

The Promoting Space Sustainability Project:

awareness-raising and
capacity-building
related to the implementation
of the LTS Guidelines

Event #1
Summary Report
Commercial Space Sector

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Global investment in and dependency on space activities are increasing rapidly. Such trends underline the need to ensure space activities are sustainable over the long-term. As the United Nations' dedicated space entity, the Office for Outer Space Affairs of the United Nations Secretariat (UNOOSA) sits at the crossroads of the global space community and is well placed to bring together both private and public stakeholders on the subject. The Promoting Space Sustainability Project: awareness-raising and capacity-building related to the implementation of the LTS Guidelines seeks to raise global awareness of the importance of space sustainability and to foster related capacity-building services for emerging space-faring nations.

The Project is made possible thanks to the generous support of the United Kingdom and is delivered in the context of the landmark [Guidelines for the Long-term Sustainability Outer Space Activities](#) of the Committee on the Peaceful Uses of Outer Space (LTS Guidelines), whose adoption by the Committee in 2019 was welcomed with appreciation by the United Nations General Assembly.

The Virtual Event Series

In its first phase, the Project arranged a series of virtual events, aimed at facilitating peer-to-peer dialogue and an exchange of experiences implementing the Guidelines for the Long-term Sustainability Outer Space Activities of the Committee. Split across two sessions, each event focused on a particular sector of the global space community. Participants shared their experiences and examples of sustainable space activities. The first event focused on the commercial space sector, the second on space agency operators, and the third event on national regulators and policymakers. The events provided a platform to share operational space sustainability case studies outlining actions taken to implement the Guidelines for the Long-term Sustainability Outer Space Activities of the Committee, as well as lessons learned. The case studies and presentation slides submitted in connection with the events are made publicly available on [UNOOSA's website](#), further supporting awareness-raising and related capacity-building on this critical topic for the global space sector.



Event #1

Commercial Space Sector

The first event of in the series introduced experiences from the private space sector. Ten representatives of space companies from different regions were invited to provide examples of their sustainable space practices. Such examples were mapped into the context of the Guideline for the Long-term Sustainability of Outer Space Activities of the Committee. Each session ended with an open, informal Question and Answer (Q&A) period focusing on the case studies.

Speakers for this event included:

- **Mr. Sivio Sandrone**, Vice President New Programmes, SpaceExploration, Airbus Defence and Space
- **Mr. Shady El-Shafie**, Vice President, Egyptian Company for Space Applications and Remote Sensing (ECSARS)
- **Ms. Abimbola Alale**, CEO, Nigerian Communication Satellite Ltd. (NIGCOMSAT)
- **Mr. Takeshi Hakamada**, CEO, ispace
- **Mr. Nick Shave**, Vice President, Inmarsat; Chair UKspace
- **Mr. Vishal Latha Balakumar**, Mission Specialist, Dhruva Space
- **Mr. Carlos A. Bello Hernández**, Partner, Bello, Gallardo, Bonequi y García SC
- **Ms. Catherine Doldirina**, Legal Counsel, D-Orbit
- **Mr. Walt Everetts**, Vice President, Space Operations and Engineering, Iridium
- **Mr. James Zheng**, CEO, Luxembourg Office, Spacety

Opening remarks

The event was opened with remarks by **Ms. Simonetta Di Pippo**, Director of the United Nations Office for Outer Space Affairs and **Ambassador Corinne Kitsell**, United Kingdom Permanent Mission to the United Nations in Vienna.

Morning Session

1. Mr. Silvio Sandrone, Vice President New Programmes, Space exploration, Airbus Defense and Space

Mr. Sandrone began his intervention by stating that Airbus is highly concerned about the topic of space sustainability, since space activities bring about enormous socio-economic benefits that might be lost without continuing access due to current space debris trends. In addition, Airbus, as a space company has a vested business interest in making sure that those who carry out space activities are doing so sustainably.

Mr. Sandrone continued his presentation, stating, there are more than thirty-four thousand bits of debris larger than 10 cm, tracked from Earth, but if one digs deeper there are about 1 million additional smaller objects, moving 9km/second on Earth orbits, and thus an impact with such objects might destroy a satellite, while generating even more debris. He stated it is also known that $\frac{3}{4}$ of the debris population can be found in low-Earth orbit (LEO), however, those who use geostationary orbit (GEO) should not think that they are not affected by the space debris issue, since their spacecraft also have to pass through LEO.

When discussing Airbus' space activities related to the Guidelines for the Long-term Sustainability of Outer Space Activities and space sustainability, Mr. Sandrone presented a three-pronged approach of the space company. First, eco-design, in other words, prevention, or sustainability by design through environmental impact assessment and improvement from early design stages, was put under scrutiny. Based on the first approach, Mr. Sandrone called the attention to an European Union (EU), ISO Certified method, called the "lifecycle assessment", which applies to every type of industrial activity. Mr. Sandrone provided assurances that Airbus implements the lifecycle and impact assessment systematically for their space activities, in every aspect of the space system value chain. Such assessment includes not only design and operation, but also retirement, and disposal, concerning the space debris dimension. This was linked to Guideline B.8, Design and operation of space objects regardless of their physical and operational characteristics.

In relation to the second category, de-orbiting systems and re-entry strategies, Mr. Sandrone argued that satellite power and propulsion passivation are key for mitigating space debris, in addition to space situational awareness (SSA), space traffic management (STM) for object surveillance and tracking and collision avoidance. Mr. Sandrone also argued that many countries already adopted national legislations related to space debris mitigation, in fact, since Airbus is based in France, the company has implemented the French space operation law in that regard. Furthermore, Airbus' active debris removal activities, linked with Guideline D.2 Investigate and consider new measures to manage the space debris population in the long term, were illustrated, as the space company partnered with Surrey Satellite Technology Ltd. (SSTL) for the "RemoveDEBRIS" EU

Project, and together they carried out a series of experiments using net, harpoon and VBN (vision-based navigation) as well as LIDAR (light detection and ranging) technologies.

The third dimension presented by Mr. Sandrone, is to turn trash into something valuable; to repurpose and perhaps recycle such assets. Therefore, the role of in-space manufacturing (ISMA) with recycling approaches, in-space resource utilization (ISRU), and on-orbit servicing were praised by Mr. Sandrone. With regards to the third category, the Vice President said that Airbus is currently developing the world's first metal 3D printer (a metal recycling device) that will be deployed on the International Space Station (ISS). He linked this to Guideline D.1 Promote and support research into and the development of ways to support sustainable exploration and use of outer space

Mr. Sandrone concluded his presentation by stating that in order to tackle the topic of space debris, there is a need for rules and guidelines, such as the Guidelines for the Long-term Sustainability Outer Space Activities of the Committee, but also design and technology to remove debris, and the appropriate economic incentives to make sure that the work actually gets done.

Mr. Sandrone's presentation in the event recording starts [here](#).

2. Mr. Shady El-Shafie, Vice President, Egyptian Company for Space Applications and Remote Sensing (ECSARS)

Mr. El-Shafie approached space sustainability from the perspective of the Arab Republic of Egypt and introduced Egyptian space capabilities since the country's first satellite launch in 2011. The Egyptian Company for Space Applications and Remote Sensing (ECSARS) has worked with the Egyptian Government related to space applications and remote sensing, which is the first company established in Egypt working on this specific field.

With respect to promoting sustainability on Earth, Mr. El Shafie pointed out that ECSARS has assisted the Egyptian government in the management of the increased urbanization and growth in commercial, industrial and agricultural activities in Egypt by using remote sensing and ground penetrating radar (GPR) applications. Additional related services of ECSARS include, space monitoring of the agricultural production, underground water exploration, subsurface utility mapping or preparing geological studies. When rearranging such urban cities and communities due to lack of resources, sometimes with thousand or even two-hundred thousand inhabitants, the use of space technology (such as satellite remote sensing or GPR), indeed directly affects sustainability on the ground, including societal and economical influences, Mr. El-Shafie noted.

In addition to helping to achieve the Sustainable Development Goals by space technology utilization, Mr. El-Shafie brought up the economic factor of space applications and how important it is to emerging space-faring nations and small and medium-sized enterprises (SMEs) to be able to build their own self-sustaining space infrastructure. As

Mr. El-Shafie explained, ECSARS is currently building its own space database infrastructure which also enables them to use their own data that they can interpret further and provide to decision makers.

Mr. El-Shafie also emphasized the role of information-sharing and awareness raising practices (both locally and internationally) in terms of space sustainability and suggested developing journals and conducting international meetings on such topics, as ECSARS have done so since its creation. This was linked with Guideline C.1 Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities; Guideline C.2 Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange, and Guideline C.4 Raise awareness of space activities.

Mr. El-Shafie's presentation in the event recording starts [here](#).

3. Ms. Abimbola Alale, CEO, Nigerian Communication Satellite Ltd. (NIGCOMSAT)

Ms. Alale began her presentation by welcoming the organization of the event series on the implementation of the global space treaties, more specifically the voluntary LTS Guidelines. According to Ms. Alale, Nigeria signed the Outer Space Treaty in 1967, among the initial parties of the Treaty, which shows Nigeria's determination to conform international space law instruments in order to ensure the peaceful exploration and use of outer space.

NIGCOMSAT is a Nigerian communication satellite operator company dealing with communication satellites, while – the CEO added – the Nigerian remote sensing satellites are handled by the Nigerian Space Agency. According to Ms. Alale, most of NIGCOMSAT's operations and activities are in conformity with the Guidelines for the Long-term Sustainability Outer Space Activities of the Committee.

Guideline A.4, Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites, Guideline B.1, Provide updated contact information and share information on space objects and orbital events and Guideline B.2, Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects were emphasized by Ms. Alale, as she stated that the Nigerian company coordinates and shares information with relevant authorities. Ms. Alale recognized that, if a space company like NIGCOMSAT does not coordinate the orbital activities and trajectory well, there may be interference with other satellites, which, in Ms. Alale's understanding, is simply against "the peaceful uses of outer space". Therefore, the NIGCOMSAT Team constantly coordinates with various countries and other space entities as the orbital Earth environment is indeed highly congested and there is a high risk for collision, especially without international coordination (Guideline C.1 Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities). In

addition, NIGCOMSAT engineers archive all relevant data to learn and improve the orbital operations and such info is also shared by other space operators (Guideline B.1 Provide updated contact information and share information on space objects and orbital events).

Additionally, Guideline B.8 Design and operation of space objects regardless of their physical and operational characteristics and Guideline B.9 Take measures to address risks associated with the uncontrolled re-entry of space objects were highlighted as guidelines that had been implemented by NIGCOMSAT even before the Guidelines for the Long-term Sustainability Outer Space Activities of the Committee were developed, as NIGCOMSAT tries to avert every risk even at the end of a satellite's lifetime. Furthermore, NIGCOMSAT makes sure that their satellites have enough propellant, so that they can be properly taken to a safer orbit when needed. NIGCOMSAT also reuses the same orbit for subsequent satellites.

Guideline C.1 Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities; Guideline C.3 Promote and support capacity-building; and Guideline B.1 Provide updated contact information and share information on space objects and orbital events were also touched upon by Ms. Alale. She explained that NIGCOMSAT has worked closely with young researchers, scientists, and others in the space industry, to support space awareness, and capacity development locally, as well as internationally. For example, the 'ActInSpace' Competition is annually organized by the European Space Agency (ESA), and for this event, NIGCOMSAT sponsored a team of five researchers and young people interested in space.

In terms of Guideline A.1, Adopt, revise and amend, as necessary, national regulatory frameworks for outer space activities; Guideline A.2, Consider a number of elements when developing, revising or amending, as necessary, national regulatory frameworks for outer space activities; Guideline A.3, Supervise national space activities; and Guideline A.4, Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites, NIGCOMSAT communicates with its national regulatory bodies to make sure that the frequency spectrum is used peacefully (i.e. NIGCOMSAT takes part in quarterly ITU meetings and also it is in close contact with the Nigerian Communication Commission (NCC), which is the entity that regulates frequency allocation in Nigeria). NIGCOMSAT, Ms. Alale noted, ensures that its spectrum is used safely, and it is preserved for future generations.

As a conclusion, Ms. Alale emphasized the need for more events such as the present one, as there is a crucial need to encourage others to continue such conversations and to implement the Guidelines for the Long-term Sustainability Outer Space Activities of the Committee.

Ms. Alale's presentation in the event recording starts [here](#).

4. Mr. Takeshi Hakamada, CEO, ispace

Mr. Hakamada approached the subject of space sustainability from his company's point of view. Ispace was founded in 2010, now has more than 100 employees from all over the world. It has the aim of expanding human presence in outer space to build the so-called Moon Valley by 2040, where Earth and the Moon can be made as one ecosystem. It is the idea of the company to utilize water resources on the lunar surface not only for drinking purposes but also to fuel spacecraft rockets.

When discussing the subject of space resource utilization, Mr. Hakamada emphasized that a very important question for ispace is how to support space assets and maintain space infrastructure (i.e., transportation on the lunar surface, or the establishment of a hydrogen energy ecosystem) in an efficient and sustainable way. This was linked to Guideline D.1 Promote and support research into and the development of ways to support sustainable exploration and use of outer space.

Currently, ispace is developing two lunar rovers for the company's exploration phase on the Moon. Also, Mr. Hakamada stated, ispace is partnering with space agencies and other commercial companies to create and share technology in order to be more aware of the lunar environment and to share information also on water utilization management, or how to use lunar water in an economically reasonable and sustainable way. He linked this to Guideline C.1 Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities and Guideline C.2 Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange.

Mr. Hakamada briefed the audience about their shared plan with the Japanese government to create a registry on the use of space resources.

Mr. Hakamada added that, although it is yet early to fully understand how space sustainability practice can be developed related to space resource management on the Moon and other celestial bodies, we should learn from our past experience in the orbital space environment as well as on Earth. Mr. Hakamada concluded stating that ispace supports and encourages the creation of proper regulations and guidelines to keep the lunar environment sustainable.

Mr. Hakamada's presentation in the event recording starts [here](#).

5. Mr. Nick Shave, Vice President, Inmarsat; Chair, UKspace

Mr. Shave introduced Inmarsat, a space company that has been an active commercial satellite operator for more than 40 years, providing L-Band network from geostationary orbit (GEO), particularly for shipping and aviation routes around the world. Over the past 10 years the company has moved into the KA-Band, which also indicates that Inmarsat is in the process of moving out from the geosynchronous orbit (GEO) into the HEO (Highly Elliptical Orbit) by 2022. The new HEO system is aimed to provide the first KA-broadband system for the Arctic region.

Next, Mr. Shave illustrated why space sustainability is crucial in the GEO environment by using an artificial general intelligence (AGI) simulated debris collision event in the trajectory. Mr. Shave continued, through the simulation, it can be perceived that a collision on the GEO belt may generate within 18-19 hours so much debris that at least half-way around GEO would be affected by the event. Therefore, it is crucial to protect GEO, in fact, Inmarsat is said to be a major promoter of space sustainability. Inmarsat also welcomed the implementation of the Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee and Mr. Shave expressed that indeed the voluntary Guidelines represent an excellent framework for both commercial and governmental operators going forward. He added that Inmarsat is also working to implement the Guidelines along with other related legal instruments, such as the Interagency Space Debris Coordination Committee (IADC) Space Debris Mitigation Guidelines, and ITU best practices.

Mr. Shave indicated, Inmarsat is specifically focusing on implementing space safety, and highlighted Inmarsat activities such as to sharing contact information, accuracy of orbital data, and looking at conjunction assessment regularly in all phases of flight in connection with Guideline B.1 Provide updated contact information and share information on space objects and orbital events; Guideline B.2 Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects; Guideline B.3 Promote the collection, sharing and dissemination of space debris monitoring information; and Guideline B.4 Perform conjunction assessment during all orbital phases of controlled flight.

Guideline C.2 Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange and Guideline C.3 Promote and support capacity-building were emphasized as capacity-building and awareness-raising across the sector and industry, which have been taking place through numerous international fora by Inmarsat on space sustainability subjects. Some of the multilateral arrangements Inmarsat is part of are, the Space Data Association (SDA), Space Safety Coalition, International Organization for Standardization (ISO), EMEA Satellite Operator Association (ESOA), European Cooperation for Space Standardization, and the Commercial Integration Cell (CIC).

Among the various organizations listed above, Mr. Shave highlighted the so-called Space Safety Coalition (SSC), formed in 2019, comprising 'willing space operators and industry stakeholders' that are looking at how the private sector can promote space sustainability, especially related to low earth orbit (LEO) constellations. All members of the Coalition, as a self-regulating body, endorse and agree to strive to implement best practices to ensure safety and commercial viability of space activities.

In terms of Inmarsat's operational activities connected to the Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee, Mr. Shave listed among others the two main sources of space debris tracking, SSA and collision avoidance, that are SDA and the Combined Space Operations Center (CSpOC). Inmarsat's Flight

Dynamics team constantly evaluates collision risks through fusion of multiple sources of warning, messages and notification. The space company has also automated handling of over 15000 messages/notifications per year using to efficiently compute Collision Avoidance Maneuvers (COLA). Furthermore, in case a risk results to be higher than a predefined threshold, actions are taken, such as satellite maneuver, re-planning, execution of ad-hoc maneuvers, or the warning of other operators through the SDA. Over the last year, Mr. Shave shared, Inmarsat has performed 12 COLA maneuvers across its fleet of GEO satellites.

Mr. Shave's presentation in the event recording starts [here](#).

Question & Answer Session

In the morning Q&A session, Mr. Shave emphasized, related to information sharing practices, that especially in the SDA with Inmarsat's operator colleagues, together they look at how they can optimize the information and get more accurate predictability about collision. Mr. Shave also introduced the so-called, 'Space Data Center 2.0' Initiative, which looks at how space operators can improve predictability through new software features. Such effective data-sharing is taking place through an anonymous approach (using a central database), which is managed by a commercial company, resulting that the whole mechanism has kept its commercial aspects.

Mr. Hakamada, expressed that even though ispace space activities will take place on the lunar surface, they are still exposed to space debris, and therefore they have to be mindful in their planning to protect their space objects as well as to avoid contributing to the Kessler syndrome. In addition, Mr. Hakamada recognized that the international space community should learn from the space debris situation related to Earth orbital environment and protect the lunar orbit from a same situation to happen.

Mr. El-Shafie, representing ECSARS noted that public private partnership is a crucial element for the space economy in Egypt and all around the world, as the public sector may guide the commercial operators, how to act responsively, according to international rules and regulations.

The Q&A session of the morning event recording starts [here](#)

Afternoon Session

1. **Mr. Vishal Latha Balakumar**, Mission Specialist, Dhruva Space

Mr. Balakumar began his presentation by introducing his company, Dhruva Space, which, according to the Mission Specialist, is the first private satellite manufacturer, full-stack space engineering company in India. In the perspective of Mr. Balakumar, space sustainability has an inherent space economy factor, and for that reason, the space company is designed to provide solutions on three segments of the space industry that are the space, launch and ground segments.

According to Mr. Balakumar the space economy is facing a serious issue, especially due to satellite constellations that are cluttering our finite orbital environment, as those spacecrafts are designed to be constantly replenished over time.

Dhruva Space is in the view therefore, that it is imperative to have a proper, clean space environment and that responsible use of space should be ensured by technology and a dedicated global space policy. Consequently, Dhruva Space is now looking to extend its collaborations related to space sustainability, and it is in the process of focusing on modularity and reusability of their technologies. In addition, the company is strategically targeting space sustainability and the Guidelines for the Long-term Sustainability of Outer Space Activity of the Committee through Guideline A.4, Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites; and the Guidelines in Section B, focusing on safety of space operations.

As stated by the Mission Specialist, over the last couple of years, the Indian space economy has opened up, and the commercial space sector is booming also with the help of the Indian Space Research Organization (ISRO), and the Indian National Space Promotion and Authorization Centre (IN-SPACe).

Related to the space debris issue, Mr. Balakumar declared that although they are a space company, they see space sustainability a more important factor than commercialization. In that context, de-orbiting mechanism and SSA capabilities are primary. Also, it was noted that the Dhruva Space Team understands that open source, collaboration, and technology transfer are crucial to ensure a sustainable space environment and Dhruva Space is following such practices. Moreover, the Indian company is working on space debris reusability with ISRO to carry out research on repurposing their rocket upper stage and creating an “on-orbit laboratory”. Furthermore, it was highlighted that they work with critical partners to build modular platforms, and ensure interoperability, which would ideally require less resources. Lastly, the concept of make local, go global was touched upon by Mr. Balakumar.

Mr. Balakumar’s presentation in the event recording starts [here](#).

2. Mr. Carlos A. Bello Hernández, Partner, Bello, Gallardo, Bonequi y García (BGBG)

Ms. Hernández noted that although at first it might be a bit strange that a law firm discusses space activities, as the space field grows, more people get access to orbital

activities, and more lawyers are needed on the field. Mr. Hernández commented that everybody who carries out space activities must observe the related regulatory framework. When it comes to satellite communications, which topic was in the center of the lawyer's intervention, operators must follow at least two types of international regulations, the United Nations space law instruments, and second, the International Telecommunications Union (ITU) Radio Regulations, which latter source regulates how frequencies are used to prevent interference of each other.

Mr. Hernández recalled that Guideline A.4, Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites and Guideline C.4, Raise awareness of space activities directly to the ITU, by stating, that the ITU ensures equitable rational and efficient use of radio spectrum and the various orbital regions used by satellites. As a lawyer, Mr. Hernández emphasized that his main area of works for 20 years has been telecommunication media and technology. Mr. Hernández explained further, in case a satellite operator wants to launch a satellite, they have to obtain an orbital slot and a trajectory assigned. For such procedure however, a satellite operator also has to confirm with national or federal telecommunications and broadcasting law, so, first the lawyer ideally has to obtain a license from the national regulatory authority. As a second stage, the government files the application - on behalf of the satellite operator - to the ITU, which process is also followed up by the law firm. In this regard, the work of law firms is aligned with Guideline A.4, which ensures equitable rational and efficient use of radio frequency spectrum and the various orbital regions, Mr. Hernández argued. Since GEO spectrum is a finite resource, there is a need for coordination, and lawyers in this regard can help to implement the Guidelines, Mr. Hernández asserted.

Guideline C.1, Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities; Guideline C.2, Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange; Guideline C.3, Promote and support capacity-building; and Guideline C.4 Raise awareness of space activities were mentioned by Mr. Hernández, in terms of promoting international cooperation by lawyers. For example, the lawyer brought up the role of the World Radiocommunication Conference (WRC), which takes place every three to four years, and where large number of people from all the space sectors are represented. The lawyer called for the attention to the work that experts carry out in between two conferences for 3-4 years, and to the fact that valuable outcome can only happen if all parties cooperate. Additionally, such events have awareness raising and capacity building elements, as law firms must train their own people on the subject, in fact BGBG also helps to educate through the ITU Academy, where governmental officials get trainings on the ITU's procedures and functions.

Mr. Hernández's presentation in the event recording starts [here](#).

3. Ms. Catherine Doldirina, Legal Counsel, D-Orbit

According to Ms. Doldirina, D-Orbit is a *Benefit (B-)Corporation*, meaning that its corporate purpose also is to create a measurable positive impact on society and the environment. When it comes to D-Orbit's products and services, the Legal Counsel listed, *ION*, a free-flying spacecraft that transports satellites into their desired operational orbit; in-orbit servicing; D3, an independent, smart propulsive autonomous decommissioning device; *D-Sense*, a multi-sensor module for space Situational awareness (SSA) and space traffic management (STM); and *NOCTUA*, which contributes to space sustainability on Earth. In terms of capacity building initiatives, Ms. Doldirina listed D-Orbit Academy, and Distributed Space, as a business model to enable access to space for countries without a space programme.

In the next part of her intervention, Ms. Doldirina connected her company's activities to the Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee beginning with Guidelines in Section A, emphasizing that D-Orbit has two activities, Collision Analysis and D3 that provides technologies, products and services that by design address the risks associated with in-orbit operations and re-entry of space objects. In addition, the principle of minimizing the impacts of human activities on Earth as well as on the outer space environment came up, which is fulfilled by D-Orbit when following the company's Benefit-Corporation vision, argued Ms. Doldirina.

In terms of the Guidelines in Section B, advocating the performance of conjunction assessment during all orbital phases of controlled flight, Collision analysis and *ION* activities of D-Orbit were listed. For design and operation of space objects regardless of their physical and operational characteristics, the D3 and Sustainable Procurement tasks were paired.

Ms. Doldirina also commented on the connection between D-Orbit activities, (D-Orbit Academy and Distributed Space) and the Guidelines in Section C, in particular, in terms of assistance efforts to countries in gathering human and financial resources and achieving efficient technical capabilities, standards, regulatory frameworks and governance methods that support the long-term sustainability of outer space activities and sustainable development on Earth.

Lastly, Ms. Doldirina emphasized that D-Orbit has been working also within the context of the Guidelines in Section D, focusing on the promotion and support of R&D activities to find ways to support sustainable exploration and use of outer space, as well as to investigate new measures to manage the debris population in the long-term. The lawyer explained that D-Orbit in-orbit servicing activities are compliant with LTS Guidelines D.

In terms of the lessons learned when addressing the Guidelines for the Long-term Sustainability of Outer Space Activities, Ms. Doldirina argued that quality and collaboration are key to follow truly valuable sustainable activities with respect to the orbital environment. In addition, coordination, such as the issue of tracking of objects in the context of rideshare-launches of multiple satellites was brought up. Finally, Ms. Doldirina called for a mind-change on the surface and in space, mainly to stop an exponential technological development at the expense of our planet and build the future of humanity by developing sustainable production processes, businesses, and lifestyles.

Mr. Doldirina's presentation in the event recording starts [here](#).

4. Mr. Walt Everetts, Vice President, Space Operations and Engineering, Iridium

Mr. Everetts articulated that when Iridium was first approached to present their activities in terms of the Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee, the company chose to highlight several sustainability practices over the others. Mr. Everetts decided to focus his intervention on the deorbiting mechanism and end-of-life effort.

Mr. Everetts highlighted Guideline B.2, Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects and Guideline B.9, Take measures to address risks associated with the uncontrolled re-entry of space objects, and highlighted transparency over all, as he expressed interest in sharing some of his company's experiences related to space sustainability.

Mr. Everetts provided some background, referring to a space debris incident that Iridium experienced in 2009, when an abandoned satellite crashed into one of Iridium's active communication satellites. Mr. Everetts referred to the incident as the wake-up call from the perspective of the space industry to improve information on the orbit of satellites and space debris. Thanks to a larger industry collaboration since then, and because all space operators have gotten a better appreciation of what is needed to maintain space sustainability, satellites can orbit more safely today. Since then, Iridium also maintains close & constant communication with all appropriate entities and stakeholders, related to information sharing, transparency on position, maneuvers and deorbit efforts. The results of such procedures, according to Mr. Everett, were enhanced mitigation and maneuvering abilities, sharing of best practices coupled with procedures to de-orbit satellites at the end-of-life and preventing additional debris from congesting space.

As Mr. Everetts emphasized, good stewardship of satellite operation comes with opportunities to improve life on Earth (through communication, EO, etc.), and it is the operators' shared responsibility to continue to maintain such tasks. Mr. Everetts projected also the five pillars of space stewardship that are "be responsible; contribute, challenge, learn; make sure that policy & procedures are in place; share information; de-orbit & demise".

Mr. Everetts also introduced Iridium's *Deorbit Program* (linked to Guideline B.9, Take measures to address risks associated with the uncontrolled re-entry of space objects), through which the company de-orbited a complete existing constellation by February 2019, including the removal of more than 33 000 kg of debris from space and it naturally decayed from 160-kilometer altitude after 10 to 12 days on Earth. At the same time of the de-orbiting procedure, Iridium conducted the largest space-based technology refresh in history.

Mr. Everetts' presentation in the event recording starts [here](#).

5. Mr. James Zheng, CEO, Luxembourg Office, Spacety

According to Mr. Zheng, Spacety is a fast-growing private new space company with headquarter in China that operates cubesats and smallsats with more than 90 employees globally. Spacety also has manufacturing capabilities especially related to smallsats, also it provides Satellite-as-a-service activities, and it is a global SAR satellite data provider. In addition, since its creation in 2016, Spacety has developed, launched and operated 21 satellites with 12 launches.

In terms of the future, Mr. Zheng expressed that Spacety is planning to launch more than 300 EO satellites as part of a new constellation with SAR capability with a five-year of mission life.

Related to space sustainability, Mr. Zheng declared that Spacety is aware of the issue since its creation, and highlighted radio frequency spectrum (especially related to mega-constellations) and space debris as two main issues affecting the company. Mr. Zheng asserted, the space sustainability situation is worsening, and if space operators don't step up, space won't be operational anymore. Spacety therefore has embedded measures into the company's satellites to take care of the issues in connection with space sustainability. From a commercial point of view, Mr. Zheng argued, all companies should invest in space sustainability in one way or another, otherwise they will all lose their space assets.

Since Spacety is a private company, their ability to act regarding space sustainability is quite limited, according to Mr. Zheng. However, the scientist continued, space companies can still do their part, such as de-orbiting own satellites, so such objects don't turn out to be space debris (linked with Guideline B.8, Design and operation of space objects regardless of their physical and operational characteristics and Guideline B.9, Take measures to address risks associated with the uncontrolled re-entry of space objects). Consequently, Spacety puts a de-orbiting device (de-orbiting panel) on their small satellites, even if they are (6U) CubeSats, and when a satellite reaches its end of life, they deploy the panel (attached to the solar panels) so it loses energy due to air electric resistance and drop slowly toward the Earth.

When it comes to larger satellites, Mr. Zheng explained, that such de-orbiting panels are not technically feasible (as it would require too large of a deployable structure due to the mass inertia of the satellite), therefore, thrusters are used to de-orbit the satellites and bring them back to the atmosphere. In order to develop the specific technology (iodine-based electrical thruster), Spacety worked with the French company, THRUSTME. In addition, Spacety now has partnered with another company to develop a water-based propulsion system, which may also reduce the level of pollution. These two collaborations also relate in terms of international collaborations for space sustainability to Guideline C.1 Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities.

When addressing the radio frequency congestion related to mega-constellations, Spacety, as a small company, is now working with other industry participants to develop laser communication technology.

Finally, with respect to active satellite debris removal, Mr. Zheng expressed that for such activities international cooperation is needed, with a valuable international organization, such as the United Nations, to coordinate such efforts.

Mr. Zheng's insights in the event recording starts [here](#).

Question & Answer Session

During the Questions and Answers, Mr. Balakumar from Dhruva Space elaborated on the biggest challenges that the company faces when addressing space sustainability. Mr. Blakumar explained that from a company's perspective when we talk about sustainability, you have to think of the economic side, how you are going to sustain yourself to be able to exist for decades, and still take care of a sustainable space environment with applying the right technology. In other words, it is necessary to find a fine balance between 'enabling' and 'restriction', also funding and investment that a space company receive can be a good option to concentrate more on space sustainability, however, such incentives tend to vary from region to region due to local institutions and policies that are in place for example.

Ms. Doldirina also explained how they try to mitigate against the cost that space sustainability can mean to the company. According to Ms. Doldirina, the D-Orbit Team tries to educate the shareholders (i.e. the suppliers) to invest in certain practices and also to enable the uptake of specific technology that in the long run pays off. As for R&D, Ms. Doldirina expressed that D-Orbit received funding from the European Investment Bank specifically to focus on on-orbit servicing and associated technology. Last but not least, the lawyer mentioned that the incredible devotion and seeing the materialization of the success of the Team have all contributed to the success of the company's activities.

Mr. Hernández elaborated on the key aspect on his law firm, BGBG's success, which is their strong focus and specialization on satellite communications. Such passionate mentality, according to Mr. Hernández can help you to believe, to enjoy and to get yourself known, as your message will also resonate with your clients. Last but not least, space lawyers also have to think outside the specific text of regulations and understand the technical side of space matters and speak the language of the clients, who in most space-related cases are indeed engineers.

Mr. Zheng elaborated on Spacety's success in addressing the issue of space sustainability, which is that the subject has been in the forefront of the company since its

creation. Such awareness was due to the past experience and willingness of the co-founders, according to the scientist. In terms of cost, Mr. Zheng shared that when a manufactured de-orbiting device can be applied to small satellites it is less costly than to make unique thrusters for large satellites. In addition, Spacety also pays attention to creating awareness among its customers to pay attention to end-of-life practices.

The Q&A session of the afternoon event recording starts [here](#).

Summary of interventions

Throughout the morning and afternoon panel sessions of Event 1, the Guidelines that the commercial space sector referred to most frequently were Guideline C.1, Promote and facilitate international cooperation in support of the long-term sustainability of outer space activities. Guideline C.2, Share experience related to the long-term sustainability of outer space activities and develop new procedures, as appropriate, for information exchange; Guideline C.3, Promote and support capacity-building; and Guideline A.4, Ensure the equitable, rational and efficient use of the radio frequency spectrum and the various orbital regions used by satellites.

Important activities such as end-of-life disposal, international cooperation, sustainability on Earth, collision avoidance, active debris removal, reusability, etc. and related, awareness raising, and capacity building were described in relation to space sustainability.

Additionally, the view was expressed by some commercial space actors that self-regulation is not enough to keep our orbital environment safe and sustainable, and that is why there have been shared initiatives and collaborations of commercial space actors as the existing frameworks are not satisfactory to guide the private space sector on the sustainability path. It was suggested also to use some of the best practices from the initiatives and look to utilize existing data in a collaborative way.

The fine line between enabling and restriction was also a concern expressed by some of the smaller space companies – how to be able to sustain a private sector entity and still apply “green technology” to take care of the space environment. Local institutional support and incentives were brought up as possible ways to address such challenges. Enthusiasm was also considered to bring the entire space community together. As it was asserted, space is hard, but it is very exciting at the same time.

Global cooperation of the space industry was also highlighted as a potential incentive for future space sustainable practices, space sustainability requires a concerted effort by the global space community.