



General Assembly

Distr.: General
25 April 2023

Original: English

**Committee on the Peaceful
Uses of Outer Space**
Sixty-sixth session
Vienna, 31 May–9 June 2023

Coordination of space-related activities within the United Nations system: directions and anticipated results for the period 2022–2023 – capacity-building for an inclusive future

Report of the Secretary-General

I. Introduction

1. The Inter-Agency Meeting on Outer Space Activities (UN-Space) is aimed at promoting synergies and avoiding duplication of efforts related to the use of space technology and applications in the work of United Nations entities.
2. In its resolution 77/121, the General Assembly urged UN-Space 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, as appropriate, in UN-Space coordination efforts.
3. At its forty-first session, held in Bangkok in December 2022, UN-Space recognized the central importance of capacity-building mandates within the United Nations system and agreed that the next report of the Secretary-General, covering 2022 and 2023, should focus on capacity-building for an inclusive future.
4. The present report was compiled on the basis of submissions from the following entities: the Economic and Social Commission for Asia and the Pacific (ESCAP), the Food and Agriculture Organization (FAO), the International Atomic Energy Agency (IAEA), the International Civil Aviation Organization (ICAO), the International Telecommunication Union (ITU), the Office for Disarmament Affairs, the Office for Outer Space Affairs, the secretariat of the Convention on Biological Diversity, the United Nations Conference on Trade and Development (UNCTAD), the United Nations Development Programme (UNDP), the United Nations Institute for Disarmament Research (UNIDIR), the United Nations Satellite Centre (UNOSAT) of the United Nations Institute for Training and Research, and the United Nations Office on Drugs and Crime (UNODC). Each entity was asked to share information on its space-related capacity-building work, including, where relevant, its experience in capacity-building for historically marginalized or underserved groups, information on targeted efforts to include such groups in broader capacity-building work and the results of capacity-building efforts that have benefited or are aimed at benefiting such groups.



II. Capacity-building for an inclusive future

5. Sustainable space-based solutions are key to ensuring sustainable development on Earth. Space technologies and their applications provide, inter alia, essential tools for evidence-based decision-making.

6. The rapidly growing importance of space-related activities – in many sectors, but notably in industry and the private sector – means that the potential for a space divide is also increasing. The objective of space-related capacity-building activities carried out by the United Nations system is to provide everyone, everywhere, with equitable access to the benefits of the exploration and use of space, leaving no one behind.

7. Capacity-building events, initiatives, tools and programmes contribute to the fulfilment of that objective, serving to educate, enable and empower. They are found in numerous forms, ranging from traditional classroom-style educational courses to policy guidance that may tackle systemic biases. They may cover scientific, technical, legal, policy or other areas and may include the exchange of experience, expertise, scientific knowledge, technology and/or equipment.

8. Many of the efforts undertaken within the United Nations system make use of interdisciplinary approaches and leverage partnerships and innovative ways of developing opportunities. The examples that follow demonstrate the range of United Nations capacity-building activities relating to outer space.

A. Access to space

9. The Access to Space for All initiative, implemented by the Office for Outer Space Affairs in collaboration with space agencies, research institutions and industry, is aimed at developing technical know-how, engineering expertise, and infrastructure in order to support capacity-building for Member States. The initiative provides opportunities to access space through gradual learning steps and hands-on opportunities.

10. Within that framework, the KiboCUBE programme of the Office and the Japan Aerospace Exploration Agency enables the deployment of cube satellites from the International Space Station. The first-ever satellite of the Republic of Moldova was launched through the programme in 2022, while Surya University of Indonesia launched its own satellite in January 2023. Three more satellites are currently being developed by teams from the Central American Integration System, the Universidad Popular Autónoma del Estado de Puebla of Mexico and the Private Higher School of Engineering and Applied Technology of Tunisia.

11. The China Manned Space Agency launched all the modules of the China Space Station in 2022. In collaboration with the Office, seven teams are developing a range of experiments to be carried out – some as early as 2023 – aboard the Station.

12. Through a partnership between the Office and Airbus Defence and Space, a team of specialists from Egypt, Kenya and Uganda was awarded an opportunity to place a payload on the International Space Station. The objective of the team's ClimCam project is to install a remote sensing camera for monitoring climate change aboard the Station, with a focus on East Africa.

13. The Bremen Drop Tower allows scientists and researchers to conduct experiments under the longest-lasting microgravity conditions achievable on Earth. Through the Drop Tower Experiment Series, a fellowship programme implemented by the Office in collaboration with the Center of Applied Space Technology and Microgravity at the University of Bremen and the German Aerospace Center (DLR), a team from the Universidad Católica Boliviana San Pablo of the Plurinational State of Bolivia had the opportunity to conduct an experiment in 2022 and a new team has recently been selected for 2023.

14. The Office and the European Space Agency (ESA) are implementing HyperGES, an opportunity to conduct hypergravity experiments at the ESA Large Diameter Centrifuge facility. The first awardee, a team from Thailand, is developing its experiment, which will be tested in 2023. Further experiments will be selected during a second round of applications, also in 2023.

15. Through the ISONscope cooperation programme, the Office and the Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences selected two awardees, from Kenya and Nigeria, to receive telescopes in order to strengthen technical and scientific education in those countries.

16. The Office and the Government of Japan, in cooperation with the Kyushu Institute of Technology, offer fellowships on nanosatellite development. In 2022, students from Egypt, Mexico, Mongolia, South Africa, Thailand and Türkiye benefited from the programme.

17. The Office is also developing a space solutions compendium as a tool for linking stakeholders that have specific needs with providers of appropriate space-based solutions. Space agencies can contribute to the compendium by proposing solutions, which will be mapped to the Sustainable Development Goals framework (comprising goals, targets and indicators) in order to help to measure impact.

18. The Office continues to organize regular technical capacity-building workshops and symposiums. For instance, the twenty-eighth United Nations/Austria Symposium, held in September 2022, addressed space for climate action. Symposium participants were given free-of-charge access to online technical training and data sets through partnerships with ESA, the Indian Space Research Organization (ISRO), the National Aeronautics and Space Administration (NASA) of the United States of America, the Earth Observation Data Centre and the European Centre for Medium-Range Weather Forecasts.

19. Additionally, the annual United Nations/International Astronautical Federation Workshop on Space Technology for Socioeconomic Benefits provides a forum for the discussion of international cooperation, capacity-building and awareness-raising with respect to the socioeconomic benefits of the use of outer space. In 2022, the Workshop was co-organized by the Office in conjunction with the seventy-third International Astronautical Congress, held in Paris, the theme of which was “Access to Space for All: bridging the space divide”.

20. In 2022 and 2023, IAEA conducted a series of webinars on nuclear technology and its potential applications in space exploration. The webinars emphasized the current research and development status of nuclear systems for space exploration, as well as the transformative potential of fusion and plasma systems in enabling various space missions. They focused primarily on nuclear power, nuclear propulsion and surface power systems for extended exploration missions, including possible missions involving human presence on other planetary bodies, and the development of fusion rockets, fusion and plasma propulsion systems, and plasma devices for the in situ utilization of resources – such as those needed for life support and agriculture, and fuels – on Mars. The webinars provided insights and updates on the latest advancements in nuclear and plasma technology, enhancing understanding of the potential applications of such technology in space exploration and travel.

21. In 2022 and 2023, ICAO continued its work on the implementation of ICAO Assembly resolution A40-26 relating to commercial space transport. That work included supporting ICAO member States in coordinating launch and re-entry operations with other airspace users and engaging with experts in addressing the risks that space debris poses to aviation.

Committee on the Peaceful Uses of Outer Space

22. The Committee on the Peaceful Uses of Outer Space, including its subcommittees and working groups, supported by the Office for Outer Space Affairs, remains the prime multilateral forum for international cooperation in the peaceful

uses of outer space. The steady increase in Committee membership (there are currently 102 member States) and the depth and breadth of the agenda items considered, and of the information shared, demonstrate that participation in the Committee's work can itself be viewed as a capacity-building endeavour.

Space for youth

23. In 2018, the United Nations Secretary-General launched Youth 2030: The United Nations Youth Strategy to recognize, inter alia, the positive contributions made by young people as agents of change.

24. The Space4Youth competition of the Office for Outer Space Affairs is aimed at giving young people the opportunity to have their voices heard and showcasing how they can contribute to the achievement of the Sustainable Development Goals through the use of space. In view of the midterm review of the International Decade for Action, "Water for Sustainable Development", 2018–2028 and the United Nations 2023 Water Conference,¹ the Office, in collaboration with the Space Generation Advisory Council, selected "Space as a tool to accelerate change in sustainable water resources management, hydrology and the protection of aquatic ecosystems" as the theme of the 2022 Space4Youth essay competition. With the support of the Permanent Mission of the United States of America to the International Organizations in Vienna, the authors of the best essays will have the opportunity to travel to that country to meet representatives of the space sector and attend an adult space camp at the United States Space and Rocket Center.

25. In March 2023, the Office for Disarmament Affairs, with the support of the Office for Outer Space Affairs, organized youth consultations on the outer space elements of the Summit of the Future, to be held in 2024.² The consultations included briefings for young people and a breakout session with participants representing the Office for Disarmament Affairs Youth4Disarmament initiative, who drew up a set of inputs as a contribution to the proposed outer space track of the Summit.

26. The organization of a regular forum enabling young people to showcase innovative space applications is now a permanent feature of the ESCAP programme for implementation of the Jakarta Ministerial Declaration on Space Applications for Sustainable Development in Asia and the Pacific.³

27. Additionally, from 2018 to 2022, ESCAP sponsored young professionals from 12 developing countries to study at the Centre for Space Science and Technology Education in Asia and the Pacific and the Association of Southeast Asian Nations (ASEAN) Research and Training Centre for Space Technology and Applications.

Space for women

28. Space4Women⁴ is an initiative of the Office for Outer Space Affairs aimed at raising awareness of the importance of gender equality and gender empowerment in the space sector; encouraging women and girls to pursue studies and careers relating to outer space and to science, technology, engineering and mathematics ("STEM subjects"); providing institutions and governments with policy guidance and knowledge management tools, sharing research and data and conducting evidence-based awareness-raising activities; facilitating capacity-building and training for individuals and institutions; and contributing to the achievement of Sustainable Development Goals 4 and 5.

29. A Space4Women expert meeting was held Daejeon, Republic of Korea, in August 2022. Experts from 30 countries discussed, among other things, education, entrepreneurship, statistics on the participation of women in the space workforce and the impact of gender empowerment activities. The next Space for Women meeting,

¹ <https://sdgs.un.org/conferences/water2023>.

² www.un.org/en/common-agenda/summit-of-the-future.

³ ESCAP/MCSASD/2022/3/Add.1 (available in Chinese, English, French and Russian).

⁴ <https://space4women.unoosa.org>.

jointly organized by the Office and the Government of Canada, will take place in Montreal, Canada, from 30 October to 3 November 2023.

30. The Office also runs the Space4Women mentorship programme, matching experienced mentors in the space sector with women and girls who would like to pursue studies or a career in space-related or STEM subjects. Mentors inspire and help other women in navigating the space industry. The Office is running the third edition of the mentorship programme in 2023, with the participation of mentors and mentees from 65 countries.

Space for persons with disabilities

31. In order to foster greater inclusion of persons with disabilities in space activities, the Office for Outer Space Affairs launched its Space for Persons with Disabilities project in 2021.

32. In November 2022, the Office held an online event on challenges and opportunities for sonification in space science research and how to improve outreach for blind and visually impaired persons. A set of related recommendations is to be published in 2023. In this connection, an art and science audio installation entitled “Sound of the Earth’s magnetic field”, organized by the Technical University of Denmark and co-funded by ESA, will be exhibited at the sixty-sixth session of the Committee on the Peaceful Uses of Outer Space and a story bank about persons with disabilities working in the space sector will be published by the Office.

33. Additionally, the Office has recently adapted three of its internship placements to suit the needs of interns with disabilities.

Radio frequency spectrum and associated orbits

34. One of the areas of focus for ITU is capacity-building in the use of the radio frequency spectrum and associated orbits. This involves developing the skills and knowledge of ITU member States and professionals in the sector to enable them to effectively use and manage space-based technologies and services.

35. The ITU Academy⁵ is the Union’s main e-learning platform, contributing to training in information and communications technology (ICT), knowledge dissemination and sustainable development for ITU members and stakeholders. Each year, it offers more than 150 training courses covering a large variety of ICT-related topics. The Academy aims to empower professionals with the knowledge and skills they need in order to take advantage of the rapid evolution of ICT. It is a platform for delivering training through face-to-face, online and blended learning methodologies and for addressing specific regional needs in the languages of the United Nations. It offers a wide range of general and specialized courses on all aspects of telecommunications and ICT, including spectrum management for satellite systems and filings for non-geostationary satellite systems. The programmes are suitable for a wide range of target audiences, such as policymakers, telecommunications and ICT business managers and practitioners, officials of relevant ministries and regulatory authorities, students, teachers and civil society. Since 2018, more than 23,000 participants have received training through the Academy.

36. The ITU Academy Training Centres programme⁶ was launched in 2023 as a successor to the Centres of Excellence programme, which had been in operation since 2001. It is the new ITU flagship programme to develop the capacity of ICT professionals around the globe. The centres, as internationally recognized training institutions offering training courses to personnel in public and private organizations, are considered core ITU delivery partners for the Union’s training activities. Fourteen centres were selected to begin operating in 2023, delivering training on a range of topics, including spectrum management and space technologies.

⁵ <https://academy.itu.int>.

⁶ <https://academy.itu.int/itu-d/projects-activities/itu-academy-training-centres>.

37. The ITU Radiocommunication Bureau organizes seminars on spectrum management for space services. The World Radiocommunication Seminar is held in Geneva, Switzerland, every two years, and annual regional seminars are held with the aim of equitably covering all ITU regions and, in particular, meeting the needs of developing countries, least developed countries, landlocked developing countries and small island developing States. The main objectives of the seminars are to provide support for spectrum management activities and to expand assistance in coordinating and registering radio frequency assignments and in applying the ITU Radio Regulations.

38. The ITU Space Plans for broadcasting-satellite and fixed-satellite services reserve part of the spectrum for future use. The Space Plans mechanism guarantees equitable access to the geostationary orbit for all ITU member States. The World Radiocommunication Conference 2019 (WRC-19) removed some orbital limitations on the geostationary arc under the Broadcasting-Satellite Service Plan. The special procedure provided for in resolution 559 of the Conference gave opportunity and priority access to 55 identified countries, mainly in the African region, to enable those countries to regain orbital capacity in those planned bands. The “administrations” in those countries, with the assistance of the ITU Radiocommunication Bureau, have since made every effort to ensure frequency coordination with other administrations identified as potentially affected. This has led 45 countries to request the revision of their respective broadcasting-satellite service plans. The implementation of the aforementioned resolution will be completed by the next World Radiocommunication Conference, which will begin in November 2023.

39. The ITU Radiocommunication Bureau also cooperates with the Office for Outer Space Affairs on the Access to Space for All initiative, providing expertise in training on the registration of satellite network filings in the ITU Master International Frequency Register.

B. Space for land and water resources

Food systems

40. The FAO Strategic Framework 2022–31 seeks to support the 2030 Agenda through the transformation to more efficient, inclusive, resilient and sustainable agrifood systems for better production, better nutrition, a better environment and a better life, leaving no one behind. Technical capacity-building in the geospatial domain is relevant to all strategic priorities. FAO, with its large network of country, subregional and regional offices worldwide, supports countries in monitoring natural resources and building sustainable and inclusive food systems in collaboration with various national entities and the public, private, research and academic sectors by generating knowledge, providing policy advice and implementing tailored projects, programmes and initiatives.

41. Through the Hand-in-Hand Initiative,⁷ in which 60 countries are currently participating, FAO uses advanced remote sensing-based mapping technology (such as light detection and ranging (LIDAR) technology) and geospatial modelling and analytics to accelerate the transformation of market-based agrifood systems in order to raise incomes and improve the well-being and resilience of poor and vulnerable populations. As part of the United Nations Decade on Ecosystem Restoration,⁸ FAO and the United Nations Environment Programme (UNEP) are promoting the use of geospatial technologies, science and traditional knowledge for ecosystem restoration as a two-way street whereby traditional knowledge contributes to solutions and those solutions contribute to improving conditions for Indigenous Peoples. FAO collaborates with the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in

⁷ www.fao.org/hand-in-hand/en.

⁸ www.decadeonrestoration.org.

Africa, on the Global Land Outlook report.⁹ It also supports the development of international standards,¹⁰ inter alia on land cover and land use, that support interoperability and consistency between its different programmes and initiatives.¹¹

42. FAO seeks to strengthen technical capacities, spatial data infrastructures and the production and use of data and information. Technical capacity development includes the provision of cost-free and open-source software (such as the System for Earth Observation Data Access, Processing and Analysis for Land Monitoring (SEPAL)¹²) and data for all (for example, through the FAO data catalogue). SEPAL offers users unparalleled access to satellite data and an easy-to-use interface powered by cloud-based supercomputers, supporting capacity-building initiatives for the use of geospatial data and the integration of data-driven land-use policies in countries. The production of data is documented and supported by specific training activities and internationally recognized standards, for instance on land cover, to suit the capacities and national specificities of the entities concerned. Technical capacity development builds on the latest technological developments while focusing on the sustainable use and adaptation of data and information.

43. For example, FAO is supporting the use of open-source software and data collection for the participatory management of ecosystem restoration in and around refugee camps in Cox's Bazar, Bangladesh.¹³ Jointly with the International Fund for Agricultural Development, FAO is running a global capacity development programme, GeoTech4Tenure, aimed at combining geospatial and information technologies with participatory and inclusive methodologies for securing land tenure rights, and at carrying out targeted development interventions for beneficiaries in Indigenous and customary communities, including women and youth, pastoralists; smallholder farmers and fisherfolk in rural areas and informal settlements.¹⁴

44. FAO has designed open-source software and a participatory data collection tool and methodology called Open Tenure. The tool is used in conjunction with satellite imagery, for example, for natural resource and land management by Indigenous communities in Guatemala; for the empowerment of women, young people and customary communities with respect to land rights in Sierra Leone; and for the documentation by fishing communities of fishery areas in Ghana.¹⁵ The use of geospatial technologies and satellite imagery supports the monitoring of land allocation and the identification of land suitable for the more sustainable management of land and water resources in the context of the humanitarian crisis in northern Mozambique. In Nepal, improved access to remote sensing information is being used to support organizations representing smallholders, rural women, forest communities and Indigenous Peoples through the FAO Forest and Farm Facility.¹⁶

Crop monitoring

45. UNCTAD is developing expertise through a technology transfer and training initiative that supports developing countries in acquiring Earth observation capabilities for monitoring their crop growth.

46. Crop monitoring through Earth observation holds immense potential for better food security planning and progress toward the relevant Sustainable Development Goals. In order to help developing countries that may not have access to the related tools, the Commission on Science and Technology for Development, a subsidiary body of the Economic and Social Council (ECOSOC), joined a partnership, through the UNCTAD secretariat, with the Aerospace Information Research Institute of the

⁹ www.unccd.int/resources/global-land-outlook/overview.

¹⁰ www.iso.org/committee/54904.html.

¹¹ www.fao.org/geospatial/en.

¹² <https://sepai.io>.

¹³ www.fao.org/documents/card/en/c/cc0518en.

¹⁴ www.ifad.org/en/web/knowledge/-/geotech4tenure.

¹⁵ www.fao.org/tenure/sola-suite/open-tenure/en.

¹⁶ www.fao.org/forest-farm-facility/en.

Chinese Academy of Sciences to help to bridge that technology gap. Funded by the Alliance of International Science Organizations, the CropWatch Innovative Cooperation Programme, a South-South cooperation project aligned with the theme of the twenty-third session of the Commission on Science and Technology for Development, “Exploring space technologies for sustainable development and the benefits of international research collaboration in this context”, was launched in 2021.

47. The CropWatch Innovative Cooperation Programme responds to the call by ECOSOC for increased South-South cooperation through technical assistance, capacity-building and technology transfer. Participating countries are given access to the necessary technology and provided with training in its use, including how to customize it to specific local requirements. The programme is aimed at enhancing developing countries’ early warning capacity with respect to food security through the use of the CropWatch Earth observation satellite system of China for crop monitoring, and enables crop monitoring at the national and subnational scale without additional investment in storage and computing facilities, thus facilitating better food security planning.

48. Thus far, Algeria, Mauritius, Nigeria, the Syrian Arab Republic and Thailand have been using the data generated by the CropWatch cloud platform to monitor their selected crops, and work to develop customized systems is ongoing. A related regional training workshop will be held in August 2023 in Mauritius.

Monitoring illicit activities

49. UNODC assists Member States in monitoring illicit activities such as illicit crop cultivation, illegal logging and illegal mining. Such monitoring relies heavily on remote sensing techniques and space-based technologies, to which end UNODC provides capacity-building support to relevant government agencies, enabling them to conduct monitoring activities and extract meaningful statistics for policymakers.

50. Since its creation in 1999, the UNODC Illicit Crop Monitoring Programme has built geospatial capacities in Member States through regular surveys, including in Afghanistan, the Plurinational State of Bolivia, Colombia, Ecuador, the Lao People’s Democratic Republic, Mexico, Morocco, Myanmar, Nigeria and Peru. In those countries, UNODC has established partnerships with government agencies and, in collaboration with universities and research institutes, has supported the development of methodologies and quality control in relation to the application of geospatial data and tools and to the use of sound statistical methods for preparing estimates of crop and drug production.

51. As an example, Indigenous communities in Colombia are heavily affected by drug trafficking and related crimes: there have been cases in which organized crime groups have taken control over Indigenous people’s territories and incited violence, including by killing Indigenous leaders, and illegal armed groups have recruited Indigenous children and adolescents to reinforce their ranks. Drug trafficking has affected local economies and livelihoods by stimulating illicit crop production and cocaine manufacture and by leading to increased drug use in communities. UNODC supports the Government of Colombia through joint research that sheds light on the situation regarding illicit drugs and related crimes and the impact of that situation on Indigenous communities. It works to enhance local governance by providing geospatial analysis of drug and crime issues for incorporation into local planning tools and supports the design of evidence-based solutions that strengthen minority rights in affected areas.

52. Additionally, UNODC has undertaken several mapping exercises with Indigenous communities in Colombia and Peru. High-resolution satellite images have been used to develop integrated planning in areas where coca cultivation and drug production have undermined security and caused social instability and environmental problems.

53. Moreover, UNODC is involved in the United Nations Development Account project through a workstream on building capacity for the monitoring of illicit mining. The project promotes the use of innovative data sources, advanced data acquisition methods and modern technologies to enhance the resilience and agility of national statistical systems in 50 beneficiary countries. Part of the project addresses the use of remote sensing technologies and geospatial analysis to monitor illegal mining. In cooperation with UNEP and regional United Nations entities, UNODC is organizing webinars that demonstrate the benefits of those technologies to the beneficiary countries and plans to assist in building up relevant national expertise.

Space for water

54. Recent Office for Outer Space Affairs initiatives on space for water include further development of the Space for Water portal¹⁷ and the holding of the Fifth International Conference on the Use of Space Technology for Water Management, organized in partnership with the Prince Sultan bin Abdulaziz International Prize for Water and hosted by Ghana. The Conference, held in May 2022 in Accra and online, included participants from 99 countries and focused on the ways in which Earth observation contributed to improving water resource management.

55. The Office hosted the first Space for Water stakeholder meeting in October 2022 and plans to arrange future stakeholder meetings on a biannual basis.

56. Also in October 2022, the Office held a workshop in Vienna for Indigenous women in order to learn directly from affected communities about changes in aquatic ecosystems and water-related challenges and to identify solutions that space applications can provide.

Geographic information systems

57. Owing to the increasing accessibility of satellite imagery and advanced analytics, the integration of geographic information systems and space technology has become a critical component of development strategies worldwide. The UNDP Geographic Information Systems Team works to address gaps in skills and capacity in its country offices and regional bureaux. Since the establishment of the Geographic Information Systems Team in 2016, over 100 countries have received support through a combination of ideation meetings, webinars and hands-on training. In 2022, the Team trained more than 200 UNDP personnel in geographic information systems and satellite imagery analytics through introductory to advanced training activities.

58. The UNDP office in Guatemala, for example, with the support of its accelerator laboratory, is currently working closely with the Ministry of Environment and Natural Resources to utilize data-driven methods to inform the design, implementation and monitoring of solid waste management policies for priority areas in the Motagua River basin and Guatemala City. As part of that effort, a workplan was defined with the specific objective of generating evidence-based information for local and central government authorities to facilitate decision-making aimed at promoting the adoption of environmental best practices. The Geographic Information Systems Team worked closely with the Guatemala office to build a strong foundation of knowledge, ensuring that the office was empowered through close mentorship and training materials. This type of close collaboration underpins such work, breaking down barriers to participation and fostering the development of robust, context-specific solutions to pressing environmental, social and economic challenges.

59. Every year, the Geographic Information Systems Team runs a series of workshops and webinars in all regional time zones. Those workshops and webinars bring together UNDP personnel working on a variety of projects, with various degrees of understanding of space technologies, and offer a chance to learn about software and tools relating to geographic information systems and to better understand how

¹⁷ www.space4water.org.

satellite data are collected from space. Such training events foster dialogue between country offices and help to generate new project ideas.

60. By drawing on the expertise of its members and partnering with other United Nations agencies, such as UNOSAT and the Office for Outer Space Affairs, the UNDP Geographic Information Systems Team strives, inter alia, to leverage partnerships and cross-sectoral synergies in order to maximize the impact of capacity-building efforts while continuing to expand its reach by targeting the specific needs of countries.

61. UNOSAT activities relating to geographic information systems are aimed at the fulfilment of a central vision: the promotion of evidence-based decision-making for peace and security, resilience and capacity development. The goal of UNOSAT is to make satellite solutions and geographic information easily accessible to the United Nations family and experts worldwide.¹⁸

C. Space for biological diversity

62. Parties to the Convention on Biological Diversity and the Protocols thereto, namely the Cartagena Protocol on Biosafety and the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, have identified capacity-building and development as a priority for the effective implementation of those instruments and for the Kunming-Montreal Global Biodiversity Framework. The secretariat of the Convention on Biological Diversity has therefore adopted a strategic, integrated and results-oriented approach to capacity development, in accordance with decision XIII/23 of the Conference of the Parties. Under this approach, it is recognized that the choice of tools and methodologies for delivering capacity development varies according to the needs and contexts of the target audience, and that the involvement of partner organizations and stakeholders is crucial to the success of any capacity development intervention.

63. The main role of the secretariat of the Convention on Biological Diversity is to coordinate and facilitate capacity-building support for parties with a view to the effective implementation of the Convention and its Protocols, in accordance with the relevant decisions of the Conference of the Parties, which serves also as the meeting of the parties to the Cartagena Protocol on Biosafety. Through the clearing-house mechanism of the Convention, the Biosafety Clearing-House and the Access and Benefit-sharing Clearing-House, the secretariat facilitates access to existing and additional guidance on capacity-building, including existing, new and innovative tools, methods and case studies on good practices and lessons learned that can assist parties, Indigenous peoples and local communities, women and youth organizations and other relevant stakeholders.

64. The secretariat plans to facilitate capacity development by, inter alia, working closely with universities and other academic institutions to develop academic courses and programmes and/or strengthen existing ones; institutionalizing capacity-building and development to ensure that related interventions are delivered as part of institutions' broader corporate strategic plans, ongoing human resources and organizational development, and knowledge management, organizational learning, mentorship and peer-to-peer support; developing dedicated national action plans; increasing focus on formal, non-formal and informal education at all levels, including adult education; applying the whole-of-government and whole-of-society approaches to national implementation proposed in the Kunming-Montreal Global Biodiversity Framework; and undertaking context-specific assessments and stocktaking processes.

65. Remote sensing data and capacity is considered key to accomplishing the above, particularly in the context of monitoring.

¹⁸ Related UNOSAT activities are elaborated upon in section D.

D. Space for resilience, safety and disaster risk reduction

66. Capacity-building is one of the core activities carried out by the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) programme in fulfilment of its mandate to ensure that all countries and international and regional organizations have access to, and develop the capacity to use, all types of space-based information to support the full disaster management cycle.

67. That work includes facilitating access to space-based data and services; providing policy-relevant advice to agencies and Governments; facilitating training on accessing and using such data; and facilitating access to infrastructure, hardware, software and services for space-based applications.

68. In 2022 and the first quarter of 2023, UN-SPIDER conducted technical advisory missions to Armenia, Paraguay and the Philippines; institutional strengthening missions to Ghana and Nigeria; and international, regional and national technical workshops and training events in Thailand, Nigeria, the Dominican Republic, Egypt and Germany. It also provided virtual support, online training, workshops and webinars, reaching participants from several countries in Africa, Asia and the Pacific, and Latin America and the Caribbean.

69. Recognizing knowledge management as a key component of capacity-building, UN-SPIDER compiles information from the disaster management and space communities on its knowledge portal,¹⁹ facilitating access to space-based information, data sources and information on practices relating to disaster management and emergency response. At the end of 2022, the portal contained 9,200 content items and was accessed by 42,000 users per month on average.

70. UNOSAT, through its humanitarian rapid-mapping service, has brought the power of satellite imagery analysis to various disaster management authorities since 2003. A team of experienced analysts, available around the clock to process requests, ensures timely and tailored delivery of analysis, reports and data derived from satellite imagery, ready for direct inclusion in evidence-based decision-making and operational planning. In order to help and prepare countries to perform damage assessments, UNOSAT uses its extensive data library to design, develop and deploy deep learning models applied to satellite imagery for humanitarian assistance and disaster response. UNOSAT benefits in this work from the International Charter on Space and Major Disasters.

71. The largest capacity development project of UNOSAT is “Strengthening capacities in the use of geospatial information for improved resilience in Asia and the Pacific and Africa”, which provides customized training for Bangladesh, Bhutan, Fiji, the Lao People’s Democratic Republic, Nigeria, Solomon Islands, Vanuatu and Uganda, offering training activities and tailored technical solutions for integrating Earth observation technologies in order to improve disaster risk management and climate resilience. Through technical backstopping activities and the development of a tailored application to support decision-making, the support of in-country experts will enable the target countries to leverage geospatial information technology for disaster risk reduction, climate resilience, environmental preservation and food security. In partnership with the Indian Ocean Rim Association, other technical training activities have been conducted to increase the reach of the technical knowledge of UNOSAT. For example, 75 individuals from 18 countries were trained through a distance learning course, and a follow-up in-person course was later organized for 34 participants.

72. UNOSAT offers learning opportunities through its advanced distance learning platform, including free online courses reaching participants in the most remote locations. The “Disaster risk monitoring using satellite imagery” course, which focuses on global public-sector climate action, trains beneficiaries on how to build a

¹⁹ www.un-spider.org.

model to automate the detection of flood events. Additional related courses are currently being planned. A further example is the geographic information technology course, “Earth observation for sustainable development”, which was launched to reach and train national and local experts of fragile and conflict-affected States. The course was made available in three languages: English (1,363 participants), French (109 participants) and Arabic (55 participants).

73. In 2018, ESCAP adopted the Asia-Pacific Plan of Action on Space Applications for Sustainable Development, which is fully aligned with the region’s road map for implementing the 2030 Agenda. Since the demand for knowledge-sharing, technical support and training remains consistently high as member countries seek to accelerate the implementation of the Plan of Action,²⁰ the ESCAP secretariat continues to respond to capacity-building demand through such initiatives as the ESCAP Regional Cooperative Mechanism for Drought Monitoring and Early Warning, training programmes supported by the regional centres for space science and technology education, affiliated to the United Nations, and training offered by ESCAP member States.

74. The ESCAP secretariat has also responded to emerging capacity development demand, notably with respect to capacity to leverage the power of innovative digital applications for the purpose of improving the processing, delivery and utilization of geospatial information.

75. Since 2022, ESCAP has been working to enhance the capacity of flood mapping experts from national space agencies, disaster management agencies and academia in India, Kiribati, Pakistan, Sri Lanka and Thailand to use digital technology and geospatial information systems to map flood-related disaster hotspots. Experts from those countries have received assistance in developing flood hotspot and risk maps using open-source and easy-to-use models that draw on digital technologies, such as artificial intelligence, big Earth data and cloud computing. In 2023, ESCAP is continuing to provide support in validating relevant tools and further improving them by integrating socioeconomic data, land cover, building footprints and machine learning algorithms in order to perform spatial probabilistic flood risk assessment modelling and mapping.

76. The accuracy of geospatial information and the extent to which analysis of such information contributes to the achievement of the Sustainable Development Goals can be further increased by improving the temporal and spatial resolution of satellite observations. Eight ESCAP member countries are participating in a project, coordinated by the secretariat, that is aimed at building the capacity of those countries to process and develop digital applications that integrate ground-based and satellite data generated by the Geostationary Environment Monitoring Spectrometer (GEMS) in order to improve operational air pollution monitoring. The data generated by GEMS allows diurnal observations of trace gases and aerosols over the Asia-Pacific region and demonstrates the value of decreasing temporal gaps and increasing spatial coverage to better understand air pollution in the region.

77. In 2022, in collaboration with the United Nations University Institute for Water, Environment and Health, ESCAP launched two online courses, open for broad participation, on using active and passive remote sensing for mapping floods and droughts.²¹ As at March 2023, more than 1,600 participants from 30 countries had enrolled in the courses, including more than 400 female participants. The courses focused on introducing the participants to the Google Earth Engine Code Editor platform and on the implementation of artificial intelligence-based algorithms for surface water detection, drought detection and monitoring.

²⁰ www.unescap.org/sites/default/d8files/2022-10/Sustainable%20Development%20Compendium_Executive%20Summary_FINAL%20251022.pdf.

²¹ https://wlc.unu.edu/courses/course-v1:UNU-INWEH+INWEH-16+2023_T1/about and https://wlc.unu.edu/courses/course-v1:UNU-INWEH+INWEH-17+2023_T1/about.

78. UNCTAD is cooperating with the Atlantic International Research Centre, with seed funding from Portugal, in running a technical assistance programme aimed at enabling two developing countries to use geospatial data to build disaster resilience and improve water quality management capabilities in urban areas. The programme is aligned with the outcome of the twenty-fifth annual meeting of the Commission on Science and Technology for Development, which highlighted the important role of satellite technology in achieving sustainable urban development.

79. The Atlantic International Research Centre plans to install and upgrade data gathering facilities and strengthen related capabilities, train national operational staff to gather and analyse data, and conduct advisory missions for policymakers and national experts. It is expected that following the planned training, the participating countries will be able to generate and share knowledge, data and information that meets critical disaster resilience and water quality needs.

Nuclear technology and safety

80. IAEA continues to support the work of the Working Group on the Use of Nuclear Power Sources in Outer Space of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space to facilitate the implementation of the Safety Framework for Nuclear Power Source Applications in Outer Space.²² The Agency is ready to support future activities relating to the consideration of potential future uses of nuclear power sources in outer space, particularly those involving nuclear reactors, including the safety implications of such uses, given that the implementation of the Safety Framework through national frameworks contributes to capacity-building by enabling the safe use of nuclear power sources in outer space.

81. IAEA also has an active programme on preparedness for and response to nuclear and radiological emergencies. The Agency maintains the international emergency preparedness and response framework, which facilitates the development and maintenance of national capabilities and arrangements for preparedness and response to nuclear and radiological emergencies and is based on international legal instruments. In that context, IAEA provides secretariat services to the Inter-Agency Committee on Radiological and Nuclear Emergencies, which maintains the Joint Radiation Emergency Management Plan of the International Organizations. The Plan establishes a mechanism for coordination and clarifies the roles and capabilities of the participating international organizations.

82. All IAEA safety standards relating to emergency preparedness and response, such as GSR Part 7, GS-G-2.1 (under revision), GSG-2 (under revision), GSG-11 and GSG-14, are general and applicable to any type of nuclear and radiological emergency, including an emergency occurring during re-entry of a nuclear-powered satellite. In order to support States in the implementation of IAEA safety requirements and recommendations, the Agency has developed technical guidance relating to the various areas of emergency preparedness and response. The Manual for First Responders to a Radiological Emergency,²³ for instance, provides guidance for those who would be called upon to respond to any radiological emergency during the first few hours following the emergency, and for officials supporting that initial response, and applies also to responses to emergencies associated with space object re-entry involving a radiological hazard. The publication *Considerations in the Development of a Protection Strategy for a Nuclear or Radiological Emergency*²⁴ provides examples of protection strategies for a range of potential emergency scenarios. The proposed protection strategy is applicable to the re-entry of satellites that use nuclear power sources and can be used to help to define and develop national-level arrangements for operations in emergencies. Both publications are accompanied by

²² <https://nuke.fas.org/space/iaea-space.pdf>.

²³ www.iaea.org/publications/7606/manual-for-first-responders-to-a-radiological-emergency.

²⁴ www.iaea.org/publications/14801/considerations-in-the-development-of-a-protection-strategy-for-a-nuclear-or-radiological-emergency.

appropriate training materials, and related training activities are conducted on a regular basis at the national and regional levels.

83. Furthermore, the International Project on Innovative Nuclear Reactors and Fuel Cycles examines the long-term sustainability of nuclear energy systems, focusing on six areas, including safety. The IAEA publication *INPRO Methodology for Sustainability Assessment of Nuclear Energy Systems: Safety of Nuclear Reactors*²⁵ guides assessors through the assessment process, and the Project offers additional support in the performance of assessments.

E. Space law and policy

84. Recognizing the need for developments in law and policy to keep pace with rapid scientific and technical advances, and in response to the growing number of requests for legal advisory services, the Office for Outer Space Affairs established the Space Law for New Space Actors project in 2019 to help Member States enhance their capacity to develop national legislation in line with international space law.

85. In 2022, the Office conducted six technical advisory missions as part of the project, including regional missions to Asia and the Pacific and Africa, and tailor-made events for the national authorities of Malaysia, the Philippines, Rwanda and Thailand.

86. In December 2022, the Office held an in-person technical advisory mission in Vienna for 15 African countries. As a next step, the Office plans to conduct in-country missions to those African countries requesting support.

87. Also in 2022, the Office conducted a series of space law and policy lectures for students enrolled on the Space Engineering International Course at the Kyushu Institute of Technology.

88. In 2023, the Office launched the Accessing Space Treaty Resources Online (ASTRO) tool,²⁶ a collection of international and national legal and policy instruments related to space activities.

89. The Space Law for New Space Actors project continues to be implemented and is supported by the Governments of Belgium, Chile, France, Japan and Luxembourg and by the Asia-Pacific Space Cooperation Organization, the Kyushu Institute of Technology and the Secure World Foundation.

90. The adoption, in 2019, of the Guidelines for the Long-term Sustainability of Outer Space Activities (A/74/20, annex II) was a landmark achievement of the Committee on the Peaceful Uses of Outer Space in the area of policymaking. The Office for Outer Space Affairs is currently implementing a project, with funding support provided by the United Kingdom, that raises awareness and builds capacity in relation to the implementation of the Guidelines.²⁷ In 2022, the Office published a related stakeholder study report that highlights key elements based on 42 interviews held with States and international intergovernmental organizations, during which interviewees were asked about their experiences in implementing the Guidelines.

91. The work of the project is continuing in 2023 and includes a virtual event series and the development of an open-source e-learning tool on the Guidelines.

Registration of space objects

92. The Office for Outer Space Affairs also maintains the Register of Objects Launched into Outer Space on behalf of the Secretary-General.²⁸ In that context, the

²⁵ www.iaea.org/publications/12298/inpro-methodology-for-sustainability-assessment-of-nuclear-energy-systems-safety-of-nuclear-reactors.

²⁶ <https://astro.unoosa.org>.

²⁷ <https://spacesustainability.unoosa.org>.

²⁸ www.unoosa.org/oosa/en/spaceobjectregister/index.html.

Office has undertaken the multi-year development of an online portal that will, inter alia, allow States of registry to directly submit registration information, facilitate and improve transparency in the revision of submissions and provide a registration dashboard for each State of registry.

93. In 2022, the Office also began “The Registration Project: supporting implementation of treaty obligations related to the registration of objects launched into outer space”, with funding provided by the United Kingdom. The aim of the project is to enhance expertise on the registration of space objects at the national level and in the Register maintained by the United Nations. The project’s first phase consists of an interview series, a stakeholder study and an event for experts.

F. Space security, disarmament and law enforcement

94. The Office for Disarmament Affairs has undertaken various activities directed at building the capacity of delegates to participate in the outer space-related workstreams within the United Nations disarmament bodies and at engaging with commercial actors and civil society.

95. For instance, the open-ended working group on reducing space threats through norms, rules and principles of responsible behaviours held its first and second sessions in Geneva, Switzerland, in May and September 2022, respectively, with secretariat services provided by that Office. Those sessions featured informal panels with experts representing commercial actors, civil society, UNIDIR and the International Committee of the Red Cross.

96. In November 2022 in Seoul, the Ministry of Foreign Affairs of the Republic of Korea and the Office for Disarmament Affairs, through its Regional Centre for Peace and Disarmament in Asia and the Pacific, convened the twenty-first Republic of Korea-United Nations Joint Conference on Disarmament and Non-Proliferation Issues. The Conference addressed the theme “Assessing the future disarmament landscape: space security and missile development” and sought to include, in particular, participants from States in South-East Asia.

97. In January 2023, UNIDIR and the Office for Disarmament Affairs co-organized a virtual intersessional consultative meeting between interested representatives of commercial actors and civil society and the Chair of the open-ended working group on reducing space threats through norms, rules and principles of responsible behaviours, in accordance with paragraph 6 of General Assembly resolution 76/231.

98. Also, in March 2023, the Office for Disarmament Affairs and UNIDIR co-organized a half-day space security workshop designed to serve as a policy primer for delegates participating in the 2023 substantive session of the Disarmament Commission. The workshop was aimed at providing useful background information on trends and developments in space security as the Commission prepared for the final year in which it would consider the item “Preparation of recommendations to promote the practical implementation of transparency and confidence-building measures in outer space activities with the goal of preventing an arms race in outer space, in accordance with the recommendations set out in the report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities.”

99. The UNIDIR Space Security Programme facilitates informed policymaking, fosters collaborative governance and common understanding and provides thought leadership on issues related to space security.

100. The Institute’s space security regional event series promotes research findings and stimulates thinking on current issues, including the work of the open-ended working group on reducing space threats through norms, rules and principles of responsible behaviours. The event series raises awareness of issues relating to space security at the regional level, gathers regional perspectives on space security and sharing those perspectives with the international diplomatic community through the

dissemination of reports. To date, UNIDIR has conducted three such regional events: an online webinar held in May 2022 for countries of the ASEAN region,²⁹ a hybrid event held in Santiago in August 2022 for the Latin American region and a hybrid event held in Nairobi in March 2023 for countries of the African region.³⁰ UNIDIR also held a briefing for Pacific island countries on space security matters in March 2023 and will continue to coordinate such regional events.

101. The UNIDIR annual flagship Outer Space Security Conference brings together a wide range of space stakeholders to discuss challenges to and opportunities for the secure and sustainable use of outer space.³¹ In 2023, the Conference will serve as a transitional platform for sustaining space security dialogue between the open-ended working group on reducing space threats through norms, rules and principles of responsible behaviours and the recently established Group of Governmental Experts on Further Practical Measures for the Prevention of an Arms Race in Outer Space.

102. UNIDIR works as a nexus between non-governmental entities – such as the commercial industry, civil society and academia – and government representatives by coordinating shared spaces in which they can exchange ideas on governance development.³² It also supports multilateral space security processes by providing expertise and substantive context on the topic³³ and publishing reports designed to assist policymakers.³⁴

103. The UNIDIR Space Security Lexicon, currently under development, will serve as a global reference point for terminological issues related to space security and will highlight, where necessary, how stakeholders may interpret key concepts in differing ways. The Institute's Space Security Portal, also under development, will be an interactive online platform designed for policymakers and scholars, offering information on international and national space policies, strategies, doctrines and other measures. It will support voluntary information contributions to promote transparency, and further information gathered by UNIDIR will be made available with a view to providing comprehensive national profiles of all Member States.

Law enforcement

104. The Global Maritime Crime Programme of UNODC supports maritime law enforcement agencies in detecting illicit activities at sea. The use of transponder information such as automatic identification system or vessel monitoring system data is insufficient, as most vessels engaged in illicit activity have their transponders switched off. Satellite technology has progressed to detecting radio frequency spectrum emissions in order to locate vessels at sea. Through the Programme, UNODC has facilitated the provision of pro bono synthetic aperture radar imagery to national law enforcement agencies to detect vessels of interest, in support of counter-narcotics operations at sea. It has also cooperated with the European Maritime Safety Agency and the Copernicus programme of the European Union in the use of satellite imagery to support maritime operations aimed at countering crimes in the fisheries sector.

105. UNODC has also partnered with Skylight, the online platform of the Allen Institute for Artificial Intelligence for monitoring vessel activities that may be non-compliant with fishery-related and other maritime regulations. Since 2020,

²⁹ <https://doi.org/10.37559/WMD/22/Space02>.

³⁰ <https://unidir.org/events/african-perspectives-advancing-space-security-through-norms-rules-and-principles-responsible>.

³¹ <https://doi.org/10.37559/WMD/23/Space/01>.

³² www.unidir.org/publication/commercial-actors-and-civil-society-consultation-report-how-can-non-governmental.

³³ <https://documents-dds-ny.un.org/doc/UNDOC/GEN/G22/248/57/PDF/G2224857.pdf?OpenElement>; <https://documents.unoda.org/wp-content/uploads/2022/09/Azcarate-Ortega-Almudena-OEWG-dual-use-presentation-FINAL.pdf>; and <https://documents.unoda.org/wp-content/uploads/2022/05/20220512-OEWG-Law-of-the-Sea-Space-Law-script.pdf>.

³⁴ <https://doi.org/10.37559/WMD/22/Space/01>.

UNODC has enhanced the capacity of law enforcement agencies in over 40 countries worldwide to detect and combat maritime crimes by facilitating access to Skylight and providing training tailored to each agency's mandate and to specific threats. More than 300 participants have been trained in person on how to use the tool, and hundreds more have been trained virtually.

106. Additionally, in 2022, UNODC conducted online training for prosecutors in the use of satellite imagery to monitor deforestation and illegal logging in Indonesia through the Law Enforcement Assistance Programme to Reduce Tropical Deforestation.

III. Opportunities for the future

107. Capacity-building is at the core of the work carried out by many United Nations entities, including those working on outer space or using space-derived data and related technology and tools to fulfil their mandates. As demonstrated above, numerous efforts are being made to reduce barriers and broaden access to the many benefits of outer space activities. Those efforts include e-learning tools, webinars, knowledge portals, open online courses, workshops, conferences, mentorship programmes, story banks, technical advisory missions and opportunities to conduct experiments and deploy cube satellites.

108. There is no one-size fits all solution for levelling the playing field. Ongoing dedicated efforts by United Nations entities address and tailor support to the specific situations of historically underserved and marginalized groups, including, but not limited to, women and girls, young people, persons with disabilities, Indigenous Peoples, refugees and internally displaced persons, rural populations and people living in informal settlements and conflict-affected areas, while also recognizing the intersectionality of lived experiences. Whether a tool or activity enables participatory management of ecosystem restoration, improves water quality management capabilities in urban areas or supports the development of national space law, the overall aim remains that everyone, everywhere should benefit equitably from developments in space science, technology, law and policy and their applications.

109. Looking ahead, there is a perceptible need to build even greater efficiencies into this work, leveraging both existing and new partnerships, optimizing information exchanges and developing additional creative solutions. Continued and improved collaboration between United Nations entities will add value to the populations they serve.