

Global Efforts on Space Sustainability: Moving From Awareness to Action

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About Secure World Foundation



- **SWF is a *private operating foundation* that promotes cooperative solutions for space sustainability.**



- **Vision:** The secure, sustainable, and peaceful uses of outer space that contribute to global stability on Earth.



- **Our mission:** Work with governments, industry, international organizations, and civil society to develop and promote ideas and actions to achieve *the secure, sustainable, and peaceful uses of outer space* benefiting Earth and all its peoples.

What is “Space Sustainability”?

- Lots more stuff happening in space
 - Growing number & diversity of space actors (governments and commercial companies)
 - Growing number & diversity of space activities
- Negative externalities could have widespread impacts for everyone
- Very few hard “rules” about what is and isn’t allowed

How do we balance continued growth and innovation with ensuring space remains usable for current and future generations?

Space Sustainability Challenges



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Human-generated space objects

	Active Satellites	Orbital Debris
United States	6,417	5,892
China	844	4,469
United Kingdom	671	26
Russia	261	6,920
Japan	108	213

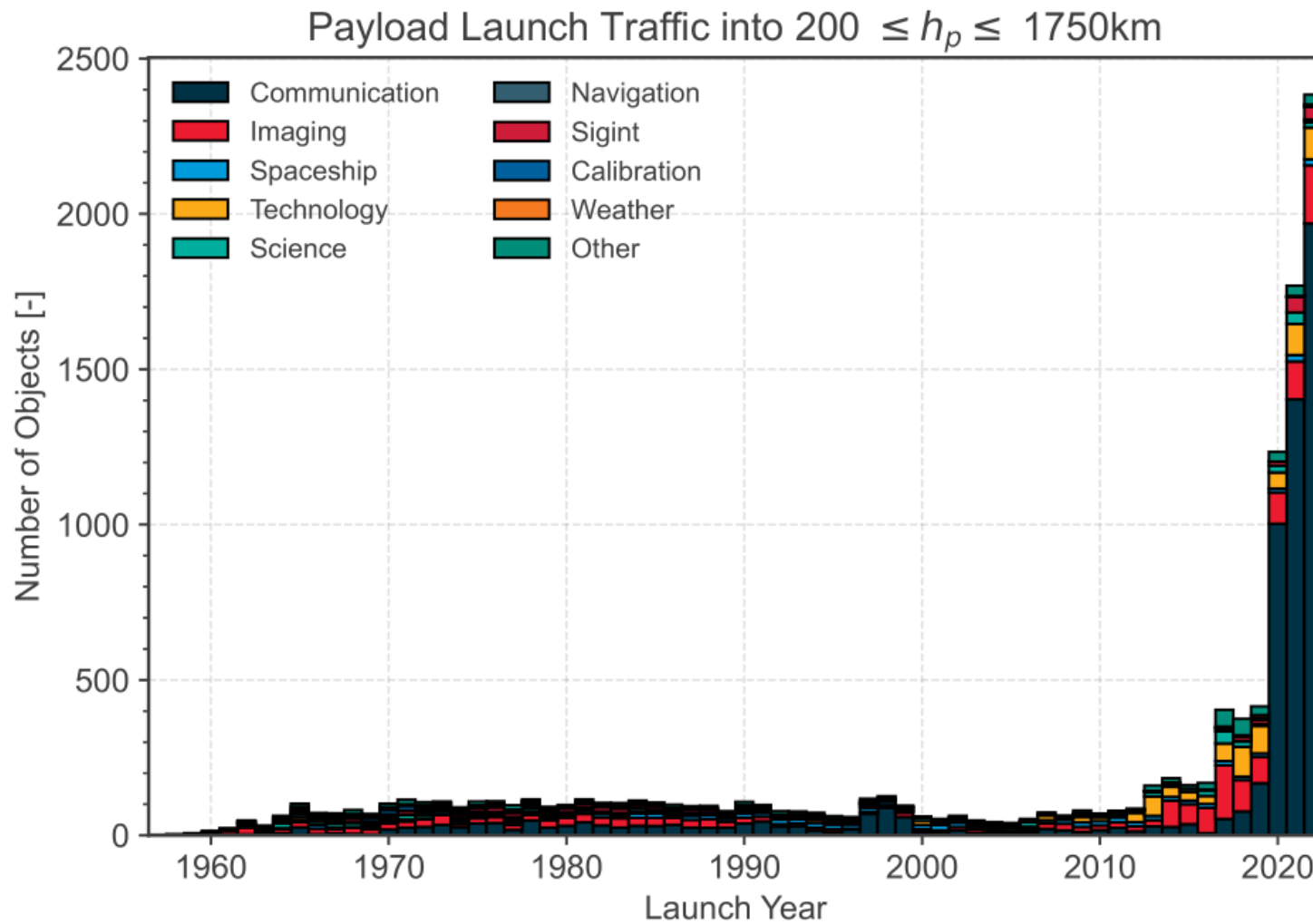
Current through 1/20/2024

Source: [Celestrak](#)

Orbital Debris		
Larger than 10 cm	~20,000	Sources of new debris
Between 1 and 10 cm	~850,000	Can cause major damage
Smaller than 1 cm	Many millions	Can cause minor damage

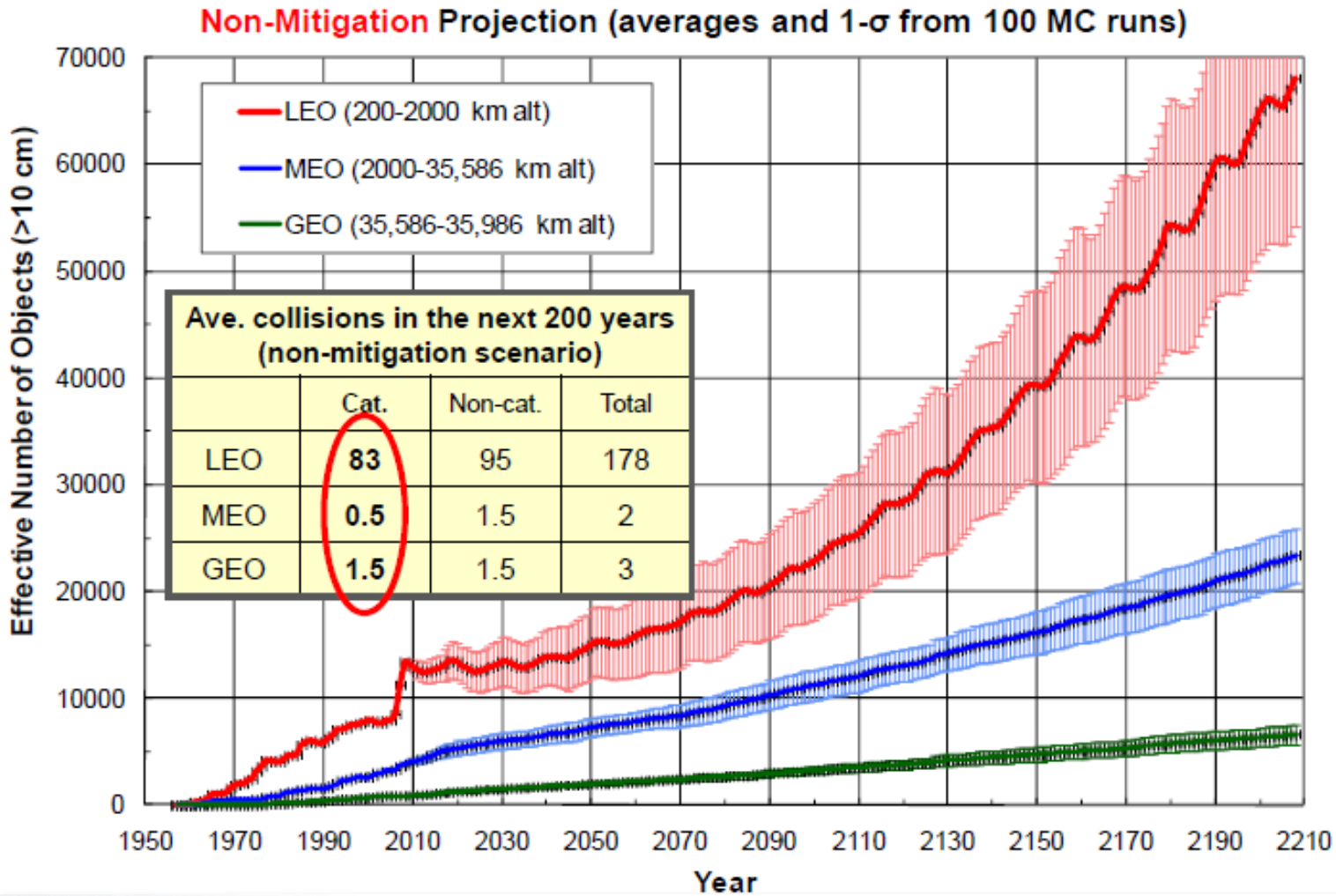
Source: Data compiled from U.S. Space Command, NASA, and ESA.

Recent Rapid Growth



Source: [ESA Space Environment Report \(2023\)](#)

The next 200 years, if things stay the same

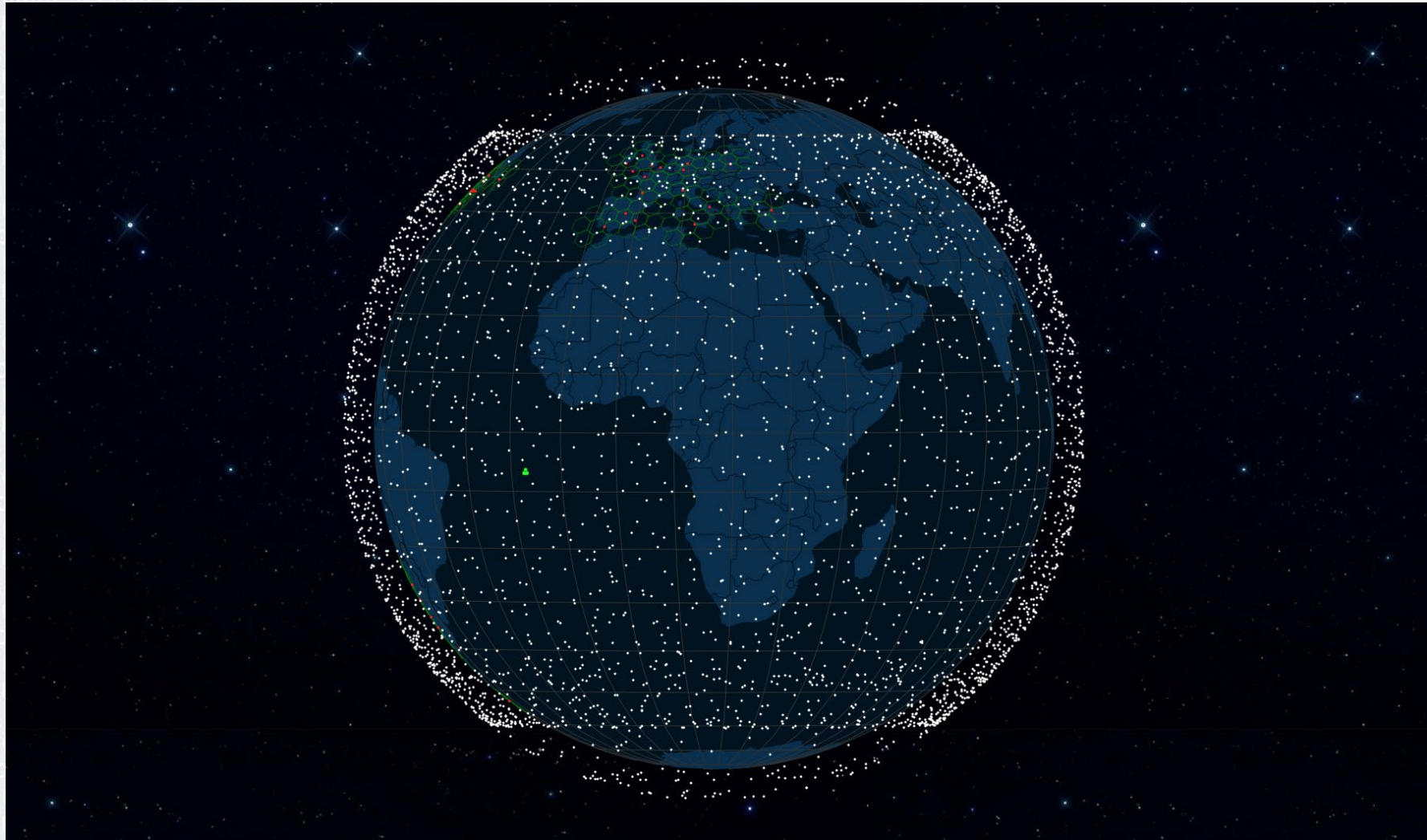


Source: J-C Liou, NASA Orbital Debris Program Office (2009)

Planned Large Constellations

Constellation	Total Satellites Planned	Altitude	Country	Status
OneWeb Gen1	716	1,200 km	UK	640 launched 620 operational 6 re-entered
OneWeb Gen2	6,372			Planning
Starlink Gen1	4,408	540 – 570 km	US	4,015 launched 3,549 operational 361 re-entered
Starlink Gen2A	7,500	523 – 530 km	US	1,724 launched 1,107 operational 26 re-entered
Starlink Gen2	22,488	328 – 614 km	US	Planning
Kuiper	3,232	590 – 630 km	US	2 launched
Lynk	2,000	450 – 500 km	US	8 launched 4 operational
AST SpaceMobile	243	700 km	Papua New Guinea	1 launched
Lightspeed	1,969	1,015 – 1,325 km	Canada	First launch 2024?
Xingwang	966	880 – 1,110 km	China	15 launched 9 operational
Guanwang (GW)	12,992	590 – 1,145 km	China	Planning
Cinnamon/eSpace	327,320	550 – 638 km	Rwanda	Filed

Current Starlink constellation



Source: [Satellitemap.space](https://satellitemap.space)

Current ITU issues

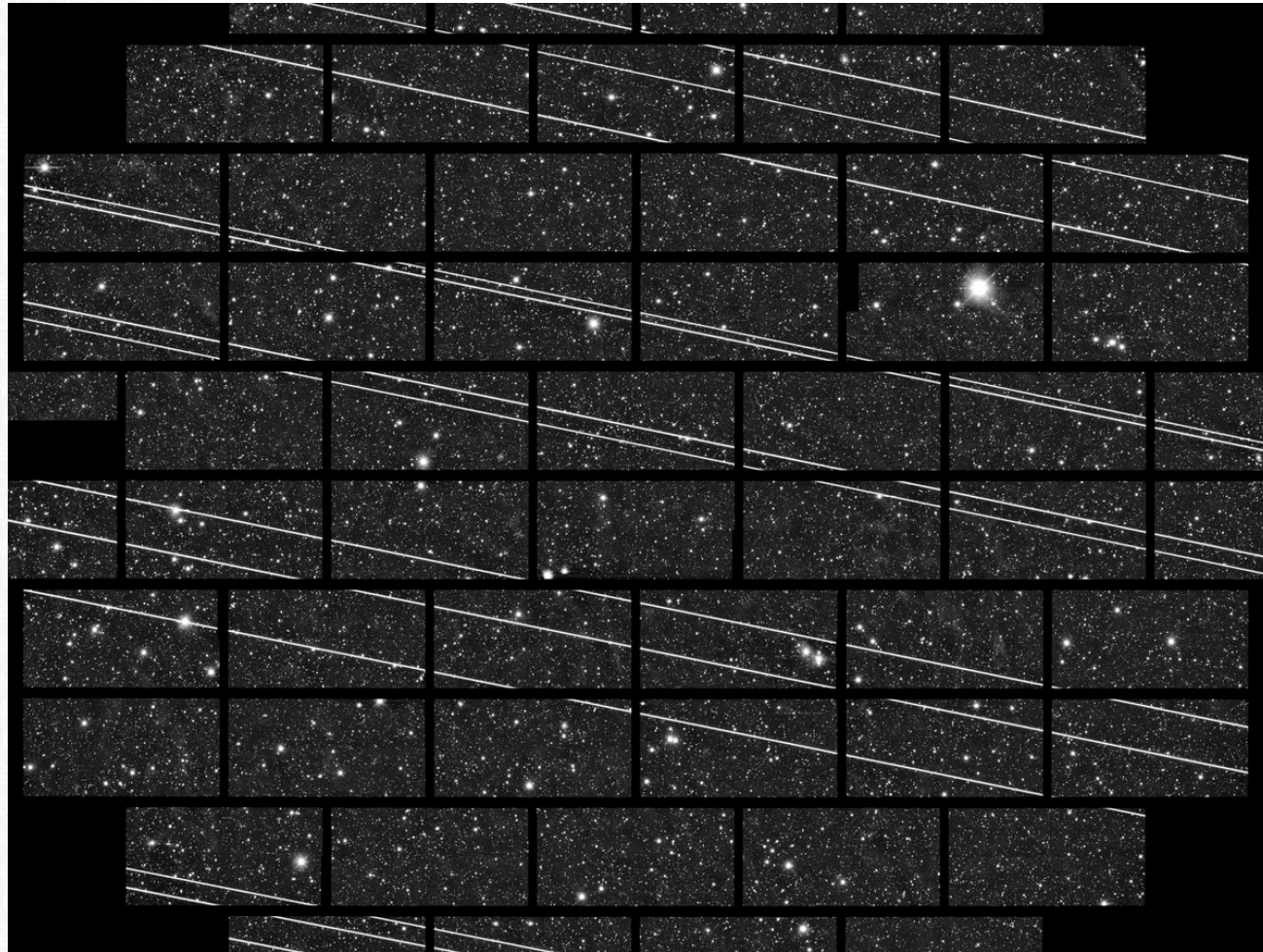


Orbital Spectrum Clash

Satellite operators mostly held off attempts from terrestrial telcos to encroach on their radio waves at the 2023 World Radiocommunication Conference (WRC-23) in Dubai, but a battle between orbits continues after one of the space industry's most contentious clashes for spectrum yet.

- Managing potential interference between GEO and NGSO
- Orbital separation for NGSO constellations
- Reallocation of space spectrum for terrestrial 5G
- Protection of radio astronomy

Light Pollution?



Starlink satellites captured by a telescope in Chile. Source: [The Atlantic](#)

Sustainability Initiatives

International Legal Framework

- Under the Outer Space Treaty of 1967, each Launching State is responsible for **authorization and continuing supervision** of their national space activities
 - Includes both government and private sector activities
- Each Launching State is also liable for damages their space activities **cause**
 - Absolute liability for damages to people and property on the ground, aircraft in flight
 - Fault-based liability for damages to other space objects

Nation States are key to managing space sustainability challenges

Multilateral Initiatives (1)

- International guidelines for Orbital Debris Mitigation
 - Limits debris created through launch, on-orbit, and re-entry operations
 - Developed by the [Inter-Agency Debris Coordination Committee \(IADC\)](#), which includes all major space agencies
 - Voluntary at the international level (several countries have implemented through national policies/standards/legislation)
- [ESA Zero Debris Approach](#)
 - Set of recommendations to achieve ***zero creation of new debris by 2030***
 - Applies to ESA member States and their national private sector activities
 - Developed the [Zero Debris Charter](#) as a set of voluntary targets to help build international support in achieving the Zero Debris goals

Multilateral Initiatives (2)

- UN Committee on the Peaceful Uses of Outer Space (COPUOS)

- Guidelines for the Long-term Sustainability of Outer Space Activities (LTS)

- *21 guidelines adopted in 2019 by 92 Member States and endorsed by the UN General Assembly*
- *Policy and regulatory, Safety of space operations, Cooperation and capacity-building. Scientific and technical R&D*

- LTS “2.0” Working Group (2022-2026)

- *Focus is on reviewing the implementation of the existing LTS guidelines*
- *Is not chartered to develop new guidelines*

- Dark and Quiet Skies

- *Agenda item for 2023, but unclear if it will continue in 2024 (geopolitical debate)*

Private Sector Initiatives (1)

- Space Data Association

- Not-for-profit entity created in 2009 by major satellite operators that provides value-added services for close approach warnings and radio-frequency interference

- Space Safety Coalition

- Group of 40+ “like-minded” companies and NGOs that developed best practices for sustainable space operations and pledge to abide by them

- CONFERS

- Industry association of 50+ companies that are developing best practices and standards for satellite servicing

Private Sector Initiatives (2)

- **Satellite Industry Association**

- Released a set of [Principles of Space Safety for the Commercial Satellite Industry](#)

- **[Space Sustainability Rating](#)**

- Managed by EPFL Space Center, the SSR is a tiered scoring system to quantify and measure sustainability decisions taken by operators.

- **[AIAA Satellite Orbital Safety Best Practices](#)**

- Developed by AIAA, Iridium, OneWeb, and SpaceX and contains best practices for low Earth orbit (LEO) operations

- **Paris Peace Forum [“Net Zero Space”](#)**

- Multi-stakeholder platform that aims to achieve sustainable use of outer space by 2030 by mitigating the production of new orbital debris and remediate existing ones

Private Sector Initiatives (3)

- Earth and Space Sustainability Initiative

- Developing Environmental, Social and Governance (ESG) space sustainability standards to inform the finance and insurance communities and policymakers

- Global Satellite Operators Association (GSOA) Code of Conduct on Space Sustainability

- Set of recommended best practices to mitigate the risk of in-orbit collision, minimize the threat of non-trackable debris, protect humans in space and limit effects on optical astronomy

- Astra Carta

- Led by His Majesty King Charles III's Sustainable Markets Initiative, it lays out a roadmap for the private sector to lead the acceleration of sustainable practices across global space-related industries


Challenges

- Is there a limit to the “carrying capacity” of Earth orbit?
- What do we do about sustainability of emerging cislunar and lunar space activities?
 - Should we have the same “learn from our mistakes” approach?
- What are the impacts of greatly expanded space activities on the Earth’s atmosphere?
- How to overcome the obstacles imposed by Great Power geopolitics?
 - Major powers cannot agree on much of anything, which has created gridlock in multilateral fora
 - What is the appropriate role of the private sector?

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