Extending the Polluter Pays Principle to Orbit

The Legal Challenges of Mandatory Life Cycle Assessments in the EU Space Act

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Research Question and Main Argument

Research Question

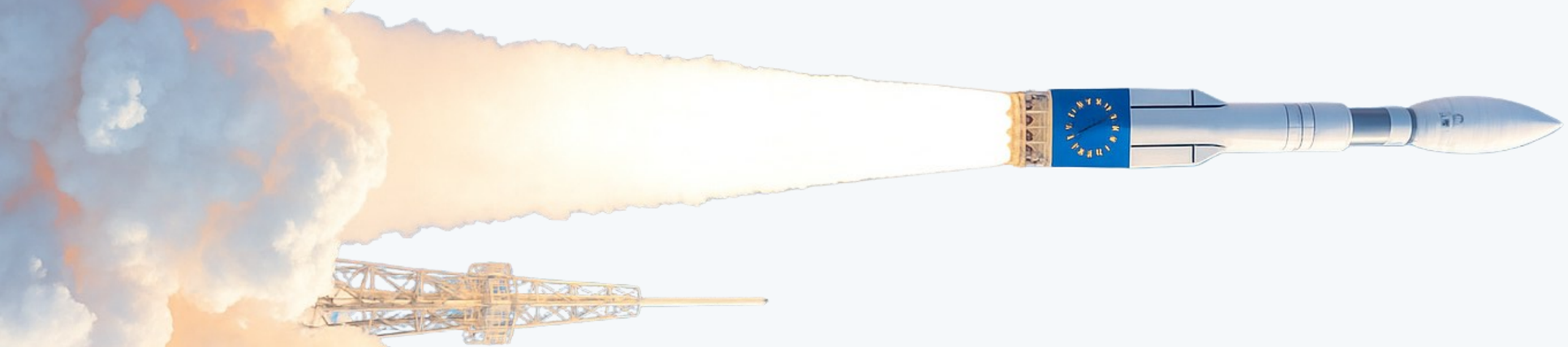
Can the **European Union** use **internal market regulation** to impose **environmental sustainability** requirements on space activities, including those carried out by **third-country operators**?

Main Argument

The **EU Space Act** should not be read merely as a technical safety instrument. It represents an attempt to transform **access to the EU market** into a **regulatory lever** for shaping responsible behaviour in orbit.

Core Tension

The Act moves from an **ex post liability model**, typical of traditional space law, to an **ex ante model** of environmental prevention and compliance.



From Traditional Space Law to the EU Space Act

Traditional space law: *ex post* liability

The **1967 Outer Space Treaty** and the **1972 Liability Convention** are built around State responsibility, jurisdiction and control, and **compensation after damage** has occurred.

Under the Liability Convention, damage caused on Earth or to aircraft in flight triggers **absolute liability**, while damage caused in outer space is subject to **fault-based liability**.

from compensation

→

to prevention

EU Space Act: *ex ante* compliance

The Proposal introduces **binding obligations** on safety, resilience and **sustainability** as conditions for authorisation and market access.

Its most innovative feature is not simply that it regulates space activities, but that it tries to **prevent environmental harm before it occurs**.

The Limits of the Polluter Pays Principle in Orbit

The Polluter Pays Principle

The Polluter Pays Principle, codified in **Article 191(2) TFEU**, is traditionally understood as an economic rule of **cost allocation**.

It requires the polluter to bear the cost of maintaining the environment in an **acceptable state**.

Why this is problematic in space

The principle presupposes that a certain level of pollution is politically and legally acceptable.

In outer space, however, **no clear threshold** exists for determining what level of debris, light pollution, orbital congestion or re-entry risk may be considered acceptable.

Key Point

The LCA/EFD mechanism does not primarily price pollution. It requires operators to assess and disclose environmental impact **before** the activity takes place.

It is therefore closer to **prevention** and **precaution** than to a classic Polluter Pays model.

Acceptable Pollution vs Irreversible Harm

The crucial distinction is between pollution that can be **tolerated and priced**, and pollution that must be **prevented** because it risks producing irreversible harm.

Category	Legal logic	Instrument	Space example
Acceptable pollution	Internalisation of costs	Taxes, charges, liability	Launch emissions within defined limits
Unacceptable or irreversible harm	Prevention or prohibition	LCA, design standards, de-orbit obligations	Orbital debris in congested LEO; Kessler Syndrome risk

Implication

Without an explicit threshold of acceptable space pollution, the EU Space Act implicitly places many orbital sustainability risks in the **prevention** column.

What Counts as Pollution in Space?

The conceptual problem

Under international space law, a non-functional satellite remains a **space object**. It retains its legal status, and the State of registry retains jurisdiction and control over it.

The environmental law perspective

From an environmental perspective, the same object may function as **waste or pollution**: an inert mass occupying a scarce orbital resource and creating collision risks.

The EU Space Act's implicit solution

The Act does not formally reclassify space objects as waste. Instead, it adopts a **functional approach**: it regulates the environmental footprint of the entire space activity, including end-of-life disposal, debris mitigation and re-entry.

Space object under international law ≠
Waste/Pollution under environmental logic

The LCA/EFD Mechanism Under the EU Space Act

Cradle-to-grave assessment

Articles 96 to 100 of the Proposal require operators to calculate the **environmental footprint** of the entire space activity.

Environmental Footprint Declaration

The operator must submit an Environmental Footprint Declaration as part of the **authorisation procedure**, supported by a certificate issued by a qualified technical body.

Life Cycle Phases

- Design
- Manufacturing
- Launch
- In-orbit operations
- End-of-life disposal

Regulatory function

The LCA/EFD mechanism transforms environmental assessment into a **condition for authorisation** and, ultimately, for **access to the EU market**.

Supply-Chain Environmental Data and the Baikonur Example

Example

A French operator assembles a spacecraft in Toulouse, launches it from **Baikonur** on a non-EU launch vehicle, uses fuel manufactured outside the Union, and sells satellite services within the **EU market**.

The EUSA logic

The operator must calculate the environmental footprint of the entire space activity, including the launch stage. To do so, it must obtain **environmental data from suppliers by contract**, even when those suppliers are located outside the EU.

Legal significance

The EU does not directly regulate the foreign launch site. Instead, it attaches **environmental data obligations** to the operator seeking access to the EU market.

Regulation through market access, not territorial command.

The Brussels Effect in Space Governance

Market access as regulatory power

The EU cannot directly command a US, Chinese or Indian satellite in orbit. Under Article VIII OST, the **State of registry** retains jurisdiction and control over its space object.

Internal market conditionality

Third-country operators providing space services within the Union may be required to **comply with EU standards**, register, obtain certification and designate a legal representative within the EU.

The Brussels Effect thesis

The EU may use the **size and attractiveness** of its internal market to export its regulatory standards beyond its territory.

Limits of the analogy

Unlike data protection, space activities involve **physical infrastructure**, jurisdiction under space treaties, and technical standards that may not be easily divisible across markets.

EU market access → **Compliance** → **Possible global standard-setting**

Market Access or Interference with the State of Registry?

At what point do market access conditions become **functional interference** with the jurisdiction and control of the State of registry?

EU perspective: market access condition

The EU does not claim jurisdiction over the object as such. The measure formally operates as a **market access condition**.

Space law perspective: jurisdiction and control

Compliance with EU market rules may indirectly **reshape the technical standards** applicable to a foreign space object.

Functional interference?

Potentially problematic requirements

If the EU requires third-country operators to comply with design-related sustainability standards, the measure may formally operate as a market access condition, but **materially affect the design and operation** of a foreign space object:

- Low-reflectivity coating
- Propulsion systems for de-orbiting
- In-space servicing compatibility
- Debris mitigation design requirements

From Compliance to Fault: EUSA Standards as Evidence of Due Diligence

The problem of fault

Article III of the Liability Convention makes in-space damage fault-based, but the Convention does not define fault.

The possible role of EUSA standards

The EU Space Act cannot amend the Liability Convention. However, detailed EU requirements on LCA, debris mitigation, collision avoidance and re-entry safety may become relevant as **evidence of reasonable diligence**.

Consequences

Compliance may support the argument that an operator acted with due diligence.

Non-compliance may support the argument that the operator failed to meet an emerging standard of care.

Key qualification

The relevance is:

Evidentiary and normative,
not formally constitutive.

Economic Leakage and Forum Shopping

The cost concern

The Commission's impact assessment acknowledges that compliance with the EU Space Act may **increase manufacturing and cybersecurity costs** for operators.

The forum shopping argument

Higher compliance costs may push operators to incorporate, manufacture or launch in **less regulated jurisdictions**.

The anti-circumvention logic

The Act follows the service into the EU market: any operator providing space services within the Union remains subject to EU requirements, **regardless of where it is established**.

The real risk

The most serious risk is not simple avoidance, but **fragmented harmonisation**: one regulatory track for the EU market and another for the rest of the world.

The Broader Risk: Fragmented Harmonisation

Internal harmonisation

The EU Space Act may reduce fragmentation within the Union by replacing divergent national space laws with a **common framework** on safety, resilience and sustainability.

External fragmentation

If EU standards evolve without sufficient coordination with UNCOPUOS, ESA, ISO and existing technical regimes, the Act may contribute to the **fragmentation of international space governance**.

The legal risk

The EU may create a highly sophisticated regulatory framework for the European market, while the rest of the international community follows different soft law guidelines, technical standards or national approaches.

Central concern

The danger is not necessarily regulatory overreach. It is **fragmented harmonisation**.

Conclusion

The EU Space Act is transformative because it moves space sustainability from soft law to **binding obligations** linked to authorisation and market access.

It does not rewrite international space law, but it may influence how existing obligations of due regard, fault and environmental responsibility are **interpreted in practice**.

Its external significance lies in the use of the **internal market as a vehicle** for global standard-setting.

Final question

Can the EU lead the international community toward **regulatory convergence**, or will it deepen the **fragmentation** of space governance?

Thank you

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Questions & discussion