

Building a Commercial Radioisotope Power Sector: Launch Approval, Spaceport Infrastructure, and Mission Operations

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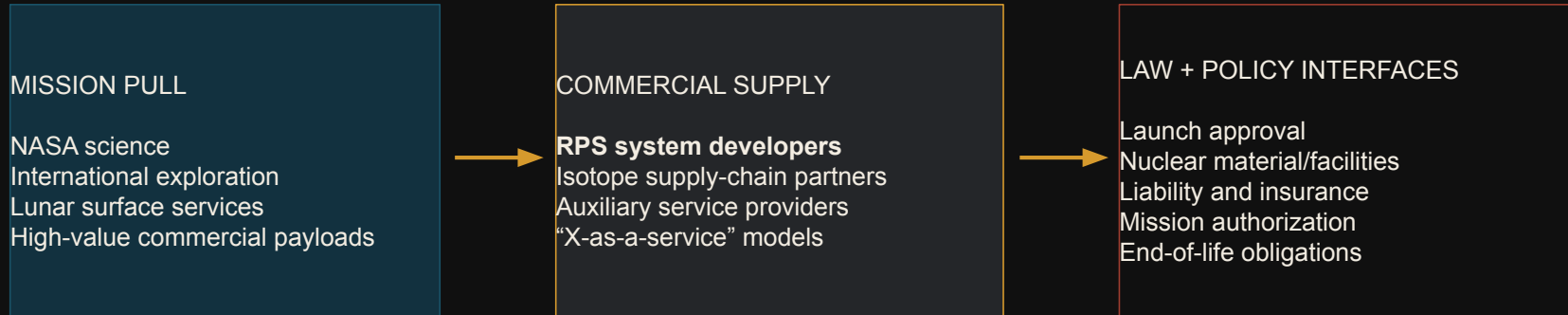


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A commercial RPS sector

Private entities are entering roles that were historically performed inside government programs.

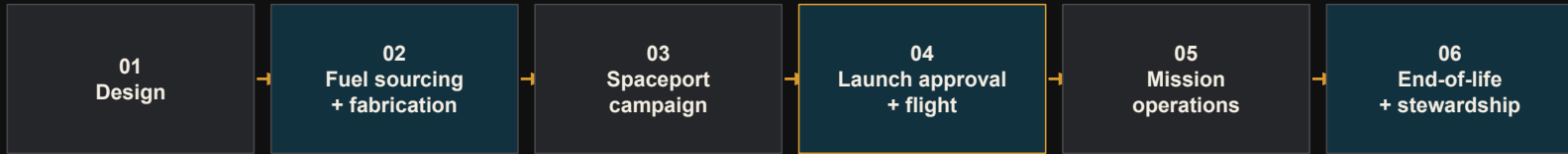


Bringing various radioisotopes, technologies, and business models, the innovation of the emergency commercial RPS sector is poised to outpace government developments

A Lifecycle Mission Safety Paradigm

Mission safety considerations extend beyond traditional “Launch safety paradigm”

Lifecycle deployment roadmap



Technical lifecycle

- safety case and mission assurance
- launch vehicle / range interfaces
- radiological constraints and procedures
- anomaly response and disposal analysis

Business-model lifecycle

- designer / developer / owner
- mission sponsor / launch provider / spaceport
- operator / power-service provider
- insurer / regulator / local community

Core proposition: commercial RPS must preserve safety continuity as responsibility moves across organizations and jurisdictions.

Make launch approval predictable, harmonized

The United States has established a commercial regulatory pathway that is risk informed, performance based, and technology neutral; licensing harmonization should begin while the sector is still nascent.

BESPOKE MISSION AUTHORIZATION

- one-off evidence packages
- agency-specific precedent
- uncertain commercial schedule
- difficult investor diligence



ESTABLISHED COMMERCIAL PATHWAY

- design reviews and certifications
- reusable safety evidence
- clear agency interfaces
- regulatory certainty as competitive advantage

Commercially facilitating launch approval

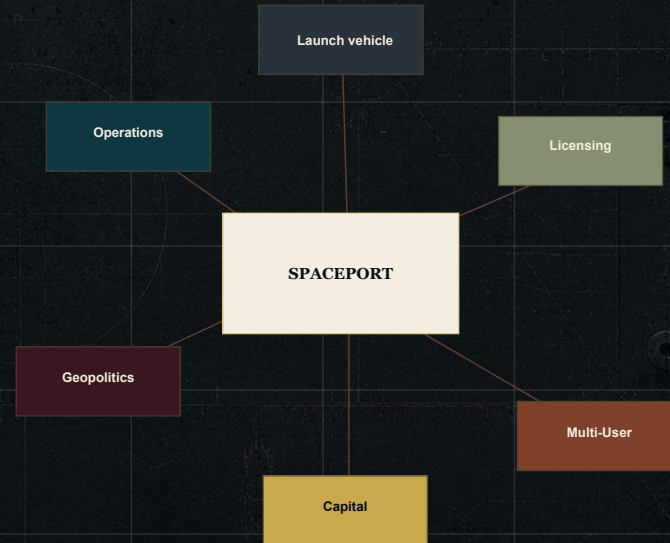
Coordination between nuclear and space regulators

Ensuring NSPM-20 and terrestrial compliance

Consideration of international missions

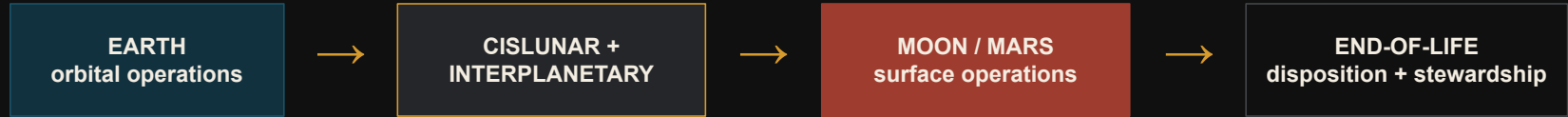
Facilitating Spaceport Operations

- Potential major bottleneck to commercial space nuclear development
- Rare, industrial, and strategic infrastructure
- Only a limited number of launch sites globally, closely tied to launch vehicles and accessible destinations
- Complex implications for nuclear normally - international missions could further complicate spaceport operations
- Implications for future international space nuclear safety norms



Mission operations

The next questions are cislunar, interplanetary, and planetary-surface operations.



Operational safety questions move across venues, actors, and legal regimes.

How do cislunar or interplanetary trajectories change accident scenarios and response assumptions?

How should astronaut interactions, mobile assets, exclusion zones, dust, maintenance, and surface anomalies be governed?

Who?

The policy frame must expand: space law is the venue but nuclear law is the substance



Recommendations

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1. The United Nations and other major stakeholders should recognize commercial participation/leadership as a major national strategy in developing and deploying RPS at scale
2. The nascency of the industry creates an opportunity for international regulatory innovation, but can be stifled by regulations that are too early or overly prescriptive
3. International licensing harmonization, spaceport norms, and mission guidance can all greatly facilitate the emergence of such a commercial RPS sector
4. Document explicit lessons learned in handling RPS technologies to inform future fission pathways



Thank you!

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For additional information please see:

- Alexander Q. Gilbert, Governance of Nuclear Energy in Outer Space, Nuclear Law Bulletin, No. 113, Vol. 2024/2, at 7, 7–42 (OECD Nuclear Energy Agency 2025), <https://doi.org/10.82155/5szz-jh50>.
- David Schleeper & Alex Anderson, Spaceport Planning for Space Nuclear System Payloads, in Proceedings of Nuclear and Emerging Technologies for Space (NETS 2026) 490–499 (American Nuclear Society 2026).
- Alexander Q. Gilbert, Nuclear for Space Propulsion and Surface Power, in New Directions in Nuclear Energy: Innovation and Opportunities in Fission and Fusion for Global Decarbonization 339–374 (Andrew Foss & Nicolas Stauff eds., Woodhead Publishing 2026).