



Space Realities in the Twenty-First Century

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Space realities in the 21st century

The launch of Sputnik in 1957 gave birth to a new era, sparking a societal, cultural, and technical revolution. While little was understood about the transformative power of space assets early on, we have gradually come to discover its boundless potential, adding another dimension to the puzzle – economic revolution. Currently standing at over \$420 billion,¹ the space economy is booming and breaking records on a year-by-year basis. Its positive implications also extend much farther beyond the sector's revenues. In advanced economies, space assets underpin at least 10 percent of the Gross Domestic Product^{2 3 4} providing data, applications, and services for a better world. Humanity has become increasingly reliant on space activities across many aspects of daily life.

These developments have also led to an expansion of the space community. From a government-led sector, we have moved into an open and diverse industry of both state and non-state actors. The private sector is increasingly penetrating traditionally governmental domains and is also leading innovation and growth in many areas. For instance, commercial entities are quickly becoming the dominant providers of space launch services and operate most functional satellites. As we strive to bridge the space capabilities gap, the emergence and scaling up of novel avenues shine a ray of hope.

However, we must remain vigilant as New Space means opportunities but also represents certain challenges.

Underscored by views of legal and policy experts, governments, the private sector and other stakeholders, the current regime is insufficiently developed to address all aspects of the unprecedented, fast-paced progress. Such governance gap creates risks for the sustainability of space activities, raising eyebrows across but also beyond the space community. As space has become a game-changer and the cornerstone of modern society, even slight disruptions of critical services could cause significant problems on Earth.

The governance gaps in the booming space industry

One of the main issues is that of space debris. While exchanges on this challenge have been going on for decades, its population has been growing across all orbital regions,⁵ especially in the low Earth orbit (LEO). This worrying trend is likely to amplify in the not-so-distant future. To date, over 11 thousand objects have been launched into space, but the annual distribution is far from equal. While prior 2012, no more than 200 objects were launched in any year, in 2020 the space community hit the record with 1,264⁶ underscoring the rapid pace of progress, especially in the satellite manufacturing and launch industries (see Figure 1). This figure represents over 10 percent of all objects launched since 1957.

Considering the plans for this decade, especially in the emerging realm of mega-constellations, we can, with a certain degree of confidence, expect even higher figures. Projects with thousands of satellites are now planned on paper and some are already being deployed to space.

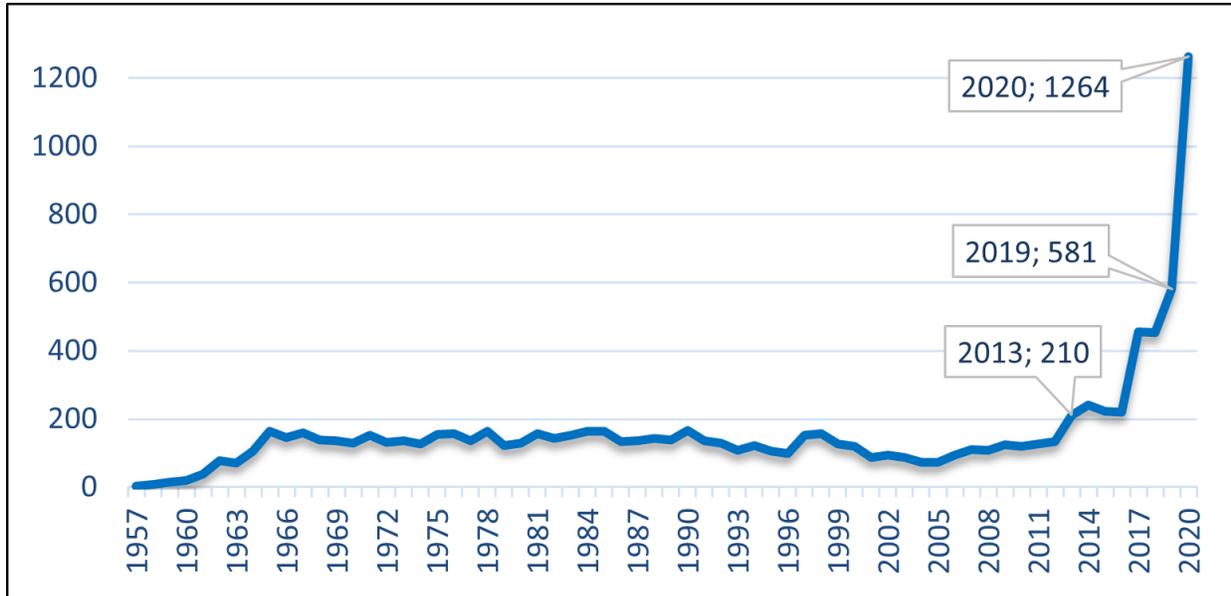


Figure 1: Number of functional objects launched annually since 1957 (Credit: UNOOSA)

If unregulated, they could exacerbate the existing sustainability challenges. The problem of rapid deployment rests especially, but not solely, in the disposal of non-functional objects which remain in orbit after their projected lifespan. Disposal rates of space objects oscillate at around 60%,⁷ far below what will be required for responsible management of the orbital density. According to research conducted by NASA and published in the *Orbital Review Quarterly*,⁸ the cumulative number of objects in LEO will grow, albeit slowly even at 99 percent post-mission-disposal, and with it the probabilities of collisions (see Figures 2 & 3).

Stakeholders have been gradually improving capabilities to monitor the space environment and some of the recently launched satellites possess automated collision avoidance systems. Even this, however, might not be enough to avoid damages. The population of space debris varies in size and the smaller the debris, the harder it is to reliably keep track of. The risk also stems from

different probability assessments that can guide operators towards incompatible decisions, prodding one to act while the other to remain idle. In addition, in case two debris objects find their orbits on a collision course, the space community is rendered a mere spectator.

Communication also remains a challenge. Still predominantly undertaken via inefficient forms such as emails, it renders the avoidance process largely manual and ad hoc decision-making less agile and efficient. In the past, we have already seen correspondence malfunction causing an issue in determining the best possible approach during collision alerts.⁹

The growing density of the orbital environment also translates into additional costs. Investments of financial, human and technological capital are necessary to reinforce monitoring, modeling and communication. When the decision is made to conduct a maneuver, it will likely lead to a reduction in the operational lifetime of a spacecraft,

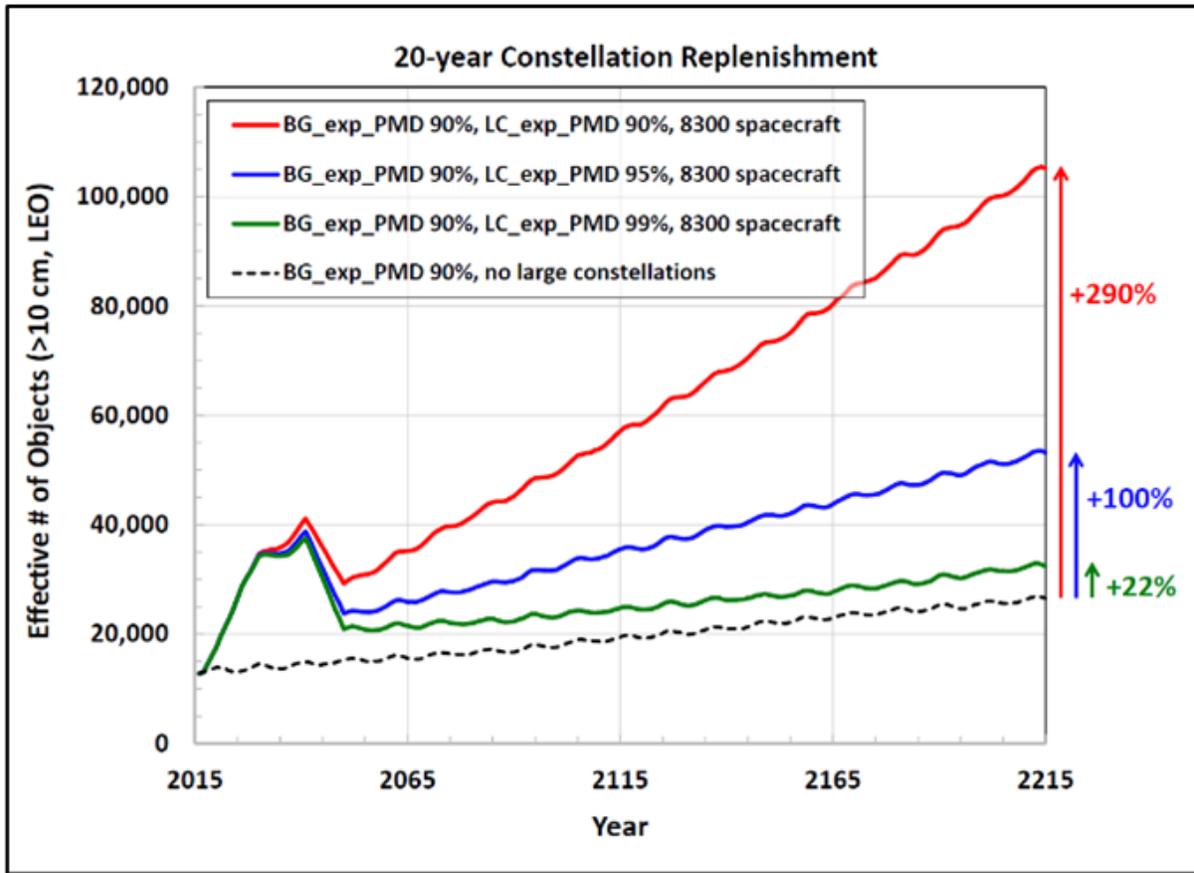


Figure 2: Cumulative number of Objects in LEO >10cm

adding another layer of complexity into the decision-making and coordination.

Creating global rules of the orbit

The growing complexity that defines the contemporary space sector demands ever more thorough scrutiny of the existing normative framework to ensure it remains fit for purpose across legal, political, scientific, and technical domains. These new realities are compelling the international space community to consider the establishment of a system for more efficient management and coordination across the full cycle of space operations. This global space traffic management will strive to seek answers for maintaining a safe, secure, and sustainable space.

Reviewing and complementing the existing governance mechanisms to address emerging issues simply cannot be unilateral. Such an approach could fuel the creation of laws and policies fitting only the needs of an individual state or stakeholder while being detrimental to the activities of others. Considering the unique nature of space, an environment in which the action of one actor ultimately influences everyone else, negotiations and exchanges on these topics must be as inclusive and open as possible, welcoming views of all actors, state and non-state alike. Ensuring that all voices are heard is the only means towards prosperity through sustainability and responsibility.

United Nations as the hub for managing New Space

The United Nations has served as the main platform to facilitate multilateral exchanges on space affairs. Its Committee on the Peaceful Uses of Outer Space considers emerging space trends and has been instrumental in creating the existing soft and hard law instruments. The consensually based decision-making at COPUOS provides for widely accepted multilateral

topics relevant to the global space traffic management and other mechanisms relevant for guiding the behavior in the era of New Space.

Complementary to the efforts of COPUOS, the Office for Outer Space Affairs conducts activities to raise awareness of and promote responsible behavior in space as a global common. Ensuring that the development of the new “rules of the orbit” is as inclusive as possible, UNOOSA launched the World

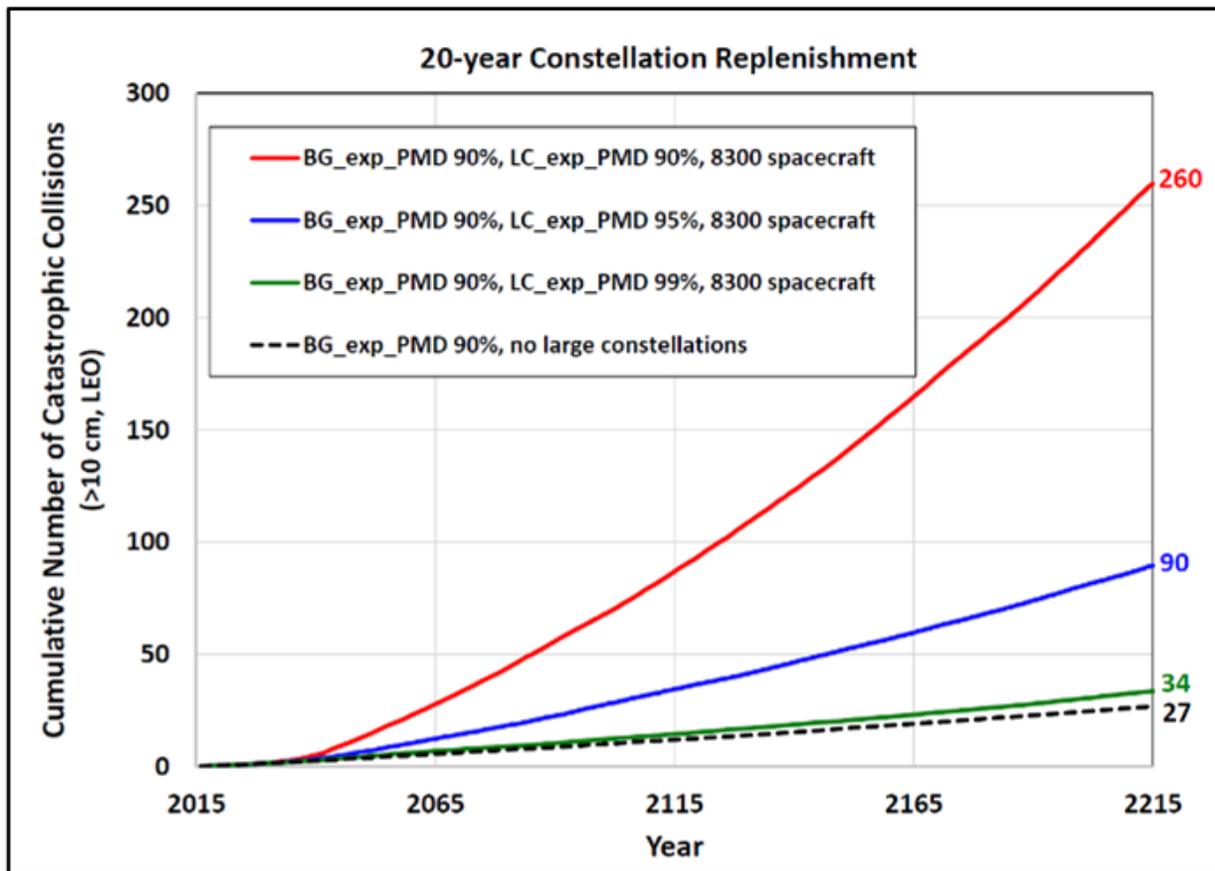


Figure 3: Cumulative number of Catastrophic in LEO Collisions (Credit: NASA ODPO)

outcomes. The adoption of the Space Debris Mitigation Guidelines and the Guidelines for the Long-term Sustainability of Outer Space Activities underscores its prominent role and the appetite of stakeholders to find new solutions to arising challenges. Deliberations have been ongoing also on

Space Forum series in 2019. As a holistic, multi-stakeholder conference, it brings together actors from across the society with a common purpose – building a prosperous and sustainable space sector.

UNOOSA is also delivering support to put policy achievements into practice.

Through targeted and tailored capacity-building activities, we help ensure space operations undertaken by new stakeholders uphold the existing provisions. The Space Law for New Space Actors project supports emerging space players in implementing existing governance mechanisms. Moreover, UNOOSA recently launched Promoting Space Sustainability Project for awareness-raising and capacity-building helping to connect the dots around the long-term sustainability of outer space activities. Delivering predictability to the global space economy needs is integral for sustained growth in the years to come.

Historically, the United Nations has played a critical role in developing rules for traffic on the road, the seas and in the air. Looking forward, international cooperation and coordination must sit at the center of efforts in creating such rules for the space environment, accentuating the need for the continuation of the United Nations' role as the hub for development and implementation of space solutions. Through its unique position at the UN as well as vis-à-vis the external stakeholders, UNOOSA stands ready to support these processes as it strives to create an environment with universal access to space benefits through responsible and sustainable behavior.

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Endnotes

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- 2 ESPI (2017) Yearbook on Space Policy 2017: Security in Outer Space: Rising Stakes for Civilian Space Programmes, p. 260.
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