

Regulatory Frameworks for a Thriving Circular Space Economy

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ClearSpace develops core In-orbit Services capabilities

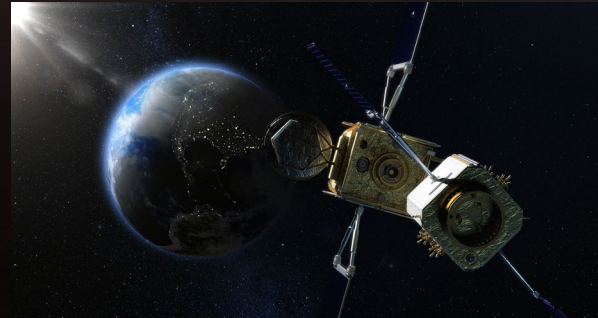
Addressing all verticals of a \$10 B market opportunity*



Active Debris Removal

Failed satellites
Spent rocket bodies

*ClearSpace-1
ADRAS-J*



Mission Extension

Attitude control
Station-keeping
Refueling

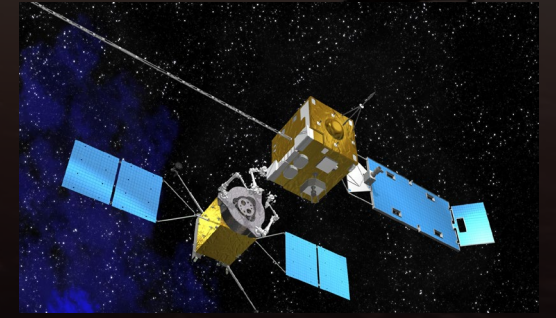
*Northrop Grumman MEV-1 (2019-
2025)*



Transport Logistics

Last-mile deployment
Relocation

*NanoRacks, Sherpa,
D-Orbit ION*



Repair & Construction

Inspection
Component replacement
In-space manufacturing

*So far all in-orbit repairs have involved
astronauts on shuttle missions
(1992-2003)*



Essential Technologies Core Competencies

ClearSpace is building the capabilities to deliver services in orbit to make the space infrastructure safer, more sustainable and more resilient



Machine learning
navigation &
autonomy



Space
robotics



Mission &
system
engineering



Low-cost
sensors



Impact
communication



Ground
mission
operations



Industrial team
& partners
management

A European company quickly expanding globally



Team members joined from

Logos of partner companies: ESA, NASA JPL, OHB, AIRBUS, Honeywell, TELESPAZIO, eutelsat, LOON, OneWeb, DLR, ThalesAlenia Space, TESLA, ORBCOMM, Together ahead. RUAG, SES, SURREY.

110
ClearSpace team members

5
Offices in Switzerland, UK, Germany, Luxembourg & USA

1500+
Years of combined experience in space engineering

An illustration of the ClearSpace-1 mission. A robotic arm with 'OMEGA' written on it is holding a large, white, spherical payload adapter. The background shows the Earth's horizon and the blackness of space.

CLEARSPACE-1 Debris removal

Removal of a payload adapter
Commissioned by the European Space
Agency (ESA)
Supported by mission elite partner
Omega

Flight: end 2026

An illustration of the CLEAR mission. A robotic arm is shown removing a rectangular satellite component from the exterior of a larger spacecraft. The Earth is visible in the background.

CLEAR Debris removal

Removal of two UK-licensed spacecraft
Phase B contracted by the UK Space
Agency

Flight: end 2026

An illustration of the ENCORE mission. A robotic arm is shown extending towards a satellite in geostationary orbit. The satellite has a gold-colored body and various instruments.

ENCORE Life extension

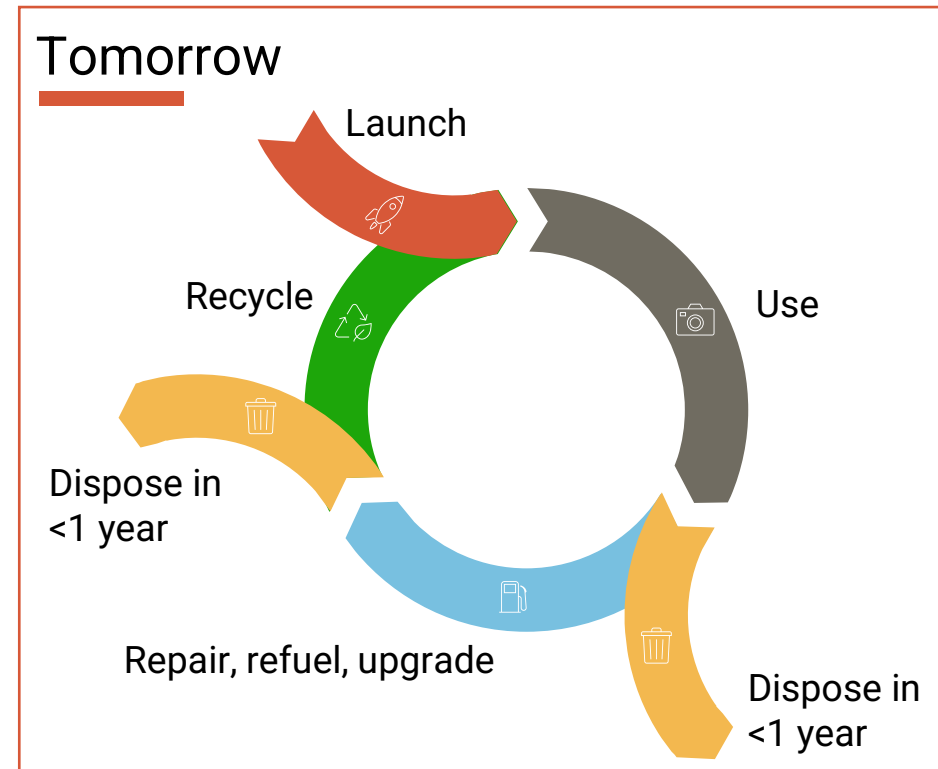
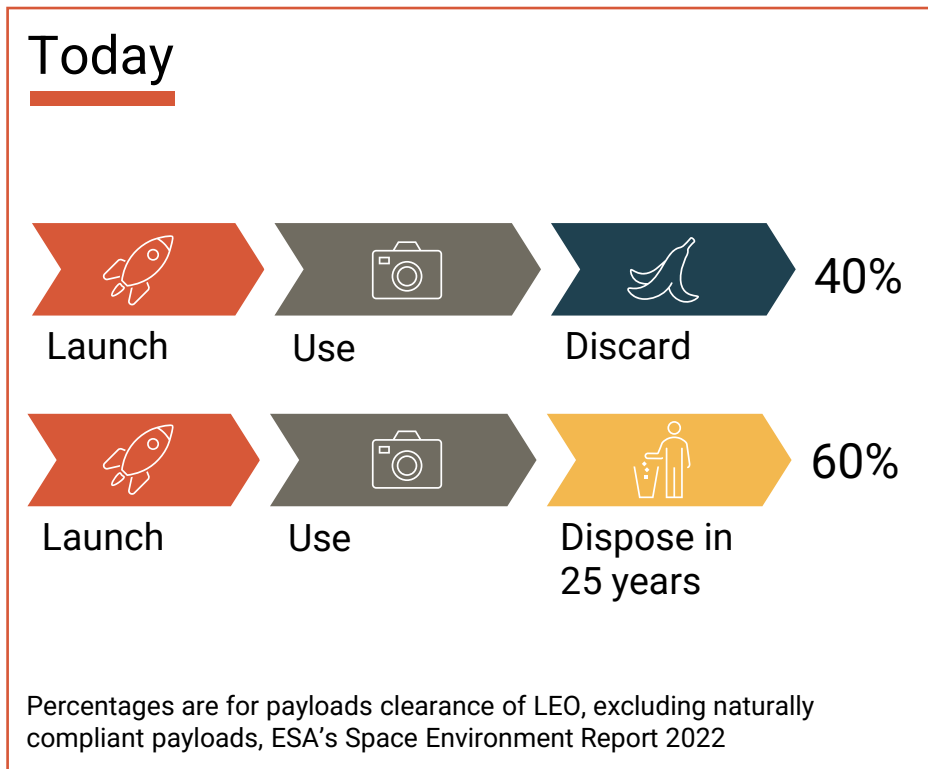
Life-extension of GEO satellites
Partnered with anchor customer for
first service

Flight: exp. 2027-2028

Towards a Space Transportation ecosystem



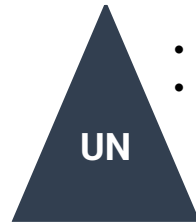
Towards a circular space economy





The regulatory framework affects ISAM activities

Space governance approach, with a focus on safety and sustainability aspects



- Five United Nations treaties on outer space
- ITU Radio Regulations



Legally binding



Binding UN treaties only provide general principles

Outer Space Treaty

The exploration and use of outer space shall be carried out **for the benefit and in the interests of all countries** (Article I)

States shall conduct their activities with **due regard** to the corresponding interests of all other States (Article IX)

States shall bear **international responsibility** for national activities (Article VI)

The activities of non-governmental entities shall require **authorization and continuing supervision** by the appropriate State (Article VI)

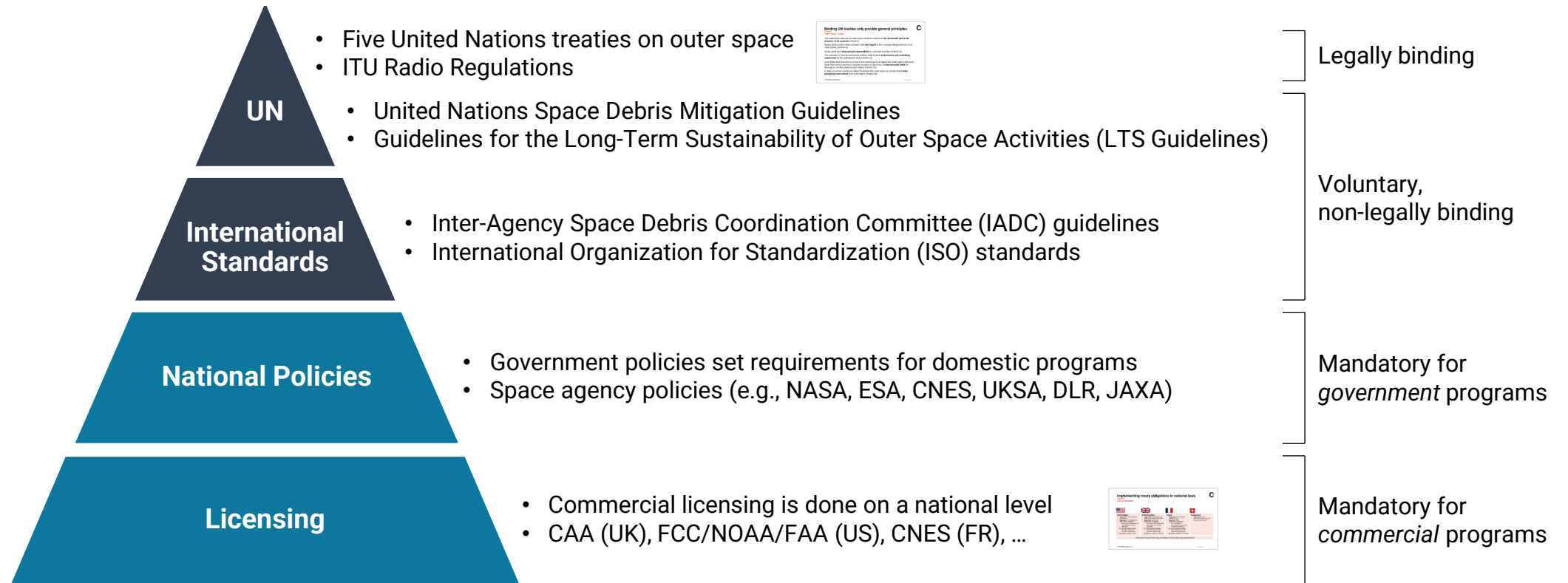
Each State that *launches or procures the launching* of an object into outer space and each State from *whose territory or facility an object is launched*, is **internationally liable** for damage to another State by such object (Article VII)

A State on *whose registry* an object launched into outer space is carried shall **retain jurisdiction and control** over such object (Article VIII)



The regulatory framework affects ISAM activities

Space governance approach, with a focus on safety and sustainability aspects





Implementing treaty obligations in national laws

A few examples



United States

- **Legal texts:** Code of Federal Regulations
- **Regulators:** FCC, NOAA, FAA
- **Space debris mitigation:**
 - Own requirements based on the ODMSP and NASA standards
- **On-orbit third-party liability:**
 - No indemnification or insurance requirement
- **Application process:** Public



United Kingdom

- **Legal texts:** Outer Space Act 1986; Space Industry Act 2018
- **Regulators:** UKSA, CAA
- **Space debris mitigation:**
 - No explicit requirements but evaluations on a case-by-case basis
- **On-orbit third-party liability:**
 - Indemnification and TPL insurance requirements
- **Application process:** Confidential



France

- **Legal texts:** French Space Operations Act
- **Regulator:** CNES
- **Space debris mitigation:**
 - Own quantitative requirements in the French Technical Regulations
- **On-orbit third-party liability:**
 - Indemnification and TPL insurance requirements
- **Application process:** Confidential



Switzerland

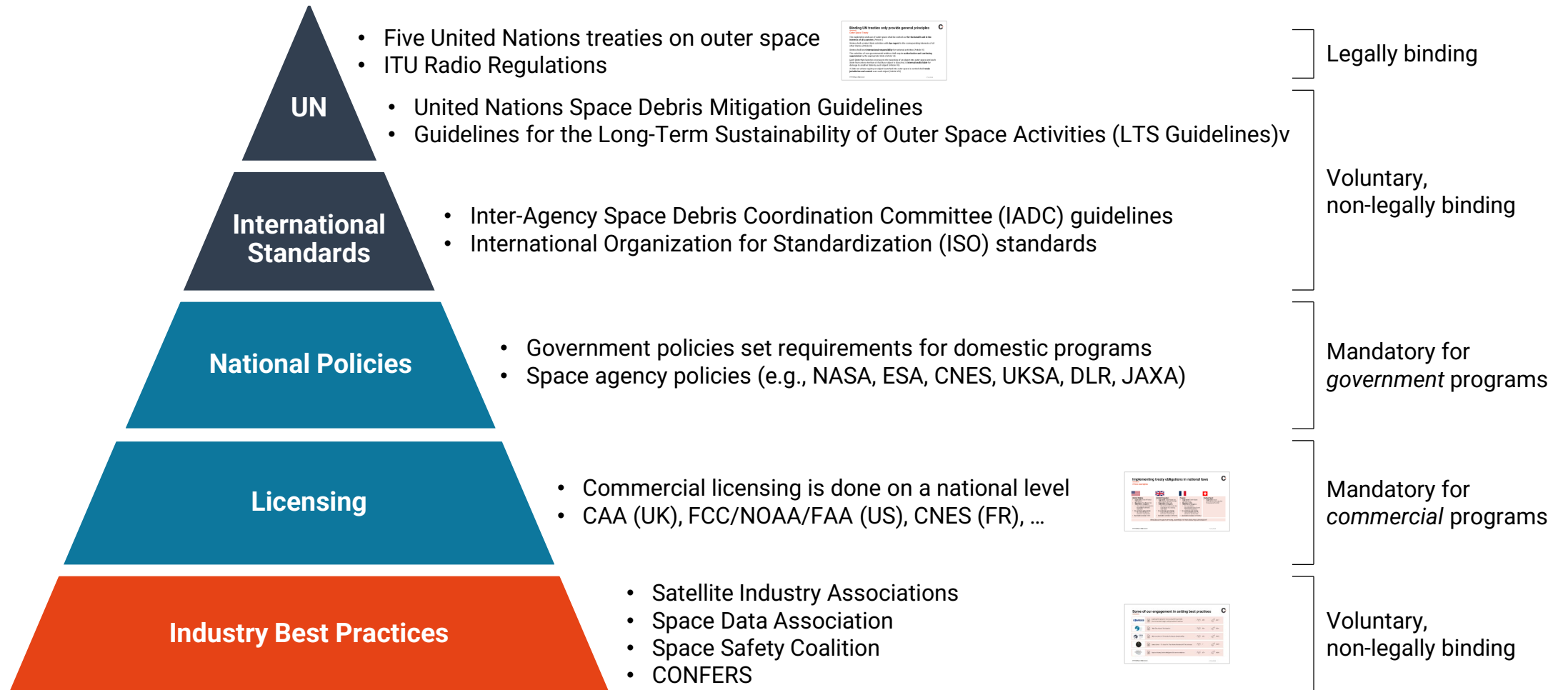
- **Legal texts:** Law in development with entry into force planned for 2027

What about in-space servicing, assembly and manufacturing authorization?















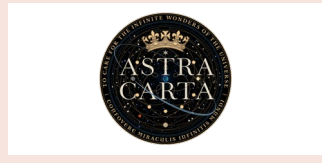







The regulatory framework affects ISAM activities

Space governance approach, with a focus on safety and sustainability aspects

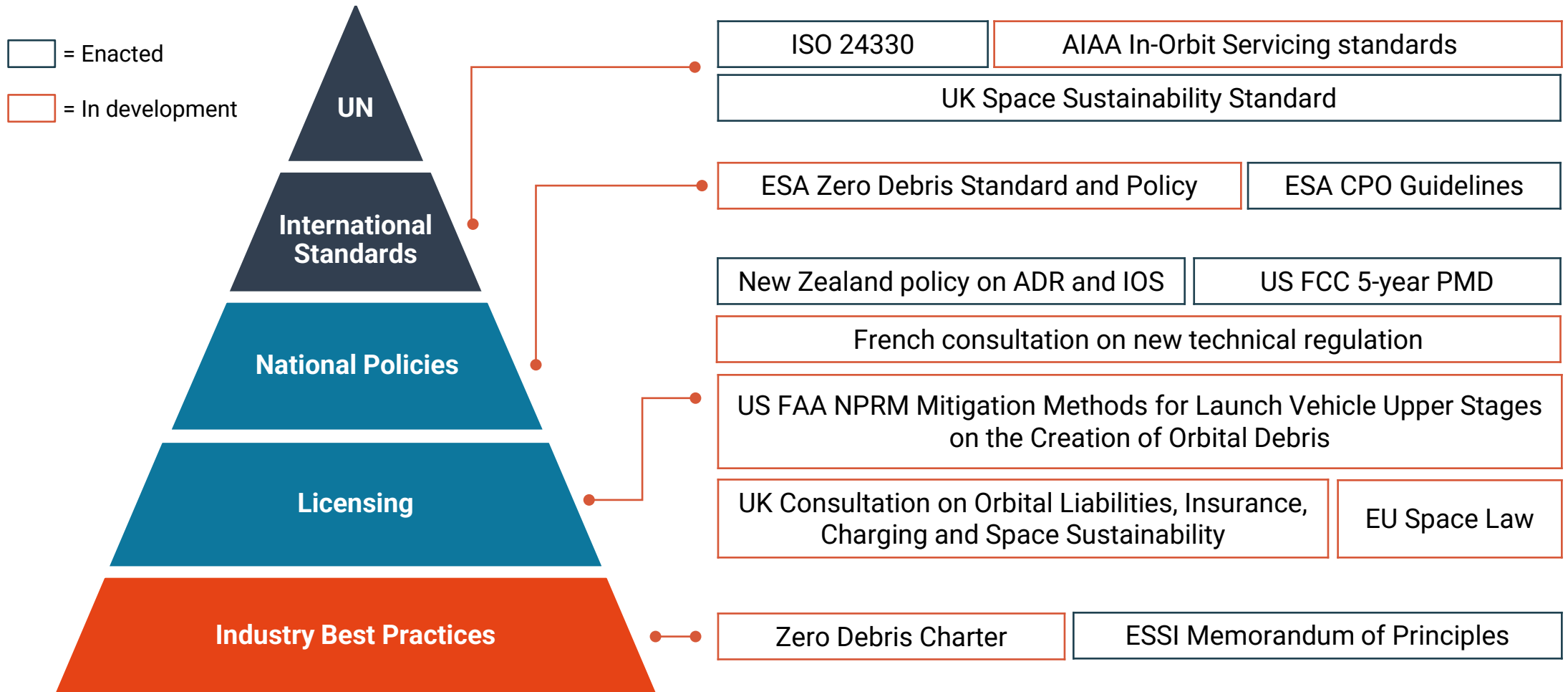


Some of our engagement in setting best practices



	 Guiding Principles for Commercial RPO and OOS Recommended Design and Operational Practices	 65+	 2017
	 "Net Zero Space" Declaration	 59+	 2021
	 Memorandum of Principles for Space Sustainability	 40+	 2023
	 Astra Carta – To Care For The Infinite Wonders Of The Universe	 ?	 2023
	 Space Industry Debris Mitigation Recommendations	 27+	 2023

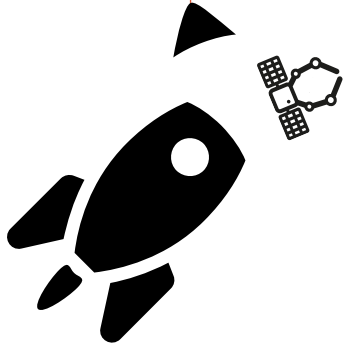
Recent developments in the regulatory framework



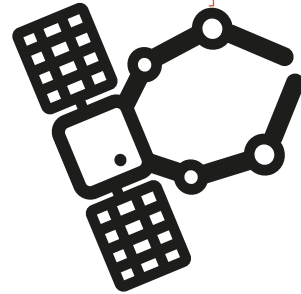
A hypothetical scenario



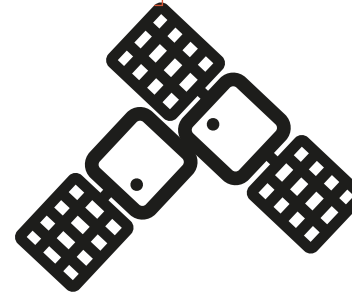
Servicer launch



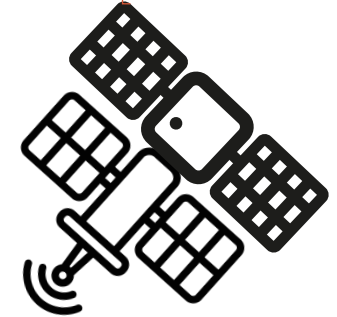
Servicer operations




Docking to a propellant depot



Capture of a derelict object







Launching States of the Servicer

-  Territory of launch
-  Launch procured from
-  Other State


Other States that might be involved

-  Servicer operated from
-  Servicer licensed in
-  Servicer owned in

Propellant depot's

-   Launching States
-  State of registry
-  Licensing state

Derelict object's

-   Launching States
-  State of registry
-  Licensing state

How to handle authorization and liability?



Regulatory hurdles can be overcome

Overview of potential gaps in the regulatory frameworks and ways to address them

Gap	Proposed solution
Licensing pathway for in-orbit services	<ul style="list-style-type: none">• Gap does not exist in every jurisdiction.• Knowledge transfer and transparent exchanges are key to developing the regulatory framework.
Assured spectrum access	<ul style="list-style-type: none">• Spectrum from client satellites can be re-used.• Clarifications at the ITU level on which spectrum bands can be used for IOS.
Definition of safety for rendezvous, proximity operations and capture	<ul style="list-style-type: none">• ISO 24330 standard for IOS and RPO published in 2022.• Quantitative thresholds might need to be included once more experience is gathered.
Interoperability standard	<ul style="list-style-type: none">• No international standards or guidelines specific to technical interoperability.• Efforts undergoing to harmonize docking interfaces and other cooperative servicing aids, which can be picked up by regulators.
Liability in stacked operations	<ul style="list-style-type: none">• This case is not addressed in UN treaties, and fault is not defined.• Can be addressed through private contracts and by establishing public multilateral agreements among spacefaring nations.
Need to secure consent for international servicing missions	<ul style="list-style-type: none">• Like-minded spacefaring nations can develop multilateral agreements to clarify expectations and potential apportionment of liability

Thank you.

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