action for Agenda 2030, as well as the time to build back better after the realizations and changes brought about by the COVID-19 pandemic, it is crucial to leverage the benefits provided by space data and applications to their maximum potential.

The [Space4SDGs pages on the UNOOSA website](#) provide an overview for readers on how space supports each of the 17 Goals. All the work of UNOOSA contributes to achieving the SDGs. In this chapter, some highlights are provided of ways in which UNOOSA directly supports the 2030 Agenda for Sustainable Development.



The hot desert climate of Illizi and Tassili N'Ajjer National Park in Algeria, captured by the International Space Station as it orbited 261 miles above.
Credit: NASA



A view of Switzerland from space.
Credit: ESA

WORLD ECONOMIC FORUM GLOBAL FUTURE COUNCIL ON SPACE PUBLISHES REPORT ON SIX WAYS SPACE BENEFITS LIFE ON EARTH

UNOOSA worked with the World Economic Forum (WEF) Global Future Council on Space, which explores challenges for the sector to support the future sustainable growth of space activities. In October, the Council published a [report](#) showing six ways in which space technologies benefit life on Earth and accelerate the achievement of the SDGs, with contributions from UNOOSA. The report covers areas such as climate change, connectivity, global security and the economy.

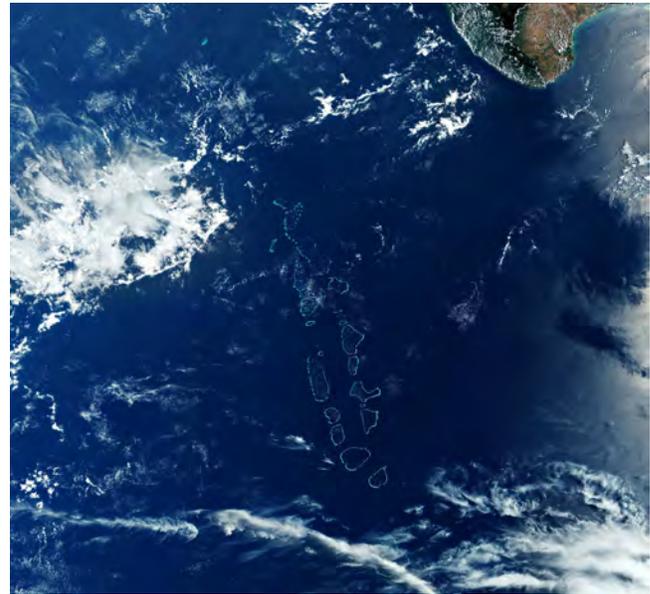
SPACE4WATER

Water conservation is one of the most critical environmental challenges currently facing humankind. Water sustainability is essential to achieve many of the SDGs, particularly Goals 1 and 6, but is interconnected to all the Goals. According to a 2018 synthesis report on SDG 6, if we continue the current course of actions and even further increase pressure on water resources, over half of the world's population, 45 per cent of the global GDP, and two-fifths of global grain production will be at risk by 2050. Strategies for securing and safeguarding humanity's water resources will be required in all sectors to avert a global humanitarian crisis.

Space technology and applications play a key role in understanding global water cycles, mapping water courses or aquatic ecosystems, and monitoring and mitigating the effects of floods and droughts. To leverage this potential, UNOOSA, together with our partner in this project, PSIPW, continued to expand the Space4Water Portal, a unique online platform that brings together space and water experts to share knowledge and resources.

In 2020, the Office launched two new features on the Portal. The dataset search allows users to search for and access datasets hosted by a globally distributed group of data providers. The "Meet a Young Professional" section features interviews with young professionals working in space and water, and highlights the importance of including youth in implementing sustainable changes for the future.

At the end of 2020, the Portal had 48 stakeholders, who shared information on 18 software tools and six projects. In 2020, the Portal attracted over 14,000 users from 175 countries. These users looked at over 30,000 pages. This represents an increase in users of more than 40 per cent; pages viewed increased by 20 per cent, compared to 2019. The table shows the main content statistics for the Portal in 2020. The Portal also offers a glossary of space and environmental terms: 600 terms had been defined and published as of the end of 2020, and 735 terms are used for tagging on the Portal.



A view of the Maldives from space.
Credit: ESA

Type of content	# of content published as of 31 Dec 2020
Stakeholders	48
Professionals	9
Articles	22
Interviews with professionals	8
Young professionals	2
Interviews with young professionals	2
Activities and opportunities	10
Publications	43
Software/web apps/tools	18
Projects/missions/initiatives/ community portals	10
Capacity-building and training material	33
Events	92
TOTAL	297

What stakeholders say about the Space4Water Portal



“The Space4Water Portal is an excellent initiative for an academic institution like IHE Delft, where space technology and Earth observation are considered key for the future of water management. The use of Earth observation data, and related research, has increased tremendously, and we see even further opportunities to do additional research and education on this topic in the future, supporting the achievement of SDG6 and other water-related SDGs.

A portal like Space4Water allows us to identify the community of players in the field, to reach out to them, with the possibility of either leveraging their results, or to think together about future opportunities to develop further innovation, allowing better synergies and avoiding duplication of efforts.”

Gaetano Casale

Liaison Officer, IHE Delft Institute for Water Education



“The Space4Water Portal is an outstanding opportunity to bring together different stakeholders from science, politics, business and local communities to pool knowledge and exchange ideas. For me, Space4Water is an encouraging example of how people can actively contribute to achieving the SDGs, according to the motto ‘leave no one behind.’”

Lukas Graf

Software engineer at VISTA Remote Sensing in Geosciences GmbH, young professional, user and author of articles on the Space4Water Portal



“The Space4Water Portal contributes to my work positively. There is a lot of information, data and case studies, as well as free training programmes. Space-based technologies such as the Global Navigation Satellite System (GNSS), Earth observation and satellite communication can be used for research purposes to map, monitor and manage water resources, to focus rainfall and climate change.”

Basuti Bolo

Endowed Chair Educational Technologies at Africa University, Zimbabwe, featured professional at the Space4Water Portal

ACCESS TO SPACE FOR ALL

The Access to Space for All initiative focuses on bridging the gap among nations in their capacity to access and benefit from space, and on developing skills in cutting-edge technologies to promote innovation, entrepreneurship and employment. The initiative offers a wide range of opportunities in micro- and hypergravity research, satellite development, launch and deployment, in-orbit research and access to laboratories in low Earth orbit, such as the ISS and the future CSS. Most of these opportunities specifically target teams from developing countries.

Access to Space for All helps all countries leverage space to advance the SDGs, in particular SDG 4, on quality education, SDG 8, on decent work and economic growth, SDG 9, on industry, innovation and infrastructure, SDG 10, on reduced inequalities and SDG 17, on partnerships for the Goals.

The Access to Space for All initiative is made possible thanks to partnerships with public and private actors operating in space, who open up their expertise and technology for international cooperation. The partners to the initiative in 2020 were the Center of Applied Space Technology and Microgravity, the China Manned Space Agency, the European Space Agency, the German



1U CubeSats Irazu (Costa Rica) and 1KUNS-PF (Kenya) deployed from the JEM Small Satellite Orbital Deployer. The 1KUNS-PF (Kenya) CubeSat was deployed under the Access to Space for All Initiative. Credit: JAXA/NASA



Aerospace Center, the Japan Aerospace Exploration Agency, Keldysh Institute of Applied Mathematics, the Russian Academy of Sciences as well as Airbus Defence and Space GmbH, Avio S.p.A. and the Sierra Space Corporation. UNOOSA is always on the look-out for new partnerships to continue expanding the initiative.

Access to Space for All is committed to developing responsible and sustainable outer space activities, including planning for the end of life of its space activities. For example, the first satellite deployed thanks to KiboCUBE, 1KUNS-PF, completed its lifetime by re-entering and vaporizing in the atmosphere during the summer, and Kenya issued its re-entry notification to the Register of Objects Launched into Outer Space, maintained by UNOOSA. The satellite deployed from Guatemala was also registered with UNOOSA.

For UNOOSA, helping teams from all over the world access the opportunities offered by the initiative, and advance in their preparation and experiments once selected, was even more crucial in 2020, as the work of so many researchers was slowed down by the COVID-19 pandemic. UNOOSA continued to expand the Access to Space for All portfolio with new opportunities, and stepped up its range of webinars on the technologies covered by the initiative and on how to prepare a competitive application. The highlights are listed on the following pages.



Illustration of the Bartolomeo platform in space.
Credit: Airbus

Applications to fly a payload with Airbus

UNOOSA and Airbus Defence and Space GmbH announced this opportunity to accommodate a payload on the Airbus Bartolomeo external platform on the ISS in 2019. On 30 January, UNOOSA and Airbus conducted a webinar to explain the opportunity and the application process.

The platform will accommodate and operate payloads provided by institutions in the participating countries, as long as their missions contribute to addressing the SDGs.

The opportunity was open to all Member States of the United Nations, and developing countries were particularly encouraged to participate. Over the course of 2020, 11 applications filed by 29 institutions from 18 countries were received. These numbers demonstrate that the opportunity promotes international cooperation and the establishment of consortiums among countries. The selection process is ongoing.

KiboCUBE

The KiboCUBE programme, which has been running for five years, is a collaboration between UNOOSA and JAXA offering teams from developing countries the opportunity to deploy a satellite from the Japanese Experiment Module (Kibo) of the ISS free of charge, through a competitive process. The programme helps selected winners develop and deploy a cube satellite (CubeSat) that ranges in weight from 1 to 10 Kg and can be as small as 10x10x10 cm.

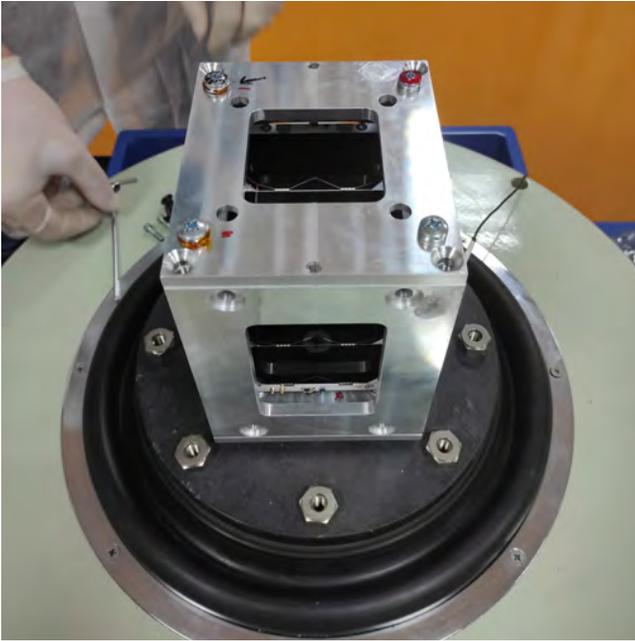
KiboCUBE has now selected six winners, with two countries (Kenya and Guatemala) having already deployed their cube satellites in orbit and four more winners working on satellites: Indonesia, Mauritius, Moldova, and the latest winner announced in 2020, an international team from the Central American Integration System (SICA). Details on the Guatemalan deployment in 2020 can be found in the highlights chapter of this report.

The KiboCUBE programme contributes to the SDGs, especially Goal 4, on quality education and Goal 9, on industry, innovation and infrastructure, by helping individuals from developing countries acquire space-relevant skills and technologies. Cubesats provide unique images and data from space, enabling strategic policy decisions and support for the achievement of the SDGs. The purposes of the cube satellites developed through the programme so far vary from weather monitoring to technology demonstration; and from disaster early warning to mitigation. The programme helps winners develop the skills to advance further in space technology, paving the way for innovation in the space sector and beyond, and inspiring young people to pursue opportunities in technology-related fields.

During STSC, UNOOSA and JAXA jointly organized an event on "Capacity-building through small satellite development: opportunities through KiboCUBE" to share the milestones achieved by the programme and raise awareness of its potential.

A new round of KiboCUBE was opened on 8 December.

The KiboCUBE programme was also mentioned in one of the daily [press briefings of the Office of the Spokesperson of the Secretary-General](#).



TUMnanoSAT of Moldova going under the vibration test.
Credit: Technical University of Moldova

Team from the Central American Integration System selected as winners of fifth round of KiboCUBE

For the fifth round of the programme, a team from the Central American Integration System (SICA) were selected as winners. Bringing together members from Costa Rica, Guatemala and Honduras, the team will develop a cube satellite called MORAZAN-SAT, measuring 10x10x10 cm and weighing 1.3 kg, for capacity-building and technology demonstration purposes. The satellite is expected to be deployed from the ISS in 2022. The selection of this varied team, which brings together several Central and South American countries to work together on a satellite, shows the importance of international collaboration in the advancement of space capabilities.

Updates from the other KiboCUBE winners

The winners of KiboCUBE past rounds, the teams from Surya University (Indonesia), the Mauritius Research and Innovation Council and the Technical University Moldova, continued working on their CubeSats. The COVID-19 pandemic created some delays in the development of some of the CubeSats, due to the difficulty of importing components, its impact on the winning teams and on international travel. Despite these challenges, some of the CubeSats are expected to be deployed in 2021.



SHIBANO Yasuko (Ms.), Engineer, and GOTO Masayuki (Mr.), Associate Senior Engineer, from JAXA, at work on the Mauritius satellite.
Credit: JAXA



The Bolivian team.
Credit: Universidad Católica Boliviana "San Pablo"

Team from Bolivia selected as winners of the seventh round of DropTES

The Drop Tower Experimental Series (DropTES) Fellowship is run by UNOOSA in collaboration with the Centre of Applied Space Technology and Microgravity (ZARM) at the University of Bremen, Germany, and the German Aerospace Center (DLR). Started in 2013, the programme enables researchers to carry out microgravity experiments at the Bremen Drop Tower. The experiments, which consist of four drops or catapult launches, can build capacity for both hardware and human space missions.

The team selected for the seventh cycle of the DropTES in 2020 is composed of five researchers from Universidad Católica Boliviana "San Pablo".

They will conduct research on manufacturing techniques such as 3D printing in microgravity conditions, which could benefit both space exploration and life on Earth. UNOOSA conducted an interview with the winning team, which can be found on the [DropTES pages of UNOOSA](#). In 2020, the winning team from Bolivia also developed a low-cost ventilator to fight COVID-19 in Bolivia that has helped save many lives in the country.

UNOOSA symposium at STSC with updates on Access to Space for All

A symposium held on the margins of the fifty-seventh session of the Scientific and Technical Subcommittee of COPUOS covered, among other topics, Access to Space for All. It presented updates about the initiative, and included a panel on Future Moon Exploration Plans, with representatives from the China National Space Administration (CNSA), ESA, ISRO, JAXA and NASA. Presentations from the event are available on the UNOOSA website.



Artist's representation of the SNC Dream Chaser® spaceplane.
Credit: SNC

Series of webinars on Access to Space for All

In October, UNOOSA started a series of webinars on the Access to Space for All initiative, free and open for all to join, aimed at helping participants and prospective applicants make the most of the opportunities provided under the initiative. The webinars addressed a variety of topics, from how to raise awareness of space projects in the media to the aspects of space law that applicants need to take into consideration. Participants also heard from past winners about their experiences and asked questions to the space experts who presented. The webinars, which were well attended, were recorded and are available on the [UNOOSA YouTube channel](#).

Call for interest for a landing site with the Sierra Nevada Corporation

UNOOSA and the Sierra Nevada Corporation (SNC) are working on a joint opportunity for selected participants to fly payloads or experiments in low-Earth orbit using the SNC Dream Chaser® spaceplane. The opportunity, which will be part of the UNOOSA Access to Space for All initiative, will prioritize payloads that contribute to one or more of the SDGs. In 2019, UNOOSA and SNC announced a call for interest to provide a landing site for the SNC Dream Chaser® on its return from the mission. Six expressions of interest were received for the call, which closed in April.

OTHER SPACE4SDGS ACTIVITIES

European Union/UNOOSA event on multilateralism and cooperation in space

On 4 February, the European Union and UNOOSA organized a joint panel discussion to celebrate 40 years of collaboration between European Union and the United Nations in Vienna. The panel showcased examples of multilateralism at work in the space sector and future plans. It included remarks by H.E. Stephan Klement, Head of

Delegation of the European Union to the international organizations in Vienna; Simonetta Di Pippo, Director of UNOOSA; and Carine Claeys, Special Envoy for Space/ Head of the Space Task Force, European External Action Service. Some of the remarks were captured in a [video of the event](#), available on the [European Union website](#).



Parts of Europe and Africa are easily recognizable in this night time image shot by one of the Expedition 25 crew members aboard the International Space Station.

Credit: ESA



UNOOSA co-published the International Atomic Energy Agency Safety Standard GSG-14

Island of Spitsbergen in Svalbard Archipelago, Norway.
Credit: NASA

UNOOSA was pleased to cooperate with the International Atomic Energy Agency (IAEA) on this publication, on Arrangements for Public Communication in Preparedness and Response for a Nuclear or Radiological Emergency. The publication supports Member States in developing arrangements for communicating with the public and media, and coordinating official information in the event of a nuclear or radiological emergency. It can be found on [IAEA website](#).

NEW PARTNERSHIPS

This section outlines additional new partnerships created by UNOOSA in 2020, in chronological order throughout the year.

Memorandum of understanding with the Space Generation Advisory Council

The object of this memorandum of understanding is to advance their common objective of elevating the voices of global youth in the space sector, especially through the Space4Youth competition, which held its second edition in 2020.

UN-SPIDER regional support office with the Mexican Space Agency

Through the renewal of this agreement, the Mexican Space Agency will continue to host the RSO of UN-SPIDER that was established in Mexico in 2016. The two entities will go on working together to promote the use of space-based resources for disaster and emergency response management, in particular building capacity in Latin America and the Caribbean.

New UN-SPIDER regional support office with the Federal University of St. Maria (Brazil)

The University is a regional and national centre of expertise in the use of space technology for disaster risk reduction. By hosting a new RSO of UN-SPIDER, the University will help build capacity on the use of space-based resources for disaster management, especially in Latin America and the Caribbean.

Memorandum of understanding with Timkat

UNOOSA and Timkat, an organization that produces documentaries, interviews and exhibitions through local reporters to contribute to societal developments, share the goal of highlighting the importance of space for implementing the SDGs. Through this agreement, they will work together on an exhibition on how space technology can help humanity transition towards a sustainable planet, which will include portraits of 17 participants, each encapsulating one of the SDGs and how space technology can help advance it.

UN-SPIDER regional support office with GRID-Arendal, Norway

UNOOSA and GRID-Arendal will continue to advance their common objective of promoting the use of space technology applications for disaster management through the UN-SPIDER RSO in Arendal.

UN-SPIDER regional support office with the International Water Management Institute of Sri Lanka

The International Water Management Institute (IWMI) will continue to host a UN-SPIDER RSO, working with UN-SPIDER to advance the use of remote sensing technologies for disaster monitoring and risk reduction.

New UN-SPIDER regional support office at Ben-Gurion University of the Negev

UNOOSA and the Ben-Gurion University of the Negev signed this memorandum of understanding to create a new RSO of UN-SPIDER in the Earth and Planetary Image Facility (EPIF) of the University. EPIF is responsible for multidisciplinary satellite and airborne remote sensing scientific research for environmental applications, including advancing and developing remote sensing methods. Through the memorandum of understanding, UNOOSA and EPIF will work together on several areas, including emergency response management, capacity-building on space-based technologies for disaster management and the dissemination of methods and results from Earth observation.

UN-SPIDER regional support office with the International Centre for Integrated Mountain Development

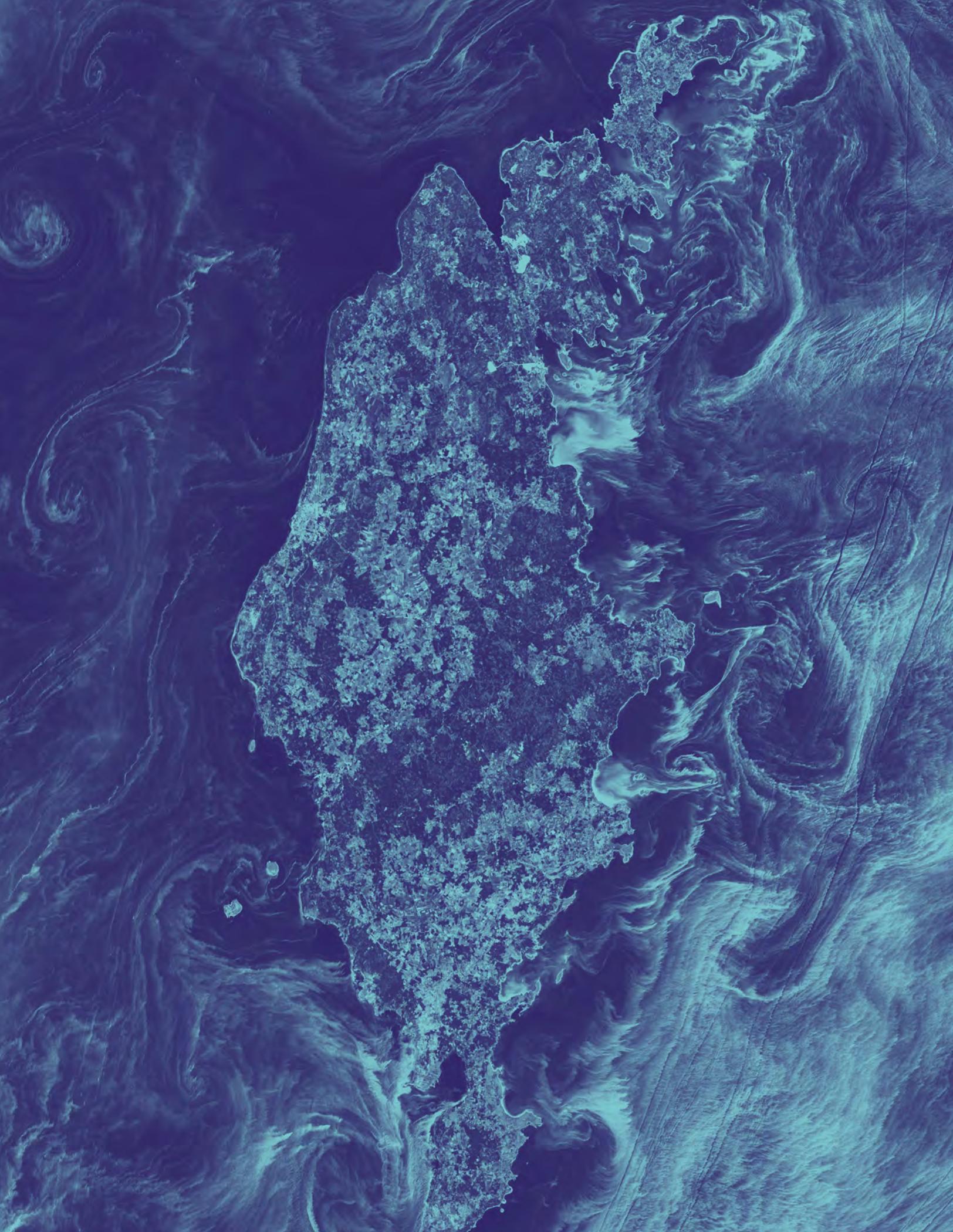
The International Centre for Integrated Mountain Development (ICOMOD) will continue to host the RSO of UN-SPIDER in Kathmandu, helping countries everywhere advance their use of space applications for disaster risk reduction.

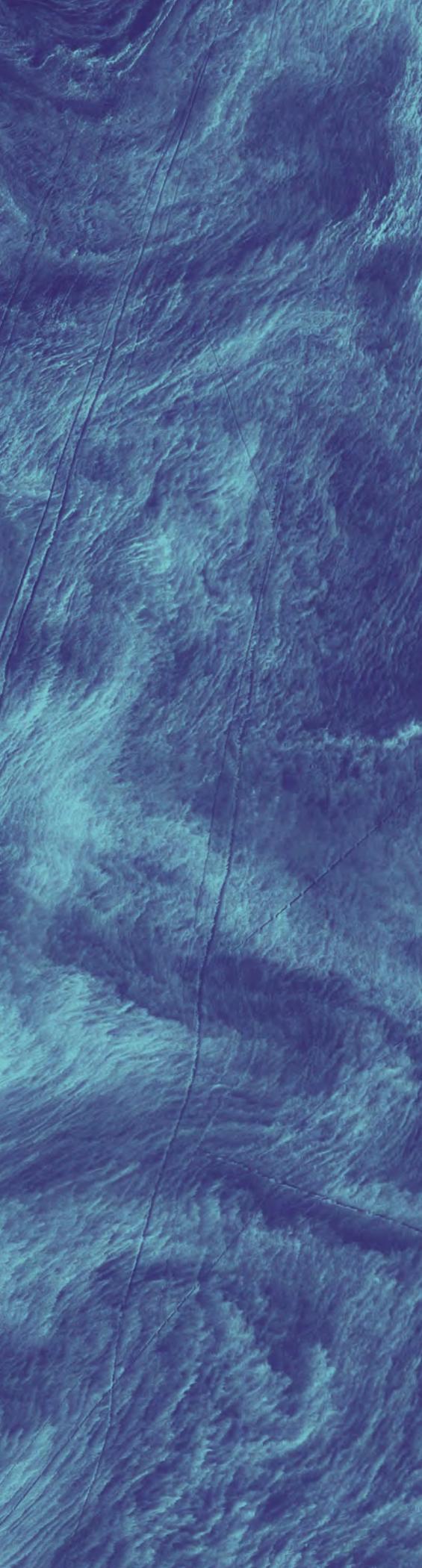
Exchange of letters with the United Nations Technology Bank for Least Developed Countries

This cooperation will provide for building capacity to access and use satellite data in Least Developed Countries, in particular to support disaster risk reduction, tackle global health-related challenges such as COVID-19, support priority areas for sustainable development, mitigate climate change and improve the management of natural resources.



The stunning lights of the Aurora Australis captured from the International Space Station in 2016.
Credit: ESA





Massive congregations of greenish phytoplankton swirl in the dark water around Gotland, a Swedish island in the Baltic Sea.
Credit: NASA

UNOOSA seeks to advance education and training opportunities in the space sector worldwide, in particular for students and practitioners in developing countries. From providing unique research opportunities on nano-satellite technologies to delivering training on space weather and GNSS to fostering education in space science and technology through its Regional Centres, this chapter focuses on the work of UNOOSA on space education.

7

SPACE EDUCATION

7 | SPACE EDUCATION

UNOOSA works to increase access to education and research opportunities on space science and technology, in line with SDG 4, on quality education. In this framework, the Office offers fellowships on space-related topics; provide advisory services to space agencies and research institutions in developing countries to expand their knowledge of space applications; organize international conferences and workshops on space applications; and provide online educational resources and directories of educational opportunities on space topics.

UNOOSA also regularly opens its doors to and engages with young people at its offices in Beijing, Bonn and Vienna, providing lectures and organizing visits and other activities on our work. In 2020, some of these activities continued online. For example, students from the Central European region were able to meet UNOOSA staff and learn about our work through a virtual version of the shadowing day organized by the United Nations Information System (UNIS) in Vienna.

Selected educational initiatives from 2020 are presented below.

REGIONAL CENTRES FOR SPACE SCIENCE AND TECHNOLOGY

In order to foster education and research on space science and technology, UNOOSA established the Regional Centres for Space Science and Technology Education, affiliated with the United Nations and hosted at existing research and higher education institutions around the world.

There are six centres so far, located in China, India, Jordan, Mexico/Brazil, Morocco and Nigeria. The aim of the Centres is to develop the skills and knowledge of university educators, scientists and government officials through rigorous theory, research, applications, field exercises and pilot projects in aspects of space science and technology that can contribute to sustainable development.

To ensure a common standard of teaching at the Centres, UNOOSA developed education curricula in all major fields of space applications, such as satellite meteorology and global climate, satellite communications, space and atmospheric science, remote sensing and geographic information systems, and GNSS. The curricula have been used at the Regional Centres and are available for other educational institutions and training initiatives across the world.

The Regional Centres actively work with UN-SPIDER to develop professional skills in space-based technologies for resilience: for example, CSSTEAP, based in Dehradun, India, regularly provides experts for the technical advisory missions and capacity-building programmes organized by UN-SPIDER in Asia.

In addition to supporting UN-SPIDER, the Regional Centres conduct regular postgraduate programmes related to the SDG framework, as presented below, helping to promote the importance of leveraging space applications for the future of our planet. Highlights from the work of selected Centres in 2020 are presented below.

Centre for Space Science and Technology Education in Asia and the Pacific

In 2020, the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), based in Dehradun, India, celebrated 25 years of services in education, training and knowledge-sharing. Over this time, the Centre has run 61 postgraduate diploma courses and 60 short courses in areas including satellite remote sensing, satellite communication, satellite meteorology, space science, GNSS and small satellite missions. These courses benefited over 2,400 participants from 56 countries.

In 2020, CSSTEAP offered four short online training courses on remote sensing, meteorological satellites, space and atmospheric sciences, and small satellite missions, to over 200 participants from the region. For the last few years, the Centre has also been contributing to off-campus programmes and technical advisory missions organized by UN-SPIDER.

Due to the COVID-19 pandemic, the Centre and UNOOSA have been unable to host regular capacity-building programmes in recent months. However, they were able to overcome this obstacle by launching the Massive Open Online Course (MOOC) on Geospatial Applications for Disaster Risk Management – for details, see the focus chapter of this report.

African Regional Centre for Space Science and Technology Education in English

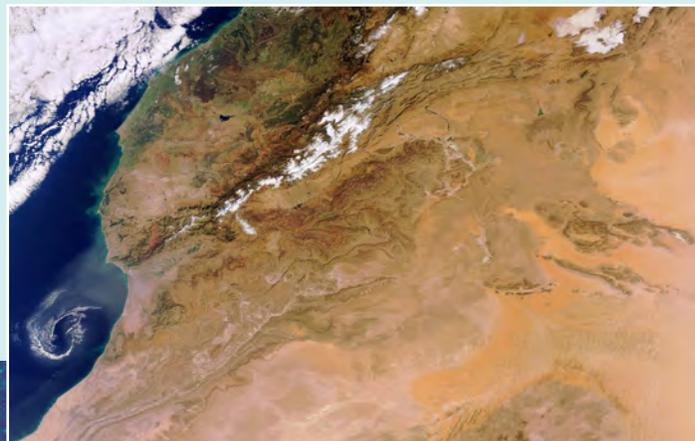
The African Regional Centre for Space Science and Technology Education in English (ARCSSTE-E) is located in Ile-Ife, Nigeria. Every year, the Centre offers nine-month postgraduate courses on remote sensing, GIS, satellite communications, GNSS and basic space science. The Centre selected 68 qualified applicants from six African countries for its courses: 44 are Nigerians and 14 are from Cameroon, Ghana, Liberia, the United Republic of Tanzania and Zimbabwe. Owing to the COVID-19 pandemic, the Centre started to deliver its courses online, with modules on space law, space biology and the principles of remote sensing and GIS. Physical classes will resume as soon as possible. The Centre offered scholarships to eight of the applicants from outside Nigeria: these will be provided once COVID-19 restrictions are lifted and the selected recipients are able to travel to Nigeria.



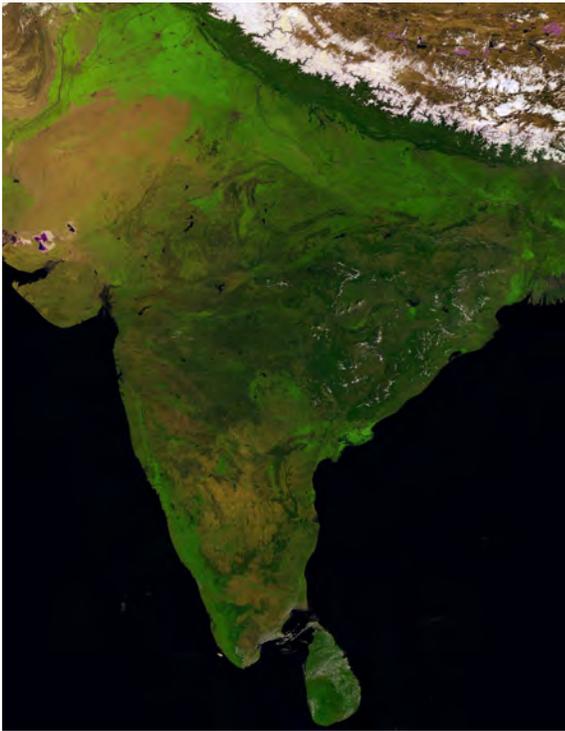
A picture from the graduation ceremony at the centre.
Credit: ARCSSTE-E

African Regional Centre for Space Science and Technology Education in French

The African Regional Centre for Space Science and Technology Education in French (CRASTE-LF), located in Rabat, held nine-month postgraduate courses on remote sensing and GIS, satellite meteorology and global climate and GNSS, from 17 September 2019 to 12 June 2020. Fifteen students from seven countries attended the course.



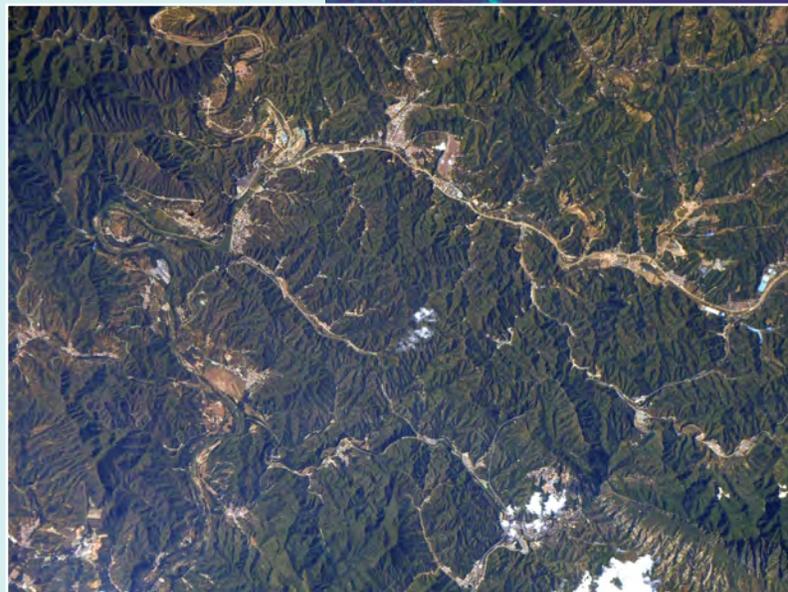
A view of Morocco and the Sahara from space.
Credit: ESA



A view of India from space.
Credit: ESA

Regional Centre for Space Science and Technology Education in Asia and the Pacific

The Regional Centre for Space Science and Technology Education in Asia and the Pacific (RCSSTEAP), hosted by the Beihang University of Beijing, taught an online master programme in remote sensing, satellite communication, global satellite navigation, space science and environment, and space law and policy. RCSSTEAP also offered four short online courses to over 500 students around the world. Owing to the COVID-19 pandemic, in 2020 all its programmes were provided virtually.



A view of the Great Wall of China from space.
Credit: ESA

RESEARCH AND TRAINING OPPORTUNITIES

United Nations/Japan long-term fellowship programme for postgraduate study on nano-satellite technologies

In 2012, UNOOSA and the Government of Japan, in cooperation with the Kyushu Institute of Technology (Kyutech), established a fellowship programme on Nanosatellite Technologies (PNST) for nationals of developing countries or non-spacefaring nations. The programme provides selected masters and doctorate students with extensive research opportunities using the nano-satellite development and testing facilities at Kyutech. The chosen candidates receive a grant from the Government of Japan for the duration of their fellowship. This fellowship equips students with knowledge of space science and technology to help their countries access the space sector and its benefits.

The 2020 round of applications for PNST closed in January: three students from El Salvador, Indonesia and Paraguay were selected for the Masters, and three students from Brazil, Nepal and Viet Nam for the Doctoral programme. The 2021 round was opened in December and UNOOSA and Kyutech conducted a webinar to share experiences from past and present fellows, the recording of which can be found on the [UNOOSA YouTube channel](#). You can read an interview with one of our past beneficiaries on the PNST page on the UNOOSA website.

One of the fellowship's beneficiaries, Pooja Lepcha from Bhutan.
Credit: Pooja Lepcha

Pooja Lepcha, currently a PhD student on nanosatellite technologies at the Kyushu Institute of Technology in Japan, at work on a satellite.
Credit: Pooja Lepcha



"Being at Kyutech is like having the entire world in our lab. We have students from all over the globe, each with different skills and backgrounds. The students currently at Kyutech could be the next space leaders in their countries. The network and friendships we built here will be important for the future, when we will be working on space technologies in our respective countries and hopefully on joint space endeavours."



Training course on GNSS

In its capacity as Executive Secretariat of ICG and its Providers' Forum, UNOOSA promotes the use of GNSS for development and provides related capacity-building activities, such as this training.

The third in a series held over 2018-20, the course is aimed at raising awareness of GNSS technology and its applications in the Asia and the Pacific region. It was organized by the ICG Working Group on information dissemination and capacity-building (Working Group C), led by UNOOSA, together with the Centre for Spatial Information Science at the University of Tokyo and the Geoinformatics Centre of the Asian Institute of Technology in Thailand, and held from 6 to 10 January. The course focused on the use of low-cost GNSS receiver systems and Android devices for high-accuracy positioning, survey methods and data processing. Seventy-one specialists from 15 countries, 24 per cent of whom were women, participated in and contributed to the training course.

Over the entire 2018–20 period, 217 specialists from the Asia and the Pacific region attended the training series. Of these, 57 trainees from 15 countries were supported financially by the ICG through UNOOSA. As a follow-up to the series, a handbook on high-accuracy GNSS data processing, summarizing data processing techniques, error analysis and various concepts related to the set-up of base stations, rover units and software, all of which were discussed during the training sessions, will be prepared by the experts of the ICG Working Group C, led by UNOOSA, for future reference.



Noctilucent or "night shining" clouds (NLC), captured over Knowlton Church in Dorset, United Kingdom, by astrophotographer Ollie Taylor in the early hours of 22 June 2020.
Credit: ESA

African workshop on the use of GNSS for space weather

This workshop provided attendees with an introduction to ionospheric physics and the science of space weather, including basic knowledge of GNSS technology and its applications. It was organized by the ICG Executive Secretariat, in cooperation with the Abdus Salam International Centre for Theoretical Physics (ICTP) in Italy, the Institute for Scientific Research at Boston College in the United States and the United Nations-affiliated African Regional Centre for Space Science and Technology – in French Language in Morocco.

The course was originally planned to be held in Rabat from 5 to 16 October, but was turned into a virtual workshop. This new format expanded the reach of the course, allowing 204 invited participants from 45 countries to attend, 30 per cent of whom were women. As interest in GNSS around the world is increasing rapidly, the flexibility to have more participants online was welcome. Lecturers included GNSS experts from the European Commission, France, Morocco and the United States, as well as from ICTP and UNOOSA.

A moment of hands-on collaboration during the training in Thailand.
Credit: UNOOSA

DARK AND QUIET SKIES

For thousands of years, the silent and ordered beauty of the night sky has inspired humankind in all its intellectual and emotional expressions, such as poetry, philosophy, religion and science. Modern science is particularly indebted to the observation of astronomical phenomena, as all its major achievements, from the theory of universal gravitation to general relativity, were stimulated and verified by careful observation of the sky.

Today, technological progress, in particular artificial illumination in urban areas, is making it increasingly difficult to observe the night sky in its pristine magnificence. Even remote sites, often chosen to host the most sophisticated astronomical observatories because of their favourable location, are becoming gradually endangered by light pollution, radio signal interference and artificially induced climatic modifications. More recently, visual interference caused by mega constellations of artificial satellites released in low Earth orbit has added to these problems.

To address this important issue, in October, UNOOSA and Spain, jointly with the International Astronomical Union (IAU) organized a series of online workshops on the topic of “Dark and Quiet Skies for Science and Society”. The online workshops replaced the Conference on this topic that was initially foreseen. The Conference has been postponed until 3–7 October 2021 and will be hosted by the Instituto de Astrofísica de Canarias at Santa Cruz de La Palma, Canary Islands, Spain. The recordings of the workshop are available on [UNOOSA YouTube channel](#).

The online event will result in draft recommendations on measures that Governments, local authorities and private enterprises can adopt to mitigate negative impacts on astronomy, due to urban lighting, radio broadcasting and satellite constellations, among other causes, without diminishing the benefits of these technologies. The conference report is intended to become a reference for further analysis of the situation in 2021, and recommendations will be presented for consideration to COPUOS, the natural platform to bring these issues to the attention of the international space community.



The poster for the original conference.
Credit: UNOOSA, IAU, NoirLab

WEBINARS ON SATELLITES FOR SUSTAINABLE DEVELOPMENT FOR WORLD SPACE WEEK

Since 1999, the week of 4–10 October has been celebrated as World Space Week, in line with a General Assembly resolution recognizing the contributions of space to human development. The dates were chosen in memory of the 4 October 1957 launch of Sputnik 1, the first Earth satellite, and the 10 October 1967 entry into force of the Outer Space treaty. The theme of World Space Week 2020 was “Satellites improve lives” and UNOOSA joined the celebrations by organizing a series of **three free and open webinars** on satellites and their contribution to sustainable development.

The webinars featured ideas from young people all over the world. The winners of the Space4Youth competition, on the subject of how to leverage space applications for sustainable development, demonstrated how UNOOSA helps all countries access space data and applications. It also allowed participants to hear from past winners and the organizers of the KiboCUBE programme about their experiences. The recordings of the webinars are available on the [UNOOSA YouTube channel](#).





A moment from the
Scientific and Technical
Subcommittee in
February 2020.
Credit: UNIS

UNOOSA is the Secretariat of the Committee on the Peaceful Uses of Outer Space (COPUOS), the main global forum for countries to discuss the scientific and legal aspects of outer space activities. This chapter presents the work that UNOOSA undertakes towards advancing international cooperation in outer space and building capacity in international space law.

8

INTERNATIONAL COOPERATION IN OUTER SPACE

8 | INTERNATIONAL COOPERATION IN OUTER SPACE

COPUOS UPDATES

COPUOS was set up as a permanent committee by the General Assembly in 1959, to address the exploration and use of outer space for the benefit of all humanity. Owing to rapid advances in space science and technology, the space agenda is constantly evolving, and the Committee, which is comprised of both well-established spacefaring nations and nations with emerging space programmes, provides a unique multilateral platform to monitor and discuss these developments. Its work is also supported by many permanent observer organizations.

As the benefits of space technologies become increasingly interconnected with everyday life on Earth, there is growing interest in, and value placed on, Committee membership. In fact, COPUOS is one of the fastest-growing committees in the United Nations system: it started with 18 Member States in 1959 and now includes 95 countries and 42 observer organizations. Together, the current 95 Member States represent almost 90 per cent of the global population.

Due to the extraordinary challenges posed by the global pandemic, in 2020 COPUOS was unable to hold its full cycle of in-person sessions for the first time in its history. The Scientific and Technical Subcommittee held its meeting in early February and considered such timely topics as space and global health, and space technology for sustainable socioeconomic development. The session was enriched by panel discussions, side events and technical presentations. Working groups also held informal consultations and meetings during the session.

As a result of the pandemic, the Office, in collaboration with States members of the Committee, needed to employ creative methods to continue multilateral work when in-person sessions became impossible later in the year. The Legal Subcommittee and the Committee, following several rounds of virtual briefings and consultations, took a series of decisions by written procedure, which allowed successful annual reporting to the Fourth Committee of the General Assembly (the parent body of COPUOS) and set up the work of the Committee to continue in 2021.



A moment from the STSC of COPUOS in 2020.
Credit: UNIS



Galaxy NGC 4535 captured by the NASA/ESA Hubble Space Telescope.
Credit: NASA/ESA

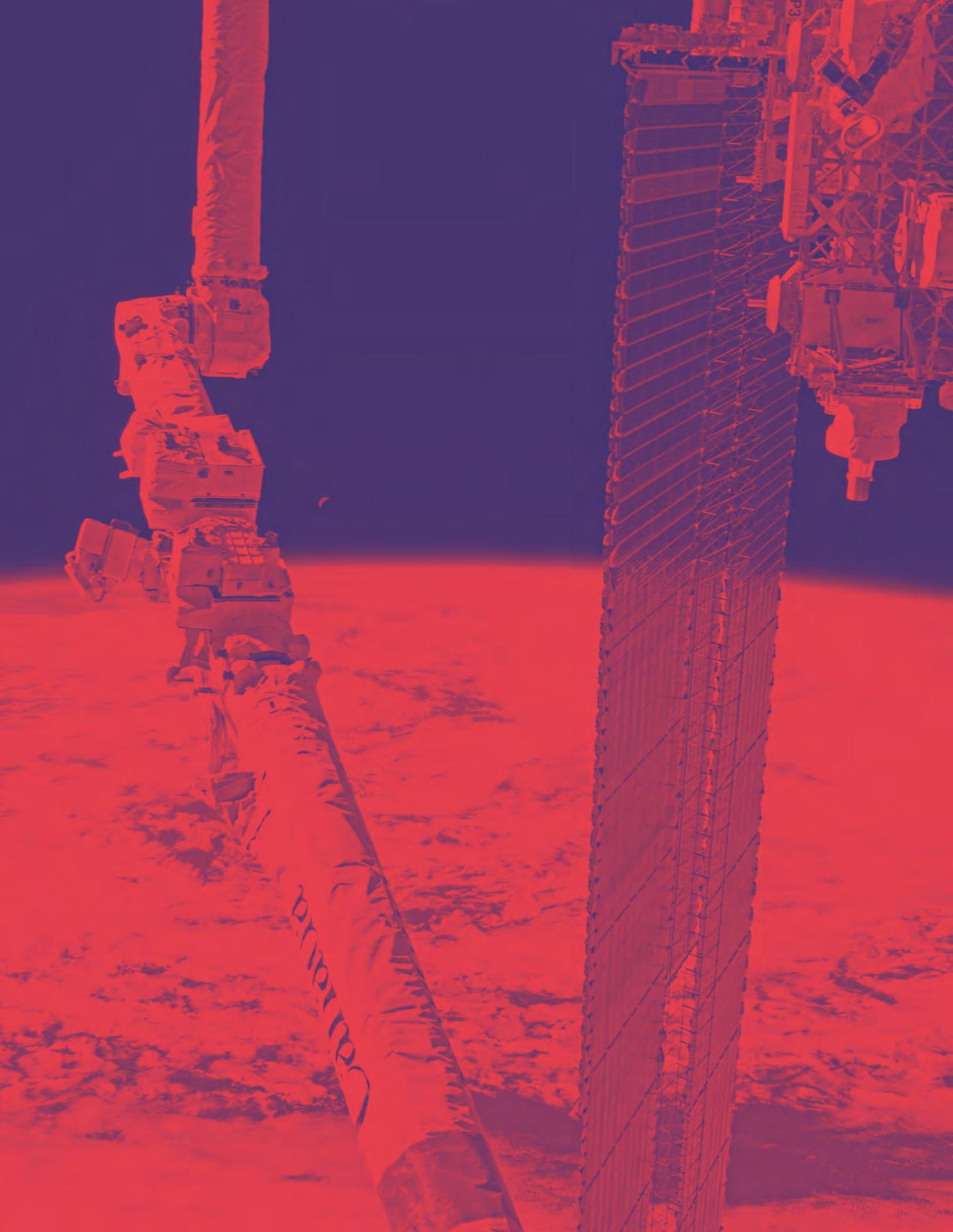
PLANETARY PROTECTION AND THE COMMITTEE ON SPACE RESEARCH

In 2020, UNOOSA continued working with the Committee on Space Research (COSPAR) Panel on Planetary Protection, in particular holding the role of Vice-Chair of the Panel. During the year, UNOOSA supported two meetings of the Panel on Planetary Protection, held virtually due to the COVID-19 pandemic; supported an update of the COSPAR Planetary Protection Policy document; prepared for the forty-third COSPAR Scientific Assembly; and undertook various outreach activities, such as articles to raise awareness of planetary protection and the related work of COSPAR.

UN-SPACE

UN-Space is the United Nations interagency coordination mechanism on space-related activities. The General Assembly urged UN-Space, under the leadership of UNOOSA, to continue to examine how space science and technology and their applications could contribute to the 2030 Agenda for Sustainable Development, and encouraged entities of the United Nations system to participate in UN-Space coordination efforts.

In 2020, UN-Space produced [a report of the Secretary-General on coordination of space-related activities within the United Nations system](#). The report examined directions and anticipated results for the period 2020–21 through the lens of the realization of the SDGs and a number of megatrends, namely, demographic changes; urbanization; climate change; conflicts and protracted crises; and frontier technologies. Eleven United Nations entities collaborated on the report with UNOOSA.





The Earth seen from
the International
Space Station.
Credit: ESA

UNOOSA maintains the United Nations Register of Objects Launched into Outer Space, an important transparency and confidence-building mechanism to increase trust among countries in outer space activities, particularly in light of the rapidly increasing number of launches globally. In 2020, 1,294 functional and non-functional objects were registered with the Secretary-General.

9

SPACE OBJECTS REGISTRATION

9 | SPACE OBJECTS REGISTRATION

As humanity stands on the cusp of a new era of activities in Earth orbit and beyond, the need for the proper identification of space objects and of the States that bear international responsibility for them continues to be increasingly important for safe and sustainable space operations. Since 1961, the Office has maintained, on behalf of the Secretary-General, a Register of Objects Launched into Outer Space, based on information provided by Governments either voluntarily under General Assembly resolution 1721B (XVI) or as a treaty obligation under the 1975 Convention on Registration of Objects Launched into Outer Space.

In 2020, 26 States and one international intergovernmental

organization registered a record-breaking 1,260 satellites and other functional objects, launched in 2020 or earlier. In addition to registrations of mega-constellation satellites and Martian probes by established space nations, new space nations such as Ethiopia, Guatemala and Monaco submitted registration information for the first time. With the addition of 34 rocket-stages and other non-functional objects, in total nearly 1,294 space objects were registered in 2020 – over three times the number in 2019. At the time this report went to print, an additional 422 objects launched during 2020 or prior were also registered.



H-IIA launch vehicle with United Arab Emirates Mars probe "HOPE" on board.
Credit: JAXA

State of registry	Functional	Non- functional	Re-entry	Change	Total
Belgium	3	0	1	0	
Brazil	10	0	0	0	
Canada	3	0	0	0	
China	76	0	0	0	
Czechia	1	0	0	0	
Egypt	1	0	0	0	
Ethiopia	1	0	0	0	
Finland	2	0	0	0	
France	6	10	4	2	
Germany	0	0	0	5	
Guatemala	1	0	0	0	
Hungary	2	0	0	0	
India	5	4	0	0	
Lithuania	1	0	0	0	
Luxembourg	12	0	0	8	
Malaysia	1	0	0	1	
Mexico	1	0	0	0	
Monaco	1	0	0	0	
New Zealand	3	6	4	0	
Poland	1	0	0	0	
Republic of Korea	1	0	0	0	
Russian Federation	16	0	7	0	
Spain	16	0	1	0	
United Arab Emirates	1	0	0	1	
United Kingdom	68	0	0	2	
United States	1 024	14	115	0	
European Space Agency	3	0	0	0	
Functional registered	1 260				
Non-functional registered		34			
Satellite re-entry notifications			132		
Change in status (decommissioned, GSO position, etc.)				19	
Total objects registered in 2020					1 294



In addition to being registered, prelaunch notifications on nuclear-powered space missions such as the Mars 2020 Perseverance rover (above) are provided to the Secretary-General under international space law.
Credit: NASA



An image of the Hubble Space Telescope.
Credit: NASA

Safety assessment notifications

In addition to satellite registration, under the Principles Relevant to the Use of Nuclear Power Sources in Outer Space adopted by the General Assembly in 1992, States inform the Secretary-General of safety assessments carried out prior to the launch of nuclear-powered space missions. During the space exploration era, China, the Russian Federation and the United States have provided such notifications for missions to the Moon, Mars and beyond. In 2020, the United States notified the Secretary-General of such an assessment carried out for the Mars 2020 Perseverance mission and subsequently registered the space object shortly after its launch.

Technical advisory services on space object registration

As part of the responsibilities in discharging the obligations of the Secretary-General under international space law, UNOOSA provides technical advisory services on space object registration-related matters to States and international organizations. In 2020, services were provided to 20 governmental entities and other institutions.

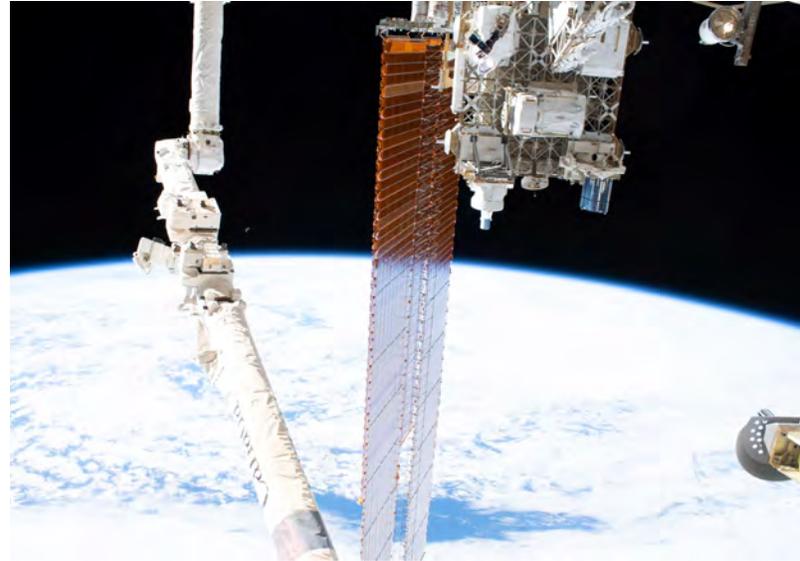


Image taken during the third spacewalk to service the cosmic ray hunting Alpha Magnetic Spectrometer AMS-02.
Credit: ESA



Cube satellites released from the International Space Station.
Credit: JAXA/NASA





A view of Lake Balaton,
Hungary, from space.
Credit: ESA

This chapter provides an overview of the UNOOSA budget, expenditure, voluntary contributions and staff numbers in 2020.

10

UNOOSA IN NUMBERS

10 | UNOOSA IN NUMBERS

This section presents data on UNOOSA's financial and human resources covering the period through 31 December 2020. The Office acknowledges and wishes to express its gratitude to all its Member States that continuously support its activities, whether through an in-kind or a cash contribution. Since January 2021, and at the time of finalizing this report, the Office received additional cash contributions from the following donors:

Government of Austria, Government of Luxembourg, European Space Agency (ESA), Japan Aerospace Exploration Agency (JAXA), United Kingdom Space Agency (UKSA) and Prince Sultan bin Abdulaziz International Prize for Water (PSIPW). The data relating to those and other contributions will be reflected in the Annual Report 2021.

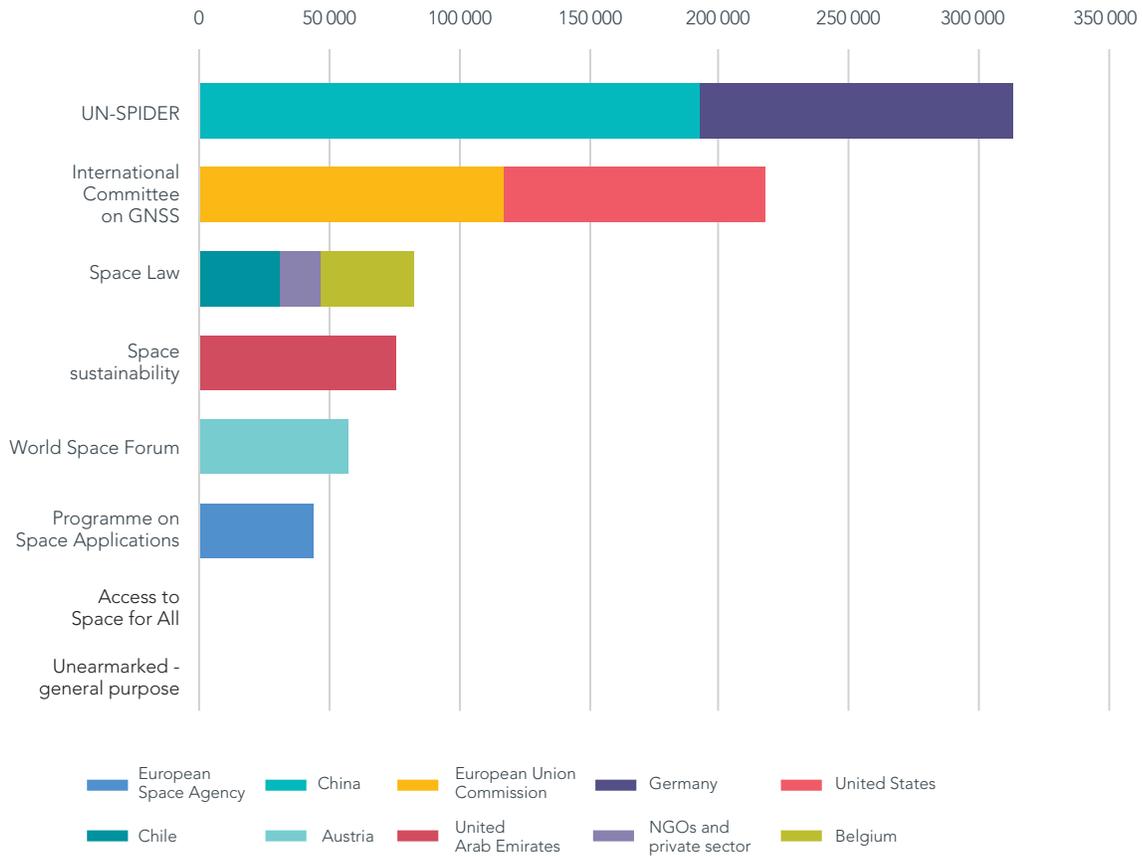
Budget overview



Expenditure



Voluntary cash contributions (does not include in-kind contributions)



Staff overview



LIST OF ABBREVIATIONS AND ACRONYMS

CMSA	China Manned Space Agency
CNSA	China National Space Administration
COPUOS	Committee on the Peaceful Uses of Outer Space
COSPAR	Committee on Space Research
CSS	China Space Station
CSSTEAP	Centre for Space Science and Technology Education in Asia and the Pacific (India)
DLR	German Aerospace Centre
DropTES	Drop Tower Experiment Series
ESA	European Space Agency
ESTEC	European Space Research and Technology Centre
GNSS	Global Navigation Satellite System
IAU	International Astronomical Union
IAWN	International Asteroid Warning Network
ICG	International Committee on Global Navigation Satellite Systems
ICTP	Abdus Salam International Centre for Theoretical Physics
ISS	International Space Station
JAXA	Japanese Aerospace and Exploration Agency
Kyutech	Kyushu Institute of Technology (Japan)
LDC	Large Diameter Centrifuge (of ESTEC)

LSC	Legal Subcommittee (of COPUOS)
LTS Guidelines	Guidelines for the Long-term Sustainability of Outer Space Activities
MOOC	Massive Open Online Course
NASA	National Aeronautics and Space Administration (United States of America)
NEO	Near-Earth object
PNST	Fellowship Programme on Nanosatellite Technologies
PSIPW	Prince Sultan bin Abdulaziz International Prize for Water
RCSSTEAP	Regional Centre for Space Science Technology Education in Asia and the Pacific (China)
RSOs	Regional support offices (of UN-SPIDER)
SDGs	Sustainable Development Goals
SMPAG	Space Mission Planning Advisory Group
STEM	Science, Technology, Engineering and Mathematics
STSC	Scientific and Technical Subcommittee (of COPUOS)
UNDRR	United Nations Office for Disaster Risk Reduction
UN-ECA	United Nations Economic Commission for Africa
UNIS	United Nations Information Service (in Vienna)
UN-SPIDER	United Nations Space-based Information for Disaster Management and Emergency Response
UVG	Universidad del Valle de Guatemala
WEF	World Economic Forum
WSF	World Space Forum

To access the electronic version of this Report, please go to

[www.unoosa.org/documents/pdf/annualreport/
UNOOSA_Annual_Report_2020.pdf](http://www.unoosa.org/documents/pdf/annualreport/UNOOSA_Annual_Report_2020.pdf)





SPACE4SDGS



**THE UNITED NATIONS OFFICE
FOR OUTER SPACE AFFAIRS (UNOOSA)**

IS RESPONSIBLE FOR ADVANCING INTERNATIONAL COOPERATION
IN THE PEACEFUL USES OF OUTER SPACE AND HELPS ALL COUNTRIES
USE SPACE SCIENCE AND TECHNOLOGY TO ACHIEVE
SUSTAINABLE DEVELOPMENT.



**BRINGING THE BENEFITS
OF SPACE TO HUMANKIND**

V.21-02518

WWW.UNOOSA.ORG