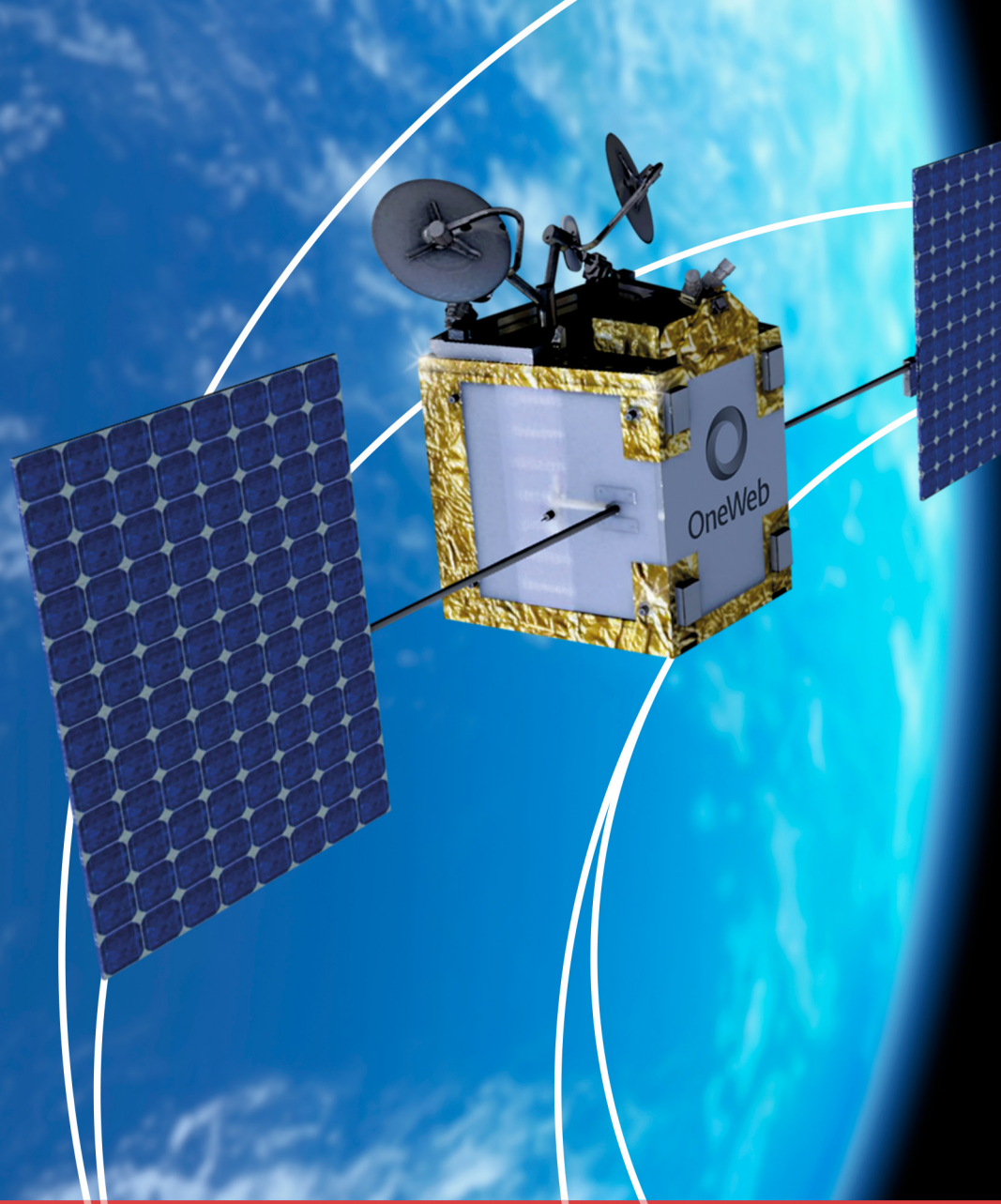
OneWeb

Global space-based connectivity



White paper

The case for tying Responsible Space to market access

Connect with OneWeb

The case for tying Responsible Space to market access

An opportunity to take the lead by advancing sustainable, global, space-based services

A call for forward-looking regulatory frameworks to support growth of the space sector.

Leadership in Responsible Space must encompass the adoption of responsible design and operational practices alongside market access incentives.

Recent years have seen the introduction of a new era of commercial space activity, driven by advancements in technology, increases in private investment, and reductions in satellite manufacturing and launch costs. Small satellites are being launched in unprecedented numbers, and proposals for large, low-Earth-orbit (LEO) constellations are a reality.

This new era of space activity is expanding space-based global communications, remote sensing, and a host of novel services that promise new opportunities for economic development, global education, rural healthcare, location-based services, and advancements in environmental science.

For the global space economy to flourish and to realize these opportunities, we must preserve a safe operating environment.

However, this era is also marked by elevated concerns over space sustainability and the safety risks posed by an increasingly congested operating environment. Space surveillance networks now track more than 23,000 debris objects 10 cm in size or larger that are catalogued and tracked for purposes of collision avoidance. However, there are estimated to be roughly 500,000 objects 1 cm in size and upwards of 100 million debris objects at least 1 mm in size, that still possess enough impact energy to disable a satellite. These figures do not account for the recent ASAT destruction of COSMOS 1408.

> "Millions of pieces of space junk orbiting the Earth present a significant threat to satellite systems which provide the vital services that we all take for granted - from mobile communications to weather forecasting."

Alok Sharma, Former UK Secretary of State, Department for Business, Energy and Industrial Strategy and President for COP26

These all pose real collision hazards that threaten the global space economy, and disrupt the services people benefit from today and in the future. They carry implications for nations that hope to make use of new capabilities, for investors and insurance underwriters, and they increase overall business risk. Growing awareness of this problem has heightened the call from stakeholders to safeguard space operations.

Space is a global natural resource

Avoiding a tragedy-of-the-commons requires all stakeholders to act responsibly. Widespread adoption of progressive debris mitigation measures will necessitate government engagement and international coordination for national regulatory administrations to establish consistent licensing rules and create a level playing field for industry.

Progress requires leadership

A new era of space commercialization is already upon us and can improve lives in a number of important ways and solve present day challenges. However, the existing regulatory frameworks do not support responsible growth of this industry.

Small satellites and constellations are already deploying in large numbers under inconsistent rules, and government regulators are reluctant to impose restrictions that might put industrial players within their jurisdictions at a competitive disadvantage. Meanwhile, more forward-looking proposals are coming from commercial industry, often featuring companies advocating for higher standards and looking to their government counterparts for support.

Common-sense principles of responsible behaviour alone are not enough to ensure sustainable growth in the space-economy.

Advocating for better, more uniform safety practices does not require draconian measures and overly burdensome or overly prescriptive regulation. It simply requires a fresh assessment of the industry trends and practices and suggests that operators be held accountable for their behaviour .

The most urgent space safety imperative is the adoption of responsible design and operational practices. Principal safety themes include:

Reliability: Satellites shall be subjected to rigorous ground qualification programme, particularly when developing large satellite systems.

Control: Operators shall be responsible for being able to identify their assets, know where they are, and control their trajectories.

Coordination: Operators shall share orbit information and manoeuvring plans with other operators and coordinate to avoid collisions.

Disposal: Upon decommissioning LEO operators shall promptly, reliably, and safely deorbit their hardware.

Safety-by-Design: Orbits and constellation shall be designed to minimise the number of satellites in orbit.

1 Space Situational Awareness (SSA) & Space Traffic Management (STM)

Collision avoidance has received much of the attention in recent years, with many focusing on improvements in Space Situational Awareness (SSA), Space Traffic Management (STM), and coordination between operators. And while these all contribute to safety, overall mission-terminating collision risk for a satellite in LEO is dominated by debris that is too small to be mitigated by active collision avoidance measures. Our only option for addressing this risk is to prevent the generation of small debris in the first place.

The key to effective SSA and STM remains an open cooperation between operators and various SSA systems. Satellite operators shall list their contact information with platforms like SpaceTrack to make sure all other operators can contact them to coordinate any possible conjunctions. Such transparent coordination should include publication of satellite Two Line Elements (TLS), ephemeris and covariance with space controllers (e.g. JSpOC) and publicly accessible platforms (e.g. CelesTrack).

When necessary, operators shall also hold coordination/awareness briefings with each other to confirm the actions each will take in the event of a possible conjunction. More specifically, satellites that use systems where manoeuvre decision are made on-board shall always have the ability to turn off their autonomous system to allow other satellite owner/operators to manoeuvre if needed.

2 Assisted Disposal and Removal (ADR)

While satellite reliability and safety-by-design remain the foundation of the behaviour of any responsible operator, several ADR mission demonstrations are advancing the technical developments required to deorbit an uncontrollable satellite. Still In Orbit Servicing (IOS) remains an uncharted territory, as no private company has ever docked, serviced and deorbited LEO satellites.

Satellite operators must work together with regulators and ADR service providers to develop the legislative and technical ecosystem with the objective to foster diversity of technical solutions and new commercial business models.

3 Radio astronomy

OneWeb has been involved in coordination discussions with the National Science Foundation (NSF) acting on behalf of the radio astronomy sites listed in US131 (all of which are facilities of NSF) concerning the protection of these sites in the USA arising from the Ku-band and Ka-band transmissions of the core OneWeb system. OneWeb and NSF have reached agreement on core principles of the coordination and are in the process of finalizing the agreement, which will be signed by NSF and appropriate astronomy facility directors. Responsible operators shall commit to finding ways to coexist with radio astronomy observatories, protecting radio astronomy sites and going forward working together to find mutually acceptable, creative solutions regarding dynamic coordination.

4 Optical astronomy

Responsible operators must acknowledge that satellites and large constellations can potentially affect large field of view observatories. Operators shall also strive to mitigate the brightness of the satellites as seen from the ground minimising the impact on night sky observers ensuring that naked eye visibility (V) is avoided (V > 7.0 mag) and the predicted visibility as function of the orbital altitude is:

$V > 7.0 + 2.5 \log_{10}$ (altitude km / 550 km)

As part of the satellite design and development phase, reflectance simulation analysis shall be performed as part of the satellite design and development phase. OneWeb has been conducting a series of observations in partnership with professional astronomers targeted at measuring the brightness of our constellation in the night skies. The data will be used to generate a correlated model that will guide the design choices of the next generation of OneWeb satellites.

Providing access to high accuracy public data on predicted locations of individual satellites (or ephemerides) is key. This will enable the real-time use of high-accuracy public data on satellite locations to adjust observational strategies and minimise the disruption on the observations.

The NSF coordination discussions also recognize separate work between OneWeb and NSF's NOIRLab, the entity responsible for key optical telescopes in the USA, to work together to assess and limit the impact of optical reflections from the OneWeb on astronomical observations. This coordination activity will be fully taken into account in the design of the second generation OneWeb satellites.

5 Carbon footprint

Space industry shall commit to play an active role in the reduction of Carbon Footprint across the supply chain.

Responsible operators shall establish appropriate systems for the collection, aggregation, and analysis of quantitative data for determination of Greenhouse Gasses (GHG) emissions for the stated period and boundaries and engage with institutions like the World Economic Forum (WEF), which is working with the École Polytechnique Fédérale de Lausanne (EPFL) on the definition and adoption of a self-certifying Space Sustainability Rating (SRR).

OneWeb engaged Carbon Footprint Ltd to verify its carbon footprint assessment and supporting evidence for the period 1st January 2020 to 31st December 2020 with a Carbon Footprint Verification Report for OneWeb Issued in July 2021. As demonstration of our commitment, OneWeb has also included the Carbon Footprint Guidelines in the design request for our next generation satellites (Gen2).

The current situation drives the necessity for national administrations to have a global impact. Nevertheless, the call for stronger rules is far from uniform.

Market access and access to finance are powerful mechanisms for leveraging national policy to influence global behaviour.

Tying safety requirements to national market access licenses is an effective way to encourage higher standards from every operator wishing to provide in-country services; regardless of the jurisdiction that issued the launch and operations license, or that sponsored the spectrum authorization with the ITU.

This will create a more level playing field for industry and will allow a national administration to uphold high standards in its own country without fear of applicants looking to locate in more lenient jurisdictions.

Leadership by individual national regulatory administrations is a catalyst for international coordination.

The UK Space Industry Act, which came into force in July 2021, includes provisions in law for the regulation of space activity to ensure the safety, security, and sustainability of the orbital environment. Specifically, it places a legal duty on the regulator to address debris mitigation (including compliance with international guidelines) when licensing UK satellite operators. Further, the recent UK National Space Strategy includes a specific objective for the UK to 'lead the global effort to make space more sustainable'. This follows agreements between the UK and UN signed in January and October 2021 to support international efforts to promote space sustainability – including the UK directly funding international collaborative projects to advance global awareness on responsible space and implement the UN Guidelines for the Long-term Sustainability of Outer Space Activities.

In 2004, the US Federal Communications Commission (FCC) adopted rules that require satellite applicants to disclose their detailed plans to mitigate orbital debris and adopted a post-mission disposal requirement for GSO space stations. These rules were updated in 2020 to apply metrics and methodologies in many areas, such as specifying that large object collision risk must be less than 1 in 1,000 over the satellite lifetime, and to address the significant increase in the number of LEO satellites. The revised rules draw from the US's Orbital Debris Mitigation Standard Practices (ODMSP) that aim to limit the generation of new, long-lived debris by the control of debris released during normal operations, minimising debris generated by accidental explosions, the selection of safe flight profiles to minimise accidental collisions, and safe post mission disposal of space structures.

France has already demonstrated to the world that strict adherence to debris mitigation rules does not negatively impact national industry nor lessen the number of foreign operators willing to provide services in-country. The French Space Operation Act (FSOA), which came into force in 2008, requires all space operators (satellite manufacturers, satellite operators, and launch vehicle service providers) subject to its provisions, to adhere to its debris mitigation rules, with no evidence of stifling competitiveness or innovation. The revision of the FSOA currently being discussed aims at further strengthening its legal and regulatory framework, for the benefit of space sustainability activities.

Recommendations to regulators

As a leader in Responsible Space, OneWeb is sharing a series of recommendations to regulators and policymakers, which if tied to market access and access to finance, will act as catalyst for the good stewardship of low Earth orbit. This approach will also minimise the risk that the suggested provisions might result in flags-of-convenience filings.

Lifetime

1. Post Mission Disposal (PMD) requirement shall be reduced from 25 years to 5 years.
2. The satellite shall be designed so that, once it has completed its operational phase, it shall be decommissioned with controlled deorbit.
3. The satellite shall be designed so that it can be passivated before losing contact with the satellite: (i) all the on-board energy reserves are permanently depleted or placed in such a condition that they entail no risk of generating debris, and (ii) all the means for producing energy on-board are permanently deactivated.
4. Operators shall disclose if they plan to release deployment devices to lower the orbit at end of life.

Collision avoidance

5. Introduce strict space and launch license regulations, prohibiting the launch of satellites without propulsion systems above a certain altitude (e.g. 400 km).
6. Operators shall disclose the extent of manoeuvrability of planned satellites, including the description of the expected manoeuvring methods and capabilities, as well as propulsive technologies.
7. Require the deployment of comprehensive Collision Avoidance capabilities through responsive, reliable, and robust onboard resources.
8. If an operator uses on-board autonomy for collision avoidance manoeuvres, they shall publish the details so other operators understand how their satellites will move and what the decision timeline is. The autonomous feature shall be able to be disabled if necessary.
9. Operators shall establish collision risk calculations with large-objects on an aggregate basis.

Space Traffic Management

10. Space is a common global resource that shall be safeguarded in line with a less-is-more approach. Operators shall be incentivized to launch fewer satellites.
11. Operators shall design for smaller constellations. Larger constellations shall be disincentivized by their ITU administrations
12. Prevent orbit altitude overlap for constellations greater than 10 satellites.
13. Incentivize coordination among operators and satellites' owners.
14. Operators shall provide access to high accuracy public data on predicted locations of individual satellites, ephemerides, manoeuvre plans and relevant safety information in near real time to minimise the chance of collisions.
15. Codify STM rules, thus simplifying options for manoeuvres between active satellites.

Assisted Disposal and Removal

16. Satellites operating in high-LEO orbits shall be designed accommodating features that will facilitate the docking from In-Orbit-Servicers to facilitate post mission disposal for defunct or uncontrollable satellites.
17. Incentivize operators and administrations to launch as few satellites as possible.

Reliability

18. Operators shall demonstrate a minimum reliability figure before launch and vetted by an independent authority (e.g. National Space Agencies), as satellites with undemonstrated or low reliability levels can become uncontrollable.
19. Operators shall demonstrate limited risk from accidental explosions and associated orbital debris throughout the mission phases with the adoption of US Orbital Debris Mitigation Standard Practices (ODMSP) standards for calculating the probability of accidental explosion metric on an aggregate basis

Green launchers

20. Upper stages and dispensers shall be de-orbited after with a controlled procedure.
21. The re-use of first stages shall be incentivized.

Optical astronomy

22. Operators shall develop brightness prediction models of their satellites and share their orbital position.

Radio astronomy

23. Industry shall develop brightness prediction models for their satellites and operators shall share their orbital positions.

Responsible Space

OneWeb's Responsible Space initiative sets out a framework of principles and best practice. The fundamental premise is that Space is a shared, natural resource which, if used responsibly, can help transform the way we live, work, and interact.

Responsible Space builds on and strengthens work already being done within the broader Space community to address this important issue.

At OneWeb, we apply the principals and values of Responsible Space into all areas of the business.

About OneWeb

OneWeb is building a communications network operating from space that will provide connectivity to communities, businesses and governments - reaching regions previously unconnected, such as rural and remote communities, but also in the air, and at sea.

OneWeb is launching and operating a constellation of low Earth orbit (LEO) satellites, together with a global network of gateway stations and a range of user terminals, to provide fast, high-bandwidth and low-latency communications services, for fixed and mobile communications, connected to the IoT future and a pathway to 5G.

OneWeb

Find out more at:

www.oneweb.net/responsible-space

communications@oneweb.net

@oneweb | #ResponsibleSpace

