



**Committee on the Peaceful
Uses of Outer Space****Report on the Workshop on Space Technology for
Socioeconomic Benefits****(Bremen, Germany, 28–30 September 2018)****I. Introduction**

1. With the support of the Office for Outer Space Affairs of the Secretariat, the International Astronautical Federation (IAF) organized the Workshop on Space Technology for Socioeconomic Benefits. The Workshop was held in Bremen, Germany, from 28 to 30 September 2018, in conjunction with the sixty-ninth International Astronautical Congress, and hosted by the Centre of Applied Space Technology and Microgravity. The European Space Agency (ESA) and the German Aerospace Centre (DLR) also contributed to the organization of the Workshop.
2. The Workshop was the twenty-sixth in the series of workshops that IAF and the Office for Outer Space Affairs have jointly held since 1991, and which examine a different topic each year. The Workshop was dedicated to highlighting how space technology supports two of the three dimensions of sustainable development — namely, the social and economic dimensions.
3. In its resolution [70/224](#), the General Assembly recalled that the 2030 Agenda for Sustainable Development acknowledged that the implementation of sustainable development would depend on the active engagement of both the public and private sectors, and recognized that the active participation of the private sector could contribute to the achievement of sustainable development.
4. The 17 Sustainable Development Goals and 169 targets of the 2030 Agenda for Sustainable Development demonstrate the scale and ambition of the Agenda, which is supported by the three dimensions of sustainable development: social, economic and environmental.
5. At its sixtieth session, held in Vienna in June 2017, the Committee on the Peaceful Uses of Outer Space endorsed the position that the Office for Outer Space Affairs should pursue greater engagement with industry and private sector entities so that they supported and contributed to the overall work of the Office.
6. Considering that mandate, the topic of this year's Workshop on Space Technology for Socioeconomic Benefits was "Industry, innovation and infrastructure for development". The Workshop provided an opportunity to demonstrate some of the

* Reissued for technical reasons on 31 January 2019.



capabilities of industry and was aimed at building capacity in the use of space science, technology and their applications.

7. Participants presented a wide range of space activities supporting sustainable economic and social development, primarily in developing countries. All participants were encouraged to share their experiences and to examine opportunities for better cooperation. The discussions provided an opportunity for direct dialogue among space technology experts, policymakers and decision makers, and representatives of the academic community, as well as private industry from both developing and industrialized countries.

8. The present report contains a description of the background, objectives and programme of the Workshop and provides a summary of the observations and recommendations made by the participants. The report has been prepared for submission to the Committee on the Peaceful Uses of Outer Space at its sixty-second session and to the Scientific and Technical Subcommittee at its fifty-sixth session, both in 2019.

A. Background and objectives

9. Sustainable Development Goal 17 (Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development) of the 2030 Agenda is aimed at strengthening global partnerships to achieve the ambitious targets of the 2030 Agenda, bringing together national Governments, the international community, civil society, private sector and other actors. Goal 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation) addresses three important aspects of sustainable development: infrastructure, industrialization and innovation. Infrastructure provides the basic physical facilities essential to business and society; industrialization drives economic growth and job creation, thereby reducing income inequality; and innovation expands the technological capabilities of industrial sectors and leads to the development of new skills. Despite advances in certain areas, more needs to be done to accelerate progress. All stakeholders will have to refocus and intensify their efforts on areas where progress has been slow. Information about progress made in 2018 on the Goals is available at sustainabledevelopment.un.org.

10. Accordingly, the Workshop with a focus on Goals 9 and 17, promoted the development, transfer, dissemination and diffusion of space technologies, data and applications, and the use and development of space infrastructure by developing countries, through discussions on space science, technology and applications in support of economic, social and environmental development.

11. Special attention was devoted to the role of industries as key players to offer innovation and infrastructure needed for sustainable development. The Workshop also served as a discussion forum, which enabled the sharing of experiences of leaders in space industries as well as networking opportunities for decision makers in Governments and for representatives of start-ups and emerging space-related businesses in developing countries.

12. The main objectives of the Workshop were the following:

(a) Raise awareness on how space exploration and innovations can lead to new partnerships and help develop capabilities that create new opportunities to address global challenges;

(b) Examine space applications for developing countries and, in particular, for the region of Africa;

(c) Foster dialogue among representatives of the space industry and the public sector;

(d) Share experiences of space-related start-ups and emerging industries, especially those from developing countries;

(e) Discuss the role of the space industry for development and its contribution to the achievement of the Sustainable Development Goals, in particular Goals 9 and 17;

(f) Bring together decision makers and policymakers and the research and academic communities to help integrate space solutions into decision- and policymaking processes.

13. Because the role of private industry in providing access to space-based services is increasing, strengthening cooperation with the space industry would potentially increase the opportunities for developing countries to access space technologies and services. The Workshop provided inputs on potential areas for partnerships, considering the needs of developing countries, in particular by doing the following:

(a) Proposing actions to progress in the definition of pilot projects that could foster collaboration;

(b) Promoting collaboration in capacity-building at the regional and international levels;

(c) Exploring the role of the space industry in cooperation on the use of space for global health;

(d) Exploring the role of the space industry towards building resilient space technologies and applications.

B. Attendance

14. The selection of participants and preparation for the Workshop were carried out by the local organizers in cooperation with a programme committee composed of international experts. The participants were selected on the basis of the relevance of their background, including experience in the development, promotion and implementation of the use of space technologies, data and applications.

15. The Workshop was attended by more than 75 participants, more than 37 per cent of which were women. The following 27 Member States were represented: Australia, Austria, Brazil, Colombia, Costa Rica, Ecuador, Ethiopia, France, Germany, Guatemala, India, Indonesia, Italy, Japan, Kenya, Mauritius, Nepal, Nigeria, Paraguay, Peru, Serbia, South Africa, Spain, Tunisia, Turkey, United Kingdom of Great Britain and Northern Ireland and United States of America.

II. Summary of the programme

16. The programme of the Workshop was developed by the Office for Outer Space Affairs in cooperation with an international programme committee including members of IAF, DLR, ESA, the Committee for Liaison with International Organizations and Developing Nations, the International Institute of Space Law and Eurisy. The Centre of Applied Space Technology and Microgravity provided support, serving as the local organizing committee. The Workshop was advertised and promoted on various websites and on social media platforms.

17. The Workshop included a welcome ceremony and a high-level panel on the role of space industry and featured five plenary sessions and three breakout sessions.

18. The five plenary sessions were designed to target specific aspects of the socioeconomic benefits of industry, innovation and infrastructure for development, namely, space for socioeconomic development; space applications for developing countries; the sharing of experiences of space-related industries, start-ups and emerging industries from developing countries; space industries for supporting specific Sustainable Development Goals; as well as a special plenary session on the Human Space Technology Initiative carried out by the Office for Outer Space Affairs.

Three breakout parallel sessions were organized on specific topics in order to elicit contributions from participants on the objectives of the Workshop.

19. The following sections provide a summary of the different plenary sessions and breakout sessions in the programme. Observations and recommendations made during the Workshop are contained in section III of the present document.

A. Space for socioeconomic development

20. In the session on space for socioeconomic development, participants were encouraged to present their visions and provide examples of space application programmes supporting socioeconomic development in their countries and regions. The session was preceded by a keynote speech that provided the relevant background and highlighted the objectives of the Workshop.

21. Presentations on regional activities were made during the session. Participants from Bhutan, Colombia, Ethiopia and Serbia provided an overview of the importance of space activities for their respective countries and how space had contributed, and continued to contribute, to socioeconomic development at the national level.

22. The session was followed by a keynote speech by the Chair of the Executive Board of DLR, which focused on various applications developed by DLR that provided socioeconomic benefits and contributed to the 2030 Agenda, the Sendai Framework on Disaster Risk Reduction 2015–2030 and the Paris Agreement under the United Nations Framework Convention on Climate Change.

B. Space applications for developing countries, in particular in Africa

23. Space is a field in which development can occur at a very fast pace, especially with regard to applications and services. That creates a particular challenge for developing countries, where capacity-building efforts are continually required to keep up with new developments in a sustainable manner.

24. The session on space applications for developing countries focused on the experiences and needs of countries that were beginning to use space for the purposes of development, the attempts made to address the challenges encountered and proposals to overcome those challenges.

25. The session presentations focused on three topics: use of space for the detection of microplastics, linked to Sustainable Development Goal 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development); innovations on emergency and early warning systems of Mexico, linked to Goal 1 (End poverty in all its forms everywhere); and the use of space technologies to assist in climate change adaptation, linked to Goal 13 (Take urgent action to combat climate change and its impacts). These presentations demonstrated how space could have an impact on socioeconomic development.

C. The sharing of experiences of space-related industries, start-ups and emerging industries from developing countries

26. The objective of the third session was to share insights concerning space innovations and infrastructure, and to share success stories and technology trends, for the benefit of start-ups and emerging businesses from developing countries, with a view to learning from difficulties encountered and capitalizing on lessons learned.

27. The session included presentations on Africa and Latin America and the Caribbean. Participants described how space activities had led to the creation of start-ups and new educational programmes and research facilities. A presentation from the Kenya Space Agency described the link between the country's space programme and industry to achieve socioeconomic benefits.

D. Space industries for supporting specific Sustainable Development Goals

28. The focus of the fourth session was on how investment in the space industry and the supporting infrastructure created by public and private actors could provide long-term benefits for society. Of particular note was how space could contribute to the achievement of Sustainable Development Goal 9 and how Governments, members of civil society, the private sector, United Nations system entities and other actors could engage in the use of space to achieve the targets of the 2030 Agenda.

29. The achievement of Goal 9 depends on technological progress, which is key to finding lasting solutions to both economic and environmental challenges. Space technology is instrumental in monitoring progress in meeting the targets contained in the 2030 Agenda, and the session featured an analysis of how investment in space technology contributes to achieving the Sustainable Development Goals.

30. In the session, presentations were made on a wide range of initiatives of the United Nations, the public sector, academia and space industries that contribute to the achievement of the Goals. Presentations focused on the following topics: the catalogue of ESA activities contributing to the achievement of the Goals; the utilization of weather and radar satellites; the use of education and educational platforms as agents of transformation, in support of Goal 4 (Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all) and Goal 5 (Achieve gender equality and empower all women and girls); private initiatives; and the streamlining of all space activities in a global partnership in order to increase the socioeconomic benefits. The presentations were followed by a keynote speech by the President of the International Institute of Space Law on space utilization and legal challenges.

E. Improving access to Earth observation technologies and data for socioeconomic benefits

31. A breakout session focused on how improved access to Earth observation inspired innovation and allowed the development of data-driven applications in more countries and sectors. The session also explored the benefits of Earth observation and the obstacles encountered, as well as efficient ways of improving access to it.

32. Participants in the session included representatives of space agencies, industry and academia. A moderator facilitated the discussion, which was centred on three main topics: free data; commercial data and CubeSats; and the benefits of, the obstacles to and the ways of improving access to these resources.

F. Programmes to help developing countries with technical advisory services and capacity-building support to assist in the development of space-based applications

33. Technical advisory services provide support to countries, assisting them in addressing challenges and benefiting from existing space technologies, data and applications. The coupling of technical advisory services with capacity-building can assist in developing the in-country expertise necessary to fully utilize space technology and applications.

34. Participants in this session were mainly from governmental organizations and industry. The discussion was seeded by a short presentation on one of the success stories of the technical advisory missions of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) and was followed by a set of moderated questions. Participants discussed the need to expand UN-SPIDER technical advisory services and identified the specific thematic areas that would most benefit from this type of support.

However, the efficiency of the technical advisory services would increase if developed countries could provide solutions for the challenges discovered and highlighted by the missions or support the implementation of such solutions.

G. Space investments and socioeconomic impacts: raising awareness among decision makers to encourage more investment in space-related industries

35. The number of entities involved in space is growing. New space start-ups are looking at innovative ways of developing and utilizing space technology, data and infrastructures. This breakout session focused on how start-ups could structure the provision of their services and their general strategies for fundraising purposes, with a view to capitalizing on lessons learned by the participants.

36. Participants were from industry, space agencies, academia, governmental organizations and a group of emerging space leaders selected by IAF. The moderator steered the discussion using participative questions covering topics related to the need for public investment, the provision of services and how to engage with decision makers.

H. Human Space Technology Initiative

37. Since 1957, the number of spacefaring nations has been constantly increasing, according to the Register of Objects Launched into Outer Space, maintained by the Office for Outer Space Affairs. At the time of writing of the present report, there were 77 Member States that had registered objects launched into outer space. The space divide — the gap between countries that have space capabilities and those that do not — is addressed by initiatives of the Office.

38. This special plenary session focused on one such initiative: the Human Space Technology Initiative. Among other successes, the Initiative provides Member States with an opportunity to have their first satellites launched into outer space, thanks to the KiboCUBE joint initiative of the Office for Outer Space Affairs and the Japan Aerospace Exploration Agency (JAXA). One recent example was the deployment of 1KUNS-PF of Kenya on 11 May 2018.

39. Through the Initiative, entities from developing countries have performed experiments in microgravity conditions, thanks to the agreement between the Office and the Centre of Applied Space Technology and Microgravity. It was also noted that the United Nations/China cooperation on the utilization of the China space station provided opportunities for Member States to propose flight experiments to be carried out on board the China space station, thanks to an agreement between the Office and China Manned Space Agency.

40. Institutions participating in the Human Space Technology Initiative, including the winners of the first and third rounds of KiboCUBE and one of the winners of the Drop Tower Experiment Series fellowship programme (DropTES), discussed their experiences. Presentations were given on new activities of the Initiative that would soon be available.

I. High-level panel

41. The high-level panel focused on the overall theme of the workshop (“Industry, innovation and infrastructure for development”) with presentations from the Director of the Office for Outer Space Affairs, the Chair of the Executive Board of DLR, the Director General of ESA, the Chief of the Digital Government Branch of the Division for Public Institutions and Digital Government of the United Nations Department of Economic and Social Affairs.

42. The panellists presented a forward-looking view on enabling technologies, and the ways in which they could be used to develop and enrich new applications. Panellists emphasized how applications could be developed to assist in, and monitor progress towards, the achievement of the Sustainable Development Goals, and in that regard, new applications could be categorized according to which Goals they contributed to. It was noted that space agencies had begun work on the categorization of programmes and projects that contributed to the 2030 Agenda.

III. Observations and recommendations

A. Observations

43. In the utilization of space, there has been a transition from State-driven to industry-driven initiatives. That transition has been assisted by the recognition by Governments of the role of industry by continuing to create value for society.

44. It was noted that some countries lacked either the capacity or the infrastructure to support the creation of a sustainable space industry and that they relied on foreign industry in order to meet their needs. However, that situation could change, thanks to free and open data policies, open data cubes and the use of cloud services, which were lowering the technological entry barriers, and thereby encouraging entrepreneurship.

45. Efforts of the Office to pursue partnerships with industry and the private sector were welcomed, in line with the endorsement of the Committee on the Peaceful Uses of Outer Space at its sixtieth session. Those efforts gave Member States access to expertise on the latest developments relating to commercial applications, leading to new opportunities in international cooperation for the peaceful uses of outer space.

46. The creation of infrastructure is to be supported by a strategy for sustainable capacity-building. The model of technical advisory services used by UN-SPIDER was regarded as a fundamental tool for capacity-building, because it identified needs and proposed best practices, documented lessons learned and recommended possible solutions.

47. It was noted that industry benefited from capacity-building efforts, which would raise the awareness of end users, in particular at the institutional level, who would gain a better understanding of the solutions available for particular challenges. Initiatives including space solution catalogues or compendiums were regarded as essential starting points.

48. Global agendas, including the 2030 Agenda, provided a set of indicators on which progress could be measured, and those could be taken into consideration by industry in developing solutions. Alternatively, industry could look to the global agendas for a description of needs for which they could develop solutions, in order to mobilize funding.

49. It was noted that space was not to be considered as an isolated domain. Integration of different technologies was indispensable for the development of certain solutions. The implementation of demonstration projects provided evidence of the applicability of the solution for obtaining the desired results. Users ready to assist in the development of projects through testing and validation could also benefit from the results of the demonstration project.

50. Industry needed to explore different funding sources, including governmental sources, venture capital, crowdfunding and public-private partnerships. Governmental investments needed to incentivize applications that had a higher risk profile and were less likely to generate immediate returns, while other investors would be inclined to fund ventures with a lower risk and a higher return on investment.

51. The activities of the Office aimed at providing opportunities to deploy and test infrastructure in outer space were welcomed by the participants. A recommendation

was made to increase the opportunities to deploy CubeSats, because they were considered to be a starting point for developing countries in building capacity to implement their own space programmes. However, in order for a space programme to be successful, it had to serve national priorities while ensuring the retention of the expertise gained.

52. It was noted that the design of CubeSats, like any other object launched into outer space, needed to take into consideration the importance of the registration of the objects and the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, in order to contribute to the sustainability of activities in outer space.

B. Recommendations

53. The recommendations identified during the Workshop have been combined to eliminate any overlaps and are as follows:

(a) Countries not members of the Committee on the Peaceful Uses of Outer Space often do not have access to the discussion forum afforded by the Committee to exchange ideas on space-related matters. Although it is recognized that the activities of the Office are also organized in countries that are not members of the Committee, the participants encourage the Office to continue with this work, in particular on the African continent;

(b) Connecting end users, decision makers and providers of space-related solutions is essential. While recognizing the efforts of the Office in that regard, it is recommended that, in the organization of future capacity-building activities, the Office should make additional such efforts;

(c) There is enormous potential in technical advisory services. With regard to the experience that the Office had accumulated from providing assistance for the entire disaster management cycle during UN-SPIDER technical advisory missions, it was recommended that that experience should be extended to other space-related areas;

(d) To assist users in understanding the capabilities of space in support of the global agendas, it is recommended that catalogues of solutions should be created. The Office could act as the gateway for the different catalogues, functioning as the single point of entry for end users;

(e) To extend the benefits of Earth observation data, it is recommended that Member States should be encouraged to make their Earth observation data openly accessible to the public;

(f) Since some countries are not aware of how space can contribute to the achievement of the Sustainable Development Goals and mindful of the activities in this respect carried out by the Office, it is recommended that the Office should continue its awareness-raising efforts concerning this topic;

(g) It is also recommended that the Office should continue to engage with the space industry and the private sector in various aspects of the peaceful exploration and uses of outer space. The objective of such cooperation is to make the best use of the contribution of industry and the private sector to the projects and activities of the Office, promoting the values of the United Nations in the industrial and private communities, as well as protecting the integrity and reputation of the United Nations;

(h) The Human Space Technology Initiative has already provided substantial benefits, thanks to the KiboCUBE programme, with which countries have the opportunity to place their first satellite in orbit. The Office is encouraged to continue seeking opportunities that allow Member States to access space through international cooperation programmes. The space industry is regarded as an important partner to facilitate new opportunities;

(i) It is recommended that the Office should continue its efforts in capacity-building on international space law in order to ensure that countries are aware of international guidelines and best practices when launching objects into outer space.

IV. Conclusions

54. There was consensus on the importance of the role of industry in providing solutions that could benefit countries in meeting the objectives of the global agendas, and it was recommended that the Office should continue to engage with industry towards that aim.

55. Participants stressed the importance of the activities of the Office concerning capacity-building, such as UN-SPIDER technical advisory services and programmes including KiboCUBE, which provided developing countries with opportunities to have access to space.
